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THE PECAN IN TEXAS

THE STATE TREE

THE PECAN--ITS HISTORY--IMPORTANCE--ECONOMIC VALUE

PECAN STREAMS, SOILS, ORCHARDS, PRODUCTION, INSECTS, DISEASES, GRADES, PROPAGATION, ETC.

J. H. BURKETT, Nut Specialist.

GEO. B. TERRELL,
Commissioner of Agriculture.

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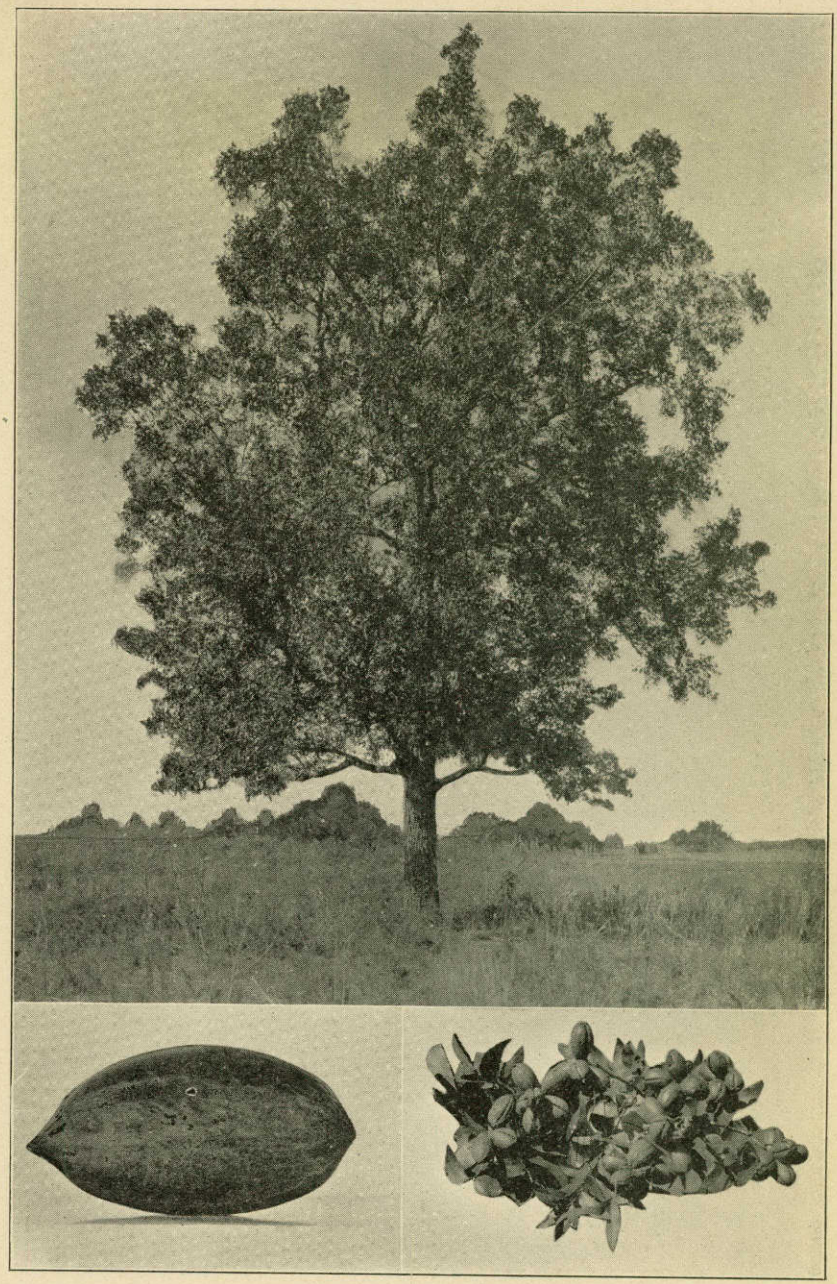

THE ORIGINAL GOVETT TREE.

I think that I shall never see
A poem as lovely as a tree.
A tree whose hungry mouth is prest
Against the earth's sweet flowing breast;
A tree that looks at God all day,
And lifts her leafy arms to pray;
A tree that may in summer wear
A nest of robins in her hair;
Upon whose bosom snow has lain;
Who intimately lives with rain.
Poems are made by fools like me,
But only God can make a tree.

—By Joyce Kilmer.

"and the leaves of the tree were for the healing of the nations."—Rev. xxii. 2.

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INTRODUCTION.

This Bulletin is a revision of Bulletin No. 73, The Pecan in Texas, and contains many new features. It has been prepared with great care by Mr. J. H. Burkett, Chief of the Division of Edible Nuts of the State Department of Agriculture. Mr. Burkett is one of the most practical and experienced pecan growers in Texas. He has given many years to the study of the pecan industry in the State.

The Bulletin contains an article by Mr. J. M. Del Curto, Plant Pathologist of the State Department of Agriculture, on diseases of the pecan and the treatment thereof; also it contains an article by Mr. J. S. Woodward, First Assistant Entomologist of the Department, on insect pests and means of combatting them, both of which add much to the value of the Bulletin.

Mr. Burkett does not claim that the Bulletin is perfect or "fool proof," but he believes that it contains much valuable information that can be used to advantage by practical pecan growers. He believes that it will fill a long felt need to those seeking information on the subject and will eliminate the necessity of so much correspondence.

The map and the location of the streams in the principal pecan belt are not as accurate as they should be and some phases of the industry and some localities in the pecan growing sections may be overlooked, or not properly treated, but if such omissions occur, it is because of the extreme difficulty of properly locating and describing any industry in the State, as almost everything is grown in Texas, almost everywhere.

I commend this Bulletin to the thoughtful consideration of everyone who is interested in any phase of the pecan industry in the State.

GEORGE B. TERRELL,
Commissioner of Agriculture.

FOREWORD.

In the preparation of this Bulletin acknowledgement is due a number of friends and co-workers in the Pecan world.

Credit is due Mr. O. S. Gray, Secretary Texas Pecan Growers Association, for timely criticisms and suggestions in arrangment of subject matter. Credit is also due Mr. R. A. Harris of Riverside, California for notes and material on irrigation; Mr. J. M. Del Curto, Plant Pathologist and Mr. J. S. Woodard, First Assistant Entomologist of the Department of Agriculture for the articles, Diseases of the Pecan, and Pecan Insects; and Prof. R. E. McDonald for valuable assistance and suggestions.

Special mention should be made of Mr. L. D. Romberg and Mr. F. J. Willman, my efficient assistants, and Miss Hazel Ricks, stenographer, for their untiring help in preparation and arrangement of the material and manuscript.

Among others who deserve mention in this connection are Ross R. Wolfe, Stephenville; Dr. A. Caswell Ellis, Austin; R. C. Govett and P. K. DeLaney, Seguin; Mrs. John Kemper, Denison; Chas. L. Edwards, Dallas. Judge B. F. Guinn, Rusk; E. W. Cole, Austin; R. E. Yantis, Austin; Brooks S. Ramey, Brownwood; R. L. Odom, Toledo; P. H. Rylander, Austin; Guy Risien, San Saba; D. F. Moore and W. J. Millican, Bend; Prof. Westcourt, Stephenville; Eugene C. Connally, Glen Rose; C. F. Denny, W. H. Durham and N. A. Palmer, Comanche; W. R. Clark, De Leon, and a host of other high class intelligent citizens which have made it possible to present to the interested public the subject matter in the pages that follow.

With gratefulness to one and all who have in any way aided and lent encouragement,

J. H. BURKETT.

THE PECAN IN TEXAS

NUTS AS FOOD.

The existence of animal life on this earth is wholly dependent upon the quality and quantity of the food supply. The laborer gets his nourishment from the same source as does the brain worker. One and all are dependent on the quality and quantity of food available for their sustenance while engaged in their different callings. The race now inhabitating the earth has from time to time become depleted and civilization received a set-back because of the lack of an adequate supply of nourishing food. It does not require an inspired prophet to fore-see that if population continues to increase at the same ratio as it has in the past, the time is not very far distant when the people of this earth will become in dire need of a sufficiency of physical subsistence.

Among the various sources of food which have heretofore been sadly neglected, stand our native nut trees, especially the pecan, the black walnut and hickory, of which there are several species found growing wild within the borders of our State. The most important of these, from the standpoint of food, is the pecan. These native edible nuts are preeminently in the foreground as a potential nourishing food for the coming civilizations, and offer unusual opportunities to those seeking profit and pleasure in the growing and improvement of them.

It seems that now would be an opportune time for those who are disposed to have a thought for the welfare of posterity and for the preservation of our civilization to begin to make a study of the potential possibilities of improving and multiplying the better species of these native nut trees, since there can be no question that food can be more cheaply grown and preserved from them than from any other source.

Our State has in the past spent, and will probably continue for many years in the future to spend, many thousands of dollars annually for nuts and nut products that can easily and with great profit be produced at home. With a proper systematic effort, Texas could, in a few years, multiply its production of nuts twenty times without in the least retarding or interfering with its other agricultural products.

There is enough waste land where it is not advisable to grow annual crops that could be used to grow pecans, hickory nuts and walnuts to great advantage to the grower and of immense benefit to the State. Besides this, there are probably now somewhere in the State several varieties of the hickory nut and the walnut which, if found, and brought into use, are well worthy of economic and commercial propagation, and would annually enrich the State many millions of dollars. I am calling attention here only to such nut trees and crops as are native to our soil and climate, and am trying to encourage our people to become interested in their growth and development.

PLATE NO. 2.

"Stranger, if thou hast learned a truth which needs
No school of long experience, that the world
Is full of guilt and misery, and hast seen
Enough of all its sorrows, crimes and cares,
To tire thee of it, enter this wild wood
And view the haunts of Nature. The calm shade
Shall bring a kindred calm, and the sweet breeze
That makes the green leaves shall waft a balm
To thy sick heart."

—Bryant.

This view indicates the possibilities of pecan growing and stock farming combined.

There can be no legitimate excuse for the neglect of growing such nut trees in our towns and cities on the score of the cost of doing so for our streets and lawns are being set with just as expensive kinds that produce only shade and beauty, yielding nothing in the way of food for man or beast. It is a shame to our boasted civilization for us to be busying ourselves in putting out such trees as hackberry, elm, ash, sycamore, etc., where the pecan, hickory nut or walnut would grow as well, and give us annually or biennially tons of highly prized nuts. While the value of these nut trees for their food products, which are highly nutritious and healthful, is incalculable, their shade and ornamental effect are not surpassed.

I am frequently asked if the present demand is sufficient to justify planting the pecan and other nuts extensively. In answering such a question I will say that the following table showing the enormous tonnage of nuts imported into this country, as well as the domestic production, is sufficient evidence to prove that the people of North America are a nut consuming people, and that we will not be able to meet the domestic demand for many, many years to come.

TABLE NO. 1.

Year.	Walnuts by Pounds.	Almonds by Pounds.	Total Value.	Export Value of Nuts Other Than Peanuts.
1900		6,317,633	$ 2,978,834.00	$ 156,490.00
1901		514,252	3,268,855.00	218,743.00
1902		9,868,982	4,044,341.00	304,421.00
1903	12,362,567	8,142,164	4,868,388.00	299,558.00
1904	23,670,761	9,838,852	5,471,166.00	330,366.00
1905	21,864,104	11,745,081	6,158,343.00	309,195.00
1906	24,917,023	15,009,326	7,373,425.00	140,959.00
1907	22,597,592	14,233,613	9,742,883.00	103,929.00
1908	28,887,110	17,144,698	9,643,943.00	89,205.00
1909	26,157,703	11,029,421	8,664,253.00	246,284.00
1910	33,641,466	18,556,356	13,246,742.00	156,284.00
1911	33,619,439	15,522,712	14,498,413.00	328,151.00
1912	37,213,674	17,231,458	15,828,008.00	303,473.00
1913	36,662,441	15,670,958	13,979,905.00	733,585.00
1914	37,195,738	19,638,405	19,888,601.00	398,312.00
1915	33,445,838	17,111,264	16,830,932.00	377,486.00
1916	36,858,934	16,596,921	21,172,417.00	441,512.00
1917	58,725,362	5,169,926	40,738,989.00	403,870.00
1918	23,289,173	23,840,145	52,847,318.00	745,483.00
1919	31,495,977	35,490,446	57,510,164.00	67,343.00
1920				
1921				
Total	502,604,899	288,672,593	$ 328,755,920.00	$ 6,154,649.00

Summary.

Total production of pecans in the United States from 1909 to 1919	209,097,380 lbs.
Total production of almonds and walnuts in the United States from 1909 to 1919	481,337,800 lbs.
Total imports of all nuts (pecans, almonds and walnuts) in the United States from 1909 to 1919	526,976,630 lbs.
Total consumption in the United States	1,217,411,810 lbs.
Total value of imports, 1909 to 1919	$266,541,498
Total value of exports, 1909 to 1919	6,154,649
Consumption of foreign nuts	$260,386,749
Consumption of domestic nuts	690,435,180 lbs.

From the above information is it not time that the people of Texas who own their homes should begin to think of making preparations to meet this ever increasing demand?

PLATE NO. 3.

Seventeen year old pecan orchard. Sabine Valley Pecan Nursery, Toledo, Texas. Courtesy of R. L. Odom.

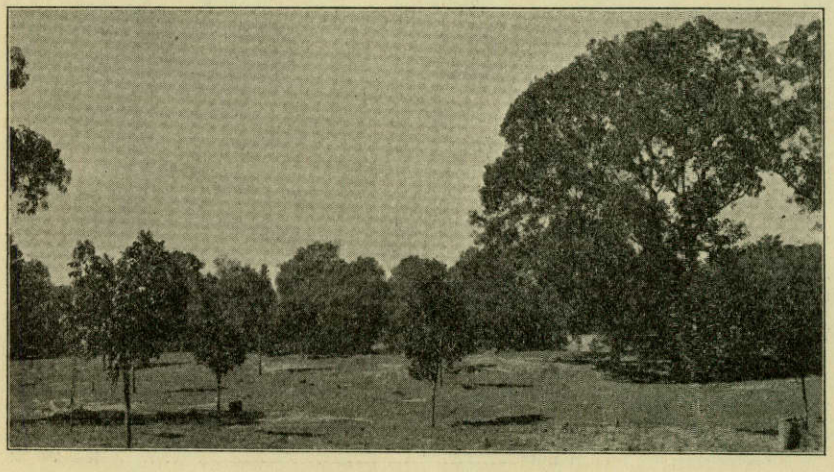


PLATE NO. 4.

View in 20-acre pecan grove at LaGrange, Texas, one year after top-working. Courtesy of John Schroeder.

As intimated heretofore, there are enough waste places on almost every farm in our State on which to grow from ten to one hundred or more pecan, hickory or black walnut trees, and which, if planted and given care for a few years, would supply a good per cent of the food needed, or furnish a cash product almost without cost, save for the gathering of them.

So far as Texas is concerned in the development of the nut industry of the State, we are yet pioneering and are in the experimental stage. While questions of suitable soils, adaptable varieties, cultural requirements and dozens of other phases of nut growing, are problems about which little is yet known, there are other problems which must be solved and other difficulties to be overcome before nut growing can be placed on a firm, established business basis.

Another most perplexing problem, in which every forward-looking citizen of the State should be vitally interested, is the establishment of an adequate, business-like marketing system. Until this is done the development of our nut industry will lag.

Within the past ten or fifteen years interest in the pecan has been growing, and at this time that interest will be the chief subject for discussion in the following pages of this small treatise, with a passing notice of both the black walnut and hickory, all of which are yet in their wild stage, none of them having yet become fully domesticated.

In any horticultural industry many questions are constantly arising, even with our horticultural plants that have for centuries been brought under the influence of man. How much more then is there a multiplicity of questions being asked about soils, climate, care, culture, varieties, etc., of this new popular growing semi-wildling—in short, of the pecan and its environments.

In an endeavor to assist in solving some of the pressing problems connected with the pecan and its culture, this abridged treatise is prepared. Pecans growing in their wild state have been under the observation of the author for half a century and its culture has been the subject of intense study and experimentation for more than twenty years.

The subject matter recorded in the following pages are the results of observations made, and is intended to serve as a guide to those who are not familiar with the various phases of pecan propagation. But it should be understood that, owing to the lack of recorded data, much of what is given herein is only the opinion of the writer, and is subject to revision as soon as it may be discovered that the information given is erroneous.

PECAN BOTANY.

The word "Pecan" is said to have been derived from the Indian "Pacan" or "Pecane" or "Powco-hicoria." There is good reason to believe that the early inhabitants of Texas were instrumental in distributing the pecans in different parts of the country. Evidence is not entirely lacking that the pecan was co-existent with a

possible former civilization which antedated the period when the American Continent was discovered by modern explorers.

A fossil pecan now in the hands of Mr. E. E. Risien of San Saba, Texas, was dug from the lime rock formation at a depth of some 30 feet or more while digging a well near San Saba town. Dr. C. N. Ray of Abilene, Texas, has in his possession a geological specimen taken from the sand formation on the banks of the Missouri River some 75 feet under ground, that is a typical pecan belonging to a pre-historic age.

Doubtless the pre-historic inhabitants used the pecan as food, as did the Indians later. According to botanists the pecan belongs to the family of plants known as "Juglandaceae" and embraces only two genera, Juglands and Hicoria; the first including the walnuts, butternuts, etc., and the latter the hickories. Of the hickoria genus of which there are ten or more species found in Texas, the pecan is so far the only one found and brought to notice that is worthy if domestication.* It is found native in Texas from the Red River on the north to the Rio Grande on the south and Devils River on the west.

There are two kinds of flowers produced on the pecan separately, the pistils and the stamens, so that the wind is the agent that distributes the pollen which is produced abundantly.

Artificial pollenation is easy and offers an inviting field to those interested in pecan breeding. The male bloom that produces the pollen is usually found at the base of the new growth in long tassels or catkins. The female, or pistillate flower, which produces the fruit is found at the terminal of the new growth in clusters usually of three to seven nutlets.

PECAN BEARING STREAMS.

All of the pecan bearing streams flow from the Devils River, Nueces and Rio Grande on the west and southwest borders of the State to the Red River and its tributaries on the north and northeastern borders of the State, finally find their outlet into the Gulf of Mexico. With the exception of the Rio Grande and the Red River all of our other streams have their rise and entire course within the State, (except a small portion of the upper reaches of the Brazos River) and have a general flow from the northwest to the southeast. While all our larger streams flow from a northwest to a southeast direction, as we near the upper reaches of the tributaries contributing to their drainage system, some of the smaller creeks and rivers flow in from south to north until they enter the larger river. For the purpose of verifying this statement that Texas has as much as 8,000 miles of river channel traversing our State, the names of each of these are given together with names of some of the most important smaller tributaries contributing to each of their drainage systems. While the Rio Grande forms a part of our river

*NOTE: The Melcher is undoubtedly a pecan hickory hybrid. This nut runs 51 per cent of meat and 58 nuts per pound.

drainage system, it is not reckoned in this list because it produces but very few pecans. Devils River is in the extreme western part of the State and joins the Rio Grande just above Del Rio. This stream produces the first pecans worthy of note. Following the meandering of this stream, there are approximately 75 miles where pecans are found growing naturally.

Nueces River.

The Nueces River is 375 miles from head to mouth. Some of the most important tributaries contributing to the Nueces drainage system and where the pecans are native, are Penbencia, Comanche, Chacon, Palo Blanco, Chaparasa, Montell, Mustang, Uvalde, Jaunez, Miguel, Sabinal, Norton and Seco Creeks; Frio, Hondo, Leona and Blanco Rivers. Three other pecan bearing streams of minor importance lying between Devils River and Nueces River are Tharoma, Elm and Las Moras Creeks. Pecans are not found on these streams to any great extent, being confined to the upper reaches of same, where there are magnificient bold springs breaking forth from the foot hills of the Edwards' Plateau.

San Antonio and Guadalupe Rivers.

These streams join just before entering into the waters of the bay. The San Antonio River receives the waters of the Medina River and its several tributaries, the Cibolo River, Cablezo, Hondo, Calavenas, Paesta, Ecleto, Blanco, Manahuilla, Glass, Colibria and Alum Creeks.

The Guadalupe River is made up of the San Marcos, Blanco, and Comal Rivers and Baron, Treadgill, Squaw, Bear, Palo Alto, Valverda, Johnson Fork, Live Oak, Crab Apple, Willow, North and South Groter, Cypress, Onion, Aremoso, Coleto, Tenney, Elm, Plum, Clearfork and Westfork Creeks.

Colorado River.

The Colorado River and its several major and minor tributaries contributing to its drainage system, are by far the most important pecan bearing streams in the State. On its lower reaches among the most important tributaries entering it are the Peach, Caney, Jones and Blue Creeks. Other rivers joining the Colorado are the Perdenales, Llano, San Saba, and the Concho. Among the smaller streams contributing to these rivers are the South Concho, Middle Concho, North Concho, Spring, Dove, Sterling, Lacy, Willow, Kickapoo, Valley, Pecan Bayou, Jim Ned, Blanket, Cherokee, Falls, Brady, Comanche and numerous other creeks of less importance, and the San Saba River and its contributing streams.

Brazos River and Its Tributaries.

The Brazos River and the streams contributing to its drainage system are next in importance to that of the Colorado River sys-

tem. The Brazos is fed by the San Gabriel, Nolan, Lampasas, Leon, Bosque, Cowhouse, Paluxy, Palo Pinto, Navasota, Old River and Little Brazos River, and Rocky Mill, Spring Branch, Big Sandy, New Year, Jackson, Coles, Clear Fork, Sandy, Deep, Battle, Hubbard, Elm, Deer, Salt Fork, Boggy, Fisk, California, Flint, Pond, Brushy and Nolen Creeks.

Trinity River.

The Trinity River drainage system is of less importance as a pecan bearing stream than either the Colorado or the Brazos River systems. Contributing to the Trinity River system are West Fork, Elm Fork, East Fork, Navasota and numerous other pecan bearing streams along the upper and lower reaches of this river system.

Red River System.

The Red River is the northern and northeastern border of our State and produces pecans sparingly on the immediate river front, but the Wichita Rivers are important as pecan bearing streams. Other streams entering the Red River are Big Mineral, Little Mineral, Iron Ore, Elm, Fish, Clear, Pecan, and Sycamore Creeks.

PECAN SOILS.

In treating of soils relative to pecan growing, the question can be discussed in a Bulletin intended for popular distribution only in a very brief manner. Naturally the subject will have to be divided into two general heads: Natural pecan soil where the pecans are found growing naturally; and soils where the pecans are not indigenous, but where experience and observation show that pecans may be grown successfully. These soils are all rich, alluvial, bottom and valley soils. Each of these various creeks and rivers have soils that differ from each other just as the soils along the streams partake of the nature of the soil found along the upper reaches of these streams. Hence there are no two of these streams that have soils exactly alike. Generally all of the soil types found within the State where pecans grow naturally are alluvial transported soils It is safe to say that on any soil where pecans are found growing naturally and are reasonably strong and vigorous, producing crops as often as climatic conditions will allow, such soil is suited to pecan growing. While the pecan is at home on our rich, deep, moist, transported soil, yet this does not prove that it will not grow and succeed on other soils. It is probable that as we gain in experience and observation a great deal of our up-land timber soils will be devoted to pecan orcharding. It is the opinion of the writer that pecan orcharding will prove more profitable on much of our up-land soils than on a large portion of our creek and river bottoms. Ideal pecan lands in Texas are very limited. Yet there are probably

more than 8000 miles of pecan bearing streams within our borders where pecans are found more or less continuous, growing and producing pecans naturally. Some of these natural groves, however, while indicating that pecans can be made to succeed on such soils in many instances produce pecan crops sparingly, owing to climatic conditions, insect depredations and impoverished soils or crowding by other forest growths.

On much of our upland orchard soils with clay or sandy clay subsoils which are to be found in many parts of the State even where pecans do not grow naturally, these untoward conditions can

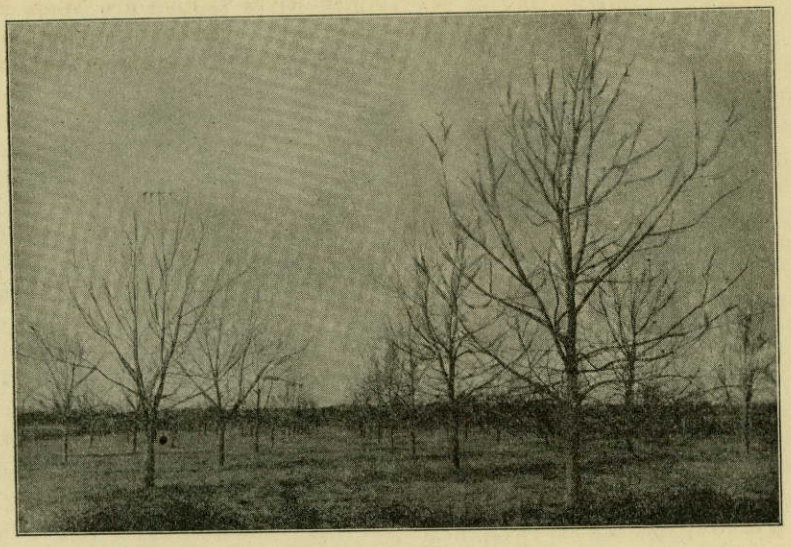


PLATE NO. 5.

Orchard 9 years from seed on post oak shinnery land, R. A. Bowden farm, May, Brown County, Texas. All these trees healthy and vigorous. Average circumference 22 inches.

be overcome. Where the soil is poor it may be built up with application of fertilizers, and the growing of legumes. Moisture may be supplied by irrigation, and air drainage will probably be naturally furnished because these soils are usually at higher elevations than the surrounding.

It has been observed that pecans are more prolific and regular in bearing on uplands than on the low, rich bottom lands where plant food and moisture are more abundant.

While the pecan is naturally a moisture loving plant, it will not succeed on wet soggy soils. The pecan is very tolerant of inundations from overflows. They have been known to have their roots covered with water from one to six weeks or longer by overflows and seem none the worse from the experience.

HOW TO SELECT A LOCATION FOR A PECAN ORCHARD WHERE PECANS ARE NOT NATIVE.

Native timber growth is usually a pretty good indication of the adaptability of a given soil for pecan growing. In the western and southwestern part of the State, the presence of vigorous growing pecan trees is an indication that the soil is adapted to pecan orcharding. In fact, wherever one finds the pecan the prevailing type of forest growth, it is safe to depend on that soil as good pecan land.

Wherever the prevailing timber consists of red elm, if the soil is of black waxy type, the indications are not so good. However, pecans can be made to grow and produce well on soils where the red elm is abundant if it be of a loose sandy texture and the subsoil is open and porous to such an extent as to permit ready underdrainage. In much of the Grand Prairie type where the elm grows abundantly pecan orcharding should be engaged in cautiously. None of the heavy black waxy soils are as well suited to pecan orcharding as the deep sandy loam. It is probable, however, that the Trinity bottom lands even where they are of the black waxy type of soil, can be made to produce pecans satisfactorily by adopting cultural methods that are suited to these soils. Cultural methods pertaining to the soils will be discussed under the heading of Cultural Requirements. The Grand Prairie section of the State, even along the streams, is not as well suited to pecan growing as is the deep alluvial sandy soils, and the planting of commercial orchards on these upland, waxy soils is not likely to prove successful. Many parts of the black waxy section of the State are underlayed with white rock sub-strata which prevents the root system of the pecans from penetrating them to any great depth, so that in times of drouth the trees suffer for lack of moisture.

Every home owner living in the Grand Prairie region should plant a few pecan trees about the yard and lots or in draws or on creek banks where there is waste land not suited to farm crops. People in towns and cities on these prairies should plant them for shade and ornament as well as for fruit. There are but very few places even in the black land prairie region where pecans cannot be made to succeed sufficiently to justify their planting in a small way.

The upland, sandy, clay soils that are well adapted to other horticultural crops are probably suited to pecan orcharding, provided the land is brought to a high state of fertility.

Any soil type that produces strong vigorous trees of oak, hickory or black walnut can be made to produce pecans. Where post oak is the prevailing forest growth, if they are small and scrubby, the soil is not likely to be so well suited to pecan orcharding. Such soils are drouthy and usually poor, not retaining a moisture supply nor fertility in sufficient abundance to grow pecans successfully. There is also to be found more or less "hard pan" in spots, even where the post oak grows strong and vigorous. These "hard pan" conditions

will have to be overcome before pecan growing can be made successful on such soils.

There are to be found also pecans that are behaving well on uplands and in valleys where the mesquite is the prevailing forest tree growth, though ordinarily mesquite land is not adapted to pecans. Broadly speaking, none of the uplands of the black waxy soil types should be used for commercial pecan growing. There may be one exception to this, however. There is a scope of country adjacent to Round Rock extending in a south and southwest direction including some of the higher hill and mountain lands surrounding Austin and extending as far south as Buda on the I. & G. N. Railway where pecans are found contending quite successfully with cedar, live oak, post oak, black jack and other native forest growth. Possibly commercial pecan orcharding could be carried on quite successfully on such upland soils. Just what cultural requirements would be necessary in order to grow pecans profitably on such soils would have to be determined by experimentation.

PLATE NO. 6.

Trees 29 years from seed, measuring 60 to 77 inches in circumference and healthy. On post-oak shinnery land three miles South of Rising Star, Texas.

BLACK WAXY SOILS.

The black waxy soils which are the prevailing soil type to be found throughout the Grand Prairie region have quite a few native pecan groves growing along the streams, and in some instances native pecan trees are found far removed from the river and creek bottom. At no place where I have made observations on this class of soil do they seem to be doing as well as where they are found on the sandy soil.

It has been the common observation for the past fifty years of farmers throughout the black waxy farming belt, that when native pecan groves have been brought under cultivation they soon begin to show signs of rebelling at the attempt to bring them under domestication. Many of the trees which seemed to be vigorous and growing and bearing nicely before, as soon as the forest floor has

been disturbed, begin to look puny and show signs of decay. Apparently such trees never become accustomed to their changed condition. It has been reported that certain trees that bore regular crops of pecans while standing in the native forests in these waxy soils have not borne a single crop for twenty-five years or more since being brought under cultivation. On this account many have concluded that "the pecan is a wild plant and that it will not respond to domestication."

The dying back of the tips of the limbs of the native trees that are brought under cultivation is due primarily to the fact that they have been growing in their native habitat for the past ages and have learned to contend quite successfully against their neighbors for room to grow and develop. In doing this, the pecan as well as the other forest plants have established a shallow root system near the surface of the soil. These conditions prevailing have been such that the pecan had to establish this shallow feeding root system because of the struggle to persist against its neighbors. Also it must do this in order to get plant food at all, for it was only the surface soil that received enough air and moisture combined to cause the bacterial action on the crude plant food to render it available. Then as soon as these natural conditions were changed, the feeding root system having been destroyed, the trees begin to become debilitated and lose their former robustness and vigor.

Then there is another change that takes place. When the tree is brought under cultivation, having abruptly lost its former neighbors which had helped it to keep the soil about its roots well shaded and covered with a dense mass of fallen and decayed leaves, it suddenly finds its neighbors gone, and the soil about its roots being deprived of their usual leaf mulch, the body of the tree that formerly depended on its forest neighbors to afford protection to its body against the direct rays of the sun and the drying winds succumbs to the changed conditions. In addition to the above, after these waxy soils are brought under cultivation, being exposed to the wind and sun, they soon begin to crack open, permitting these drying elements to come in direct contact with the numerous feeding roots that are to be found near the surface, causing the trees to suffer. No wonder that the pecan tree when thus treated, or rather mistreated, decides to "give up the ghost," because of such radical changed conditions.

Also it seems probable that when the rainfall or overflow comes on these black waxy soils, the surface becomes supersaturated and the soil swells and expands so as to prevent the moisture from sinking down to the subsoil. And when the drying of the surface again takes place, the surface cracks and permits the small feeding roots to be destroyed by this undue exposure. And, too, as moisture permeates the soil mass the expansion of the soil particles press together so compactly and densely that the soil air is retarded or completely excluded, which also causes the pecans to lose their vigor. This swelling and contracting of the soil keeps the fine hair

roots constantly disturbed and broken, thus destroying their function completely.

It has been suggested that deep plowing once a year in the winter and establishing a constant dust mulch throughout the growing period will cause pecan trees to succeed on such soils. This may be true. I am inclined to the opinion that some form of mulching with trash or hay will give the best results. A Johnson grass meadow where it is kept constantly mowed and the hay left on the ground seems to me might give good results. Or a system of clean cultivation, combined with an application of a thick covering of the surface with straw or other vegetable refuse would be suited to this class of soil.

It seems that where pecan growing is undertaken on the black waxy soil types, it will be necessary to adopt some cultural system that is radically different to the methods that are suited to the deep alluvial sandy soils. Liberal quantities of sand applied to the black waxy soils would probably be helpful in rendering them more friable and make them better suited to pecans.

EAST TEXAS SOILS.

East Texas is blessed with an abundance of rainfall and is a natural tree growing section. Wherever the red oak and hickory together with other species of oak grow vigorously it will probably be suited to pecan orcharding. Everyone owning homes in East Texas where the above native trees are the prevailing types can feel certain that they have soils that are well suited to pecans. There is, however, to be found certain species of upland hickory occupying a deep sandy soil, where it would not be advisable to plant pecan orchards of commercial proportions. Such soils are too drouthy and thin to justify the expense. If, however, such soils are suited to the ordinary farm crops and will naturally produce one-half bale of cotton or forty bushels of corn or more to the acre, such soils could be profitably used for pecan orcharding, in fact, pecan trees require three things: Moisture, drainage and plant food in a proper climate. Only soils which supply these requirements are suited to pecan orcharding. Where these East Texas soils have a red clay subsoil they will be found the best if the clay subsoils are sufficiently open so that the tree roots can easily penetrate them, since they never become sour or soggy, and hold their fertility from leaching away. Such soils are easy of improvement. Sour, wet, soggy soils where the willow, black gum and other such trees are the prevailing tree type, should never be used for pecan growing, unless they are first well drained. Any soil that naturally grows large, vigorous trees is always a strong one. Remember that the pecan is a deep rooted tree and should be grown on soils in which the roots can be supplied with these favorable conditions. Sections of the country where wells are 15 to 20 feet deep usually grow better trees than where the water is found at 25 to 100 feet depth, especially if there is no intervening impervious strata.

GRANITE SOILS FOR PECANS.

It has long been contended by many of our best informed pecan men that one of the necessary requirements for the successful growing of pecans was an abundance of lime in the soil. Whether or not this is true has not yet been verified. It may be true of varieties that have had their origin in soils that are highly impregnated with lime, but it will not hold good for all soils where pecans are to be found growing and behaving well naturally.

In portions of Llano, Mason and Burnet counties the writer has observed as fine specimens of thrifty pecan trees and groves growing and behaving as well in every way on soils that are entirely devoid of lime and succeeding equally as well as are the native trees and groves where it is known that the soils have been derived from the erosion of limestone .

On Reads creek in Llano county, also Black Fork and Dreary Hollow, small tributaries of the Little Llano River there are to be found native pecan trees that are as strong and vigorous as are to be found in West Texas. These small streams have their source and entire course from head to mouth, throughout, traversing only well defined igneous rock formation. Other streams in Burnet, Llano and Mason counties have similar soils. In Mason county, Comanche Creek, a small tributary of the Llano River, passes through the igneous formation for more than twenty miles and magnificient pecan trees and groves that are splendid specimens of the species are to be found. At Marble Falls in Burnet county much the same conditions prevail. The foregoing may be duplicated in several instances, but is enough to show that the pecan tree is not always dependent on lime in the soil for its health and vigor.

Most all of our Texas streams bearing pecans along their banks either have their course through the limestone formation or have their source in the same, so that the majority of our pecan producing streams are more or less impregnated with lime. Yet it is contended that lime is not a necessary element in good pecan soils. While it is probably true that all soils having their origin from the igneous granite formation are relatively poorer than soils that have had their origin from the lime and sand formations, the proof is lacking that pecan soils must necessarily have lime as a part of their make-up.

PLAINS SOILS FOR PECANS.

From minor observations made and reports reaching the writer he is inclined to encourage the experimental planting of pecans in certain parts of the Plains section. The writer has had occasion to visit and examine the soils along the upper reaches of the Red, Brazos and Colorado River draws, both above and below the Cap-rock, and he is decidedly of the opinion that there are many places and localities along these draws where pecans will succeed. It would be inadvisable, however, for one to undertake to plant large commercial or-

chards until experimental tests have proven that the investment would likely prove profitable.

Among the draws visited are Prairie Dog Fork, Tule Draws, Cat Fish, Pease River, The Wichita's, Duck Creek, Yellow House, Deep Creek and Double Mountain Fork. The soil and moisture conditions in many places where observations were made seemed to the writer to be well suited to pecan growing.

Near the head of Duck Creek in Dickens County there is to be found what appears to be a native pecan grove of some fifteen or twenty trees, estimated to be fifty to seventy-five years old. The trees were as healthy and vigorous as those found in the average native groves on the lower reaches of our pecan bearing streams.

A word of caution to those undertaking pecan planting in the above section. Unless you are prepared to give your pecan trees intensive care until they shall have become thoroughly established you should not undertake it, for your venture will likely prove disappointing.

There are a few pecans being planted experimentally in Scurry, Dickens, Garza, Lynn, Lubbock, Floyd, Swisher, Castro, Armstrong and other northwestern counties, and reports are rather encouraging where proper soil and moisture conditions exist and where intelligent care is given. Before undertaking to plant pecans commercially in any of these sections of the State you should investigate carefully the behavior of trees now growing in nearby localities and study the proposition and profit from the experience of others.

As to suitable varieties for this northwest section, it seems safest to recommend the selection of a variety that has its origin as far north and west as is possible to secure. Halbert which originated near Coleman, Texas and Burkett which originated near Putman in Callahan County might succeed better than varieties which had their origin farther east and south. Pecan seed grown in the San Angelo section or those grown in the central and northern part of Oklahoma may prove best for the Plains section of Texas.

If you are prepared to give pecans irrigation you should by all means plant a few trees. From Roswell, New Mexico and other portions of the west, come reports that pecans are behaving well under irrigation. (See "Irrigation for Pecan," page 25.)

SOIL PROBLEMS.

For the past several years, in passing over the State, numerous pecan trees purposely planted, sometimes in orchard form or only a few specimens, have been observed growing on all kinds of soils. In some instances the trees were found growing on soil types where the pecan does not grow naturally and seemed to be behaving in every way as well as if they had been planted on tested native pecan soil. At other places some of the trees seem to be doing well while others are not.

With a view of trying to determine why some soils grow strong vigorous pecan trees and others grow only rosetted blighted trees,

a soil survey was planned. Samples of soils were taken from 25 different sections of the State and 57 different premises, some from near healthy trees and some from near sickly trees. These samples were taken every six inches to a depth of eight feet. A careful study of these soil samples is now being made with a view of classifying them and if possible, learning what the difference is of the different soil types. It requires an immense amount of work to make these determinations but is it believed that when our studies and investigations are completed that we will be enabled to draw some definite conclusions and advise those interested in pecan orcharding more intelligently.

It is hoped that the findings can be reduced to such simple terms that the prospective planter may make his own investigations of the adaptability of his soil before planting. If we can do this we will be able to guide the planter in his selection of a pecan orchard site and thus make a good saving both to the citizen and the State.

ROSETTE.

Rosette is in my judgment caused from impoverishment or lack of proper nutrition. The mere fact of it being found on different soil types does not mitigate against this theory.

DIFFERENT KINDS OF ROOTS.

There are three kinds of roots to all pecan trees. The large brace and tap root system radiates in all directions, similar to the top or spray formation. Then the fiberous roots, which are much more numerous than the large brace roots, extend in all directions from these brace and lateral roots. The last and least in size but of equal importance arising from the many fiberous roots are myriads of hair roots.

The office of each of these kinds of roots are to a certain extent separate and distinct and yet are to a large extent dependent one on the other. The large brace roots are usually located within one to four feet of the surface of the soil and serve the purpose of affording anchorage to the tree and bracing it against storms as well as furnishing an abundance of stationary capillaries.

The fiberous roots serve the purpose of carrying the crude plant food to the large roots, and the hair roots serve the purpose of reaching out after the plant food in the soil which is held in solution, and conveys it to the fiberous roots. The fiberous roots convey it to the larger roots which in turn convey it to the stem or trunk of the tree where it is conveyed to the remotest parts of the tree.

If, from any cause, the hair roots cannot extend outward rapidly enough to secure the requisite amount of crude plant food, either because of the soil being too dry, wet, course, loose, fine, or hard, then the tree is not properly nourished, and rosette, and die-back is the result. Wherever and whenever these conditions exist we have rosette. If these conditions can be overcome by artifical means rosette can be cured.

There seem also some other factors that contribute to the development of rosette. It is believed that certain pecan seed will produce trees that are more tolerant to the untoward soil conditions which superinduce rosette and die-back than other seeds. It has been observed that of two pecan trees found growing in close proximity one may be affected with rosette and the other may be strong and vigorous. This can hardly be accounted for satisfactorily in

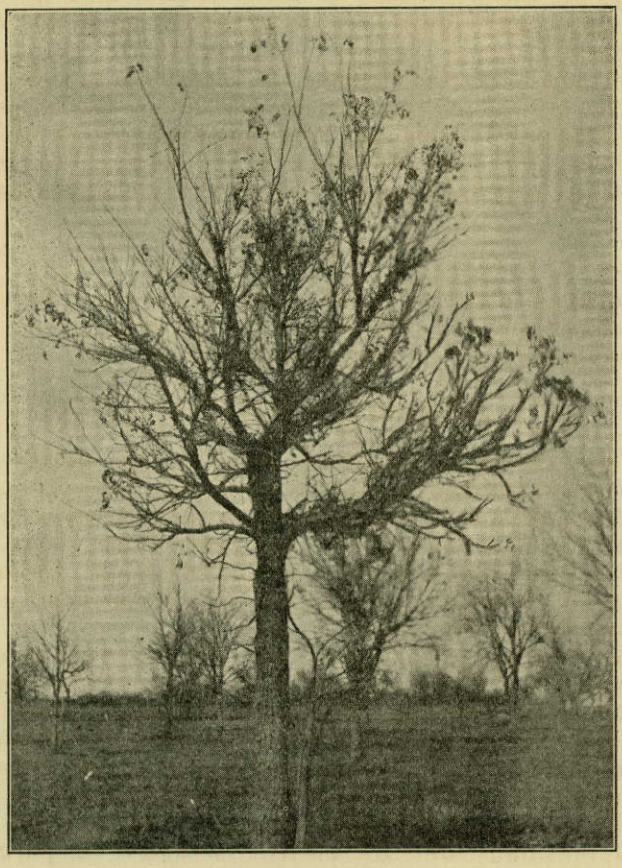


PLATE NO. 7.

Rosetted Pecan Tree. Capps Pecan Orchard.

any other way, except to attribute it to the difference in the vitality of the seed that produced the trees.

It has also been observed that where these conditions exists one tree may have a lateral surface root system and the other, the healthy tree, has a root system that extends downward. It is believed that this trait is also inherent in the seed from which the trees originated.

If a tree or trees originating from a variety of pecan that is inclined to develop right angled lateral roots, happens to be

brought under cultivation, the root system, being constantly disturbed by the plows, will develop rosette and die-back. If on the other hand the varieties that develop a deep penetrating root system be brought under cultivation the plows do not disturb the roots to the same extent because the roots lie below the reach of the plow.

As before stated, the roots of the pecan are divided into three classes, the hair roots, fiberous roots and the large woody roots; while the top has the stem and trunk, the branches and twigs, and the leaves. The roots, trunk, limb and leaves are the prime essential organs of the tree. At the extremities of the roots are to be found the hair roots whose function it is to take in the plant food from the soil, and at the extreme ends of the branches are the leaves whose function it is to elaborate the crude plant food taken up by the hair roots and change it into plant food. In performing this the leaves through the influence of the sun and air change the plant food elements taken up by the roots into sap cells and send it downward to the branches, stems and roots in order that each may continue to grow and enlarge their usefulness one to the other. If the soil and moisture conditions happen to be unsuited to the needs of the hair root system, the tree develops rosette or die-back.

CULTIVATING ORCHARDS AND GROVES.

Cultural requirements relative to pecan orcharding are yet to be worked out in Texas. Enough is known, however, to justify the statement that pecans are as amendable to intelligent care and cultivation as any other horticultural crop. The cultural methods suited to one given soil and section of the State doubtless would differ from that of a different soil and section. Take for instance the heavy black soils found along the upper reaches of the Trinity River. The methods that would give good results there would not in all probability be applicable to the alluvial sandy soils of the Brazos and Colorado River bottoms or the sandy clay upland soils of the Cross Timbers Section or in the East Texas Timber Belt. The black waxy soils in order to grow pecans successfully in orchard form need to be managed in a manner that would keep the soil from cracking open and exposing the roots of the trees to the drying effects of the wind and sun. This is the main reason why, when native forests are brought under cultivation on such soils that have native pecan groves, the trees usually begin to succumb to these changed conditions. Probably such soils would produce pecans more satisfactorily if the undesirable timber was removed and the vegetation kept mowed, rather than the soil plowed, and used to grow other crops. In their native habitat there is a constant mulch of leaves, weeds, grass, etc., on the forest floor and the roots of the native pecan trees are established near the surface. If the grove is brought under cultivation, this natural condition is abruptly changed.

In the sandy, alluvial soils, such as are found on the Colorado, Brazos and other streams the trees' roots are not so easily disturbed

when brought under cultivation, nor do the roots of the trees form so near the surface as in the stiffer, heavier soils. Such soils are decidedly better for pecan orcharding than are the black waxy soil types.

IRRIGATION FOR PECANS.

Some of the most vigorous and prolific pecans to be found in Texas are where the soil is brought under irrigation. There have been no records kept on this phase of pecan growing in Texas, with reference to the amount of water necessary to pecan orcharding, yet enough is known to justify the statement that pecans will respond to intelligent irrigation. It is probable that almost any of our Texas soil can be made to produce pecans profitably under irrigation. It should be understood, however, that where one undertakes to grow pecans under irrigation a regular and constant supply of moisture about the roots of the trees, commensurate with the trees' requirements, must be given or pecan growing under irrigation will prove a disappointment. The amount of water to supply the deficiency of rainfall will have to be determined by trial. Some soils would need more water than others. No one can tell beforehand how much water per acre it would be necessary to supply in the absence of actual test. On some soils and in some parts of the State the application of water through the winter season would probably be sufficient. On other soils and in other parts of the State it would probably be necessary to apply water during the growing period in addition to winter irrigation. One thing seems certain, if pecans are to develop normally there must be an adequate supply of moisture about the roots of the trees throughout the early period of growth continuing, say up to the first of August. By that time the fruit will have attained its full size and the foliage on the trees its full development so that the fruit will mature in the absence of further irrigation. Where irrigation has to be depended on entirely it would probably be advisable to make an application of water in August or September in addition to earlier watering. The above is merely suggestive, for, as stated before, there is nothing actually known as to the volume of water that is required for successful pecan growing.

The following quotation is taken from Mr. R. A. Harris, Riverside, California, who has had wide experience in horticultural pursuits in West Texas, Arizona, New Mexico and California, where orcharding is usually carried on under irrigation.

In Texas there is but very little recorded data on the subject of irrigation for pecan and the writer submits this excerpt from Mr. Harris in order that those interested in this phase of pecan growing may have the benefit of Mr. Harris' experience and observations.

The writer is convinced that where one has plenty of water available for irrigation it will be found profitable to apply it to pecans during drouth periods.

Irrigation.

"The pecan tree, to do its best, must have ample moisture at the root. I do not know of any other tree that can use so much water profitably as the pecan. I have made the statement in other publications, that the quantity of moisture a tree can profitably use is the measure of its capacity for production. Soil food must be in complete solution before the tree can use it and the more moisture the tree can profitably handle the more food goes into the tree, and the more food the greater the production.

"This is the reason that ideally located pecan trees have produced a ton of nuts in a single crop, worth as much, measured in calories for human food as 3½ tons of the best beef steak. Do you know of any other living thing that can in a single year do this? The production of perfect nuts and maximum yields depends upon the moisture available at certain periods of their development, taking it for granted that your soil has good drainage; not an open sandy subsoil, but a soil that will in a few days drain off an over abundance of surplus moisture. Many of our clay subsoils will do this and will prevent the soil food from being leached away.

"Our normal rainfall here is about 10 inches, which almost all comes in the winter months. If we have had during these late fall and winter months as much as 8 inches, I do not irrigate until about March 1st, but if our rainfall has been much below our average amount, about February 1st, I irrigate in quantity enough or more to bring the moisture in the soil up to or somewhat more than it would have been if the rainfall had been normal. I have used at this time with good results, as high as 10 acre inches. One miners inch of water running 50 hours, will give close to one acre inch, or the reverse; 50 miners inches running one hour will give one acre inch. I have run 50 inches two days on 5 acres, which gives a little less than 10 acre inches, if all could be put into the land without any loss from run off, which of course cannot be done. But I have very little run off; not over 10 per cent. My method of getting so much moisture into the ground I will give later on.

Blooming Period.

"The second irrigation depends upon when the first one was given, but is usually about six weeks later than the first one. If the first one was about March 1st, the second should be given about April 15th. This irrigation is only 5 acre inches and comes a little before the staminate bloom starts to put out, which here is from the 15th of April to 5th of May. This irrigation provides the tree with ample moisture to carry and perfect the bloom and to push the leaf growth to sufficient length to put out a good pistillate bloom, which forms after the terminal shoots have grown from *six inches* to a *foot* in length and follows the staminate bloom ten days to two weeks or more. It is important to have ample moisture preceding the staminate bloom to furnish and perfect the pollen so it matures at the time the pistillate bloom is ready to receive it. This irriga-

tion also comes at a favorable time to push the terminal twig growth that the pistillate bloom springs from and is far enough in advance of this latter bloom that there is not an excess of moisture at this time, which if there were too much moisture might push off a proportion and lesson the crop.

"The weather here in late April and early May is generally cool; mean average 60 to 65 degrees. The pistillate bloom develops slowly and is receptive to pollen for a period of 10 days to two weeks. This is very favorable for a heavy set of nuts as the weather at this time is quite dry and pollen can be blown during almost all this time, insuring almost a full fertilization of the pistillate bloom.

"I have been very particular to make this as plain as I can as this is the starting of the crop, and large crops depend upon well timed irrigations.

Developing Size and Plumpness.

"The next period the nut is developing in size. This can only occur while the shell is soft. After the shell hardens the nut will not grow any larger and lack of moisture during this period will cause the shell to harden earlier and stop size growth of the nut. The time the nut is getting size here is from the 10th of May to almost if not quite to the last of September. Some years if we do not have our average summer heat, it may extend to September 15th. So the next irrigation should come about five weeks after the second, or the 20th to the 25th of May. This and following irrigations are the same amount; 5 acre inches. June here is usually quite hot; mean temperature about 71 degrees with some days apt to go as high as 110 to 114. Moisture is transpired by the tree very rapidly at these high temperatures and it would not be safe to have irrigations too far apart. And supposing the last one was May 25th; the next one would probably be better to come by June 20th; same amount as last one. July and August are also as hot or hotter than June, so time irrigations accordingly; say July 15th and August 10th. This last irrigation should complete the growth in size of the nut and the shell by September become quite hard. But we cannot lessen our irrigation, as the next period the nut is perfecting the kernel, especially in plumpness, and must have ample moisture. So on Sptember 1st to 5th give a like irrigation, and on October 1st to 5th another. By this time the kernel should be plump and well developed.

Final Period.

"The next period the nut is toneing up (developing quality). This period is the only one that does not require abundant moisture and six weeks should ordinarily be allowed from previous irrigations; say about November 15th, same amount of irrigation. This is the last irrigation and is very important as it causes the husks to crack open, letting the nut fall of its own weight to the ground. Also this irrigation coming after the nut has matured or nearly so, the tree turns its efforts to maturing strong buds for the growth of tree and crop for next year and must have sufficient moisture to do this. If best crops

and finest nuts are to be had the tree must be kept functioning properly during all these periods. If at any period moisture is neglected this will affect the particular development of that period. Lack of proper pollenization, which lessens the crop; lack of maximum size, owing to the tree not having plenty of moisture at some time of this period; lack of plump kernels or only partially filled shells because moisture was short during some of this period; lack of quality because moisture was not regulated nicely during this time, and lastly, hulls sticking to the nut, causing many to be of second quality because there was not ample sap flow in the tree from lack of moisture to cause them to break open and release the nut. Also poorly matured buds for next year's crop. All these or some of them may happen just because the tree needed a drink at certain times and failed to get it until the damage was done. It will be noted if the number of irrigations I give my trees is computed that the amount of water that is used per year is from 50 to 60 acre inches. This amount, if timed properly, should be sufficient in most soils.

Study Your Conditions.

"Every orchardist should have a soil auger that he may know moisture conditions at all times and the nut orchards need one most of all and a longer one. It should be able to reach at least 8 feet in the soil and 10 feet is better. All soils differ. Also seasons vary. So no set rule based upon one type of soil or season can be applied to every other soil or season. Use the soil auger often and cut a nut in half a few times and by careful attention and a little judgment you can learn your own conditions and requirements.

Applying the Water.

"The method of spreading the water is not of so much importance as getting it deep into the ground. Some of the lighter soils will allow the water to penetrate deeply from its own weight in a short time and generally speaking will loose its moisture in a relatively short period. As stated before, my soil, especially from the third to fourth foot, is a rather heavy clay. Above and below for a great depth it is a good sandy loam. The problem with this soil is to get the water quickly below the fourth foot. The clay strata that stops the penetration might be broken up with a subsoil plow to this depth, but would quickly be packed together by the clay setting back in its former place. Blasting would no doubt act in the same way, so some other method that would keep this passage constantly open to quick penetration had to be devised. I have accomplished this by the use of a 4-inch soil auger. When I plant the tree I bore a hole directly under where the tree is to stand. Through this clay strata, I refill this hole with the best top soil containing a good proportion of leaf mould or finely pulverized barnyard manure. If I use manure, I am careful to not fill so the tree roots will touch it for a considerable time after it commences growth. The next irrigation after the tree is planted I bore two more holes where the furrow will come and fill them the same as first hole was filled. These two holes are about 18

inches from the tree. Later I bore other holes, but always farther from the tree. In this way I quickly get the water to considerable depth and have very little run off. Yes, it is considerable work, but if one wants a valuable orchard he must expect to work. And if he is not willing to give his trees the care they need he had better never start. I can bore and fill from ten to fifteen holes an hour to a depth of four feet. Fifteen holes would probably be sufficient for a tree ten years old, and the difference in the crop of one tree at this age from one that had only ordinary care would pay for boring 500 to 1,000 such holes. There would probably be a difference every year for the life of the tree, and the age a pecan tree will live and produce heavy crops has not been determined, but undoubtedly is for severel hundred years."

Relative to growing pecans under irrigation, the following quotations are made from 'Pomological Possibilities in Texas,' by the late Gilbert Onderdonk (who has been called "the Father of Southwestern Horticulture"), printed in Bulletin No. 18, by the State Department of Agriculture, Chapter 12, pages 45, 46 and 47:

"There are places in abundance where natural water conditions do not exist, and yet where pecan culture is successfully conducted because water is artificially supplied from irrigation ditches. We may safely say that a water supply would make pecan growing possible on almost any piece of land. All pecan culture found by the writer in Mexico, is pursued under such artificial conditions. When the question was asked about the frequency of water application to the trees, the uniform reply was 'every fourteen days.' "

At Bustamente, one hundred and seven miles beyond Laredo, are pecan trees two hundred years old that have been watered all of their lives and have continued productive. From those trees grown from Texas pecans, pecan culture has been extended until there are now thousands of thrifty pecan trees at Bustamente under irrigation. One owner of a small lot sold his water right when his trees were about seventy-five years old, and when the writer visited his grounds fourteen years later, every one of his pecan trees were either dead or dying. The Bustamente trees are in a very black heavy soil, only from three to four feet in depth, underlaid in solid rock. Such success on shallow soil surprised the writer, as we all know that our Texas pecan trees are noted for the enormous depth to which they send their lower roots. Here in Texas the pecan roots go down deep to get the water. In case of the Bustamente trees they have the water brought to them, instead. We found many pecan groves in Mexico doing well in situations very different from their natural habitation in Texas, but they are doing well because they are supplied with water. If the water conditions are complied with, the pecan may be grown and be made productive anywhere in Texas.

The question has been asked whether there is any way to make pecan trees become annual bearers. I think the subject may properly be introduced in this chapter, and the writer hopes that our people will make a test, under our conditions, of the principle illustrated below.

In a small park in Saltillo, Mexico, is a large pecan tree, probably

one hundred and fifty years of age. Information from nearby residents, shows that this tree produces fruit every year. On three sides of that tree at a distance of perhaps fifty feet from the tree, are irrigation ditches. The soil is a loose loam. The water from these ditches so far saturated the soil around that tree that its surface roots had a contsant moderate degree of moisture. Was that constant moderate supply of water the cause of an annual instead of triennial production?

Again, while the writer was among the Tlascalan Indians he observed a lot of pecan trees on an abrupt mountain side, from which was a light continual drop of water—not enough to flow a stream—but enough to maintain continual soil moisture. Those Indians told me that these trees produced a crop every year.

Again, at Guadalajara, on the Pacific side of Central Mexico, I was told by a reliable person that at Atoyac, some seventy-five or a hundred miles southward—latitude twenty—there were pecan trees that produced every year, and that he obtained his annual supply of nuts from those trees.

I went to Atoyac to investigate the conditions surrounding these trees. I found the grove consisting of a considerable number of trees. They were about sixty-five years old. They stood about sixty feet apart. There were ditches leading from a very old tannery across the flat on which the trees stood. These ditches carried the wash water from the tannery to an orange and lemon grove and other tropical fruits. The entire surface soil was moderately moist and never became dry; and those trees produce a crop of pecans every year.

Is not the presentation of facts in the above three cases sufficient intimation of our own Texas possibilities in any locality where the same conditions can be maintained?''

PLANTING ORCHARDS.

Preparation of the soil for an orchard should be thorough; this is especially advisable where the orchard is of commercial proportions. It goes without argument that no soil can receive as good preparation after the crop is planted as it can before. Planting pecan trees in poorly prepared soil is poor economy. One had better take a year or two, or even five years, getting ready in preparing the land rather than planting the trees in poorly prepared soil, or unsuitable soil conditions that can be remedied by properly preparing it beforehand.

If the land is covered with timber, it should be cleared away and the soil cultivated for a year or more before planting the trees. Corn planted in wide rows, with each alternate row planted to cow peas is a good crop to grow to prepare the ground for the trees. On the land that has been cultivated for some years, it is a good plan to apply barnyard, or other vegetable manure a year in advance where the trees are to stand. Deep and thorough breaking with fertilizer applied will be a profitable investment. The average soils of Texas cannot be made too rich for the growing of a profit-

able pecan orchard. THOROUGH, DEEP PREPARATION with an abundance of humas will increase the moisture holding capacity of the soil. Ten to fifteen inches deep breaking will be time well spent. Take time to thoroughly prepare the pecan orchard site. The above is intended to apply to soils where pecans are not native.

Purchasing Pecan Trees.

Pecan trees should be set in the early winter and one should place his order early so as to get good thrifty trees. It is advisable to have your plans made a year in advance and your trees bought before the time to plant them in the field. It is a mistake to delay buying your trees until time for setting arrives. If one is planting a small commercial orchard there should be but two or three varieties used. In a five or ten acre orchard two or four varieties are enough. The object should be to grow as few varieties as possible, even if one is planting twenty to forty acres. Ten varieties on twenty acres of land will give a crop of mixed nuts, whereas, if there are only two or three varieties the crop will be more uniform in size, shape, color, cracking quality, etc. Buy few varieties rather than many.

Buy trees from some reliable nurseryman that has a reputation for fair dealing. If the nursery man grows his own trees on his own ground, the chances are better for the purchaser to get the varieties he wants.

There are six important factors that enter into successful pecan orcharding: good land, thorough preparation, good trees, good cultivation, the right varieties and the man behind the job. The last is probably more than 50% of the important factors, which if present will almost insure success.

The cost of caring for poor trees is the same as for good ones. Do not hesitate to pay a good price for good trees; they will prove cheaper in the long run. Pecan trees are usually graded: 1-2 feet grade, 2-3 feet grade, 3-4 feet grade, 4-5 feet grade, etc., on up to seven and eight feet. The smaller grades are usually one to three year tops on two to four year old roots; the larger sizes, six feet and upwards, are sometimes two or more years older. The difference in the sizes of these trees is caused by the difference in age, size and vigor of stocks used, on which the scions were set; the vigor of the scions, the variety used and the cultural care given the stocks and trees. The greatest difference, however, is the inherent vigor of stock and scions. The most desirable of the above grades of trees, price and results to be had considered, are the larger and more vigorous trees. The smaller trees usually show undesirable inherent qualities. The older and larger trees require more care in digging, handling and setting than younger and smaller trees. It is believed, however, that two to five year old roots with one to two year old tops, other qualities being equal, give a better chance of success.

Cost of Nursery Trees.

At the present time nurserymen charge fifty (50c) cents to three ($3.00) dollars or more a tree in small quantities, and these prices are considerably reduced in lots of one hundred (100) to one thousand (1000) trees.

Directions for Planting.

NOTE: The following directions for planting are given by Mr. Charles L. Edwards, a veteran pecan grower of Dallas, Texas, and are inserted here for the benefit of the readers of this book.

For your convenience I am sending you my method of transplanting pecan trees that has been satisfactory in my own work. To make this brief, let me say that it is a good plan to wet the bundle of trees thoroughly on arrival. Have holes dug before opening bundle; the hole should be at least three feet across and two and a half feet deep. In digging the holes, it is well to throw the top soil on one side of the hole and the subsoil on another side. Take one tree at a time from the bundle, leaving the roots of the other tree covered, for the roots will not bear exposure to air or sunshine. On taking trees from the bundle, first trim off all bruised or broken roots with a sharp knife, cutting from below outward and not from above downward. Let the tree set two to four inches deeper than it grew before digging. In filling the hole, first put in the more fertile top-soil around the roots, straightening them out as the dirt is filled in. When the roots are covered with topsoil, then put in the subsoil, all of it, mounding up around the stem of the tree. In filling the hole no packing is necessary; settle the soil with water. When the tree is planted, cut back the top, leaving six to eight buds above the point of union of the bud shoot with the stock. There is always a crook at the point of union; this will disappear as the tree grows. In windy regions the hump of this crook should be turned to the south to prevent the tree becoming top-heavy on the north side. When growth starts, allow nothing to remain on the stem below the crook, but rub off such growth as soon as it appears. And let everything that comes out on the bud-shoot remain for two or three years; if you want a straight tree in a windy country, it ought to head low; when headed on tall stems, the trees bend northward under pressure of southerly winds in this country and not unfrequently snap off. It is usually better to put fertilizer on top of the ground around the tree; very few people can be trusted to mix manure with the soil in planting the tree. Not one hired man in a thousand can be trusted to set out pecan trees, except under the eye of the master; and that eye will be needed at all times during growth of the trees. Cultivate well.

How Far Apart. L

The distance apart to set trees or the number to set per acre should be governed by the variety to be planted, the climate where planted, the quality of the ground, the moisture and the individu-

ality of the owner. Some varieties have a habit of growing upright, others broad and spreading.

On good rich, deep, moist, transported alluvial, natural pecan soils the trees should probably be as few as five to ten per acre. On thin upland soils, probably twenty to twenty-five trees per acre would be best. Anyone at all familiar with nature's processes can readily understand that individual trees compete with each other at the roots for plant food and moisture and at the top for sunlight and air. In the higher altitudes where strong winds prevail and all tree growth is affected—dwarfed by the wind and dry arid conditions—the trees should be planted closer than in the eastern humid belt on deep rich soil where trees naturally grow luxuriantly. The owner can prune and cultivate so as to dwarf his trees so as to make them more compact and capable of producing large quantities of nuts and growing closer together or he may prune so as to make them grow tall and possibly fruit sparingly. (Really there is not much known in regard to pruning). Pecan orchards may be planted anywhere from thirty-five feet to seventy or eighty feet, or in extreme cases one hundred feet when they attain their maturity. It will require a long term of years of painstaking investigations to determine the proper distance to plant pecans. The opinion has recently been expressed by some that twenty-five to forty feet apart will be more profitable in pecan orcharding in Texas than greater distances.

When and How to Plant.

The best time to plant is in the early winter, as soon as the trees have lost their foliage. December, January and February are good planting months; under exceptional circumstances, pecans may be planted as late as March or first of April with fairly good results. Late planting, however, is to be discouraged. Observation leads to the conclusion that much of the indifferent results in pecan planting in the past are chargeable to carelessness of the workman in digging and packing the trees preparatory to delivering to the planter, and the exposure of the trees to the wind and sun by either the nurseryman or the planter, or by both. If the root system of the pecan is unduly exposed, to the extent that the roots dry out, no amount of after care can overcome the damage caused by this inexcusable carelessness and indifference. Exposing the root system of the pecan, even for as short a time as five minutes, may injure its vitality, or kill it outright.

Digging the Hole and Planting the Tree.

Presupposing that the tree has been properly grown, dug and delivered to the planter in good condition, the next important step is to preserve the vitality of the tree while it is being set. As soon as the trees have been received from the nursery, the bundle should be opened up and the trees heeled in or covered with wet hay, straw or sawdust. In transferring the trees to the field a good plan is to

prepare a barrel of water and clay mixed so as to make an adhesive mass called puddling the roots. Place a few trees in the puddling barrel and let them remain until ready to set in the hole.

When trees are to be set on other than alluvial native pecan soil, there should be made an excavation for the tree at least two and one-half feet wide, (but three and one-half feet would be better) and three to four feet deep. Throw out the surface soil on one side, and the subsoil on the other. If the subsoil is at all of an impervious nature, it would be a good plan to take a post hole digger and make a hole in the center of the excavation two or three feet deeper, going down through the impervious subsoil strata. The excavation should be filled with a good quality of topsoil sufficiently deep to permit the lower end of the roots to rest on the bottom. Then the hole should be filled full of water and allowed to soak away.

Set the tree in the center of the hole and fill in around the roots with good moist topsoil. Do not let any manure or fertilizer come in contact with the roots. The foregoing applies especially to all soils where the pecan is not indigenous, or to soils that have an impervious soil or subsoil near the surface. If the soil should be a deep alluvial sandy transported soil where the pecan grows well naturally then so large an excavation is not necessary, and a whole sufficiently large to permit the planting of the tree with its roots in natural position is all that is necessary. After the tree is set in place, the soil should be gradually filled in, and the tree made firm by tramping or ramming the soil around it. Be sure to avoid bruising of the roots. A good plan to settle the soil around the tree is to flood the soil around the tree with water, and as the soil becomes saturated, slightly shake the tree sideways, up and down, so as to allow the soil to settle around the roots. After the tree is set and the soil is settled around the tree, the trench formed should be filled in with the topsoil and it raked into a fine silt. This condition should be maintained throughout the season of the first year. A month or two later water should be applied in a trench a foot or more from tree in sufficient volume to thoroughly saturate the surrounding soil as deep as the roots of the tree. After the water soaks away and while the surface is still wet, dry earth, thoroughly pulverized, should be applied to prevent evaporation. The first season is the critical period in the life of the transplanted tree. In yards or places where cultivation cannot be given, a mulch of straw hay or old sacks filled with leaves or straw, and placed about the tree will prevent the rapid evaporation of the moisture and will also have a tendency to keep the ground around the roots of the tree protected from the sun and wind.

When you plant a pecan tree, remember that you are not only planting for your own benefit, but also to bless the generations that are to follow; that you are planting to transmit to posterity a living monument to your memory long years after you have "shuffled off this mortal coil," and that you cannot bestow too much care in giving it a good start.

If you are not situated so as to give all the care and attention that

is necessary to carry your tree through the first two years of its infancy, it is advisable that you do not undertake the growing of pecan trees, but leave this work to others who are more favorably situated, and who are disposed to harbor the thought that posterity is entitled to some consideration, and that those who have planted, nurtured and bequeathed to them such an annually recurring blessing, certainly had a thought for their future welfare and happiness.

It is not an advantage to you or to the nurseryman who grew the tree, or to the development of the pecan industry, to buy a pecan tree, go to the trouble of setting it, and then permit it to perish for lack of care. Patriotic nurserymen prefer not to sell their trees to one who is going to neglect them, and such neglect will certainly not stimulate the development of the pecan industry in Texas.

As soon as you have set your tree and the soil becomes firm around it the top should be cut back severely, and the wounds covered with some good pruning compound. There are numerous compounds which may be used for this purpose. The paint manufacturing companies put out a splendid product for this purpose. Ordinary grafting wax is also good. Melted paraffin serves admirably, and may be applied with a small paint brush while hot. Grafting wax for such use is sometimes made as follows: Two parts beeswax and one part rosin, melt together and stir. After it is melted remove from the fire and add a small proportion of linseed oil to soften and keep the mass pliable.

DESTROYING THE TAPROOT.

There has been so much discussion and confusion in recent years relative to cutting the taproot of the pecan that a few observations seem necessary.

It has been asserted that the practice of growing pecan trees in nurseries, budding and transplanting to the orchard is unnatural, devitalizing and pernicious; that a pecan tree, grown in the nursery, dug and transplanted will not make as strong and vigorous tree, as will a seedling, the seed of which is planted where the tree is to remain permanently. It is also contended that one may transplant a nursery grown tree and at the same time plant a seed and that the tree resulting from the seed will make a stronger and more vigorous tree than a nursery grown tree.

As to the first statement that the practice of digging and transplanting the tree is unnatural, I will remark that none of the ordinary horticultural practices are natural. The setting of buds and grafts is as unnatural as is transplanting trees. Breaking ground, digging holes, top-working native forest trees, subduing underbrush, thinning out pecan timber so as to give the remaining trees more space, etc., are all as unnatural as the transplanting of pecan trees. If the value of the process is to be judged on the mere basis of the unnaturalness of transplanting trees and is to be condemned on that ground, then civilization as we now know it should be condemned almost in toto. It is unnatural to build houses, clear farms, cultivate crops, improve seed, build railroads, ride on trains, use

automobiles, or to do thousands of things which civilized man does daily.

Is the Transplanting of Pecan Trees a Devitalizing Process?

Is it actually true that severing the taproot of the pecan and transferring it to another location so weakens its inherent vitality that it is unprofitable? The only way to arrive at the correctness of this statement is to test it out and determine the actual results. Your attention is called to Plate No. 8. At (a) is a pecan tree four years old when budded. It was dug and reset at five years old, one year after budding. The "X" shows the point of union between

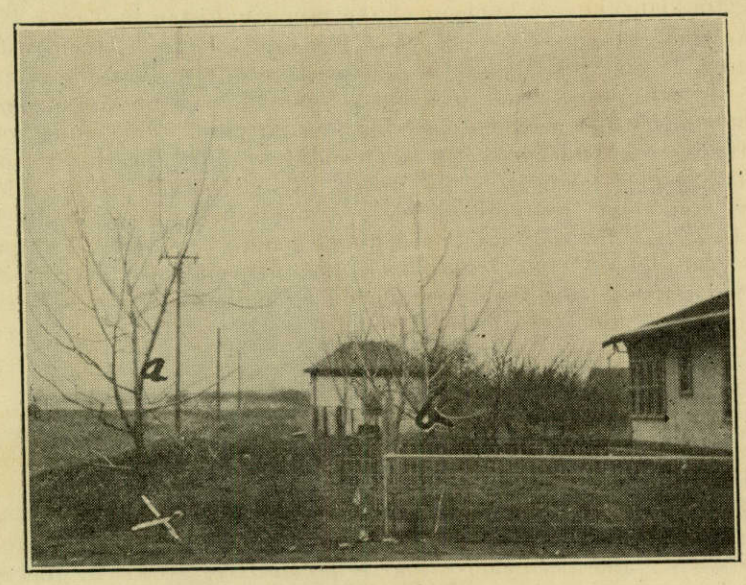


PLATE NO. 8.

NOTE: This view shows the comparative behavior of a nursery grown tree at (a) and one grown from seed at (b).

stock and scion. This tree has grown three years since it was transplanted. It measures at the ground 14½ inches in circumference, three feet from the ground, 13 inches in circumference; and is 15 feet tall with 11 foot spread; began bearing second season from transplanting.

At (b) is shown a tree which grew from seed that was planted and was two years old at the time the tree at (a) was set near it. This tree at (b) was budded when two years old, or the same season that the transplanted tree was set. It measures 10½ inches at the ground and 8½ inches three feet from the ground, and is 12 feet tall with 8 foot spread. The body of this tree is hid by the yard fence. The tree at (a) has borne its first crop this season, 1922. This one case can be duplicated in hundreds of instances as any observing horticulturist will verify. But if this was the only in-

stance known, it proves conclusively that the practice of growing pecan trees in nursery rows and budding or grafting them there and then transplanting is *not always* a devitalizing process.

Because most of the pecan trees grown in nurseries in the past have failed to grow, or if they have grown, have failed to make satisfactory growth, does not prove that the practice is necessarily a devitalizing process. The illustration shown in Plate 8, at (a) and (b) verifies the contention that just as strong and vigorous trees

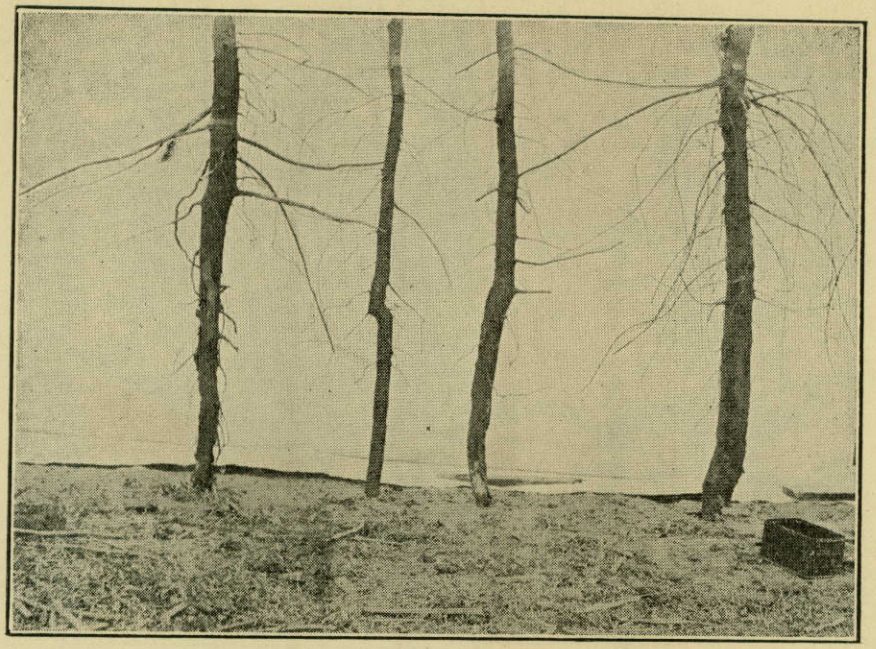


PLATE NO. 9.

NOTE: Plate No. 9 shows the normal development of the taproot system when grown from planted seed. Notice where the taproot has been severed.

may be grown from nursery grown transplanted trees as if they were grown from seed planted where the trees are to remain permanently. Again, any observant, experienced horticulturist knows that the transplanting of trees, plants and shrubs is an advantageous process. It causes trees to multiply their lateral root system, and also induces them to bear younger than if they had never been transplanted. The writer knows of a certain pecan tree that the owner took up and transplanted three times, and at the age of five years from the seed, it stood seven feet tall and bore a few nuts. Not many seedling trees that have remained where the nuts were planted have done that well.

CUTTING THE TAPROOT—PERNICIOUS?

But most of the confusion arising relative to the growing of pecan tree in nurseries centers around the practice of cutting the taproot. The observation here recorded with reference to the prac-

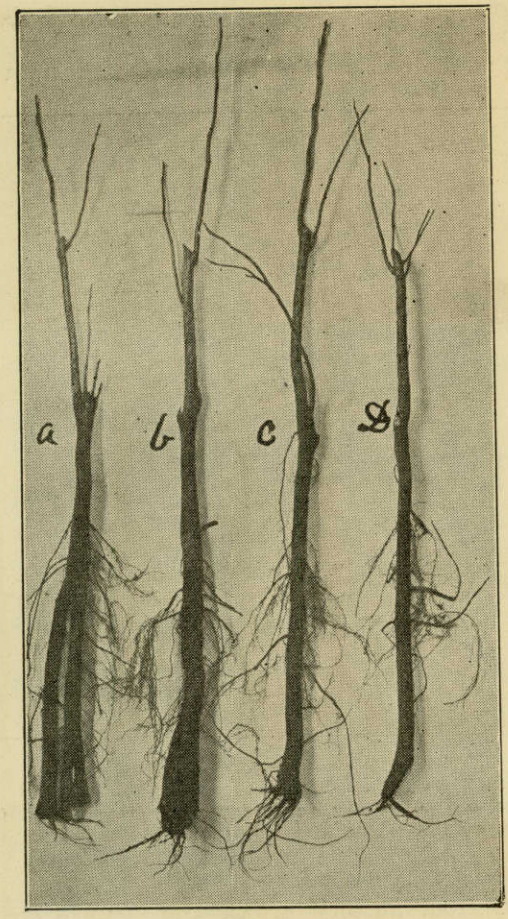


PLATE NO. 10.

NOTE: This plate shows the development of the root system after the taproot had been cut and the trees having grown one season after transplanting.

tice of transplanting pecan trees being contrary to nature, as is contended by some as being unnatural and devitalizing, answers in part the affirmations of the above objections, on the part of those opposing the general practice of nurserymen and horticulturists.

In order to arrive at a correct conclusion as to the actual facts with respect to nature's processes, the following experiment was planned, and has been under way for four years. In 1919 several seedling pecan trees were dug up in the nursery rows and reset

the same season on the same character of ground, but in different rows.

Plate No. 9 shows the development of the root system at the time they were first dug. Plate No. 10 shows the development of the root system after one season's growth. Note the tendency of these

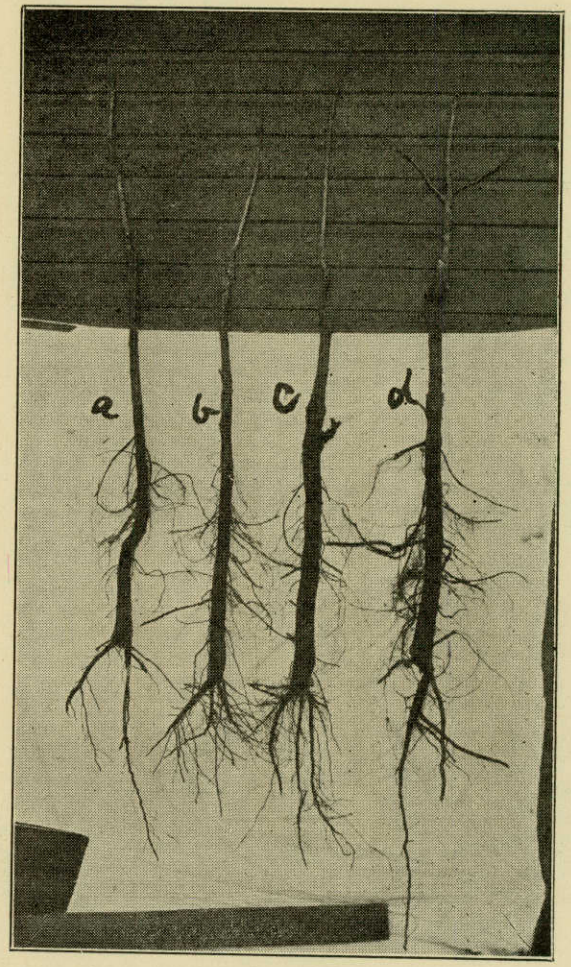


PLATE NO. 11.

NOTE: Showing the development of the taproot system after the seedlings had been growing two seasons from resetting. Compare Plate No. 9 with Plates Nos. 9, 10, 12, and 13.

trees to force out roots at the extreme lower end where the taproot was cut. Plate No. 11 shows the development of the root system after the trees have been reset and grown two years. The trees at (a) and (d), Plate 11, each shows a new taproot going straight down together with an additional semi-taproot, (b) has four semi-taproots, while (c) has three well defined taproots in course of development.

These photographs show what nature does when the taproot is cut and the tree is reset. It becomes evident that nature knows how to grow another taproot as well as it does to grow a new top. Whenever any plant is brought under domestication the processes applied are all unnatural. The severing of the taproot is no exception.

PLATE NO. 12.

NOTE: Plate No. 12 shows the development of the root system after transplanted and grown for three seasons.

The assertions that the growing of pecan trees or other fruit trees in nursery rows and transplanting them to other grounds are unnatural and therefore devitalizing are mere assumptions without anything to prove them.

Having observed the planting of pecan trees for the past ten years, I am becoming more and more convinced that the carelessness of workmen in digging, handling and caring for pecan trees is responsible for the death of most of those that have failed to grow.

Nurserymen need to see that their pecan trees are carefully dug and handled before sending them out to the planter. And the planter needs to understand that pecan trees have roots that normally possess greater amounts of moisture and stored up plant-food than any other horticultural subject with which he has to deal; and that this large spongy root system has to be kept protected from the drying effects of the wind and sun. If this is properly done

PLATE NO. 13.

NOTE: Plate No. 13 shows the development of the root system after transplanting and grown for four seasons. Note the robust development of the tap root system after having been grown four years from transplanting. Also observe the almost complete healing of the wounds made in digging four years before.

there need be no uneasiness felt as to the results in transplanting and growing successfully the pecan tree.

I have known pecan trees to remain dormant for one entire year before starting in to growth after having been transplanted. I have also occasionally seen a pecan tree that was carefully dug, transplanted and cared for afterwards that succumbed to the operation. But this is the exception and not the rule. Why an occasional tree dies, I do not know. Nor why it is that occasionally a

stout, robust, vigorous man will die even from the loss of a finger, I do not know. The transplanting of the pecan tree is an unnatural process, but it is not necessarily a devitalizing one, nor is it a pernicious practice. All that anyone has to do to grow good, strong, vigorous pecan trees by using nursery stocks, is to learn the required conditions necessary and put them in practice and he will succeed. Naturally, pecan trees want to grow, and most of them will recover from cutting the taproot if given intelligent care.

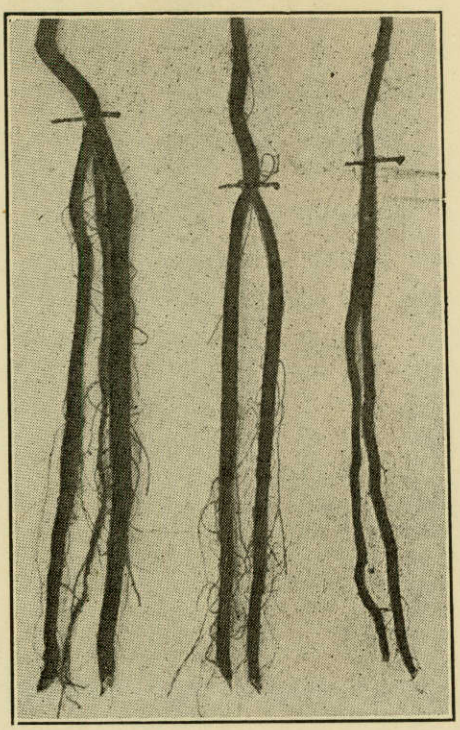


PLATE NO. 14.

NOTE: These small seedlings were dug and photographed in April after the sprouts had grown one season from the planting of the sprouted seed. The place where the root was severed is indicated. One has three taproots, the other two have two taproots each.

Plate No. 14. shows three small year old seedlings that had the lower part of the root destroyed at the time the seed was planted in nursery rows. The radicle was three inches long at the time they were planted and the taproot pinched back about half of their length. Instead of cutting the taproot being detrimental to the growth of these seedlings, the reverse is true. They not only reestablished a new taproot system but they made two or three taproots instead of one, which nature ordinarily grows when the taproot has been permitted to develop normally. Not only is this true but the year old seedlings that had the lower part of their taproot destroyed or cut back have made much stronger growth above the

ground than those that were planted with their entire root undisturbed. The above photograph was made of the Old Mexico seedlings on April 1st, 1922, in order to discover to what extent the cutting of the taproot would retard the growth of the seedling.

(See discussion of Mexico seedlings in tables 1, 2 and 3, Pages 47 and 48.)

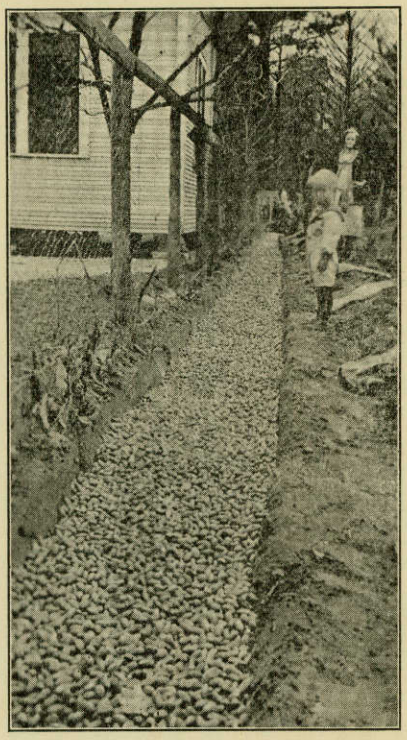


PLATE NO. 15.

One way to stratify pecan seed nuts. This view furnished by R. L. Odom, Toledo, Texas.

DIFFERENT METHODS OF ESTABLISHING A PECAN ORCHARD: SEED NUTS vs. NURSERY GROWN STOCK.

It must be borne in mind that seedlings almost never possess the characteristics of the parent tree, and that the trees obtained by planting seed nuts scarcely ever bear as large or as desirable nuts as the parent tree. Therefore, in planting seed nuts it must be expected that the tree obtained will have to be budded or grafted to one of the desirable varieties, the nuts being planted merely to obtain stock for this budding or grafting.

From the standpoint of expense it is possible that planting seed will be best, as this method involves less cash outlay than planting nursery grown trees, and it is sometimes satisfactory to establish an orchard by planting the seed where the trees are to grow per-

manently. However, the seedlings require so much care and such intensive cultivation that if one is not prepared to give this care it is best not to undertake it. Which will prove the least expensive in the long run will depend upon the man behind the project.

If pecan seed are to be planted it is advisable to put the soil in first class condition. The nuts should be put into a box of wet sand in layers of alternate sand and nuts, having the layer of sand about two inches deep between the nuts. They should be kept thus until they begin to sprout and then planted in orchard rows, either where the trees are to stand permanently, or in nursery rows wherever it is most convenient with a view of transplanting them later. The early spring is the best time to plant. Frequently planters report that they have planted pecan seed several seasons and have never been able to get them to come up; others report that after the seed nuts germinate and the shoots appear above the surface they soon perish. It must be remembered that the seed require moisture to get them to germinate, and that the young plants require the best of soil and care after they start growing.

It requires from two to four years for the young seedlings to become large enough to bud. If one is not experienced in budding and grafting the pecan, it will require two or three years to get all of them budded. In other words, when one undertakes to grow a pecan orchard by planting seed nuts it should be understood that it will require from four to seven years to get all of the trees developed with new tops. In growing an orchard by planting the seed where the trees are to stand permanently there is another feature that should not be overlooked. Seedlings each have their own individuality, some grow rapidly, while others grow tardily. It happens, therefore, that one hardly ever gets an orchard of uniform size and vigor by planting the seed and budding them later. On the other hand nursery grown trees of the same age and size are separated into uniform grades when dug by the nurserymen and one can get a more uniform result by setting nursery grown trees. It is also found in actual nursery practice that the buds set do not develop into growth uniformly, so this may be a contributing cause of lack of uniformity in developing an orchard by the seed planting method. Then again not all of the buds set at one time unite with the stocks at once, so that it will take from one to four years to get all of the trees successfully budded. This will also cause an orchard planted by the seed method to be irregular in size and height as well as in vigor and growth.

In undertaking to establish an orchard by setting nursery grown trees, it is probable that the same results could be had in from two to four years. But the first cost of the trees is very much more than the expense of planting the seed. However, when the cost of planting and nursing the seedlings from two to four years and of budding them and giving them skilled care in forcing out the buds and re-establishing the tops is considered, it may be found that it is about as expensive to establish an orchard by planting seed as it is to plant nursery grown trees at the start. Nursery grown trees cost from fifty

cents to three dollars each, depending on the size and age of the tree used.

BEST TIME TO TRANSPLANT TREES.

The late fall and early winter is usually considered the best time for transplanting trees—after they have shed their leaves. I have however, been quite successful in planting them as late as April.

Opinion varies as to what age trees it is best to plant. Some contend that the three year old trees transplant better than the older trees. However, the older trees would come into bearing earlier, and many will prefer to plant 5 to 6 year old trees. The younger trees are usually recommended because of lesser expense and trouble in setting. I have frequently seen trees four to six inches in diameter successfully transplanted. In speaking of the age of trees here, I refer to the age of the root stocks. With a budded tree, a two year old top on a four or five year old root is a good selection.

SELECTING SEED FOR STOCKS.

That some seed nuts are superior to others for the growing of stocks goes without argument. It has long been asserted that large nuts that are well matured produce better stocks than small ones. In order to determine whether this is true or not, an experiment was planned and seed of different sizes and from different sections of the country were stratified in December, 1920. Forest seed was secured from Old Mexico, Fort Clark, Uvalde, Bend, Texas and from Louisiana. These were carefully graded separating them into three or four different sizes, except the Bend pecan, which were all from one tree. The different sizes were weighed and samples of each separate lot were taken and preserved.

Each separate lot was planted separately. The following table shows how many different separate groups of forest seedlings and named varieties were used in the experimental planting. The four different sizes of Old Mexico seedlings averaged 8.3 inches in height, whereas the nuts for all the Mexico groups averaged 167 to the pound.

The Louisiana nuts were plump, well filled and the shells comparatively thin. They gave about 38 to 40 per cent of meat when cracked, releasing the kernel freely.

Of the named varieties only Burkett of the West Texas sorts was used. None of the others were available on account of the frost that destroyed most of the 1920 crop. The following named varieties grown extensively in Georgia, Florida, Mississippi and Alabama were planted in two pound lots; Moore, Waukena, Stuart, Russell, Frotscher, Teche and Success from Florida; Success, Schley, Curtis and Money Maker from Georgia.

These were all stratified and planted out in the field at the same time. All were given the same cultivation. One surprise that came early in the experiment was that when the time came to plant them out in the field the Old Mexico nuts were all sprouted, some of the roots being three inches long. The Louisiana nuts showed no signs

of germination and did not begin to show up above the ground until June. Table 2 shows the development of the different lots of nuts after completing two seasons growth.

At the time the foregoing project was planned and entered into by the writer the results were prejudged in favor of the larger seed nuts. The opinion had become firmly fixed that the large well developed nuts either of seedlings or of the named varieties would produce superior nursery stocks in point of thriftiness and rapidity of growth than would the smaller sized inferior forest seedlings. In fact, the writer had come to the conclusion that nurserymen were following the wrong practice in using small cheap inferior forest seed for nursery purposes if they could secure the large well developed nuts of the named sorts even at greater increased figures. The prime object was to prove that the small cheap seed would produce dwarfy inferior stocks and that orchardists were entitled to the better class of trees that could be produced by the use of the larger seed; and if it could be shown that the larger nuts were superior to the small ones that the nurserymen would use them, which if it could be proven would open up an increased demand for the larger nuts for seed stock purposes.

In addition to this I felt sure after examining the quality of the various forest nuts that the Louisiana nuts would certainly produce a better class of nursery stocks than would the small Mexico nuts. The Louisiana nuts were plump, well matured and the shells were comparatively thin, while the Mexico nuts were hard, thick shelled, and many of them very poorly filled. The nuts from Uvalde and Fort Clark were not much better. Some of them running as small as 210 to the pound. (See table 1 below.)

A very surprising feature appearing early in the experiment was that at the time the nuts were removed from the stratifying beds the old Mexico nuts all showed sprouts of an inch or more in length while the Louisiana nuts showed no signs of germination.

The tables speak for themselves. In arriving at the average height of the trees as given in the tables there was an average of forty trees counted and measured, in making the count and measurements average parts of the rows were selected so as to have the results as nearly correct as possible. In some of the different lots there were but few nuts in the lot, for instance, where the Mexico seed weighing 78 per pound there was only about forty nuts used because of the scarcity of them to be found when the nuts were graded. Also the first lot of Burketts where only twenty of them came from a certain tree was planted. Also the Moore from Florida and Pabst from Georgia but few nuts were planted because of the fact that the package had been pilfered in transit so that the entire two pounds was not planted.

CONCLUSION.

The effort has been made to get fair and impartial results. Whether or not the same results would be duplicated in other sections and on different soils remains to be seen. While the re-

sults as tabulated are not conclusive, the indications are that some seed is decidedly superior for nursery seed stock purposes than others. It is also clearly indicated that some small inferior seed pecans are superior to the large named varieties when grown in a wet humid climate and planted in a semi-arid climate. The indications also point to the importance of using seed having their origin in a droughty section if the resultant trees are to be set in a dry section.

There is one very noticeable feature appearing in this experiment; the old Mexico trees with very few exceptions begin active growth from seven to fifteen days in advance of the Louisiana seedlings and continued in full active foliage two or three weeks later in the fall. Neither are they as sensitive to hot dry weather conditions in the summer as are the Louisiana trees.

The old Mexico trees and those also from Uvalde seem to be much more tolerant of unsuitable soil conditions.

It seems also that nurserymen are not only justifiable in using inferior cheap seed, especially if they are grown in extreme southwest; but the writer is inclined to encourage them to do so, especially if the trees grown are intended for planting in the arid or semi-arid part of the pecan belt.

TABLE NO. 1.

Name of Varieties.	Where Grown.	Number of Nuts Per Pound.	Percent Germination at Time of Planting.	Average Growth First Year.
Burkett	Clyde, Texas	50	Show signs of germination	7.1 in.
Mexico Seedlings	Old Mexico	210	75%	7.7 in.
Mexico Seedlings	Old Mexico	78	50%	9.8 in.
Mexico Seedlings	Old Mexico	110	50%	8.4 in.
Bend	Bend, Texas	70	10%	6.4 in.
McCullum	Clyde, Texas	65	5%	5.5 in.
Louisiana	Louisiana	165	none	5.7 in.
Mexico	Old Mexico	202	50%	8.7 in.
Uvalde	Uvalde, Texas	112	75%	6.9 in.
Louisiana	Louisiana	145	none	5.5 in.
Uvalde	Uvalde, Texas	165	90%	6.0 in.
Moore	Florida		10%	5.7 in.
Waukena Seedlings	Florida	71	75%	7.5 in.
Stuart Seedlings	Florida	55	0%	6.5 in.
Russell Seedlings	Florida	57	0%	4.6 in.
Frotscher Seedlings	Florida	50	25%	5.6 in.
Tesche Seedlings	Florida	67	50%	5.5 in.
Success Seedlings	Florida	54	2%	7.1 in.
Uvalde Seedlings	Uvalde, Texas	220	50%	6.6 in.
Uvalde	Uvalde, Texas	60	75%	6.0 in.
Fort Clark Seedlings	Fort Clark, Texas	110	50%	4.9 in.
Stuart	Georgia	60	0%	6.1 in.
Pabst	Georgia		2%	6.4 in.
Delmas	Georgia	52	0%	5.4 in.
Success	Georgia	50	50%	5.5 in.
Schley	Georgia	59	50%	5.1 in.
Curtis	Georgia	89	50%	6.6 in.
Money Maker	Georgia	71	10%	8.0 in.

TABLE NO. 2.

Result of Second-Year Experimental Seed Planting, 1922.

Name of Varieties.	Where Grown.	Number of Nuts Per Pound.	Average Growth Second Year.
Burkett	Clyde, Texas	50	19 in.
Mexico Seedlings	Old Mexico	210	22 7/20 in.
Mexico Seedlings	Old Mexico	78	18 5/8 in.
Mexico Seedlings	Old Mexico	110	19 in.
Bend Seedings	Bend, Texas	80	18 5/8 in.
McCullum Seedlings	Clyde, Texas	65	19 5/8 in.
Louisiana Seedlings	Louisiana	165	9 1/2 in.
Mexico Seedlings	Old Mexico	202	
Uvalde Seedlings	Uvalde, Texas	112	20 1/4 in.
Louisiana Seedlings	Louisiana	145	12 7/8 in.
Uvalde Seedlings	Uvalde, Texas	112	17 9/10 in.
Moore	Florida	76	11 2/8 in.
Waukena	Florida	71	14 1/2 in.
Stuart	Florida	55	10 3/4 in.
Russell	Florida	57	8 3/4 in.
Frotscher	Florida	50	9 1/3 in.
Tesche	Florida	67	12 in.
Success	Florida	54	14 2/5 in.
Uvalde Seedlings	Uvalde, Texas	220	16 in.
Uvalde Seedlings	Uvalde, Texas	60	18 2/3 in.
Fort Clark Seedlings	Fort Clark, Texas	110	12 in.
Stuart	Georgia	60	9 in.
Pabst	Georgia	52	15 in.
Delmas	Georgia	52	15 1/2 in.
Success	Georgia	50	13 in.
Schley	Georgia	59	16 in.
Curtis	Georgia	89	18 in.
Money Maker	Georgia	71	7 3/4 in.

TABLE NO. 3.

Average Growth of Experimental Seed Planting.

Kind of Seed.	Third Year Number Nuts.	Average Heigth.	Highest.
Mexico, 110 per lb.	210	41.3 in.	57 in.
Burkett, No. 5	50	36.6 in.	40 in.
Mexico, 78 per lb.	78	41.3 in.	63 in.
Mexico, Rows 6 and 7	110	43.8 in.	80 in.
Seedlings from Bend	70	37.5 in.	67 in.
Seedlings from McCullum	65	36.5 in.	64 in.
Louisiana	165	20.6 in.	40 in.
Mexico, 202 per lb.	202	47.6 in.	76 in.
Uvalde	112	41.2 in.	76 in.
Louisiana	145	26.3 in.	35 in.
Uvalde	165	28.2 in.	56 in.
Moore, from Florida		18.8 in.	28 in.
Waukena, from Florida	71	22.4 in.	37 in.
Stuart from Florida	55	17.7 in.	28 in.
Russell, from Florida	57	13.5 in.	20 in.
Frotscher, from Florida	50	13.1 in.	22 in.
Tesche, from Florida	67	20.5 in.	56 in.
Success, from Florida	54	26.7 in.	42 in.
Burkett	50	43.8 in.	62 in.
Uvalde, 200	220	28.0 in.	57 in.
Uvalde, 60	60	28.3 in.	51 in.
Fort Clark	110	28.4 in.	50 in.
Stuart, from Georgia	60	22.9 in.	39 in.
Pabst, from Georgia		23.8 in.	39 in.
Delmas, from Georgia	52	15.8 in.	27 in.
Success, from Georgia	50	19.0 in.	33 in.
Schley, from Georgia	59	19.5 in.	39 in.
Curtis, from Georgia	89	24.0 in.	51 in.
Moore, from Georgia	71	19.0 in.	44 in.

It is worthy of note that the average nuts grown in Old Mexico were hard, thick shelled and brittle, releasing their meats with difficulty. These nuts produced about 27 to 33⅓ per cent meat, and rarely could one be found that could be taken out in halves.

PLANTING SEED.

Where one desires to develop an orchard by planting the seed it is a good practice, early in the winter, to stratify the seed in sand or soil. The reason for this is that if the seed are planted early the seed nuts will absorb and hold moisture for a long period, and many of the weak and imperfect specimens will succumb to the rigors of the winter, leaving only the stronger seed to produce seedlings.

To Stratify the Nuts.

This may be done by taking a box or other container of suitable size and burying its entire depth out in the open. Place a layer of sand in the bottom of the box about two inches deep. On this spread out an inch or two of nuts. Then spread layers of sand and nuts alternately. Fill within two or three inches of the top and cover with sand two or four inches deep. Keep the mass moist throughout the winter.

In the early spring, February or March, the nuts will begin to show signs of germinating, when they should be taken up and planted either where they are to stand permanently or in nursery rows.

If the object is to grow an orchard by planting the seed where the trees are to remain permanently, it is advisable to plant five to seven nuts, and after they have grown for one or two years, all except one, the most vigorous, should be treated as weeds. These seedlings may be budded or grafted in from two to four years from the time of planting the seed.

EVERY CITIZEN URGED TO PLANT PECANS.

Efforts Being Made to Revive Spirit of Governor Hogg in Texas.

CHARLES L. EDWARDS.

By Permission of Publishers of Farm and Ranch.

The men and women who are now selecting the best pecan nuts they can find for planting, or sending for catalogues of nurserymen, are laying foundations for constructive work—work that will live after them. Like the pioneers who have demonstrated not what can be done, but what has been done, some of them will be discouraged by local wiseacres, snubbed by snobs and belittled by big business. This may be expected by planters who make beginnings in any locality. For all this, new planters in new places, as the years pass, will be staying on the job and gaining in confidence with sucessive

seasons. Success has come to others and it will come to them. Finally, doubting neighbors will see the point and confess error for the pecan is a tree of knowledge, "good for food, pleasant to the eyes, a tree to be desired to make one wise," and its fruit not forbidden except to such as are unwilling to work and wait a few years. And not many of these have as much as a peach or a pear tree. This proposition may be easily tested. When one hears a citizen complaining of the long time necessary for pecan trees to bear, it is easy to ask him how his peach trees are doing; and in almost every instance, the answer will be that he hasn't any.

Gov. Hogg's Desired Monument.

Some seventeen years ago James Stephen Hogg, one of the great Governors of Texas, passed to his reward. It is related of him that a short time previously, he expressed a wish that no monument be erected to his memory, but that a pecan tree be planted at the head and a walnut tree at the foot of his grave; that the nuts from them be given out among the plain people of the State so that they could plant them and make Texas a land of trees. Thinking people everywhere were impressed with the grandeur of the thought and the press of the country gave it publicity far and wide. Broad-minded editors of leading daily newspapers and magazines appreciated the wisdom and feasability of it, declaring the utterance to be that of a great publicist, understanding a law of nature, and a capable adviser of his people. This man had begun life in a humble sphere, had worked, waited and won—reaching the highest honors within the gift of his State. A constructive worker he was, too. Noting the rapacity of a great commercial corporation, the arrogance of certain railroad managements and their disregard of the rights of the people, he favored stringent anti-trust statutes for curbing the greed of the one and a railroad commission restraining the tyranny of the other. Strenuous resistance met the latter demand, many leading men and newspapers considering it a dangerous innovation. It was something new; no other State had a railroad commission; why should Texas venture upon an untried experiment? In all this, James Stephen Hogg as Governor of the State fought without cessation until the Legislature gave him what he wanted. It was not long before the law-making bodies of other States took notice; they recognized that the State of Texas, under leadership of its Governor, had taken a step in progressive legislation. In due season, these other States began to fall into line until every American commonwealth, forty-eight of them in all, had its railroad commission, representing all told more than a hundred million people. It's only a strong man that can head such a following in the course of a few years. So it was that his request for a pecan tree and a walnut as memorials arrested attention of press and people, as the vision of a far-seeing man; practical, sensible, within the means of every dweller in a home willing to plant a nut and grow a tree. Think of what it will mean to Texas when this splendid idea is carried out. And it will be carried out. It is one of those ideas that will live a

hundred years and it is safe to predict that a century hence, Texas will be "a land of trees"—the pecan in the lead—and like Saul among the sons of Israel, a head and shoulders above them all. The pecan growers of today are laying foundations for just this thing; those who are joining with us and the younger generations who shall follow after us will see to it.

Plan Made Inoperative by Vandals.

At the time of the Governor's death a few forwarding looking men, scattered here and there over the State, had organized themselves into a working body, called the Texas Nut-Growers' Asso-

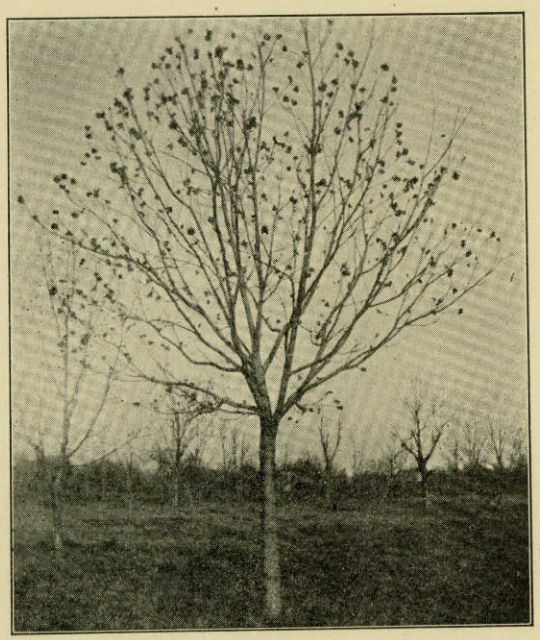


PLATE NO. 16.

Delmas tree 8 years from bud crop, 25 pounds. Pecandale Farm, Denison, Texas. Courtesy of Mrs. John Kemper.

ciation. They were wrestling already with the problems of producing the better sorts of pecans in their several localities. In numbers they were few, hardly exceeding the fingers of the two hands, but they caught the spirit of the Governor's historic request and Edward Knox, their president, at once sent to the Hogg family two pecan trees, a Stuart and a Russell, also a walnut. The trees were committed to the care of F. T. Ramsey, one of the early god-fathers of the pecan industry, for transplanting. He did the work well and at a subsequent meeting of the association was able to announce that the trees had entered upon promising growth. Thereupon, Mr. Ramsey was made their honorary guardian for life. Three years from transplanting came the first showing of nuts and both trees have

made good bearing records ever since; but it must be said with feelings of sorrow and reluctance, only a very few of the nuts have reached the "plain people of Texas." Regularly as the seasons come, trespassers with unhallowed footsteps invade the cemetery, steal the nuts before they have matured and actually maltreat the trees in the act of despoiling them. Think of it! Instead of going forth on the high mission intended for them, the nuts from these almost sacred trees are subjected to utter degradation in the maws of unprincipled marauders. No sentinel less violent than Argus, the sleepless watch-dog of ancient myth, could protect the trees against vandals who respect neither grave, grave-yard or the honored dead. The very thought is enough to bring the blush of shame to the cheek of a savage.

Catching the Hogg Spirit.

Two years ago when there was a general failure of the pecan crop all over Texas, the prowling brotherhood overlooked these trees. The National Nut-Growers' Association held its annual meeting at Austin in the fall of that year and the members visited the tomb of the dead Governor. They had heard long ago of his famous request and were desirous of paying their merited tribute of respect. Of the visiting membership, not a few came from States of the North and West; and when, to our pleasant surprise, a few nuts were found on the trees, it was interesting to witness these outside visitors gathering them, one nut each as far as they went, for planting at their homes. They had caught the Hogg spirit. As a befitting conclusion of the visit, C. A. Reed of the United States Department of Agriculture, lined us up and took the photograph that is here reproduced. It will be noticed that there are a few women in the gathering; some of them attend all of our meetings, coming long distances. When a woman takes an interest in pecan culture, we have an associate of unflagging faith and untiring effort. The pecan trees—Russell on the right and Stuart on the left—show up well in the picture. The walnut, immediately in front of the monument, has made but little growth. The pecan trees were well chosen, when it is borne in mind that the early pioneers had but little experience with the finer varieties at the time they were planted. The Russell is considered one of the very best for the lower altitudes, where the seasons are longer, the winters less severe and the rainfall more abundant than in the up-country. The Stuart is decidedly more hardy and successfully withstood the winters as far north as Connecticut, though not fruiting in the short seasons of that latitude.

Continued spoliation of the fruitage of those pecan trees has caused the nut-growers of Texas to do some hard thinking. It is next to impossible to maintain a guardianship over trees in a cemetery that will ward off the attacks of watchful depredators; and it is unthinkable that we should permit the vision of our wise and great fellow-citizen to fade into nothingness. Texas must be made "a land of trees"—trees of knowledge—even as that in the Garden of Eden, but without penalty for the enjoyment of its fruit. So upon lay-

ing their heads together, progressive pecan men have decided that since tree raiders do not take the branches when stealing the nuts, we must try to make use of the buds and in that way assist the "plain people" in planting pecan trees. We have nurserymen and horticulturists whose minds are receptive to progressive ideas and it is being urged upon these to secure scions from the Hogg memorial trees and propagate from them; and when such trees are sold, allow just one tree to one patron at the same price that other trees of like sizes are sold, at the same time enjoining the patron to give nuts of it to any one wanting them to plant. Such a course cannot be fairly criticized as commercializing a noble sentiment, but should rather be commended as a rational and practical means of extending distribution of nuts and growing trees. In the meantime, individual horticulturists not engaged in the growing of trees as a business can have them on their home grounds and give out either nuts or scions as enlightened and patriotic friends may wish—all bred from those memorial trees.

Opportunity for Service.

Every lover of pecan trees within the confines of this great State owes it as a duty to himself, to our citizenship and to the memory of the dead governor to carry out his wishes with a stronger hand and on a broader plan in the face of the difficulty that has developed. It is nothing less than the proper thing to show to the country that we are not to be baffled by shameless raiders. Citizens of our southern and eastern sections, where the seasons are milder and more equable, may secure scions of the Russell and those north and west from the Stuart without risk of having to rebud undesirable sorts. In all this, we may remember that the man we are seeking to honor never balked when confronted with difficulty, but went up against it with redoubled energy. In this connection it may not be amiss to say that for persistent effort and the spirit of tenacity in the face of disappointment, the pecan growers of Texas stand not far from the head of the class. With this in mind, the prediction may be safely ventured that ten years hence thousands of homesteads in this commonwealth will have pecan trees bred from the Stuart or Russell at the grave of Jim Hogg and that every owner of them will be proud of his possession. No tree of the same age is equal in appearance to a well-tended pecan five years old and upward. On reaching twelve to fifteen years and a height of twenty-five to thirty feet, there is a real majesty in them; and as their shapely tops bow and sway before our breezes, the man who can look upon them without feelings of admiration is made of cold clay.

Those who have pecan trees and have eaten of their fruit know more than they did when the trees were planted, for the pecan is really and truly a tree of knowledge.

SHAPING PECAN TREES.

Courtesy of Farm and Ranch.

BY O. S. GRAY.

Secretary, Texas Pecan Growers Association.

The proper shaping of a young pecan tree has a very important bearing upon the future tree; upon its ability to withstand storms and to stand up under the strain and heavy crops and upon the ease and economy with which the tree may be sprayed for protection against insects and disease, and even upon the economy of harvesting the nuts.

Pecan orchardists, from the man with one tree in his dooryard to

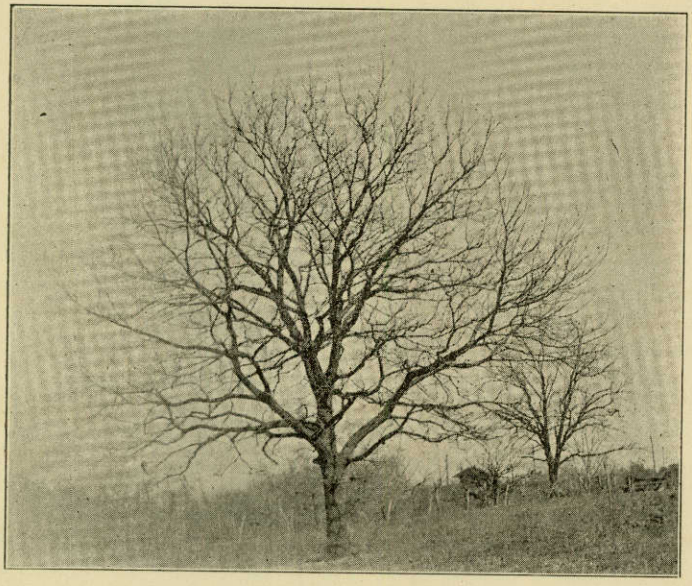


FIG. 1.

Mature modified leader tree showing wonderful symetry and strength. It has a spread of sixty feet and is not too high for convenient spraying.

the orchardist with a thousand acres or more, are concerned with the proper pruning and shaping of pecan trees.

The pruning and training of fruit trees, especially of the peach, is generally understood by a great many people, and when we realize that more profitable pruning methods of the peach are just being developed after years of experience and observation we do not wonder that so little attention has been given to this phase of orcharding—pecan growing.

The pecan industry is new; most of its problems are still unsolved, and I do not recall having seen a single article or bulletin dealing extensively with the proper pruning methods to use for the shaping

of young pecan trees. There is enough information available, however, to enable us to bring to the attention of pecan growers many of the advantages and disadvantages of some of the various types of trees as applied to the pecan. Many of our conclusions are drawn from a similar though older industry found in walnut growing where growers have had several years of experience. The walnut tree is very similar to and a kinsman of the pecan tree.

Central Leader Type.

When a pecan tree is allowed to grow without pruning, it usually normally develops an upright, pyramidal tree with a distinct central

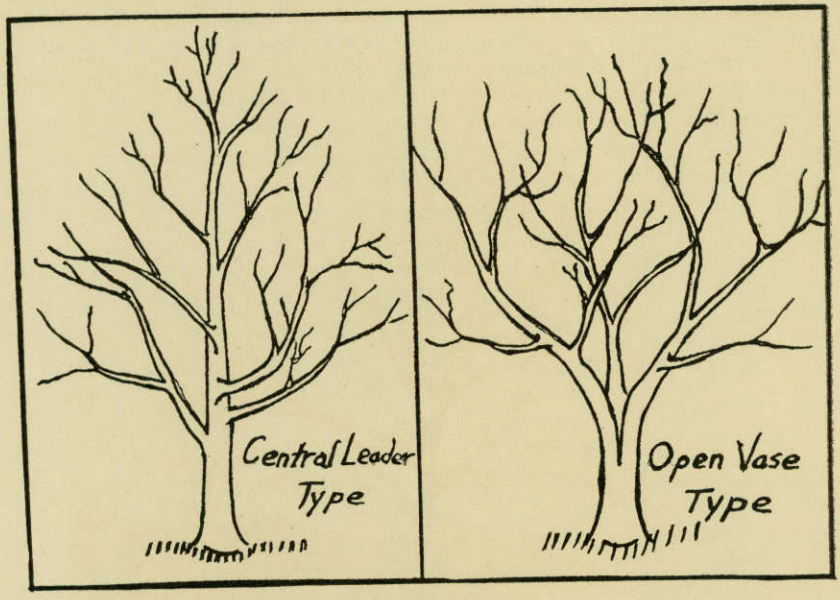


FIG. 2 and 3.

In case of injury (including pruning) to the terminal bud or the central leader, oftentimes the lower lateral buds get a vigorous start, take all the strength of the tree and as a result the central leader is starved out. This usually results in a distinct type of tree, best explained by the illustration, known as the open vase or "V" type. This type is usually recommended for peach trees.

stem or central leader, as shown in the illustration. It is likely that most native trees would have this shape, generally speaking, had they developed unhindered with no injury to its terminal bud. Pine and sycamore trees usually furnish unmistakable examples of trees of the central leader type.

In transplanting a pecan tree it is a safe rule to follow to cut back the top in proportion to the amount of root cut off and left behind in digging the tree. This operation, of course, removes the terminal bud, but as a rule the upper lateral bud forms an upright limb and de velops into a leader.

Advantages and Disadvantages.

Both types of trees have their advocates. The principal advantage of the central leader type is the great strength of this type of framework that enables the tree to withstand severe storms and to bear up enormous weights. With the open vase tree, especially in extreme types where the tree branches from almost the same point, it is not uncommon to see one-third or one-half the tree split off. If this form or tree is used, the branching should most assuredly be spread over eighteen to twenty-four inches of trunk to avoid bad crotches as much as possible. Expensive bracing with iron rods and chains is usually necessary on a large scale in orchards where this type prevails.

The pyramidal or central leader type develops into a much taller tree than the open vase type and presents more difficulty in spraying and harvesting. One great advantage that the orchard owner should enjoy over the wild grove owner should be that he can develop his bearing surface much closer to the ground where they are more accessible. It is not uncommon to find native pecan trees in the forests of Texas where it is forty and fifty feet from the ground to the first limb, and for this reason spraying for insect control is out of the question, unless somebody develops a balloon or airplane sprayer.

Advocates of the open vase type claim a greater bearing surface, and while this may be true with the peach where it is the recognized standard and where annual pruning keeps the topmost limbs within easy reach of a person standing on the ground, it is a very difficult point for anyone to prove with a pecan tree.

Modified Leader Type.

The author's personal choice of types is a combination of both the central leader and the open vase, called the "modified leader." It seems possible to combine in a large way the good points of both extreme types with a minimum of their disadvantages.

In this type there is a pronounced central leader through the first four to ten feet of the main frame which then divides into a strong, compact, spreading top. This type is obtained by maintaining the leader for the first four to five years, or longer if necessary, and then cutting it back to a strong lateral branch fifteen feet or less from the ground.

The tree of this type illustrated in Figure 1 might well serve as a model for training pecan trees. This particular tree developed naturally without the aid of pruning saw, and is one of the most beautiful and symmetrical trees that the writer has seen. It has a spread of over sixty feet; its framework is well built and strong, and its upper branches can be reached with a good power sprayer.

When a pecan tree reaches the proper height for heading, usually four to six feet from the ground, the grower should be careful not to leave over two or three lateral limbs; otherwise they may take the entire strength of the tree and choke out the leader. Even with this precaution, it is often necessary to check the growth of some or all the laterals by careful pruning. This can often be done by judiciously

"pinching" off terminal buds from the limbs to be checked. Terminal buds, which are usually larger than the lateral buds, usually grow more rapidly than the latter.

Always Keep Type in Mind.

The business of shaping a pecan tree is not easy. Ravages of bud worms often give much trouble to the orchardist. Certain varieties have certain characteristics of growth that must be taken into consideration.

The important thing is for the grower to select for himself an ideal and to constantly work toward it. It is surprising to note the little attention that has been given to the proper shaping of the thousands of pecan trees that have been set during the past few years and it is hoped that this little bulletin will help to focus the attention of growers upon the importance of beginning the early life of pecan trees with a strong and well distributed framework.

NOTE: This is a revision of a story appearing in the "Farm and Ranch" on October 6, 1923.

PECAN VARIETIES.

With a view of securing the opinion of growers from different parts of the State as to the behavior of varieties and as to their preferences, about seventy-five letters were written to that many different growers, and the answers are herewith printed.

In addition to these replies, a partial list of the most popular of the varieties are here given, together with photographic reproductions of the varieties named.

We also insert a view of the best native varieties and photos representing them, together with the locality where found.

The writer is decidedly of the opinion that Texas Pecan Growers will eventually come to depend mainly on Texas varieties and the more popular of the Eastern varieties, which are now being used by our nurserymen and planters will be supplanted by Texas sorts. For this reason the names and photographs of several new sorts are shown in this Bulletin.

It is hoped that pecan growers over the State will take renewed interest in hunting out and bringing to notice any new varieties that in their judgment would be worthy of commercial propagation. Our State is so large and soil and climatic condition are so variable that it is not likely that any one variety will be found that will be suited to all sections of the State. The typical eastern and western varieties evidently belong to different species, and it is hardly probable that the varieties having their origin in the South Humid Belt will succeed as well in our dry, arid western climate as will varieties that are native to our western section. Nor is it probable that a variety originating in the southern part of the pecan belt will behave as well in the northern section of the pecan growing area as some native variety.

The writer therefore would like to encourage all pecan growers everywhere to lend their aid and influence in hunting for new and

superior varieties in their own locality, with a view of using them, when found, to propagate in the locality where found. Occasionally there may be found one or more varieties that are more nearly cosmopoliten than others, for instance the Stuart, and yet it will probably be found that in many parts of the State of Texas there are now many varieties native to that particular section that are more valuable for that locality than the Stuart is. It is probable, also, that in the course of time each locality will have to build up a variety or varieties that are specially suited to that particular section. There is so very little now known as to the behavior of varieties in different parts of the State, that the best anyone can do at this time is to make a blind guess and name one or more varieties for use in a given locality.

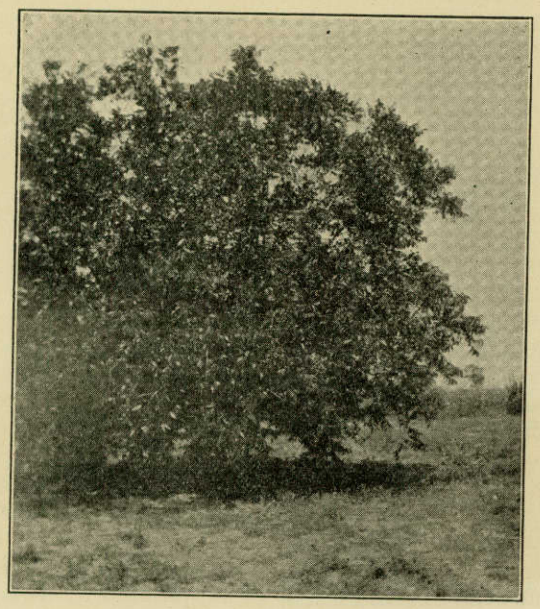


PLATE No. 17.

Burkett tree 7 years from 2 buds. Crop 45 pounds. Circumference 31 inches. Pecandale Farm, Denison, Texas. Courtesy of Mrs. John Kemper.

Description of Standard Varieties.

Bradley.—From Baker County, Fla. Size below medium; shell of average thickness, hard; kernel plump; flavor very good. Very productive. Especially promising for Florida and South Georgia. Promising in portions of East Texas.

Burkett.—From Callahan County, Texas. Size large; shell thin; Kernel plump; flavor excellent. Said to be productive. Should be especially adapted to planting in West and Central North Texas. Gaining in popularity.

Colorado.—From San Saba County, Texas. Little propogated as yet. Size large; shell somewhat thick; kernel plump; quality rich; flavor excellent. A seedling of San Saba. Probably adapted to planting in Western Texas.

Curtis.—From Alachua County, Fla. Size below medium; shell thin; kernel plump, cracking quality excellent; quality rich, flavor excellent. Very productive. Widely disseminated. Popular in Florida. Recommended for East Texas.

Daisy.—From Comal County, Texas. Widely disseminated, though not extensively planted. Size medium; shell moderately thin; cracking quality not good; kernel plump; quality rich; flavor very good. Tree vigorous, said to be productive. Probably best adapted to Western Texas.

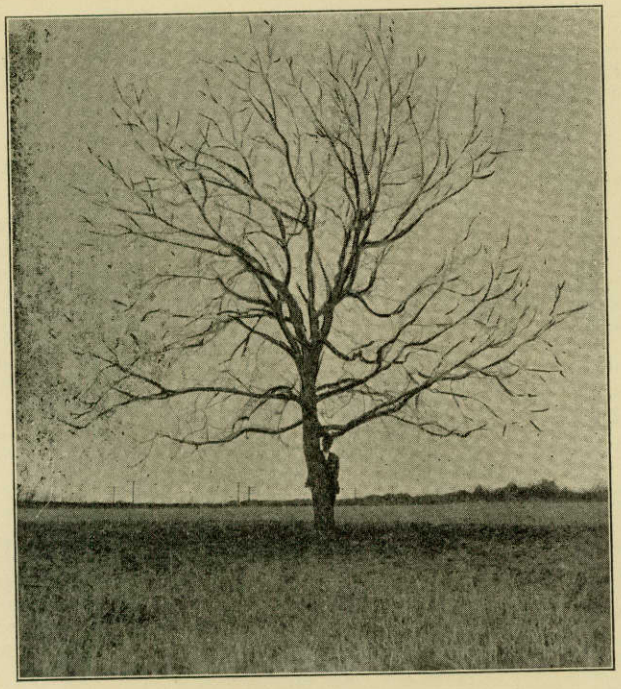


PLATE NO. 18.

Original budded Burkett tree 3½ miles East of Putnam, Texas. Budded 1903. Photo March 10, 1922. Circumference three feet, eight inches. Spread of top, 35 feet. Height, 35 feet.

Delmas.—From Jackson County, Miss. Widely disseminated. Size large to very large; shell moderately thin; kernel plump; quality good to very good; flavor excellent. Tree vigorous, productive. Very much subject to scab under certain conditions in the East. Here in Texas it has not been observed to be subject to scab.

Frotscher.—From Iberia Parish, La. Widely disseminated. Size large; shell very thin; kernel moderately plump, often dark colored; quality fair; flavor medium. Popular in Southwestern Georgia and parts of Louisiana. Very free from disease. Generally reported as being a shy bearer.

Halbert.—From Coleman County, Texas. Widely disseminated, mainly by scions used in top-working. Size small; shell very thin; kernel unusually plump; quality rich; flavor excellent. Very prolific. Especially adapted to planting in Western Texas and places of similar climatic conditions. Very susceptible to scab.

Kincaid.—From San Saba County, Texas. Well disseminated in Central and Western Texas. Size large; shell of medium thickness; kernel plump; quality very good; flavor sweet. Very prolific. Especially recommended for Western Texas. Very much subject to scab in the Atlantic States.

Money Maker—From Madison Parish, La. Widely disseminated. Size medium; kernel fairly plump; quality fair; flavor sweet. Very prolific. Especially suited to planting in the northern range of the area adapted to Southern varieties. Undesirable on all points except that it is prolific.

Moore.—Synonyms, **Long Moore, Moore No. 1, Moore No. 2.** From Jefferson County, Fla. Size below medium; shell of average thickness; quality fair; flavor fair. Unusually productive and one of the earliest to mature. Well suited to Northern Florida. Suited for East Texas.

Nelson.—From Hancock County, Miss. Size very large; shell thick; medium; flavor good. Tree unusually vigorous, very productive. Not recommended for extensive planting in any section.

Pabst.—From Jackson County, Miss. Widely disseminated. Size large, shell somewhat thick; kernel usually plump; quality good; flavor sweet. Generally productive, though by some thought not to be an early bearer. Not recommended in Texas.

Russell.—From Jackson County, Miss. Widely disseminated. Size medium; shell very thin; kernel somewhat shrunken; quality good; flavor sweet. Prolific. Said to be sensitive to cold weather. Not desirable in Texas.

San Saba.—From San Saba County, Texas. Very well known. Size small; shell unusually thin; kernel very plump; quality very rich; flavor excellent. Highly productive. Especially adapted to Western Texas. Not suited to Eastern planting. Of special value.

Schley.—From Jackson County, Miss. One of the best known and most widely disseminated varieties. Size medium to large, although often variable even on same tree; shell very thin; kernel plump; quality very rich; flavor excellent; moderately productive, but a regular bearer. Although sometimes quite subject to scab it is one of the most popular varieties at the present time. Recommended for humid belt or where irrigated.

Sovereign.—Synonym, **Texas Prolific**—From San Saba County, Texas. Size large; shell of medium thickness; kernel plump; quality rich; flavor sweet. Unusually prolific. Especially well adapted to planting in Western Texas.

Stuart.—From Jackson County, Miss. More extensively planted than any other variety. Size medium to large; shell of average thickness, cracking quality not good; kernel plump, usually breaking into crumbs while being separated from the broken shell; quality good; flavor sweet. Moderately productive. Has succeeded in nearly all parts of the range adapted to Southern varieties East of Central Texas. Should be discarded in Central and West Texas.

Success.—From Jackson County, Miss. Of comparatively recent introduction. Size large to very large; shell of average thickness, cracking quality not good; kernel plump; quality rich; flavor very good. Generally reported to be highly prolific. Gaining in favor in South and Southeast Texas.

Van Deman—From St. James Parish, La. One of the most widely disseminated of all varieties. Size large to very large; shell of medium thickness; kernel plump; quality rich; flavor sweet. Very popular until recently, when it developed a susceptibility to scab, which is serious in some sections. Not recommended for any part of Texas.

TABLE GIVING THE OLD VARIETIES OF PECANS AS TO MEAT CONTENT AND NUMBER PER POUND.

Name of Variety.	Location Where Grown.	Meat. Percent.	Number Pound.
Alexander	Mason, Texas	52.1%	68 nuts.
Big "Z"	Mason, Texas	47.3%	53 nuts.
Burkett	Calahan, Texas	55.7%	46 nuts.
Daisy	Center Point, Texas	49.0%	55 nuts.
Delmas	Mason, Texas	46.7%	44 nuts.
Halbert	Mason, Texas	60.7%	67 nuts.
Kincaid	Mason, Texas	47.7%	61 nuts.
Mobile	Mason, Texas	44.1%	56 nuts.
Money Maker	Center Point, Texas	48.9%	75 nuts.
Napier	Menard, Texas	52.0%	55 nuts.
Oliver	Mason, Texas	39.4%	39 nuts.
Pabst	Mason, Texas	48.0%	51 nuts.
Russell	Mason, Texas	55.6%	59 nuts.
San Saba	Mason, Texas	61.7%	78 nuts.
Schley	Mason, Texas	55.7%	60 nuts.
Soveriegn (Tex. Pro.)	Mason, Texas	54.0%	58 nuts.
Stuart	Mason, Texas	48.2%	44 nuts.
Success	Fredericksburg, Texas	52.6%	52 nuts.

TABLE GIVING THE NEW VARIETIES OF PECANS AS TO MEAT CONTENT AND NUMBER PER POUND.

Name of Variety.	Location Where Grown.	Meat. Percent.	Number Pound.
Big Ben	Seguin, Texas	49.6%	60 nuts.
Commonwealth	San Saba, Texas	60.7%	54 nuts.
Colorado	San Saba, Texas	59.3%	51 nuts.
Cunningham	Comanche, Texas	55.8%	74 nuts.
Daniel	Lankin, Texas	54.4%	61 nuts.
Deats	Llano, Texas	46.8%	56 nuts.
Eanes	Comanche, Texas	61.5%	76 nuts.
Evans	Comanche, Texas	60.1%	53 nuts.
Fair	Arp, Texas	57.5%	75 nuts.
Franklin	Bend, Texas	52.8%	48 nuts.
Govett	Seguin, Texas	58.3%	50 nuts.
Guadalupe	Seguin, Texas	47.0%	56 nuts.
Hilderbrandt	Gonzales, Texas	45.0%	45 nuts.
Hollis	Bend, Texas	46.8%	38 nuts.
Jersey	San Saba, Texas	63.3%	86 nuts.
Johnson	DeLeon, Texas	55.7%	53 nuts.
Kincaid X Onliwon	San Saba, Texas	55.4%	57 nuts.
Lane	Stephenville, Texas	55.1%	49 nuts.
Leon	Lampkin, Texas	56.4%	58 nuts.
McCully	San Saba, Texas	62.1%	63 nuts.
McDaniel	Gap, Texas	59.1%	63 nuts.
Matsler	Bend, Texas		
Melcher	LaGrange, Texas	51.2%	58 nuts.
Menard	Menard, Texas	56.5%	74 nuts.
Merit	DeLeon, Texas	49.0%	53 nuts.
Millican	Bend, Texas	59.8%	48 nuts.
Mosty	Center Point, Texas	55.6%	65 nuts.
Murchison	Marble Falls, Texas	53.0%	63 nuts.
Number 60	San Saba, Texas	61.9%	66 nuts.
Odom	Toledo, Texas	54.8%	42 nuts.
Onliwon	San Saba, Texas	60.7%	75 nuts.
Owens		53.6%	57 nuts.
Reed	Luling, Texas	51.5%	77 nuts.
San Saba Improved	San Saba, Texas	61.2%	55 nuts.
Schenk	Iredell, Texas	59.1%	51 nuts.
Scott	Comanche, Texas	57.5%	64 nuts.
Shearer	Mason, Texas	54.5%	66 nuts.
Sirocka	LaGrange, Texas	53.7%	60 nuts.
Spikes	Proctor, Texas	50.8%	44 nuts.
Supreme-Risien	San Saba, Texas	61.7%	70 nuts.
Squirrels Delight	San Saba, Texas	57.0%	52 nuts.
Ward	Sidney, Texas	57.0%	81 nuts.
Western Schley	San Saba, Texas	60.1%	59 nuts.
Willmann	Mason, Texas	45.2%	36 nuts.
Y. P. Oliver	Junction, Texas	44.7%	57 nuts.
Zesch	Mason, Texas	43.9%	51 nuts.

SOME NEW PECAN VARIETIES, CATALOGUED 1923.

The following varieties are introduced here to call attention to the importance of pecan growers over the State to the importance of hunting for the superior native varieties growing near them. The writer is very strongly of the opinion that probably the best and most valuable nuts now growing in the State have not yet been introduced to the public. Every one reading this is urged to collect specimens of the most superior varieties growing in their locality and send them in for inspection and testing. Texas is so very large and climatic conditions so varied that it is not likely that any one variety will prove valuable for all parts of the State. You are also invited to send in any variety of the named sorts for identification, if you are in doubt as to its identity.

The following new varieties as they appear in the photographs are about one-third under size of the nuts from which the photographs were taken. All of these nuts are well worthy of propagation, provided they prove to be strong and vigorous, regular in bearing. But the grower is cautioned, to proceed cautiously in planting extensively of new and untested sorts. If a variety has its origin near the locality where it is to be planted, and it is successful, there is not much risk in using it; but if a variety originated in a different section, there is a possibility that the variety will prove a success.

Beene.—Pecan originated near Marquez, Robertson County, on the ground of Mr. W. E. Beene, a seedling—history not given. One of the largest nuts found in the State; thin shell; full meat; good cracker.

Decherd.—Sent in from Junction, Texas. Taken from a large native tree; medium in size; thin shell ;splendid cracker; history of tree not given. Individually the nut is well worthy of perpetuation; equally as valuable as Halbert, San Saba, Sovereign and nuts of like qualities, if it proves to be prolific and adapted to other localities.

Welty.—Sent in from Gordon, Texas. Description of Decherd also describes Welty. Welty, however, has slightly thinner shell of the two.

Schweitzer.—Sent in from Hocheim, Texas. Resembles Delmas in every particular except that it is about ten per cent smaller. Schweitzer is said to be very prolific, and regular in bearing.

Slaughter.—Originated at Stephenville, Texas, on the grounds of R. C. Slaughter. Shell about like the Stuart, and about as difficult to crack. Medium in size. History not given.

Llano.—Originated at Junction, Texas, on the grounds of R. S. Price. Nut small; very thin shell; full meat. In class with the San Saba. Mr. C. A. Reed gives Llano a place among the standard sorts.

Hallford.—Originated and growing on the Colorado River in Llano County near Kingsland. Medium in size; thin shell; splendid cracker; releases its meat well; equal to Halbert, and larger. Well worthy of propagation in the locality where found. Owner, Mr. J. C. Hallford, Llano, Texas.

Keith.—Originated near Breckenridge, Stephens County, Texas. The most attractive small pecan yet found in Central Texas. Very thin shell; plump kernel; delicious flavor. Well worthy of propagation as a family nut. Valuable. Originated on grounds of J. L. Kieth, Breckenridge, Stephens County, Texas.

Sutton.—Originated on Indian Creek, Brown County; nut large; thin shell; superior to Stuart, which it resembles.

Brown.—Sent in from Throckmorton County, off the Clear Fork of the Brazos. If it proves to be prolific and vigorous, it is worthy of being multiplied.

Deavers.—Sent in from near Temple, Texas, Bell County; classes with San Saba.

Gladys.—Originated on the grounds of Mr. Hallford near Kingsland, Texas, near where the Hallford was found. Slightly inferior to Hallford.

Merge.—Sent in from the North Llano above Junction; equal to Halbert in every respect, if it proves to be a regular and prolific bearer.

Papershell.—Furnished by Joe A. Williams. In a class with Curtis.

Boggus.—From Gordon, Texas. Sent in by Claud Boles. One among the superior named sorts. History not given.

Govett.—This nut originated near Seguin, Guadalupe County, Texas. In a class with the Schley, larger and said to be more prolific. The writer considers the Govett the highest class nut yet examined, of all of the Texas sorts, even surpassing the Burkett, because of its better shape, being better adapted to our commercial shellers. Picture of the original Govett tree is shown on page 2. The single nut shown is probably 25% smaller than the average sized Govett nut.

NEW PECAN VARIETIES, LISTED 1924.

It requires a long time to test out the value of new pecan varities. A new variety may be a success in the locality where found or in the locality where it has its origin and be a complete or partial failure when transfered to a different section. Also, in as much as soil types vary so much in all parts of the State from a deep sandy alluvial transported soil type to a close textured residual black waxy type; a new variety may be found on a given type of soil where it is succeeding admirably and prove a failure if used on a different soil, though it be removed only a short distance.

For this and other reasons I have encouraged the search for promising new varieties in order that they might be brought to notice and be tested out as quickly as possible.

I began to disseminate scions of Burkett in 1911, sending them to different parts of the State at my own expense and although the Burkett has been used now for 13 years in many parts of the State it has not been sufficiently tested for us to determine for certain just where it will succeed.

There have been so many new varieties brought into notice recently that it would be impractical to mention each one and you are referred to our table of meat percentage in this bulletin for a further study. Also it has been impossible for us to secure a detailed history of the parent trees of these new varieties, hence the list is catalogued and the recommendation is made that they be taken under observation by those interested with a view of determining their value. These new sorts are also introduced and listed and their meat content given so as to encourage the continued search

for better varieties, as it is confidently believed that we have probably not found our best native varieties yet.

I will discuss only a few of those that appear to me to be the most promising. Some of these are illustrated by cuts which appear in the body of this bulletin, others are only mentioned by name. Some of the most promising are as follows:

Murchinson.—Growing on the grounds of A. F. Murchinson, Kingsland, Llano County, Texas. Runs 53% meat, 62 nuts per pound. The parent tree is probably more than 200 years old. The owner has gathered nuts from it for 50 years. Regular in bearing, some years bore 600 pounds. Bore 250 pounds in 1923. Submitted by Arthur W. Jones, Marble Falls, Texas.

McCulley.—Originated on farm of Dr. McCully, Brownwood, Texas. Runs 63 nuts per pound, 62.1% meat. Shell thin, extra good cracking quality. Resembles Burkett but the shell is thinner. McCulley seems to be a shy bearer. It is very valuable if it proves to be prolific.

Kincaid X Onliwon.—Sent in by Guy Risien. Runs 55% meat, 57 nuts per pound. Deficient cracking quality, sutures too deep, kernel brittle. Not desirable.

San Saba Improved.—Runs 61% meat, 55 nuts per pound. Thin shell, good cracking quality, well filled, excellent color and shape, very valuable. Sent in by Guy Risien.

Jersery.—Sent in by Guy Risien. Runs 84 nuts per pound, 63% meat. Very thin shell, excellent cracking quality, meat plump, solid, sweet. Releases perfectly. Valuable for commercial cracking and home use.

Western Schley.—Runs 59 nuts per pound, 60% meat. Thin shell, good cracking quality. Probably more valuable than the Eastern Schley for western conditions. Very prolific. Sent in by Guy Risien.

Commonwealth.—Runs 60.7% meat, 54 nuts per pound. Thin shell, good cracking quality, meat solid, good appearance. Medium to large in size.. Promising. Sent in by Guy Risien.

Onliwon.—Runs 60.7% meat, 59 nuts per pound. Very thin shell, excellent cracking quality. Equal to the best. Sent in by Guy Risien.

Supreme.—Runs 67.7% meat, 70 nuts per pound. Very thin and soft shell, well filled, meats plump and solid. Possibly too full at the apex end. Sent in by Guy Risien.

No. 60.—Runs 61.9% meat, 60 nuts per pound, very thin shell, good cracking quality, plumb and solid. Desirable. High class in every respect. Sent in by Guy Risien.

Commercial.—Runs 67.5% meat, 75 nuts per pound. Very thin shell, extra good cracking quality, well filled. Valuable for commercial cracking machine, except possibly too round. Sent in by Guy Risien.

Leon.—Grown by D. A. Barnett, Lampkin, Texas. Runs 56 nuts per pound, 56.4% meat. Thin shell, well filled, good shape and color, good cracking quality. Sent in by Ross R. Wolfe, Stephenville, Texas.

Lane.—Grown by Dan Lane, Stephenville, Texas. Runs 49 nuts per pound, 55% meat. Corky substance, too abundant. Does not release meat easily. Medium cracking quality, well filled. Sent in by Ross R. Wolfe, Stephenville, Texas.

Schenk.—Grown by Wm. D. Schenk, Iradell, Texas. Runs 51 nuts per pound, 59% meat. Thin shell, good color and shape, good cracking quality. Sent in by Ross R. Wolfe, Stephenville, Texas.

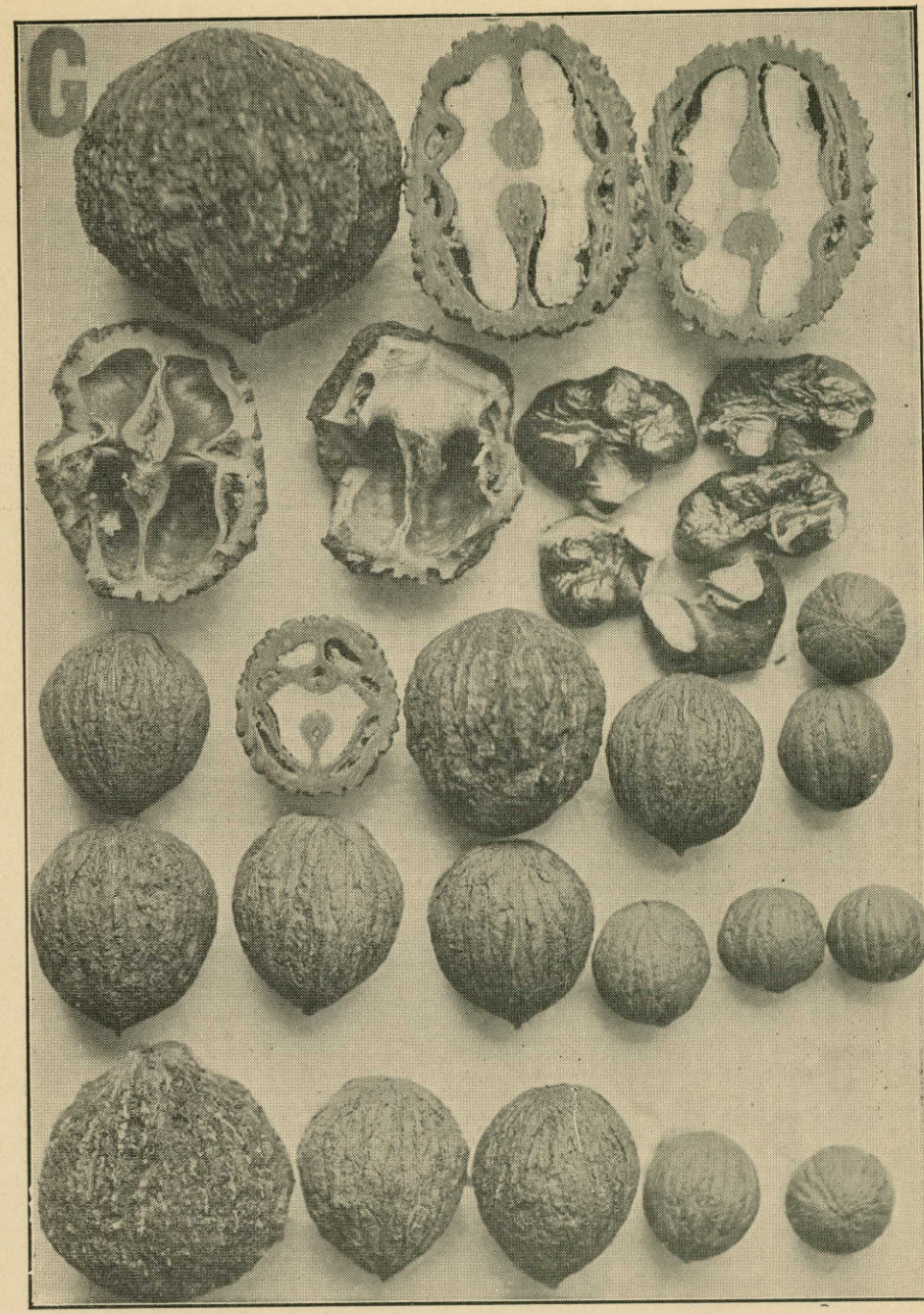
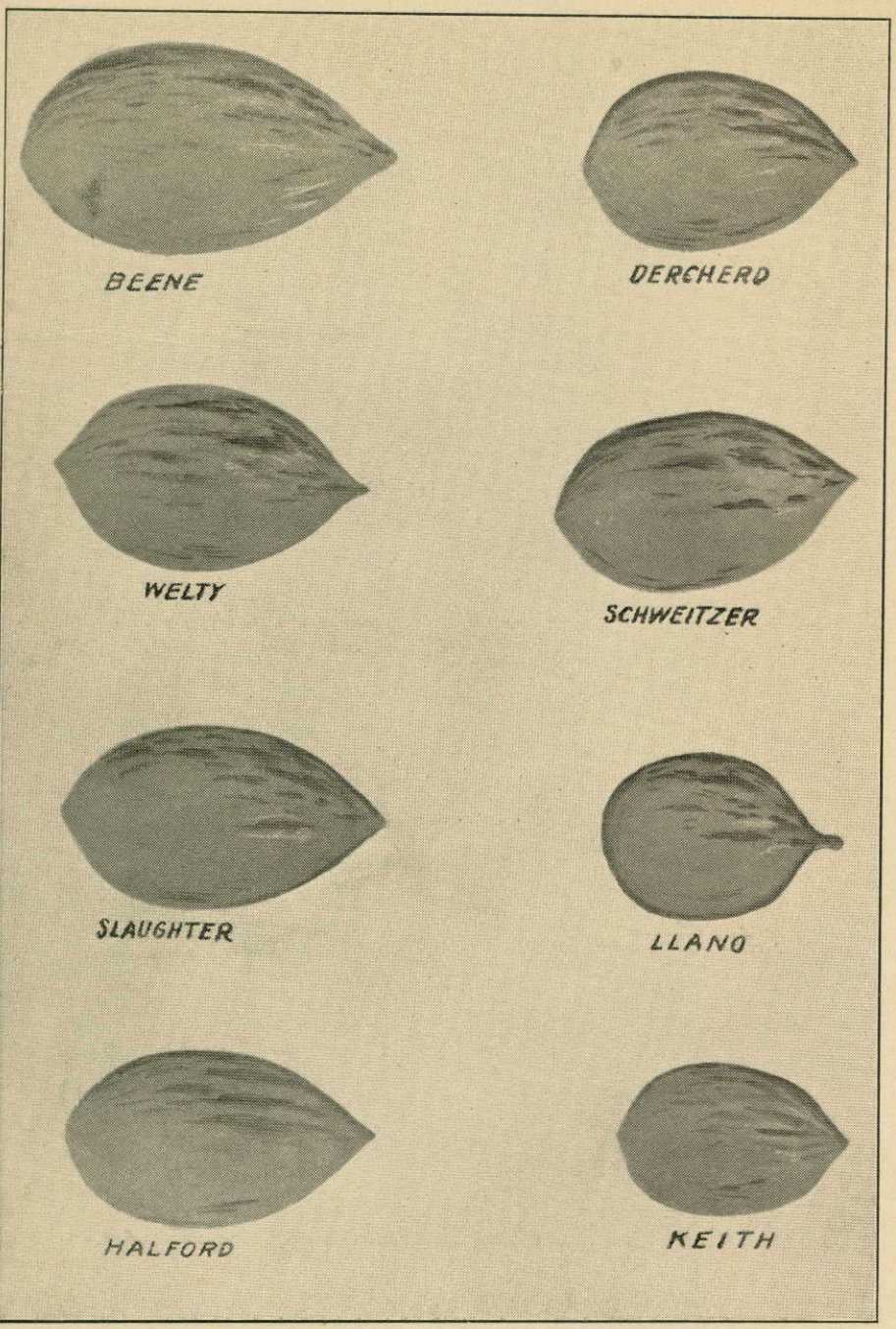
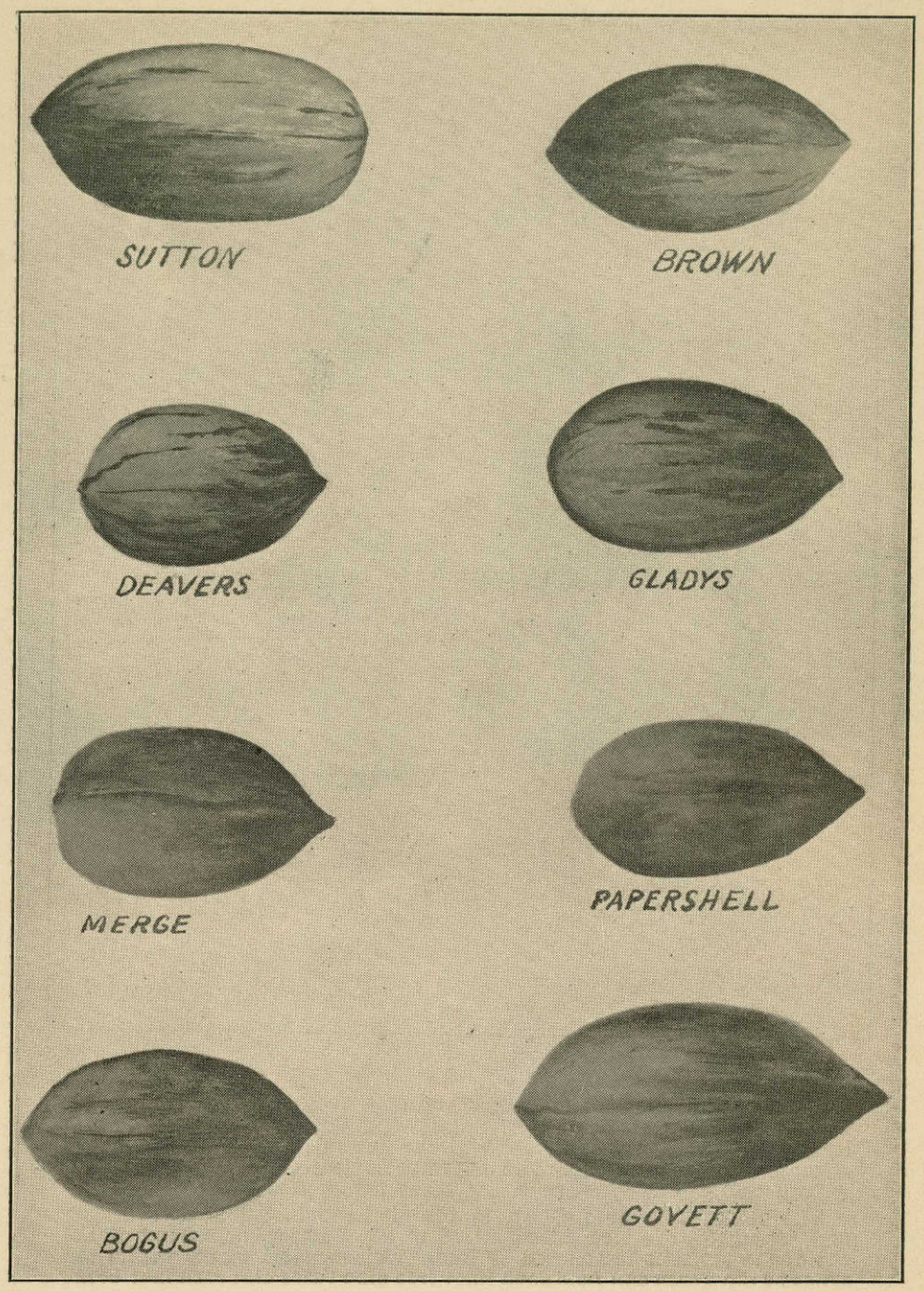


PLATE 19.

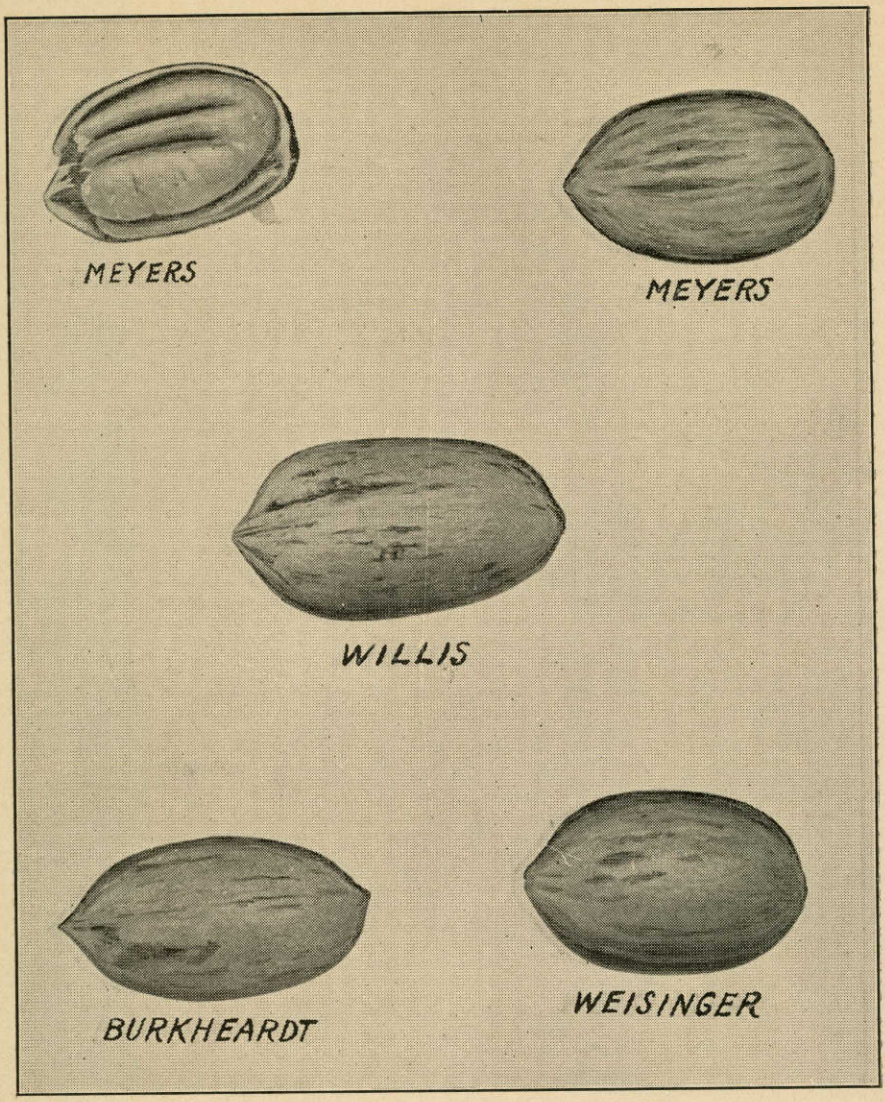
NOTE: Top row is Thomas Black Walnut bearing on top-worked trees at Clyde, Texas. Second row shows shells and meats of this walnut, 38 to 40 per cent meat. The first four walnuts in third row show black walnuts grown on the same trees in the same year that the Thomas was grown as shown above in first and second rows. The other walnuts are specimens of the black walnuts found growing at different places over the State. The smaller ones are the western (Rupestris) native to West Texas.


BEENE
DERCHERD
WELTY
SCHWEITZER
SLAUGHTER
LLANO
HALFORD
KEITH

MOUNT NO. 1.


SUTTON
BROWN
DEAVERS
GLADYS
MERGE
PAPERSHELL
BOGUS
GOVETT

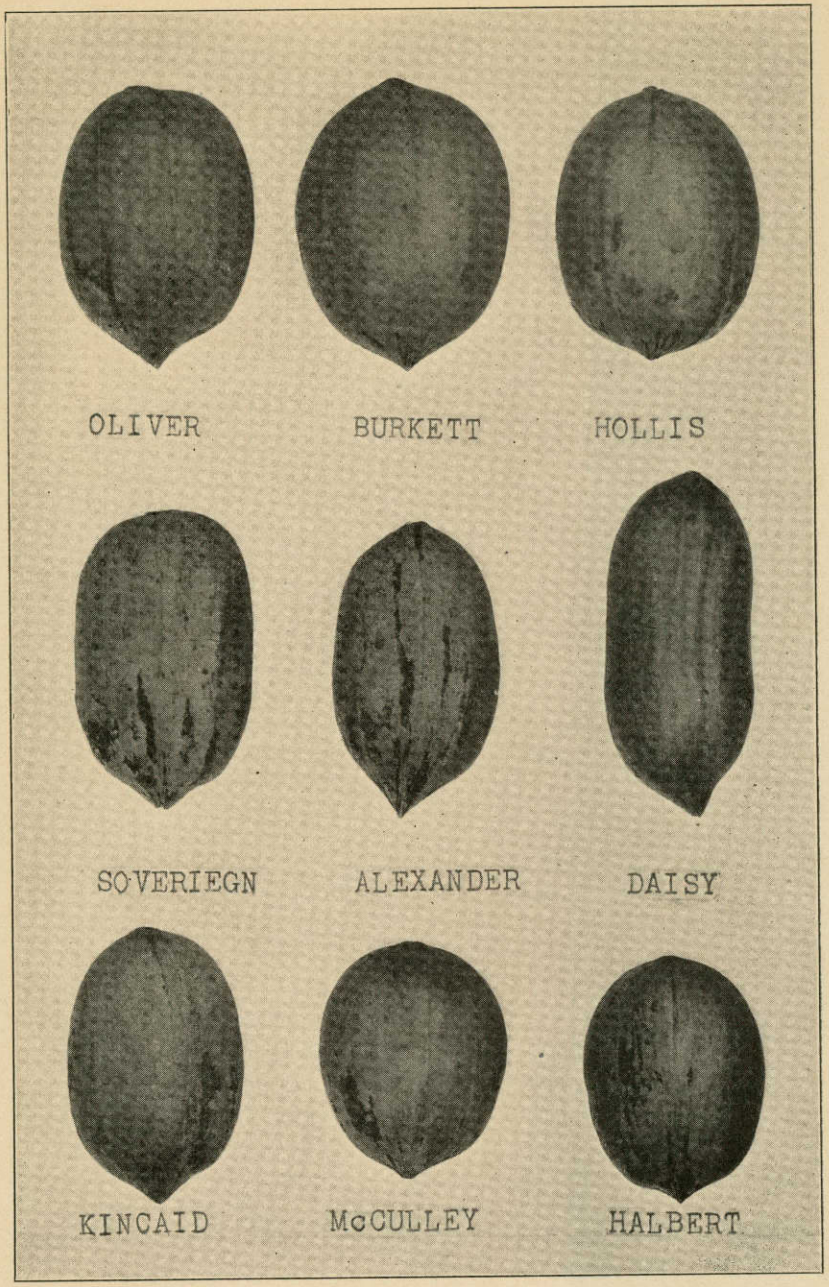
MOUNT NO. 2.



MOUNT NO. 3.

Myers.—Originated 20 miles northwest of Austin. Tree about thirty years old. Introduced by F. T. Ramsey, Austin, Texas. The Myers is equal in every respect to the best of our known named varieties, above medium sizes, very attractive in apperance; meat solid, sweet and firm. A very valuable acquisition to our Texas list of nuts.

The other three nuts shown in the photograph, Willis, Burkheardt, and Weisinger, are also introductions of Mr. Ramsey, and stand at the top of the varieties introduced by him. Weisinger originated within ten miles of the Texas and Louisiana line; tree nine years old; seedling; borne three crops; very prolific; entirely immune to scab; a high class nut.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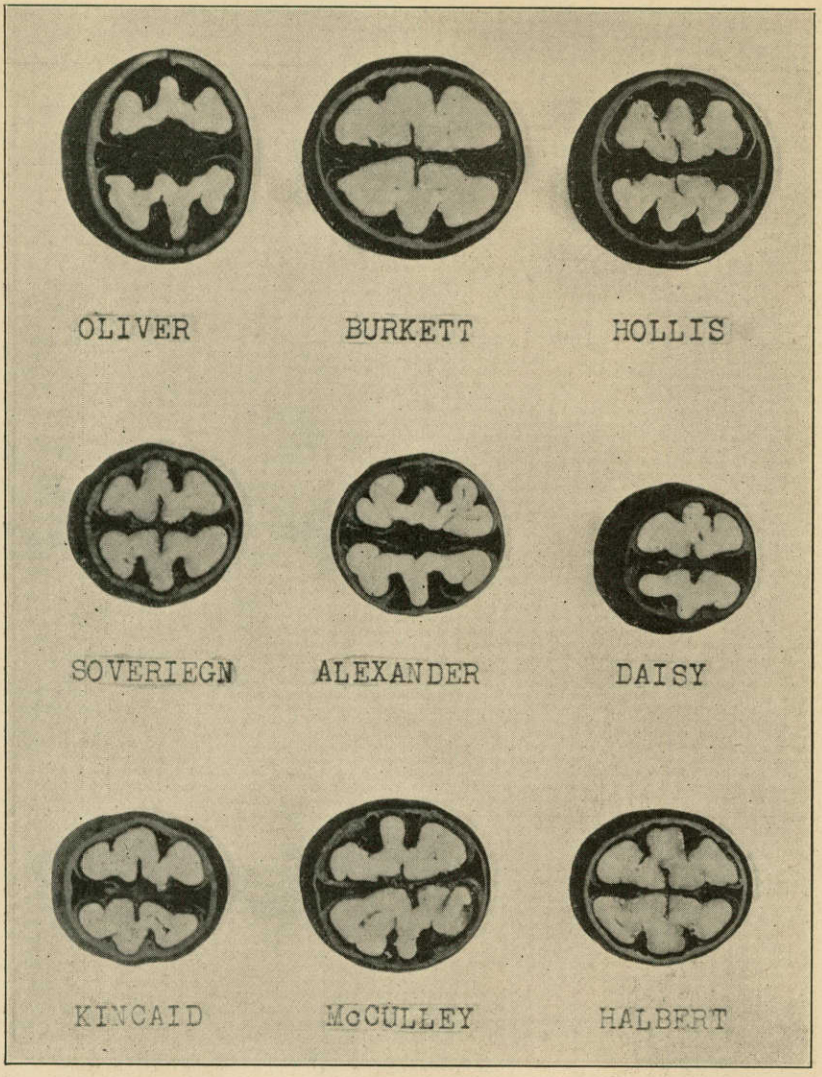
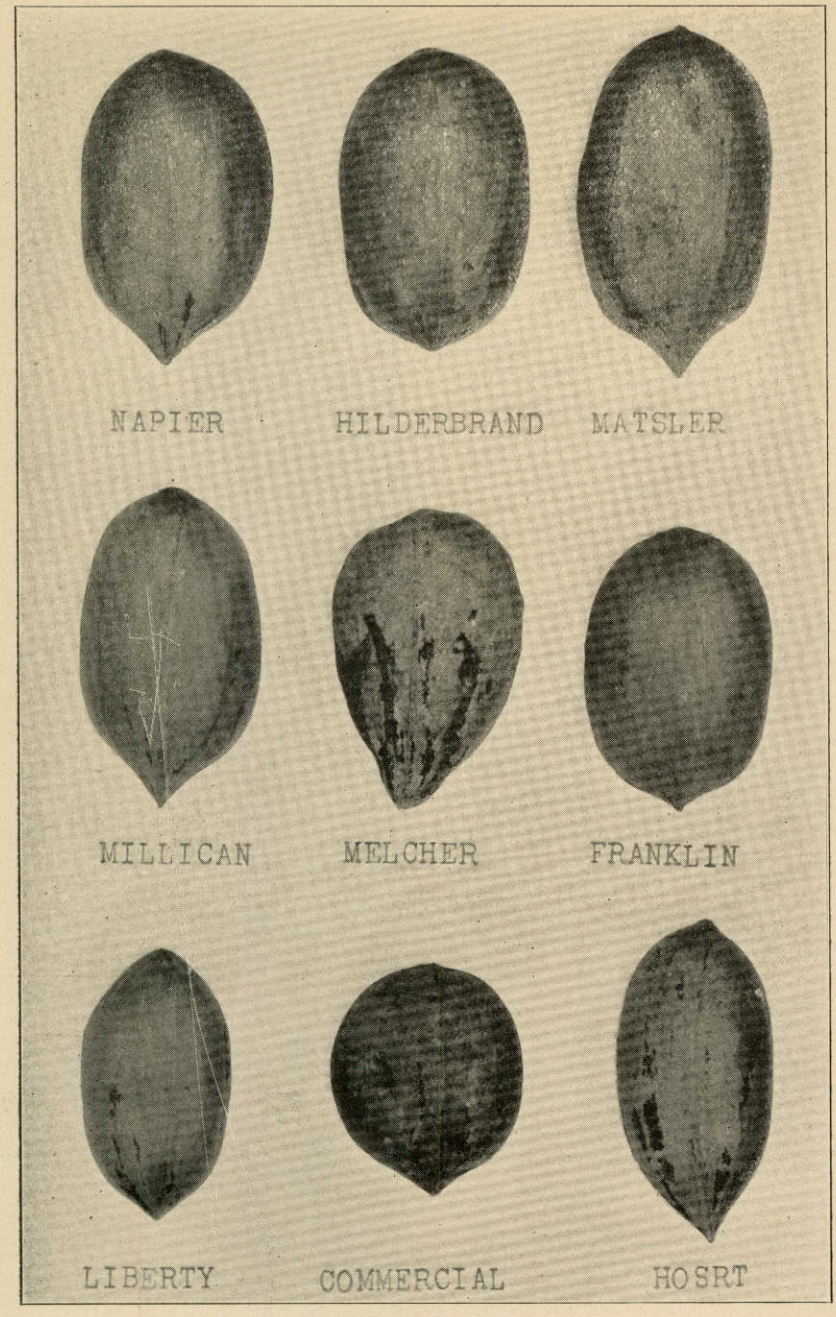
BURKETT
HOLLIS
SOVERIEGN
ALEXANDER
DAISY
KINCAID
McCULLEY
HALBERT

MOUNT NO. 4.


OLIVER
BURKETT
HOLLIS
SOVERIEGN
ALEXANDER
DAISY
KINCAID
McCULLEY
HALBERT

MOUNT NO. 5.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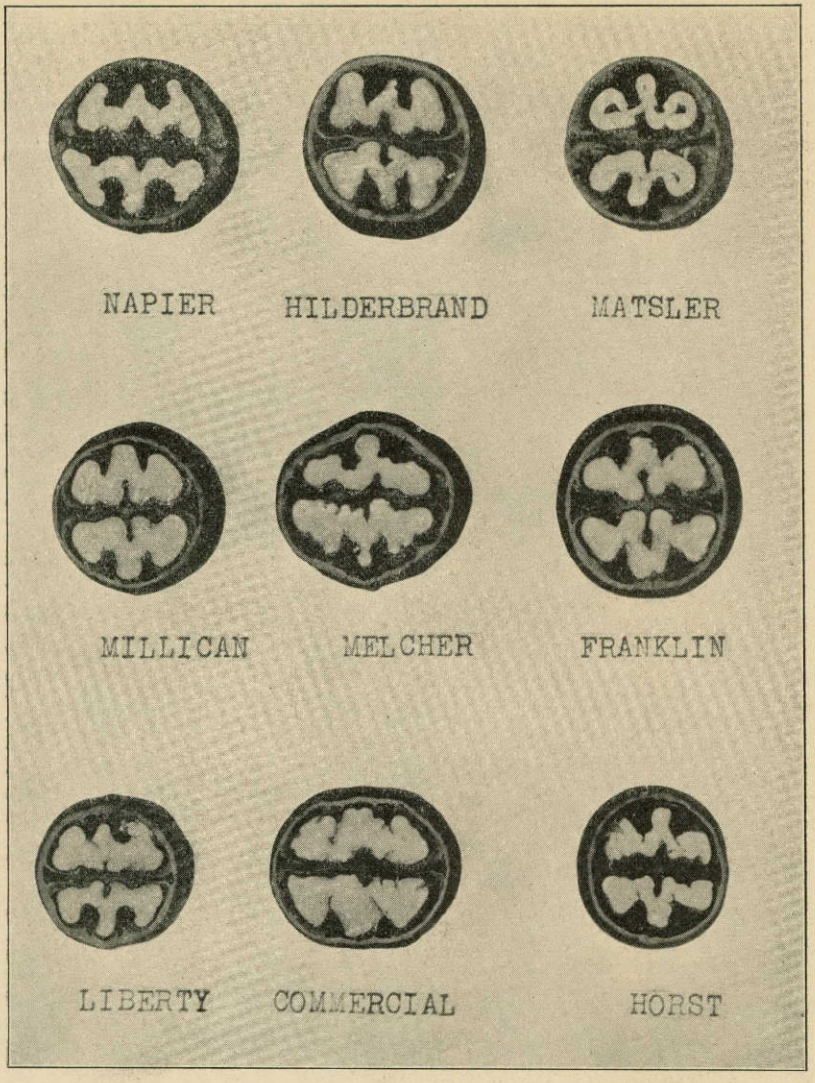
HILDERBRAND
MATSLER
MILLICAN
MELCHER
FRANKLIN
LIBERTY
COMMERCIAL
HOSRT

MOUNT NO. 6.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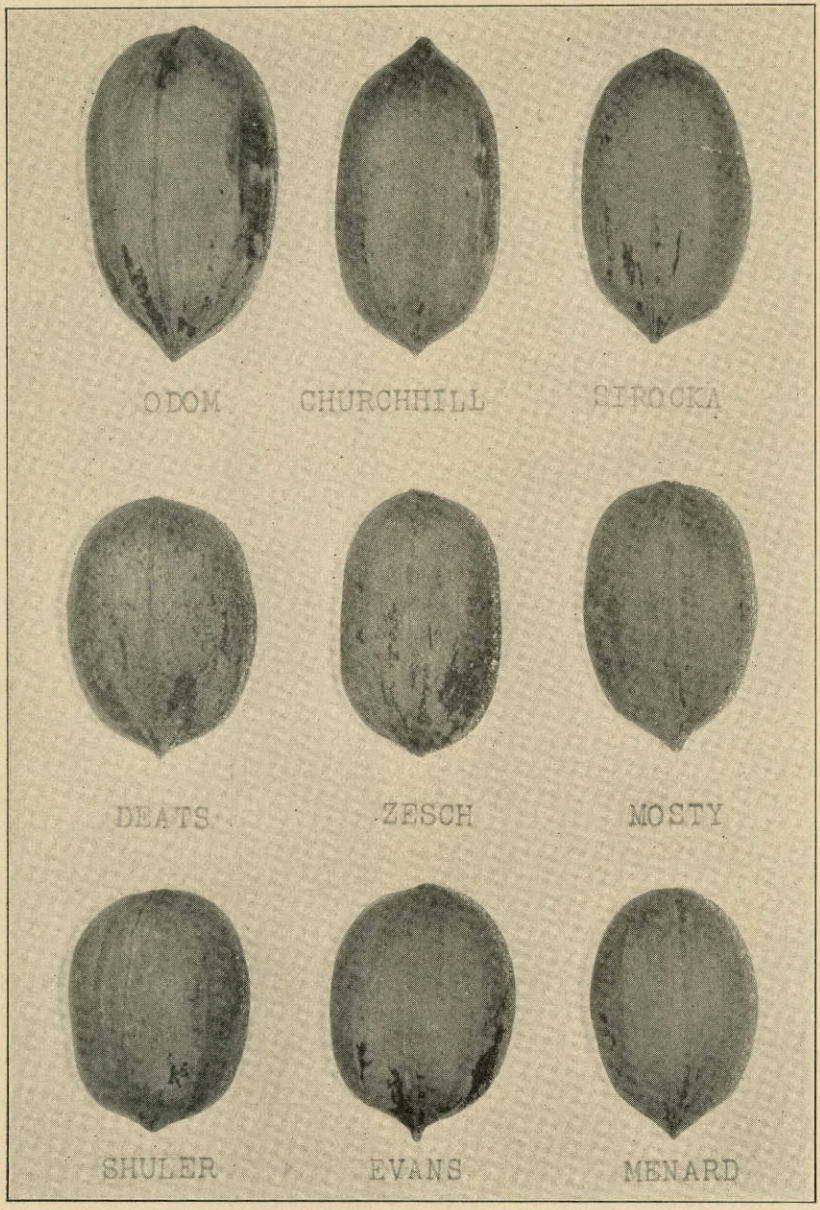
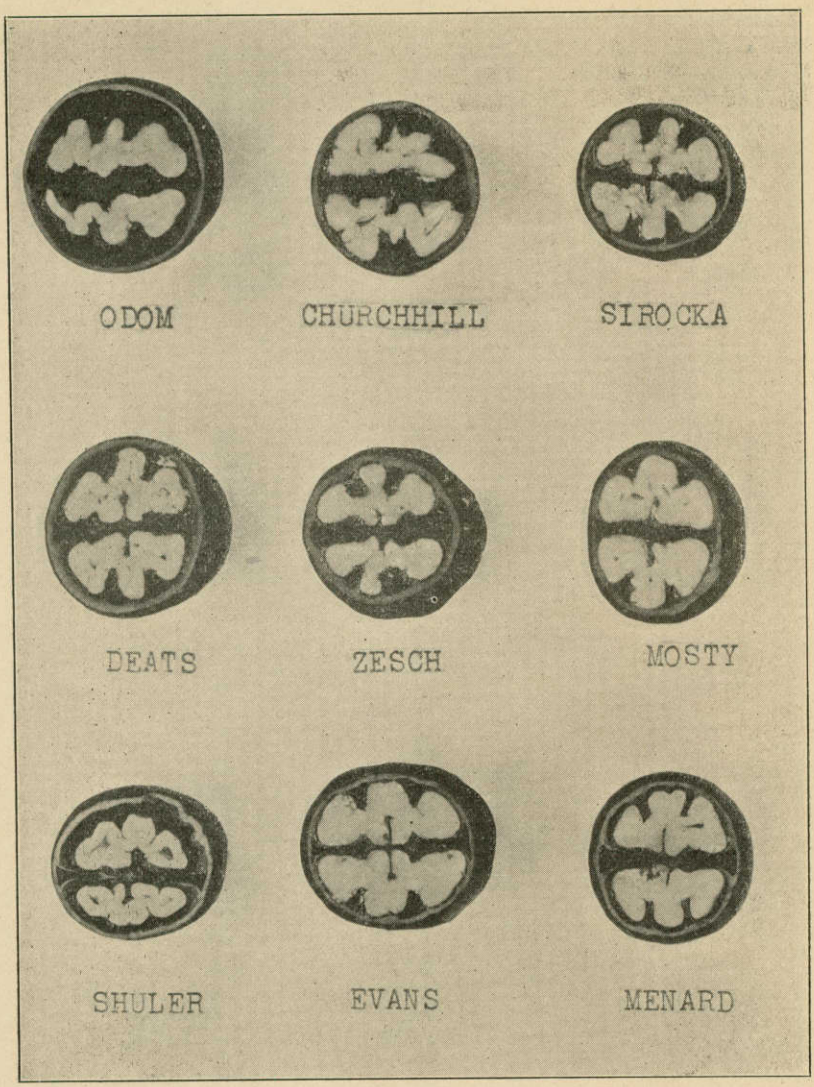
HILDERBRAND
MATSLER
MILLICAN
MELCHER
FRANKLIN
LIBERTY
COMMERCIAL
HORST

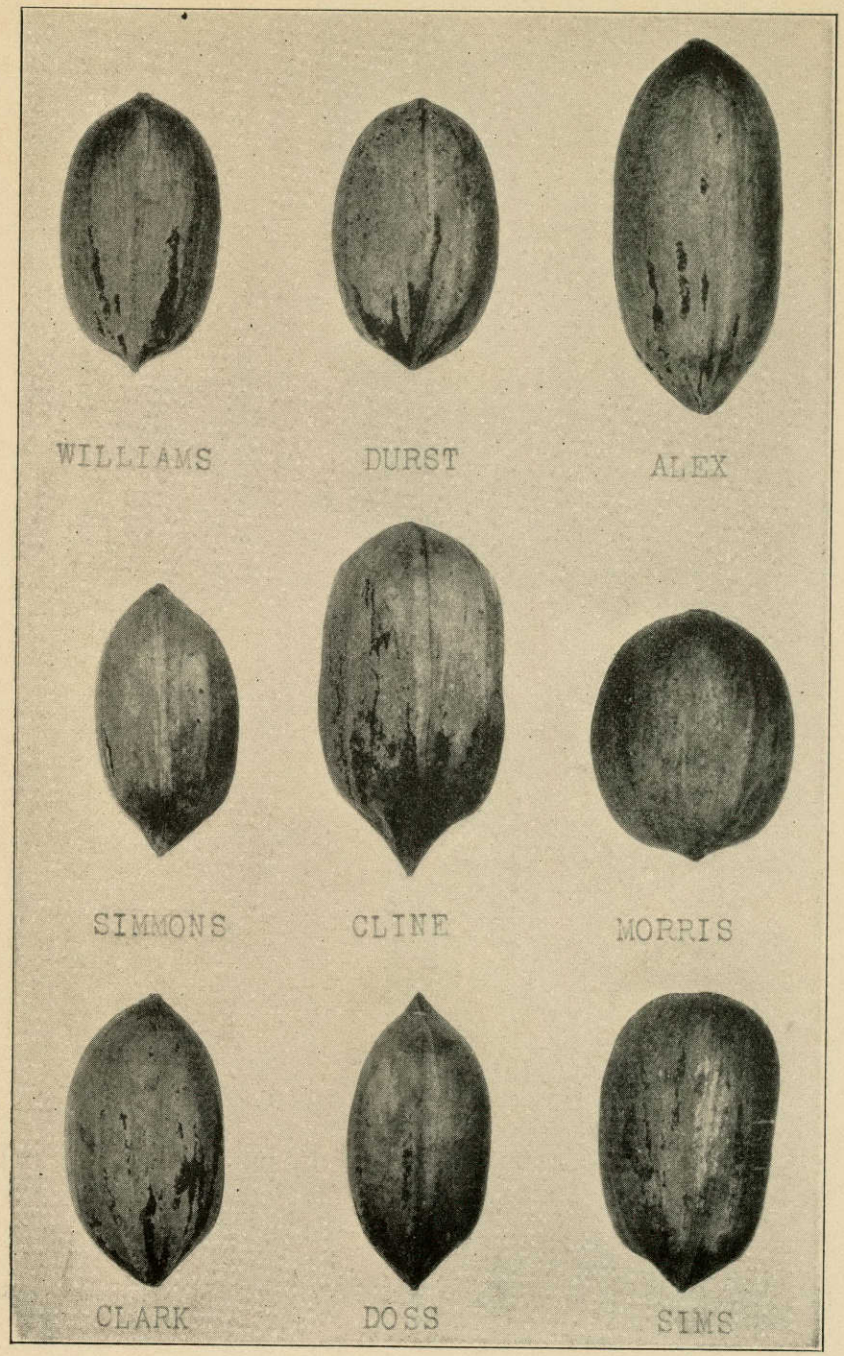
MOUNT NO. 7.


ODOM
CHURCHHILL
SIROCKA
DEATS
ZESCH
MOSTY
SHULER
EVANS
MENARD

MOUNT NO. 8.


ODOM
CHURCHHILL
SIROCKA
DEATS
ZESCH
MOSTY
SHULER
EVANS
MENARD

MOUNT NO. 9.



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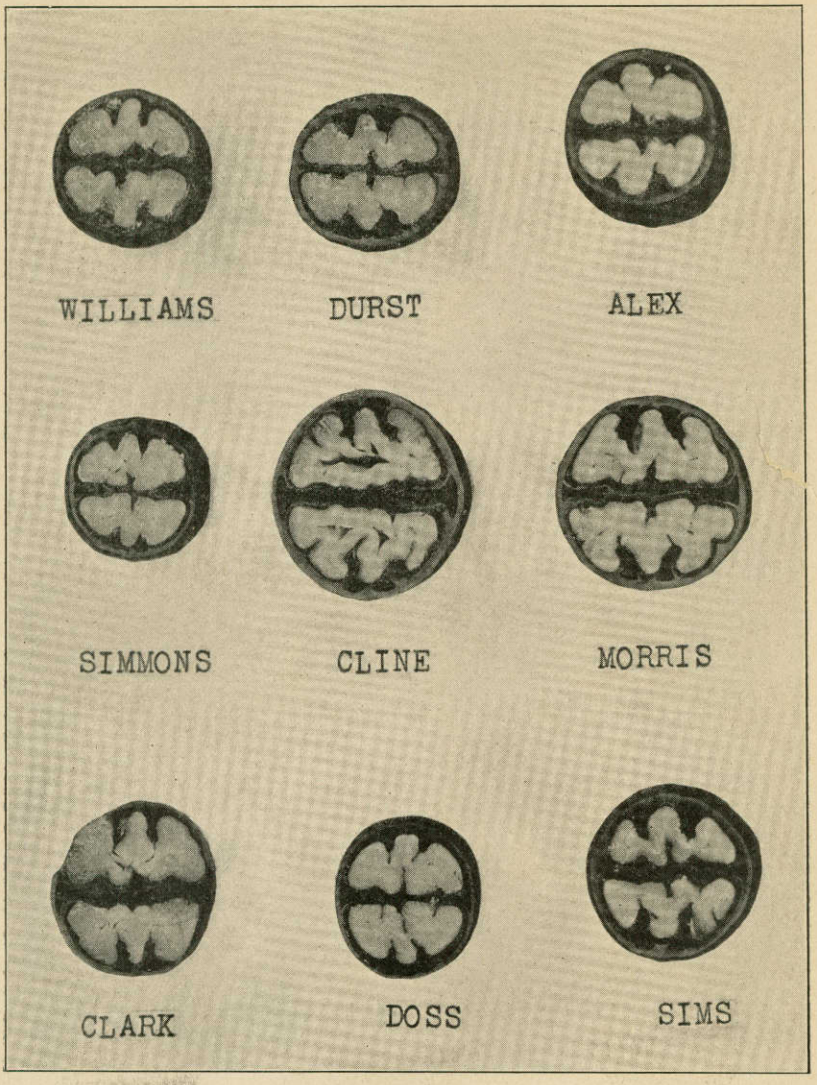

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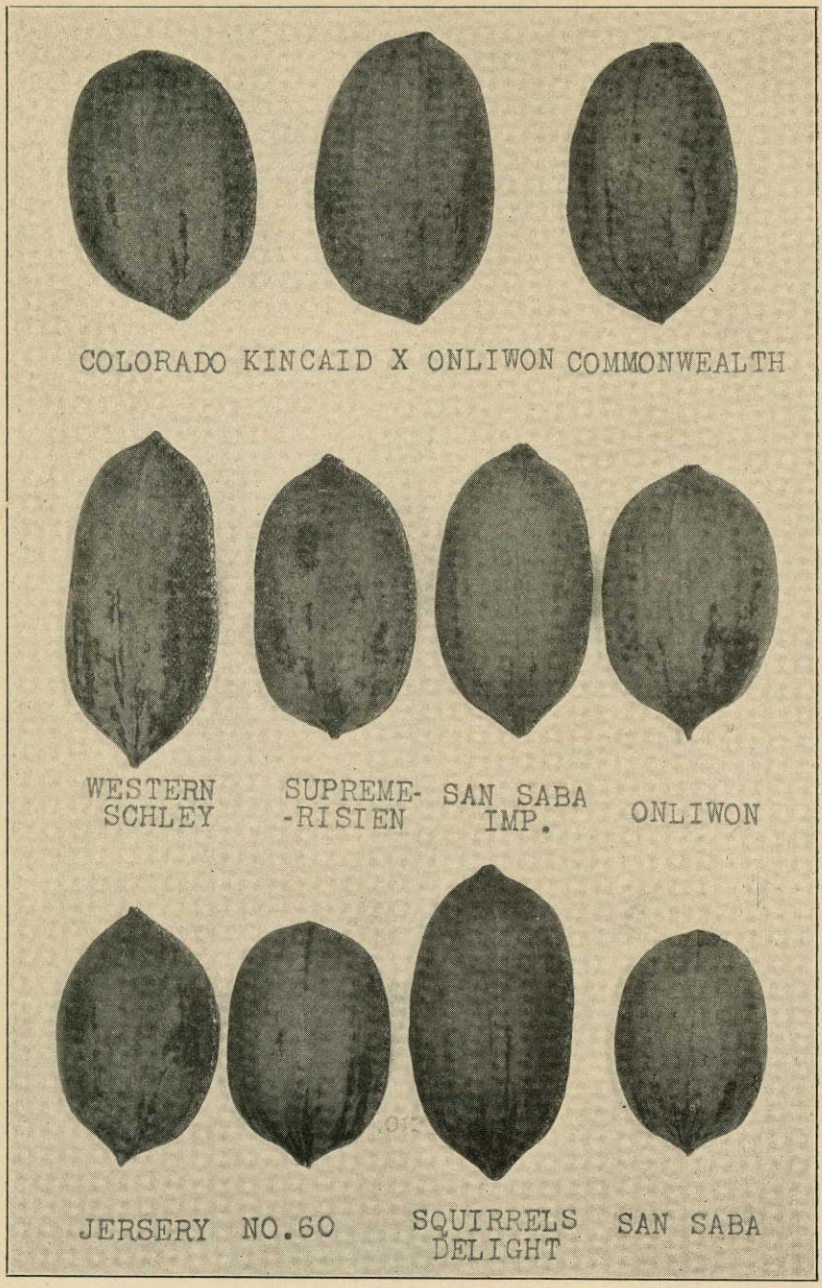
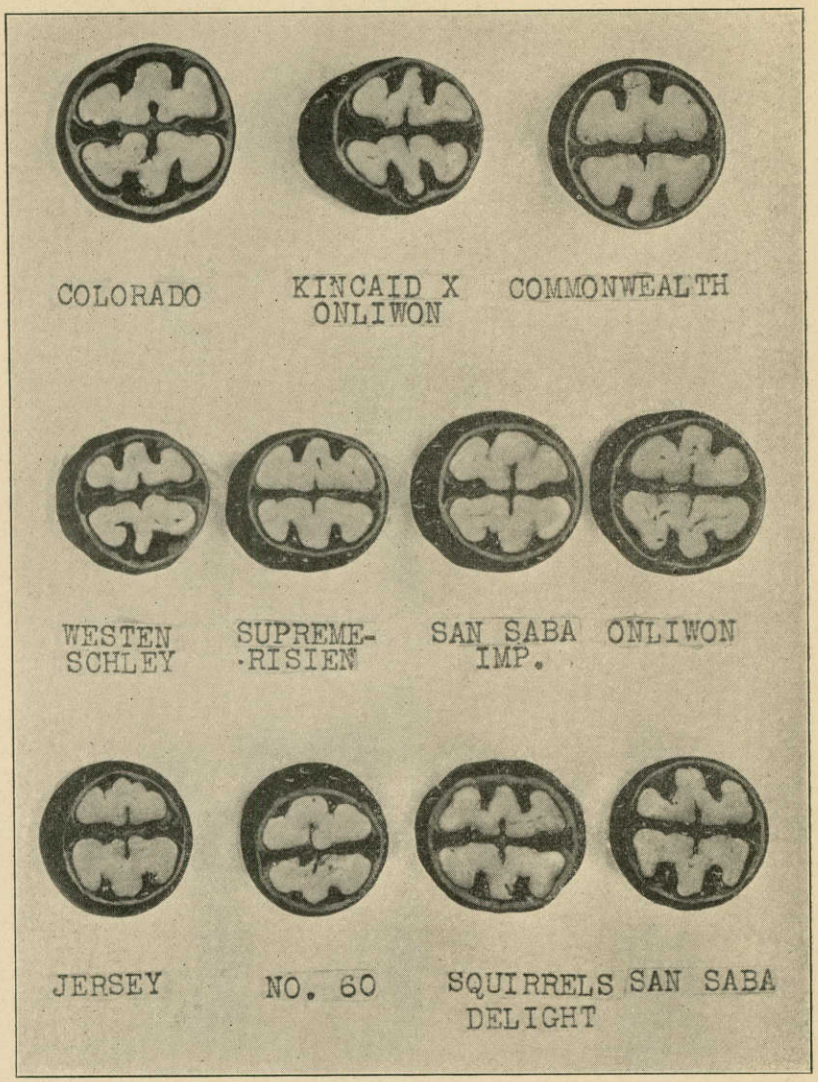
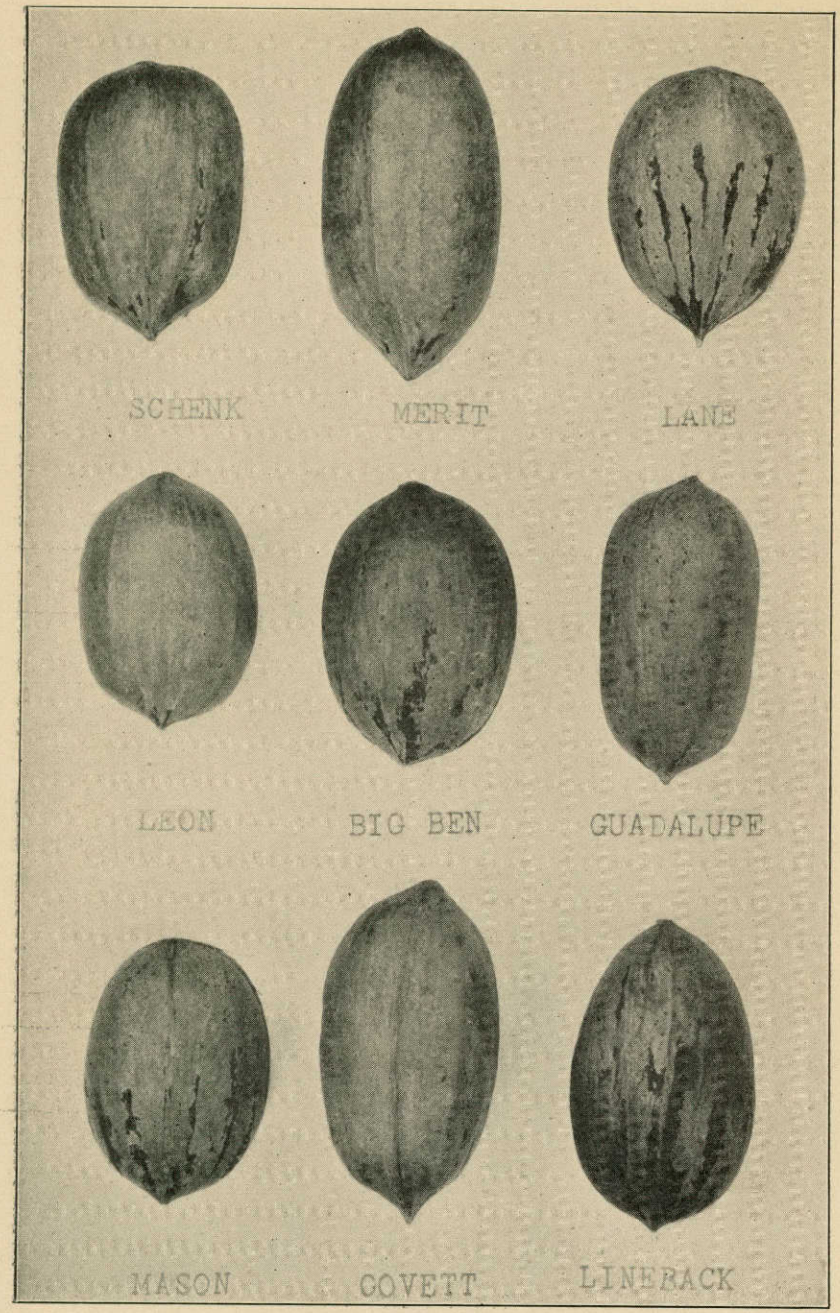

COLORADO KINCAID X ONLIWON COMMONWEALTH
WESTERN SCHLEY
SUPREME- -RISIEN
SAN SABA IMP.
ONLIWON
JERSERY NO.60
SQUIRRELS DELIGHT
SAN SABA

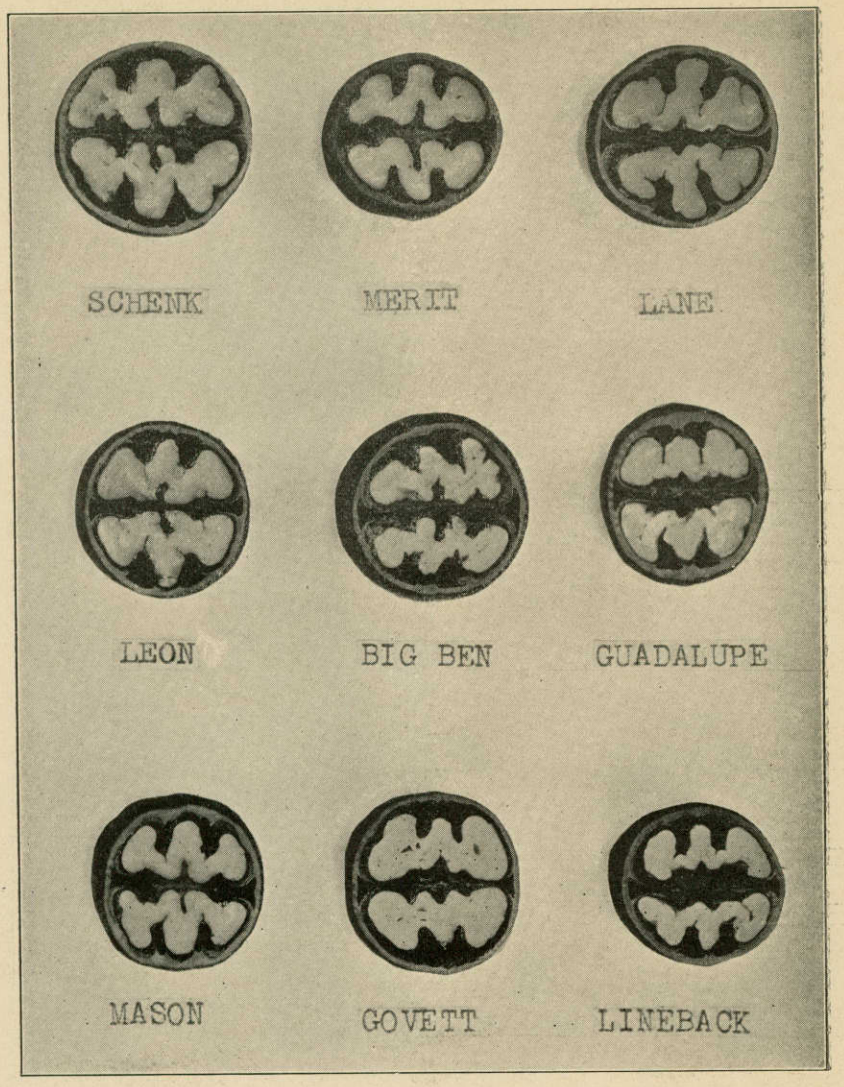
MOUNT NO. 12.


COLORADO
KINCAID X ONLIWON
COMMONWEALTH
WESTEN SCHLEY
SUPREME-RISIEN
SAN SABA IMP.
ONLIWON
JERSEY
NO. 60
SQUIRRELS DELIGHT
SAN SABA

MOUNT NO. 13.


SCHENK
MERIT
LANE
LEON
BIG BEN
GUADALUPE
MASON
COVETT
LINERACK

MOUNT NO. 14.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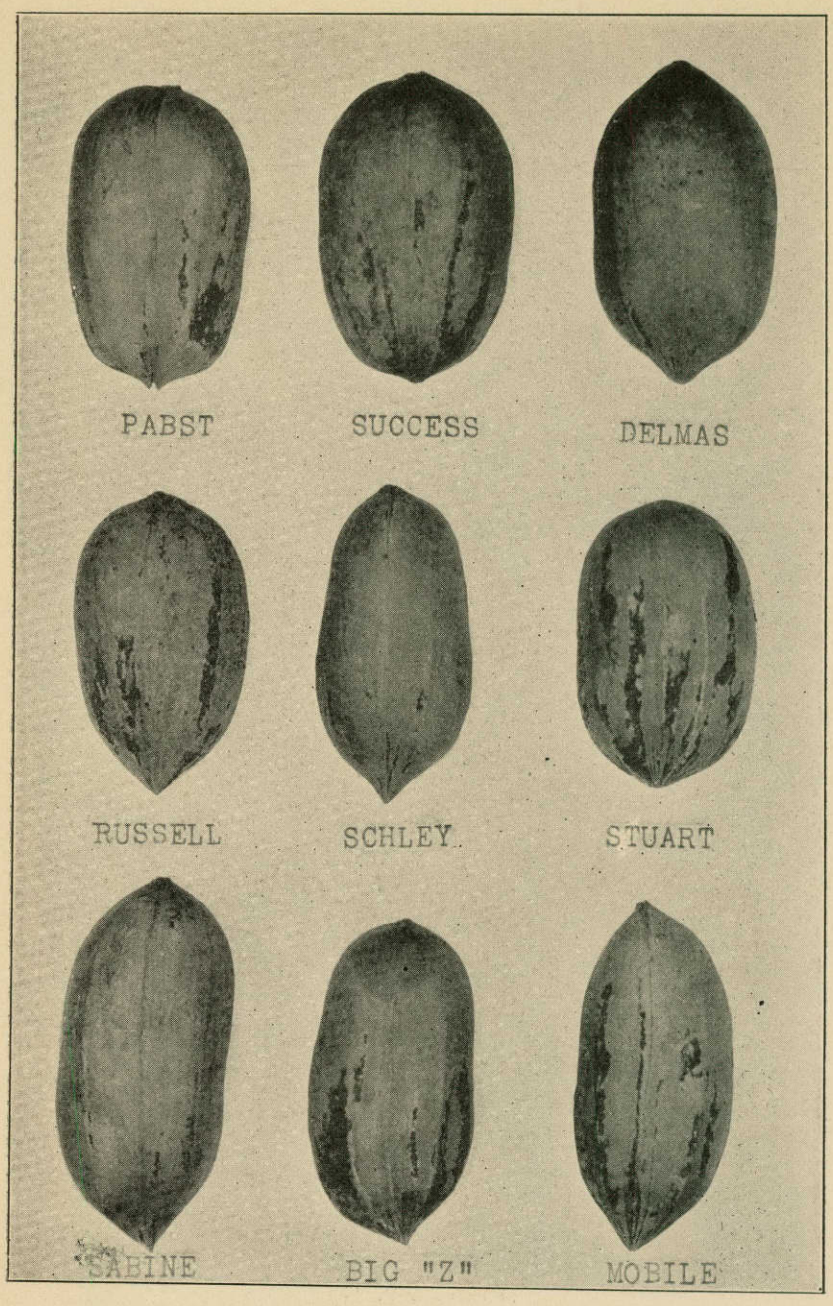
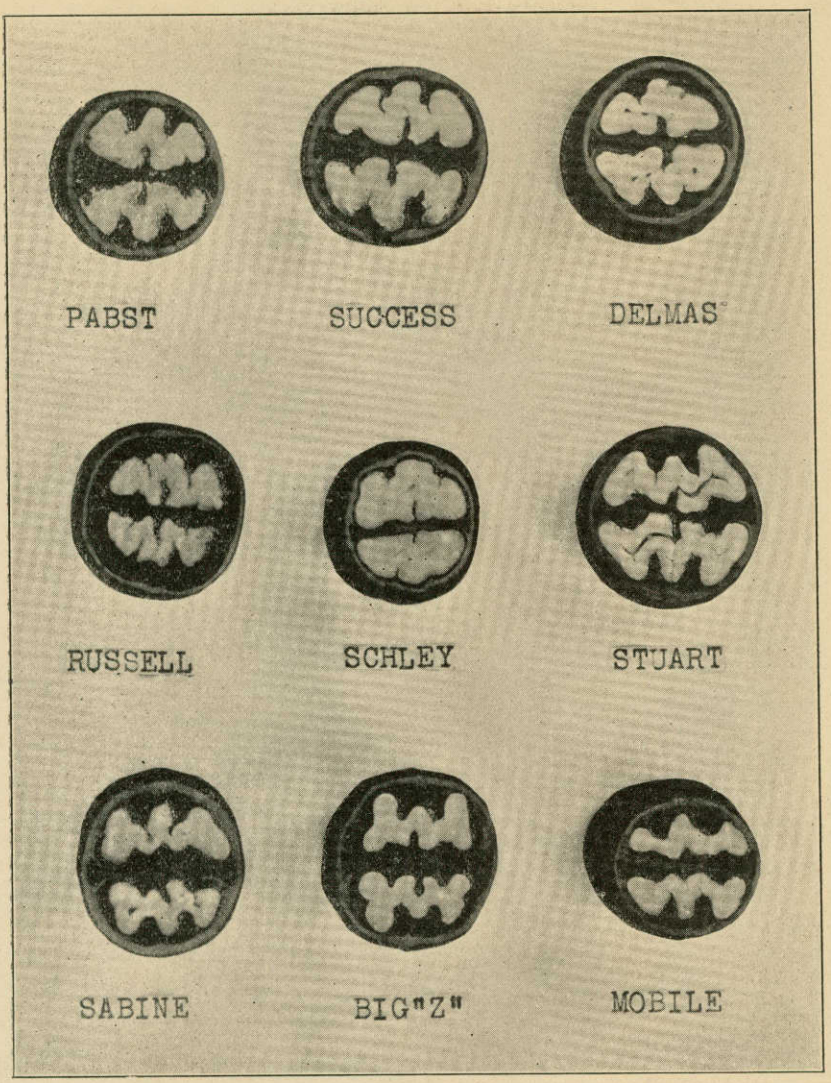
MERIT
LANE
LEON
BIG BEN
GUADALUPE
MASON
GOVETT
LINEBACK

MOUNT NO. 15.


PABST
SUCCESS
DELMAS
RUSSELL
SCHLEY
STUART
SABINE
BIG "Z"
MOBILE

MOUNT. NO. 16.


PABST
SUCCESS
DELMAS
RUSSELL
SCHLEY
STUART
SABINE
BIG "Z"
MOBILE

MOUNT NO. 17.

Merit.—Grown by L. D. Merrett, DeLeon, Texas. Runs 53 nuts per pound, 49% meat. Medium thin shell, extra fine cracking quality, good color and shape. Desirable. Sent in by Ross R. Wolfe, Stephenville, Texas.

Millican.—Runs 48 nuts per pound, 59.8% meat. Thin shell, well filled, desirable shape. Defective in that the sutures of the kernels are deep and narrow and the corky substance hard to remove. Good cracking quality. Sent in by D. F. Moore, Bend, Texas.

Franklin.—Runs 48 nuts per pound, 52.8% meat. Medium thin shell, good cracking quality, well filled, good shape and color. Sent in by D. F. Moore, Bend, Texas.

Hilderbrandt.—Runs 47 nuts per pound, 45% meat. Thin shell, poor cracking quality, brittle kernels. About equal to Stuart. Undesirable. Sent in by Mrs. W. J. Hilderbrandt, Gonzales, Texas.

Alex.—Sent in by Frank Willmann. Grown by Mr. Alexander, Menard, Texas. Runs 50 nuts per pound, 46.7% meat. Medium thick shell, poor cracking quality, plump solid kernels, brittle and dark colored meat. Undesirable.

Williams.—Sent in by Frank Willmann, Owner, Charles Williams, Fredonia, Texas. Runs 74 nuts per pound, 59.2% meat. Thin shell, fine cracking quality, well filled, good color and shape. Valuable for commercial cracking plants.

Durst.—Sent in by Frank Willmann. Owner, Charles Durst, Art, Texas. Runs 64 nuts per pound, 52.9% meat. Medium thin shell, well filled, good shape, good cracking quality, small size. Sweet and delicious. Excellent family nut.

Sirocka.—Sent in by J. A. Evans. Originated on farm of John Sirocka, LaGrange, Texas. Runs 60 nuts per pound, 53.7% meat. Said to be an early and very prolific bearer. Promising for the section where it originated.

Evans.—Sent in by J. A. Evans. Originated on farm of John Sirocka, LaGrange, Texas. Runs 53 nuts per pound, 60% meat. Thin shell, rich yellow oily meat, superior flavor. Promising.

Simmons.—Sent in by J. A. Evans. Originated in the Leon Valley near DeLeon, Texas. Too small to catch the eye of the passer by. Runs 66% meat. Is said to be a regular and consistent bearer. Excellent table nut. Will probably prove of special value.

Napier.—From Menard County. Sent in by Frank Willmann. Runs 50 nuts per pound, 51.5% meat. Inferior cracking quality, releasing its meats gingerly. Makes fine appearance.

Deats.—Sent in by Frank Willmann. Originated on farm of Mr. Deats, Llano, Texas. Runs 56 nuts per pound, 46.8% meat.

Zesch.—Sent in by Frank Willmann, Mason, Texas. Runs 59 nuts per pound, 43.9% meat. Ripens very early.

Odom.—Sent in by R. L. Odom, Toledo, Texas. Runs 42 nuts per pound, 54.8% meat. Extremely thin, loose shell. Very best cracking quality. The individual nut is superior to any yet examined. Parent tree said to be shy in bearing. Most likely a seedling of Russell, which nut it resembles closely.

Melcher.—Sent in by John Schroeder, LaGrange, Texas. Originated on farm of J. C. Melcher, 8 miles west of LaGrange. Runs 58 nuts per pound, 51.2% meat. A pecan-hickory hybrid. See cuts of new varieties.

Mosty.—Sent in by Frank Willmann. Owner, Mosty Brothers. Center Point, Texas. Runs 65 nuts per pound, 55% meat. One of the most prolific of any variety yet observed. Very promising on account of its unusual production.

Alexander.—Sent in by Frank Willmann. Originated at Coleman, Texas. Owner, H. A. Halbert, Coleman, Texas. Runs 67 nuts per pound, 52% meat. Very prolific.

Menard.—Sent in by Frank Willmann, from Menard County. Runs 74 nuts per pound, 56% meat.

Horst.—Sent in by A. Horst, Navasota, Texas. Medium in size, good cracking quality, very prolific.

Guadalupe.—Sent in by R. C. Govett, Seguin, Texas. Medium thick shell, medium cracking quality, not filled well, good color. Runs 47% meat, 56 nuts per pound.

Big Ben.—Sent in by R. C. Govett, Seguin, Texas. Medium cracking quality, not filled well, meat brittle and off color. Runs 49.6% meat, 60 nuts per pound.

NOTE: There were more than 100 unnamed varieties submitted and examined, some of which are possibly of equal value as those listed above, but lack of space and information relative to them makes it impractical to list them here.

EASTERN VERSUS WESTERN VARIETIES.

It has long been claimed that pecans having their origin in the dry, semi-arid sections of the pecan belt would not succeed when carried to lower altitude and humid climates; but that on the other hand varieties which originated in the eastern humid belt can be safely and successfully carried west.

The writer is of the opinion that there are two distinct species of pecans. The Halbert is a representative of the extreme type of the western species, and the Success, Delmas and Stuart are fair representatives of the eastern. Halbert has short joints, straggling limbs, and stout crotches with spreading spray formation with numerous small narrow leaves. The eastern varieties have long slender joints, upright spray formation, with weak crotches, smooth bark and broad thick leaves.

The Halbert, because of its general characteristics having been evolved and developed under our dry, windy arid western section, with numerous parentages of similar characters given to it through sexual influence through the generations past, is typical of the genuine distinctive western species.

On the other hand, the Success, Delmas, Stuart and like varieties have had their origin in low altitudes, wet climate, moderate wind movements and have developed their distinctive characteristics in conformity with these influences. Between these two extreme representatives of the two species, we have numerous varieties shading into, and approaching towards, one or the other. On the one hand, I call to mind the Curtis, the Money Maker and the Bradley,

all of which have markings of having had their origin possibly one or two generations removed of belonging to the western type, yet they originated in the humid belt. As typical of the inter-gradations we have Burkett, Sovereign, and Oliver approaching in some of their characteristics towards the eastern species. Between these extreme types nearly all of the other named varieties are placed. Burkett, Oliver and Sovereign are proving to be more tolerant of the humid climate conditions than Halbert; whether the opposite is true relative to the Curtis, Money Maker and Bradley the writer does not know, as he has not had opportunity of observing them growing under our arid western condition. But this is aside from the main point.

At Marshall, Texas, growing on the grounds of M. Lothrop, a planting of pecan seed was made by Mr. Lothrop about forty years ago. The seed came from Brownwood. The trees resulting from this planting were visited by the writer in 1916, and again in 1917 and again in 1918. None of these trees showed any signs of scab or mildew. Mr. Lathrop informed the writer at the time of the first visit that one of these trees had been a regular and prolific bearer for more than twenty-five years, and that the tree brought an income of something like fifty dollars per annum, and that the tree never missed a crop. The other trees like most seedlings were shy bearers. These trees, though growing in Northeast Texas, while being immune to scab, were typical west Texas species in bark, texture, spray formation, foliage and fruiting habits.

Near Tyler, Texas, on the grounds of Dr. B. F. Bell, a seedling pecan orchard, planted from seed which came from San Saba twenty years before, no trees showed any sign of scab.

At Houston, Texas, a planting of pecans was made about twenty years previous to 1917, when the writer visited this orchard. A Mr. Collins located in the edge of the city, owner of the orchard, stated that the seed from which this orchard was planted came from San Saba, Texas. None of these trees showed any signs of scab or mildew.

Another seedling grove at Mount Pleasant was visited in 1918. These seed came from Denton County, if I remember correctly; anyway it was from some of the pecan growing counties lying west. Almost all these seedlings had mildew and some few of them had scabs.

At numerous other places in East Texas observations have been made where West Texas seed had produced pecan trees that were free from scab. The Western varieties are probably as subject to scab in the western part of the pecan growing region as they are in the East, under the same moisture conditions.

The Halbert has been observed to be badly affected with scab on the Paluxy in Erath County, on the Llano in Kimble County, at

Austin, on the Colorado River, at San Antonio on the Medina River, and at numerous other places in all parts of the State where there was a lack of air drainage and an abundance of moisture. The Burkett, another western variety, which has larger leaves and more abundant foliage than the Halbert, was observed to be slightly infected with scab, both fruit and foliage, at Austin and San Antonio.

At Center Point in Kerr County, in August 1921, on the grounds of Mosty Brothers a Schley tree ten years old growing close to the residence and on the west side was observed to be heavily infested with scab. There were doubtless some unusual local conditions present that caused this infestation, as the Schley is said to be very resistant to the scab.

In the opinion of the writer many of our western varieties may be safely planted in the eastern humid part of the State provided they are set where there is free air circulation. Rolling lands will probably prove best for growing the western variety, while the eastern sorts will probably be better suited to low moist places. Under these conditions it is probable, too, that the Western varieties may be as safely planted in the east as the eastern varieties will succeed in the west.

The typical eastern varieties, of which the ones named are representative, have evolved and developed their peculiar inherent characters, thin bark, large thick leaves, upright habits, weak crotches in keeping with the needs of the varieties under such climatic conditions. It does not therefore seem reasonable that they would be as well suited to our western conditions as would our native western varieties.

BLACK WALNUTS.

The black walnut, by nature, is more generally distributed over the United States than any other of our native nuts. It is found in some of its forms in all parts of Texas, wherever other timber grows naturally along our numerous streams.

Owing to this and the further fact that there have been found some few varieties that seem worthy of economic and commercial value, it appears advisable to encourage the planting of the black walnut. Referring to the photo marked mount 19 you will see the various species shown. The top row shows the Thomas walnut; the second row shows one of the nuts cracked with a hammer and the sized pieces of kernels extracted; the other three rows show the nuts as found growing wild in many parts of the State.

These have been planted and from experience nearly all of them have proven well adapted to use as stocks on which to bud the large thin shelled varieties of walnuts as shown in the two top rows.

The small western walnut, Juglans Rupestris, are shown in "B"

appearing in the photo. They have a smoother surface than the large walnut. Only two of these are shown in the picture.

The larger seed of the Rupestris produces as strong vigorous stocks as the Juglans Nigra shown in the photograph.

The improved black walnut should be planted in all parts of the State for both shade and ornament. The Rupestris stocks will grow on almost any soil where the Mesquite grows. And if budded to the better variety will, in a few years, produce an abundance of nuts which, will, in a large measure, take the place of pecans.

There are only two varieties that the writer would recommend, one of which he is planting for commercial purposes, the Thomas and the Benze. The former is a native of Indiana, and the Benze is a native of Texas, having been introduced, and being disseminated by the Texas Nursery Company of Sherman, Texas. The Thomas is succeeding well at Clyde, where the writer has had it under test and observation for six years. Every home owner should plant a few black walnuts for shade and fruit. They are very resistant to insects and diseases.

THE NATIVE HICKORY.

There must be somewhere in the native hickory forests some one or more varieties that are worthy of commercial propagation.

Five or six years ago the writer under the direction and encouragement of the then Commissioner of Agriculture, Honorable Fred Davis, made an effort to discover, if possible, such a variety. Through the State papers publicity was given and announcement made that a prize of $25.00 would be given for any variety of hickory nuts found that proved to be worthy of commercial propagation.

There were more than 200 samples of hickory nuts sent in, but few that gave promise of special value were received.

There was, however, one sent in from some point in South Texas that had a very thin soft shell. The nut resembled the Persian walnut of commerce. Unfortunately the sender failed to furnish his name and address, and it was impossible to find the locality from which the nuts came. This is recorded here with the hope that some one who chances to read these lines may happen to know of this very unusual variety of hickory nut—a thin soft shell hickory nut. As I remember, the nut itself, so far as meat content is concerned, was of no special merit, but it would probably prove of value for breeding purposes.

There was another hickory nut received that seemed to be a special value which came from Wood County, Texas. The writer wrote to the address appearing on the package and the letter was returned marked, "unclaimed." The writer would like to hear from the person who sent it.

There were also two other varieties, one, the McGee from Marshall, and the other the Zorn, from near Tyler, Texas. The writer has the McGee growing on his grounds at Clyde, and the Zorn has been disseminated and attempts to grow it have been made at two places,

in New York State, and at Rusk, Texas. Neither of these two last named varieties are deemed worthy of being perpetuated except for experimental and scientific purposes.

The writer would like to urge that any persons reading these lines should become interested in trying to locate any hickory nuts* or black walnut growing within the State that he believes possess superior value. Anyone knowing of such a nut that would prove to be of commercial importance would become a benefactor to his race by making his discovery known. Just write the Commissioner of Agriculture, Austin, Texas, and he will see that the clue is followed up.

If a black walnut that is native to Texas and which is superior to the now known and named sorts, or hickory nut that would be of value for economic and commercial purposes can be found in Texas they will doubtless prove to be worth many millions of dollars to the State, and will reflect credit and honor to the finder.

Let the public school children in all parts of the State become interested in hunting for such nuts where they happen to be native.

BLOOMING HABITS OF DIFFERENT VARIETIES.

In the spring of 1923 some twenty pecan trees of different varieties were selected in an orchard of Mr. F. T. Ramsey. A record was kept of the dates that the blooms appeared, both male and female. It was my intention to keep this record from the time the buds began to swell until the nuts were gathered, but most of the nuts were destroyed by the nut case-bearer. You will note that no record was made from March 12th until April 10th. This was due to the severe freeze that came on March 18th and killed all of the swollen buds.

Some trees died and some were not far enough along to be completed when I was forced to discontinue my observations, which was on May 7th. Tree No. 17 was in full leaf on March 18th when the freeze came. The previous year's growth was killed. By April 23rd a new crop of catkins and pistillate flowers had both been set on growth that had been put on since the freeze.

*NOTE: There has been found what appears to be a hybrid pecan-hickory near LaGrange, Texas, which is illustrated by picture under "New Varieties" in this Bulletin.

Tree No.	Variety	Date Male Blooms Appeared	Date Leaf Buds Appeared	Date Female Blooms Appeared	Date Male Blooms Active	Date Female Blooms Receptive	Date Male Blooms Inactive	Date Female Blooms Fertile
1	Stuart	April 23	April 10	April 28	May 2	May 2	May 7	May 7
2	Hempstead	April 16	April 10	April 28	May 2	May 2	May 7	May 7
3	Swinton	April 16	March 12	April 23	May 2	May 2	May 7	May 7
4	Burkett	April 23	April 10	April 28	May 2	May 2		
5	Burkhardt	April 16	April 10	April 28	May 2	May 2	May 7	May 7
6	Halbert	April 16	April 10	April 23	May 2	May 2	May 7	May 7
7	Seedling	April 23	April 23	May 2	Tree died.			
8	Colorado	April 23	April 10	May 2	May 7	May 7		
9	Owens	April 16	April 10	April 23	May 2	May 7	May 7	
10	Longfellow	April 23	April 16	May 2	Male flowers inactive before female flowers are receptive.			
11	Stuart	April 23	April 28	No female blooms appeared.				
12	Delmas	April 16	April 10	April 23	May 2	May 7	May 7	
13	Seedling		April 16	No blooms of either appeared.				
14	Seedling	April 16	April 10	April 28	May 2	Male blooms gone before female receptive.		
15	Pabst	April 16	March 12	April 23	May 2	May 2	May 7	May 7
16	Pabst	April 16	April 10	April 28	Male blooms inactive before female receptive.			
17	Seedling	April 23	March 12	April 23	May 2	May 2	May 7	May 7
18	Seedling	April 16	March 12	April 28	May 2	May 2	May 7	May 7
19	Seedling	April 10	No blooms ever appeared.					
20	President	April 16	April 10	No female blooms appeared.				

The spring of 1924 observations on the relative blooming periods were made at Glen Rose, Somervell County, in the top-worked grove of Dr. A. Caswell Ellis. The data obtained is given in the table below.

RELATIVE VARIETAL BLOOMING PERIODS, GLEN ROSE, TEXAS, 1924.

Variety	Average Length of Catkins	First Pollen Shed	Maximum Dehiscence	Last Pollen Shed	First Stigmas Receptive	Maximum Receptiveness	Stigmas Last Receptive
Banquet	2½	April 24	April 26	April 29	April 25	May 5	May 16
Bradley	3⅞	May 5	May 7	May 9	April 22	May 1	May 9
Burkett	5	May 5	May 8	May 12	April 22	April 30	May 10
Carmen	3½	May 5	May 8	May 9	April 21	April 27	May 5
Colorado	4½	May 2	May 4	May 7	April 22	April 28	May 5
Curtis	4¼	May 9	May 12	May 15	April 24	May 5	May 14
Delmas	4½	May 5	May 6	May 9	April 22	April 28	May 9
Frotscher	5	May 8	May 10	May 12	April 22	April 29	May 9
Halbert	2¾	April 25	April 27	May 1	April 22	May 1	May 14
Kincaid	5½	May 5	May 8	May 12	April 23	April 30	May 12
Mobile	3	April 24	April 27	April 29	April 25	May 3	May 14
Money Maker	5½	May 3	May 4	May 7	April 21	April 27	May 4
Oliver	3	April 24	April 26	April 28	April 23	April 30	May 12
Pabst	3	April 28	April 30	May 2	April 24	May 5	May 14
Russell	4½	May 6	May 7	May 9		May 4	May 12
San Saba	2½	April 28	April 29	April 30	April 25	May 5	May 16
Schley	4	May 5	May 6	May 9	April 22	April 29	May 9
Sovereign (Tex. Pro.)	2½	April 25	April 27	April 29	April 25	May 5	May 16
Stuart	3½	May 6	May 8	May 11	April 24	May 5	May 12
Success	2½	April 28	April 30	May 2	April 24	May 5	May 14
VanDeman	6½	May 5	May 7	May 9	April 21	April 28	May 4

It will be noted that there are two distinct groups of varities with respect to pollen shedding. The first group, in which are Banquet, Halbert, Mobile, Oliver, Pabst, San Saba, Sovereign and Success, sheds its pollen early, even before the maximum receptiveness of the stigmas. The second group, in which are the remaining varieties generally sheds its pollen from 10 to 15 days later, after the maximum

receptiveness, and when the stigmas are from 20 to 98 percent past receptive.

To secure the best pollenation it is therefore advantageous to alternate two or three rows of Group I and II beginning with Group I on the south.

It was found that the two groups may usually be identified by certain floral characteristics. In the first group the embryonic catkins are enclosed in broad bud scales and protrude several days before those of Group II relatively. The matured catkins are short and thick as compared with their length and the individual flowers are shielded by short bracts.

In the second group the embryonic catkins are enclosed in long, narrow bud scales and the individual flowers of the mature catkins generally have long narrow bracts. The catkins are generally much longer and comparatively much thinner than those of the first group and usually there is only one pair at each bud node while the first group usually develops two pairs, which give the appearance of a bunch.

In pecan breeding advantage may be taken of the fact that most varieties become more or less receptive before shedding pollen. By mailing pollen from the southern part of the State to the northern part and applying it before any pollen is shed there and then covering the flowers with absorbent cotton, a cross may be made as nearly certain as possible and without previously covering the stigmas. Otherwise a great deal of work is necessary to cover the young, expanding nutlets and keep foreign pollen excluded until the desired pollen had matured, especially when pollen from a variety of Group II is used. By the above method several hundred clusters may be cross pollenated in a day.

A number of form letters were sent out to growers in the spring of 1924 requesting that they observe the relative varietal blooming periods in their grove. Reports were only received from Mrs. John Kemper, Denison; R. L. Odom, Toledo; and R. C. Govett, Seguin, which are given below.

Blooming Periods, John Kemper Grove, Denison, Grayson County, Texas.

Variety	Date Leaf Buds Appear	Date Catkins Appear	Date pistillate Flowers Appear	Date pistillate Flowers Receptive	Date First Pollen Sheds	Date Stigma Surface Dried
Evans		April 12			May 4	
Halbert		April 10		May 1	May 2	
Jerome		April 12			May 4	
Money Maker		April 12			May 7	May 9
Nelson		April 12			May 4	
Oliver		April 10			May 4	
Onliwon		April 12			May 4	
Pabst		April 14			May 4	
San Saba Improved		April 12			May 4	
Success		April 12			May 4	
Texas Prolific		April 12			May 2	
Welty		April 12			May 4	

Remarks: "I had to guess at the date of appearance of some of the catkins. Our man gave me the dates on the pollen shedding of twelve of the varieties."

Blooming Periods, R. L. Odom, Orchard, Toledo, Newton County, Texas:

Variety	Date Leaf Buds Appear	Date Catkins Appear	Date pistillate Flowers Appear	Date pistillate Flowers Receptive	Date First Pollen Sheds	Date Stigma Surface Dried
Money Maker	April 1	April 1	April 13	April 27	Very irregular.	
Frotscher	April 11	April 5	April 20	April 27		
Pabst	April 7	April 7	April 20	April 25		
VanDeman	April 1	April 7	April 20	April 30		
Tesche	April 5	April 10	April 20	April 30		
Curtis	April 8	April 10	April 20	May 2		
Stuart	April 10	April 15	April 26	May 2		
Sabine	April 10	April 15	April 26	May 2		
Odom	April 10	April 15	April 26	May 2		
Success	April 20	April 20	April 26	May 2		

All varieties listed above were very irregular in blooming, but each have set a good crop.

Blooming Periods, R. C. Govett Grove, Seguin, Guadalupe County, Texas:

Variety	Date Leaf Buds Appear	Date Catkins Appear	Date pistillate Flowers Appear	Date pistillate Flowers Receptive	Date First Pollen Sheds	Date Stigma Surface Dried
Govett	March 25	April 10	April 25	April 20	April 25	May 5
Churchhill	March 25	April 10	April 25	April 20	April 25	May 5
Success	March 20	April 5	April 10	April 15	April 20	May 1
Oliver	March 20	April 5	April 10	April 15	April 20	May 1

"I have tabulated the above partly from memory."

OPINION AS TO BEST VARIETIES.

Dear Sir and Friend:

Another year has given you an opportunity of observing the behavior of pecans in your locality. I am asking that you name the variety of pecans that you consider best. Please give first, second, third, fourth and fifth choice, in order of your preference. I desire to use this information in a revised pecan bulletin. Please return at once.

Very truly yours,

J. H. BURKETT, Nut Specialist.

Mr. Alex Forke, New Braunfels, Texas, replies:

"First choice, Burkett; second choice, Success; third choice, Daisy; fourth choice, Schley; fifth choice, Halbert." Jan. 12, 1924.

Mr. Webster Miller, San Saba, Texas, replies:

"First choice, Kincaid; second choice, Texas Prolific; third choice, Deberry; fourth choice, Burkett; fifth choice, Delmas." Jan. 12, 1924.

Mr. B. F. Orr, Del Rio, Texas, replies:

"First choice, Burkett; second choice, Halbert; third choice, Oliver; fourth choice, Schley.

"Many pecans sprouted before falling from trees, probably due to excessive rains in the fall—all trees blossomed from three to four weeks later than usual." Jan. 13, 1924.

Mr. W. T. Evers, Denton, Texas, replies:

"First choice, Burkett; second choice, Texas Prolific; third choice, Halbert; fourth choice, Schley; fifth choice, Liberty Bond.

"As time goes by I may change the order of my preference, as some of what I expect to be first-class varieties have not yet borne any pecans. Other promising varieties are: Western Schley, Onliwon, Kincaid, San Saba Improved." Jan. 13, 1924.

Mr. W. L. Mewhiney, Holland, Texas, replies:

"First choice, Burkett; second choice, Halbert; third choice, Texas Prolific; fourth choice, Success; fifth choice, Stuart." Jan. 12, 1924.

Mr. S. E. Harber, San Saba, Texas, replies:

"First choice, Burkett; second choice, Kincaid; third choice, Texas Prolific; fourth choice, Halbert; fifth choice, Colorado.

"All pecans in this section seemed to have some nuts that did not fill. Halbert almost totally ruined by shuck worm. Kincaid badly affected by same. Burkett not affected." Jan. 12, 1924.

Mr. T. H. Ridgeway, San Antonio, Texas, replies:

"First choice (for lowlands), Stuart; second choice (for uplands), Burkett; third choice (for uplands), Halbert." Jan. 12, 1924.

Mr. C. B. Starke, Holland, Texas, replies:

"First choice, Burkett; second choice, Texas Proific; third choice, Stuart; fourth choice, Oliver; fifth choice, Halbert." Jan. 12, 1924.

Mr. M. D. Tilson, Texarkana, Texas, replies:

"First choice, Stuart.

"As practically all of my trees are Stuart, have had very little experience with any other, therefore could not state which I would recommend." Jan. 12, 1924.

Mr. E. B. Cartwright, Weatherford, Texas, replies:

"First choice, Halbert; second choice, Burkett; third choice, Stuart; fourth choice, Schley; fifth choice, Delmas." Jan. 12, 1924.

Mr. H. A. Halbert, Coleman, Texas, replies:

"First choice, Halbert; second choice, Lilly, alias Alexander; third choice, Stuart; fourth choice, Texas Prolific; fifth choice, San Saba.

"Halbert and Lilly original trees stand in one mile of each other on Hord's Creek—my introduction, Stuart, is more universal than any pecan. I have never grown the Burkett but the first specimen I ever saw had nothing but size to recommend it; since then better specimens have been shown me. Texas Prolific and San Saba have originated close to me. Plant that nut which originates the closest to you, is the safest rule to follow." Jan. 13, 1924.

NOTE: "The variety called Lilly is the original Alexander as I am reliably informed. Mr. Halbert at one time showed me a top-worked tree on his grounds that he designated as 'Alexander or Lilly.' "—J. H. Burkett.

Dr. A. Caswell Ellis, Glen Rose, Texas, replies:

"First choice, Halbert; second choice, Kincaid; third choice, Texas Prolific; fourth choice, Burkett; fifth choice, Houston.

"Halbert and Kincaid bore twice as much, at least, as Burkett or Texas Prolific for the past three years—probably five to ten times as much as Eastern varieties. Burkett and Texas Prolific seem to bear about alike, about one-half as much, or less, as Halbert and Kincaid and twice to five times as much as Eastern varieties. Eastern varieties may do better other years. The nuts of Schley, Stuart, Delmas, Frotscher, Russell, Bradly and Curtis are fine, but cold spring snaps and bugs got them largely the past three years. Schley did better than any other Eastern nut this year for me. It made a fifth of a crop." Jan. 12, 1924.

Mr. W. H. Schevertzer, replies:

"First choice, Moneymaker; second choice, Burkett; third choice, Success; fourth choice, Texas Prolific; fifth choice, Stuart and Schley.

"I have come to the conclusion that Texas varieties are best for Texas. If I had my time to go over again, would not propagate any other than good Texas sorts."

Mr. Dale C. Glen, Granbury, Texas, replies:

"First choice, Oliver; second choice, Burkett; third choice, Stuart; fourth choice, Halbert; fifth choice, San Saba." Jan. 12, 1924.

Mr. C. E. Kaigler, San Angelo, Texas, replies:

"First choice, Halbert; second choice, Burkett; third choice, Stuart; fourth choice, Texas Prolific; fifth choice, Success and Delmas.

"All varieties have one or more weak points. Halbert heaviest annual bearer, but after damp, rainy seasons, kernels fail to fill well. Burkett growing in favor with both growers and consumers. No trouble to sell Burkett at good price. Faulty cluster-formation is its one fault, making it much subject to injury by insects. Stuart in moist locations is bearing good crops now, but much subject to die-back in heavy or limy soils. Texas Prolific fails to fill well in wet seasons like 1923. Some Success trees budded in 1915 still healthy and bearing well, Delmas doing nicely but not fruiting yet." Jan. 12, 1924.

Mr. J. W. Taber, Brownwood, Texas, replies:

"First choice, McCulley; second choice, Burkett; third choice, Texas Prolific; fourth choice, Halbert.

"I do not think any Eastern variety is desirable for this section."

Mr. C. F. Denny, Comanche, Texas, replies:

"First choice, Burkett; second choice, Halbert; third choice, Texas Prolific; fourth choice, Delmas; fifth choice, Success.

"I do not consider my choice worth anything as my orchard has not come into bearing, but I have named the varieties in the orler in which I am budding my 100-acre orchard. My first buds were placed in the Spring of 1923." Jan. 14, 1924.

Miss Carrie Lyendecker, New Ulm, Texas, replies:

"First choice, Delmas; second choice, Eggshell; third choice, James Papershell; fourth choice, Success; fifth choice, Moneymaker.

"Also think the Frotscher, Curtis and Stuart a success here; we have a few Schley and Carman top-worked trees which I think will bear this year." Jan. 14, 1924.

Mr. J. W. White, Mason, Texas, replies:

"First choice, Schley; second choice, Halbert; third choice, Stuart; fourth choice, Delmas; fifth choice, Burkett."

Mr. N. A. Palmer, Comanche, Texas, replies:

"First choice, Burkett; second choice, Halbert; third choice, Texas Prolific; fourth choice, Delmas; fifth choice, Burkhardt.

"I have Moneymaker, Stuart and Daisy, but so far they have not come up to my expectations. Success may possibly prove as good or better than some named in my choice list. The Burkhardt is one I have had all the while but got the wood from Mr. Ramsey in 1917 for Burkett. So never got it identified until this year. It is the most prolific and regular bearer of any large pecan I know." Jan. 13, 1924.

NOTE: "The variety Mr. Palmer calls Burkhardt I have identified as an unnamed variety seedling."—J. H. B.

Mr. W. H. Oglesby, Goldthwaite, Texas, replies:

"First choice, Burkett; second choice, Oglesby; third choice, Delmas; fourth choice, Success; fifth choice, Stuart.

"I have some Burkett and Delmas that are four years old and gathered 10 pounds to the tree in 1923. The pecan that I call the Oglesby is just as fine as any of them; it is not as thin shell as the Burkett."

Mr. D. F. Moore, Bend, Texas, replies:

"First choice, Matsler; second choice, Millican; third choice, Franklin; fourth choice, Hollis; fifth choice, Clark.

"Burkett, Halbert, Texas Prolific, San Saba, Kincaid all do well in Central and West Texas." Jan. 14, 1924.

Mr. E. C. Butterfield, Winona, Texas, replies:

"First choice, Schley; second choice, Stuart; third choice, Pabst; fourth choice, Success; fifth choice, Moore." Jan. 14, 1924.

Mr. M. Lothrop, Marshall, Texas, replies:

"First choice, Stuart; second choice, Curtis; third choice, Success.

"Stuart first and always." Jan. 12, 1924.

Mr. W. F. McDaniel, San Augustine, Texas, replies:

"First choice, Sturat; second choice, Pabst; third choice, Moneymaker; fourth choice, Nelson; fifth choice, Schley.

"I am only growing varieties that have been well tried out; all except the Schley—it has not been grown in this section enough for us to yet know how it will do. The old Nelson has but a few friends but seems like it is going to be a heavy cropper on this red belt of land. I am not offering but few of them for sale." Jan. 13, 1924.

Mr. E. J. Kyle, School of Agriculture, College Station, Texas, replies:

"First choice, Delmas; second choice, Success; third choice, Texas Prolific; fourth choice, Burkett; fifth choice, Stuart." Jan. 14, 1924.

Mr. W. J. Millican, Bend, Texas, replies:

"First choice, Millican; second choice, Clark; third choice, Matsler; fourth choice, Franklin; fifth choice, Hollis or Jumbo.

"Breeding for a variety that don't set in thick clusters but on the

order of corn, one to two on each side of the stem. We find that the nut case bearer does not affect them as severely as those in 5 to 10 in a cluster. When they become infested, it affects the nutlets of the whole stem and causes those not bored to fall." Jan. 14, 1924.

Mr. O. P. Griffin, replies:

"First choice, Texas Prolific; second choice, Burkett; third choice, Halbert; fourth choice, Stuart; fifth choice, San Saba."

Mrs. John Kemper, Denison, Texas, replies:

"First choice, Burkett; second choice, Halbert; third choice, Stuart; fourth choice, Texas Prolific; fifth choice, James.

"Onliwon, Western Schley, Success, Carman all make excellent showings. Also some other varieties that fruited for the first time and I do not feel safe in judging by one crop. Hope to be able to control the scab entirely in another year or two—then Halbert may head the list. Delmas averaged best yield to all varieties—fine large nuts but did not fill well. Our first crop of them, 1917, ruined by October freeze. Few nuts to judge by until this year." Jan. 14, 1924.

Mr. John Kemper, Denison, Texas, replies:

"First choice, Burkett; second choice, Halbert; third choice, Texas Prolific; fourth choice, Stuart; fifth choice, Success." Jan. 14, 1924.

Mr. J. E. Fitzgerald, Stephenville, Texas, replies:

"First choice, Burkett; second choice, Halbert; third choice, Stuart; fourth choice, Texas Prolific; fifth choice, Delmas.

"I have recently found two very fine pecans. One is on Dan Lane's place near Stephenville. Will propagate some of these nuts next season. The other is owned by Mr. L. D. Meritt at DeLeon. If these two prove to be good bearers and I am informed they are, they are liable to make their mark in the world." Jan. 14, 1924.

Mr. Emmett Brown, Cleburne, Texas, replies:

"First choice, Schley; second choice, Stuart; third choice, Success; fourth choice, Delmas, fifth choice." Jan. 15, 1924.

Mr. Charles B. Metcalfe, San Angelo, Texas, replies:

"First choice, Burkett; second choice, Halbert.

"We had some fine Stuarts this year but it was on account of wet weather. Ordinary average years it does not fill." Jan. 14, 1924.

Mr. Ross R. Wolfe, Stephenville, Texas, replies:

"First choice, Halbert; second choice, Burkett; third choice, Texas Prolific; fourth choice, Kincaid; fifth choice, Alexander.

"I consider the Halbert an upland variety for West Texas. Burkett, Texas Prolific and Kincaid are fine in upland and lowland. Alexander is even more prolific than Halbert, this past season it had a percent of faulty nuts. Stuart is more subject to rosette; Delmas, Success and Schley are doing well where supplied well with moisture. We have some natives that are looking very promising." Jan. 15, 1924.

Mr. O. S. Gray, Waxahachie, Texas, replies:

"We are on the dividing line between Eastern and Western varieties, and some of both sorts are doing well here. Since I have not trees

bearing yet, I prefer to not determine the relative value of varieties but to state that we are using the best of both Eastern and Texas sorts. Halbert, Burkett, Western Schley, Delmas, Success and Stuart are giving satisfaction. Delmas is often highly recommended for the black-waxy upland soils. We find that the susceptible Western varieties sometimes scab badly in low, damp bottom locations, especially in wet years." Jan. 15, 1924.

Mr. W. D. Bunting, Uvalde, Texas, replies:

"First choice, Texas Prolific; second choice, Halbert; third choice, Onliwon; fourth choice, Pabst; fifth choice, San Saba Improved." Jan. 14, 1924.

Mr. E. B. Stokes, Crockett, Texas, replies:

"Curtis first, last, and all the time.

"My reason for saying what I do is not the fact that the Curtis nut is a real first-class nut, but because it is precocious, bears almost annually. It is prolific and resists insect ravages." Jan. 14, 1924.

Mr. John Schroeder, La Grange, Texas, replies:

"First choice, Burkett; second choice, Schley; third choice, Bradley; fourth choice, Oliver; fifth choice, Stuart.

"I would caution all parties living as near the coast as we do not to plant too heavily of the Western varieties as they scab in this latitude. Burkett and Oliver are exceptions to this rule and have done exceedingly well during the last three years, never failing to have a good crop although the native pecans only had one real crop during this period.

"Everyone who owns native pecans should not fail to top-work the same. A little energy and attention at this time will be certain to bring good returns within a few years." Jan. 16, 1924.

Mr. F. Lukenbach, Menard, Texas, replies:

"First choice, Kincaid; second choice, Texas Prolific.

"Above are the only varieties I had bearing this season. I have the following varieties coming on now but too young to bear, Halbert, Stuart, Daisy, Van Deman, Success, Schley, Delmas, McCulley. I have several hundred grafted and top-worked native trees, and have two orchards planted of 600 to 700 trees, which will not bear for several years." Jan. 16, 1924.

Mr. A. Horst, Navasota, Texas, replies:

"First choice, Success; second choice, Stuart; third choice, Pabst; fourth choice, Frotscher; fifth choice, Columbia." Jan. 17, 1924.

Mr. Geo. McLain, 1210 W. 5th. St., Austin, Texas, replies:

"First choice, Napier; second choice, Texas Prolific; third choice, Hollis; fourth choice, Houston; fifth choice, Kincaid.

"I do not know the name of my first choice; it favors somewhat the Frotscher. The tree belongs to J. E. Pierce, Professor of the University, and is located 8 miles up Lake Austin, on the East side. This tree has delicate limbs, slender leaves and has produced 7 full crops without a failure. Any person having a variety resembling this variety we will be pleased to know as J. H. Burkett, Nut Specialist, is trying to determine the variety, also the location of the original tree. I consider it one of the more valuable trees in the State of Texas for its size." Jan. 17, 1924.

Mr. Otto Locke, New Braunfels, Texas, replies:

"First choice, Daisy; second choice, Schley; third choice, Van Deman; fourth choice, Success; fifth choice, Stuart.

"We name Daisy first as it originated here and considering the growing habit of productiveness the Daisy is the best for our location, grows twice as fast as any other variety." Jan. 15, 1924.

Mr. Frank Morgan, Belton, Texas, replies:

"First choice, Burkett; second choice, Delmas; third choice, Liberty, a native of our farm.

"I have several other varieties but as they have not come into bearing I cannot list them in the proper order, but will state that the Eastern or Coastal varities do not do well here, they grow thrifty but fail to bear, while Burkett the same age have borne heavy crops of first quality nuts two years from buds put on native sprouts or young trees." Jan. 15, 1924.

Mr. R. W. Fair, Arp, Texas, replies:

"First choice, Schley; second choice, Success; third choice, Stuart; fourth choice, Delmas; fifth choice, Moore; sixth choice, Moneymaker.

"West Texas-Burkett, Halbert, Kincaid, Texas Prolific, Stuart, Delmas, Success—it's hard to tell."

Mrs. Geo. R. Felter, Austin, Texas, replies:

"First choice, Houston;. second choice, Hollis; third choice, Stuart; fourth choice, Texas Prolific; fifth choice, Kincaid." Jan. 15, 1924.

Mr. P. K. DeLaney, Seguin, Texas, replies:

"First choice, Schley; second choice, Success; third choice, Delmas; fourth choice, Pabst; fifth choice, Moneymaker.

"Insect pest has been so bad since trees began to bear, have not been able to decide as to the best bearer. Moneymaker has proven best so far with Success second." Jan. 18, 1924.

Mr. Fred W. Westcourt, Stephenville, Texas, replies:

"First choice, Burkett; second choice, Halbert; third choice, Texas Prolific; fourth choice, Kincaid; fifth choice, Delmas." Jan. 21, 1924.

Mr. M. L. Campbell, Waxahachie, Texas, replies:

"First choice, Delmas; second choice, Success; third choice, Stewart; fourth choice, Schley; fifth choice, Halbert."

Mr. R. C. Govett, Seguin, Texas, replies:

"First choice, Govett; second choice, Church Hill; third choice, Burkett; fourth choice, Success; fifth choice, Schley.

"All of the above pecans are of the best quality; we had five months drouth in this immediate section, which pinched the nuts to a certain extent. The reason I give the preference to the first two, they are natives to this immediate locality, are good bearers under adverse conditions and free from disease so far."

F. T. Ramsey & Sons, Austin, Texas, replies:

"First choice, Burkett; second choice, Texas Prolific; third choice, Success; fourth choice, Moneymaker; fifth choice, Stuart.

"Meyers may be listed in the 'best' list, Schley should be on the list, Oliver will sell for more dollars per pound or per tree or per acre than any we have grown." Jan. 29, 1924.

A. C. Easley, Waco, Texas, replies:

"First choice, Halbert; second choice, Success; third choice, Delmas; fourth choice, Burkett; fifth choice, Banquet.

"Don't ever forget that the above is merely my present opinion, subject to change without notice. As I wrote you before, I am earnestly trying to find out what varities are best adapted for Central Texas. To this end I have 18 varieties growing on my place. Two of them, however—Moneymaker and Hollis—I have permanently discarded and am top-working to Success. In fact I am budding this year only to Halbert and Success. The other 14 varieties I am holding 'on suspicion.' Some of them got by this year by 'the skin of the teeth' and will more than likely lose their tops another year. It is not my plan, however, to limit my orchard to the two varities mentioned, nor to any other two even tho they should prove to be better than any others. I expect to keep about six varieties—3 Texas and 3 Eastern." Jan. 27, 1924.

Eugene Tipton, Ft. Worth, Texas, replies:

"First choice, Halbert; second choice, Burkett; third choice, Texas Prolific; fourth choice, Cline." Feb. 2, 1924.

E. Toepperwein, Menard, Texas, replies:

"First choice, Texas Prolific; second choice, Kincaid; third choice, Burkett; fourth choice, Halbert; fifth choice, Schley.

"Grafting and budding pecans is so far too new in this country to be certain which would be the best nut in years to come, there will be several years yet before we can be sure of the best varieties."

Mr. R. L. Odom, Toledo, Texas, replies:

"My experience with pecan varieties has been:

"The Van Deman is a fine nut, the prettiest and quickest shade tree of all, but a shy bearer.

"The Stuart is a fine nut, a safe tree all around, a little later to begin bearing than most varieties. Free from diseases.

"The Moneymaker does well here, is very prolific, ripens early and pays better than most of the others.

"The Teche is also very prolific but does not always fill well, is smaller than the Moneymaker, but thinner shell. We have as high as 92 pounds for seventeen-year-old Teche this year.

"The Curtis is small with thin shell and fine flavor, is very prolific, but ripens too late to suit me.

"The Pabst is a fine tree and bears well, the nuts are fine when the scab does not hit it. It was the only variety that scabbed with us.

"The Success bears like a blackberry vine, but cannot fill all the nuts. If it filled well it would be the best of all in bearing.

"The Sabine, a new East Texas variety, is very large and bears well, but does not fill well except under very favorable conditions. I sold a party a Sabine tree 12 years ago and bought half the crop from the tree this year for $28.60, getting 38 pounds.

"The Odom, also a new nut originating in East Texas, is a large thin shell nut, bears well and is healthy, bids well to be one of the best."

WESTERN PECAN SUPERIOR IN FLAVOR.

O. S. GRAY.

Secretary Texas Pecan Growers' Association.

(Extract from "Farm and Ranch," December 15, 1923, by permission.)

Prominent Western Varieties.

The western varieites come mostly from the fertile valleys of Western Texas where the tops are in warm, dry atmosphere and the roots descend to a moderate, steady supply of moisture. Western nuts are superior, as a rule, in richness and flavor, to the eastern, while the limbs of the trees branch and spread to a much greater extent.

Prof. C. A. Reed, head of the nut division of the United States Department of Agriculture, said in a recent address on "Pecan Varieties" before the National Nut Growers' Association, "Texas has produced a number of varities, which, in so far as combinations of early age of bearing, habits of heavy bearing, thinness of shell, plumpness, richness and sweetness of kernel are concerned, are without peers. Anyone who has seen, cracked and tasted San Saba and Halbert knows this to be a fact. For table consumption few can be better. They are seriously subject to pecan scab under conditions of humidity. They are not planted with safety east of Central Texas."

The Halbert, a small pecan from Coleman County, Texas, introduced by H. A. Halbert of Coleman, is perhaps the most prolific and earliest to bear of our well known varities. The shell is very thin, kernel unusually plump, quality rich, flavor excellent, a true "gentleman's pecan" par excellent for table use, but relatively poor as a machine cracker on account of its shape, being a round pecan. The Halbert is highly susceptible to scab and should not be used on very rich soil. It is very sensitive to soil and atmospheric conditions. Air drainage seems to influence to a marked extent its susceptibility to scab. Representative Halberts will run approximately fifty per pound with 60 per cent meat.

The Burkett, from Callahan County, Texas, introduced by J. H. Burkett of Clyde, Texas, is one of our largest nuts and is attracting wide attention. Thin shell, excellent quality. It cracks well but is too round to be handled successfully by machine crackers. The Burkett is generally reported free from scab in Texas, seemingly a reasonably resistant variety. Choice nuts will run somewhere around forty to fifty per pound with a meat percentage of about 60 per cent. While the Burkett is hardly as early as the Halbert, Mr. Burkett thinks it will compare favorably with it in pounds of nuts produced, and it is showing up well in many parts of Texas.

The Texas Prolific, originating in San Saba County, Texas introduced by E. E. Risien at San Saba, is a nut of medium size, approximately fifty to fifty-five per pound with over 50 per cent meat. The pecan has a moderately thick shell and a plump kernel of rich

quality and sweet flavor. It is hardly as resistant to scab as the Burkett. It is proving a wonderful variety in many sections of Texas, though it seems that it will be somewhat more restricted in territory than the Burkett.

The Oliver, originating in Southwest Texas, is an extra large pecan with a thick shell. The tree is a heavy and consistent bearer. Quality fair. This variety, fairly resistant to scab, is valuable chiefly as a good producer of big nuts that have nothing but size to recommend them.

The Kincaid, another Texas variety, a nut of only fair quality and medium shell, is becoming more popular as it is proving a heavy bearer of medium to large nuts. The nut is superior to the Oliver.

The Western Schley, another of Mr. Risien's introductions, is a wonderfully prolific tree. The nut is shaped somewhat like the Schley; is medium large and ranks approximately a little above 50 per cent in meat. The writer thinks this variety is well worthy of more extensive use principally on account of its prolificacy.

Propagation of Texas Varieties.

Very little, if any, propagation is done outside of Texas with Texas varieties; consequently it is often difficult to obtain them in quantity. This is only natural when we realize that the greatest demand in the past has been for trees to be planted in other States where our Texas varieties are not adapted because of their usual susceptibility to scab.

Several nurseries are coming into prominence in Texas, and it is hoped that within a few years the demand will be such as to cause all nurseries to begin the propagation of Texas trees in larger numbers. It has even been necessary for some planters to make special contracts for propagation in order to secure supplies of Texas varieties.

At some later date it is hoped to bring before the growers some of the outstanding and promising new varieties originating in Texas that seem worthy of extensive trial. It is safe to predict that the pecan industry in Texas will be made over anew by the use of more suitable varieties as time goes on and our experience enables us to pick out the most profitable kinds.

PECAN CROP FAILURE.

There are several contributing causes or factors bearing directly on the average failure of the pecan crop in Texas.

Freezes and Frost Damage.

Late frosts, occurring after the pecan has begun its new growth for the season, sometimes destroys the pistilate flowers, partially or wholly destroying the crop. When the new growth is just beginning and the temperature is sufficiently low the terminal shoots are killed for that year. The staminate flowers are rarely ever destroyed by

late freezes to such an extent as to destroy the crop entirely. This is especially true of the native Texas varieties. The eastern varieties, such as Schley, Stuart, Delmas, Success, etc., are more susceptible to the loss of their crop on account of late spring frosts than are the Texas sorts.

Late frosts seldom cause the entire loss of the pecan crop throughout the pecan bearing area of the State. It frequently happens that native groves in a given locality will suffer greatly, while a nearby grove or locality will escape entirely. This is accounted for because of poor air drainage. "Frost pockets" recur so often in some small isolated sections that the pecans very seldom produce a good crop. Occasionally climatic conditions are so favorable that all parts of the State escape all destructive agencies, and conditions are favorable throughout, when a "bumper" crop is produced over the entire State.

Another reason for a pecan failure is the presence of an overabundance of rainfall occurring at blooming time. Continuous heavy rainfall appearing daily for a period of five or six days at the time that the pistilate bloom becomes receptive, causes a partial failure of the crop. Also the catkins, once in a great while, are attacked by a black mold during rainy periods. Very seldom is the crop destroyed on account of heavy continuous rainfalls, unless the wet spell is accompanied by still, damp, cloudy, foggy weather, and such conditions cause the attack of the black mold which invariably destroys the pollen, rendering it impotent. Under these weather conditions the pistilate blooms may not be affected at all, but fail of fertilization because of the destruction of the pollen, which causes the nut to fall for lack or fertilization.

Long continued damp, foggy, rainy weather at the time the pollen is ready to ripen and when there is but slight wind, will cause the catkins to develop a black mold or fungus which destroys the vitality of the pollen. A crop failure under such conditions is almost inevitable. Hard dashing rain with clear skies with high wind following soon, even if it occurs daily while the pollen is flying and the nutlets are receptive, does not interfere with the crop production to any great extent.

It also happens sometimes that the pecan crop is cut short because of long periods of drouth the year previous This was a contributing cause of the crop failure in the year 1922. The long dry period, which began in June, 1921, and continued until April, 1922, caused the pecan trees to go into the dormant period 1921 prematurely. When the April rainfall began, it occured at the season of the year when the sap flow became active, and the trees became immediately and unusually responsive, which caused them to grow so rapidly that numerous pecan trees actually pushed off many of the pistilate and some staminate flowers, thus destroying a part of the prospective crop.

Nut Case Bearer.

The writer has been familiar with the nut case bearer for the past forty years; but owing to the fact that several well trained entomological experts have in recent years been making a study of its habits with a view of inaugerating methods of control, I have never given the

insect serious thought until the spring of 1923. From the fact that the authorities, who have been making a study of the life history and habits of the nut case bearer, have differed somewhat as to the identity of it compared with the "pecan bud worm" or "leaf case bearer," so called by some observers; the writer planned and carried out some original investigational projects with a view of trying to find out something as to the life history of these insects, especially the nut case bearer.

Accordingly in April, 1923, I had built a small 3x3x3½ foot wire cage of screen wire, constructed around a bunch of small pecan sprouts. Beginning the last of April and including the first 15 or 20 days of May, I made diligent search for the nut case bearer and pecan bud worm, as I could find them infesting the young growing shoots of pecans and walnuts. I would take them to my cage and place them in it. These worms were watched at intervals throughout the summer through their three generations, but when cool weather came on in September they disappeared. In October a careful search was made for the hibernating insects. Every particle of the wood and leaf growth of the pecan sprouts were carefully cut and inspected without discovering a single hibernacular.

Later in December the search for them was renewed. The pecan sprouts were cut six inches below the surface of the ground, and a close inspection revealed four empty hibernaculars and one well developed nut case bearer in hibernation. The other hibernaculars were well formed, but empty. These hibernaculars were attached to the collar of the sprouts, about two or two and one-half inches below the surface of the ground.

The writer is planning to carry on the same kind of an investigation again this year on a considerably enlarged scale. It is planned to use three cages, which will be built around bearing trees. The number of insects appearing to be nut case bearer will be placed in one cage, those that appear to be bud worms will be placed in another and those whose identity is uncertain will be placed in another. It is planned to keep an accurate record of the date and number of insects placed in each cage and an effort will be made to trace each throughout their several life cycles. If any are reared through until fall a careful search will be made to locate their hibernating quarters.

TOP-WORKING NATIVE TREES TO IMPROVED VARIETIES.

(This paper was prepared by Judge Guinn to be read before the meeting of the Pecan Growers' Association, held in Brownwood, May 23-24, 1922).

We have in our State a large number of native nut and fruit trees which produce nuts and fruits of little value, but which, if top-worked to improved varieties, would produce nuts and fruits of great value and use.

There are millions of young pecan trees along the rivers and water courses which will, in time, bear a very large proportion of small, inferior nuts, and these by proper top-working, thinning and some attention, could be turned into groves producing very fine pecans with great profit to the owner and great blessing to the consuming public.

The advantages of top-working such trees over setting out groves of improved varieties are many. First—results, that is production, could be thus secured much earlier. Second—lands could be utilized which, on account of overflows and lack of drainage could not or would not be cleared up and set to pecans; and, Third—it would cost much less and the method would be in reach of many who would not feel able to purchase and set out and care for young trees.

In East Texas there are in places wild pecan trees which could be top-worked. In other places the bitter pecan or pig nut, in others some of the many varieties of hickory. All these could with little trouble and expense be converted into profitable pecan trees.

I have on my place hundreds of top-worked hickories and am securing good crops of fine pecans from them, in fact, I find that so far my top-worked hickories, where the situation and environment is equal to that of the pecan trees, the top-worked hickories are more regular and prolific bearers than the pecan trees. This may be, and probably is, the result of the fact that in most instances the top-worked hickories have an older root system than the pecan tree. As to the quality of the nuts obtained from the top-worked hickories, there is little difference, though, as a rule, I find that the pecans grown on hickories are a shade smaller than the same varieties grown on pecan roots. Further, it must be borne in mind that care must be had in what variety of pecans should be used on hickories. In my experience I have found that a number of our best varieties of pecans are not suitable for top-working hickories. The Stuart, for instance, does very little good on hickories, and very few of the West Texas varieties do well on hickories in East Texas, but the same may be said as to the West Texas varieties on pecan stocks in the eastern part of the State, as they scab too badly.

The Burkett has so far appeared to be an exception to the rule, and is doing fine in Eastern Texas on both pecan and hickories. The Oliver also does fairly well, and is extremely productive with us, its defect being its quality. The varieties I have found to be successful on hickories are Delmas, Frotscher, Success and Burkett. I do not pretend to say that these are all, nor that they are the best, as I have not tried all varieties. But they are the best, so far as my experience goes.

Then we have many common black walnuts in East Texas, and the wild varieties grown farther west. They offer great opportunities to the energetic, progressive nut grower. Improved varieties of the black walnut are much superior to the ordinary and by proper selection and the planting of the best varieties of seedlings great improvements can and will be made. By careful watch other varieties will be discovered having superior qualities, and in time we may hope to see as great improvement in the black walnut as has been made in the best varieties of pecans over the common run. The walnut is easily grown and propagated, and is a fine nut naturally, and besides, the timber is highly valuable, and the extensive growing walnuts will add much to the wealth of the country. In addition to the possibilities of growing improved varieties of native black walnuts, there are, in my opinion, great possibilities in top-working our native walnuts to the

Persian or English walnuts. I have fruited on my place as good English walnuts as are grown in California. Some grown on West Texas stock and some grown on our native black walnut.

The varieties fruited are the Mayette and Franquette and I have a good crop set this year on these, and on some other varieties. It will require patience and time to come to definite conclusions on the problems involved, but under the inspiration and leadership of Mr. J. H. Burkett, our enthusiastic and able nut expert, much may be accomplished in a few years along this line.

Mr. Burkett has also been looking up varieties of fine hickory nuts, and this is a most promising field for profitable development. I am fruiting some hickory nuts this year, which promise great things in that line. They are from scions furnished by Mr. Burkett.

We can use the common chinquepin for improvement, the nut being a fine edible nut and the tree a regular and prolific bearer. Great improvements in varieties should, no doubt, be obtained by top-working to any improved varieties which might be found by careful observation. The chinquepin is good stock upon which to top-work the chestnut, and offers a wide field of usefulness in that particular.

As to wild or native fruits, which could be top-worked to improved varieties with profit, the common persimmon is a noted example. We have already found some native persimmons of extra fine quality, and still others will be found or developed, and as the persimmon has an ambition to take possession of the cultivated fields over a large portion of the State, the idea is to find varieties which are valuable and top-work the intruders, and let them take the land or a portion of it. If such should be done, I am wondering if they will not have to be coaxed a bit to grow so freely as at present, or if some insects or disease will not find it to be worth their while to attack and destroy them. I am in favor of trying the experiment, and then, if we could top-work sassafras and bull nettles profitably, much of our East Texas trouble would be over.

The common persimmon is the best basis for growing the improved Japan persimmon, and there is an increasing demand for the better varieties of Japan persimmons, though far inferior, in my opinion, to our better grades of native persimmons.

There are many other native trees which could be profitably utilized to grow improved nuts and fruits, but I have mentioned a sufficient number to point to a field of great possibilities

Let us hope that many Burbanks will grow up in Texas, and bless the people and the generations to come by developing and pushing a work which promises so much of good and of usefulness to the people of the State and of the whole world.

TOP-WORKING—NATIVE WILD GROVES.

So many problems present themselves and there being so very little recorded data and so little actually known in regard to this subject that it will be impossible to give it more than a general discussion.

It may be safe to assert that it is entirely feasible for one to

undertake to top-work any strong, vigorous pecan tree, regardless of its size or age. Whether it would be profitable to do so would depend upon several conditions that might, or might not, be present. It should be understood that each separate grove presents a different problem. No two groves are alike. The soils are probably somewhat different, as well as the age and size of the trees. Then. again, one grove may be on soils well suited to the ordinary

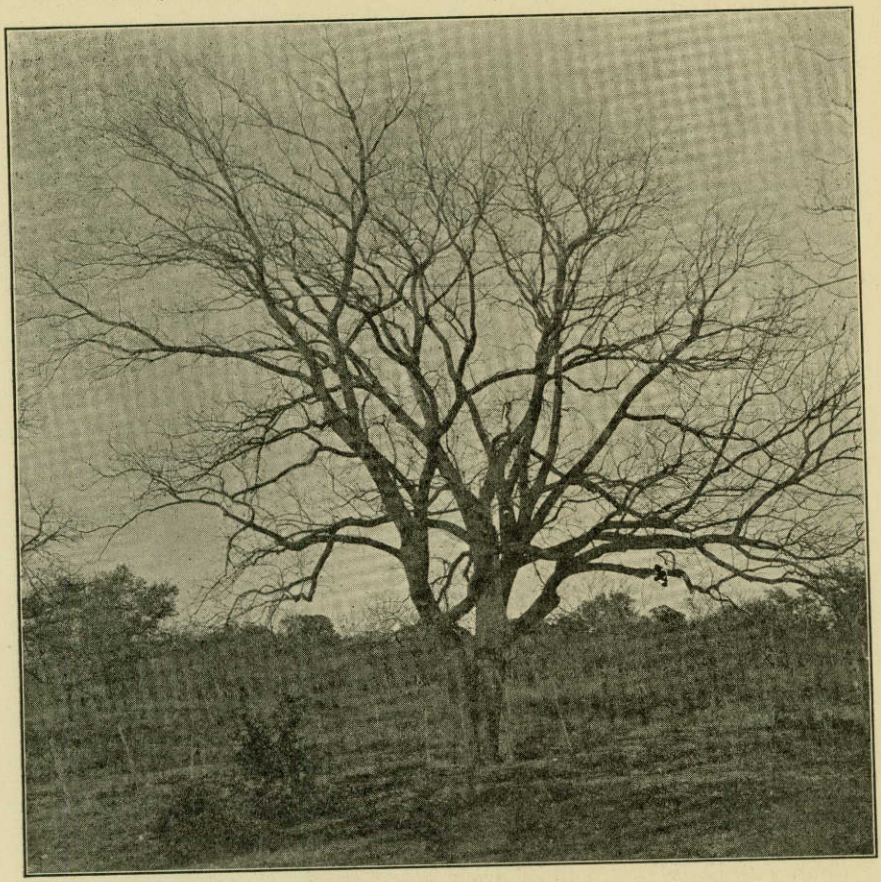


PLATE NO. 20.

NOTE: Large tree as it looked before cutting back the top preparatory to top-working. Observe the same tree after removing the top on opposite page, somewhat closer view shown after topping.

methods of cultivation or domestication, while another has soils that rebel at being disturbed or it is impracticable to bring them under cultivation.

Where one has a native grove that is located on good pecan soil and it is desired to develop it to improved varieties, the first thing to do is to clear the land from all other timber and underbrush. This undesirable growth should be cut even with the

ground. This should be done in the winter. Where the pecan trees are too thick they should be thinned out. The distance to which they should be left will depend upon the size of the trees and the

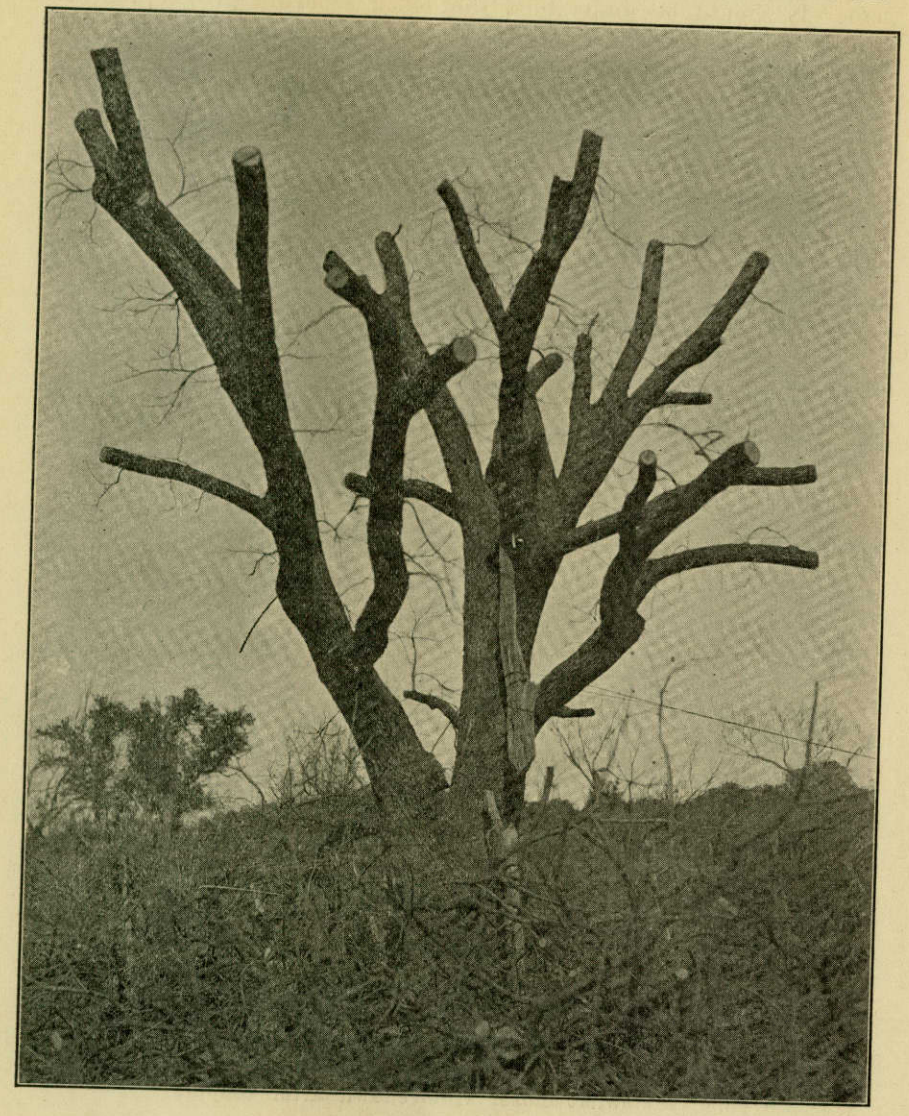


PLATE NO. 21.

NOTE: Same tree as that shown on opposite page after the top had been removed. Photos furnished by Mr. Donnelly of Austin, Texas.

character of the soil. If the grove is to be left unplowed, the trees should stand from ten to forty feet apart, dependent on the richness and moisture content of the soil.

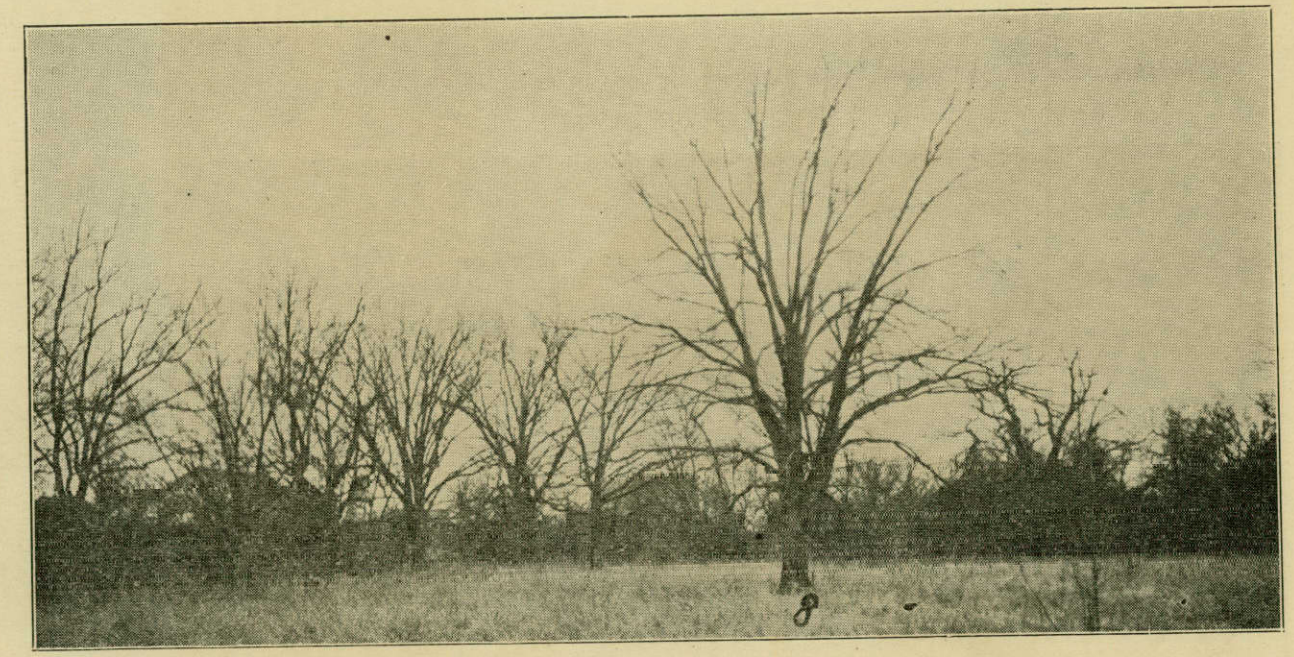


PLATE NO. 22.

The above photo shows a wild native grove as it appeared in February, 1920, before any work was done preparatory to clearing and cutting back the tops so as to develop the grove to improved varieties. At figure 8 is indicated a certain tree referred to in other photographs and discussed in connection with different phases of pecan development.

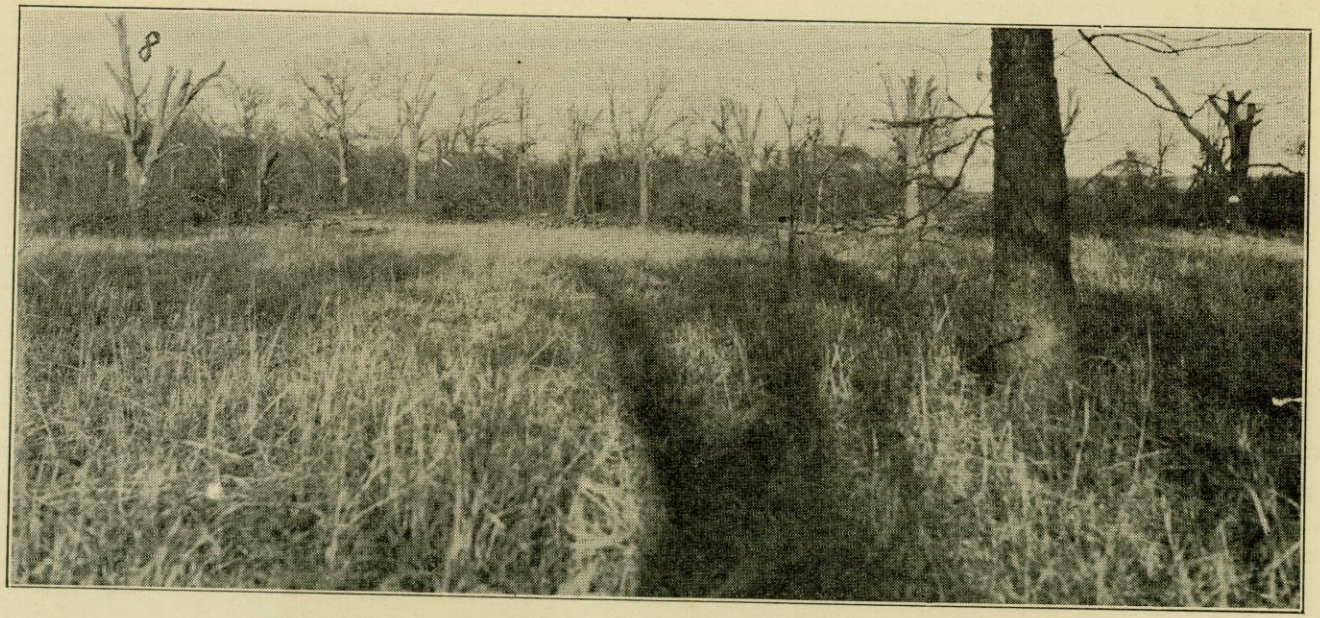


PLATE NO. 23.

This photograph shows the same grove as No. 22 after having been cleared and the tops removed.

Cutting Back the Trees.

As a general rule it is advisable to cut back the tops of the trees that are to be top-worked to within eight to fifteen feet of the ground. This should be done in January or February. See Plates 20 to 30. Cut the limbs so as to get a symmetrical, well spread top of stubs, averaging about 3 inches in diameter and cut off the upright growing limbs with a slope so as to permit easy drainage. This slope should

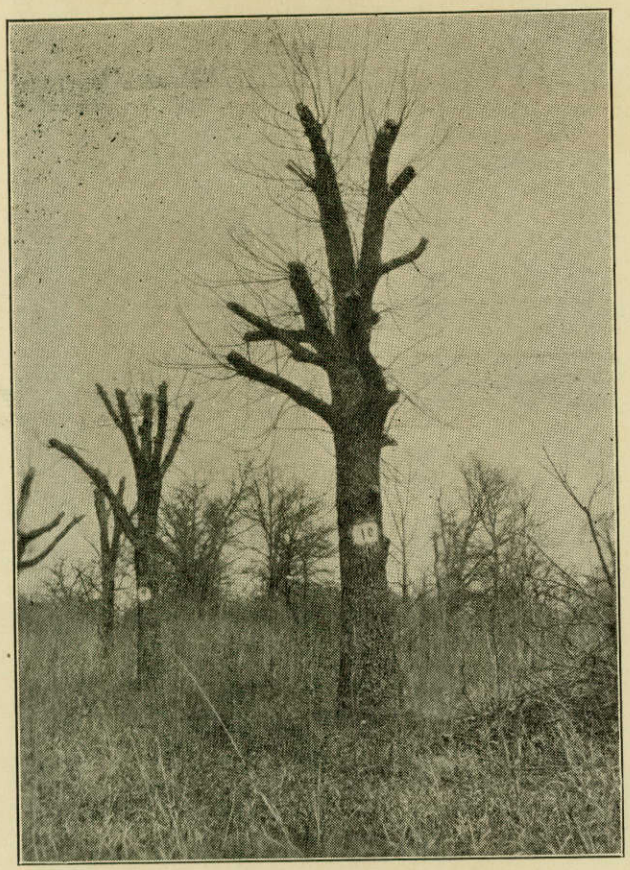


PLATE NO. 24.

Photograph 24 gives a view of tree 10 after the top had been removed and the tree had made one season's growth. This one of the trees shown in Plates Nos. 22 and 23, Plat A.

slant so as to place the cut surface on the north. This is especially advisable where the stub left is expected to send out new shoots near the extreme top of the slope.

If the trees are to be top-worked by grafting, all cuts and wounds should be covered at once with some good grafting or pruning compound. For this purpose some use some form of coal tar prepara-

PLATE NO. 25.

NOTE: Plate No. 25 shows a grove that was cut back six years prior to the time this view was taken. The long limbs are buds and grafts resulted from work done at the time the trees were first cut back. In order to produce new desirable shoots to push out, that would be suited to budding, these trees were retopped and photographed as shown.

tion as these are said to possess antiseptic properties preserving the wood from the attacks of rot organisms which attack exposed wood.

In the past the rule has been to recommend that only a part of the top be removed in preparing a tree for top-working. In the judgment of the writer the entire top should be removed, provided

PLATE NO. 27.

NOTE: Plate No. 27 is introduced to illustrate about how a young sapling should be cut back. The slanting marks indicate where it should have been cut. The cross marks indicate where buds should be set now in order to develop a new top. The point where the lower bud, which since this photo was taken, has been set, is five feet from the ground. It is advisable to always set buds as close to the old stock as conditions will admit.

the dehorning is done in the winter or early spring while the tree is dormant, and before the sap begins to swell the buds.

The reason for this is that if the entire top is removed while the tree is in the dormant stage, that it will throw out numerous new

shoots, as the growing period advances, and these new shoots will make more rapid growth on the tree that has lost all of its top than if part of the old top is left. The object in the past has been, in leaving a part of the top to take care of the vegetative processes, to permit the foliage of the portion left to conserve the vitality of the crippled tree. This looks reasonable. But on the other hand, when all the top is removed during the dormant period, the stored up plant food which is present in the roots and body of the dehorned tree, becomes active and the stumps and stubs left will develop a more uniform supply of new shoots than will the tree

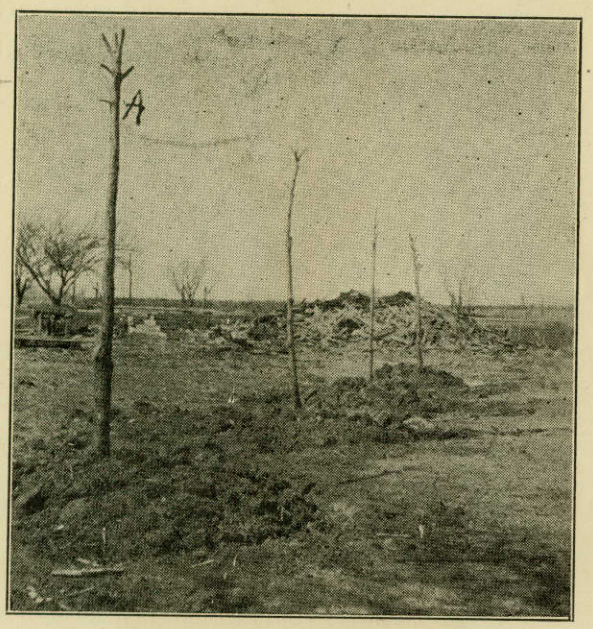


PLATE NO. 28.

NOTE: This view illustrates how a six year old sapling should be cut so as to develop new shoots, on which to bud. The following spring after such a tree is cut back it usually throws out strong vigorous shoots that are ready to bud the first season after having been cut back.

when only a part of the top has been cut away. All horticulturists know from experience that in order to induce new, vigorous wood growth we cut back severely in the winter time.

Height to Be Cut from the Ground.

The distance from the ground that is best to cut back, as intimated elsewhere, will depend on several conditions which may or may not be present in a given case. Where a grove is subject to periodical overflows that cover the ground, it will be the best practice to cut the tree high enough so that the new tops that are to be developed will not be covered by the flood waters. This would be advisable, regardless of the size of the tree, unless one is budding on small rapidly growing sprouts or small seedlings.

If the grove is not subject to an occasional flood then the trees should be cut back 8 to 15 feet from the ground. Leave as many stubs as the tree has produced and the particular point at which the limbs should be cut will depend somewhat on the size and age of the tree, as well as on the tree's individuality. However, it is

PLATE NO. 29.

How to top an upright tree.

difficult to find many trees that have not the inherent vitality to push out enough new shoots to develop a new top, if they lose their tops ten or fifteen feet from the ground. provided the cutting back of the top is done during the dormant season.

Where the trees are badly crowded and are long and slender without side limbs, then it would be a good plan to cut them at as near a uniform height as seems practicable to the manager. If the

trees are young and the surplus overhanging timber is removed, they will develop new tops near the ground, so as to conform to their new environments. If they be large, they should not be left so tall as to interfere with a vigorous development of their neighbors of lower stature. One mistake that is usually made in top-working native groves is that most of the workmen endeavor to re-establish the new top too high above the ground. In Texas where there are usually high winds and hot dry weather conditions prevailing, it is best to establish the new top to within five to eight feet of the ground, so as to furnish protection from the high winds and hot sunshine.

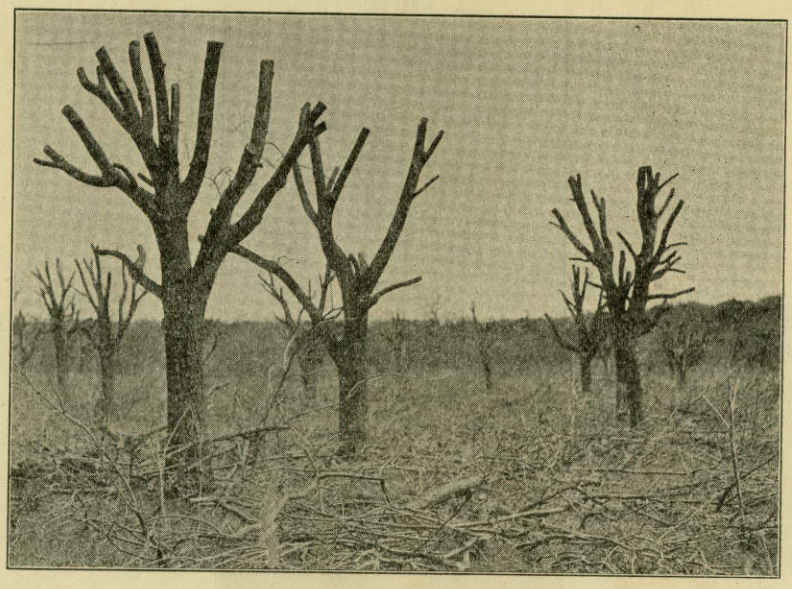


PLATE NO. 30.

Trees topped preparatory to budding. J. R. Donnelly farm, Wallace Creek, San Saba County, Texas. Photo courtesy of Mr. Donnelly.

Owners of groves and orchards frequently cut back lower limbs of their trees so as to permit of easy cultivation. In the opinion of the writer, this is decidedly a serious mistake.

DETAILS IN TOP-WORKING PECAN TREES.

In discussing this phase of pecan development in Texas regarding the development of new tops on pecan trees, the suggestion offered will also apply to top-working the hickory and other native trees as well, viz: the black walnut and persimmon. The time is not very far distant when hundreds and probably thousands of our Texas citizens will top-work and otherwise develop their native grown trees to the improved varieties. There are also scores of good people being misled who are planting seed of named varie-

ties expecting them to reproduce the exact variety planted who will have to top-work their trees if they ever produce satisfactory crops. This part of this treatise is intended to meet these condi-

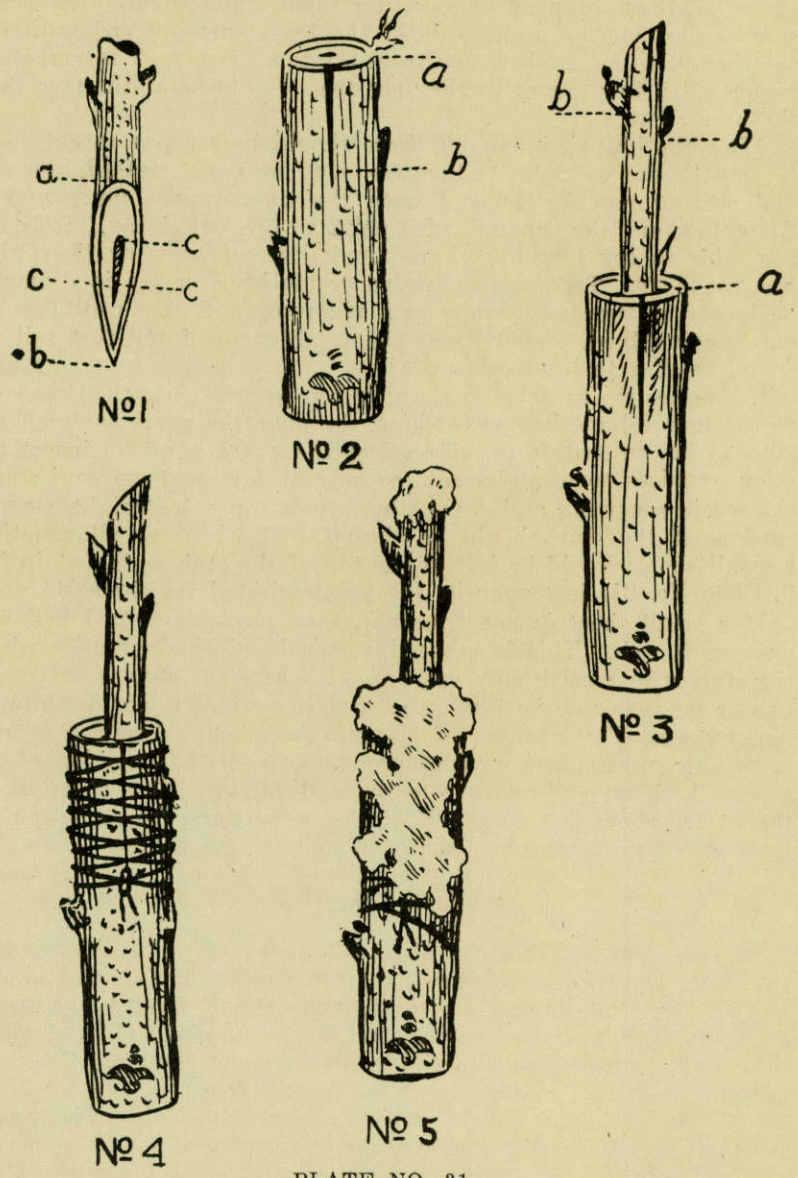


PLATE NO. 31.

tions. There is abundant evidence now to show that it is profitable and economical to convert the tens of thousands of native pecan trees into those bearing the improved varieties.

In January or February while the tree is yet dormant, the limbs

are removed as indicated. See Plates Nos. 20 to 30. In removing the branches it is advisable to begin at the lower limbs removing them first and then proceed upwards. In removing limbs there is always danger of splitting them. To obviate this begin sawing first on the under side of the limb, saw upward until the saw begins to hang, then saw from the top. It is best to make the under cut a few inches further out from the body of the tree than the upper cut.

After the branch is cut off there should be a separate cut so as to smooth the wound. If the tree is to be bark grafted, the second cutting may be delayed until the time arrives for grafting. All cuts should be covered with paint to prevent decay. It is not advisable to try to top-work old and decrepit trees or those that are too large. Trees up to twelve or eighteen inches in diameter or larger if they are strong and vigorous, will pay well for the expense involved. Small trees ten to thirty or forty feet tall respond readily to top-working.

If one desires to develop the new top by grafting, then, as soon as the new foliage begins to show, the operator again saws off the stub to be grafted fresh. To select the exact point to insert the scion requires some judgment, as several factors have to be considered in renewing and developing a new top. A straight, smooth surface of the stub should be chosen, and where at all practical a small shoot should be left at the top of the stub as in (a) in No. 2, Plate No. 31, just opposite the point selected for the scion.

If a small shoot is not apparent, then an undeveloped bud will answer as well. This is especially considered good practice where the stub is to receive only one scion. Where the stub is to receive two or more scions the leaving of a shoot or bud is not of so much importance. The purpose of leaving this shoot of native growth is to keep up an active vegetative process in that portion of the tree as high up and as close to the scion as possible. In addition, the native shoot is to assist later in the proper care and development of the growing scion, which will be discussed later.

Preparing the Scion.

By referring to Plate No. 31, No. 1, (a-b) you will observe that the graft is cut with a long slope, beginning at (a) and ending at (b). This cut should be straight and smooth, from two to three inches in length, and perfectly straight from (a) to (b). A sharp thin bladed knife is indispensible for this work, and if the point is rounded so that a concave surface of the scion is made as shown at (c) Plate 31, the growth will be surer of success. The reason for this is to have the cambium surfaces of the scion fit as closely as possible to the white wood of the stock. *Inserting the scion.* Plate 31, No. 3 at (a) shows scion (No. 1) inserted in stock No. 3. The bark of the stock is shown at (b No. 3) slightly split. The corners of the bark are then raised and the scion pushed down at (a). See No. 3 and 4 at (a) Plate 31. The scion is then slightly wrapped with strong cord as shown in No. 4 and all wounds and cuts care-

fully covered completely as shown in No. 5. The success of this operation depends on careful attention to details in performing the various steps, the condition of the propagating wood and the stock, also the after-care of the work.

How Growth Is Made.

An explanation of the uniting process of stock and scion will be helpful and when once understood will assist the propagator in understanding the different reasons why the various operations are performed, and why the stock and scions are manipulated and cared for as outlined.

Propagating wood for grafting and budding, cut in the winter time, has stored up in its wood bark and bud structures a supply of the reserve plant food upon which the plant, in nature, is enabled to draw from at the beginning of the growing period. When these scions are cut and stored a portion of this reserved food remains dormant. As soon as these scions are placed in the active growing stock the ascending sap from the white wood of the stocks enters into that part of the white wood of the scions lying next to the stock. see Plate No. 31 at (a to b) and No. 3 (a) and finds its way to the base of the buds, Plate No. 31, No. 3 which causes them to open and expand. As soon as the bud (b) pushes open it begins to manufacture new sap cells. These cells and their accompanying organisms of the plant constitute the downward sap flow, and are deposited at the outer edges of the old wood or cambium. See Plate No. 31, No. 1 at (c). The inner edges of the bark forms a callous and then a healing process is carried on at this point. Union of stock and scion is thus begun, and as the new scion develops foliage the process of depositing sap cells at the point of union is accelerated and perfected.

The union of stock and scion must take place by this operation of nature's laws and cannot be accomplished in any other way. Wood fibers when once severed never heal. The ability of the scion to grow and form a new top to take the place of the native top which was severed, depends on the ability of the scion to push out foliage and thus manufacture the necessary plant food.

The process of bark grafting may be successfully performed on small nursery grown stock ¾ to 2 inches in diameter near the ground line, or on 6 to 50 year old orchard or native forest growth on stubs not over 4 inches in diameter.

After Care.

When a part or all of the tree top is removed in preparing the tree top for top-working the equilibrium is destroyed, and when the growing season opens, the tree begins to push out new foliage and grows very rapidly each successive season until there is again a balance established between the top and the root system. The top and root are dependent upon each other for health and vigor. Should the tree lose all of its foliage as is the case when cut back

preparatory to top-working, and the new foliage kept destroyed throughout the season, it soon succumbs to such harsh treatment. There are thousands of valuable pecan trees all over Texas that have been sacrificed on the altar of ignorance of the would-be scientific horticulturists who cut pecan trees to mere stumps, regardless of their size and age and tried to grow a new top by setting a few buds and keeping the balance of the foliage destroyed. It requires experience and good horticultural judgment as well as knowledge of the principles of tree growth to develop well formed tops in top-working.

Where small young trees are top-worked and the shoot left as suggested by Plate No. 31 No. 2 (a), the shoot may be used as a brace to which the fast growing scion may be tied, or, in case the scion is making too feeble growth, it may be made more vigorous by cutting back the native shoot, so as to throw the responsibility of furnishing plant food for the root system upon the scion. It is also very desirable in placing scions to set them on the inner side or top of the stock.

Grafting and budding are processes that depend upon the fact that the tree does its growing in the cambium layer—that thin slippery layer between the bark and the wood that we can see when the bark slips in early summer. It is well to remember that the tree does all of its growing in that thin crack. Outside the cambium builds bark layers; inside, it builds wood layers.

On examination with the microscope it is shown to be a soft jelly-like substance, with big, soft square cells like a brick wall. When the tree grows these cells multiply and become bark or wood, according to the needs of the tree. This jelly of life does its work in the dark interior, protected from air and light by the bark, and it perishes in the sunshine almost like a sensitive film of the camera.

The job of grafting or budding successfully consists in connecting the living cambium of the stock with the living cambium of the scion in such a way and under such conditions that the life current will flow from one to the other. In the case of a tree like the pear, this is so exceedingly easy that a beginner should make ninety per cent and upward of successes if he follows the simplest rules of grafting; but with the pecan the vegetative processes are slower and require greater care.

TOP-WORKING BY BUDDING AND GRAFTING.

The accumulated experience of propagators goes to show that top-working nut trees by grafting is being used less and is gradually being replaced by budding. When one has an abundance of scions that are not suitable for budding, the grafts may be set as above noted and should the grafts fail to grow, there is nothing lost except the time that was devoted to setting them. The cut-back tree soon puts out an abundance of new shoots which may be utilized for budding. If some of the grafts have made growth and there is need of other scions to restore a well developed top, buds can be set on the young shoots as soon as they have attained

proper size. This kind of propagation is done by patch budding, ring budding, H budding and in exceptional cases by chip budding and shield budding.

No one process of budding or grafting is equally suitable to the propagation of all horticultural plants. A specified method might be well adapted to a certain class of trees and almost a failure for another. Under other conditions and circumstances, however, different methods might be more desirable. The successful use, therefore of various propagating methods depends upon the character and condition of the plant that is being propagated, the location and circumstances of the task and upon the individual worker. For this reason the plant propagator should not only be familiar with the budding and grafting method best adapted to his particular species at hand, but should be familiar and efficient in many of the other important propagating procedures.

The pecan and walnut are known to be two of the most difficult of our trees to bud and graft successfully. Consequently those who undertake this work should possess knowledge and practice of a variety of methods in order to be able to choose the most expedient and successful process for the special undertaking.

Among the many different methods of grafting used by horticulturists may be listed the following: Whip graft, bark graft, side graft, slot graft and shoulder graft, (the most useful with pecans); in addition to the above for other plants, kerf graft, spur graft, approach graft, saddle graft, splice graft and Japanese graft. The chip bud, ring bud, patch bud, H bud, inverted shield or T bud, and modified shield bud, are suited to pecans. These and several other methods of budding and grafting are useful in multiplying our many horticultural plants.

A knowledge and practice of all these methods is a valuable asset to any orchard owner. The most commonly used and successful methods of budding and grafting the pecan, however, are herein discussed and will in all probability fulfill the needs of the pecan propagator.

Budding Discussed and Illustrated.

Propagating pecans by budding is not difficult and yet the operation is usually not very successfully accomplished by the beginner. It takes practice.

Budding consists of taking a single bud having no mature wood tissue, or it may have a small layer of matured wood, and applying it to the growing stock. The bud is sometimes attached to the stock by the method called chip budding and shield budding. With this method a thin film of wood is usually transferred with the bud, especially if one uses stored wood for scions. The ring bud, patch bud, H bud and one form of the shield bud when used on pecans, the bark containing only the bud is used.

Chip Bud: The stock is prepared to receive the bud by cutting out a section of the bark and wood as shown in Plate No. 32 at (a) and (b). The bud is cut from the scion in the same way in which

the cut on the stock is made. It should be as near the same length, width and thickness as the bud piece removed from the stock.

The bud should be firmly tied for two or three weeks, then the string should be loosened. If the binding material used is raffia it will not be so necessary to loosen the string until the bud has become united. But if cord is used in tying, then it should be loosened once or twice before it is removed entirely. After the scion shows that it has united, then the top should be cut back, and all growth kept cut back below the bud. It is also advisable to leave a small

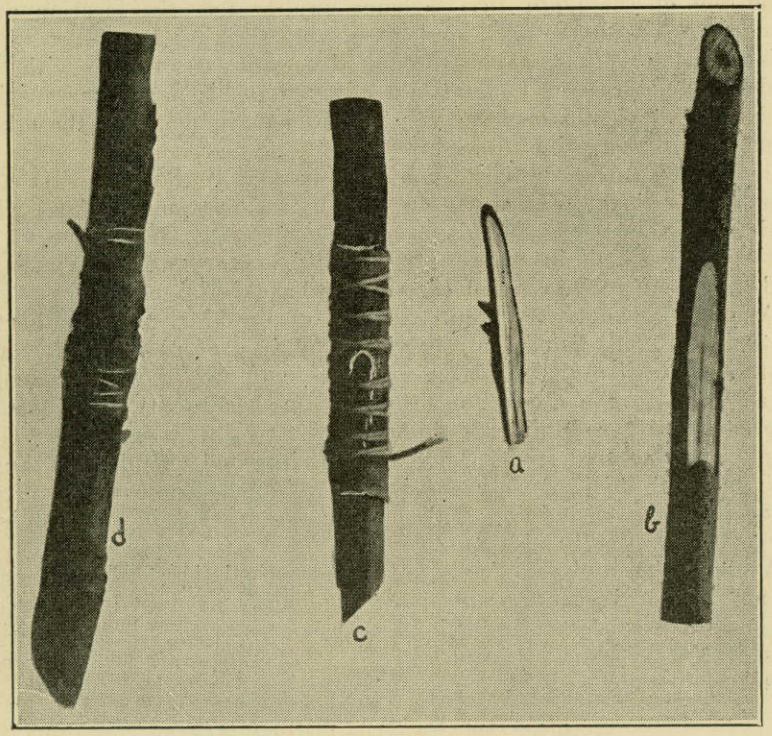


PLATE NO.—32 CHIP BUDDING.

This method is useful in utilizing a class of wood that is unsuited to other methods of budding because of the inferiority of the bud wood. See Plate 35. At (a) is shown the manner of cutting the bud, (b) shows the bud (a) bed at (c) the bud is tied and (d) the wounds are covered with wax.

growth above and below the newly set bud. In setting chip buds it is very important that the cambiums of both stock and scion are made to meet exactly. Often where one fails to get a chip bud to grow, the failure may be traced to the fact that the bark of the stock and scion were not of the same thickness, consequently, while there was a nice fit on the outside, the cambiums failed to meet. It is not absolutely necessary that stock and scion be of the same size. Often a bud taken from ⅜-inch scion may be made to match a ½-inch stock and vice versa. Neither are stocks or scions perfectly round.

Chip budding has some advantages over grafting. It is more economical in the use of propagating wood, and should the bud fail to "take" as they often do, the stock is left in good condition for other methods of budding which may be done later in the season; whereas, if the whip grafting method is followed and the graft fails to grow, the stock will not be in condition to work for another season. If the chip bud fails there is nothing lost except the time and the buds used. Whenever either of the above methods, whip grafting and chip budding, succeed the resultant tree has an entire season to grow and the tree is ready to transplant the following fall.

Bark Grafting Discussed.

Bark grafting, crown grafting, slip bark grafting, as it is variously called, consists of sawing off a large stock usually one inch to four or more inches in diameter and inserting the scion under the bark of the stock. The different steps in the process are illustrated in Plate No. 31.

Under ordinary conditions this method is useful for top-working stocks that are too large to be budded. This method also has the advantage of using scions that are not suited for budding, and is usually practiced after the season has passed for whip grafting. In addition it serves the purpose of gaining one year's growth in the development of a new top on trees that are to be top-worked.

In bark grafting the stocks should be cut back the preceding winter while the tree is perfectly dormant. The removal of the top is illustrated in Plates Nos. 20 to 30. It is advisable to cut the limbs to mere stubs, six to eighteen inches, dependent on the size of the limbs and the body of the tree. The underside of the limbs should be sawed first, and then finished from the top so as to prevent the splitting of the stub. The cutting on the under side of the branch should be a few inches further out than the top cut, which will prevent the splitting of the branch. The lower branches should be cut first and thus continued to the top of the tree. (See Plates 20-30.) As soon as new shoots appear on the cut back trees and the sap is flowing freely, the stocks are ready to insert the grafts. The different operations are illustrated in Plate 31 at Nos. 1 to 5. Where this method is used it is necessary to have stored wood. See discussion on Cutting and Storing Wood. The wood should be cut in January or February while the tree from which the scions are taken is perfectly dormant, and held in storage until the stocks are ready to insert the grafts. The different operations of preparing the scion and tying, waxing, etc., are shown in Plate 31.

There is a strong tendency now among experienced propagators to abandon the practice of top-working pecan trees by the bark grafting method, and instead, to rely almost wholly on patch budding. One advantage, however, in the bark grafting method is that it gives an opportunity of making a possible saving of propagating wood that is not at all suited for patch budding or other methods

of budding where only the bark attached to the scion wood is used. This is explained and illustrated at Plates 34-35 at (a) to (g) which see.

SLOT GRAFTING.

The drawings accompanying this is designed to illustrate the important steps in the process of preparing the stock and scion and making the slot graft.

In selecting the place of inserting the slot graft it will be found that there is always present on socks a flattened portion of the stock

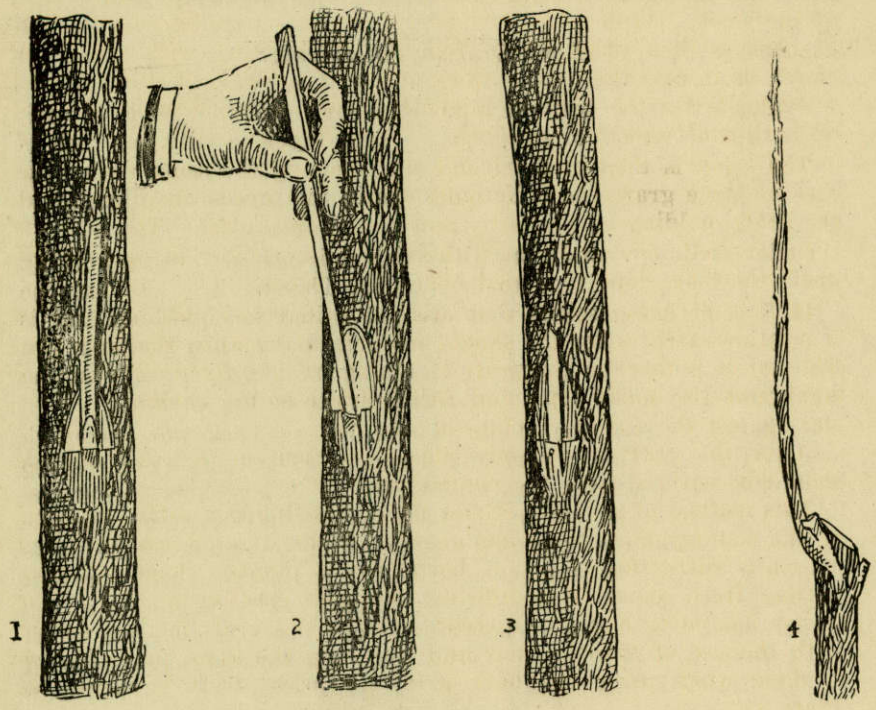


PLATE NO. 33.

NOTE: No. 2 shows manner of preparing the stock for reception of the graft. Observe the slits in the bark of the stock, in preparation of slot bed for the graft, and the bark being gently and carefully pried loose for the insertion of the graft. No. 1 shows the graft partially inserted. No. 3 shows the graft pushed down into place and tacked or nailed, and the whole entirely covered with **warm, melted,** not hot, paraffin. No. 4 shows the manner of cutting back the stock after the graft has become permanently attached.

which will present a flattened surface for the reception of the graft. This kind of place should be selected for inserting in order that the cambium of the graft may come in close contact with the cambium of the stock.

How the Operation Is Performed.

First, a cut is made in the stock with a chisel or knife or drawing knift, downward, penetrating into the wood of the stock. Then

with the same tool a transverse cross is made at the base of the first cut so as to form a shoulder or shelf at the lower point of the first cut. (Plate No. 33, 1 and 2.)

The graft is then prepared by shaping a wedge graft, making the outside slope of the graft shorter and more abrupt then the inside slope. The graft should not have more than two good buds above the wedge portion of the graft. After the graft is shaped take the measure of the width of the graft by placing it against the shoulder of the stock, then with the knife or chisel cut two vertical parallel slits through the bark being careful not to penetrate the white wood of the stock. After making these two vertical parallel cuts the slot of bark is then pried away from the stock either with the knife, chisel, or in case the bark is thick and stiff a prepared stick of hard wood made for the purpose is gently pushed down between the slot of bark and wood of the stock. (See Plate 33 at 2.)

The scion is then inserted and tied down with strong cord or in case of large grafts tacks or nails with broad heads are driven into the graft, holding it compactly and snugly into place. The whole is then covered over entirely with melted paraffin. In setting the graft the long slope is placed next to the stock.

It is sometimes necessary to use more than one tack or nail or if cord or raffia is used it should press firmly against the bark slot. The object is to press the graft on the stock side, firmly against the stock and also make close and firm contact of the cambium of the slot against the outside surface of the graft.

After the graft is securely placed in position then all wounds should be covered with the melted paraffin.

This method of grafting is now being tested out in different parts of the country and the claims are made that it is successfully used on many different species of horticultural plants. Some advocate cutting fresh scions from growing trees and grafting at once. The writer has never had any success with the slot graft method except with the use of stored scions and following the same procedure as is done when using the bark graft and side graft methods, see Plate 31.

When large stocks that have thick rough bark are to be grafted the rough bark should be pared down smooth before beginning to prepare the stock for the setting of the grafts.

Scions the size of a lead pencil are best used on stocks one inch to two inches in diameter. Where stocks are two to four inches in diameter or larger, then scions ranging in size from one-half to three fourths inches in diameter is preferable. Hard, firm, well matured wood should always be selected for scions in any kind of grafting.

Advantages of Slot Grafting.

This method has some advantages over other methods. Where one has large stocks that has not been cut back as is recommended in "Top-Working" see pages 91 to 96, and which he desires to graft, this method can be employed without much injury to the stocks,

that is, the slot graft method may be employed in setting side slot grafts on stocks ranging in size from one inch to six or eight inches in diameter, after the tree is out in full foliage. Different sized stocks require also different sized scions, yet it frequently happens that small scions three-eights of an inch in diameter may be successfully used on large stocks.

This method of grafting also has the advantage over the bark graft, wedge graft, and shoulder graft methods of preserving the health and vitality of the stock in that it leaves the entire stock to function normally until it has been determined that the graft has united with the stock; after which time the stock may be cut back in whole or in part and the scion thus be pushed into growth. If the graft fails to unite with the stock it may again be grafted or budded. Another advantage this method has over the other methods is that one in propagating the stock and selecting the scion to be inserted is that there is a wider latitude of variation allowable in the selection of both stock and scion. That is if one has only small scions they may be prepared so as to be set on large stocks, and vice versa.

The greatest advantage however, is that this method gives an opportunity of performing the operation of grafting so as to insure the cambium of the graft to come into close and complete contact with the cambium of the stock on both sides of the graft.

Pushing Scions Into Growth.

After it has been determined that the scions have united with the stock it is then desirable to endeavor to push them into growth. If the season is not too far advanced and the stock is growing rapidly the scions can be pushed into growth by cutting back the stock, more or less severely, depending on size and vigor of the stock. Cutting back the stock above the graft is considered good practice if the stocks are small and growing tardily leaving only enough of the stock to form a good brace to tie the growing graft to. If the stock is large and growing rapidly it is advisable to leave a good part of the foliage above the point of union so as to hold the graft back from making too rapid growth.

All wounds made in cutting back the stock should be covered with paint, paraffin or grafting wax in order that insects and fungi may be held in check.

PATCH BUDDING.

Patch budding may be done in early spring, sometimes quite successfully by using dormant stored wood, or by using fresh cut wood taken directly from the growing trees.

If one desires to use stored wood to bud early in April or May, the wood is taken from storage and kept in wet soil, moss, or old tow sacks, anywhere from one to ten days, depending on the temperature, until the bark will peel freely. Then the buds are ready for use. Only such buds as are illustrated at (a) in Plate 34 should be used. Under ordinary conditions there is but a small per cent of these buds found on stored wood that is desirable to use for patch

budding. When stored wood is not available, fresh cut wood taken from the tree after the new growth has started in the spring, may be used, sometimes quite successfully. The buds used from this fresh cut wood are called Reserve Buds and may be found on one, two and three year old wood, and sometimes suitable buds of this class are found on five or six year old wood, though they are very few. The best and most numerous of these reserve buds are usually found on one and two year old wood. These are taken and set as illustrated at (c), (e), and (f) in Plate 34. The most dependable class of buds

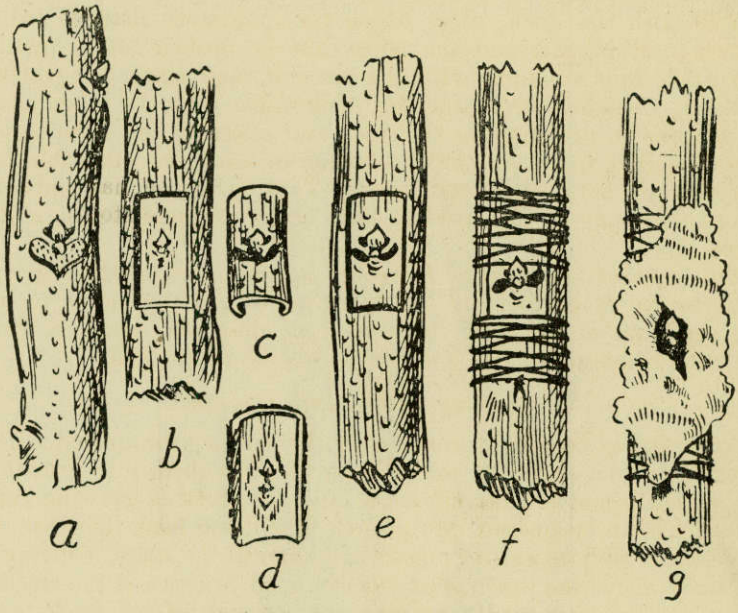


PLATE NO. 34—PATCH BUDDING.

NOTE: This drawing illustrates the different operations in performing the method of patch budding. At (a) is shown the bud before it is removed. At (b), (c) and (d) is shown the place from which the bud was taken, and how it appears after being removed. Notice the smooth under surface at (d). This class of buds are of the most desirable class to use for the patch bud, ring bud, and H bud. At (e) is shown the bud fitted to the stock, at (f) is shown the bud tied in, and at (g) is shown the wounds covered with wax, the operation being completed.

to use in patch budding is found on current year's growth, and they mature normally in June, July and August. These current season's buds may be hastened to maturity by artificially maturing the buds. This is done by cutting off the leaf stem. Buds are always formed in the axil of the leaf stem. After the new growth has produced shoots three-eights of an inch in diameter to larger, cutting the foliage away and leaving an inch or two of the leaf stem causes the bud to mature. As soon as the leaf stem drops, as it will do from ten to fifteen days, after the foliage is cut off, the bud is ready to use, and can be set as a patch bud, ring bud, or inverted shield bud, see Plates 34-36.

This class of buds can be materially increased above what nature ordinarily produces, by continuing the process of cutting back the leaf stems on the same shoots at intervals of a week or ten days. Under average conditions nature only produces five to seven buds that are suited to patch budding, but by taking advantage of artificially maturing the buds by cutting off the leaves, we force the leaves left towards the terminal of the new shoot to deposit sap cells uniformly along the entire shoot, and are thus enabled to make the shoot develop, by this method a lot more buds that are suited to patch budding. These buds from the current year's growth are especially suited for use in top-working cut back trees as late as July, August

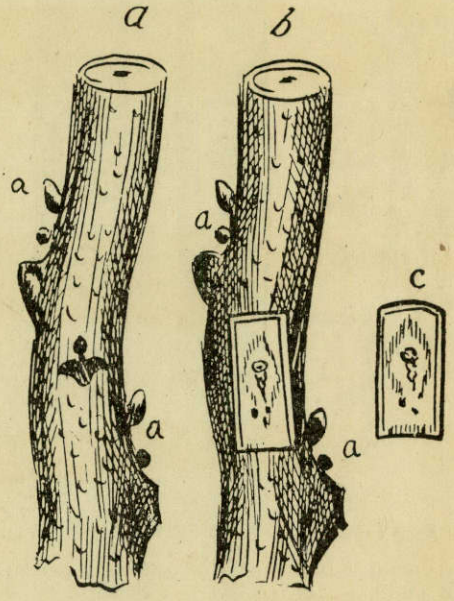


PLATE NO. 35.

NOTE: This drawing illustrates buds that are strong and well developed, but are unsuited to patch budding, ring budding, and H budding, but are splendid for chip budding and for grafting.

and September. They are also the best class of buds to use on nursery stocks.

Where one desires to have a bearing tree produce a large quantity of current year's buds, the parent tree should be cut back severely in winter so as to force out a large quantity of strong, vigorous shoots. By artificial means, irrigation, cultivation and fertilizing one can also force nursery stocks into a long continued, vigorous growth, whereby they will be in proper condition to bud with the forced bud produced on the parent tree from the current year's growth. In patch budding, it is desirable that the stock and

the scion or bud stock from which the bud is taken should be of the same size as nearly as is practicable. A patch of bark about three-fourths of an inch long and about one-half inch wide is cut from the

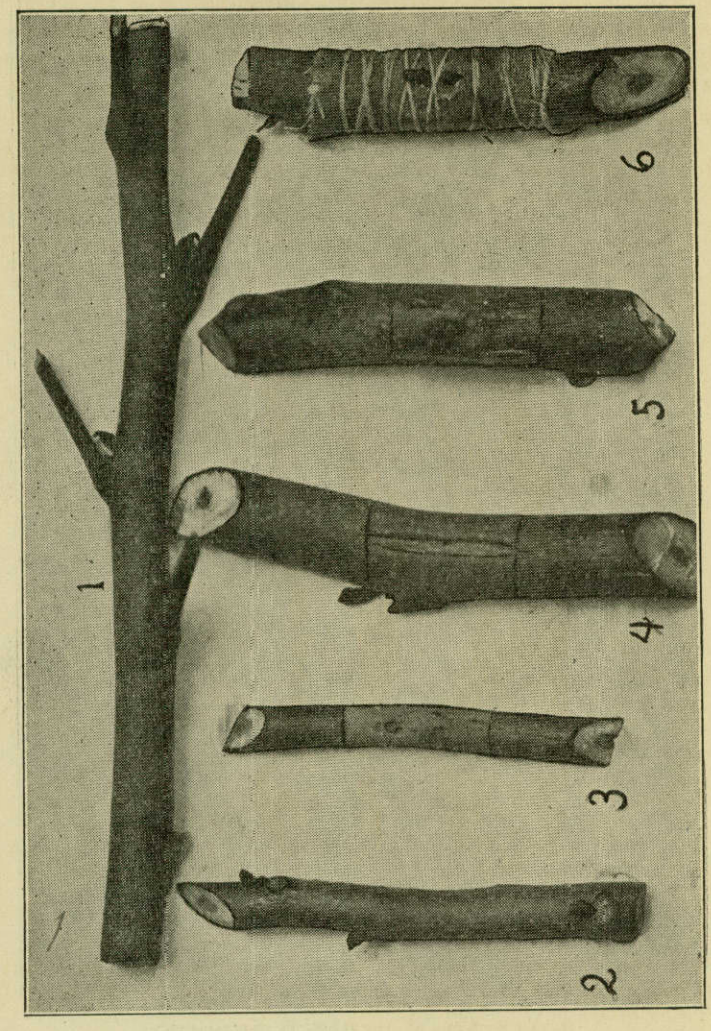


PLATE NO. 36—H BUDDING.

This form of budding is used by some of the most successful budders. At (1) is illustrated an undesirable class of buds to use in this method. At (2) is shown the better class of buds, at (3) the bud removed, at (4) the stock is prepared, and at (5) the bud inserted. At (6) the bud and wounds covered with waxed cloth and tied down compactly with grocery twine.

stock at some desirable point. See Plate 34 at (a) to (c). A patch of bark exactly the same length and width containing a plump, well matured bud is cut from the bud stick and fitted snugly in the place

left by the removal of the patch from the stock. The bud patch is tied firmly into place with raffia, strips of waxed cloth or wrapping

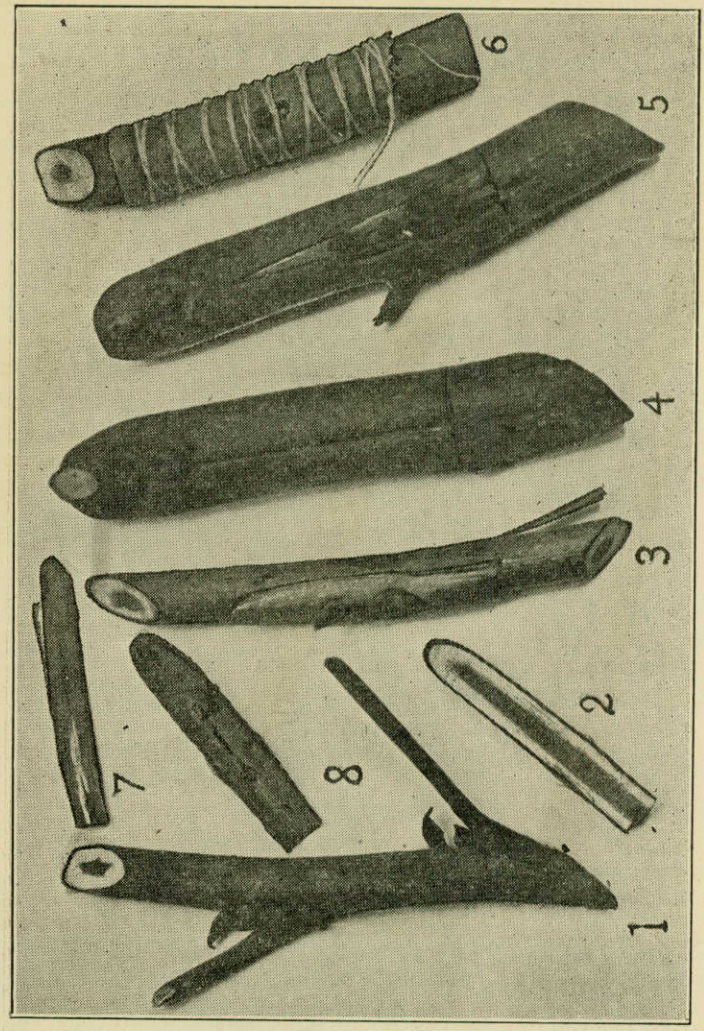


PLATE NO. 37—SHIELD BUDDING.

This method of budding is introduced here so as to make a saving of bud wood that is too immature for successful patch and H budding. Fig. (1) illustrates the class of wood that is used, immature, but well developed buds. Fig. (2) and (3) shows how the bud is cut, after which the bud is gently pried loose as in Fig. (7) and Fig. (8) shows the wood after having the bud bark taken. At (4) is shown the manner of preparing the bud matrix, (5) shows the bud inserted with a part of the flaps pared down, at (6) shows the job complete.

cord. See Plate 34 at (a), (b), (c), (d), (s), (f), and (g). Care should be taken not to cover the bud on the patch in such a way as to hinder the growth of the bud.

SHIELD BUDDING.

See Plate 37, Page 110.

This method of budding is used for the purpose of saving valuable buds of varieties, where bud wood is scarce, and stocks are plentiful.

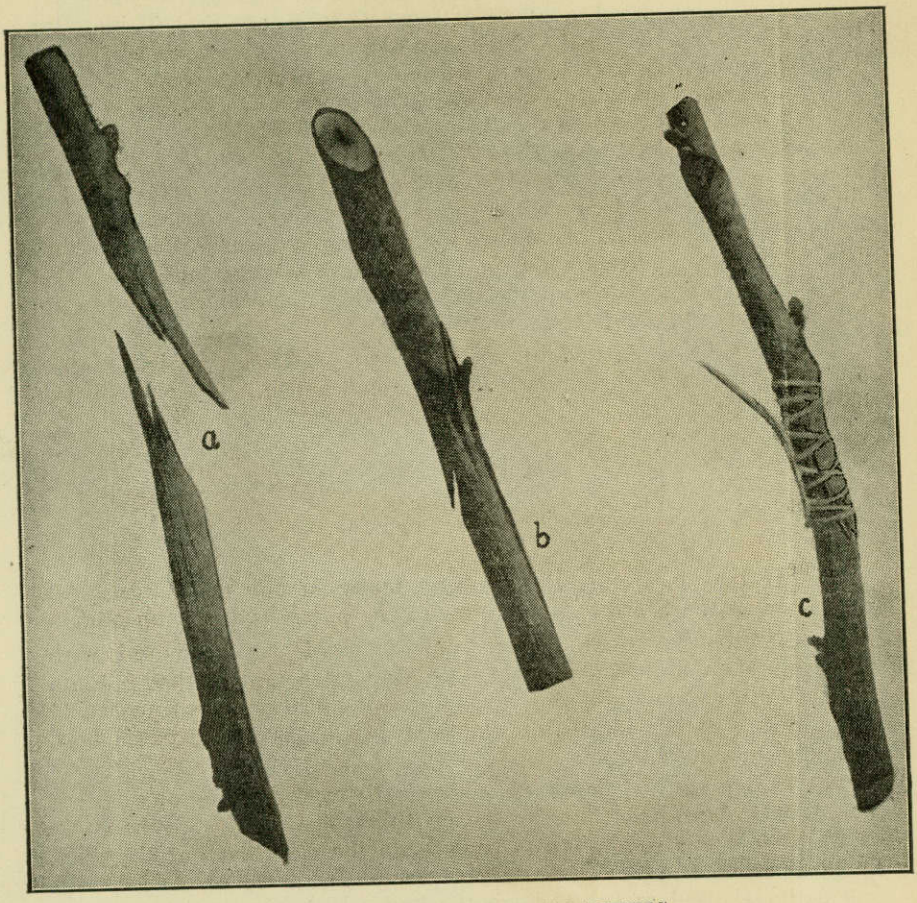


PLATE NO. 38—WHIP GRAFTING.

Whip grafting is performed as shown in the above photo, and is very useful in propagating pecans in nursery rows. Where one has a uniform moisture supply and a uniform temperature, this method is employed quite successfully. The soil is removed from the stocks usually about six or eight inches under the surface, the stock being cut sloping and the scion is cut and dove-tailed into the stock, as shown at (a) and (b). The graft is then tied down, preferably with raffia, and the soil placed back over the graft. The success of this operation depends on the accuracy of making the cambiums of stock and scion to match and the condition of the stocks and scions. Grafting wood should have some less sap flow than the stocks.

It is not usually as successful as patch budding, ring budding or H budding, but is resorted to because of the immature condition of the bud wood from which the buds are taken.

The buds are taken from current year's growth situated towards the end of the growing shoot. It is also best to set this class of buds on current year's stocks. Instead of using twine to bind the bud in place, raffia, if to be had, is a better material.

Where one is careful to follow the details as outlined in Plate 37, there may be expected a saving of from 25 to 50 per cent of buds by using the above method. This method, however, is recommended only where one desires to save valuable bud wood, and where both stocks and scion are in full sap flow. The writer has used this method the latter part of June, July, August and as late as September, having made a saving of from 25 to 75 per cent. When using this method as well as the patch bud and H bud methods, where current year's bud wood is used, the operator should be careful to cover all cracks or crevices, because of the injury by the wood bud worm. The moth of this pest deposits eggs at any point about the new set bud where the wound is exuding sap, and the larva hatches out soon and begins to burrow under the bud, destroying it.

This may be prevented by using melted grafting wax or paraffin and applying it to the wounds with a small brush. The wax should be *warm* and not *hot*.

H BUDDING.

See Plate 36, Page 109.

The H bud is frequently used by many of the most successful operators in the State in preference to the *patch bud* or *ring bud*.

This method is used at the same time of the year and with the same class of material used with the patch bud method. Plate 36 illustrates fairly well the various manipulations in setting the H bud. Many of the details are the same in this as in the patch bud, ring bud and shield bud.

The H bud method, however, is especially useful where one desires to set buds from thin bark scions on thick bark stocks. When this is the case it is a good plan to pare down the thick bark of the stock so as to make it soft and easily yielding to the pressure of the binding material used in tying down the bud. It is also important that the flaps of bark, which are raised up and cover the bud patch, should be pared back so as to permit the tying material to press firmly against the exposed surface of the bud patch. See Figure 5, Plate 36. Often this method of budding is used without either waxed cloth patches or wax to cover the buds. This is entirely permissible during the warm summer season. The H bud is a somewhat slower method than the patch bud, but when one has become accustomed to it and has mastered its details, as some of our best budders have, it would be useless to change to another method.

HISTORY AND METHOD OF PATCH BUDDING LARGE PECAN STOCK.

First Used in 1912.

In 1912, the writer having previously introduced the Burkett variety received a request for some large four or five year old Burkett bud wood, from the late Professor Van Deman, who at that time was engaged in pecan development work in Louisiana. This caused me to set a few of these old reserve buds from four or five year wood experimentally. Two of these buds united with the stock which was about three inches in diameter and four or five years old. One of the buds set was pushed out the same season. The other remained dormant and was pushed out six years afterwards.

After becoming an employee of the State in 1916, this method of budding was handed out to propagators over the State. Since this time the method has been used more or less extensively and in fact some of the most successful propagators are employing it exclusively. Grafting may also be done on the same kind of stocks quite successfully.

Method Explained.

In setting buds in these large stocks the bark of the stock should be pared down to conform to the same thickness of bark as that of the bud patch to be used. All of the other operations are performed exactly in the same way as is done in the ring bud, patch bud and H bud methods and can be employed throughout the budding season the same as the other methods commonly used.

Discussion.

The value of this method of patch budding on large rough stocks is the successful utilization of any reasonable sized stocks at once without having to wait for new shoots to become large enough, as is recommended in the topic under "Top-working." (See Top-working, Page 96.) It also has the advantage of utilizing buds from large scions which may have bark that is too thick for small, thin barked stocks.

The principal disadvantages however, in employing this method is the slow and tedious operation involved. A good propagator can set only forty to seventy-five buds a day when budding large rough stocks in this manner, whereas, the same propagator can set from seventy-five to two hundred or more buds when small thin-barked stocks that match the bark of the scions are used. Both methods are good and useful, however, when conditions warrant their use.

WHY BUDS AND GRAFTS FAIL TO GROW.

There are several reasons why scions may fail to "take." The following are the most common: Poor condition of bud wood; too

abundant sap flow in each season; impaired sap flow, caused by cold weather; dry weather or maturing of the current season's growth; failure to select the right class of buds and stocks; failure to fit and tie the bud down snugly; failure to match the scion and stock cambiums; failure to observe and understand the vegetative processes; and the conditions which should be present in order to attain success.

The inexperienced propagator usually makes a very small per cent of saving buds or grafts set, because of the fact of his failing to study and follow the details of instructions. The sap flow in stocks should be ample at the time the scion is set, and yet there seems to be certain stages in the sap flow of the stocks, when the stocks will fail or refuse to nourish the scion. This seems to occur at about the time when the sap flow is very rapid in early spring, after the stock has used up the stored up plant food, and prior to the time when the foliage on the new growth attains its full development. At this stage of growth the stock is not ripening sufficient mature sap cells to permit the depositing of these cells about the wounds to cause them to heal. Also there is at this time such an abundant movement of crude sap being pumped up from below by the fast expanding leaf growth, that any wound made on the body of the stocks causes "bleeding" and this too abundant immature sap substance is said to "drown" the new set bud or graft. Buds or grafts set slightly in advance of this too abundant sap movement will "take" much better than they will if set during the rapid movement. Also scions set soon after this rapid sap flow will live better than those set while the sap is flowing too freely. It requires quite a bit of experience and judgment to determine the proper condition of the stocks for budding and grafting.

It is always advisable to endeavor to select stocks that have a greater amount of sap than has the scion. If a bud or graft is taken from the scion that has more sap flow than the stock from which it is set, the chances are not favorable for a "take."

Another cause for a lack of success is because the scion is not bound sufficiently firm against the stock to insure a good "take."

It is not likely that bark grafts will be bound too tight so as to cut off the free circulation of sap flow, but this often happens where one is setting buds, especially when current year's buds are being used on current year's stocks.

When budding or grafting is done late in the season and a drought period begins soon after the scions have been set, the chances are that the per cent of scions saved will be disappointing. It requires several weeks for scions to become firmly united to the stocks.

Another cause for failure is, that one tries to force out new set buds, the same season the buds were set. This is especially true where the patch bud, H bud or shield bud has been used.

In forcing out buds it is advisable to cut back the stocks cautiously above where the buds are set. This is especially true when one tries to force out the bud the same season it is set. If a bud is set that shows a desire to push out, it is best to assist it. This

is done by cutting back the stock above, but even in this case it is always safest to leave some native foliage above the bud to insure that the vitality of the stock is maintained near the new set bud. Oftentimes even after a bud begins to grow it is destroyed by cutting the stocks back too close, so as to destroy all of the foliage above. Frequently when one undertakes to force out the bud by destroying all of the foliage, the stock is killed entirely even into the ground, and occasionally the root also perishes. It should be understood that the health and vigor of the stock is dependent on the foliage above the ground, as well as upon the root system under the ground.

When one undertakes to force out the buds the following spring, it is not considered good practice to cut the stock too close to the bud. On this account many buds are destroyed. To push out these buds, it is well to leave a few native buds above the transplanted bud. This should be done in February or March, just before growth begins. And as the transplanted bud breaks into growth, the native foliage should be pinched back, or rubbed off, and the stub used to tie the new shoot to so as to prevent its breaking off.

CUTTING AND STORING BUD WOOD.

It is important that wood designed for budding and grafting pecans should be properly cared for. The writer has observed where wood was cut in large quantities, left in the wind and sun, exposed to the elements several hours, and sometimes for a day or more before being collected in bundles and placed in packing material, and in such cases success is impossible.

Propagating wood thus handled having been allowed to dry out or freeze and thaw, nothing but failure may be expected by using scions thus mistreated for propagating work.

A good practice is to cut the wood in late winter, while the scions are perfectly dormant, and immediately place the wood in damp wrapping material, or bury it temporarily in wet earth. As soon as a supply of wood is cut it should be carried to the cellar or warm room and kept moist and free from exposure to wind and sun. Then it should be cut into proper lengths and bound in bundles of uniform length and size and immediately placed in the packing material. After cutting and while collecting in bundles, each different class of wood should be placed separately; that is, wood that is to be used for patch budding should be bundled to itself; that for grafting to itself; and that designed for chip budding and bark grafting should be put by itself. The different classes should also be stored in separate packages and properly tagged before being placed in storage. It is very difficult to undertake to cut bud wood for one class of propagating work and not also be compelled to cut other classes.

Bud wood designed for patch and ring budding is usually produced near the base of a certain season's growth and the other classes of wood mentioned are usually found farther out on the same shoots of the season's growth that produces patch bud wood.

As stated elsewhere, bud wood suitable for patch buds, ring buds and H. buds is usually produced rather sparingly unless artificial means are used to increase the number of such buds. (See discussion on patch budding and H budding).

After the wood is cut and bound in suitable bundles it is ready for placing in the packing material.

MATERIAL FOR PACKING.

The material used for packing may be sawdust, shingle tow, fine shavings, clean sand, or Sphangum Moss, or if nothing better is to be had, newspapers will do. Of the above materials, probably moss and shingle tow are to be preferred. Whatever the material used, it should be uniformly moist throughout, not wet. If sawdust, shingle tow or shavings are used the addition of a good per cent of fine charcoal that is free from ashes will be helpful in keeping down molds that attacks decaying wood.

Place a layer of packing material in a box of suitable size to accomodate the supply of wood to be stored, then a layer of wood and packing material alternately. After filling the box, the wood should be covered with the packing material, and the top nailed down secure, and the box placed in an ice vault or cold storage where the uniform temperature is kept. A temperature of 32 to 40 degrees will maintain the wood in good condition for a whole season provided the moisture is kept at the right degree. The object should be to keep the moisture content so as to preserve the normal supply of the wood at about the same as when it was cut.

STORING BUD WOOD AT HOME WHERE ONE IS NOT CONVENIENTLY SITUATED IN EASY REACH OF COLD STORAGE FACILITIES.

A small supply of wood may be stored at home in a cellar or in the earth, and it can be kept in good condition, sometimes up to the first and middle of May. To do this the wood should be cut and packed as above outlined and placed in the cellar. If, however, one stores the wood in a cellar it is well to take the precaution of lining the box well with paper so as to exclude the entrance of air to the packing material. Where one has no cellar, then a cool shady place at the north end of the building, or some shed that has a dirt floor, may be used. When wood is placed in the soil it requires closer attention than it does when placed in a cellar or cold storage. The wood should not be placed in a soil that is too wet, nor that is too dry. It is desirable that the moisture content of the package be maintained at a uniform degree of moisture, as near as possible as the wood had at the time it was cut. An occasional examination of the wood should be made. If the wood seems to be drying out, moisture may be added. If too wet, it should be dried out and restored. It is advisable also when storing in the soil to place the wood at least twelve inches below the surface of the ground and cover with well pulverized earth so as to exclude the air.

TO DETERMINE THE CONDITION OF STORED WOOD.

It sometimes happens that a failure to get stored wood to grow after being set in the stocks is caused by using wood that has lost its vitality through bad management, either while being cut for storage or while in storage. In order to determine if bud wood has lost its vitality, a careful examination of it will reveal the condition of the wood. By making a dissection of the bud with a sharp knife, paring the buds down to the base of the bud where they attach to the cambium of the wood, if a brown circle is present at the base of the bud, the wood showing this discoloration should not be used. If one is not familiar with the appearance of a healthy bud, he can soon gain this knowledge by examining sound healthy twigs yet growing on the tree. Another test which reveals the soundness of the wood is to make a diagonal cut as if preparing the scion for grafting. If there appears a discolored brown circle where the bark and white wood meet the wood should be rejected. Close observation and comparison made of the appearance of buds and wood of sound healthy fresh cut wood from trees, and that from storage would soon qualify them to judge as to the quality of the stored wood. Many failures may be traced to the use of bad bud wood.

When the propagating season arrives, it is a good practice to remove only enough bud wood to be used in a week or ten days. The supply to be used may be kept in good condition by keeping it wrapped in damp cloth, tow sacks or other material, and kept in a cool shady place. Never allow the wood to be exposed to the drying effects of sun and wind for a longer time than is absolutely necessary. Remove only one or two sticks at a time. The writer has often seen workmen take out enough wood from the package to last half a day or longer and carry it around loose in a work apron until it becomes dry and shriveled. This kind of care always results in disappointment or failure.

COST OF TOP-WORKING A GROVE.

Until recently there has been but little recorded information on this phase of pecan development, and while the data at present is not plentiful, enough is known to indicate that the top-working of a native grove may be done at reasonable cost to the owner.

In order to throw some light on this phase of developing the State's pecan industry, the writer secured a two-acre plat of ground situated on the Leon River some two miles south of Eastland, which was covered with native pecan growth. (See Plate 22.)

The following gives in detail the number of hours of labor employed in clearing the land and cutting back the trees preparatory to budding. Plate 22 consisted of fifty trees that had been cut to mere stumps six years previous. (See Plate 22-25.)

Plate 23 had never been disturbed except that part of the trees that had stood in the edge of a cultivated field. (See Plate 23.) The other trees in this plat were wildlings and were badly crowded with large elms, hackberry and other obnoxious undergrowth.

The timber cut from Plate 23 was worked up into cord wood and produced eighteen cords of four-foot wood, which costs fifty cents per cord to cut into cord wood lengths. The brush was piled and burned.

Labor was paid 37½ cents per hour for cutting the timber and burning the brush. There is a total of 120 trees in both plats ranging in size from one and one-half inches in diameter, two and

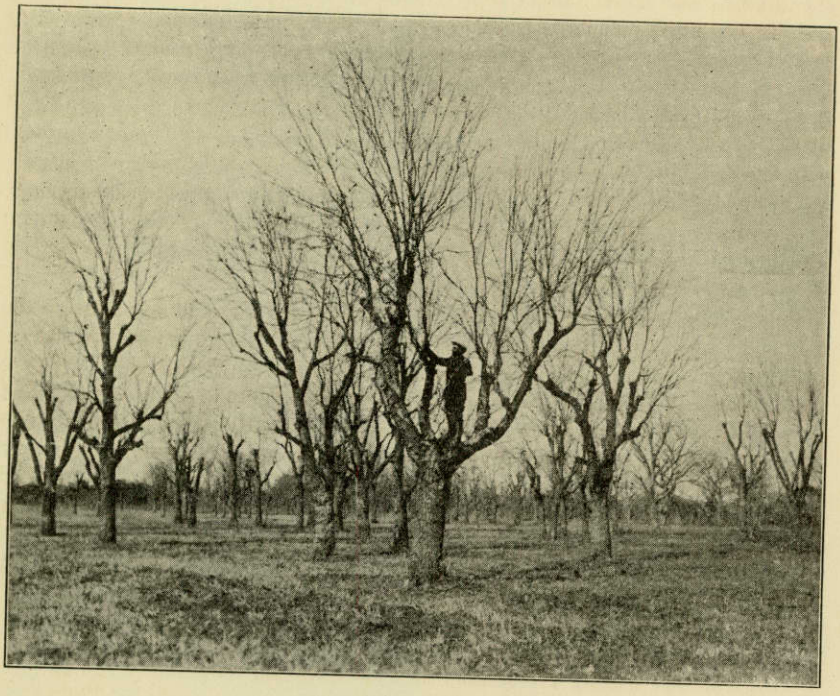


PLATE NO. 39.

Pecan grove third year after top-working, J. W. White farm, Mason, Texas. Cost was $5.00 per tree.

one-half feet from the ground to trees as large as three feet in diameter. The trees when cut back had from four to twenty-seven stubs each. A few, however, were cut to mere stumps without any side stubs. The stubs range in size from one inch to six inches in diameter.

Plate 23 at Figure 8, tree No. 8, shows one of the larger trees, 67 inches in circumference, two and a half feet from the ground, estimated at fifty years old.

This tree had a spread of fifty feet and was fifty-five feet tall. It required two hours and ten minutes to cut this tree back as shown at Plate 23, Figure 8, and it required three hours to clear away the tree top and brush.

Five hours and ten minutes at 37½ cents per hour is	$1.88
Setting 42 buds at 6 cents each	2.52
Value of buds at 3 cents each	1.26
Estimated cost of Raffia at 5 cents	.05
Time spent in cutting the Raffia, caring for the buds and cutting back the shoots, 31 minutes	.18
Total cost	$5.89

Photo 12, tree 24, Plat A, cost of cutting back, clearing away the brush and wood, one hour and twenty-five minutes at 37½ cents per hour	$ .54
Setting 12 buds, 6 cents each	.72
Value of buds, 3 cents each	.36
Raffia used (estimated) at 2 cents	.02
Time in cutting strings, caring for buds to date	.06
Total cost per tree	$1.70

See Photo 12. Photo J. (NOTE: This tree should have been cut as indicated by the pen stroke. Ten buds were set in this tree in June).

Cost of cutting back, ten minutes at 37½ cents per hour	$ 06
Cost of setting ten buds at 6 cents each	.60
Cost of buds, 3 cents each	.30
Raffia 2 cents (estimated)	.02
Total cost for tree	$ .98

There were 60 trees in Plate 23 including several small sprouts, upon which there was no labor bestowed. I have, therefore, eliminated them from the expense involved in this subject. There were 50 trees which were cut back, all of which have been budded since these photographs were taken, which are here given to illustrate these experiments in trying to determine the approximate cost of the project. There was a total of 111 hours and 30 minutes expended on this plot which cost the sum of $41.80. The average cost per tree was approximately 80 cents per tree preparing them for budding.

There were a total of 120 trees in both Plat 22 and Plat 23. The labor cost for cutting back both plats was at 37½ cents per hour for 193 hours' work preparing the trees for top-working	$ 72.27
150 hours setting 2000 buds at 37½ cents per hour	56.25
Cost of buds at 3 cents each	60.00
Cost of Raffia	.50
Total	$189.02

Average cost per tree, $1.57.

It is assumed that it will possibly cost an additional expenditure of $189.02 to complete the job of developing the 120 trees included in this project, as there are some buds that fail to "take." Figuring them on that basis it will cost a total of $3.14 for each tree to clear the grove of undesirable timber and re-establish a new top.

There have been several groves over the State where the owners have undertaken to develop them by contract. The prices agreed on range from 50 cents per tree to as much as $4.00. These con-

tracts sometimes designate that the propagator will clear the land and prepare the trees for top-working himself. In other instances the owner of the grove assumes all expense except the setting of the buds and developing the new top.

Where a person owns a grove and contemplates having it developed it would be safest for him to contract with the propagator to guarantee a complete top before paying for it in full, for the reason that information has reached this office that there are men going over the State and agreeing to re-top pecan trees at fancy prices, and who having collected their money skip out, leaving the owner with a mutilated tree for his money.

We suggest that those desiring to have their native groves developed confer with this office if, from any cause, they are in doubt as to the qualification of the propagator.

These three trees, as shown, have been selected with a view of endeavoring to approximate the cost of top-working an average forest tree. However, it is recognized that no two native groves are alike in size, age and density of obnoxious timber growth, etc., and that the cost in each separate grove will depend on the price of labor and the materials used.

In the foregoing, the labor cost is given at 37½ cents per hour, and the buds used at 3 cents each, and the cost of setting the buds at 6 cents each.

It is, therefore, assumed that one desiring to develop a native grove to the improved varieties can safely figure the cost upon the above basis and can do so with reasonable assurance that the average cost within the State will not exceed the figures given.

Assuming, therefore, that the above three trees illustrated are only fifty per cent finished, the average cost would not exceed $6.42 each.

When top-working a pecan grove or orchard by any method it is not likely that all of the scions set will "take," hence it is necessary to figure on re-working the trees either the same season, or the year following. In order to furnish the basis on which to figure the cost of the second working, the following is given:

There were four men used for five days and two others for the last two days. The total time was equal to 28 days for one man at a cost of $2.25 per day. There was a total of 2,369 buds set.

Cost of labor	$ 63.00
Cost of buds at 2 cents each	47.38
Material, twine and grafting wax	1.50
Total costs	$111.88

Cost per bud set, 4.7 cents.

The cost of looking after the buds and pushing them out should be added, which would probably bring the cost up to 6 or 7 cents each.

COST OF THE PURCHASE PRICE AND THE IMPROVEMENT OF FIFTY ACRES OF LAND WITH NATIVE PECAN GROVE 13 MILES FROM THE CITY OF SAN ANTONIO WITH STATEMENT OF PRODUCTION THEREFROM SINCE 1918.

By T. H. RIDGEWAY
of San Antonio, Texas

50 acres purchase price, $60 per acre	$3,000.00
Clearing and grubbing, leaving approximately 600 bearing pecan trees	500.00
Cost of budding and grafting 150 native trees, including care of trees, including my own time	150.00
Removing moss and dead limbs from bearing trees	25.00
Hog proof fences	150.00
Total cost to date	$3,825.00

PROCEEDS.

1919	Sale of wood	$ 200.00
1919	Sale of pecans	1,800.00
1919	Sale of 300 bushels corn grown on 12 acres, at $1.15 per bushel	345.00
1920	Complete failure of pecans and corn. Used entire 50 acres for pasture for hogs and cattle	.....
1921	Sale of pecans	1,500.00
1921	300 bushels corn grown on 12 acres at 50c per bushel	150.00
1922	400 bushels of corn, 50c ber bushel	200.00
1922	4000 pounds pecans (estimated) 20c	800.00
	Value of pasturage, at $100 per year for 4 years	400.00
	Total	$5,395.00

To those that do not know Judge T. H. Ridgeway, the author of the above statement relative to developing a native pecan grove, I will say, that the Judge was born and reared on a farm in Missouri, been practicing law in San Antonio for several years; elected to the office of city attorney in 1920; elected to State Senate, September, 1922.

Judge Ridgeway has been, and is now, a very successful business man and has kept an accurate itemized account of the expense involved in developing this 50 acre pecan grove.

The cost of developing this grove has been less than $1.00 per tree. Counting a total of 600 bearing trees the income for nuts has been approximately $7.00.

It should also be remembered that this grove has just recently been reclaimed from the forest and that it will continue to increase in production as it increases in age and becomes accustomed to the improved surroundings, by being brought under cultivation. Just below the Judge's grove and adjoining it with only a wire fence as the dividing line is another grove still in the native jungle, which I was told produced less than one-tenth of the crop that the Judge's does. Also adjoining Judge Ridgway's grove, above, there is another grove yet undeveloped which shows the same results of unprofitable production.

The outstanding feature, which it is desired to emphasize by the introduction of this statement, is to show that it is entirely feasible and highly profitable for one owning a native pecan grove to at least clear away the obnoxious growth and give the pecan trees a chance to develop.

One feature which Judge Ridgeway refrained from mentioning in his statement is the increased value of his pecan grove for purely pasture purposes. The livestock, hogs and cattle which he has grown and sold off of this pecan land equals the income from the grove itself.

Another thing worthy of special note is that Judge Ridgeway had had no former training. Prof. J. A. Evans, who was then pecan specialist with the Extension Service of the A. & M. College, visited the grounds in May, 1918, and held one demonstration from which the Judge learned the art of bark grafting. Since which time he has continued until he now has about 150 pecan trees top-worked to the improved varieties. This grafting has been done as a matter of recreation, a surcease from his intense nerve-racking law practice. And while Judge Ridgeway has learned how to develop a native pecan grove and make it profitable, he has also recovered from a weak, emaciated physique to a strong vigorous specimen of manhood, which is more valuable than the income from his pecan grove.

INFLUENCE OF HICKORY STOCK ON PECAN SCION.

Pecan literature for the past several years is still discussing the advisability of top-working our native hickory trees with pecans. There is a tendency, from some cause or other, to discontinue the practice which at one time was very popular, and received full endorsement from some of our leading horticulturists. So far as I now recall there has been no record kept in Texas of the production of top-worked hickory pecans as to production compared with the same variety grown on similar soils and same size and age of pecan stocks. About the best that can be done at this time is to make a few general observations.

It is conceded by those who have given the matter as careful test as average farm conditions will permit, that hickory stocks do influence the behavior of the foster scion of some of the best known popular named varieties.

Without going into details and citing at length the several different letters received and observations made during my connection with the State, I will attempt to give the results as they appear at this time.

(1) Pecans growing on hickory stocks are much smaller than those grown on pecan stocks where the soil and moisture conditions are similar. That is, pecans grown on pecan roots produce larger nuts than the same variety grown on hickory roots.

(2) Some varieties of pecans grown on hickory stocks have slightly thinner shells and plumper meat than they do when grown on pecan stocks.

(3) Some varieties of pecans grown on hickory stocks are not so likely to fill out and make as great per cent of meat as when grown on pecan stocks.

By making the above statements it should not be understood that the practice of utilizing hickory stocks for pecan growing is to be condemned; on the other hand, I would urge every one who has hickory stocks growing on their grounds to select a few of those that are favorably situated and top-work them with some of the improved pecan varieties. This is especially to be encouraged for home use. But if one desires to engage in pecan growing for commercial purposes, I would recommend that they use pecan stocks upon which to grow their nuts. If one will select a strong, vigorous second growth hickory sprout and bud an improved variety on it, he will in a short while be highly pleased with his experiment. For a further discussion of this subject the reader is referred to the paper prepared by Judge F. B. Guinn of Rusk, Texas, on top working hickory and other trees.

GRAFTING CLOTH AND WAX.

A great variety of methods and materials is used in covering grafts and buds. For grafting and budding cloth the general practice is to use bleached domestic or, if available, old bed sheets, dipping the same in either paraffin or beeswax. For use in cool spring weather, however, a mixture of resin, beeswax and tallow or linseed oil as given below for grafting wax is desirable as it sticks and holds the bud in place until it can be tied.

One way to prepare cloth for budding is to tear it into strips of the desired width, dip into the melted wax or paraffin and then draw out between two strips of board so as to remove all excess wax. The cloth is then folded back and forth into blocks of the size desired and a small leather punch or a knife blade is driven thru to cut holes for the buds. In budding the squares are torn off as desired.

Another method is to lay three or four strips together, cut off squares of the desired size with shears, and cut holes for the buds. The ready-cut squares are then carried loose in a special pocket in the budding apron and are taken out and held between the lips ready to use without delay when the bud has been placed.

A third method is to roll up the cloth strips tightly, soak thoroughly in the hot wax and then remove and allow to drip out well. Patches for budding or strips for grafting are pulled off as needed.

For waxing buds and bark grafts the following formula is recommended:

Resin . . . . . 2 pounds.
Beeswax . . . . . 1 pound.
Denatured grain alcohol.

Melt the resin first, then add the beexwas; when these have melted

and mixed allow to cool until beginning to thicken. Now add alcohol and stir until the wax becomes of a grainy golden color.

For root grafting the following formulas are recommended:

Resin .....4 pounds
Beeswax .....2 pounds
Tallow (rendered) 1 pound or linsed oil 1 pint.

The amount of tallow or linseed oil should be varied according to the temperature at which the wax is to be used.

Paraffin.

A new material that is proving very satisfactory and coming into use is melted paraffin. In the nursery a special lantern with a cup in the top for melting is generally used. In top-working the melted paraffin is generally carried in a pint thermos bottle placed in the apron. The paraffin is applied with a long one-half inch varnish brush inserted thru the cork, which is taken off with the brush.

Splendid success has been obtained in bark grafting, Morris or slot grafting, and chisel grafting by painting over the entire graft with paraffin. This prevents evaporation that would otherwise often dry the graft before the union is made, yet is free from injurious effects and allows the beneficial action of the sunlight upon the chlorophyll.

Mr. Ross R. Wolfe of Stephenville has the following to say as to the best temperature at which to use paraffin and the use of stearic acid to prevent cracking:

"The lowest temperature at which I can keep 'Parowax' melted is 116° Fah. The lowest temperature at which it will spread well on buds or grafts 126° Fah. I have made the same test with Stearic Acid, and the lowest liquid temperature is 119° Fah. and spreading well on bud wood at 130° temperature. I have not been able to detect injury to buds when paraffin is applied from 178° Fah. or less. We are using 10% Stearic Acid with 90% paraffin to keep paraffin from cracking. I have used this mixture to cover whip grafts, bark grafts, chip buds and patch buds with very gratifying results."

PRESERVATIVE PAINT.

The following information in regard to preservative paints is taken from U. S. Farmers' Bulletin 995, Preventing Wood Rot in Pecan Trees, a copy of which should be in the hands of every pecan grower or propagator.

"Pure white lead and linseed oil, grafting wax, coal tar, a mixture composed of one-third creosote and two-thirds coal tar, and various proprietary preparations have all been used with more or less success in protecting wounds on trees. The most desirable compound is one which disinfects the wound, furnishes complete protection for the longest period, and causes least injury to the tissues. From these standpoints the coal-tar-creosote preparation is probably the best. After a wound is made it should be left until dry and then

given a thorough coat of some protective substance, which should be renewed as often as necessary for complete protection until the exposed area is healed. The same principles apply to the protection of cavities from further decay. After the diseased area is entirely removed the exposed wood should be treated with creosote and then with the protective material."

It is important not to apply creosote to a fresh, undried cut, just above a bud as the creosote will then be carried into the stub with the sap often killing the tissues to below the bud, and of course the bud too.

Formula for Whitewash.

Many people having yard trees want to beautify them by whitewashing the trunk. The below mixture serves this purpose though it is doubtful whether it keeps out borers. For borers use the formula given under the discussion of the Flat-headed Borer.

Slake ½ bushel of fresh lime with hot water, keping it covered during the process. Add ½ peck of salt previously dissolved in warm water, 2 pounds of ground rice boiled to a thin paste. Stir in boiling hot ½ pound Spanish Whiting, ½ pint glue well dissolved in warm water. Dilute the above with 8 gallons of hot water, stirring it well to become thoroughly mixed. Strain through a fine sieve or strainer, and allow it to stand a few days before using. Apply while hot with a spray pump. Coloring matter may be added for any shade desired.

PECAN INSECTS.

By

J. S. Woodard, First Assistant Entomologist.

THE NUT CASE BEARER.

By far the worst pecan insect in Texas is the nut case bearer. In fact, I feel safe in saying that it does more damage than all other pecan insects taken together. It is reported as destroying one-half of the entire pecan crop of the State. Texas produces more than one-half of the United States pecan crop, an average crop of which is 350 cars. Figuring 30,000 pounds to the car and 12½ cents per pound, this would be a total of $1,312,500.00 annually. If the nut case bearer takes on an average of one-half of the crop, his damage would amount to $656,750.00 annually.

The work of the larvae of the nut case bearer will first be noticed in early spring. The small green twigs and expanding buds will be hollowed out and several silkish threads with excrement and frass will be protruding from the burrow. This frass and excrement is the characteristic work of the nut case bearer, and by close observation it can be told from the work of several pecan insects, which sometimes attack the tender buds and nuts in the same manner as the case bearer but with the latter the excrement and frass is wanting.

Life History.

The nut case bearer has as many as three generations each year, and some years has four. When the fourth generation makes its appearance, it's work is usually mistaken for that of the shuck worm, as the nuts are then too hard for it to penetrate. It is forced to work in the shuck, but the excrement and frass mentioned above is always present. The case bearer is said to pass the winter in the

Figure 1.—Represents the work of the nut case bearer. "A" represents larva, "B" pupa, "C" adult, "1 and 1" represents the work of the first generation, "2" represents the work of the second generation, "3" represents the work of the third generation. Number "4" represents the work of the fourth generation. (Original).

larva stage, usually fastened to the mature bud, and as soon as the tender buds begin to put out, the hungry larvae will attack them. The first generation of moths makes their appearance usually in May, developing from over-wintering larvae. In a few days they deposit their eggs on the calyx end of the nut and as soon as the larvae hatch they will atack the small nuts at the base end; and if no nuts are present they will attack leaf galls or the tip ends of the twigs, the work of which resembles very much that of the bud worm.

but the excrement and frass, which is typical of the case bearer, is never present in the work of the bud worm. It is a very difficult matter to distinguish the larvae of the case bearer from that of the bud worm as they are about the same size and color,, but on close examination it will be found that the contents of the alimentary canal are visible in the bud worm and are not in the case bearer.

The nut case bearer passes through four distinct stages, namely egg, larvae, pupa and moth. The grayish black moth has a wing expansion of about three-fourths of an inch. The hind wings are some broader and much brighter than the fore wings. The full grown larva is about three-fourths of an inch in length and is an olive green in color, and the body is covered with white inconspicuous hair.

Control.

The control of this insect is a very difficult task and I doubt very much if it will pay to spray tall seedling trees. Through a series of experiments carried on by the Department of Agriculture on grove trees, it has been shown that at least a fifty per cent increase can be had by following carefully the rules laid down here. Watch your trees closely and when the first evidence of the case bearer is present, that is when he attacks tender shoots, or it is still better to locate several over-wintering larvae and watch them closely, and when they begin to show signs of restlessness or a tendency to feed, then it is time to spray. Be sure that every expanding bud is thoroughly covered with the spray. This spray should be applied again when the nuts are the size of peas, or better still to watch on the calyx end of the young nuts for the eggs and spray when they are found. A third spray should be applied six weeks from this date. No results need be expected unless a close observation is made and these rules followed closely. Use three pounds of arsenate of lead to fifty gallons of water.

If a person has only a few trees that are of the better varieties and them somewhat isolated it will pay to collect the nuts and burn them as he notices them on the trees. I am not prepared to say just what varieties are most resistant or susceptible to the ravage of the nut case bearer, but I am convinced after watching a number of trees the past season that some are more resistant than others. Some trees matured a heavy crop of pecans, while others that were growing so close that their limbs overlapped set a crop of pecans but every nut was destroyed by the nut case bearer.

PECAN SHUCK WORM.

This insect is next to the nut case bearer in destructiveness in Texas. It's work is usually in the fall of the year and is altogether in the shuck. Dark discolorations are caused on the nuts, thus injuring the sale. Sometimes when the nuts are attacted early they will be faulty and the shucks will remain on them. Much damage was done in the Spring of 1922 to the young nuts, as they were attacked and eaten out in much the same way as the case bearer does.

Description.

The larvae of this insect reaches the length of about three-eighths of an inch when full grown and is a creamy white color with brown head. The winter is passed in the larva stage in the shucks, both in the ground and on the tree.

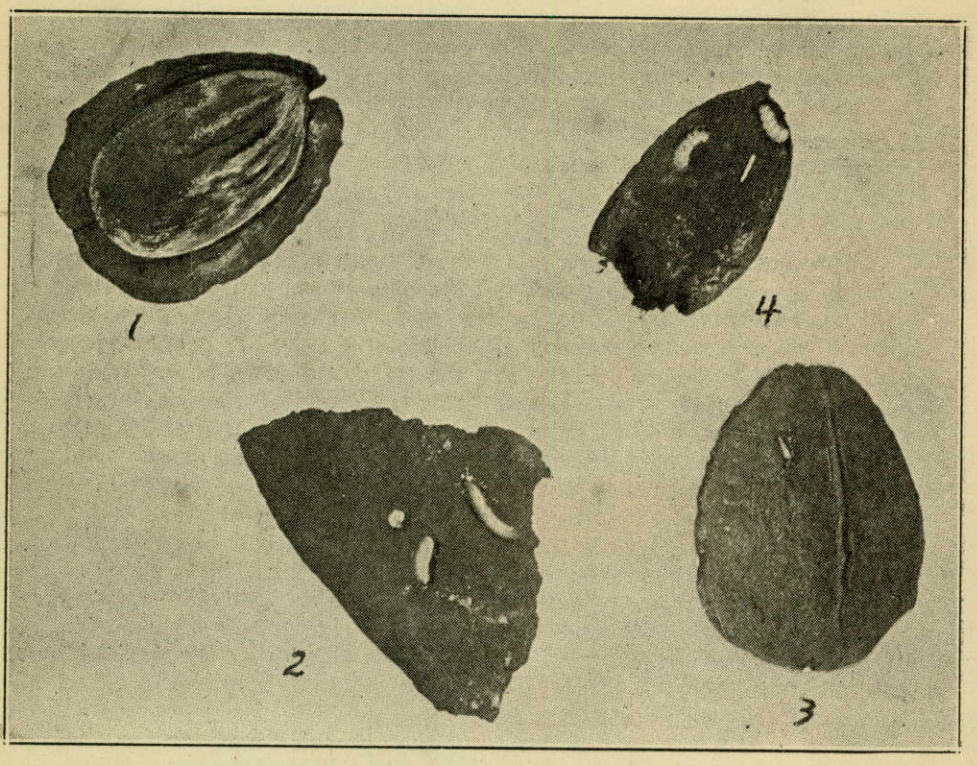


Figure 2.—Represents the work of the shuck worm, Number "1" shows the dark colored marks on the nut. Numbers "2" and "4" represent larva, and "3" represents the pupa case protruding from the hull. (Original).

Control.

About the best method of controlling the shuck worm is by gathering and burning the shucks after the pecans have fallen. Almost all of the shuck worms can be destroyed in the fall by plowing them under if they are covered five or six inches deep.

OBSCURE SCALE.

It seems that this scale is liable to become one of the worst pecan insects in Texas. Most of the pecan insects will come and go—that is, they will be numerous for a year or two and then they will disappear, but this is not true of the obscure scale, for if it once gets a start it will continue until it has killed the tree unless something is

done to rid the tree of it. Two or three years are all that is required to kill an average size tree, and there are so many people that will not notice such a small insect as the obscure scale until it has killed or partially killed their orchard.

Description.

The obscure scale somewhat resembles the San Jose scale, but is very much larger and colored much like the natural bark of the pecan. The insect usually first attacks the limbs about the size of a person's thumb and gradually spreads over the body and larger limbs.

Control.

This scale insect is very hard to control and lime sulphur spray that is so effective for San Jose seems to have no effect on it, but a spray of missible oil will give satisfactory results. It seems that it might be advisable to cut a tree back to a mere stub and spray with a very strong lime sulphur spray. This should be done in the dormant stage and the cuttings burned. A blow torch flame might be used to burn the scale after the tree has been cut back.

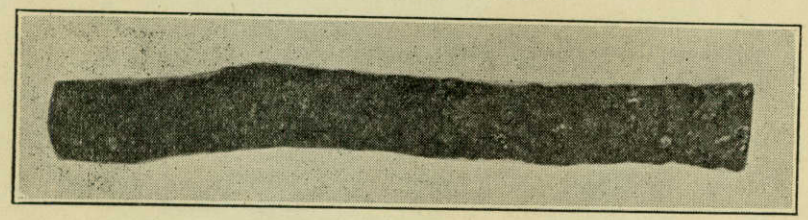


Figure 3.—Specimen of Obscure Scale. (Original.)

Since the obscure scale is a serious enemy of the pecan in Texas and is capable of being spread over the State by the shipment of nursery stock, Mr. J. H. Burkett, Nut Specialist, Department of Agriculture, insisted very early in the year 1923 that some more effective and economical means of control of this insect be worked out.

Early in March, 1923, the entire pecan orchard just south of Austin belonging to Mr. Ramsey was secured for the purpose of testing several control measures. Mr. Ramsey furnished the labor and the Department of Agriculture furnished the chemicals and machinery. This orchard consisted of about 150 trees, ranging in age from ten to twenty-five years and in size from four inches in diameter and twelve feet tall to four feet in diameter and forty feet tall. Some trees were almost dead from the effect of this scale and some were only slightly injured. Many seedlings on the Colorado River and Barton Creek, adjacent to the orchard, are now dead from this insect.

On March 11th, with three men and a wagon and team, I began spraying this orchard. An ordinary hand barrel pump was used. Two men operated the pump and two handled the nozzles. Extension rods, about fifteen feet long, were used and on ordinary trees not over 25 feet tall the operation could be carried on from the ground but on trees about thirty feet tall the operators had to climb the trees

in order to reach the tops with the spray. About sixty-five of these trees were sprayed with oil emulsion composed of one pound of fish oil soap, one gallon of red engine oil or parafiin oil and one-fourth pint lye to eight gallons of water. The soap was dissolved in one gallon of water by boiling, then the oil was added to this and thoroughly stirred until emulsified. The lye was dissolved in the seven gallons of water and the hot soap, oil and water all mixed and

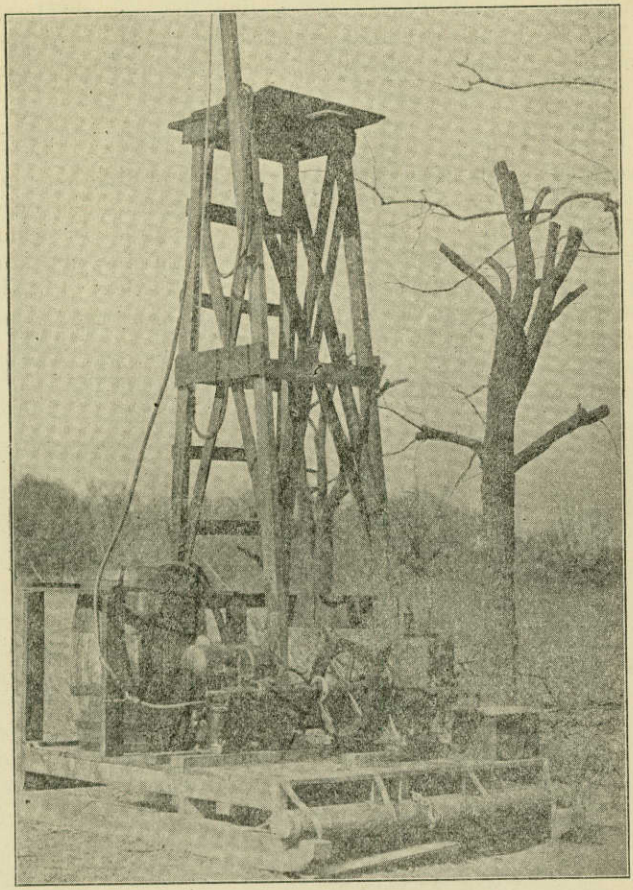


Figure 4.—Outfit for spraying obscure scale used by Mr. J. R. Donnelly, San Saba, Texas. Courtesy of Mr. Donnelly.

stirred and applied while hot. Another sixty-five trees were sprayed with heavy black engine oil that cost twelve cents per gallon less than the paraffin oil. It was mixed in the same proportion with soap, lye and water. Both sprays seemed to kill the scale and did not injure the trees, but the heavy engine oil was very heavy and more undesirable to use than the paraffin oil, as it was worse about clogging the nozzles.

Four men worked steadily for about nine hours spraying these 130 trees. Two hundred gallons of liquid were used, twenty-five gallons of oil and twenty-five pounds of soap. The soap cost thirty cents per

pound and the oil thirty-five cents per gallon. The soap cost was $7.50 and the oil $8.75, or a total amount of $16.25. This amount used on 130 trees would amount to twelve cents per tree. Four men working for a period of nine hours would be equivalent to one man working for a period of thirty-six hours. Since 130 trees were sprayed, that means that on an average fifteen minutes was consumed in spraying one tree and that it costs about twelve cents per tree for the material and takes one and one-half gallons material per tree.

As stated above, a number of different sprays were used with results as follows: A number of young pecan trees, all about the same size and on the same type of soil, all of the Success variety, and all heavily infested with the scale, were selected and sprayed. Two of these trees were sprayed with lime sulphur spray, double strength; or instead of using twenty pounds of lime and fifteen pounds of sulphur to fifty gallons of water, forty pounds of lime and thirty pounds of sulphur to fifty gallons of water were used. This did not injure the trees, but it did very little good. Another tree was sprayed with pure kerosene and the tree never did show any sign of life when leafing out time came. Another tree was sprayed with pure crude oil. The scales were killed and the tree was slow about putting on foliage and died later in June. One tree was sprayed with oil drained from the crank-case of automobiles. This tree never did show any sign of life. Two trees were sprayed with oil emulsion, but instead of using one pound of soap and one gallon of oil per eight gallons of water used above, the amount of water was doubled and sixteen gallons to one pound of soap and one gallon of oil were used. This did not injure the tree, but did not kill the scales.

Therefore, out of the seven different sprays used, some doing no good, some injuring the trees and some killing them, I would suggest that the only spray worthy of using is the first one mentioned above: that is, where one gallon of fish oil soap was dissolved in one gallon of boiling water and one gallon of red engine oil was then added to this and thoroughly mixed. One-fourth pint of lye was added to seven gallons of water and then the soap and oil was added to this and thoroughly mixed and sprayed while hot.

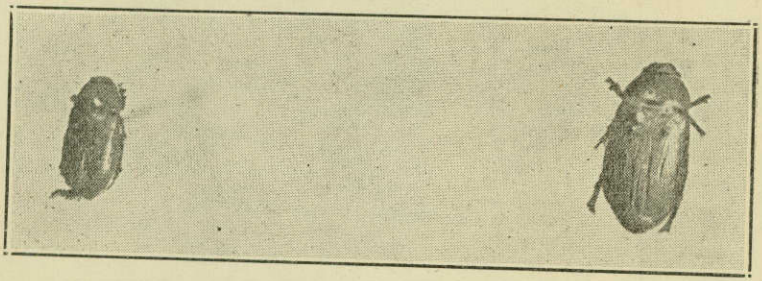


Figure 5.—An adult May Beetle. (Original.

MAY BEETLES.

Description.

Considerable damage is sometimes done in the early spring to tender pecan twigs by this robust brown beetle. It usually makes its

appearance in early spring and continues to feed for several weeks. They feed at night and go into the ground about day. They usually can be found by digging in the ground under the tree. This beetle

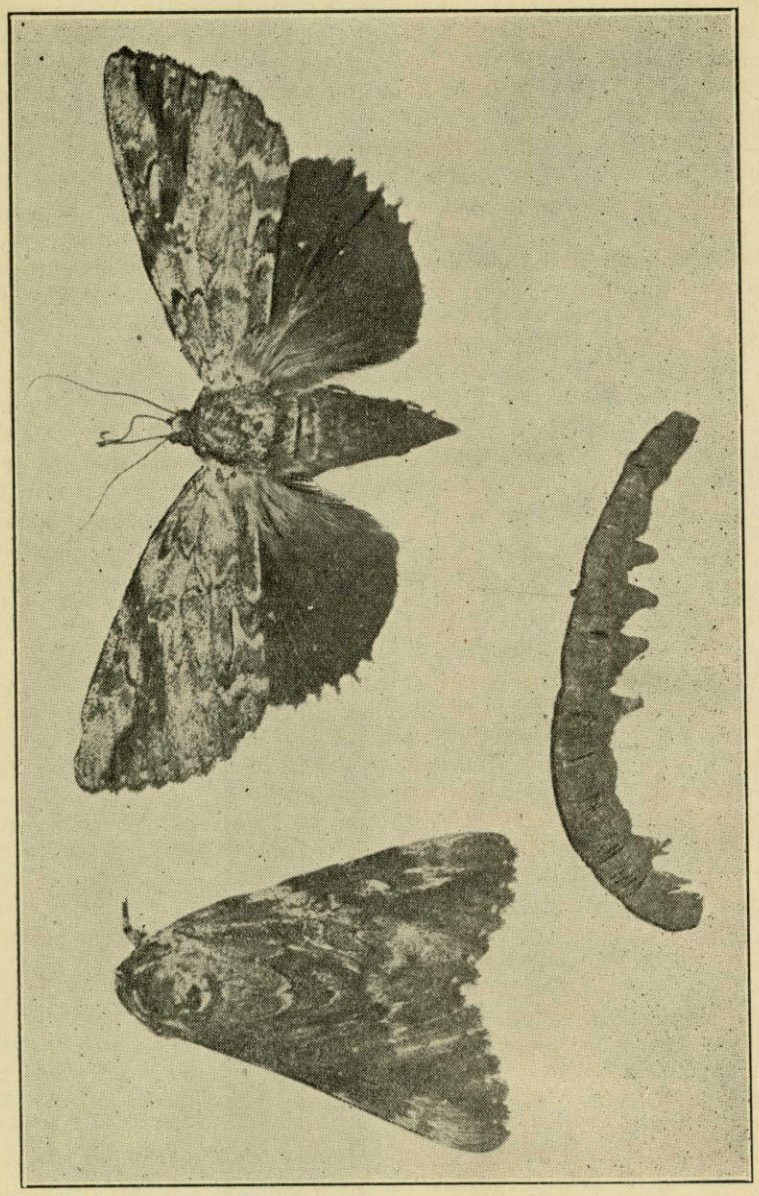


Figure 6.—Adult and larva of catacala.

is the adult of the white grub or common grub worm. They usually deposit their eggs in Bermuda patches or un-cultivated fields. The larvae remains in the ground from summer until the following spring year.,

Control.

Keeping an orchard in a thorough state of cultivation will help in ridding it of May beetles. They can also be controlled by spraying the trees with arsenate of lead, three pounds to fifty gallons of water.

PECAN CATACALA.

Description.

The adult of this insect is a large moth with dark grey fore wings and red hind wings. The caterpillars when full grown, measure between two and three inches in length and are of a dark gray color with various markings. The larvae are usually present in April and May, and on account of their habit of hiding in the day and feeding at night, they are seldom noticed.

Control.

They seldom become serious enough to justify means of control but if they do, they can be controlled by spraying the trees with arsenate of lead at the rate of three pounds to fifty gallons of water.

PECAN OR HICKORY TWIG GIRDLER.

Description.

This is a motley gray beetle about an inch in length, with antennae as long or longer than the body. The antennae of the male is much longer than those of the female. The work of this insect will be noticed in September and October. Small twigs about the size of a lead pencil will be noticed dropping off and upon examination the twig will be found to be cut in a perfectly smooth manner. This work has often been attributed to the work of squirrels, large horn worms and various other things, but is the work of the female beetle described above. Several slits will be made crosswise the twig before it is girdled and it is not definitely known whether she is hunting a place to deposit her eggs or a favorable place to girdle. The eggs are usually found near the bud. Between this egg and the body of the tree the girdling is done. The twig usually drops to the ground and the following fall a new beetle will appear, but in some cases it will take two years for the beetle to make its appearance. It is not definitely known why this insect girdles the twig between the egg and the body of the tree and there are different opinions. Some believe that it is girdled to stop the sap from flowing through and enable the egg to hatch, while others claim that she girdles it in order that the twig will fall to the ground and the ground will furnish them moisture to hatch and mature the larva. Experiments show that a very small percentage of the larva mature, both buried in the ground and stored in a dry place.

Control.

If the twig girdlers become numerous enough to justify means of control, the fallen twigs can be gathered and burned and in this way the infestation can be kept down.

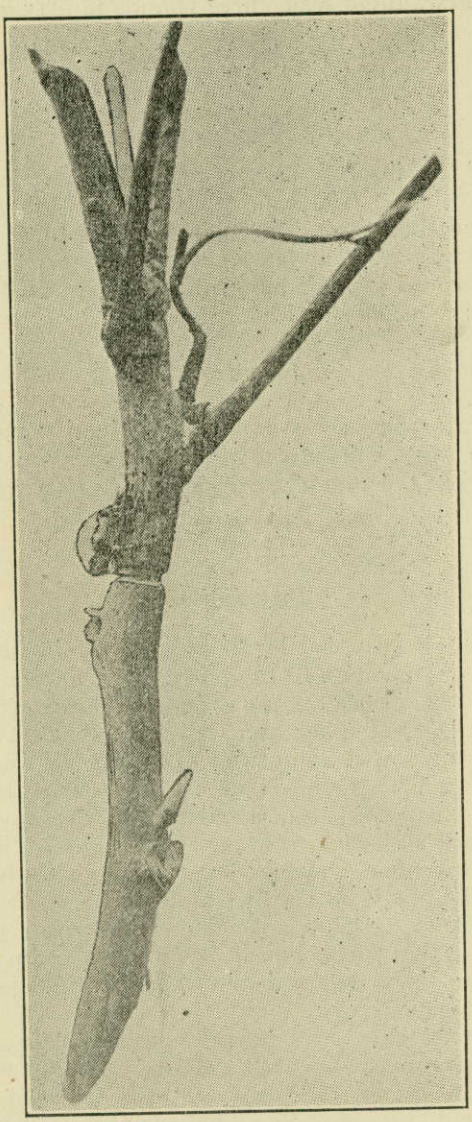


Figure 7.—Shows the pecan twig girdler at work. (Original).

PECAN WEEVIL.

Description.

The pecan weevil is a dark brown or grayish beetle, having a very long slender beak. The female has a much longer beak than the male. The larva is a soft-bodied, creamish white, legless grub

found in the interior of the nuts. The eggs are deposited in the nuts by the female ranging in time from June until the middle of September. Without any external evidence the grub remains in the nut until it has fallen, or sometimes it has not gnawed out by December or January. After it has eaten out it enters the ground and burrows itself in the ground eight or ten inches deep, where it remains until the next summer.

Control.

After the nuts have been infested, the only thing that can be

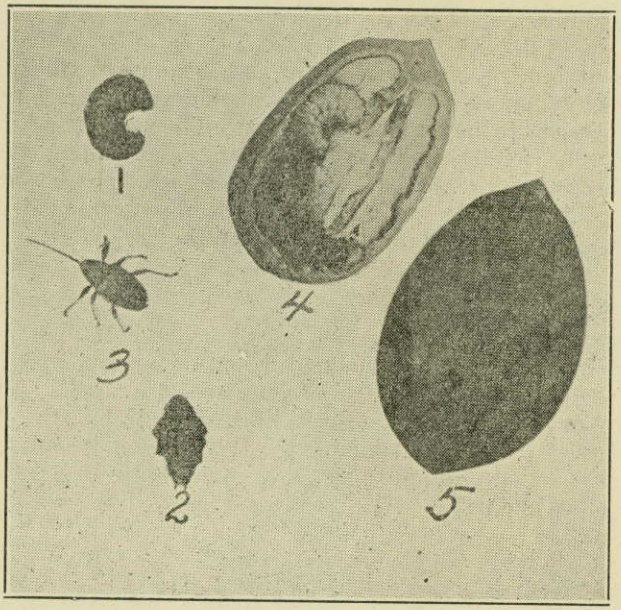


Figure 8.—Represents the work of the pecan weevil. Number "1" is a larva, Number "2" a pupa, Number "3" the adult weevil, Number "4" represents the larva at work and "5" represents the exit hole of an emerged weevil. (Original).

done is to place them in an air-tight container and fumigate them with carbon bisulphide. The best thing for an entire bottom is to trim out all of the underbrush, burn all leaves and if possible break the land. Hogs and turkeys are very beneficial in a bottom, as they will gather many of the grubs and adult beetles. Sheep and goats are also beneficial, as they will eat out the undergrowth. Plowing is of no importance in killing the weevils, as they go too deep for the plow to reach.

THE FALL WEB WORM.

Description.

The fall web worm is a common sight in the fall of the year. Great masses of caterpillars all feeding within and about one web

can be seen from most any pecan grove. The caterpillars never leave the web to feed but when new food is desired the web will be extended and new food taken in. The larva leave the web in the fall and go into the ground. The next spring new moths will appear.

Control.

If possible, the webs should be destroyed by fire or by a pruning knife, but if they are too numerous, the larva can be destroyed by spraying with arsenate of lead, three pounds to fifty gallons of water.

PECAN BUD WORM.

This insect is a pest principally of pecan nursery stock. It seldom does any damage to amount to anything to large trees but nurserymen seem to have considerable trouble with it, as the larva will attack the tender buds in the spring and tunnel them out, causing the twigs to die back and afterwards bunch out. This ruins the growth of the young tree as the nurserymen depend on the length of the growth for the value of the tree.

Description.

The wing expansion of the moth is about one-half inch. Its general color is gray. The fore wings are streaked and mottled with black or brown patches. The hind legs are also gray. When full grown the larva is about five-eighths of an inch in length. Its body is covered with fine hair and is a yellowish green in color.

It is transparent enough that the contents of the alimentary canal are always visible. The head and neck are dark brown or black.

Life History.

There are from four to six generations a year. The winter is spent in the adult stage and as soon as the buds begin to develop in the spring, the over-wintering moths begin to deposit eggs on branches and in from three to six days they hatch and the larva begins to feed. The larva lives on an average of 25 days.

Control.

The bud worms seldom become serious enough to justify means of control, especially if the orchard is kept in a thorough state of cultivation. They seem to attack weak and unhealthy trees and many times if the trees are watered and fertilized, they will put on leaves so rapidly until the work of the bud worm will not be noticed. They can also be controlled by spraying with arsenate of lead, if it is applied while the buds are young.

THE FLAT-HEAD APPLE TREE BORER.

The larva of this insect does considerable damage to young pecan trees, especially if they are in a weakened condition from cold,

heat, drought or unfavorable conditions. Pecan trees have been found to be seriously injured where other timber adjacent was dead and dying from being girdled, belted or chopped down. As stated above the borers prefer timber in this condition and trees should never be left in this condition near a pecan orchard, as this furnishes an excellent breeding place for them.

Description.

The adult beetle of this insect is a beetle about one-half inch long. The eyes are extremely large and the antennae short. The upper part of the wing covers are of metallic color while the underside is copperish and the body bluish-green. The larva when full grown is about an inch long and has a flat broad head, the color is yellowish-white, and the larva has no legs.

History.

The adults are present in the orchard from early March until late November, and larva of different size may be found any time of the year. The beetle deposits her eggs in the cracks of the bark on the trunk of the tree or on the large limbs and when the eggs hatch the young larva begin to gnaw their way into the tree. One year is required for an egg to hatch and mature into an adult.

Means of Control.

About the most practical means of control after the trees have become infested is to locate the larva and cut them out with a knife, This should be done two or three times a year. Young trees should be kept in a vigorous state by getting plenty of water and turning cover crops under. All dead timber and dying trees should be removed and burned.

The following formula has been very effective in controlling this borer in apple and pear orchards and some good should be done in pecan orchards.

Common laundry soap	50 pounds
Water	3 gallons
Flaked Napthaline	25 pounds
Flour	2 pounds

Place the soap in the water over steam pipes and allow it to soften for a few days, use a potash soap which will form a smooth mixture, not a soda soap since the latter becomes jelly-like. Then place in a double boiler and cook until the temperature reaches 180°F. Stir in the flour and add the napthaline and bring the temperature to 180°F, at which temperature the napthaline will have melted, the melting point of napthaline being 176°, then cool as quickly as possible stirring the mixture occasionally. This compound may be applied with a brush.

SQUIRRELS.

Many complaints are coming from owners of groves stating that the squirrels are giving them quite a bit of trouble by gnawing and breaking off tender buds and grafts. It seems that they prefer these tender twigs to any others. Many nuts are also carried off and destroyed by them. I have found as many as a peck of nuts in a hollow log or under rocks evidently carried there by one or two squirrels.

Control.

I suppose the best method of control is to shoot the squirrels but I have seen strips of tin made in the shape of a funnel and these tacked around the trees with the big end down. Of course this is only used where the trees are far enough apart that the squirrels can not jump from one to the other.

LEAF GALLS.

During the past two seasons a number of specimens and inquiries have come in wanting to know if anything can be done to control this gall. The galls are small swellings that occur on the leaves and leaf petioles and often in the clusters of the nuts. They usually occur in the spring and are caused by soft-bodied insects commonly called Plant Lice or Aphids. They attach themselves to the tender twigs or leaves and the swelling is formed over them. These swellings are at first closed but later, just at the proper time, the galls burst and thousands of aphids crawl out to start life for themselves.

Control.

These galls have never been considered injurious enough to justify any means of control and for this reason no means of control has been worked out. It seems that hand picking might be practiced on small trees, provided this was done before the galls burst.

WHITE ANTS OR TERMITES COMMONLY CALLED WOOD LICE.

Sometimes considerable damage is done to young nursery trees by hollowing the main tap root out after they have been transplanted. Especially is this true if they are planted on or near new ground. The termites are seldom noticed until after they have done quite a bit of harm as they work under the ground.

Control.

Termites live in nests like true ants and can best be controlled by pouring carbon di-sulphide in the hole and then packing the ground around and over the hole. The fumes will kill all of the ants in the nest. No fire should be brought near the carbon di-sulphide.

THE BLACK WALNUT CURCULIO.

It seems probable that the walnut industry of Texas has an enemy waiting that will probably be as bad on the walnut as the nut case-bearer is on the pecan. In the latter part of May and the early part of June the ground under the black walnut trees will be found covered with young walnuts ranging in size from very small walnuts up to some half grown. Upon close examination it will be found that they are infested with white, creamy, legless larvae. The smaller walnuts have a crescent puncture, while the larger ones are simply pricked and a small hole made where the eggs are laid. The adult is a weevil about one-fourth inch long, and of a reddish brown color. The eggs are deposited by the female in the young walnuts during May and June and in about six or seven days they hatch and the larvae begin their work. Here they feed for about two weeks, causing the young walnuts to drop off. When the larvae get ready to pupate they enter the ground and remain there for from two to three weeks, then the new beetles appear. This weevil is known as the Black Walnut Curculio.

BENEFICIAL INSECTS.

We read, talk, hear and see evidence of destructive insects everywhere we go. The boll weevil, the pink bollworm, the leaf worm, the grasshopper and the nut case-bearer all take their toll each year, which runs into millions. The mosquito spreads yellow fever and dengue, the house fly its filth and different diseases. All of these cause destruction to plants, animals and human beings. When we look and think of the tremendous amount of damage done by them we almost lose respect for the insect kingdom. Yet we have our beneficial insects and if it were not for them we would cease to exist. For every destructive insect there is a beneficial one; that is, every insect has its enemy that helps to hold it in check, and when an insect is transported to a foreign country without its enemies it is difficult to control it. The boll weevil is an example of this kind.

We have two types of beneficial insects: Predacious and Parasitic. By predacious we mean the insect that devours its host by simply eating it, and by parasitic we mean those that make their living by sucking nutriment from their host. In the following paragraphs I will discuss in a very brief way some enemies of the nut case-bearer.

THE LACE WING FLY OR APHIS LION.

Among the most beneficial insect known is the lace wing fly. It is called aphis lion because the larva is so greedy when it comes to devouring aphis. They are very fond of the eggs of different butterflies and moths and they will eat any insect that they can overpower. Many people become alarmed when they find the lace wing fly so numerous. They imagine that the lace wings are responsible for some trouble that is always present when they are found; they

are not responsible for the trouble and if left alone will soon correct it. The lace wings like most other insects pass thru four distinct stages, namely: the eggs, the larva, the pupa and adult. The eggs are shining tiny white bead like balls, all deposited on bristle like hairs every one separate and about one-half inch high, they are placed on top of these bristles to prevent the first of these larva that hatch from eating the others. The larva resembles a tiny alligator more than anything else and is always busy looking for something to eat. When they get ready to pupate they roll themselves up in a tiny ball and at the proper time a circular lid will open and out comes this beautiful green fly. Its wings resemble lace, its antenna are very long and slender, its eves are large and resemble balls of gold. Figure 9 represents adult of the lace wing fly.

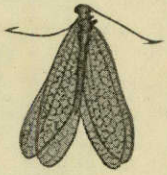


Figure 9.—Represents the adult and larvae of the lace wing fly.

THE ICHNEUMON FLIES.

These wasp-like insects constitute the greatest part of the parasitic insects. There are many different kinds and sizes, ranging in size from almost invisable to the naked eye up to and including some that measure 10 inches in length from tip to tip. Each one has his preferred host and their hosts vary from the smallest of aphis up to some of our largest borers. The ovipositors of the female of some species are strong enough to pierce the body of a hard oak tree to a depth of one-half inch and deposit an egg in the body of the borer, that is located by sounding from the out-side.

At this particular time of the year, June 1, 1924, it seems that the nut case bearer is apt to be held in control by one of the hymenoptera wasps. This particular one is about one-half inch in length and its body is very slender, the entire body is a dark steel-blue, its legs are light red and wings transparent, its antenae are straight slender and about as long as its body. The female has three appendages at the end of the abdomen, one of which (the middle) is the ovipositor, the male has no appendages. The egg is deposited in the back of the nut case bearer by the female, she does this by locating the larva in the nut or in the twig and drills a hole into it. It seems that the young Inchneumon fly lives by sucking the blood; for in most cases the nut case bearer lives to pupate but instead of a nut case bearer moth emerging a young wasp appears. Figure 10 represents the adult Ichneumon fly, side and back view.

Mr. L. D. Romberg of the State Edible Nut Division has the following to say about the Ichneumon fly and the nut case bearer.

"Ichneumon flies were seen in the grove at several different times searching the shoots for case bearers. On May 13th one was observed in the nursery ovipositing on a bud worm in his pupal case. The fly immediately knew there was a bud worm inside and with little delay proceeded to thrust it's ovipositor into the case of webbed-up leaves to the worm, depositing its egg.

In the grove a well developed Ichneumon larva was found on May 3rd, but no flies emerged from case bearer larva collected until May 15th, and the maximum emergence occured within the next few days. The first case bearer emerged May 8th and maximum emergence was about a week later.'

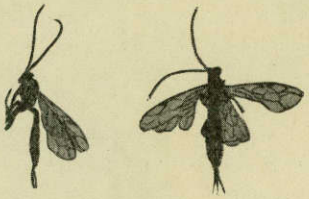


Figure 10.—Represents the adult Ichneumon Fly.

THE TACHINA FLY.

These are more parasitic insects. The female deposits her eggs on the back of living larvae and as soon as the eggs hatch, the young maggots make their way into the hosts and devour them. The maggots then go into pupation within their hosts and remain there until the adult flies come forth. This Tachina fly resembles the house fly very much and is still more like the flesh fly. The larvae are white, legless maggots and the pupae are dark brown, oblong, about three-fifths of an inch long. Figure 11 represents the adult Tachina fly. Mr. L. D. Romberg has the following to say about Tachina flies:

Figure 11.—Represents the adult Tachina Fly.

"On April 16th, when observations were begun, several case bearer larva with Tachina fly eggs attached were found. On May 3rd this had increased to 33 per cent. On May 13th nearly all case bearer pupa found were infested with either Tachina or Ichneumon fly larva. The first Tachina fly emerged on this date in the grove. Emergence from case bearers collected was from May 15th to 20th."

THE WHEEL BUG.

Another of our beneficial predacious insects is the wheel bug. The larva from the time it hatches until the adult is ready to pass away is always ready to devour any insect it happens to discover. It has been seen sticking its long beak down into the burrow of the nut case bearer and pulling out the larvae and eating them, several before one meal was finished. This wheel bug belongs to the true bug order and its metamorphosis is incomplete; that is, the eggs hatch into young bugs and not larvae. The eggs are deposited by the female in great masses that are usually placed where food is the most plentiful and at the proper time a host of young wheel bugs are hatched and begin their search for food. The young do not resemble the adults very much until they have molted

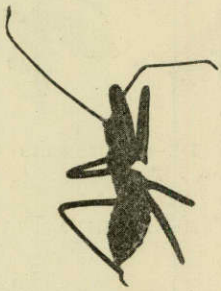


Figure 12.—Represents the Young of a wheel bug.

several times. The adult is easy to recognize as it gets its name from a large wheel or comb on the top of its back or rather its thorax. The adult is something over an inch long and probably half an inch wide. The beak is something like half as long as the body. Figure 12 represents the young of the wheel bug.

DISEASES OF THE PECAN.

By J. M. Del Curto, Plant Pathologist.

The effect that environmental conditions, the general health status and peculiar physical properties of the animals bear toward disease susceptibility, has been universally recognized. These factors enter so vitally into the health of human beings that many times they are wholly responsible for such common maladies as headaches, indigestion, rashes, etc. As a result a simple and effective treatment not only of non-parasitic troubles, but of parasitic diseases, is to subject the patient to better health conditions with reference to environment, climate and diet.

In this same way, a plant's environment has much to do with its behavior, growth and disease resistant powers. Plants act differently in different soils and climates, a phenomenon which is generally governed by inherent requisites of a related group of plants.

These peculiar likes and dislikes, however, extend into the varieties, and sometimes less conspicuously to the individual.

Successful plant disease prevention and control deserves a consideration of these realities. Regardless of the disease under consideration a plant should be given an opportunity to help itself in resisting the trouble by the assistance of judicious varietal se-

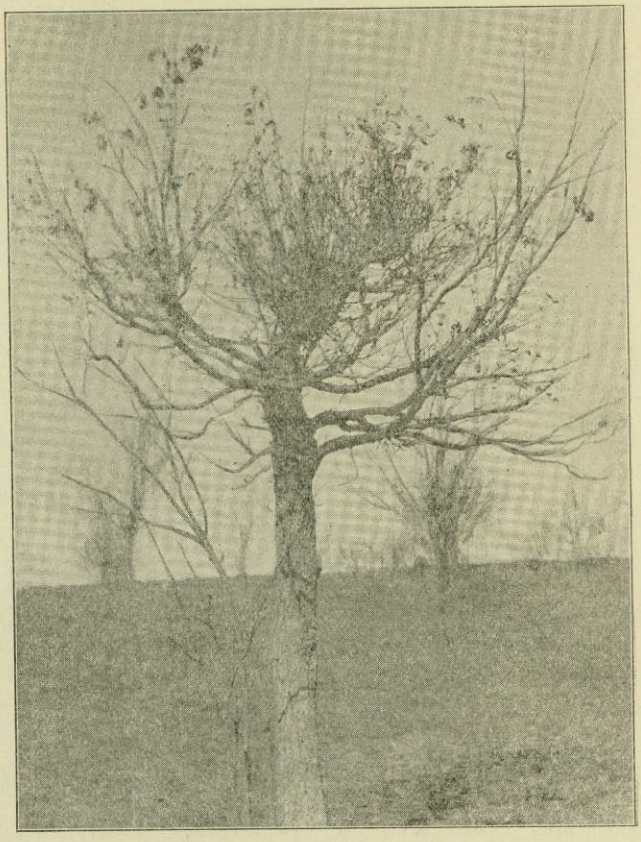


Figure 1.—A rosetted tree during winter showing twig formation. (Original).

lection, planting, cultivation, fertilization and irrigation, in so far as conditions will permit.

This recommendation has a special significance with reference to pecan diseases as the pecan is exceedingly sensitive and responsive to its environment. Accordingly the subject will be considered under the headings of non-parasitic and parasitic diseases. It will be understood, however, that the complicated relationship that exists between the activity of disease organisms and environmental conditions prevents a sharp line being drawn between physiological

and parasitic diseases, but a rough classification of his kind will serve as an expedient one here, as it permits a comprehensive and interesting viewpoint.

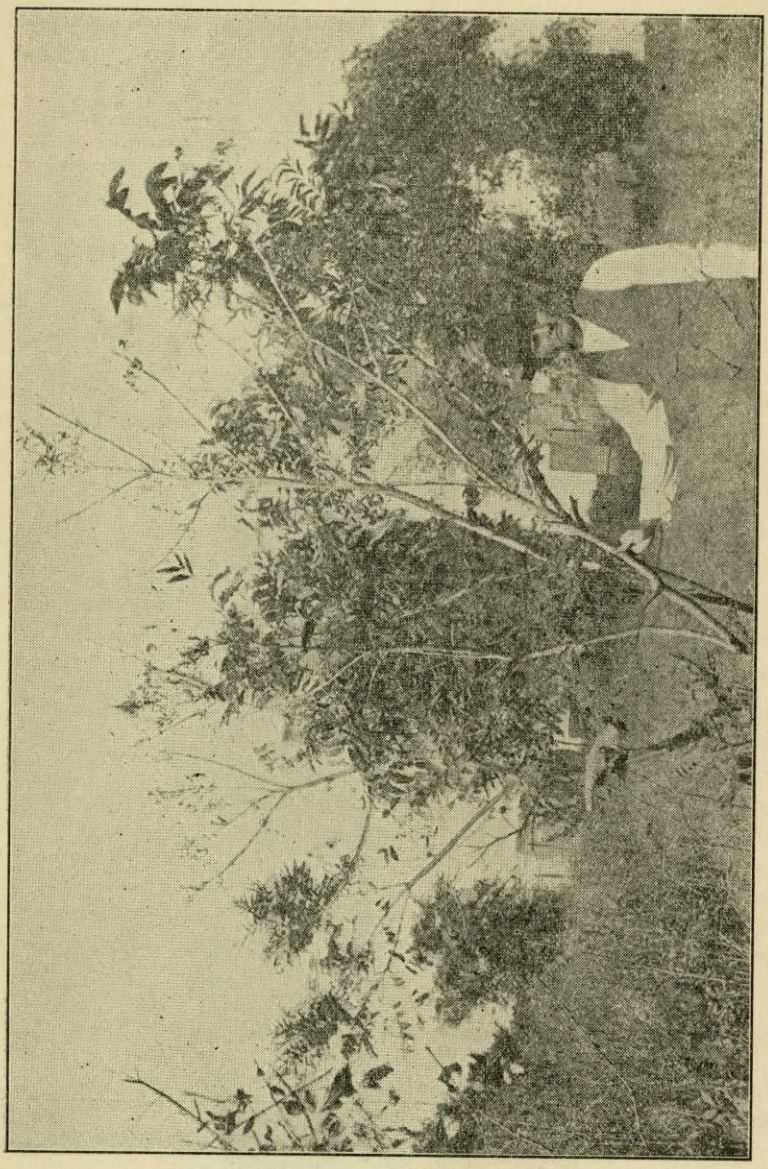


Figure 2.—Rosetted tree during fall showing leaf cluster formation. (Original).

NON-PARASITIC DISEASES.

ROSETTE.

Description.

The symptoms of "rosette" are shown in the accompanying illustrations, Figures 1, 2, 3. The name rosette has been well taken, in

that trees affected show dense clusters of poorly developed foliage in the form of frizzles or rosettes at the twig-terminals. These clusters consist of characteristic elongated yellow mottled leaves which are slightly curled at the edges and contain large prominent veins.

Discussion.

Rosette appears to be a peculiar manifestation of the pecan as a result of adverse environmental conditions. Its close association with soil not adapted to pecan growth is very conspicuous, and attempts to transmit the disease from diseased trees to healthy trees have failed. Diseased trees have temporarily and sometimes permanently recovered of their own accord, which is probably explained by moisture conditions and the contact of the root system with various new soil stratas in penetrating from year to year.

The trouble is commonly found associated with impermeable subsoils or "hard pan" conditions. Very porous subsoils with insufficient water retaining qualities are also found with the disease. It may be stated in a general way that rosetted trees occur on soil deficient in humus or moisture retaining capacity, and are many times accompanied by a similar under-nourished condition of the surrounding vegetation.

Control.

In that the cause of rosette is primarily a soil question and on account of the variety of soils in Texas upon which the pecan is planted, each case of the disease is somewhat of an individual problem of control in itself. The most important factor, however, as reflected in the occurrence and behavior of the disease, is the humus and moisture feature. The pecan is very sensitive to its moisture requirements. Although it is what may be termed a "tap-rooted" tree, the importance of the surface lateral root system must not be underestimated. It is appropriate to note here, that the author has observed typical rosetted trees growing in various types of soil completely recover when well-rotted stable manure was applied as a fertilizer and the moisture content of the soil increased during drouth periods by irrigation and the application of a straw mulch. Untreated check trees nearby failed to show any signs of recovery. The character of subsoil would determine in a measure the readiness to which a tree would respond to such treatment. With this in mind, the grower must study his individual problem and decide the practicability of control measures on the soil in question.

A few general suggestions, however, are offered:

Avoid planting pecans on poor land or soil with a subsoil of an impermeable character or white quicksand. Before setting out trees, break land deeply as possible. The use of dynamite in the preparation of soil for planting trees will be found to be a very economical and efficacious method. It should be used only when soil is very dry and will cause the formation of cracks for many feet in all directions. Trees planted by this method will be found

to show a faster and more lasting growth. Use care in planting, in order that the trees may become correctly rooted. Duplicate the ideal conditions of the native forest, as far as possible, by the application of a thick straw mulch, rotted manure, or with cover crops. Practice shallow cultivation, the turning under of green crops or a continual process of crop mowing, according to type of land. Irrigation when pactical should be lessened toward fall to assist hardening of wood.

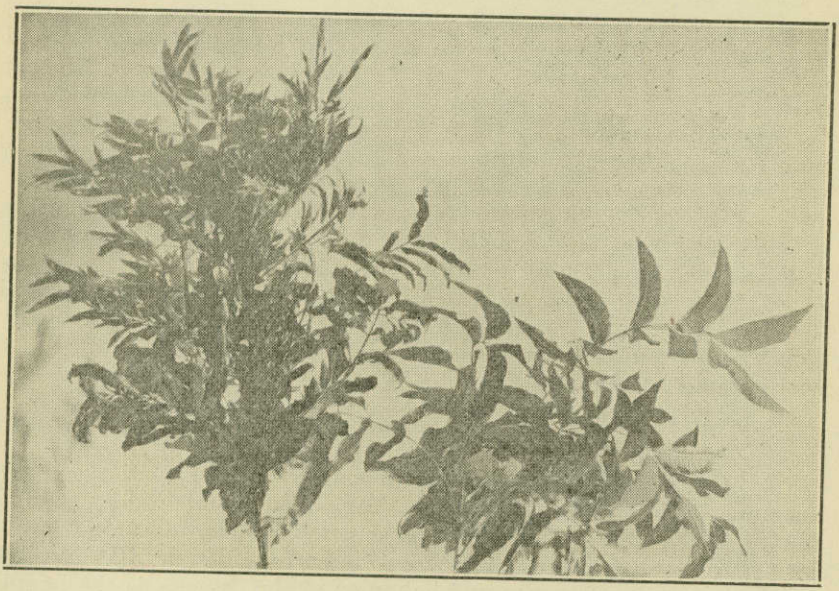


Figure 3.—Rosetted twig showing leaf formation compared with healthy twig. (Original).

Selection of Root Stock as a Possible Means of Developing Disease Resistant Trees.

The importance of root stock selection with the older fruit and nut industries has been fully realized. In fact many of such industries could not have developed to their present magnitude without the advantage from this source. Expermients have shown that not only class selection of seed and seedlings has much to do toward governing the development of the trees, but that individual selection is of great importance.

While much interest has been manifested in the selection of pecan varieties with reference to disease resistant powers in various sections, very little attention has been given root stock selection for this purpose. Varietal selection and its relation toward disease resistance is principally a matter of climate, while root stock selection is more of a soil problem. Consequently in attempting to develop rosette resistant trees, the selection of root stock is a very important factor. Experiments are now under

way with several classes of seedlings. Mexican pecans produced from trees growing under very unusual conditions are giving promising results. Although the results are yet meagre, much is to be expected from such work towards the development of disease resistant pecan root stock.

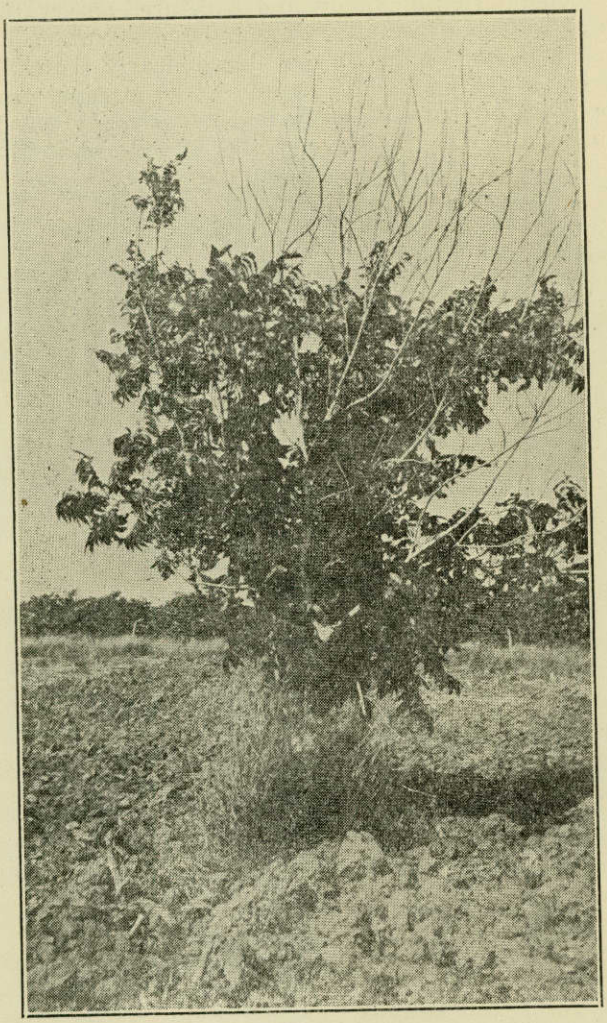


Figure 4.—Tree affected with "die back." (Original).

DIE BACK OR PHYSIOLOGICAL BLIGHT.

Die back is one of the most common diseases of the pecan in Texas. While it is very conspicuous on old neglected trees throughout the State, many soils invariably grow luxuriant trees for several years and then develop the characteristic die back, shown in Figure 4. Generally the tips of the leaves or the space between the

main veins blight and a dark line of demarcation separates the dead area from the green healthy tissue. The dead area, however, may cover any part of the leaf, becoming brittle and falling out, as shown in Figure 5.

Proper pruning, judicious cultivation and fertilization directed toward accumulation of humus and moisture conservation has corrected the trouble in several cases under observation. The occurrence and behavior of the disease shows clearly that affected trees suffer from a deficient water supply and too rapid transpiration. In some cases irrigation assists and temporarily checks the die back, but many times the lower stratas of soil are at fault in mois-

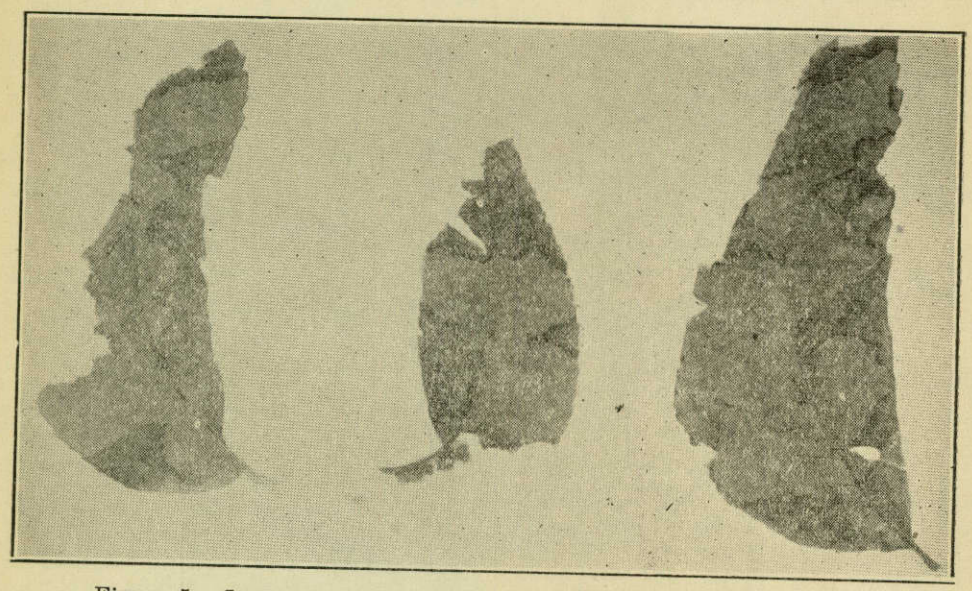


Figure 5.—Leaves from a tree affected with "die back" "physiological blight." (Original).

ture conditions. General methods of care in helping the tree to become vigorous as given under "Rosette" will undoubtedly do much toward correction.

WATERY KERNEL.

During season of heavy rainfall, many apparently healthy pecans are found with watery kernels, which later blacken and shrivel or decay. No outward signs of the trouble can be detected, except for the slightly premature falling of the nuts. This condition is here referred to as "watery kernel" and differs from other imperfect kernel developments by the large moisture content. The disease has been found to be more common on seedlings and varieties with small leaves or scarcity of foliage. It is a very conspicuous trouble during years of excessive moisture, especially when such years were preceded by drouth periods. Its occurrence strongly indicates that it

is due to reduced transpiration and excessive absorption of moisture. In many cases the tree adjusting itself to periods of drought by root formation and lack of foliage development is unable to meet rapid changes involved in a sudden rainy season.

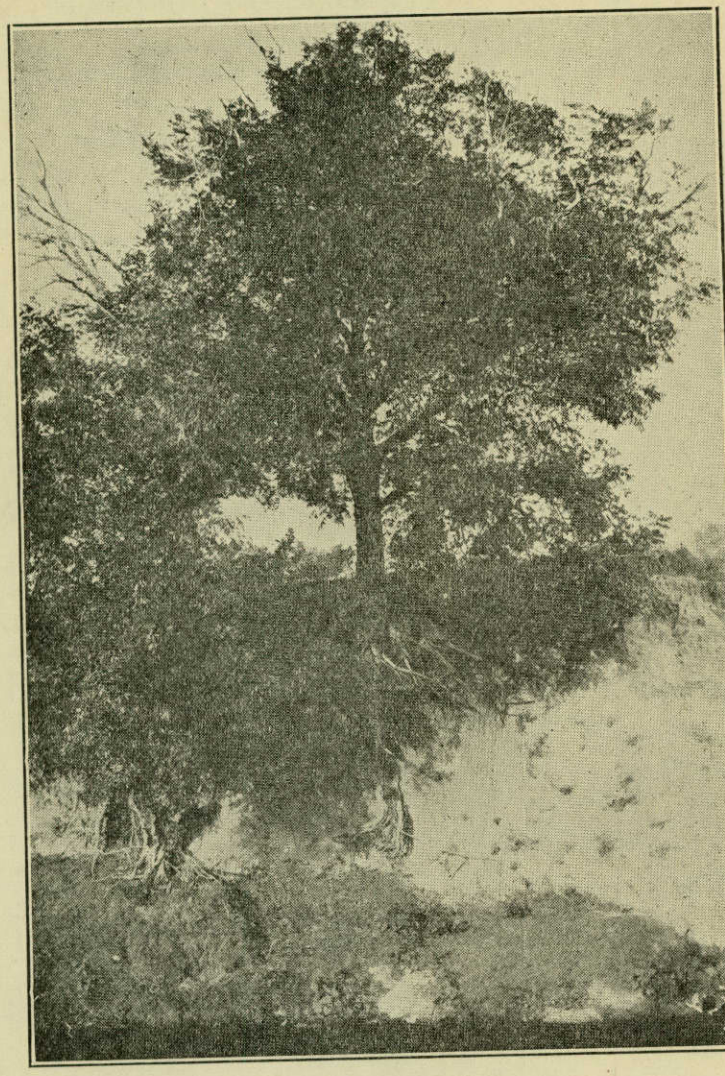


Figure 6.—Tree affected with "die back" as a result of exposure of roots due to erosion of land. (Original).

Failure of the female bloom to be fertilized may also result in this manifestation.

Severe pruning or sudden depositing of soil high on the trunk by floods has been observed as favoring the disease.

COLD INJURY.

A sudden cold spell or freeze following a warm period during winter occasionally results in severe injury to young pecan trees, especially those weak from other causes. Injured trees may show

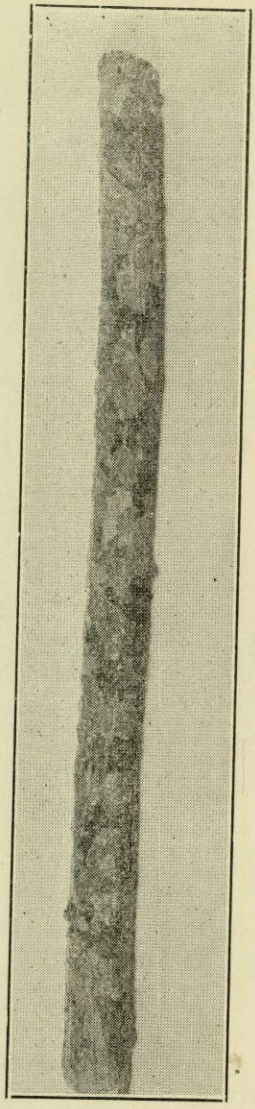


Figure 7.—Twig injured by cold showing gray discolorations and swollen lenticels. (Original.)

weak foliage the following spring as the result of the stored plant food within their twigs, but later wilt. Sprouts many times appear, however, from the uninjured roots. Affected wood soon after shows

a grayish discoloration on the bark and prominent swollen lenticels. (Figure 7) The state of activity and general conditions of the individual tree has much to do with its susceptibility.

The lessening of irrigation towards fall and the growing of a late fall cover crop will hasten a hardening of wood and do much to prevent such injury. The wrapping of the trunks of young trees especially near the base, also affords protection.

Another type of injury results from cold snaps in the early spring. The bursting buds may be caught and the tree later show dwarfed characteristics, crinkled tipped leaves, or a later freeze may

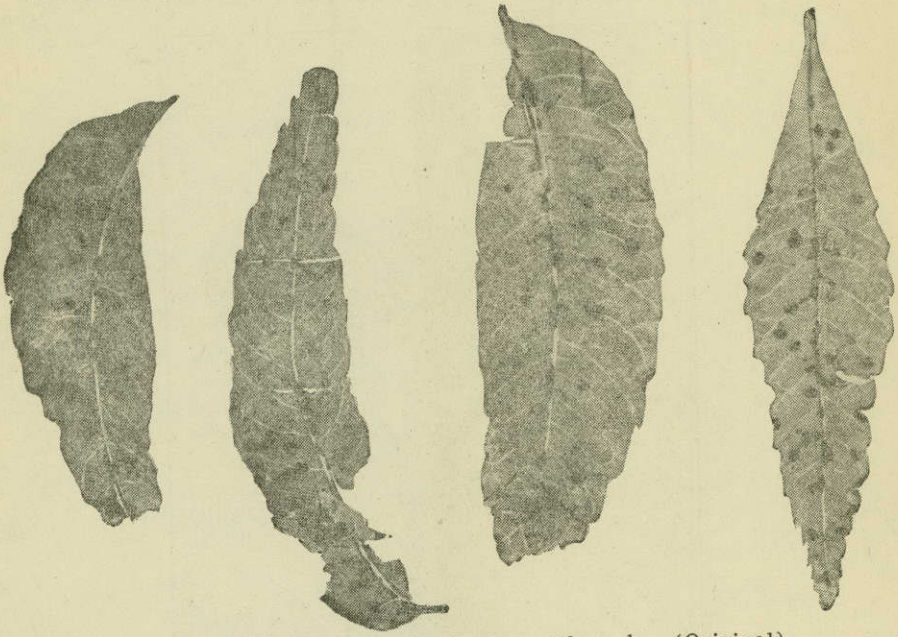


Figure 8.—Leaves of pecan affected with scab. (Original).

destroy the fruit buds. Late freezes rarely occur in Texas that kill pecan trees after the foliage appears.

SUN SCALD.

Sudden severe hot weather during summer accompanied by dry winds has occasionally been observed to cause a leaf tip scorch of the pecan. This is especially true when the pecan roots are not ideally located and is probably due to excessive evaporation and transpiration. The leaf scorch sometimes resembles affected leaves from physiological blighted trees. Sun scald, however, is of temporary duration and usually occurs on the south side of the tree. Sun scorched leaf tips also have a crinkled surface, suggestive of an acute trouble.

PARASITIC DISEASES.

SCAB.

Fusicladium effusum (Wint).

Description.

Scab may be recognized by the black velvet-like spots occuring on the leaves, twigs and nuts. (Figure 8-9-10.) The leaf spots occur on both sides of the leaf and are slightly raised on the sporing sur-

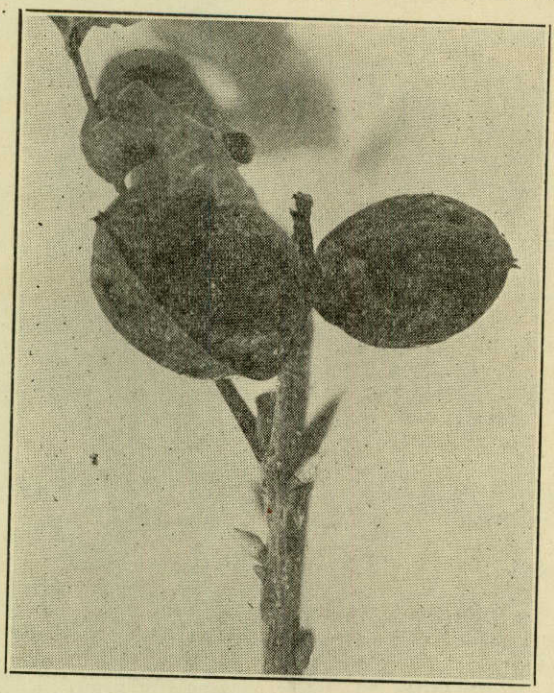


Figure 9.—Pecans affected with scab. (Original).

face. The lesions on the twigs and nuts are slightly sunken, but otherwise resemble the leaf blemish.

The disease occurs throughout the pecan section of the State, but is most serious during periods of great humidity. In West Texas the disease is not of great importance on the account of the unusual hot and arid summers. In North, South and Central Texas, where rainy springs and early summers are common, the disease frequently manifests itself temporarily, but as the hot, dry, summers follow, the disease generally succumbs with but slight damage to the crop.

Occasionally, however, it secures a strong foothold and accompanied by mildew, pink mold and favorable climatic conditions causes serious injury. A peculiar cracked effect as shown in the accompanied illustration in Figure 11 results.

In East Texas the disease is most common. Western varieties, especially, show the trouble in this section, while the eastern varieties generally exhibit a pronounced resistance, which is undoubtedly a matter of acclimatization. Irrespective of this grouping there is a marked difference among varieties in their susceptibility to scab.

Control.

Where scab is an important factor, the suseptibility and resistive powers as exhibited by the different varieties should be taken into consideration. Observations have shown that Stuart, Money Maker, Success, Van Deman, Mobile and Schley are resistant in their order named. Halbert and San Saba are very susceptible. Seedlings also vary widely in their powers of resistance.

Control of scab by spraying may be accomplished by the application of bordeaux mixture, beginning when the leaves have unfolded. The number of supplementary sprayings is dependent on

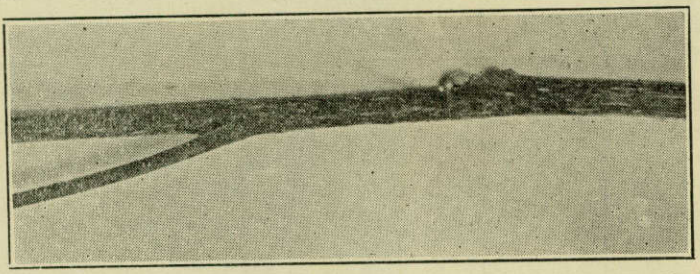


Figure 10.—Pecan twig showing scab lesions. (Original).

weather conditions. The nut clusters and foliage should be kept well covered with the spray, especially during weather favorable to the spreading of the disease. In Central Texas scab has been successfully checked in comparatively favorable seasons for the spreading of disease, with two sprayings. It will be noted, however, that the thoroughness with which the spray is applied determines its efficiency.

MILDEW.

Microsphaera olni (Wallr).

A white cottony mold appearing on the leaves and nuts characterizes this disease. Fig. 12. This mold is the mycelium of the casual fungus, which derives its food from the plant tissues. The same conditions favorable for scab are favorable for mildew, consequently both are commonly found together.

If control measures become necessary, any of the standard fungicides (summer strength) thoroughly applied will serve to check the disease. Sulphur dusted upon affected trees is very efficient during weather of temperature high enough to cause rapid oxidation. This chemical also has been used successfully against scab.

NURSERY BLIGHT.

Phyllostica caryae (Peck).

Nursery blight is caused by the fungas *Phyllostica caryae* and manifests itself by small brown spots with conspicious gray centers.

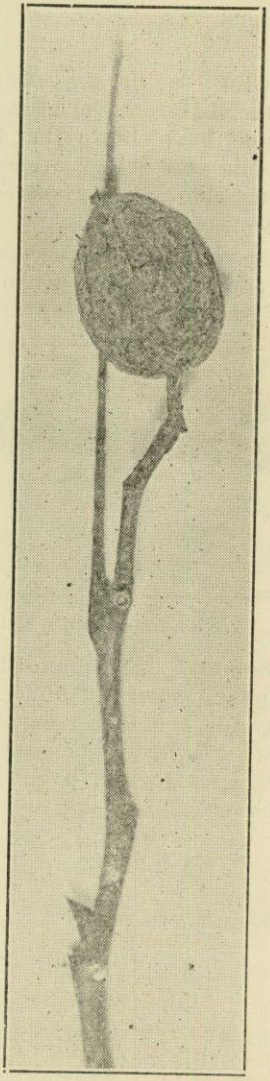


Figure 11.—Pecan affected with scab mildew and pink mold showing fissured effect. (Original).

Spots are commonly found along the mid and large veins. Small spots may coalesce to form large irregular blotches which, however, still retain the gray centers. Fig. 13.

As the name implies this disease is most common on pecan nur-

sery stock. The crowded condition of the young trees is favorable for the development of the exciting fungus and serious defoliation or devitalization of the trees frequently results. The disease is also found upon larger trees, but rarely becomes of importance.

In the nursery row the disease may be controlled by the application of Bordeaux mixture, 4-4-50 strength. Applications should be administered beginning when the trees have leafed out and continued as conditions demand. The disease is unable to spread in a destructive way without moisture and it is necessary to spray during

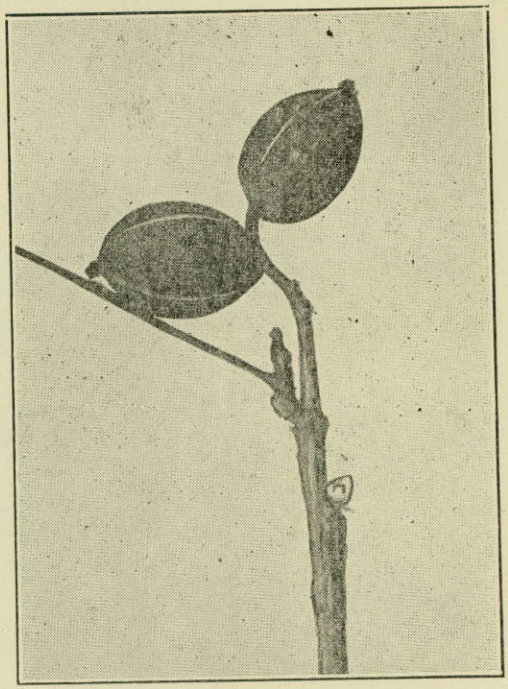


Figure 12.—Mildew on pecan. (Original).

periods of drouth. Ordinarily two or three sprayings will control the disease.

ANTHRACNOSE.

Glomerella cingulato (Stonem).

Anthracnose is a disease of the leaves and nuts. On the leaves it is characterized by large iregular brown blotches as shown in Fig. 14. On the nuts brown to black sunken spots form on their husk. Early infestions under favorable weather conditions cause defoliation and dropping of nuts. Early affected nuts generally show undeveloped kernels and are commonly found later in the season with husk closely and tightly adhering to the pecan. The fungus winters over on the fallen infected leaves and nuts.

KERNEL SPOT.

Kernel spot, as the name implies, is a distinct trouble of the pecan kernel. Affected kernels are characterized by dead slightly sunken areas of a brown to black color. Fig. 15. Ordinarily no exterior sign of disease is present, but occasionally slight sunken areas are found on the husk directly over the spot on the kernel.

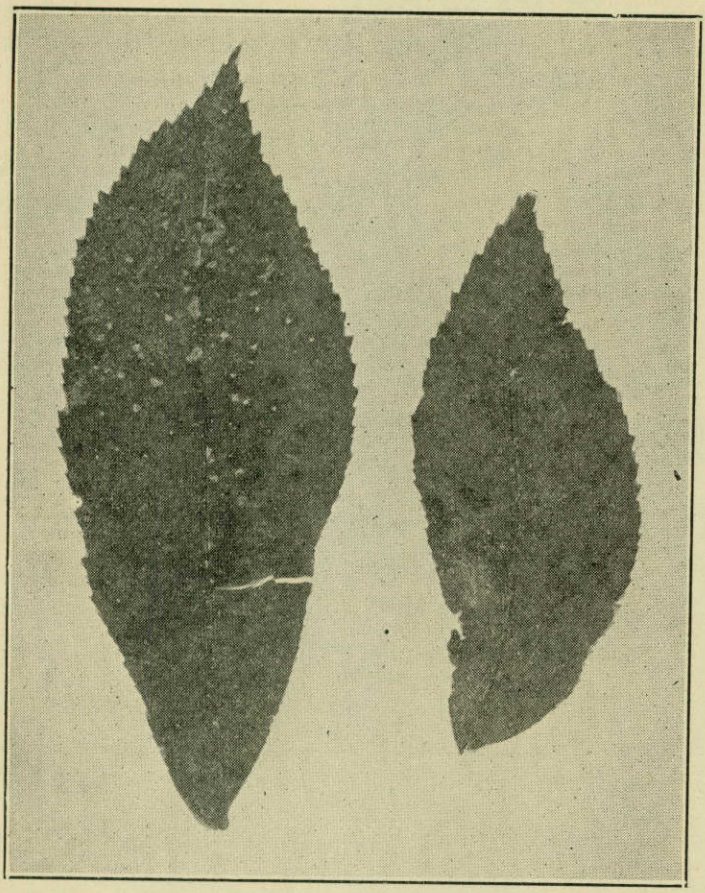


Figure 13.—Pecan leaves with nursery blight injury. (Original).

It has recently been proven by J. B. Demaree, United States Bureau of Plant Industry, that the cause of kernel spot is due to the punctures of the green soldier bug (Nezara hilaris). The injury has been reported from all pecan sections of the State but has been sporadic in its appearance, probably due to the effect of weather conditions upon the green bug. Winters in which sudden changes of temperature are common are usually followed by a scarcity of the bugs and injury.

Parasites and the occurrence of preferred host plants in the vicinity of pecan trees undoubtedly play an important role in the

amount of injury. All varieties seem to be susceptible, but Moore, Schley and Curtis are more commonly affected.

So sporadic is the occurrence of the disease that control measures are seldom applicable. The avoidance of cowpeas and other preferred host plants as cover crops or as adjoining garden crops is advisable. Small plantings of preferred host plants, maturing early

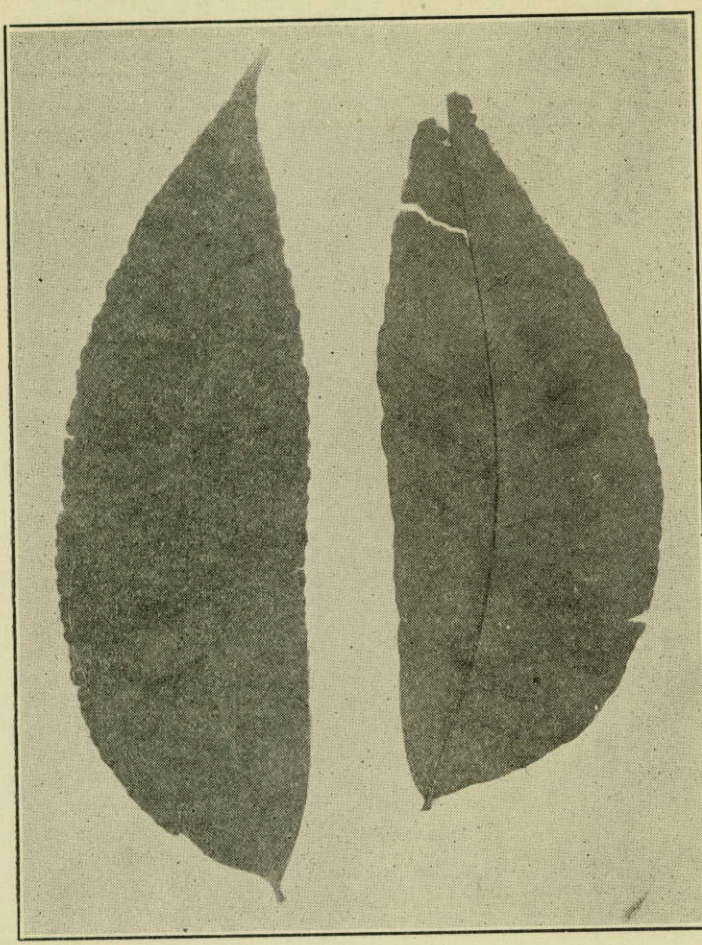


Figure 14.—Pecan leaves affected with anthracnose. (Original).

enough to be effective as trap crops have not come under the author's observation, but might prove of value.

LEAF SPOTS.

Leaf spot diseases are characterized by the formation of dead areas in the leaf tissues, which frequently become brittle and fall out, leaving ragged holes. There are a large number of these leaf spots that occur on pecan which are of importance only when defoliation

results. As most of them appear late in the season, control measures are not warranted.

Septoria caryae (*Ell and Ev*) *Clasterosporium diffusum* (*H. and W.*) *Cercospora fusca* (*Rand*) or (*brown spot*) are known to cause various forms of leaf and petiole spots on the pecan in Texas.

Brown spot is by far the most common and important. The

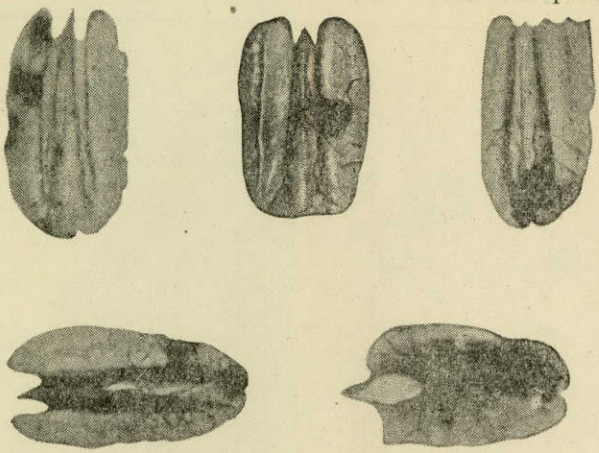


Figure 15.—Kernel spot of pecan. (Original).

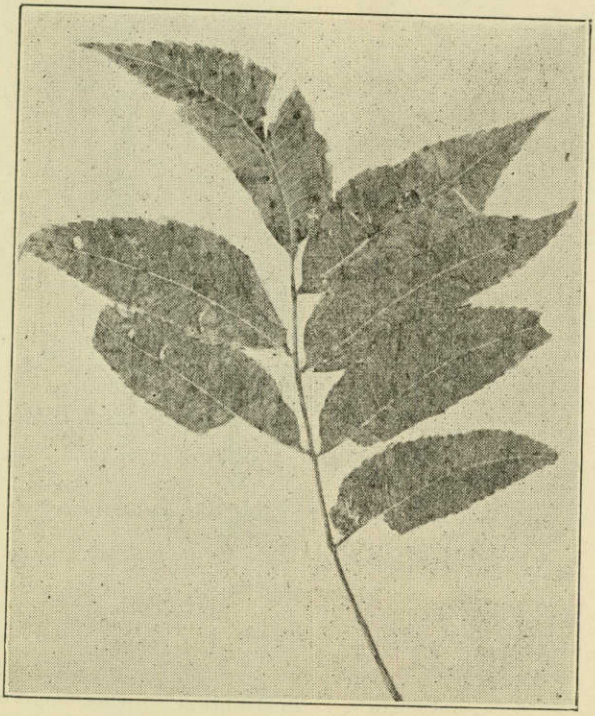


Figure 16.—Pecan affected with brown leaf spot. (Original).

disease ordinarily appears in mid summer on the older foliage and increases more or less toward the close of the season. Unthrifty trees seem to be more susceptible.

Two or three sprayings with Bordeaux mixture beginning when the first signs of the disease appear, will readily control the trouble. This, however, is only waranted under extraordinary conditions.

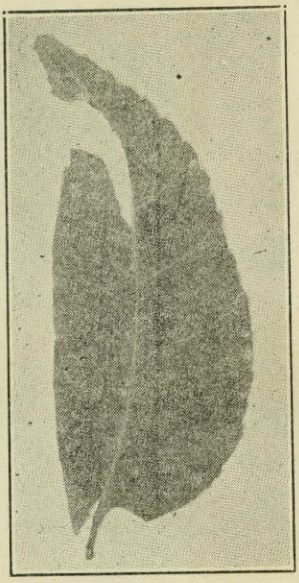


Figure 17.—Pecan leaf spot.* (Original).

CROWN GALL.

Bacterium tumefaciens.

Crown gall occurs in rare cases on pecans. It may be recognized by the abnormal growth or tumors which form at the base of the tree, upon the roots and trunk.

Control.

So uncommon is the disease on pecans, that infected trees should be destroyed when found, and soil disinfected with a formaldehyde solution. The following points, however, should be kept in mind; 1st, Avoid diseased nursery stock; 2nd, Avoid injury to roots and trunk base.

*Clasterosporium diffusum (H. & W.).

TEXAS ROOT ROT.

(*Ozonium omnivorium.*)

Texas root rot is a disease common to the South and affects a large list of host plants. Among them cotton is by far the most

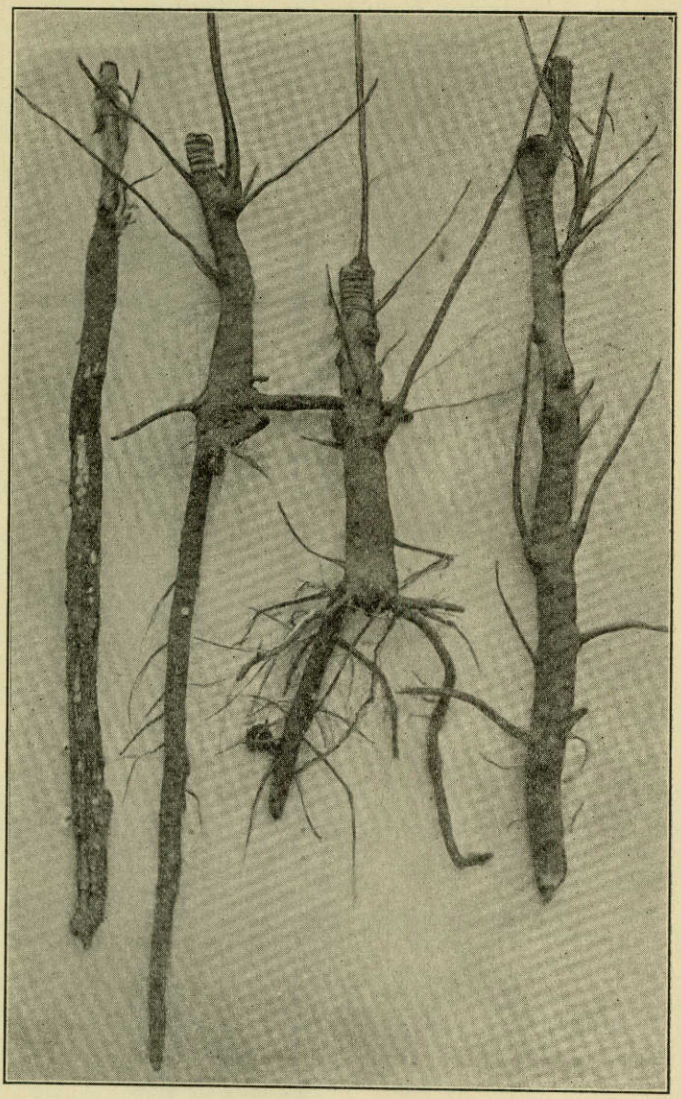


Figure 18.—Pecan trees showing effect of root rot. (Original).

commonly affected. Its presence in the cotton field may be recognized by the occurrence of dead patches of cotton at blooming time, scattered throughout the cotton field, a condition often incorrectly referred to as the result of "alkali land."

The pecan, while not readily susceptible, is sometimes attacked. Young trees first show the disease by sudden yellowing and wilting of the leaves. Older trees are affected more slowly. Examination of the roots in either case reveal the rotted condition characteristic of the disease. (See Figure 18). White to brown streams of the mycelium of the fungus, *Ozonium omnivorium*, are to be found in abundance just beneath the bark. Young trees seriously affected may be easily dislodged, due to the partial loss of the root system. When once a tree is infected it is rarely possible to save it, as the trouble is not externally evident until the disease has reached an advanced stage. It is therefore generally advisable to remove and destroy infected trees. Special care should be exercised in removing the stumps to get all the roots possible. All weeds should be eradicated and the soil drained and aerated as well as possible. This procedure is of prime importance in attempting to free the land of the trouble.

As individual trees have shown resistance toward the disease, some authorities are in hopes of securing strains immune or highly resistant to the trouble. In the event of any such experimentation or in an effort to save especially valuable individual trees, extreme care should be taken toward preventing the spread of the disease. A deep narrow trench around the tree made so as to confine the root system within would probably reduce the possibility of the disease spreading. The application of sulphur to the surrounding soil appears to retard the trouble.

BLACK MOLD OF POLLEN.

During excessive moist seasons, when rain continues throughout the pecan blooming period, the pollen is frequently attacked by various semi-parasitic fungi, which destroy it. As a result pollenization is prevented and the crop of nuts serously reduced. Continued rains during the receptive stage of the female bloom may in itself cause a serious reduction of the crop.

MISTLETOE.

Phoradendron flavescens.

Occasionally this parasite attacks pecans. Chisel from tree and paint with Corbiloneum or asphalt paint, or wrap with burlap. Do not allow berries to form.

SPANISH MOSS.

Spanish moss, *Dendropogen usneoides* is found growing on pecan trees in shady moist bottoms where it meets ideal conditions. This plant, however, is not in reality a moss, but a flowering plant belonging to the pineapple family, (Bromeliaceae). It is not a plant parasite, but an epiphyte which merely finds lodgment on the branches of various trees and derives its food from the air. It is mentioned here on account of the injury resulting from its inter-

ference with new shoot development, the natural functioning of the foliage and the harbor offered to insect pests.

THE 1920 CENSUS REPORT.

In giving the number of pecan trees as recorded by the Fourteenth U. S. Census Report, I wish to remark that the number given approximating one and one-half million bearing trees seems decidedly too small. My estimate in the past, which is mere guess work, has been around ten million trees. Some of our enthusiastic pecan men of the State assert that there are probably now growing within the State fifty or one hundred million trees.

The writer, while disposed to discount the Government's estimate as being entirely too few, is inclined to accept the statement as the most authentic figures yet given, and he has recorded in this Bulletin the figures given in the Census Report which all must accept until it shall be proven that the Government's estimate is erroneous.

If the figures given are too small, and do not represent the pecan industry of Texas fairly no one is to blame, as I can see it, but our own citizenship. The enumerators that took the Census were citizens of Texas and doubtless gave the figures as furnished by the owners of our pecan groves and orchards. It is conceded, of course, that the figures given of the wild native groves were mere estimates of the owners. They doubtless gave such estimates as they deemed to be as nearly accurate as possible, without making an accurate count of the territory owned by them.

In order for Texas pecan growers to have accurate statistics relative to the number of pecan trees now growing and bearing in Texas, those interested should see that ample provisions and facilities are furnished the enumerators for securing the exact number of trees in the State. It would be well for each pecan grower or owner of pecan groves or orchards also to remind their Senators and Representatives in the State Legislature that they desire that said Senators and Representatives should make provision for the different county assessors to be compelled to take an annual enrollment of pecan trees owned or controlled by each tax-paying citizen of the several counties of the State.

PECAN PRODUCTION IN THE UNITED STATES.

Compiled by R. E. YANTIS, Statistician,
Department of Agriculture of Texas.

The following statistics have been gathered by correspondence with the various Commissioners of Agriculture of the states mentioned, and by information given by the railroads of Texas, upon request from this Department.

Alabama—From Market Journal & Crop Reporter.

1919	3000 acres, 1,000,000 lbs	Value	$250,000
1920	3000 acres, 900,000 lbs	Value	$315,000
1921	4000 acres, 2,000,000 lbs	Value	$600,000

Arkansas—From Commissioner of Agriculture.

Crop estimate for the year 1921 is 110,000 lbs. The White River section in a good year will produce 300,000 lbs. Price ran from 6 to 25c, figures most quoted were from 10 to 14c. Some improved varieties brought 35 cents. Sixty per cent of the crop gathered was shipped out. The grafted pecan is increasing in numbers.

Florida—From Biennial Report of Department of Agriculture.

1920	Number of bearing trees	65,164
	Number of non-bearing trees	201,802
	Value	$367,256
	Production 42,079 bushels, value	$414,714

Georgia—From Commissioner of Agriculture.

1920	900,000 lbs	Sold at 45c
1921	2,600,000 lbs	Sold at 42c

No statistics on seedlings.

Illinois—From Commissioner of Agriculture.

Pecans are not grown commercially, but large quantities grow on river bottoms in Southern part of state. No statistics on production.

Kentucky—From Commissioner of Agriculture.

No figures on the output of pecan crop. Federal figures give fifty per cent of full crop, twenty-six per cent sold to outside market. Output largely seedlings.

Louisiana—From Commissioner of Agriculture.

1919	Number of bearing trees	94,513
	Number of pounds yielded	2,242,859

1920 and 1921 production not yet compiled.

Maryland—From Commissioner of Agriculture.

The pecan is not grown to any extent in this State. Several years ago an attempt was made to develop pecan growing on a commercial basis, but with very slight results.

Mississippi—From Commissioner of Agriculture.

The pecan industry is so young in this State that no reliable statistics are available. This Department does not collect or publish agricultural statistics, but depends upon Federal Government reports for such information.

Oklahoma—From Commissioner of Agriculture.

1909	Production	894,172 lbs.
1919	Production	4,296,642 lbs.
1920	Production	644,496 lbs.
1921	Production	2,019,422 lbs.

Growers received 22 cents for improved and 12 cents for seedlings. It is estimated that 45 per cent of 1921 crop was shipped to outside markets. The per cent of improved nuts in this State is very small, but farmers are beginning to realize the value of the pecan.

Texas—

The various railroads of the State have been very willing to co-operate with this Department in furnishing information of shipments over their respective lines. The following is a summary of reports made by the companies.

The total number of cars so far reported is 274 cars in carlots and about 2 cars in L. C. L. shipments. Ten or twelve cars from Mexico were shipped into this State and forwarded to St. Louis and New York.

The figures for the following counties are 60 per cent of the crop of 1919, which is the estimate put upon the crop of 1923 by the Bureau of Agricultural Economics of the United States Department of Agriculture.

County.	Pounds.	County.	Pounds.
Anderson	3,500	Lavaca	43,000
Angelina	2,200	Lee	64,000
Atascosa	4,500	Leon	7,000
Austin	23,000	Liberty	2,000
Bandera	26,000	Limestone	19,000
Bexar	371,913	Llano	414,000
Blanco	41,000	McCulloch	67,000
Bosque	92,000	McLennan	85,000
Bowie	2,000	Madison	2,000
Brazoria	3,100	Marion	900
Brazos	21,000	Matagorda	28,000
Burleson	2,600	Milam	1,000
Caldwell	85,000	Montague	43,000
Callahan	22,000	Montgobery	3,700
Cameron	1,000	Morris	2,000
Camp	1,000	Nacogdoches	3,700
Cass	3,500	Newton	2,000
Chambers	2,800	Orange	1,300
Cherokee	1,100	Panola	2,000
Clay	38,000	Polk	2,500
Coke	21,000	Rains	1,000
Collin	88,000	Randall	8,000
Comal	89,000	Reagan	1,500
Concho	21,000	Real	37,000
Cooke	67,000	Red River	7,000
Coryell	63,000	Robertson	24,000
Dallas	148,000	Rockwall	19,000
Dickens	700	Runnels	31,000
Edwards	42,000	Rusk	3,000
Erath	36,000	Sabine	1,000
Fannin	33,000	San Augustine	2,500
Fort Bend	78,000	San Jacinto	1,500
Freestone	10,000	Schleicher	19,000
Galveston	4,000	Shackelford	2,000
Goliad	1,000	Shelby	4,000
Gregg	1,500	Smith	12,000
Grimes	2,000	Sterling	4,500
Hamilton	47,000	Sutton	5,500
Hardin	2,000	Tarrant	71,000
Harris	14,000	Taylor	3,000
Harrison	5,000	Throckmorton	37,000
Henderson	7,000	Trinity	2,500
Hood	21,000	Tyler	3,500
Hopkins	9,000	Upsher	2,500
Hunt	38,000	Van Zandt	1,500
Irion	39,000	Victoria	2,000
Jack	66,000	Walker	2,000
Jackson	2,500	Washington	21,000
Jasper	7,000	Wharton	79,000
Jefferson	48,000	Wilson	43,000
Johnson	8,000	Wise	182,000
Karnes	8,000	Wood	2,000
Kaufman	42,000	Young	61,000
Lamar	25,000	Zavalla	6,600
Lampasas	37,000		

Note: Counties producing less than 1,000 pounds are omitted from this table.

NUMBER OF NURSERY PECAN TREES LISTED IN TEXAS BY NURSERY INSPECTORS—1921-1922.

	1921
Budded and grafted	129,995
Seedlings	714,705
	1922
Budded and grafted	77,107
Seedlings	640,917
	1923-24
Budded and grafted	143,560
Seedlings	1,114,500
	1923-24
Black Walnuts—budded and grafted	500
Seedlings	9,060
	1923-24
Pecan scions inspected and offered for sale	17,500

ADDENDA.

From Statistical Abstract of the United States, 1920, Bureau of Foreign and Domestic Commerce, it is shown that the product of pecans in

1899 was.....3,206,850 lbs.
1909 was.....9,890,769 lbs.

The value of 1909 crop was $971,596, equaling 9.8 cents per pound.

The report of the Bureau of the Census of the United States Fourteenth Census, 1920 for Texas, gives the number of farms reporting number of trees not of bearing age as follows:

Number farms reporting 1920	9,590
Number farms reporting 1910	6,174
Number of trees for 1920	449,464
Number of trees for 1910	621,550

Number of Farms Reporting Trees of Bearing Age:

For Year 1920	19,204
For Year 1910	10,519
Number of Trees, 1920	1,045,604
Number of Trees, 1910	1,087,619
Number of Pounds, 1919	16,755,421
Number of Pounds, 1909	5,832,367
Value, 1919	$ 3,686,191
Value, 1909	$ 556,203

From Foodstuffs Division, Bureau Foreign and Domestic Commerce, April 11, 1922.

Chemical Composition of American Food Materials.

Food Materials.	Number of Analyses.	Refuse.	Water.	Protein.	Fat.	Total Carbohydrates (Including Fiber).	Fiber (Number of Determinations in Parentheses).	Ash.	Fuel Value Per Pound.
		P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	Cals.
Pecans, polished:									
Edible portion	1	------	3.0	11.0	71.2	13.3	------	1.5	3,455
As purchased	1	53.2	1.4	5.2	33.3	6.2	------	.7	1,620
Pecans, unpolished:									
Edible portion	1	------	2.7	9.6	70.5	15.3	------	1.9	3,435
As purchased	1	46.3	1.5	5.1	37.9	8.2	------	1.0	1,846

The above taken from Bulletin No. 28 (Revised Edition), U. S. Department of Agriculture, Office of Experiment Stations. **The Chemical Composition of American Food Materials.** (Corrected April 14, 1906) by W. O. Atwater, Ph. D., and A. P. Bryant, M. S.

PECAN PRODUCTION CROP 1921.

Reported by the railways, 272 cars. Probably 50 cars were handled by express and parcel post, making a total estimated crop for the State of 322 cars.

TOTAL PRODUCTION OF PECANS, WALNUTS AND ALMONDS IN THE UNITED STATES IN THE YEARS 1909 AND 1919.

Name of State.	Production.		Value.	
	1919	1909	1919	1909
Delaware	11,205	39,142	$ 4,660	$ 964
Maryland	6,301	318,148	1,648	5,687
North Carolina	145,753	74,861	43,736	8,194
South Carolina	525,783	159,823	157,734	26,888
Georgia	2,544,377	354,046	890,585	47,845
Florida	1,025,673	307,632	307,705	43,692
Kentucky	50,352	28,577	15,110	2,887
Tennessee	70,594	25,581	17,654	2,566
Alabama	1,179,735	228,341	353,924	30,540
Mississippi	1,559,245	637,298	389,823	79,936
Arkansas	348,382	249,955	87,106	17,603
Louisiana	2,242,859	723,578	672,862	70,635
Oklahoma	4,296,642	894,172	859,331	59,481
Texas	16,755,421	5,832,367	3,686,191	566,203
Illinois	182,347	107,069	45,592	10,301
Missouri	555,184	147,420	166,561	10,476
Kansas	252,802	20,583	75,841	1,462
Total	31,752,655	10,148,582	$ 7,776,013	$ 985,351

NUMBER OF PECAN TREES ENUMERATED IN THE UNITED STATES FOURTEENTH CENSUS REPORT FOR YEARS 1910-1920.

Name of State.	Number of Trees.	
	1910	1920
Indiana	4,833	4,590
Illinois	28,330	25,289
Iowa	247	763
Missouri	48,822	85,434
Kansas	27,716	29,193
Maryland	172	211
Virginia	868	12,452
North Carolina	6,876	17,470
South Carolina	33,366	58,025
Georgia	75,519	444,722
Florida	42,512	113,547
Kentucky	1,227	304
Tennessee	2,037	4,127
Alabama	44,683	176,426
Mississippi	60,524	129,971
Arkansas	13,958	19,233
Louisiana	36,527	94,513
Oklahoma	96,766	400,480
Total, excepting Texas	524,983	1,616,750
Texas	1,087,619	1,045,694
Total	1,612,602	2,662,444

Texas has 50 per cent of the total number of pecan trees growing in the United States and produces 52 per cent of the pecans.

TOTAL PRODUCTION OF PECANS, WALNUTS AND ALMONDS WITHIN THE ENTIRE UNITED STATES DURING THE DECADE 1909-1919.

Name of State.	Number of Pounds Pecans	Number of Pounds Walnuts and Almonds.
Delaware	251,730	
North Carolina	1,103,070	
Maryland	1,162,240	
South Carolina	3,428,030	
Georgia	14,492,080	
Florida	6,666,520	
Kentucky	394,640	
Tennessee	480,870	
Alabama	7,040,380	
Mississippi	11,182,690	
Arkansas	2,991,630	
Louisiana	14,832,180	
Oklahoma	25,954,070	
Illinois	1,447,080	
Missouri	3,513,020	
Kansas	1,366,920	
California	320,400	478,633,280
Oregon		2,704,520
Arizona	10,890	
Texas	112,938,940	
Total	209,097,380	481,337,800

A copy of the following letter was addressed to about 125 individuals resident in about 100 counties. Of this number we received replies from only about 40 counties. It is hoped that the information secured will prove a stimulas in future development of suitable soils in all parts of the State.

TO THE COUNTY AGENT:

Dear Sir: It is desired to obtain more recent data than that given in the last census report. The information is needed at once and if you can supply any part or all of the data asked for, your doing so will be greatly appreciated.

This letter is being sent to a total of 125 individuals representing 100 counties in the State. If you desire and so indicate, a copy of the summary we are able to prepare from the replies will be mailed you.

Very truly yours,

J. H. BURKETT.

1. What would be your estimate of the total acreage of pecan trees in your county, not of bearing age? .....

.....

2. What would be your estimate of the total acreage of bearing age? .....

3. What would be your estimate of total production for your county for the year 1923:

(a) Planted orchard .....

(b) Native orchard .....

(c) Top-worked native groves .....

4. What would be your estimate of total acreage of top-worked native groves? .....

Name .....

County .....

Post Office .....

REPLIES AS GIVEN BY EACH COUNTY OF THE ABOVE CIRCULAR LETTER.

County.	Total Acreage Not Bearing Trees.	Total Acreage of Bearing Trees.	Total Production for			Total Acreage Top-worked Native Groves.
			Planted Trees.	Native Trees.	Top-worked Trees.	
Brazos	50	100	1,000	20,000	500	25
Brown			10,000	350,000	5,000	
Calhoun	25			60,000		
Camp	50		380	200		
Cass	15	25	1,100			
Comanche	20,000	50,000	600	500,000	100	20
Dickens						
Eastland	5,000	4,000	2,000	3,000	1,000	1,000
Grayson	200	1,000		10,000	5,000	50
Gregg	100	75				
Grimes	30	200		60,000	2,000	40
Hood	500	2,000		100,000	100	100
Houston	100	500	5,000	2,000		10
Jack	75	150	100	20,000		
Jasper	250	50	1,200	250	500	10
Jefferson	420	420	4,000			
Jones	500	300	1,000			
Karnes	10	200	40,000	600		1
Kaufman	5,000	2,000	20,000	150,000		25
McLennan	50	50	3,000	2,000	100	10
Mason	300	1,200	1,000	190,000	6,000	200
Matagorda	10	90	1,000	6,000		5
Mills	4,000	3,000		300,000		40
Morris	20	14	1,000			
Navarro	100	1,000	500	25,000	10,000	40
Rockwall	200	100	600	27,000		2
San Saba	100	500	5,000	100,000	5,000	50
Smith	150	1,500	30,000			
Somerville	50	400	500	59,000	5,000	15
Titus	25	15	200	800	100	2
Travis	25	1,500	90,000	75,000	1,500	30
Tyler	50	15	400	200		
Uvalde	3,000	1,500	1,000	100,000	4,000	65
Victoria	500	1,000	1,000	80,000		
Wharton	100	2,000	25	935,000		
Wichita	20	500		4,000		10
Palo Pinto	10,000	25,000	1,000	1,000,000	2,000	500
Robertson	10	300	1,000	5,000	1,000	100
Totals	51,011	100,704	260,105	4,185,050	48,900	2,349

STATE DEPARTMENT OF AGRICULTURE PROMULGATION OF STANDARDS FOR FOREST AND ORCHARD SEEDLING PECANS AND TOLERANCE TO BE ALLOWED FOR ERRORS INCIDENT TO THE APPLICATION AND USE OF SAID STANDARDS.

Austin, Texas, Dec. 3, 1923.

By virtue of authority vested in the Commissioner of Agriculture of the State of Texas, by General Laws, Chapter 181, Acts of Regular Session, Thirty-fifth Legislature, I, Geo. B. Terrell, Commissioner of Agriculture, do hereby promulgate, establish and publish the following standard grades, and tolerances, for forest and orchard seedling pecans, effective on and after September 1st, 1924, until amended and superseded by standards hereafter prescribed and promulgated under said law.

Jumbo Fancy.

Jumbo Fancy shall consist of pecans which are over 15/16 of an inch in diameter at right angles with the polar axis and which will pass over, not through, a 15/16 inch mess screen and shall consist of pecans with shells which are dry and clean, and with meats which are dry, clean, fresh, sweet, plump and well formed, and which are free from damage caused by disease, insects, rodents, heat, moisture, mechanical or other means.

In order to allow for variations incident to proper grading and handling 10% by weight of any lot may be less than the diameter requirements for this grade and 7% by weight may not meet the quality requirements of this grade.

Jumbo Choice.

Jumbo Choice shall consist of pecans which are over 15/16 of an inch in diameter at right angles with the polar axis and which will pass over, not through, a 15/16 inch mesh screen and shall consist of pecans with shells which are practically dry and clean, and with meats which are practically dry, clean and fresh and which are practically free from damage caused by disease, insects, rodents, heat, moisture, mechanical or other means.

In order to allow for variations incident to proper grading and handling 10% by weight of any lot may be less than the diameter requirements of this grade and 10% by weight may not meet the quality requirements of this grade.

No. 1. Fancy.

No. 1. Fancy shall consist of pecans which are from 13/16 to and including 15/16 of an inch in diameter at right angles with the polar axis and which will pass over, not through, a 13/16 inch mesh screen, and which will pass through a 15/16 inch mesh screen and shall consist of pecans with shells which are dry and clean, and with meats which are dry, clean, fresh, sweet, plump and well

formed, and which are free from damage caused by disease, insects, rodents, heat, moisture, mechanical or other means.

In order to allow for variations incident to proper grading and handling, 10% by weight of any lot may be less than the diameter requirements for this grade and 7% by weight may not meet the quality requirements of this grade.

No. 1. Choice.

No. 1. Choice shall consist of pecans which are from 13/16 to and including 15/16 of an inch in diameter at right angles with the polar axis and which will pass over, not through, a 13/16 inch mesh screen, and which will pass through a 15/16 inch mesh screen and shall consist of pecans with shells which are practically dry and clean, and with meats which are practically dry, clean and fresh, and which are practically free from damage caused by disease, insects, rodents, heat, moisture, mechanical or other means.

In order to allow for variations incident to proper grading and handling, 10% by weight of any lot may be less than the diameter requirements of this grade and 10% by weight may not meet the quality requirements of this grade.

No. 2. Fancy.

No. 2. Fancy shall consist of pecans which are from 11/16 to and including 13/16 of an inch in diameter at right angles with the polar axis and which will pass over, not through, a 11/16 inch mesh screen and which will pass through a 13/16 inch mesh screen, and shall consist of pecans with shells which are dry and clean, and with meats which are dry, clean, fresh, sweet, plump and well formed, and which are free from damage caused by disease, insects, rodents, heat, moisture, mechanical or other means.

In order to allow for variations incident to proper grading and handling, 10% by weight of any lot may be less than the diameter requirements for this grade and 7% by weight may not meet the quality requirements of this grade.

No. 2. Choice.

No. 2. Choice shall consist of pecans which are from 11/16 to and including 13/16 of an inch in diameter at right angles with the polar axis and which will pass over, not through, a 11/16 inch mesh screen and which will pass through a 13/16 inch mesh screen, and shall consist of pecans with shells which are practically dry and clean and with meats which are practically dry, clean and fresh, and which are practically free from damage caused by disease, insects, rodents, heat, moisture, mechanical or other means.

In order to allow for variations incident to proper grading and handling, 10% by weight of any lot may be less than the diameter requirements of this grade and 10% by weight may not meet the quality requirements of this grade.

No. 3. Fancy.

No. 3. Fancy shall consist of pecans which are from 9/16 to and including 11/16 of an inch in diameter at right angles with the polar axis and which will pass over, not through, a 9/16 inch mesh screen, and shall consist of pecans with shells which are dry and clean, and with meats which are dry, clean, fresh, sweet, plump and well formed, and which are free from damage caused by disease, insects, rodents, heat, moisture, mechanical or other means.

In order to allow for variations incident to proper grading and handling, 10% by weight of any lot may be less than the diameter requirements for this grade and 7% by weight may not meet the quality requirements of this grade.

No. 3. Choice.

No. 3. Choice shall consist of pecans which are from 9/16 to and including 11/16 of an inch in diameter at right angles with the polar axis and which will pass over, not through, a 9/16 inch mesh screen and which will pass through a 11/16 inch mesh screen, and shall consist of pecans with shells which are practically dry and clean, and with meats which are practically dry, clean and fresh, and which are practically free from damage caused by disease, insects, rodents, heat, moisture, mechanical or other means.

In order to allow for variations incident to proper grading and handling, 10% by weight of any lot may be less than the diameter requirements of this grade and 10% by weight may not meet the quality requirements of this grade.

No. 4. Fancy.

No. 4. Fancy shall consist of pecans which are from 7/16 to and including 9/16 of an inch in diameter at right angles with the polar axis and which will pass over, not through, a 7/16 inch mesh screen and which will pass through a 9/16 inch mesh screen, and shall consist of pecans with shells which are dry and clean, and with meats which are dry, clean, fresh, sweet, plump and well formed, and which are free from damage caused by disease, insects, rodents, heat, moisture mechanical or other means.

In order to allow for variations incident to proper grading and handling, 10% by weight of any lot may be less than the diameter requirements for this grade and 7% by weight may not meet the quality requirements of this grade.

No. 4. Choice.

No. 4. Choice shall consist of pecans which are from 7/16 to and including 9/16 of an inch in diameter at right angles with the polar axis and which will pass over, not through, a 7/16 inch mesh screen and which will pass through a 9/16 inch mesh screen, and shall con-

sist of pecans with shells which are practically dry and clean, and with meats which are practically dry, clean and fresh, and which are practically free from damage caused by disease, insects, rodents, heat, moisture, mechanical or other means.

In order to allow for variations incident to proper grading and handling, 10% by weight of any lot may be less than the diameter requirements of this grade and 10% by weight may not meet the quality requirements of this grade.

Culls.

Culls shall consist of pecans which are less than 7/16 of an inch in diameter and which will pass through a 7/16 inch mesh screen, and which will not meet the grade requirements for quality of the grade sizes.

Definition.

For the purpose of determining the grade size, and grade quality of any lot of pecans, samples shall be so drawn from different parts of the lot that, when taken together, it will be a representative fair sample of the entire lot.

"Practically" means that whenever used herein with other words to define a particular grade of pecans the quality and conditions thereof may be inferior to a similar grade defined with the same words and in the same manner, except eliminating the word "practically," but not to such an extent as to be readily apparent upon casual examination. Provided that in all cases the meats shall be edible and fit for food for human consumption.

IN TESTIMONY WHEREOF, I have hereunto set my hand and caused the official seal of the Department of Agriculture to be affixed, in the City of Austin, State of Texas, this 3rd day of December, 1923.

GEO. B. TERRELL,

(SEAL) Commissioner of Agriculture.

RECEIPES FURNISHED BY H. G. LUCAS, PRESIDENT, TEXAS PECAN GROWERS' ASSOCIATION, BROWNWOOD, TEXAS.

The simplest dish when garnished with pecan halves or ground pecans will have a "company" appearance as well as a distinctive flavor. We find it convenient to grind them in a food chooper. Try them salted.

Pecan Bread.

1 egg
1 cup sugar
1½ cups milk
4 cups flour
4 teaspoons baking powder
1 cup pecans.

Beat egg in large bowl, add sugar, then alternately milk and flour sifted with baking powder. Mix well, add pecans. Pour in greased pan, let stand 20 minutes. Bake 1 hour in slow oven.

Pecan Souffles.

2 egg whites
½ cup sugar
½ teaspoon vanilla
1 cup pecans.

Beat egg whites to stiff froth, then gradually heat in ⅔ of the sugar. Continue to beat for 5 minutes, fold in rest of sugar, pecans, and vanilla. Drop by spoonfuls on oiled paper. Bake ¾ hour in slow oven. Makes 16 to 20 cakes.

Pecan Cake.

¼ cup butter
1 cup sugar
¾ cup milk
1½ teaspoons baking powder
1 cup pecan pieces
1½ teaspoons orange extract
Flour.

Cream butter and sugar, add eggs well beaten, milk, flour to make firm but not stiff batter, and other ingredients.

Pecan Icing.

Add ½ cup of pieces to your favorite filling and put between layers. Frost with plain icing and decorate with pecan halves.

Pecan Caramel Filling.

3 cups brown sugar
¾ cup rich milk
1 tablespoon butter
1 teaspoon vanilla
½ to ⅔ cup pecan meats.

Boil sugar, milk and butter about 5 minutes. Remove from fire, add vanilla and beat well until it begins to get thick, add pecans and spread.

Pecan Russian Rocks.

2 cups pecans
1 package raisins
1 cup butter—3 eggs
1½ cups dark brown sugar
3½ cups flour
1 teaspoon cinnamon
1 teaspoon soda, dissolved in a little hot water.

Make a stiff batter, drop by spoonfuls.

Pecan Pie.

3 eggs
1¼ cup sugar
1 cup cream, sour preferred
½ teaspoon cloves
1½ cups pecan pieces
2 tablespoons sugar.

Make custard of 1 egg white, 3 yolks, 1¼ cups sugar, cream and cloves. When cool add pecans, pour into crust and bake. Cool slightly, cover with meringue made of 2 egg whites, and 2 tablespoons sugar, return to oven and bake meringue. If cream is not available use milk and butter.

Pecan Molasses Pie.

2 eggs
½ cup molasses
½ cup sugar
½ cup milk
½ tablespoon butter
½ tablespoon flour
½ teaspoon vanilla
¾ cup pecan pieces.

Let molasses and butter come to a boil, then pour slowly into eggs, sugar, milk and flour, which have been well beaten. Cook, add vanilla and pecans. When cool pour crust and bake.

Pecan Caramel Pie.

First Part—
Butter, size of egg
2 cups sugar—¾ cup water.
Second Part—
4 egg yolks
1 cup cream
3 tablespoons flour
1 cup chopped pecans
2 teaspoonsful vanilla.

Cook first part to consistency of thick pudding sauce. When cool add second part mixture and cook to a thick custard. Remove from fire, add vanilla and pecans. Put in pastry shells and top with meringue or whipped cream. Makes 14 individual or two large pies. These are especially delicious when topped with ice cream.

Pecan Caramel Sauce.

1 cup sugar
1 cup pecan pieces
½ cup boiling water.

Brown the sugar, add the boiling water. Remove from fire and add pecans. Good on ice cream, etc.

Pecan Melange.

½ cup pecan pieces
¾ cup diced apples
6 marshmallows in small pieces
1 cup whipped cream.

Mix, sweeten and flavor to taste and serve. Garnish with pecan halves in sherbet glasses.

Pecan Date Pudding.

1 package dates
1 package graham crackers
1 cup chopped pecans
1¼ cups cream or milk
1 cup marshmallows, cut up
1 teaspoon vanilla.

Grind dates and crackers in meat grinder. Mix well with hands, add nuts, moisten with the cream or milk, add marshmallows, mix all well and put into mould. Chill, slice and serve with whipped cream.

Pecan Cheese Balls.

Mix an equal quantity of chopped pecans and grated cheese or cottage cheese, moisten with cream or mayonnaise. Season with salt and paprika. Shape into balls, roll in chopped or ground pecans and serve on lettuce with salad dressing.

Pecan Chicken Mousse.

½ cup pecan pieces
½ cup diced chicken
1 cup chicken stock
3 egg yolks
1 tablespoon gelatine
1 cup heavy cream
Salt, cayenne and paprika.

Slowly pour hot chicken stock on slightly beaten egg yolks, add seasonings and cook stirring constantly until it begins to thicken. Add gelatine, which has soaked 5 minutes in a tablespoon of cold water, chicken and pecans. When it begins to thicken fold in the well whipped cream and pour into mould.

Lone Star Salad.

Sprinkle slices of canned or fresh Elberta peaches with ground or chopped pecans, arrange on lettuce leaf in star shape, serve with mayonnaise with pecan half in center.

Pecan Candy.

2 cups brown sugar
1 cup cream
1¼ cups pecan meats.

Cook sugar and milk to soft ball stage. Remove from fire, add pecans and beat till creamy. Pour into buttered platter and cut into squares.

Pecan Pralines.

2 cups sugar
1 cup milk
2 tablespoons caramel
Small piece butter
2 cups pecans.

Add milk to sugar, then caramel. Boil 5 minutes. Take from fire, add butter and beat until creamy. Add pecans and beat till just ready to sugar. Drop on marble slab or oiled paper.

Sugared Pecans.

2 cups sugar
2 cups pecans
1 teaspoon vanilla.

Put sugar into pan with sufficient water to moisten it thoroughly. Bring slowly to a boil without stirring. When it hairs well remove from fire, add flavoring and pecans. Stir till it begins to sugar, pour into platter. When cool pull apart into pieces.

Pecan Cream Candy.

1 egg white
1 cup powdered sugar
Pecans.

Beat egg white until stiff then gradually add sugar till of a consistency to mould. Shape into balls and press pecan half in each. This is greatly improved if ground pecans are added to the mixture before moulding, or

1 tablespoon thick cream
1 cup powdered sugar.

Beat sugar gradually into cream and mould as above.

Pecans added to any dish greatly increases the food value. Pecans in your favorite fruit salad will give an added zest.

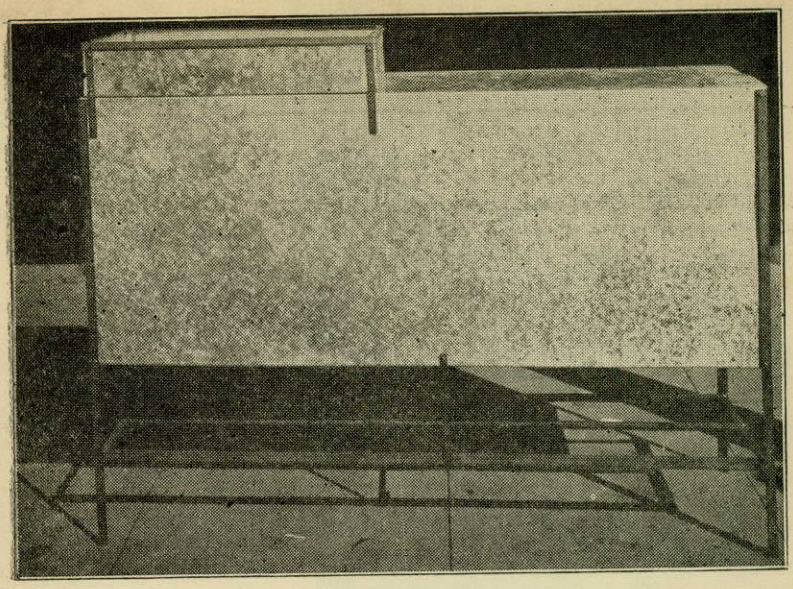


PLATE NO. 40.

The Rylander Pecan Grader. (Side view).

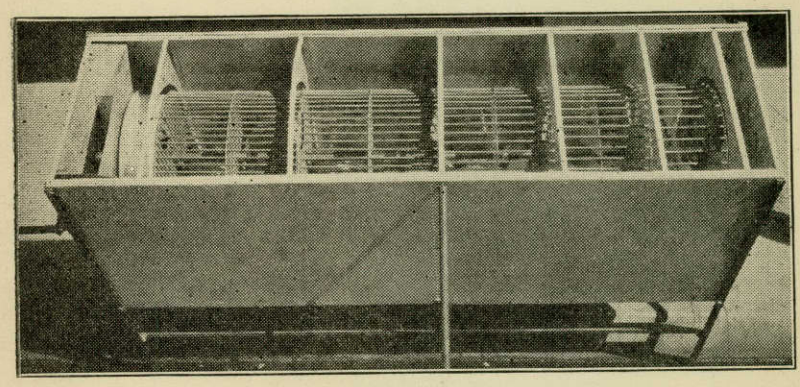


PLATE NO. 41.

The Rylander Pecan Grader. (Top view).

The above machine meets the requirements of the legal promulgated standards by the Department of Agriculture.