Report From The Natchez Branch Experiment Station on Pecan Work
To December, 1929

By
S. J. Greer
W. T. Mallory

A Valuable Tree
Native pecan tree topworked in May, 1914 to Stuart. It has produced nuts as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount</th>
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<tbody>
<tr>
<td>1917</td>
<td>5 lbs.</td>
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<tr>
<td>1918</td>
<td>20 lbs.</td>
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<tr>
<td>1919</td>
<td>20 lbs.</td>
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<tr>
<td>1920</td>
<td>35 lbs.</td>
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<td>1921</td>
<td>60 lbs.</td>
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<td>1922</td>
<td>100 lbs.</td>
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<td>1923</td>
<td>75 lbs.</td>
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<td>1924</td>
<td>110 lbs.</td>
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<td>1925</td>
<td>210 lbs.</td>
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<td>1926</td>
<td>240 lbs.</td>
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<td>1927</td>
<td>250 lbs.</td>
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<tr>
<td>1928</td>
<td>350 lbs.</td>
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MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. College, Mississippi
J. R. Ricks, Director.
Report of The Work Done at The Natchez Branch Experiment Station on Pecans Prior to January 1, 1930

FOREWORD

This report presents the progress of the work at the Natchez Branch Experiment Station on the topworking of pecans. A brief historical sketch is given below in order that one may have a better appreciation of the facts which led to the arousing of interest in this work and to the soliciting of help in the establishment of a station for the investigation of the problems confronting the people of this section in the transforming of native seedling pecans to trees of standard varieties.

In various parts of Mississippi, Louisiana, Arkansas, Oklahoma and Texas millions of native pecan trees are to be found. In the section of country surrounding Natchez are thousands of such trees. These trees are worthless as producers of an acceptable commercial commodity, but they represent exceptional opportunity for use as stock on which may be topworked the various standard varieties of large, paper-shell pecan. Realizing the vast number of these trees already established and the possibility of converting them into valuable trees, farmers, business men, and progressive organizations have for many years shown an interest in methods by which these native seedling trees can be successfully changed to selected varieties.

As far back as 1914 a few pecan trees were topgrafted in this vicinity. These are now serving as an example of the possibilities in this work. In February, 1924, a few small bundles of Stuart pecan wood were cut and stored in an ice box at Natchez, Mississippi. This wood was kept dormant until May of the same year when it was used into the topworking native pecan trees for a few interested farmers in Adams County. Some of these grafts lived and made a good growth. Being well located in the county, they were studied by farmers generally, and created a great deal of interest.
In 1925, grafting wood was again cut and stored for spring work. Several methods of grafting and budding were attempted during the year, and a small number of trees were worked for nearly every farmer in Adams County. This was repeated in 1926. In February, 1927, an invitation was sent to Mr. J. R. Ricks, Director of the State Agricultural Experiment Stations, to come to Natchez and look over the work that was being done. This invitation was sent with the object of enlisting his aid in solving some of the important problems connected with topgrafting pecans. He studied very closely the work already started and found that some of it demonstrated wonderful possibilities. He also saw some work that was unsuccessful, and the failures were hard to understand. As a result of his visit, the Natchez Association of Commerce decided to raise $3,000.00 which was given to Mr. Ricks to be used in this region for studying and standardizing.
pecan topworking methods. In April of 1927 Mr. W. T. Mallory was sent to Natchez to begin this work. He immediately selected eight farms in Adams County on which preliminary work was started. Five of these places are on public highways where they serve as demonstrations. One is at the city park, and two are on overflow lands near the Mississippi River.

In addition to working out methods of topworking, there was a demand for more definite knowledge on fertilizers, cultivation, varieties, and disease control. These considerations led the State Legislature, at the regular session in 1928, to make provision for the establishment of a permanent branch experiment station to be located in the southwestern region of the state. Appropriations were made for the support of the station for 1928-1929. Provision was also made whereby any county in this region could donate land, or money for the purchasing of land for the station. In accordance with this provision, Adams County donated $25,000.00 for the purchase of land and buildings. This money was turned over to the trustees of the A. and M. College, and was used by them in purchasing three hundred and two acres of land at Foster, Mississippi, six miles from Natchez, on the Y. & M. V. Railroad. Plans were immediately made for fencing this land and for the construction of the necessary buildings. In the meantime a permit was secured from a special session of the State Legislature whereby the College authorities were permitted to spend part of the state appropriation for the purchase of more land containing the necessary buildings. The 1928 appropriation by the state was then used to purchase twenty-five additional acres of land on which were a dwelling, light plant, deep well, barns, poultry houses, garage and orchard.

Work was begun on the permanent station in October, 1928. The land was broken and planted to oats, rye, vetch, Austrian winter peas, and clovers. Nearly three miles of heavy wire fence and one-fourth mile of board fence with concrete corner posts were built. Terraces were constructed on part of the land, fence rows were cleared, and some of the rough lands were cleaned up, tenant houses were renovated, and cold frames were built.

PROBLEMS NEEDING SOLUTION

Ever since men began to give serious thought to fruit growing, budding and grafting have been practiced; but the topworking of pecans has brought new problems to this old art. When several hundred square miles suddenly appear as a potential pecan orchard where Nature has prepared the growing stock, the problem becomes much greater.

Observations on the behavior of grafts made in the earlier efforts at topworking pecans had, in the failures and successes which were experienced, presented many specific problems for solution, and suggested rather definite lines of investigation. At the very beginning
of the experiment the following points stood out as those needing special investigation:

1. Size of trees possible and practical to topwork.
2. Size of limb adapted to topworking, with respect to successful grafting and later healing.
3. Conditions necessary for union of grafts.
4. Time of year for cutting back native pecan trees.
5. Paints, waxes and preserving fluids for covering wounds.
6. Number and arrangement of native branches necessary to leave on trees of different sizes.
7. Length and treatment of stumps.
8. Advantage of insertion of scions at various points in the ultimate shape of the tree.
10. Age and size of scions.
11. Methods of storing and wrapping scions.
12. Temperature and humidity suited to storage of scions.
13. Time and method of setting each of the different types of grafts.
15. Method of preventing injury from wind, insects and diseases.

INVESTIGATIONS CARRIED OUT

Pecan trees ranging from small to large have been cut back from November until May to force out new growth necessary for budding. Large and small limbs have been cut off in an effort to determine the best size of branch in which to insert grafts. The ends of stumps have been painted, unpainted, and covered with grafting wax and various preserving fluids. Varying proportions of the native branches have been removed in cutting back the trees, ranging from a removal of all to the retention of a large portion of them. The limbs have been cut back close to the trunk, and quite a distance out. Efforts to secure different shapes by inserting scions at different parts of the tree have been attempted.

Grafting wood has been cut and stored from November to March. One, two and three-year old wood has been stored and used in grafting. Scions have been wrapped in bundles with paper and kept moist, have been left unwrapped and stored in boxes of moist sawdust or moss. Temperature and humidity have been varied with the various lots.

Whip grafts and cleft grafts have been set from January to April. Bark grafts with both dormant and current year shoots have been attempted from April until August. Patch buds and ring buds have been used from June until September. Paraffin, coal tar, asphalt, and various grafting waxes and bandages have been used to seal unions and cover wounds. Tree surgery has been practiced in an effort to prevent decay and to promote healing. Records of the results of each of these methods have been made.
GENERAL INSTRUCTIONS PREPARATORY TO
GRAFTAGE OPERATION

As a result of many years' observations and three years of experimental work, certain rather definite instructions may be offered in deciding upon some rather general points which necessarily come up before one is actually ready for the placing of the grafts. These have to do with:

1. The selection of proper varieties for the new tops.
2. The selection of properly spaced trees in the native groves and of such size as experiments have shown possible and practical to topwork.
3. The selection and preparation of branches of the proper size.
4. The use of the proper type of graft.
5. The relation of the type of graft used and season of the year grafting is done.

In the selection of varieties the list seems to narrow down to the Stuart, Success, Moneymaker and Schley. The Stuart is practically free of scab and a good fruiter, but the fruit is not of the best quality. The Success often scabs and is not a heavy fruiter, but the fruit is more desirable than the Stuart. The Moneymaker fruits regularly and heavily, but the nuts are of medium quality and irregular in size. The Schley produces a nut of the finest quality, but the tree is subject to scab and does not fruit regularly or heavily. There are other varieties that seem desirable, such as the Hale and Frotscher.

The trees which are to be used as stock should not be too large, nor should they stand too close together. To get satisfactory results, they should be at least fifty feet apart; and on heavy soils of high fertility, sixty to seventy feet apart. On land that overflows regularly grafts should be set above the water line; and where pastured, the grafts should be out of reach of the horses and cattle.

Branches from one to three inches in diameter offer the most desirable size for grafting. It is possible to make grafts on old stumps or very large limbs, but these are extremely slow in healing and are likely to produce worthless short-lived trees. It is seldom possible to secure a sound union and perfect healing when a limb is grafted more than four inches in diameter. Young and fast growing stock will heal over rapidly if not exceeding four inches in diameter, provided the cut surfaces are kept well protected by paint or grafting wax. If the tree is old or making slow growth, three inches should be the maximum diameter of limbs used for grafting.

By the use of different types of graft the season for grafting may be extended over a considerable portion of the year. The whip graft in the nursery may be used in January, February or March; the cleft graft may be used in February and March; the bark graft in April, May or June; and the ring or patch bud in July, August and September. Usually, trees from one to four inches in diameter are
selected for cleft grafting; trees from four to eight inches in diameter can generally be successfully worked by the bark graft. New sprouts from cut back tops offer the best point for inserting either the ring bud or patch bud. Occasionally trees greater than eight inches in diameter are bark grafted or cut back and buds placed on young shoots in July, August or September. Extremely old trees with rough limbs that are making a very slow growth are hard to topwork and are rarely profitable.

A wax consisting of four pounds of resin, one to two pounds of beeswax, and one pint of linseed oil, kept warm and applied with a brush, offers the best method of covering wounds and sealing unions.

**WHIP GRAFTING**

Whip grafts work best on stock not more than three-fourths inch in diameter. This method is most commonly used on two to four year old nursery stock in February, March, or early April. The scions should be cut from a tree of known variety, using a branch of the previous year’s growth and as near as possible the same size as that of the stock to be grafted. Remove the dirt from the base of the nursery stock so that the graft can be set low. With a sharp knife remove the top of the seedling stock by a long sloping cut, as shown in Figure 4. Then split the stock about an inch deep, beginning nearest the upper edge of the cut surface as shown in Figure 4.

When the stock is prepared, select a scion of as near the same size as possible, make a cut of the same length and shape as the stock, cut the scion off about two or three buds in length, wedge the stock and scion together as shown in diagram; the split tongues should slip one into the other so as to make a tight union, taking care that the cambium layer (the inner bark) is brought in contact on at least one side of the stock and scion. If the stock and scion are of the same size, there is no reason why the cambium layer should not come in contact on all sides of the graft. Where the scion is smaller than the stock, a contact of cambium layers can be had on only one side. When the stock and scion are wedged firmly together, they should be carefully waxed and wrapped with a cloth bandage. The wax should be put on with a brush; for this purpose it will be necessary to have a

![Fig. 4—Whip graft showing method of cutting stock and scion](image-url)
slow fire to keep the wax melted. The bandage is made of strips of cloth about one inch wide. Care should be taken to seal all cut surfaces with wax, and then draw the bandage tight over the wax and tie it, or stick the ends in the wax. After the grafts are waxed and bandaged, most nurserymen prefer to cover them with loose dirt. This prevents evaporation, and the scions are more likely to grow. If the dirt becomes packed from heavy rains, it should be broken away or loosened as soon as the grafts begin to grow. Whip grafts can be set above the ground or in the top of trees, on small limbs, but are not as satisfactory there.

CLEFT GRAFTING

Cleft grafting is done in the late winter and early spring. The best season is February, March and early April. Earlier work can be done, but there is greater danger in the grafts drying out before the sap begins to flow in the spring. If grafts are to be set in early February, they should be entirely covered with a thin coat of melted paraffin or grafting wax to check evaporation.

In cutting the grafting wood for cleft grafting use wood of the previous year's growth and take it from trees of known varieties. Two year old wood can be used if the buds are normal. The wood should be kept wrapped in moist paper to prevent its drying. It can be kept for several days if wrapped well, buried in moist soil, or stored in an icebox; but it is best to take it from the tree each day as it is used.

![Fig. 5—Showing method of cutting scion for cleft grafting.](image)

![Fig. 6—Showing cleft grafts set in the stock.](image)

After the scions are cut, the limb of the tree to be grafted should be sawed off as shown in Figure 6. The best tool to make a cleft in
the stock is a broad chisel. A sharp hatchet or drawing knife can be used with good results. Set the chisel at a small angle with the grain of the wood so that it will cut rather than split the stock. If the chisel follows the grain of the wood, a very uneven edge is left on the bark, and it is impossible to get a good contact with the cambium. When the cleft is made in the stock, the scion should be driven in, as shown in Figure 6. The thick edge of the scion should be turned out and the cambium layer or inner bark brought in contact with the cambium layer of the stock. Where the limb to be grafted is two inches or more in diameter, two grafts can be set, one on each side. Sometimes it is necessary to drive a small wedge in the cleft to hold it open until the scions are placed. When the scions are placed, all openings and cut surfaces should be carefully sealed with grafting wax and then covered with a cloth bandage. For best results the wax should be melted and applied with a brush. Either waxed or unwaxed cloth bandage can be used. The wax should always be put on before the bandage.

**BARK GRAFTING**

Bark grafting is done in April, May and June, and best results have been gotten from work done in the early part of the season. It can be started as soon as the bark will slip in the spring. About April 10th is the average date for this region. This method should not be used after hot, dry weather begins, in June. Satisfactory work has been secured in July, but most of the work done that late has not given good results.

Scions for bark grafting should be cut the previous January or February and kept dormant. Cut medium sized twigs in bundles of fifteen or twenty, cover them with wet paper as soon as possible, and store them in an icebox where they will be kept moist. Wood for early April grafting may be stored in a cellar or buried in moist soil, but it will not keep in that condition after the warm weather of May.

If the tree to be grafted is four inches or more in diameter, it should be cut as shown in Figure 8. If the tree is less than four inches in diameter, it may be cut back to a stump, preferably about five or six feet high. When sawing the limbs, care should be taken to prevent them from splitting. Cut the under side of the limb first and then saw it off from above. Small trees, if grafted in April or early May, may have all the native branches cut away. If the work
is done later, one or more branches should be left to keep the tree alive until the grafts start. Large trees should always have a few branches left on them. See Figure 8. If too much top is left when a tree is cut back for grafting, the scions will not be forced out properly, and will either remain dormant or make a very poor growth. After the tree is properly cut back, begin setting the grafts. Take a stick of grafting wood from a bundle that has been kept dormant in an icebox, and cut the scion as shown in Figure 9.

![Fig. 8—Showing a tree cut back for bark grafting](image1)

![Fig. 9—Showing bark graft scion](image2)

When the scion is properly cut, hold it against the bark on the stock where it is to be set and split the bark on each side with a knife, as shown in Figure 8. This insures a close fit. Push the scion down behind the bark, as shown in Figure 10.

The longer sloping cut on the scion should be turned toward the wood on the stock. When it fits tightly in place, it should be fastened with a nail, as shown in Figure 10. A number 18 regular wire nail, one inch long is best. The nail holds the stock and the scion tightly together and does not interfere with the growth. Care should be taken not to bruise the bark in driving the nail. The nail may be driven through the tongue of bark on the stock, or the bark may be cut back, as shown in Figure 10. After the scion is nailed in place, cover all cut surfaces with melted wax, and bandage it as in cleft grafting.
If the operator works fast, several grafts can be set before they are waxed and bandaged. Until he develops some skill, each scion should be waxed and bandaged as soon as it is set.

**BUDDING**

There are several different methods of budding in common practice. Some have distinct advantage over others, but with any method, much of the success depends upon the skill of the operator. Ring budding has been most satisfactory with us here. It seems to be best suited to the average person. Patch budding is just as simple, but has not given quite as good results.

While buds have been successfully set on stock one, two and even three years old, the best results have been obtained when buds of the present year's growth were set on stock of the same age. Buds, as a rule, become mature enough for use about the middle of July in this region. The budding season will last from then until about September 15th unless cut short by dry weather. Ring and patch budding are most successful when the bud wood and stock have a crisp, growing appearance and the buds come loose from the wood easily. If the
buds are removed from the stick with difficulty, or the stock is dry, they will not live. If the bark is thin and tender, and the twigs are not cylindrical, it is likely that the buds are too young and immature to grow. In budding, the necessary equipment is a budding knife and some waxed cloth or tape. The knife should have two parallel blades about one inch apart. If a regular budding knife cannot be bought from a hardware store, one can be made by fastening together the handles of two small fruit paring knives, or by taking a piece of wood one inch square and six inches long, and fastening two safety razor blades to the opposite sides of the stick near one end so that the blades extend about one-fourth inch below the wood, then by shaping up the handle and hollowing out the wood slightly between the blades.

If seedling pecan trees or nursery stock make a good growth, they can usually be budded in July and August of any summer from the time they are three years old until they are five or six. After they reach a height of ten or twelve feet, the wood of the proper age to bud is usually too high to begin a new top.

In order to successfully bud large trees, they should be cut back the previous winter or spring. Figure 14 shows a tree that was cut back in January and buds set on the new growth in July or August following. Sometimes grafts set in the early spring do not grow, and buds can be set on the new growth the same summer as if the tree had been cut back for budding. All cut surfaces should be carefully painted with a good grade of oil paint to prevent rot. It may be necessary to prune out some of the new growth in the spring in order to have large sprouts to bud in the summer. From two to five or

Fig. 12—Showing a tree improperly grafted. Limbs cut too large.
more sprouts should be left on each limb to be budded. The operation of ring budding is very simple, but a little skill is necessary for satisfactory results.

Waxed cloth for bandage is necessary and can be prepared as follows: Take cheap domestic or sheeting and tear it in sheets about one foot square and dip it in a melted wax consisting of equal parts by volume of beeswax and resin with a small amount of linseed oil added. When the sheets are thoroughly saturated, take them out and draw them between the edges of two smooth boards to remove the surplus wax. They can then be torn into strips about three-fourths inch wide, as they are used. Some prefer to tear the cloth into strips and wind it into balls before dipping into the wax. After the cloth is ready, cut the bud wood. Take the larger and older branches of the present year’s growth from a tree of known variety. (Young trees produce better budding wood than old trees, because they make a more rapid growth.) As soon as the wood is cut from the tree, remove the leaves to prevent evaporation. The leaves should be cut close to the wood without injuring the buds. In the early part of the budding season usually not more than one-half of the stick is old enough for use. It is always best to throw away the younger part of the bud stick. As soon as the leaves are removed, wrap the wood in wet paper or sacking. If possible, never cut it from the tree more than a day before it is to be used. When it is necessary to keep the wood for several days, store it in an icebox or other cool, moist place. Do not put it in contact with the ice.

Nursery stock is usually budded from four to eight inches above the ground, but not higher than two feet, as it often
dies back when transplanted. If the trees are not to be transplanted, buds may be set higher. With larger trees, where the buds are intended to make branches rather than a main trunk, they can be set at any height. Nursery stock is generally given but one bud, while larger trees are often given as many as one hundred buds.

THE OPERATION OF BUDDING

Select a smooth place on the stock and cut the bark through to the wood with a double bladed knife (See Figure 13); rock the knife back and forth across the stick to cut the bark, but do not girdle the stock. A strip of bark not less than one-fourth inch wide should be left on one side of the stock to insure a steady flow of sap; next, select a bud on the scion and cut around it above and below with the same budding knife, then with vertical strokes on each side of the bud block it out. If the bud is in good condition, it is now readily lifted off with the thumb nail; next, remove the bark on the stock and place the bud as shown in Figure 13. The bud should fit snugly at the top and bottom, but should not quite fill up the space on the sides. A space the size of a match stem should be left on each side of the bud, as shown in Figure 13. This gives best results, probably because it allows better drainage of the sap. Buds cut with a patch budding knife fit on all sides and have not given as good results as those set by a ring bud method. When the bud is in place, hold it firmly and wrap with a piece of waxed cloth. Begin at the bottom and go up as you wrap, allowing the tape to overlap about one half of its width. The tape should cross above and below the growing point of the bud so that it is the only part exposed. The tape should be drawn just tight enough to hold the bud firmly in place. The stock should then be cut off about eighteen inches or twenty-four above the bud.

Twelve or fifteen days later the tape should be loosened or cut to prevent it from binding. It is generally best not to remove the tape until the following winter. Buds set early in the season will often make a growth of from one to two feet before the first winter. In case it begins a rapid growth the stock may be cut back to within six or eight inches of it. The stock should never be cut smooth with the bud during the first season's growth. Buds set late in the season should be left dormant until the following spring, when they are forced out by cutting the stock back to within six or eight inches of the bud. The tree should be pruned out during the winter following the budding. The tape should be removed, and the cut surfaces painted. If there are not enough buds living to make a well-balanced top, some branches should be left for budding the following summer.

AFTER CARE OF TOPWORKED TREES

Trees grafted early in the year often make a very rapid growth. If not pruned back, native wood will likely shade the grafts and cause them to die. This should have constant attention during the growing season. Grafts often grow so fast that a wind will break them off.
This can be prevented by keeping them pruned back from two and a half to three feet the first year. Braces are also helpful in preventing harm from the wind. Small lathes or poles can be tied or nailed to the tree and the grafts tied to them. The braces should be left until the grafts are firmly attached to the stock. A combination of pruning and bracing has given best results. We have had practically no trouble from grafts bursting out of small trees and nursery stock. The greatest amount of damage is done in larger trees. Topworked trees should be carefully pruned out each winter until all native wood is removed, the top is well balanced, and all cut places healed over.

All brush and limbs cut from a tree should be burned to prevent the breeding of bark beetles.

Fig. 15—Showing a tree that produced 20 lbs. of nuts three years after being grafted.
NURSERY PRACTICE

Pecans from various trees were stratified in December, 1928, and were planted in nursery rows in March, 1929. Most of the nuts germinated and there was quite a variation in the rate of growth. With the common pecan it appears that the rate of growth for the first year seedlings is in direct relation to the size of the nut. That is, the larger nuts consistently made a better growth than the smaller ones; however, it remains to be seen whether or not this relation will continue from year to year. Seed from bitter pecans or water pecans (Hicoria aquatica) was planted with the other pecan seed, and made a much better growth than the largest pecans. Many of the water pecans were large enough to bud in September, 1929, and practically all of them will be of sufficient size to whip graft in March, 1930. This variety makes good stock for grafting, and seems to thrive best in low lands.

Fig. 16—Showing Hicoria aquatica on the left; seedling from extremely large pecan in center; and seedling from small pecan on right. Average trees dug from the nursery October, 1929.