CIRCULAR No. 115
SEPTEMBER, 1953

Factors Affecting Pecan Yields

Recommendations For Increasing Nut Production

AGRICULTURAL EXPERIMENT STATION
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First Printing 8M—September, 1953

FACTORS AFFECTING PECAN YIELDS

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Pecan production in Alabama during the last 50 years has grown from the output of a few trees around homes to over ¾ million trees. Before 1900, Texas, Oklahoma, Arkansas, and Louisiana supplied the Nation's markets with nuts from native seedling trees. Plantings of orchards of grafted pecans began to appear soon after the turn of the century. Most of the commercial plantings of improved varieties were made in the six Southeastern States of Georgia, Alabama, Florida, South Carolina, North Carolina, and Mississippi.

In 1910, Alabama had 44,683 pecan trees. By 1930, the number had been increased to 742,757, and by 1950 to 864,474. The average annual production of pecans in Alabama for the period 1941 to 1950 was 12,203,000 pounds; the highest production was 26,000,000 pounds in 1951. Average yield per bearing tree from 1941 to 1950 was approximately 17 pounds.

The pecan earlier was thought to be free of any major disease or insect trouble. A small orchard was pictured as a good investment for old age and a means for providing a college education for the children. Long-time yields of 200, 400, and even 600 pounds for certain old trees were cited. With the coming of commercial plantings, there appeared a large number of insects and diseases, many of which have proved to be of high importance. Yields of trees in orchards failed to measure up to those of old isolated trees. Yields, in fact, were often very low and only a limited number of orchards proved profitable.

Native pecans are of minor importance in Alabama. As new va-

[1] Resigned.

[2] The authors acknowledge the assistance of: L. G. Brackeen, of the Alabama Department of Agriculture and Industries, who classified the soils in the survey; J. R. Cole, J. H. Hunter, and Max R. Osburn of the Pecan Station of the U. S. Department of Agriculture, Albany, Georgia, for suggestions on procedures; L. M. Ware, Head, Department of Horticulture, who proposed the project and in the absence of the senior author prepared this circular.

rieties have been developed in other states, they have been propagated and widely planted in the southern part of the State. Where favorable conditions have been provided, production has been good. Where conditions were unfavorable, production has been unsatisfactory. The problem of the grower is to know and provide conditions favorable to high production. The first problem is to determine the conditions under which production is satisfactory.

Existence of a large number of orchards, with yields ranging from very low to medium or high and with an almost infinite variety of conditions, offers an ideal laboratory for study of the factors and conditions related to success or failure of pecans.

For 2 years, the Agricultural Experiment Station of the Alabama Polytechnic Institute has studied factors and conditions in pecan orchards as related to success or failure. This circular summarizes the findings of this study and offers recommendations for managing pecans for higher production.

OUTLINE of STUDIES

The study involved 176 orchards in 20 counties, representing 73,067 trees or approximately 10 per cent of the total bearing trees in the State.

Factors studied included location, site, soil type, fertilizer practices, cultural practices (cover crop, sod, clean cultivation, etc.), presence of rosette caused by zinc deficiency, prevalence of insects and diseases, condition of trees, and yield of nuts. In all orchards an effort was made to get records for a minimum of 5 years; in many instances records were given for a period of 12 to 15 years.

RESULTS

This analysis is based on complete records of 169 orchards. Yield of nuts has been used as the most satisfactory criterion for measuring performance. Orchards have been placed in seven classes, according to the average yield per tree for the past 5 years or more. Yield classes are designated as A, B, C, D, E, F, and G. The average yield of orchards classed as A has been 56 pounds per tree or more; those classed as G, 5 pounds per tree or less. Intermediate yield classes are separated by average differences in yield of 10 pounds per tree, Table 1.

TABLE 1. DISTRIBUTION OF ORCHARDS ACCORDING TO YIELD CLASS

Yield class	Approximate average yield per tree	Orchards in yield class	
		Number	*Per cent*
A	56+	7	4
B	46—55	4	3
C	36—45	9	5
D	26—35	36	21
E	16—25	53	31
F	6—15	39	23
G	0— 5	21	13
		169	100

In presenting results, a summary is first given of conditions and practices found, the relationship is next given of yield classes to individual practices, and finally the relationship of yield classes to the use of combined practices.

Practices Found

The number and percentages of orchards in the survey receiving different treatments or in which different conditions were found are given in Table 2. Of the 169 orchards analyzed, 44 per cent were growing winter legumes or legume-nonlegume mixtures, 15 per cent were intercropped, 30 per cent were in Bermuda sod, and 52 per cent were grazed. Rosette or zinc deficiency was found in 33 per cent of the total orchards surveyed, but 90 per cent of the orchards in one county showed this deficiency. Approximately 55 per cent of the trees in all orchards surveyed were of scab-resistant varieties; 22 per cent, moderately resistant; and 23 per cent, highly susceptible.

Distribution of Yield Classes

The number and percentages of the orchards in the different yield classes are given in Table 1. Twelve per cent of the orchards had an

TABLE 2. OCCURANCE OF PRACTICES IN ORCHARDS ANALYZED

Practice	*Number*	*Per cent*
Total number orchards analyzed	169	100
Orchards grazed	87	52
Orchards showing some zinc deficiency	55	33
Intercropped	26	15
Winter legumes	49	29
Winter legumes and oats	26	15
Oats or rye	5	3
Bermuda sod	51	30
Native grasses	51	30
Summer legumes	4	2

average yield of 36 pounds per tree or more; 52 per cent, 16 to 36 pounds; and 36 per cent, below 16 pounds.

Yields as Related to Winter Legumes

The number of orchards in the different yield classes, the percentage of the orchards in each class receiving a winter legume-nonlegume mixture, and the average number of years legumes have been grown are given in Table 3. One hundred per cent of the orchards

TABLE 3. YIELD CLASS AS RELATED TO USE OF WINTER LEGUMES OR WINTER LEGUME-NONLEGUME MIXTURES

Yield class	Orchards in yield class			
	Number	Percentage with winter legume or winter legume-nonlegume mixtures grown		Average number years legume grown
		1949	*1951*	
A	7	100	100	10
B	4	100	100	7
C	9	89	89	6
D	36	69	86	4
E	53	36	83	4
F	39	26	74	3
G	21	10	29	1

in the two highest yielding classes and 89 per cent of those in the third highest yielding class were in winter legumes or legume-nonlegume mixtures; the winter crops had been grown in these 3 classes an average of 8 years. In the lowest yielding class, only 29 per cent of the orchards (1951) were growing legumes, and the average length of time grown was 1 year. The percentage of orchards in legumes or legume-nonlegume mixtures, and the average number of years cover crops were grown were progressively lower for each lower yielding class.

Yields as Related to Use of Different Winter Covers

The percentages of orchards with winter legume, winter legume-nonlegume mixtures, and nonlegumes are given in Table 4. More orchards had winter legumes than any other type cover crops. Very few orchards were planted to winter nonlegumes. Yields were closely related to use of winter legumes and to use of winter legume-nonlegume mixtures.

TABLE 4. YIELD CLASS AS RELATED TO TYPE OF WINTER COVER CROP

Yield class	Orchards in yield Class			
	Number	Percentage with		
		Winter legume	Winter legume and winter legume-nonlegume mixtures	Oats or ryegrass
A	7	86	14	0
B	4	75	25	0
C	9	78	11	11
D	36	53	16	6
E	53	17	19	2
F	39	10	16	3
G	21	5	5	5

Yields as Related to Fertilizer Practices with Winter Legumes

Fertilizer applications had a pronounced effect on yields, although highest applications were associated with other good practices, such as use of winter legumes, Table 5. In orchards receiving winter legumes or winter legume-nonlegume mixtures, the average application of fertilizer per acre in the form applied dropped progressively from 1,405 pounds per acre for the highest yielding class to 40 pounds for the lowest yielding class. Similarly, the rate of phosphoric acid (P_2O_5) dropped from 159 to 7 pounds, and the rate of potash (K_2O) from 112 to 0 pounds from the highest to the lowest yielding class. Nitrogen applications fluctuated; however, it should be noted that all orchards reported in this table had winter legumes or winter legume-nonlegume mixtures, which provided varying quantities of nitrogen. In no instance did an orchard have high yields without a liberal application of fertilizer. This indicates that fertilizers are a limiting factor in pecan production in Alabama.

TABLE 5. YIELD CLASS AS RELATED TO FERTILIZER PRACTICE IN ORCHARDS WITH WINTER LEGUME OR WINTER LEGUME-NONLEGUME MIXTURES

Yield class	Orchards in yield class					
	Number	Percentage with winter legume or winter legume-nonlegume mixtures grown	Average amount of fertilizer applied per acre per year for past 5 years			
			As applied	N	P_2O_5	K_2O
			Lb.	*Lb.*	*Lb.*	*Lb.*
A	7	100	1,405	45	159	112
B	4	100	935	5	126	90
C	9	89	640	10	79	57
D	36	69	540	12	64	45
E	53	36	440	7	55	39
F	39	26	275	5	33	24
G	21	10	40	0	7	0

Yields as Related to Fertilizer Practices Without Winter Legume

Yield classes and fertilizer rates in orchards not growing legumes or legume-nonlegume mixtures are shown in Table 6. Results in-

TABLE 6. YIELD CLASS AS RELATED TO FERTILIZER PRACTICE IN ORCHARDS WITHOUT WINTER LEGUMES

Yield class	Orchards in yield class					
	Number	Percentage without winter legume or winter legume-nonlegume mixtures grown	Average amount of fertilizer applied per acre per year for past 5 years			
			As applied	N	P_2O_5	K_2O
			Lb.	*Lb.*	*Lb.*	*Lb.*
A	7	0	—	—	—	—
B	4	0	—	—	—	—
C	9	11	220[1]	8	20	24[1]
D	36	31	520	17	56	39
E	59	64	365	10	34	29
F	39	74	265	8	30	21
G	21	90	55	1	7	5

[1] Manure applied each year to this orchard.

dicate that the relationship in orchards without winter legume or legume-nonlegume mixture was similar to that in orchards where these cover crops were grown in that an increase in fertilizer increased yields. There were no orchards in this grouping in the two highest yielding classes; however, no orchard in this grouping received high enough fertilizer application to indicate whether or not it is possible to produce good yields without legumes.

Yield as Related to Use of Bermuda Sod

Bermuda sod was found in about 50 per cent of the orchards in the 3 highest yielding classes, in about 31 per cent of the orchards in the middle yielding classes, and in only 10 per cent of the orchards in the lowest yielding class, Table 7. It should be pointed out that,

TABLE 7. YIELD CLASS AS RELATED TO SUMMER SOD

Yield class	Orchards in yield class		
	Number	Percentage in summer sod	
		Bermuda	Native
A	7	43	14
B	4	50	25
C	9	56	44
D	36	31	28
E	53	30	28
F	39	31	21
G	21	10	57

in general, Bermuda sods, winter legumes, high fertilizer rates, and grazing were closely associated as practices. The relation of Bermuda sod to high yields was probably the result of a combination of several favorable practices. The data show conclusively that the presence of Bermuda grass did not reduce nut production.

Yields as Related to Grazing

Grazing was practiced in approximately 75 per cent of the orchards in the three highest yielding classes, in about 54 per cent of those in the middle yielding classes, and in only 14 per cent of the lowest yielding class, Table 8. Of the orchards grazed, 52 per cent

TABLE 8. YIELD CLASS AS RELATED TO GRAZING

Yield class	Orchards in yield class	
	Number	Percentage grazed
A	7	57
B	4	100
C	9	78
D	36	56
E	53	55
F	39	51
G	21	14

of the owners indicated that pecan yields increased due to grazing, 41 per cent thought that yields were not affected, and only 7 per cent reported a reduction in yield due to grazing.

Yields as Related to Scab Susceptibility of Varieties

Ninety-nine per cent of the trees in the highest yielding class, 100 per cent of those in the second highest yielding class, and 92 per cent of those in the third highest yielding class were of scab-resistant varieties or of varieties moderately resistant to scab, Table 9. The

TABLE 9. YIELD CLASS AS RELATED TO SCAB SUSCEPTIBILITY OF VARIETIES

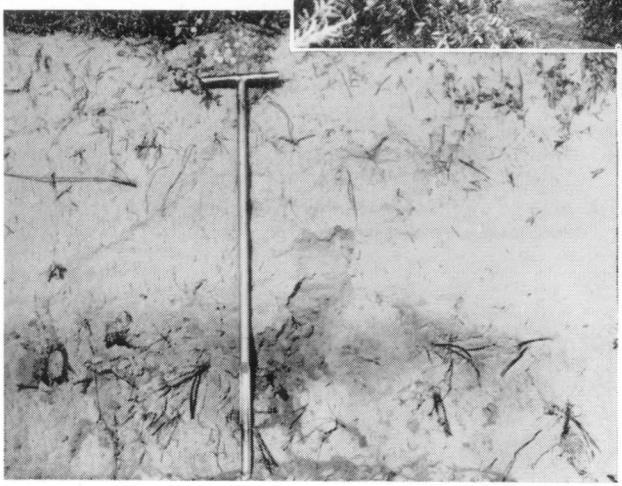
Yield class	Total number orchards in class	Average percentages of trees in orchards by yield class			
		Highly resistant to scab	Moderately resistant to scab	Total highly and moderately resistant to scab	Very susceptible to scab
A	7	65	34	99	1
B	4	75	25	100	0
C	9	62	30	92	8
D	36	67	18	85	15
E	53	61	28	89	11
F	39	42	16	58	42
G	21	54	19	73	27
Weighted average		55	22	77	23

TO GET GOOD

Plant new orchards and top to scab-resistant varieties Elliott, Farley, and Curtis.

Prevent rosette, caused by applications of zinc sulfate per tree per year.

Plant a winter legume and apply 1000 to 1200 pounds of fertilizer per acre per year divided equally between the legume and trees.



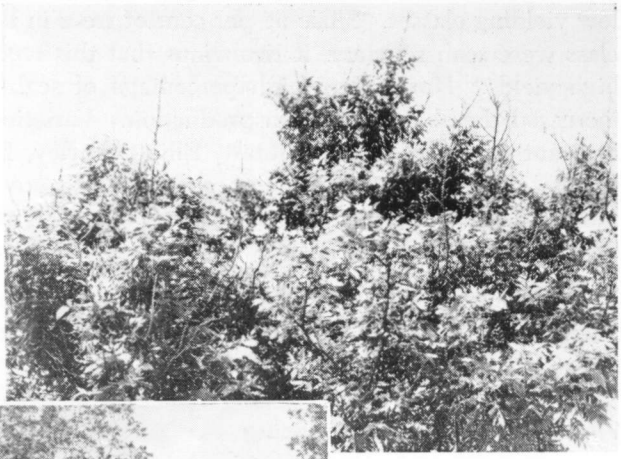
Control diseases and insect tion of trees and serious and shoots.

Plant orchards on soils with loam topsoil and a well-d moisture-holding capacity.

PRODUCTION —

work scab-susceptible trees such as Stuart, Desirable,

inc deficiency, with regular at the rate of 2 to 3 pounds



Graze winter legumes and summer grasses for additional income from the orchard and to reduce competition for moisture and nutrients.

that cause early defolia- damage to developing nuts

fine sandy loam or sandy ined subsoil with a good

percentage of trees of highly susceptible varieties was larger in the low yielding classes. Since 54 per cent of trees in the lowest yielding class were scab resistant, it is obvious that this factor did not assure high yields. However, a high percentage of scab-resistant varieties increased the chances of high production. Varieties found generally resistant to scab were the Stuart, Elliott, Farley, Lewis, Davis, and Curtis; those found moderately susceptible were Success, Tesche, Moore, Mahan, Hall, Frotscher, and Moneymaker; those found highly susceptible to scab were Schley, Pabst, and Delmas.

Stuart represented approximately 96 per cent of the first group, Success approximately 90 per cent of the second group, and Schleys about 95 per cent of the third group.

Yields *as* Related *to* Spacing

There was no very close relationship between yield and tree spacing, although about 85 per cent of the orchards in the three highest yielding classes were spaced 60 feet or more apart, Table 10. Wide

TABLE 10. YIELD CLASS AS RELATED TO SPACING

Yield class	Total number orchards in class	Percentages in yield class according to spacing	
		Less than 60 feet	60 feet or more
A	7	0	100
B	4	25	75
C	9	22	78
D	36	28	72
E	53	24	76
F	39	31	69
G	21	33	67

spacing did not assure high yields, and close spacing did not prevent high yields. Apparently much may be done to increase yields of orchards with close spacing by use of good practices, although many experiments have shown that thinning will increase yields and have other desirable effects. Nut production in crowded orchards usually was limited to the top of the trees.

Yields *as* Related *to* Rosette

In many orchards rosette caused by zinc deficiency was a critical factor, Table 11. The amount of rosette varied greatly in different counties. In one county, 90 per cent of the orchards had rosette. Orchards in the three highest yielding classes showing different de-

TABLE 11. YIELD CLASS AS RELATED TO PRESENCE OF ROSETTE AND WEEVIL

Yield class	Orchards in yield class	Percentages of orchards showing rosette and weevil damage in yield class	
		Rosette	Weevil
	No.	*Per cent*	*Per cent*
A	7	14	28
B	4	25	25
C	9	11	56
D	36	36	50
E	59	42	57
F	39	44	56
G	21	57	76

grees of damage to rosette ranged from 11 to 25 per cent; in the three lowest yielding classes, the range was from 42 to 57 per cent. In the Gulf Coast counties, use of zinc sulfate was general and very few orchards showed signs of rosette.

Yields as Related to Weevils

In some orchards, weevils constituted a critical factor. Weevil damage was found in all areas except the Gulf Coast counties. The percentage of the orchards with weevil infestation ranged from 28 per cent in the highest yielding class to 76 per cent in the lowest yielding class, Table 11. There was a close relation between prevalence of weevils and yield class.

Yields as Related to Soils

Highest producing orchards were usually located on Orangeburg, Red Bay, Greenville, Norfolk, Ruston, Kalmia, Tifton, Marlboro, or Bowie soils. Yields of orchards were usually low when located on Susquehanna, Oktibbeha, Vaiden, Wickham, Leaf, and Flint soils, Table 12. Best production was predominantly on fine sandy loam or

TABLE 12. YIELD CLASS AS RELATED TO SOIL GROUPS

Soil group	Percentages of orchards of each yield class in different soil groups						
	A	*B*	*C*	*D*	*E*	*F*	*G*
Norfolk, Ruston, and Kalmia	29	25	23	31	32	31	28
Orangeburg, Americus, and Red Bay	57	25	33	13	26	18	24
Tifton, Marlboro, Bowie, and Izagora	0	50	44	31	21	15	14
Greenville	14	0	0	0	2	8	14
Susquehanna, Oktibbeha, and Vaiden	0	0	0	11	8	8	10
Shubuta, Boswell, and Cuthbert	0	0	0	8	5	18	5
Wickham, Leaf, and Flint	0	0	0	6	6	10	5
TOTAL ORCHARDS	7	4	9	36	53	39	21

sandy loam soils. Production was generally low on the stiffer and less well-drained soils. Data from this study do not necessarily prove that good yields cannot be produced on soils of the last group. It might be possible to produce satisfactory yields if good practices are used. It is likely, however, that low response to good practices was responsible for growers not using good practices on these soils. While orchards on rather deep sandy soils require more intelligent management, it appears that with unusually good attention fair production may be obtained.

Data on 13 Highest Yielding Orchards

Records of the 13 highest yielding orchards in the survey offer a basis for determining the combination of favorable factors associated with good production. The highest producing orchard averaged 101 pounds per tree during the past 5 years, Table 13. This orchard was 20 years old; 80 per cent of the trees were of scab-resistant varieties and the remaining 20 per cent were moderately resistant. An average of 1,200 pounds of fertilizer per acre per year had been applied in the last 5 years or more. For 18 years a winter legume had been grown, and for 17 years the orchard had been in a Bermuda sod, which had been grazed each year. The trees were spaced 60 × 60 feet and the soil was an Orangeburg fine sandy loam. Similar data are given in the table for the other 12 orchards.

Conditions and Practices in the 13 Highest and 21 Lowest Yielding Orchards

Combinations of conditions and practices associated with high and low nut production are given in Table 14. The average yield per tree of the 13 highest yielding orchards was 67 pounds and of the lowest yielding orchards 3 pounds. Only 2 per cent of the trees in the orchards of the highest yielding group were of varieties highly susceptible to scab, whereas 27 per cent of the trees in orchards of the lowest yielding group were in varieties highly susceptible to scab.

An average of 1,080 pounds of fertilizer per acre or 94 pounds per tree was applied to the highest yielding orchards, but only 54 pounds per acre or about 4 pounds per tree was applied to the lowest yielding group. One hundred per cent of the orchards in the highest yielding group but only 10 per cent of those in the lowest yielding group were in winter legumes. Approximately 70 per cent of orchards in the highest yielding group were in Bermuda sod, while only 10 per

TABLE 13. DATA ON 13 HIGHEST YIELDING ORCHARDS

Item	1	2	3	4	5	6	7	8	9	10	11	12	13
Yield, lb. per tree, 5 years	101	96	95	86	83	73	64	50	48	48	47	44	42
Age, years	20	20	25	34	25	37	30	35	27	23	52-21	30	35
Scab resistant varieties, pct.	80	43	11	81	25	75	66	100	68	100	70	73	70
Mod. scab susceptible, pct.	20	57	89	19	68	25	34	0	32	0	30	27	15
Fertilizer, lb. per acre	1200	1400	400+M[1]	2200	1600	1000	1000	500	1000	900	1000	600	1200
Culture W[2], years	L18[3]	L5	L3	L10	L12	L-NL6	L-15	L-NL10	L5	L8	L5	L-NL6	L6
Culture S[2], years	B17[4]	B10	0	B12	Clean	B15	Clean	0	B5	B10	B5	B6	B6
Grazing, years	17	5	0	12	0	15	0	10	5	1	5	3	6
Trees per acre	12	12	12	12	12	8.6	12	17	8	12	12	8	12
Soil series	Orgb.	Norf.	Orgb.	Red B.	Red B.	Red. B.	Rust.	Marb.	Orgb.	Norf.	Norf.	Red. B.	Bowie
Soil type	fsl[5]	fsl	sl	fsl	fsl	fsl	fsl	fsl	fsl	fsl	fsl	fsl	fsl

[1] Manure applied each year, 500 pounds per tree, in addition to commercial fertilizer.
[2] W = winter, S = summer.
[3] L = legume, L-NL = mixture winter legume and nonlegume.
[4] B = Bermuda.
[5] fsl = fine sandy loam, sl = sandy loam.

TABLE 14. SUMMARY OF CONDITIONS AND FACTORS FOUND IN 13 HIGHEST AND 21 LOWEST PRODUCING ORCHARDS

Factors or conditions	13 highest yielding orchards	21 lowest yielding orchards
Orchards represented, per cent	7	13
Average yield, pounds per tree	67	3
Trees of varieties highly susceptible to scab, per cent	2	27
Trees resistant and moderately susceptible to scab, per cent	98	73
Fertilizer rate, pounds per acre	1,080	54
Fertilizer rate, pounds per tree	94	4
Orchards in winter legume or legume-grass, per cent	100	10
Average period in legumes, years	8	1
Orchards in Bermuda sod, per cent	70	10
Average period in Bermuda sod, years	10	6
Orchards grazed, per cent	70	14
Period grazed, years	8	2
Trees per acre	11.5	14

cent of those in lowest yielding group were in Bermuda sod. Seventy per cent of the orchards in the highest yielding group were grazed, while only 14 per cent were grazed in the lowest yielding group. These conditions and practices in general represent the difference between success and failure in pecan production.

CONCLUSIONS

There are three general conclusions that might be made from this study:

1. No single favorable factor alone assured good production.
2. There were certain critical factors that alone limited production, although all other favorable factors were present.
3. Highest production was the result of the use or presence of a number of favorable factors without the presence of any critical or limiting factor.

Factors that by themselves under certain conditions were found to limit production were: very stiff or poorly drained soil, low sites and poor air drainage of orchards in varieties susceptible to scab, varieties highly susceptible to scab, lack of fertilization, serious rosette or zinc deficiency, and serious weevil infestation.

Combinations of conditions and practices that usually have been associated with high production were: sites with good air and water drainage, soils with fine sandy or sandy loam topsoil and with well-

drained but good moisture-holding subsoil, varieties resistant or moderately resistant to scab, liberal fertilizer applications, use of winter legumes or legume-nonlegume mixtures, Bermuda sod and summer grazing, and absence or control of rosette and weevils. Clean culture was also found satisfactory as a summer practice.

RECOMMENDATIONS

There are certain factors that cannot be changed in an established orchard. These are location, site, and soil. There are other factors that are difficult to change. It is difficult to change an old orchard from one variety to another. The other factors generally may be changed by introduction of different orchard practices or by doing a better job with each.

The following recommendations are based on data and observations resulting from the survey and on other information.

Soils. Soil is an important factor. New orchards preferably should be planted on soils with a fine sandy loam or sandy loam topsoil and a well-drained subsoil with a good moisture-holding capacity. Soils having poorly drained subsoils should be avoided. On deep sands or on extra heavy soils, it appears that good practices might improve production of established orchards.

Site. Site is often a critical factor where orchards are composed largely of varieties susceptible to scab. Orchards on low sites with poor water and air drainage planted to scab-susceptible varieties probably should be abandoned or top-worked to scab-resistant varieties.

Varieties. Varieties in many cases constitute a critical factor. This is especially true in orchards located on low sites. Where orchards are composed largely of highly scab-susceptible varieties, top-working should be considered. Many top-worked orchards even of old trees have been highly successful, although the job is expensive and requires considerable skill and experience. Only varieties resistand to scab such as Stuart, Desirable, Elliott, Farley, Curtis, and Davis should be used for top-working old orchards or for establishing new ones.

Winter Cover Crop. A winter cover crop is a must. Use of a winter legume or a legume-nonlegume mixture should be a standard practice in all pecan orchards. Crimson clover or vetch with ryegrass or oats is a good mixture. Reseeding crimson clover is an excellent winter legume.

Fertilizers. Lack of fertilizer is a critical factor in a large percentage of low-producing orchards. Each tree in young orchards should receive 2 to 3 pounds of fertilizer per tree for each year of its age in addition to that applied to cover crops or inter-planted crops. Orchards 15 to 20 years old should receive 1,000 to 1,200 pounds of fertilizer per acre divided between the legume and trees. Older orchards should receive 1,200 to 2,000 pounds per acre divided between the two crops. Where a Bermuda sod is present, an additional 50 to 75 pounds of nitrogen (N) per acre should be added during the summer, especially if the orchard is grazed. The winter legume should receive an 0-14-14 or 0-16-8 fertilizer. A complete fertilizer, 4-10-7 or 6-8-4, should be applied to trees in February or March. When no legume is planted, 1,200 to 2,000 pounds of 4-10-7 or 6-8-4 per acre should be applied to the trees. If trees tend to become too vigorous, nitrogen applications should be reduced[3]. Phosphorus may be supplied from basic slag if the pH of soil is not above 5.8.

Bermuda Sod. Use of Bermuda sod in pecan orchards can be safely recommended as a desirable practice when combined with winter legumes. In the fall before planting the winter legumes, fertilizers should be applied, the sod lightly broken or harrowed, the legume seed planted, and the soil leveled or packed with a cultipacker or similar type of equipment.

Grazing. Use of pecan orchards for crops to be grazed by livestock seems to be a highly desirable practice from the standpoint of land use, since it offers a second source of income. While this study does not indicate the relative yield of livestock products from land in orchards and not in orchards, the data do indicate that a relatively high percentage of the high producing pecan orchards are being grazed.

Rosette. Rosette is often a critical factor in pecan orchards. Zinc is a specific cure for this trouble. A single application to the soil of ½ to 1 pound of zinc sulphate per tree for each year of its age up to a maximum of 10 to 15 pounds applied with the complete fertilizer in February or March normally will correct rosette. If the dis-

[3] According to Crane and Hunter, U. S. Department of Agriculture, it is possible to add too much nitrogen to pecan trees. The result may be too heavy a set of nuts with poor filling and low yields for the next 1 to 2 years. However, the orchards in the survey indicated a need for more and not less nitrogen.

Crane, H. L. "The Problems of Irregular Crops and Low Nut Quality in Pecan Production." Proc. 43rd Annual Convention, Southeastern Pecan Growers Association, pp. 40-53. 1950.

Hunter, James H. "Some Interrelationships of Cultural Practices, Fertilization, and the Production of Quality Pecan Nuts." Proc. 43rd Annual Convention, Southeastern Pecan Growers Association, pp. 78-83. 1950.

ease is serious, two applications at 1-year intervals may be needed. Use of a small amount of zinc in fertilizers should be a standard practice even though there is no evidence of zinc deficiency.

Weevils. Weevils are frequently a critical factor in Alabama pecan orchards. At times, whole crops of nuts are damaged or destroyed. Weevil damage in the State appears to be increasing. They can be controlled effectively by spray applications of 6 pounds of 50 per cent wettable DDT or 40 per cent wettable toxaphene per 100 gallons of water applied the middle and last of August[4].

Liming. Liming should be done with caution. However, lime should be added to soils too acid to permit satisfactory legume growth. Too much lime reduces zinc availability. Liming should be done on advice of a soil technician after a careful soil test. After liming trees should be carefully observed for evidence of zinc deficiency and an extra application of zinc applied if deficiency symptoms appear. When basic slag is used on legumes, lime should not be required. Where liming is done, the dolomitic form is preferred.

Interplanted Crops. Planting the land between trees is satisfactory in young orchards. Pecan trees are bare of foliage for about 6 months of the year. The interplanted crop should be low growing and not too competitive for moisture, especially in late summer, and it should not be planted closer than 6 feet from the row of trees. Truck crops, especially those growing and maturing in early spring, are desirable. Use of peanuts, cowpeas, and soybeans increases the stinkbug population and damage from kernel spot.

Spacing. Spacing usually does not appear to be a critical factor except in seriously overcrowded orchards. Overcrowded orchards should be thinned to 6 trees per acre. Good management may maintain satisfactory yield for a number of years in closely spaced orchards. In establishing new orchards, the trees should not be spaced closer than 60 × 60 feet. At this spacing every other diagonal row should be removed when the trees begin crowding.

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[4] Osburn, Max R. "Experiments for Pecan Weevil Control in 1951." Proc. Southeastern Pecan Growers Association. 45: 105-109. 1952.