HIGHLIGHTS

of agricultural research

VOL. 19, NO. 4/WINTER 1972

Agricultural Experiment Station
AUBURN UNIVERSITY

DIRECTOR'S COMMENTS

THE TEACHING OF Agriculture at Auburn University began its 101st session this fall. Also the Alabama Agricultural Experiment Station began its 90th year of service to the people of the State.

Agricultural teaching began with establishment of the Alabama Agricultural and Mechanical College at Auburn in 1872 when the State Legislature accepted the Morrill Act of 1862. This Act of the National Congress provided colleges for the benefit of agriculture and the mechanic arts – the system of Land-Grant Colleges.

R. DENNIS ROUSE

The Agricultural Experiment Station dates from 1883 when the Alabama Legislature appropriated funds to purchase land at Auburn on which to establish an agricultural experiment station where professors of this land-grant college could learn more about the science of agriculture. The president of what is now Auburn University named C. L. Newman, a horticulturist, as the first director. Five other men held the title before I filled the position left vacant by retirement of E. V. Smith: P. H. Mell, a botanist and meterologist; J. F. Duggar, an agronomist; Dan T. Gray, an animal scientist; M. J. Funchess, an agronomist; and E. V. Smith, botanist and plant physiologist. Beginning with Dan T. Gray in 1921, the director also had responsibility of dean of the School of Agriculture.

It is an exciting privilege to be appointed to this office and to experience the opportunity it provides for working with the faculty, staff, and students who are the School of Agriculture and Agricultural Experiment Station. Others who have assumed this office no doubt had an appreciation for the quality of the faculty and staff that made up the organization they were asked to administer. However, none before me could have moved into this office with a staff nearly as outstanding as the scientists and teachers who make up this organization in 1972. I have worked with and been truly interested in the contributions of each.

One of my goals will be to assure continued support as they endeavor to discover new facts and improve mankind's knowledge in the broad area of agriculture. Not only are these scientists investigating the biological and physical aspects of the world in which we live, but they are also seeking new understanding of the people that live and work in this world. It is not enough to be the most agriculturally productive nation. We must learn how to live productively and harmoniously with one another and how better to keep Alabama beautiful as a place to live, work, and enjoy life.

I fully believe that what has made this Nation so great agriculturally is the cooperation between those in all aspects of agriculture. The Land-Grant College System with teaching, research, and extension, State Department of Agriculture and Industries, the U.S. Department of Agriculture, the U.S. Department of Interior, farmers and foresters, and the agri-business interest have all worked together to bring better food and fiber products more economically to the consumer. We shall endeavor to maintain this spirit of cooperation, knowing that our research must be directed towards problems that are important to people of our State.

In future issues of "Highlights" we expect to bring you results of timely research as we have in the past, but we also plan to have some special issues devoted to topics of particular interest such as the environment. In this column subjects will be reviewed to bring a better insight of agricultural research in Alabama.

may we introduce . . .

W. Alfred Dozier, Jr., senior author of the story about apple rootstocks on page 3, is assistant professor of horticulture at Auburn University School of Agriculture and Agricultural Experiment Station. His research is concerned with production of fruits and nuts commonly grown in Alabama, and he also teaches undergraduate horticulture courses.

Dozier joined the Auburn faculty in 1971 following completion of his doctoral studies at Virginia Polytechnic Institute. He received the B.S. degree in 1963 and M.S. in 1965, both from Auburn University. From 1965 to 1968 he served as instructor of horticulture at Auburn before beginning doctoral studies at VPI.

Dozier has been author or coauthor of several publications reporting results of his research on such subjects as pecan growth and development, chemical thinning of pecans, minimum tillage for apple and peach production, and peach variety performance.

The Hurtsboro, Alabama, native holds membership in Alpha Zeta and Gamma Sigma Delta, agriculture honoraries.

HIGHLIGHTS of Agricultural Research

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ON THE COVER. Experimental apple orchard at Piedmont Substation, Camp Hill.

Performance of Selected Apple Rootstocks in Alabama

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SELECTION OF ROOTSTOCK for apple trees is one of the most important decisions made before establishing an orchard. A wrong choice will penalize the grower as long as the orchard is maintained.

A recent-year trend in apple growing regions has been a shift from standard (seedling rootstock) to semi-dwarf trees. Semi-dwarfs have the advantage of earlier fruiting, lower labor and maintenance cost, and higher per acre yields.

Performance of seedling and selected semi-dwarfing apple rootstocks was studied at the Piedmont Substation, Camp Hill. Effect of rootstocks on yield, tree size, and susceptibility to root rot diseases and woolly apple aphids was determined. Medium size, year-old apple whips were planted in winter 1965 (seedling and Malling-Merton 104) and winter 1966 (MM 106 and MM 111).

Tree infected with black root rot was blown over in full foliage and fruiting.

Miller Sturdy Spur strain of Red Delicious was the main scion variety and Sundale Sturdy Spur Golden Delicious was the pollinator.

The strain of Golden Delicious used did not bloom with the Red Delicious. This resulted in poor pollination, which made it difficult to measure rootstock influence early in the orchard's life. The Golden Delicious trees were subsequently grafted to Mollies Delicious, a good pollinator for Red Delicious, to overcome the pollination problem.

All trees in the test set a heavy crop in 1972 and required thinning. Trees on MM 106 rootstocks produced the highest yield per tree (78 lb.), even though they were 1 year younger than the trees on MM 104 and seedlings. MM 104 trees were second with 75 lb. per tree and those on seedling rootstock next at 65 lb. Lowest yields, 45 lb. per tree, were produced by trees on MM 111 rootstock. Trees on MM 104 and MM 106 came into production sooner and heavier than those on MM 111 and seedling rootstocks.

Seedling rootstocks produced the largest trees and MM 111 the smallest, as shown by these October 1972 measurements (diameter measured 1 ft. above ground and width at widest point of canopy):

Rootstock	*Diameter, in.*	*Width, ft.*	*Height, ft.*
MM 106	3.3	7.7	10.9
MM 104	3.4	7.0	10.0
Seedling	3.9	7.7	11.5
MM 111	2.7	6.1	9.4

Trees on seedling rootstocks were excessively vegetative and more difficult to manage than trees on semi-dwarfing rootstocks. Trees on MM 111 exhibited poor vigor. Lateral branches did not develop from the major scaffold branches; therefore, potential fruiting surface was less than with the other rootstocks. Foliage was small and sparse in comparison with trees on the other rootstocks.

During the 7 years of observations, 17.5% of trees died. Samples from the root system of dead trees were used for laboratory determination of the causal agent. Black root rot accounted for 15% of the losses, and 2.5% was caused by white and armillaria root rots. Malling-Merton 104 rootstock was the most susceptible to root rot diseases, with black root rot being especially deadly to trees on this rootstock (see photo). MM 104 rootstock appears to be much more susceptible to black root rot than seedling, MM 106, and MM 111, according to results in the table.

SUSCEPTIBILITY OF APPLE ROOTSTOCKS TO ROOT ROTS

Rootstock	Rootstock loss from root rots[1]			
	Black root rot	White root rot	Armillaria root rot	Total
	Pct.	*Pct.*	*Pct.*	*Pct.*
MM 106	6	0	2	8
Seedling	8	2	0	10
MM 111	12	0	0	12
MM 104	34	2	2	38

[1] Covers 7 years for MM 104 and seedling rootstock and 6 years for MM 106 and 111.

During July 1971, roots of all trees were sampled from the drip line to the trunks at a 6-in. depth to determine woolly apple aphid infestation. Seedling rootstocks were significantly more susceptible to woolly apple aphid than the Malling-Merton rootstocks, as shown below:

Rootstock	*Susceptibility rating (1 = least, 5 = most)*	*Percentage infested*
MM 106	1.0	4.3
Seedling	2.7	55.5
MM 111	1.2	19.1
MM 104	1.1	3.2

Most seedling rootstocks were moderately to heavily infested with aphid colonies, and galling was found on lateral roots as well as on small feeder roots. Malling-Merton rootstocks were lightly infested or galled primarily on small feeder roots. MM 111 showed a considerably higher degree of susceptibility than MM 104 or MM 106, although these differences were too small to be definitely established as being caused by rootstock.

Malling-Merton 106 appears to be the apple rootstock best suited to Alabama conditions, when considering all factors investigated.

Photo shows 10 years of winter burning (l.) compared with the control (r.).

PRESCRIBED BURNING in a HILLY PINE FOREST

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W. J. WATSON, *Lower Coastal Plain Substation*

PRESCRIBED BURNING is recognized as a useful tool for controlling understory hardwood species and for improving wildlife habitat in pine stands on gentle terrain. Similar use on hilly terrain has been open to question.

This study was started in 1961 at the Lower Coastal Plain Substation, Camden, in 30- to 40-year old loblolly pine stands, of old-field origin, on Ruston and Susquehanna soils. The terrain was hilly, with slopes varying from 5 to 35%. The three treatments, each applied on seven 1/5-acre plots, were repeated summer burning, repeated winter burning, and no burning (control). Completely killed and topkilled hardwoods, 1 to 3 in. in diameter, were tallied in 1966 and 1971.

The initial burning was conducted on all plots in the winter of 1962 to reduce hazardous fuel accumulation. Summer burns were applied, usually in August, in 1963, 1965, 1967, 1969, and 1970, and winter burns, usually in February, in 1964, 1965, 1968, 1969, 1970, and 1971.

TABLE 1. UNDERSTORY HARDWOODS COMPLETELY KILLED, WITHOUT SPROUTING, BY BURNING

Treatment and year tallied	Sweet-gum	Wing. elm	Hick.	Red oak	Water oak	All species
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Summer burn, 1966	18	2	4	0	6	8
Winter burn, 1966	13	0	0	2	0	4
Summer burn, 1971	27	4	5	0	15	13
Winter burn, 1971	15	6	0	9	5	8

Table 1 shows percentages of complete kill by species. After burning in 6 summers and 7 winters during 1962-71, 13% and 8% respectively of all species were completely killed. The last 3 summer burnings (1966-71) added 5% kill to the previous 8%; the last 4 winter burnings (1966-71) added 4% kill to the previous 4%. The highest complete kill was attained on sweetgum. Summer burning killed most species more effectively than did winter burning. Red oak was the outstanding exception.

TABLE 2. UNDERSTORY HARDWOODS TOPKILLED BY BURNING

Treatment and year tallied	Sweet-gum	Wing. elm	Hick.	Red oak	Water oak	All species
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Summer burn, 1966	92	100	83	82	94	90
Winter burn, 1966	89	85	61	64	88	78
Summer burn, 1971	96	100	86	88	96	93
Winter burn, 1971	95	93	69	76	90	86

Table 2 shows percentages of hardwoods topkilled by burning, including the non-sprouting hardwoods of Table 1. By subtraction, it can readily be seen that most of the topkilled hardwoods had live rootstocks even in 1971. The effectiveness of summer burning in topkilling had nearly reached its maximum by 1966. Topkilling progressed more slowly under winter burning, but it reached 90% or more effectiveness by 1971 for all species except the hickories and red oaks. Neither the summer nor the winter burns caused appreciable damage in the pine overstory. In non-burned plots, mortality in both overstory and understory was negligible.

TABLE 3. HERBAGE PRODUCTION, OVEN-DRY WEIGHT, IN BURNED AND UNBURNED FOREST

Treatment	Grasses	Legumes	Other herbs	Total
	Lb./A.	*Lb./A.*	*Lb./A.*	*Lb./A.*
Winter burn	158	272	319	749
Summer burn	59	106	150	315
Unburned	34	14	8	56

Table 3 shows burning effects on herbage production from 1971 summer measurements. Herbage production of unburned plots was far below that of burned plots. Repeated burning maintained a high diversity of herbage, particularly in legumes, grasses, and composites. Since winter burning produced by far the greatest weight of herbs in all the classes, it must be considered the superior treatment for improving wildlife habitat.

In summary, neither summer nor winter burning was highly effective in killing hardwood rootstocks. Both burning treatments were effective over the 10-year period in topkilling the hardwoods. Winter burning best improved wildlife habitat and was less hazardous to apply than summer burning.

Light in the Corn Field

C. E. SCARSBROOK, *Department of Agronomy and Soils*
B. D. DOSS, *Foundation Seed Stocks Farm (Coop. USDA, ARS)*

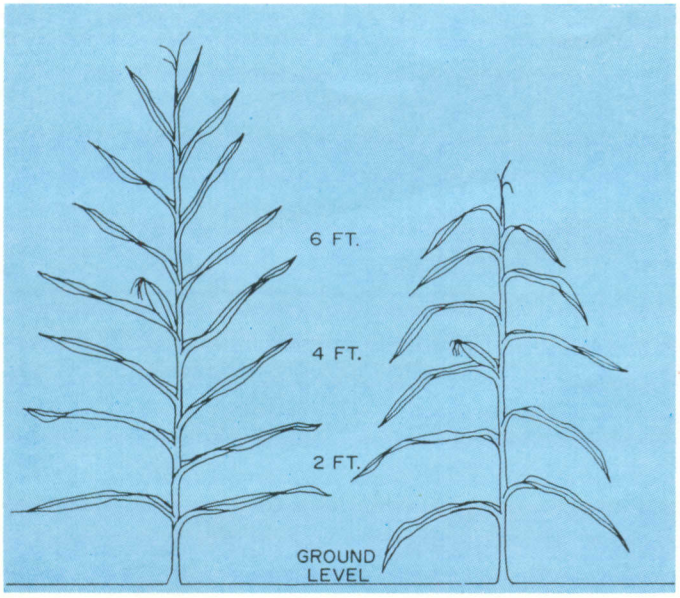


FIG. 1. Light measurements at ground level and at 2, 4, and 6 ft. heights showed differences in amount of light penetrating canopies of Funk's G-5945 (left) and Funk's G-5757 (right) corn.

CROP YIELDS COULD BE HIGHER if sunlight were used more efficiently. Sunlight that misses plant leaves and directly hits the ground (sometimes called sunflecks) is mostly wasted. Only that striking the leaves is used.

The goal in crop production is for plants to use as much of the sunlight energy as possible in the food manufacturing process. More sunlight energy can be trapped by using more plants per acre or plants with upright leaves. The upright-leaf characteristic is used in the new wheat and rice varieties that are the basis for what is called "the green revolution."

Auburn research is concerned with determining light conditions within corn canopies. Two varieties were used, with two row widths and three plant populations. The crop was irrigated.

One hybrid, Funk's G-5945, was a full season corn with the topmost leaves nearly vertical and lower ones progressively more horizontal. The other was Funk's G-5757, which matured 7 to 10 days earlier than G-5945 and had horizontal leaf orientation.

Row widths were 20 and 40 in. Plant populations tried were 8,000, 16,000, and 32,000 plants per acre. The 8,000-plant population was grown only in 40-in rows.

Light was measured midway between the rows with light-sensitive paper placed on the ground and at 2, 4, and 6 ft. above ground, Figure 1. These measurements began in early June and were continued to mid-July.

At all heights measured, less light penetrated the more upright leaf (G-5945) canopy than the more horizontal (G-5757) leaves, Figure 2. This disputes the idea that upright leaves allow more light to penetrate the canopy. However, this variance from the expected is explained by the greater plant height (9-14 in. at maturity) of the more upright variety. Thus, there were more leaves above each measuring point to intercept light on G-5945 than on G-5757.

Each increase in plant population resulted in more light being absorbed by the plants, which is one purpose of increasing numbers of plants per acre. There was more absorption of sunlight in the 20-in. rows than in 40-in. rows, reflecting a better distribution of plants.

Greater absorption of light with increasing numbers of plants per acre showed up in grain yield. More plants and narrower rows each resulted in higher yield. Thus, increased light absorption because of both more plants and better distribution of plants increased grain yields, as shown below:

Row width and population	*Per acre yield by variety, bu.*	
	G-5757	*G-5945*
40-in. rows		
8,000 plants	89	100
16,000 plants	116	118
32,000 plants	126	123
20-in. rows		
16,000 plants	124	125
32,000 plants	145	132

Obviously there is a limit to the number of plants that will give increased yield. If the planting is too dense, much foliage but little grain will be produced. While these limits were not reached in this study, the high populations did cause some undesirable features. Plants in the dense populations were as much as a foot taller than on thinner plantings. Then, too, the stalk cross-sectional area with 32,000 plants was only half that of stalks from 8,000-plant populations. While lodging was not severe, the taller plants with smaller stalks were more subject to breaking over.

Studies are continuing at Auburn in efforts to better utilize sunlight for high yields while minimizing undesirable side effects of high plant populations.

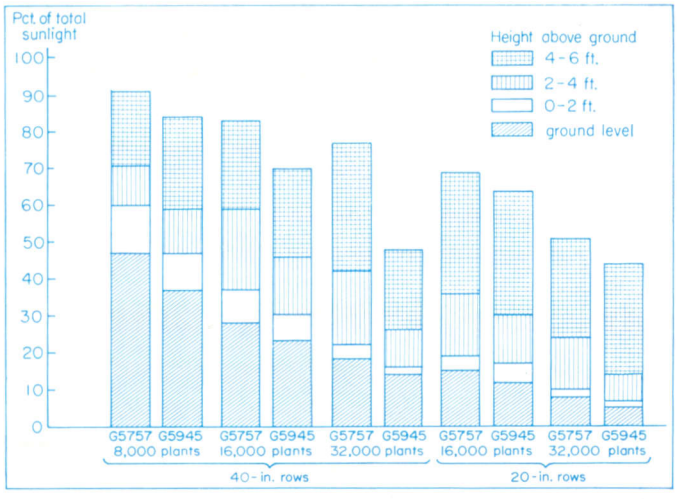


FIG. 2. Proportion of total sunlight at four depths in the corn canopy at different row widths, plant populations, and varieties.

Program assistant contacts homemaker on EFNEP program.

HOMEMAKER RESPONSE to EFNEP

N. W. MARTIN[1] A. B. PRATT[2] and J. E. DUNKELBERGER
Department of Agricultural Economics and Rural Sociology

DETERMINING what food is best to meet a family's needs can be a difficult task for low-income homemakers.

Once the purchase is made, many homemakers are handicapped by a limited knowledge of good nutrition and a lack of skill in food preparation. To assist these homemakers the Cooperative Extension Service initiated an educational program – Expanded Foods and Nutrition Program (EFNEP).

A major effort was made in 1971 to expand EFNEP throughout Alabama. At the same time an Agricultural Experiment Station study was begun by the Department of Agricultural Economics and Rural Sociology to investigate a number of questions pertaining to the program. Questions for which answers were sought included: Who are the homemakers and families being reached? Are some homemakers more responsive than others? Do identifiable characteristics exist that distinguish enrolling families from those that do not enroll? And, are some techniques more effective than others in motivating a homemaker to enroll?

Chambers County was the site for this study. As the list of prospective participants in EFNEP was obtained from a variety of local agencies during the spring of 1971, trained interviewers contacted each homemaker. The prospect list included 150 families from which interviews were completed with 147.

Immediately following completion of these interviews, county Extension personnel began enrollment activities. At the end of 4 months, program assistants had contacted homemakers on the original prospect list and had enrolled 85 (58%) in the program. The following comparisons are made between those homemakers who accepted, and those who rejected, participation in EFNEP.

Several differences were observed in homemaker response to the program, see table. More of both the younger (under 30) and older (45 and over) homemakers enrolled. Acceptance was somewhat greater among the "middle poor" with incomes in the $1,800 to $3,000 range than among those with incomes either below or above this range. Homemakers were more likely to enroll, too, when the home included common household conveniences such as stove, refrigerator, and running water. Absence of these home conveniences may serve as a barrier to participation in EFNEP, since the program assistant actually visits in the home.

Acceptance of EFNEP was associated with family participation in other community programs. The most important was the commodity foods program. Families not receiving commodities had a lower acceptance rate than those receiving them. However, even then, acceptance of EFNEP occurred among only two-thirds of the commodity families contacted. A similar observation was made in relation to other community assistance programs. Families indicating a history of program participation were more likely to enroll in EFNEP than were those lacking this experience.

Employment of the homemaker outside the home was another major factor. Homemakers employed full-time were twice as likely not to enroll in EFNEP than were those not employed. Part-time employment also affected the rate of enrollment, but not to the same extent as full-time work.

Of particular interest was the nutritional adequacy of the daily diets in these families. A simple measure of dietary adequacy based on daily servings of foods from the four basic food groups – meat, milk products, bread/cereal, and vegetable/fruit – was used. More than 80% of the families were deficient in two food areas, usually milk products and vegetable/fruit. In addition, families with the least adequate diets were also least likely to enroll in EFNEP.

Program assistants who attempted to enroll homemakers in EFNEP with different approaches were more successful than those emphasizing only a single approach. The approaches used included: talking about the commodity foods program and the cooking school operated by the County Extension Service; offering sample foods to introduce the topic of nutrition and cooking; and an "idea basket" to stimulate interest in a number of domestic activities. Most homemakers enrolling in EFNEP did so the first time contacted by a program assistant.

HOMEMAKER ACCEPTANCE OF EFNEP COMPARED FOR SELECTED FAMILY CHARACTERISTICS

Characteristic	EFNEP response	
	Acc.	Diff.[1]
	Pct.	*Pct.*
All homemakers	58	
Age:		
Under 30 yr.	68	+10
30-44 yr.	45	−13
45 yr. and over	70	+12
Employment of homemaker		
Full-time	39	+19
Part-time	47	+11
None	66	+8
Commodity foods program		
Participating	65	+7
Not participating	41	−17
Adequacy of daily diet		
No adequate food groups	32	−26
One adequate food group	56	−2
Two adequate food groups	60	+2
Three adequate food groups	74	+16
Four adequate food groups	100	+42

[1] Difference between the percentage of all homemakers contacted by the program assistants (58%) and the percentage of homemakers with each attribute who joined EFNEP.

[1] Former Specialist, Cooperative Extension Service.
[2] Resigned.

What Makes Weeds Grow?

DAVID H. TEEM, C. S. HOVELAND, and GALE A. BUCHANAN
Department of Agronomy and Soils

ARE SICKLEPOD (coffeeweed), tall morningglory, and prickly sida problem weeds in your fields? Were they problems 5 or 10 years ago? If not, what has happened to cause them to become problems?

Shifts in weed population may be caused by changes in soil pH, planting dates, or use of herbicides. If we are to obtain effective and efficient weed control we need to know as much as possible about the weed itself and how these factors affect its growth.

Competition between weed and crop species is often critical during the seedling stage. Generally, the most rapidly established species will crowd out or seriously delay other species. Root growth rate is critical in the establishment of one species and the failure of another. However, little attention has been given to the factors which may affect seedling root growth of crops or weeds. To understand root growth better, experiments were conducted to determine the influence of soil pH, soil temperature, and trifluralin (Treflan) rates on seedling root growth of three weed species that have become problems in summer annual crops in the Southeast.

Sicklepod, tall morningglory, and prickly sida were grown on Norfolk sandy loam soil at pH 5.1, 5.5, and 6.5. Root growth of each species was somewhat less at lower soil pH values, Figure 1. The detrimental effect of low pH was greater for sicklepod than for tall morningglory or prickly sida. However, roots of these three weed species are more tolerant of low soil pH when compared with roots of sensitive crops such as cotton, thus giving the weeds a competitive advantage when liming is neglected.

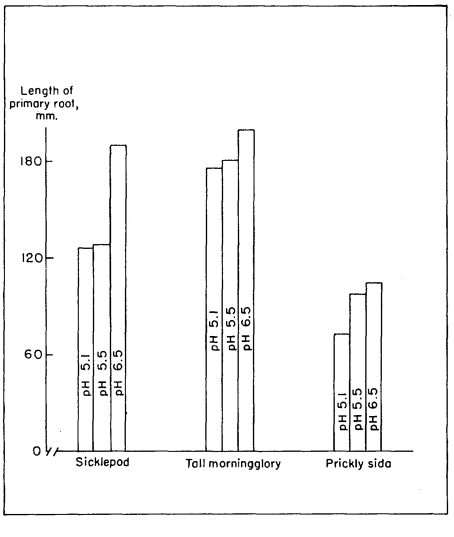


FIG. 1. Influence of soil pH on root elongation of three weed species.

The same three weed species were also grown in Dothan loamy sand at controlled soil temperatures of 64°F, 77°F, 90°F, and 102°F. The optimum temperature for root growth of these weeds was found to be approximately 90°F, which is similar to that for cotton, Figure 2. At this temperature cotton roots grew much faster than any of the weeds studied. However, when roots were grown at temperatures similar to those that exist when cotton is usually planted (64°-77°F), root growth of all species studied was similar. When seedling competition is considered, early planting of cotton in cool soils would appear to favor these weed species. However, for a crop such as corn, which is more tolerant of cool soils, early planting might be an effective means of reducing competition from these weeds.

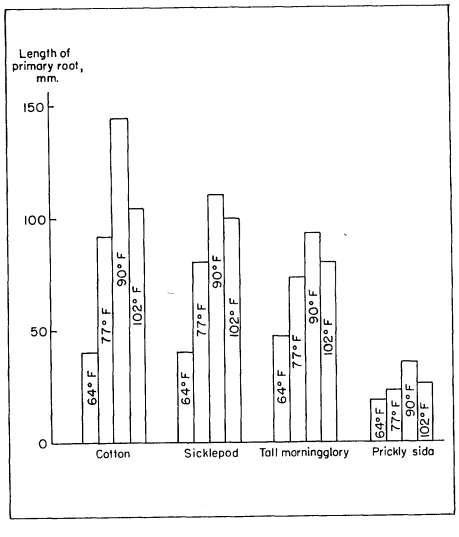


FIG. 2. Influence of soil temperature on root elongation of cotton and three weed species.

Trifluralin was mixed in Dothan loamy sand at rates of 0.0, 0.2, 0.4, and 1.0 p.p.m. Roots of sicklepod and prickly sida were remarkably tolerant of trifluralin.

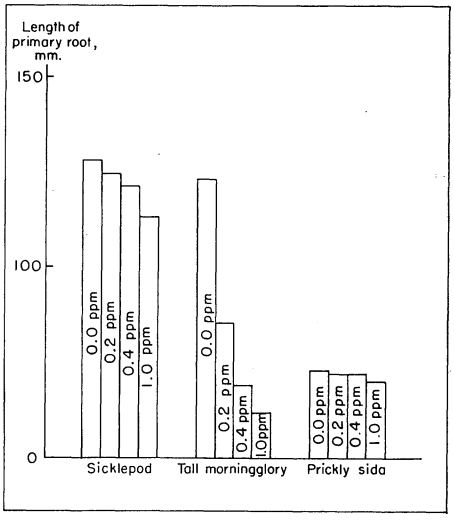
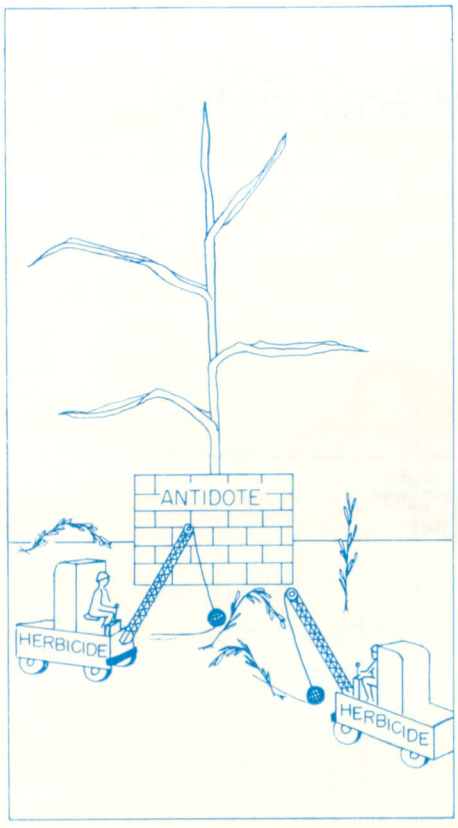


FIG. 3. Influence of trifluralin on root elongation of three weed species.

However, tall morningglory root growth was reduced by each rate of trifluralin studied, Figure 3. This tolerance of sicklepod and prickly sida may in part account for their increasing in fields where trifluralin is used. However, increases of tall morningglory must be explained by something other than tolerance. Tall morningglory apparently survives by escaping contact with the herbicide. Although several methods of escape are possible, the most probable is germination and emergence from below the treated zone in the soil. Trifluralin is generally incorporated to a depth of 2 to 3 in. and tall morningglory will emerge from as deep as 7 in.

At a time when the use of pesticides is under attack, more information is needed on the weeds themselves and how various control measures affect them. Hopefully, we will find a weakness in the weed and devise a control method to most effectively exploit that weakness.



Antidotes protect crop plants against damage from herbicides while the chemical weed killers knock down pesky weeds.

Herbicide Antidotes for Crop Protection

GALE A. BUCHANAN, ROBERT D. MCLAUGHLIN, and GEORGE WARD
Department of Agronomy and Soils

Selective herbicides are so designated because they control weeds and at the same time cause little or no crop injury. This selectivity is the basis for successful chemical weed control programs in agronomic crops. Nonselective herbicides are used where control of all vegetation is desired.

Techniques of obtaining herbicide selectivity are many and varied. For example, atrazine does not injure corn because corn has the capacity to change atrazine into a non-toxic form after it is absorbed by the plant. Many common weeds (and most crop plants other than corn) do not have this capacity and are severely injured or killed by contact with atrazine.

The opposite situation makes possible the use of 2,4-DB for control of cocklebur and other weeds in soybeans. Cocklebur contains enzymes necessary to convert the inactive 2,4-DB into 2,4-D, which is toxic. Once a cocklebur plant has synthesized 2,4-D, it is killed by the herbicide it has synthesized. Soybeans also convert 2,4-DB to 2,4-D, but at a much slower rate, so there is much less injury than to the cocklebur.

Placement of herbicide is another method of getting selectivity. This simply means that crop seed are placed to escape the damaging effects of the herbicide. Selectivity in many crop situations is a result of combining placement with the other technique described. After the crop has emerged, selectivity can be obtained by directing the herbicide to the base of the crop plant.

Charcoal can be used to achieve selectivity in certain situations. Either seed are coated with a layer of charcoal or the charcoal is placed near roots of transplanted seedlings. The charcoal strongly absorbs the herbicide, thereby protecting emerging seedlings or new transplants.

A new technique of selectivity – use of herbicide antidotes – has received considerable attention in recent months. The antidote is supposed to protect the crop from a damaging herbicide without affecting its control of weeds.

One such antidote[1] has been evaluated for protection of corn during the past 3 years by Auburn University Agricultural Experiment Station. This research has centered around three of the thiocarbamate herbicides – EPTC, vernolate, and butylate. Butylate is currently used for weed control in corn. The antidote was tried both as a seed treatment and as an additive with herbicidal spray.

There was no apparent advantage from adding the antidote to butylate, as shown by results in the table. But this is not unexpected. Butylate is labeled for weed control in corn and is currently used for this crop. Some varieties of corn are more sensitive to butylate than others, however, and these might be protected by the antidote.

Without the antidote, vernolate caused substantial injury to corn. Injury ranged from 8% at 3 lb. per acre in 1971 to 94% at the 8-lb. rate in 1972. When the antidote was included in the spray mixture there was no injury to corn in 1971 and only slight damage in 1972. Corn treated with 8 lb. of vernolate plus the antidote was similar to that on untreated checks.

Almost the same pattern of results was obtained with EPTC. Without the antidote, injury to corn was 81% and 95% in 1972. When the antidote was included there was no noticeable damage.

An additional experiment in 1972 indicated that the antidote was effective at rates as low as 1/16 lb. per acre. And it greatly reduced corn injury even at the lowest rate, 1/64 lb. per acre, as shown below:

Antidote per acre	*Corn injury*	
	Butylate, 8 lb.	*EPTC, 8 lb.*
1/8 lb.	0	1%
1/16 lb.	0	0
1/64 lb.	4%	21%
None	3%	95%

Use of antidotes as a protective technique represents a promising way to get herbicide selectivity. Refinement of such a method would mean that volunteer plants could be removed from the same crop by applying the antidote to the crop seed planted. Further development of this technique might give still another weapon for use in the farmer's war on weeds.

Corn Injury from Butylate, Vernolate, and EPTC, with and Without Antidote

Treatment	Injury to corn	
	1971	1972
	Pct.	*Pct.*
Butylate, no antidote		
4 lb. per acre	6	0
8 lb. per acre	0	3
Butylate, with antidote		
4 lb. per acre	5	0
8 lb. per acre	0	6
Vernolate, no antidote		
3 lb. per acre	8	---
4 lb. per acre	---	73
6 lb. per acre	48	---
8 lb. per acre	---	94
Vernolate, with antidote		
3 lb. per acre	0	---
4 lb. per acre	---	6
6 lb. per acre	0	---
8 lb. per acre	---	0
EPTC, no antidote		
3 lb. per acre	18	---
4 lb. per acre	---	81
6 lb. per acre	49	---
8 lb. per acre	---	95
EPTC, with antidote		
3 lb. per acre	0	---
4 lb. per acre	---	0
6 lb. per acre	5	---
8 lb. per acre	---	0

[1] The antidote studied was supplied by Stauffer Chemical Co.

FARM CREDIT - - - Needs and Sources

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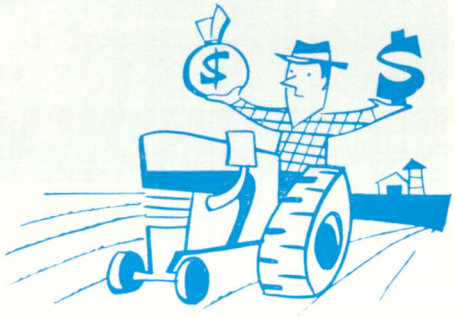

CREDIT is increasingly important in farming because of mushrooming capital and operating expense requirements. Farmers face critical credit decisions in acquiring the resources to get set up in farming and to carry out farming operations. They also make decisions involving credit for personal items just as does the nonfarmer. Wise use of credit can mean the difference between success and failure.

Total capital investment per farm more than doubled in the past 10 years, according to USDA reports. In 1960, the average investment or value of farm real estate, livestock, machinery, and inventories of feed, seed, and supplies on hand was $42,100 per farm. In 1970, the average investment was $91,700 per farm, an increase of 118%. Considering the trend of increased farm capital investment, one can see why questions are being raised about who will control agriculture in the future and who will supply the capital needed to produce food and fiber for a growing population.

Farm real estate makes up about 75% of the average total capital investment per farm for the U.S. While total investment in farms doubled in the past 10 years, the amount invested in farm real estate increased by a greater percentage. The average investment in real estate per farm was $31,700 in 1960 compared with $70,700 in 1970, an increase of 123%. U.S. farm real estate values per acre increased 68% during the same period. The increase in farm real estate investment occurred because of acres added and higher per acre farm real estate prices.

Farmers found it was necessary to increase their volume of production. This was done, in part, by adding acres to their operations. They bought or rented additional land. If land nearby became available for sale, they frequently bought at a price somewhat above the overall market value prevailing for similar farm land because the land nearby was worth more to them. Since about half of all farm land purchases in recent years have been for farm enlargement, this has been a factor in higher investments and the need for credit. If additional land were rented, a rental cost was incurred. In any case, with larger farm operating units, input expenditures have increased. This too has pushed farm credit needs upward.

In the U.S. from 1960 to 1970, total farm operating expenses increased 56%, an increase considerably less than that in capital investment per farm during the same period. However, certain categories of operating expenses increased substantially. For example, fertilizer and lime expenditures by U.S. farmers increased 69%, livestock purchases 74%, taxes on farm property 97%, and interest on farm mortgage debt 173% in the past 10 years. Total farm production expenses went from $26.4 billion in 1960 to $41.1 billion in 1970. On a per farm basis the increase in operating expenses during the 10-year period was more dramatic. Although all production expenses do not involve credit transactions, the increased needs and demands for credit are evident from the increases that have occurred in expenses.

In Alabama, the major lender for farm real estate loans outstanding January 1, 1970 was the Federal Land Bank, see table. Operating banks were also important for this category of farm debt, as were individual holders of farm mortgages. Life insurance companies and the Farmers Home Administration were also holders of substantial amounts of farm mortgages.

As for total non-real estate loans outstanding for major lending institutions, the leader was operating banks. They held 55% of the total volume of non-real estate loans as of January 1, 1970. Production Credit Associations were second and the Farmers Home Administration was third for this category of loans. Data were not reported for the many kinds of individual business firms and companies that finance agricultural production items. These are also important sources of farmer credit.

Agriculture is no longer the same as it was even a few years ago. It changes almost annually as the scientific advances resulting from research and experimentation are applied on farms and in agribusiness firms. As a result, capital and credit needs change.

Today's farmers generally need substantially larger amounts of credit and at varying times throughout the year. Their credit needs are influenced by farm organization, kinds of enterprises, production systems and schedules, prices, and marketing dates. Farmers are increasingly aware of the need for and usefulness of financial statements of various kinds in making credit decisions. It is a challenge for the suppliers of credit to those in the broad field of agriculture to keep up with changing credit needs and to move ahead in meeting these needs.

REAL ESTATE AND NON-REAL ESTATE LOANS OUTSTANDING ON FARMS, ALABAMA, JANUARY 1, 1970[1]

Principal lenders and institutions	Amount
	1,000 dol.
Farm real estate loans	
Federal Land Bank	126,857
All operating banks	83,478
Life insurance companies	47,500
Farmers Home Administration	24,820
Others[2]	79,179
Total	361,834
Non-real estate loans	
All operating banks	79,175
Production Credit Assoc.	52,937
Farmers Home Administration	11,200
Total	143,312

[1] Source: Agr. Finance Review, ERS, USDA, Vol. 31, Supp. Dec. 1970.
[2] Mortgages held primarily by individuals.

DETERMINING LIGNIN CONTENT of SERICEA

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Stems of common (l.) and Interstate (r.) provide vivid contrast, but these stem differences may not reflect lignin content differences.

Lignin is a highly indigestible part of grazed or harvested forage. Thus, accurate measurement of lignin is important in determining the nutritive value of the forage. This is especially so when breeding for low lignin to improve the feeding value of a crop. More accurate lignin measurements on parent plants should enhance progress in selecting low lignin offspring.

Lignin percentage of sericea forage was found to be much higher than appeared reasonable when measured by the method used for most plants – the sulphuric acid method. Consequently, other methods that would give a more accurate lignin measurement were sought.

Leaves were separated from stems of both high- and low-tannin sericea. Tannin was determined by the Folin-Denis method described by Wilson[1]. Acid-detergent fiber and lignin were determined by the method of Van Soest[2]. Lignin was also determined by the sulphuric acid method[3].

Leaves of two normal (high-tannin) sericea varieties, common and Serala, and low-tannin Beltsville 23-864-8 were higher in tannin than were stems, Table 1. When analyzed by the sulphuric acid method, leaves of the high-tannin varieties were higher in apparent lignin than were stems. Conversely, leaves of the low-tannin sericea were lower in apparent lignin than were stems when analyzed by this method. These data suggest that high-tannin leaves will show higher apparent lignin values than low-tannin leaves. Since leaves are higher in tannin than stems, leaves will show higher apparent lignin values than will stems in both high- and low-tannin plants.

When tannin, other acid-soluble material, and protein were removed from sericea leaf and stem forage by the acid detergent lignin method, lignin in leaves averaged 29% less than lignin in stems, Table 1. Leaf lignin values were reduced 51% and stem lignin values were reduced 26% by the acid detergent lignin method in comparison with the sulphuric acid method. Again, it was indicated that tannin interferes with lignin determination of sericea forage.

When 12 sericea lines and varieties were analyzed for tannin, and for acid-detergent fiber and lignin by the acid detergent lignin method, differences were found among these lines for all three components. Data from the two lines that averaged lowest and highest for these components are shown in Table 2. The lowest sericea line averaged (stems and leaves of two hay cuts) 12% less lignin and 6% less fiber than the highest.

TABLE 1. TANNIN AND APPARENT LIGNIN CONTENT OF SERICEA LESPEDEZA FORAGE

Plant material	Tannin	Method for determining lignin	
		Sulphuric acid[1]	Acid detergent
	Pct.	*Pct.*	*Pct.*
Common			
Leaves	9.3	18.5	9.3
Stems	3.0	16.3	12.8
Serala			
Leaves	8.4	19.6	8.8
Stems	2.2	16.1	12.1
Beltsville 23-864-8			
Leaves	2.8	15.5	8.0
Stems	1.5	17.8	12.0

[1] Determinations made by Law & Co., Atlanta, Ga.

These data show that lower and more reasonable lignin values can be obtained for sericea forage by using the acid detergent lignin method rather than the conventional sulphuric acid method. Tannin was associated with high apparent lignin values when determined by the latter method. Differencs in lignin content among sericea lines and varieties were found, indicating that varieties lower in lignin than present ones can be developed. Such varieties should result in the production of higher quality forage.

TABLE 2. TANNIN AND ACID DETERGENT FIBER AND APPARENT LIGNIN OF STEMS AND LEAVES OF SERICEA LINES[1]

Lines	Tannin		Acid-detergent			
			Lignin		Fiber	
	Stems	Leaves	Stems	Leaves	Stems	Leaves
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Low	2.1	9.3	13.6	8.2	50.4	21.8
High	2.4	10.2	15.4	9.6	52.6	24.2

[1] All values are means of 2 hay cuttings.

[1] WILSON, CLARENCE M. 1955. The Effect of Soil Treatment on the Tannin Content of Sericea Lespedeza. Agronomy J. 47:83-86.

[2] VAN SOEST, PETER J. 1963. Use of Detergents in the Analysis of Fibrous Feeds. II. A Rapid Method for the Determination of Fiber and Lignin. Assoc. Off. Agr. Chem. J. 46:829-835.

[3] ELLIS, G. H., G. MATRONE, AND L. A. MAYNARD. 1946. A 72% H_2SO_4 Method for the Determination of Lignin and its use in Animal Nutrition Studies. J. Animal Science 5:285-297.

EFFECTS of RECREATIONAL INVESTMENTS on AREA EMPLOYMENT and INCOME

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ALABAMA is currently engaged in the largest park facilities development program in the State's history.

Eleven major parks and numerous smaller recreational facilities are being constructed. The total investment is projected to exceed $60 million during the period 1970-75.

Researchers in the Department of Agricultural Economics and Rural Sociology are studying economic effects of the construction program. Questions being studied include: Once a construction contract is awarded how much of the money is spent in Alabama? How many new jobs are created? What kinds of jobs are they? Where do the new workers come from? What types of materials and services are purchased? Where are they purchased? When these and other questions are answered, the total "economic impact" occurring in various counties as a result of park facilities development can be measured.

One park project being studied at Auburn to help answer these questions is the Lake Guntersville State Park, located in Marshall County near Guntersville. To date, the Alabama Department of Conservation and Natural Resources has awarded contracts totaling $7.3 million for the primary construction phase which commenced in 1970. These contracts are about 75% complete. When additional contracts are awarded for the secondary construction phase, total projected cost of the park will be nearly $12 million.

Ten primary contracting firms and at least 36 subcontracting firms have been employed in the construction of the park thus far. Although complete information is not yet available, business firms in at least 16 counties have provided construction materials and services for the project. Over $2.3 million worth of materials have been purchased. Only about 12% of these materials (by value) have been purchased from firms outside of Alabama. Jefferson County firms have provided 26% of the materials, Figure 1. Butler and Marshall County firms have each provided 15% of the construction materials, followed by Madison (9%) and Morgan (8%).

Construction workers from at least 21 counties have been employed at the job site to date, Figure 2. Over 260,000 man-hours, or about 173 man-years, of employment has been created at the job site alone. This total does not include thousands of hours of work performed by managers, engineers, architects, bookkeepers, and secretaries employed by firms under contract for the project. More than half (56%) of the man-hours created by the park's construction has been high-paying skilled jobs, such as plumbers, stonemasons, carpenters, and electricians. Such workers typically have earned $5 or more per hour. Unskilled workers, primarily laborers, have accounted for about 40% of the employment and have earned about $2.50 per hour. Semiskilled workers such as truck drivers, blasters, and welders have accounted for only about 4% of the job-site employment; they have usually earned about $3.75 per hour.

Gross wages paid thus far for work performed at the job site total more than $1.1 million. Of the 21 counties sharing this payroll, Marshall County workers have earned the largest share (42% or $435,126). Workers in the adjoining counties of Etowah (18% or $191,234), Madison (9.6% or $100,540), DeKalb (6% or $62,446), and Cullman (4.3% or $44,912) have also earned large portions of the construction payroll.

The total economic impact caused by construction of the park cannot be measured until the project is complete. However, the widespread and immediate impact on wages and sales in the area can already be seen. When the recreational complex becomes operational, about 50 permanent and 200 seasonal jobs will be created. Wages earned and spent by these workers will in turn become income for other individuals and businesses in the area. The continuing economic impact, after completion of the park, will come from expenditures by visitors to the park. The nature and magnitude of these expenditures will be determined after the park becomes operational. Park expenditures for goods and services, as well as direct expenditures by visitors, will increase gross incomes throughout the area. Thus, the total increases in the area's income and employment will be many times greater than the State's original $12 million investment.

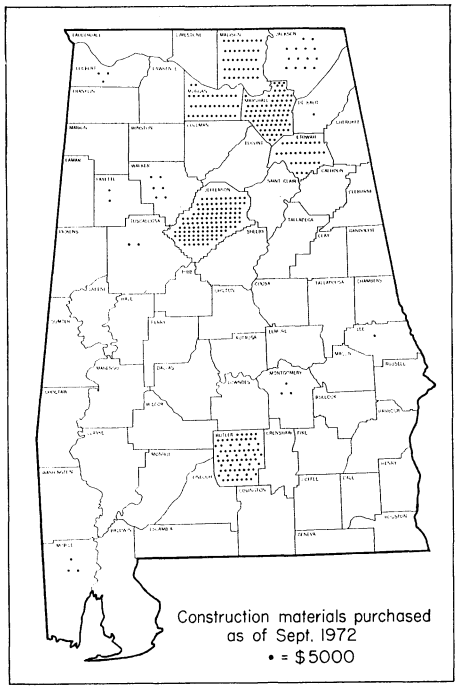

FIG. 1. Distribution by counties of material purchases used in construction of Lake Guntersville State Park.

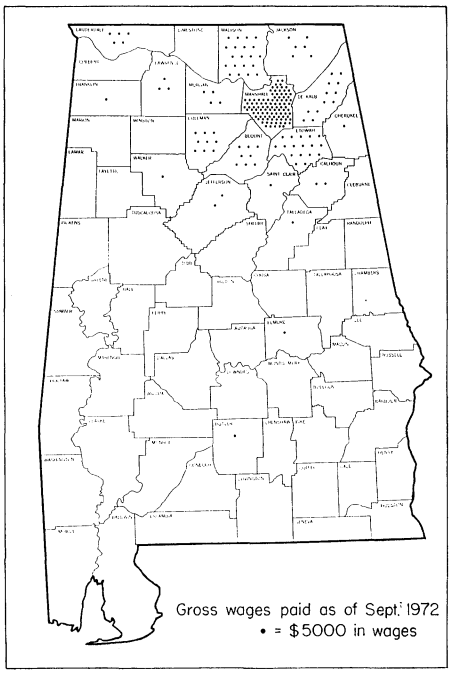

FIG. 2. Distribution by counties of wages earned by workers constructing Lake Guntersville State Park.

Nutritive Value of Pelleted Coastal Bermudagrass Hay

LARGELY DETERMINED BY STAGE OF MATURITY, LESS AFFECTED BY METHOD OF CURING

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GOOD HAY MAKING practices assure top quality Coastal bermudagrass hay, but stage of cutting is the major factor to consider.

Cutting Coastal at immature stages (about 3-week intervals) resulted in much better hay than less frequent harvesting in 2-year Alabama tests. Dehydrating gave small quality increases over sun curing, but the difference was too small to be economical.

A uniform stand of Coastal at the Lower Coastal Plain Substation, Camden, was used in research to determine how certain management factors affected nutritive value of hay. The grass received mineral fertilizer according to soil test and nitrogen at a rate of 180 lb. per acre in split applications.

All swards were cut initially in April and regularly thereafter at 3- and 6-week intervals throughout the season. Portions of each early season (May-early June) and late season (September) cuttings were either dehydrated or sun cured.

EFFECT OF TIME OF CUTTING, GROWTH INTERVAL, AND METHOD OF CURING ON CHEMICAL COMPOSITION AND NUTRIENT DIGESTIBILITY OF COASTAL BERMUDAGRASS HAY

Component	Content and digestibility, by treatment					
	Season		Growth interval		Curing method	
	Early	Late	3-week	6-week	Dehydrated	Sun cured
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Composition[1]						
Crude protein	12.70	11.42	13.73	10.30	12.00	12.12
Cellulose	32.10	32.19	31.67	32.62	31.61	32.68
Ether extract	2.72	2.16	2.60	2.78	2.81	2.07
Sugar	4.24	3.69	3.99	3.94	3.92	4.00
Starch	6.20	6.52	6.10	6.62	6.27	5.67
Ash	5.81	4.89	5.72	4.98	5.44	5.25
Calcium	.64	.54	.62	.54	.57	.58
Phosphorus	.29	.25	.30	.24	.27	.27
Digestibility[2]						
DDM	53.28	51.35	53.91	50.72	53.53	50.82
Digestible energy	51.94	50.14	52.74	49.34	52.56	49.52
Digestible protein	51.28	51.02	55.39	46.90	51.82	50.37
Digestible cellulose	55.88	51.77	56.34	51.32	53.58	54.08

[1] Mean of four hays harvested each of 2 years.
[2] Mean of 24 determinations made during the 2 years.

All hays were pelleted and fed to yearling beef steers in conventional digestion trials.

Protein content of the experimental hays averaged 12.1% on a dry matter basis, about equal to quality of hay produced by better Alabama farmers. (Samples of Coastal hay used in another study that were collected from two farms in each of the State's counties had an average protein content of 12.7%.)

Particular effort was made to obtain sun-cured hay that had not been rained on during curing. Chemical composition data in the table indicate that protein content of the hays generally declined with advance in season and with increasing growth interval from 3 to 6 weeks. The change from 3- to 6-week cutting interval reduced protein content one-third.

Method of curing had no definable effect on chemical composition of the hay. Chemical components other than protein were not altered significantly by the management variables studied.

Digestibility of nutrients in the hay declined with advance in season and lengthened growth interval. Sun-cured hay also was less digestible than that getting artificial dehydration.

Nutrients in the 3-week growth hays were always more digestible than those in 6-week growth hays (difference slightly above 5%). Except for cellulose, dehydrating improved digestibility of nutrients an average of 2.4%. This quality improvement was consistent, but even the greatest increase (4.3%) would not justify investment in equipment necessary to dehydrate Coastal on a routine basis.

Data on early season immature forage showed near 55% digestibility of nutrients in Coastal hay. However, one sample of the early season grass cut at 3-week growth interval and dehydrated had a digestible dry matter (DDM) content of 58.4%. In contrast, a sample of late season, 6-week growth interval, sun-cured hay was about 47% DDM.

Even when harvested at 3-week intervals and dehydrated, Coastal bermuda hay did not have nutritive value comparable to good quality corn silage or alfalfa hay (around 65% DDM usually). Additionally, hay yields averaged 5.5 tons per acre when cut at 6-week intervals but were reduced 26% by cutting every 3 weeks.

Results of this study show the need for good management in making Coastal hay, but indicate only small rewards for management efforts. Growth interval affected nutrient digestibility more than other management factors.

Control of FROGEYE LEAFSPOT, EUROPEAN RED MITES on Apple Foliage

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Control of foliage problems is essential for good apple production in Alabama orchards. Frogeye leafspot and European red mites are common causes of such problems that require attention.

Frogeye leafspot damages trees by defoliation, which may result in inferior quality fruit that year and a reduced crop the following year. The fungus that causes this leafspot also causes blackrot of the fruit.

European red mites represent a major apple pest because they contribute to foliage problems. Their feeding on the underside of green leaves results in plant water losses, reduced photosynthesis, and bronzing of leaves.

Control of frogeye leafspot and European red mites was studied at the Piedmont Substation in 1971 and 1972. Fungicides were evaluated for both leafspot and mite control since certain fungicides possess miticidal or mite-suppressing activity.

Three-tree plots of Red Delicious spur type apples (7 years old when the experiment began in 1971) were treated with fungicides. Applications were made as dilute high pressure sprays (400 to 500 p.s.i.) using a John Bean sprayer equipped with a hand gun. Streptomycin (60 p.p.m.) was applied at 3- to 5-day intervals only during bloom for fire blight control.

Fungicides were applied during bloom at 7-day intervals through petal fall and 10 to 14 days thereafter in the cover spray. Those applied singly or in combinations were Benlate 50W, Cyprex 65W, Dikar 80W, Ferbam 76W, Phaltan 50W, Polyram 80W, Thylate 65W, Thynon 75W, and Topsin-M 70W. Guthion and Systox were applied to fungicide plots at recommended rates in all cover sprays for insect control.

Frogeye leafspot incidence was calculated on percentage leaf area infected, using 5 terminal leaves from 5 different areas of the tree (a total of 25 leaves per tree). Adult mites were counted from 10 leaves per plot within 2 weeks of harvest in both 1971 and 1972. A leaf-color mite index with three readings per plot was made August 27, 1971, to correlate visual observations of leaf conditions with mite damage.

Visual comparisons of treatments with unsprayed check plots showed apparent fungicidal control of frogeye leafspot. Likewise, bronzing and defoliation was particularly noticeable in plots showing high mite counts, as reported in the table. Plots sprayed with Dikar 80W exhibited the healthiest, or darkest green, leaves with least amount of diseased or dead leaf tissue. No differences among fungicides were found in 1972 for control of frogeye leafspot, but all treatments were better than unsprayed trees.

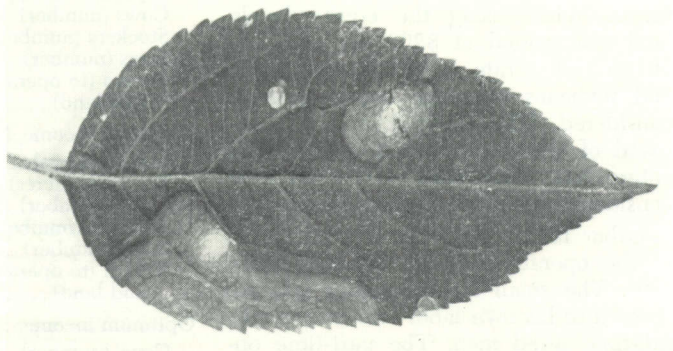
The leaf-color mite index was not computed in 1972 since only a low incidence of leaf problems was observed. Lowest populations of mites occurred on trees sprayed with Benlate 50W, Dikar 80W, Polyram 80W, and Topsin-M 70W. Highest populations were noted on trees sprayed with Phaltan 50W, Thynon 75W, and unsprayed trees.

Fungicides that have miticidal properties offer advantages to growers. They eliminate problems that may be encountered when mixing several different materials in one spray tank. Benlate, Thynon, and Topsin-M are experimental chemicals that are not registered for apple disease or mite control.

Effectiveness of Fungicides for Control of Frogeye Leafspot and Mites in Alabama Apple Trees

Treatment, lb./100 gal.	Fungus infected area/leaf		Mite control ratings		
			Mites/leaf		Leaf-color index[1]
	1971	1972	1971	1972	
	Pct.	*Pct.*	*No.*	*No.*	
Benlate 50W (0.5)	32.6	4.6	14	0.8	1.7
Cyprex 65W[2] (0.5) + Ferbam 76W[2] (0.5) + Phaltan 50W (2.0)	19.7	....	164	....	3.1
Dikar 80W (2.0)	2.1	.9	31	6.2	1.3
Polyram 80W (2.0)	8.5	3.7	36	8.6	2.3
Thylate 65W[2] (0.75) + Phaltan 50W (2.0)	21.2	1.4	99	29.6	2.8
Thylate 65W[2] (0.75) + Thynon 75W (0.50)	....	1.4	....	42.8	....
Topsin-M 70W (0.75)	32.2	4.2	19	6.2	1.9
Unsprayed check	53.8	17.6	121	35.2	2.8

[1] Leaf-color mite index: 1 = bright dark green leaves; 2 = lighter green leaves, slight bronzing; 3 = bronzed leaves from mite infestation; 4 = bronzed leaves, yellow veins, some leaf abcission. Ratings are for 1971 only.
[2] Applied during bloom period only.



Disease spots on this leaf are characteristic of frogeye leafspot, a damaging disease of apples in Alabama orchards.

BEEF CATTLE In the ALABAMA BLACK BELT

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How much income can be expected from representative farms in the Black Belt when varying quantities of open land are utilized by beef production?

This question was the major one considered in a study of beef cattle in the Black Belt area by the Department of Agricultural Economics and Rural Sociology. Three resource situations were considered – (1) a large farm with size and composition patterned after the open land found on the average farm in the area, (2) a small farm with size and composition determined by the average of all farms whose open land acreage was smaller than the large farm, (3) a part-time farm with size and land composition limited only by the amount of labor the operator could provide when he was not working at a full-time, off-farm job.

Linear programming was used to obtain least cost combinations of feedstuffs for livestock and to select optimum combinations of enterprises. Combinations of enterprises to maximize income were determined with land equity levels of 50, 75, and 100% for both large and small farms. When using the equity levels, land was valued at $200 per acre and charged at a rate of 6%. Cotton, corn, and soybeans were the only row crops considered. The livestock systems consisted of sow-pig, cow-calf, and stocker enterprises. Only beef enterprises were considered for the part-time farm.

Labor for the large farm was limited to the operator and six full-time hired men. The small farm operator was restricted to his own labor and that of two full-time hired men. The part-time operator provided 939 or 1,034 hours yearly depending on his use of vacation time.

Table 1. Three Most Important Reasons for Raising Beef Cattle, 267 Beef Farms, Black Belt Area of Alabama, 1969

Reason	1st	2nd	3rd
	Pct.	*Pct.*	*Pct.*
Land suitability	19	13	3
Personal preference	18	10	0
Family influence	15	3	0
Less labor requirements	12	28	23
Part-time farming	9	3	10
Returns on investment	9	7	20
Less risk	6	3	7
Net income	3	15	10
Availability of roughage	0	6	20
Other reasons	9	12	7

Farmers gave both economic and subjective factors as reasons for being in the cattle business, Table 1.

The large acreage study farm had 952 acres of open land consisting of 854 acres suitable for row crops and 98 acres usable for pasture only. The cotton allotment was 57 acres. The optimum organization when all feasible enterprises were considered yielded returns of $59,823, $62,646, and $65,469 for land equity levels of 50, 75, and 100%, respectively, Table 2. When beef systems used 50 and 100% of open land at the 100% land equity level, returns were $45,121 and $18,604, respectively.

The small acreage study farm had 312 acres of open land consisting of 280 acres suitable for row crops and 32 acres usable for pasture only. The cotton allotment was 19 acres. The optimum organization when all feasible enterprises were considered produced returns of $27,115, $28,040, and $28,965 for land equity levels of 50, 75, and 100%, respectively, Table 2. When beef systems utilized 25, 50, and 100% of open land at the 100% land equity level, returns were $23,346, $20,650, and $12,342, respectively.

The part-time farm yielded optimum returns of $2,328. By using his off-farm vacation time for farm labor, the part-time farmer could increase returns to $3,268.

Under the price and yield levels used in this study, beef systems were not competitive with cotton, soybeans, and hogs when all enterprises competed equally for available resources. As beef systems used increasing proportions of open land, the large and small farms yielded decreasing returns.

Stockers were more profitable on large, small, and part-time farms than was the cow-calf system. Since the cow-calf enterprises were high users of open land, the requirement in each organization of large and small farms to utilize all open land caused cow-calf enterprises to enter some solutions that they would not have entered without this provision.

Table 2. Summary of Organization of Large and Small Acreage Farms

Organization	Large farm	Small farm
Optimum income		
Cotton (acres)	57	19
Soybeans (acres)	785	241
Sows (number)	288	140
Return (to operator's labor, management, and land)		
50% land equity	$59,823	$27,115
75% land equity	$62,646	$28,040
100%	$65,469	$28,965
Optimum income, 25% beef		
Cotton (acres)		19
Soybeans (acres)	(Solution	187
Cows (number)	infeasible	7
Stockers (number)	with labor	305
Sows (number)	restriction)	70
Return (to operator's labor, management, and land)		$23,346
Optimum income, 50% beef		
Cotton (acres)	57	19
Soybeans (acres)	359	117
Cows (number)	208	13
Stockers (number)	772	513
Sows (number)	142	47
Return (to operator's labor, management, and land)	$45,121	$20,650
Optimum income, 100% beef		
Cows (number)	457	34
Stockers (number)	1,325	1,036
Return (to operator's labor, management, and land)	$18,604	$12,342

VACCINATION with HVT Helps Prevent MAREK'S DISEASE

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It became a common practice in some poultry areas to inject broiler and commercial layer chicks with HVT-infected turkey blood as a preventative against Marek's disease because of the delay in licensing of commercial vaccine.

Scientists in the United States and Europe had shown that HVT (a herpes virus of turkeys) when injected into 1-day-old chicks reduced Marek's disease (MD) significantly. When commercial vaccines became available, they replaced turkey blood in some areas, especially for replacement stock. However, turkey blood was still widely used for broilers in Alabama during this period.

Initially some thought vaccination of broilers would not be economical. However, it soon became apparent that vaccination with turkey blood reduced broiler condemnation losses and that as little as 1% reduction at a cost of 0.6¢ per dose was economically feasible. Commercial tissue culture vaccines soon became competitive because it was found that less than a full dose (1:4 to 1:6 dilutions) gave good results and the potential use of MD vaccination was many times greater for broilers than for replacement stock.

Research goals[1] of the authors were to make an inexpensive tissue culture vaccine for the broiler industry of Alabama and to evaluate the effectiveness of it as well as other vaccines and turkey blood for the prevention of MD and tumor formation in broilers. When commercial vaccine became available, vaccine production research was discontinued but studies on application and evaluation of vaccination were intensified.

Prior to the practice of vaccination, condemnation for Marek's disease (tumors) was higher in Alabama than in any of the 10 leading broiler states. The severity of the problem in Alabama by the winter of 1971 is illustrated in Table 1. A small but increasing percentage of Alabama broilers were injected with commercial vaccine or turkey blood from June through September 1971. Increasingly more were vaccinated each month until more than 80% were vaccinated by January 1972. From September 1971 through August 1972 more than 75% of the vaccinated broiler chicks received turkey blood, and during this period except for 2 months, Alabama had the lowest condemnation of the 10 top broiler producing states. The decrease in total condemnation each month was largely because of reduced Marek's tumors with essentially no change in condemnation for other causes. However, total condemnation for 3 months in the winter of 1971-72 was above 3%. This was because vaccination contamination problems until corrected caused increased deaths, stunting, and condemnation.

Data presented in Tables 2 and 3 represent condemnations of chicks placed in three areas at the same time having been vaccinated with one of four commercial vaccines or turkey blood. Commercial Vaccine 4, Table 2, appeared inferior to the other three. Vaccine 3, Table 2, performed best in a high exposure area. Periodic titering of commercial vacvines revealed that although all were well above the minimum potency requirement (1,000 pfu's/dose), one averaged higher titers than the other three. Generally, condemnation for Marek's was lower following vaccination with citrated turkey blood than with 500-750 pfu's (1:6 to 1:4 dilutions) of commercial vaccine, but the risk of accidental contamination was greater than with commercial vaccine.

Investigations of problems related to MD vaccination revealed: (1) vaccine contamination by air-borne microbes in chick-processing rooms during a working day, (2) microbial contaminated materials (distilled water, diluents, syringes, and bottles), (3) HVT vaccine suffered little loss in potency during 1 hour in tryptose phosphate broth, Ringer's or buffered saline but significant loss in the last two by 2 hours, and (4) varying degrees of MD exposure at different locations in the field. In addition to reduced condemnation, vaccination resulted in improved livability, growth, vigor, feed conversion, pigmentation, grade, and processing. Vaccination with turkey blood was accomplished for 0.32 to 0.5¢ per chick and with diluted commercial vaccine (mostly 1:6 to 1:4 dilution or 350-750 pfu's) for 0.6 to 1¢ per chick. If condemnation was the sole benefit from vaccination, which was not the case, it had to be reduced by 1% at no more than 0.6¢ per dose to be economically feasible. Thus the return on investment during the study period was profitable.

During the 12 months, Table 1, after vaccination was commenced, it is estimated that vaccination cost less than $1½ million and reduced condemnation by 12 million birds valued at $6 million or a net return of $4½ million.

Table 2. Effect of Three Commercial Vaccines and Turkey Blood on Broiler Condemnation

Lots	Birds	Vac.	Leukosis	Total
No.	*No.*			
11	169,850	Comm. No. 2	.37	.98
202	3,018,020	Comm. No. 3	.49	1.07
15	222,029	Comm. No. 4	1.77	2.66
342	5,548,989	Turkey blood	.29	1.35

Table 3. Condemnation of Broilers Vaccinated with Commercial Vaccine (Diluted 1:4 to 1:6) per Dose, Reared in a High MD-Exposure Area

Lots	Birds	Vac.	Leukosis	Total
No.	*No.*			
40	207,915	Comm. No. 1	1.95	3.27
16	75,915	Comm. No. 2	2.44	4.23
217	1,256,270	Comm. No. 3	1.27	2.82
200	1,057.894	Comm. No. 4	2.72	4.02

Table 1. Broiler Condemnation Before and After MD Vaccination

Month slaughtered	Before vaccination			After vaccination		
	Chickens processed (millions)	Condemned in 1970-71		Chickens processed (millions)	Condemned in 1971-72	
		Marek's	Total		Marek's	Total
	No.	*Pct.*	*Pct.*	*No.*	*Pct.*	*Pct.*
Sept.	28.3	2.86	4.41	32.0	1.18	3.00
Oct.	29.2	3.08	4.67	31.2	0.84	2.74
Nov.	23.6	3.83	5.49	27.9	0.78	2.87
Dec.	25.9	4.27	6.18	30.0	0.88	3.26
Jan.	25.9	4.92	6.98	29.0	0.96	3.42
Feb.	25.5	5.17	7.11	28.6	0.90	3.22
Mar.	29.8	5.14	6.99	31.9	0.68	2.95
Apr.	29.0	4.71	6.52	31.3	0.62	2.62
May	28.5	3.75	5.42	35.3	0.47	2.34
June	31.6	2.92	4.50	36.4	0.52	2.41
July	31.8	2.00	3.66	33.3	0.45	2.50
Aug.	34.1	1.42	3.10	38.2	0.43	2.59

[1] Compiled from: Poultry Slaughter, Sept. 1970-Aug. 1972, Crop Reporting Board, SRS, USDA.

[1] Supported in part by a grant from Alabama Poultry Industry Association.

Energy Value of Silages fed to Beef Steers

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Silage is a valuable feed ingredient for cattle. When used in certain combinations with grain, silage may actually increase rather than decrease feed cost.

The Alabama Agricultural Experiment Station's research program on feeding silage to beef cattle covers more than a decade. This work has been done at Experiment Station units located at Auburn, Belle Mina, Camden, Camp Hill, and Headland. This report is based primarily on results collected from two locations during recent years.

These results revealed that silages had most feeding value when fed as the major ration component. In contrast, when grain was the major ration component in cattle finishing rations, silage feeding value was greatly reduced.

The nutritive value of silage was calculated from feeding trial results by a difference technique. This calculation is based on the assumption that the feeding value of U.S. No. 2 shelled corn is constant. Published data are available for calculating the nutrient requirements of animals of various live weights and levels of performance.[1] Using this procedure, the nutritive value of corn silage was calculated using animal performance data from feeding trials conducted at the Wiregrass Substation, Headland. In the trials yearling cattle were finished for slaughter on mixtures of corn and corn silage. All rations were supplemented with protein, minerals, and vitamin A.

In three of seven trials, Table 1, the corn portion of the ration furnished sufficient nutrients to meet the animals' requirement for maintenance (NE_m) and gain (NE_g). In the other four trials, the energy value (NE_m) obtained for silage was far less than the NRC average value of 22 megacalories per 100 lb. Thus, in these Wiregrass steer finishing trials, silage had little nutritional value. With proper management cattle can be fed rations composed of corn and supplement only. However, silage in the ration is an aid in getting cattle on full feed. When used for this, silage should be reduced to a low level (about 6-10 lb. per head daily) after the cattle are on feed.

[1] Nutrient Requirement of Beef Cattle, 4th Revised Edition. 1970. National Academy of Sciences, NRC.

Table 1. Maintenance (NE_m) Values of Corn Silage When Fed With Concentrate to Finishing Cattle

Year	Ration		NE_m obtained for silage[1]
	Silage	Corn	
	Lb.	*Lb.*	*Mcal/cwt.*
1966	16	15	−1.38
1966	20	19	−4.28
1967	39	6	6.78
1969	33	8	4.56
1970	20	15	1.33
1970	20	16	−0.16
1971	23	13	0.35

[1] Calculated values based on the assumption that corn was used to support maintenance and gain; silage was used only for maintenance.

In contrast to feeding high grain rations to finishing cattle, stocker cattle are often grown on rations containing silage as the major energy component of the ration. Using data from feeding trials with stocker cattle at the Lower Coastal Plain Substation, Camden, the NE_g value of silage was calculated, Table 2. In these trials corn and sorghum ensiled with various additives were fed. The data in Table 2 reveal that corn and sorghum silages as fed had about the average NRC feeding value (NE_g) of 13 and 9 megacalories per 100 lb. respectively. In these trials the silage was the major ration component and was supplemented with protein, minerals, and 2 to 4 lb. of corn per head daily.

Finishing cattle for slaughter and growing stockers represents contrasting uses of silage. When silage was combined with a generous level of corn and fed to finishing cattle, silage had little feeding value. However, when silage was used as a major component of the ration for growing stockers, silage had expected nutritive value, Table 2. Based on these results, silage should be fed as the major energy component of the steer growing ration, but it should be reduced to about 10 lb. per head daily when used in a grain finishing ration.

Table 2. Net Energy for Gain (NE_g) Obtained for Silages from Steer Feeding Trials

Silage	Additive	Years	NE_g[1]
		No.	*Mcal per cwt.*
Corn	none	6	13
Corn	urea	1	12
Sorg., immature	none	6	11
Sorg.	corn, 100 lb./ton	5	8
Sorg.	$CaCO_3$	2	11
Sorg.	urea	3	10
Sorg.	urea and corn	1	9
Sorg.	$CaCO_3$ and urea	1	8
Sorg.	ProSil	1	7

[1] Calculated as follows: NRC value × observed value; the NRC value for corn silage is 13 and for sorghum it is 9.

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