HIGHLIGHTS

of agricultural research

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Agricultural Experiment Station
AUBURN UNIVERSITY

DIRECTOR'S COMMENTS

E. V. Smith

NOT LONG AGO the President was quoted as having said, "We now have the knowledge and capacity to vanish hunger from the United States." As a generality, the statement is supportable. It is a high compliment to American farmers, agribusinessmen, and agricultural scientists. Yet few of us seem to realize the thinness of the line that separates feast from famine nor the smallness of the push required to tip the balance toward one or the other.

The hybrid corn story beautifully illustrates this point. When the first settlers came to this continent, they found the Indians cultivating corn and quickly adopted it. As their agriculture spread across the continent, corn became the most widely grown crop. Until well into the 20th century, however, corn grown by American farmers differed little in its productive capacity from that originally grown by the Indians.

Then a seeming miracle occurred. The then recently rediscovered principles of genetics, including heterosis or "hybrid vigor," were applied in corn breeding. Hybrid varieties were developed that were adapted to specific climatic regions. They were more efficient in the utilization of plant nutrients and possibly water and energy. As a result, the per acre yields of corn increased manyfold. Thus, the development of hybrid corn has been listed, along with nuclear energy and space exploration, among the most significant scientific achievements of the century.

The rapid acceptance of hybrid corn led to the establishment of a new rural development industry – the hybrid seed industry. This involved breeding, production, processing, and marketing.

The labor involved in hand-detasseling the female parent in hybrid seed production became increasingly costly. The industry quickly adopted male sterility, when it was discovered, as a mechanism for producing hybrids while eliminating the costly process of detasseling. Unfortunately the same source of sterility was generally used throughout the industry. Thus, no matter how widely different the varieties were in most respects, they were generally essentially pure line in this one respect.

The appearance and rapid spread of Southern leaf blight in 1970, the resultant losses, the uncertainties for the immediate future, and the connection of the disease with T-cytoplasm have become an oft-told story. It emphasizes the fact that agriculture is a dynamic industry because it is always concerned with living things. Recognition of this fact challenges scientists, agribusinessmen, farmers, and policy makers to attempt to foresee the broad, as well as specific, effects of future scientific innovations.

look for these articles

may we introduce . . .

Dr. Frank S. Arant, author of the article on page 11. In relating the history of the Department of Zoology-Entomology, he has recalled many events to which he was an eye-witness, for he first joined the staff of the Agricultural Experiment Station in 1926.

Arant is a native of McKenzie, Butler County, Alabama. He received the B.S. degree from Auburn University in 1926 and the M.S. degree in 1929. His doctorate was earned at Iowa State in 1937. After receiving his Ph.D., he returned to Auburn where he remained until he entered the Army in 1942.

Arant returned to Auburn as Entomologist in 1946. In 1949 he was appointed Head of the Department to replace the late Prof. J. M. Robinson. During his time at Auburn he has conducted extensive research on controlling insect pests of cotton, corn, vegetable crops, and stored foodstuffs. He is the author of numerous publications on insect control, a laboratory exercise text for general zoology, and a State Department of Conservation bulletin on the status of game birds and mammals in Alabama.

He is a member of Phi Kappa Phi, Gamma Sigma Delta, and Sigma Xi. He also holds membership in several professional societies.

HIGHLIGHTS of Agricultural Research

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ON THE COVER. Providing recreational services, such as public fish ponds, may be a source of income on many farms, according to the story on page 3.

Outdoor Recreation — Another Source of Farm Income

E. W. McCOY, *Department of Agricultural Economics and Rural Sociology*

OUTDOOR RECREATION may provide another ingredient for a profitable mix of farm enterprises. This income source was used by 802 Alabama farmers in 1965, but more could profit from it.

- Many farmers could supplement incomes by adding a recreational enterprise that would not compete for land, labor, or capital with the farm business.
- Some could increase income by substituting a recreation enterprise for a portion of their farm enterprises.
- A few farmers could profitably shift their entire operation to producing recreational services.

Participation in outdoor recreation in Alabama has shown substantial growth over the last decade. Out-of-state visitation for recreation purposes has increased much faster than general population growth. Such unique Alabama features as Gulf Coast beaches, TVA lakes, and the moderate climate, as well as numerous lakes, rivers, and forests to support a multitude of fish and game, could greatly increase recreation participation in the future.

An active program of developing outdoor recreation facilities is being carried out by the State and many local groups. At present in Alabama, increases in supply of recreational services create their own demands. A major park facility attracts visitors who also support many small facilities.

Outdoor recreation as an enterprise, however, is not a bonanza. Profitable operation requires the same qualities of management and investments as profitable operation of a farm. In addition, the manager must be willing to serve people with all their idiosyncrasies.

Such enterprises as farm based vacations, fishing lakes, hunting, and camping fit well into farm operations. In many cases these can be fitted into a farm operation without seriously lowering farm production and without competing for land or labor. Alternately, these recreation enterprises can be increased and, if demand warrants, replace less profitable farm operations.

As the scope of the farm based recreation enterprise is increased, it begins to compete with other areas of production for capital, labor, and management.

There are several special provisions for providing capital for rural outdoor recreation facilities.

- The Soil Conservation Service assists in building farm ponds and the State Department of Conservation aids in stocking ponds.
- Farmers Home Administration has special provisions for individual or cooperative loans for recreational facilities, with low interest and long terms. In addition, the agency offers management assistance.
- Federal Land Banks and Production Credit Associations make loans for developing farm based recreation.
- Many local banks recognize recreation facilities as worthy of loans.

The recreational enterprise should not receive capital that could be more profitably invested in other segments of the farm business. It should be subjected to the same decision making process to determine its suitability to a particular farm.

Although demand for outdoor recreation services is increasing faster than the population, every such enterprise does not automatically have enough customers for profitable operation. Demand for a specific site is initially determined by size of the surrounding population, ease of access to it, and availability of alternate sites. Demand can be increased by advertising, providing a pleasurable visit to customers, and creating multi-recreational facilities. For example, adding picnic tables, rest rooms, and a concession stand at a fishing lake could increase its profit potential.

Providing a selection of activities that has something to offer at every season of the year can also increase returns from a recreation site.

Amount of income from a recreational enterprise usually is directly proportional to number of visitors. Many farm based outdoor recreation enterprises report low returns when all costs are considered, generally because demand is lower than anticipated.

A careful appraisal of the market is needed before committing resources to a recreational enterprise, including answers to three questions: (1) What is the general demand for the activity? (2) How many similar facilities are available to satisfy existing demand? (3) What is the anticipated cost of providing the recreation facilities?

Answers to these questions make it possible to estimate the number of recreational customers at a specified rate to show income potential of supplying the market. A comparison of anticipated income with expected capital investment provides the basis for deciding whether to include the outdoor recreation enterprise.

Income, expenses, and net returns for several types of outdoor recreational facilities or enterprises are listed in the table. The figures are averages from several national studies and include operations with losses as well as farms with high returns. The profitable hunting areas had pen-reared birds, guide services, and dogs. The low return hunting was based on natural game. In general, enterprises with higher net returns also had higher capital investments and greater variable expenses.

If a farm has good access to urban population and the manager enjoys meeting and providing services to the public, outdoor recreation can fit into his farming operation. It is important to remember, however, that word-of-mouth advertising is equally effective in spreading the word about both pleasant and unpleasant experiences.

RANGE IN AVERAGE ANNUAL INCOME, EXPENSES, AND NET INCOME FOR SELECTED FARM BASED OUTDOOR RECREATION ENTERPRISES[1]

Facility or enterprise	Range in income and expenses[2]					
	High			Low		
	Income	Expenses	Net	Income	Expenses	Net
Riding stable	$12,000	$ 5,275	$6,725	$4,369	$2,353	$2,016
Hunting area	27,785	20,515	7,270	560	230	330
Fishing area	11,207	7,142	4,065	538	117	488
Campground	3,375	678	2,697	1,295	324	971

[1] From recent studies of farm based recreational enterprises throughout United States.
[2] Net income includes return to capital and unpaid family labor.

ALACHLOR for Peanut Weed Control

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ALACHLOR, sold under the trade name Lasso™, has been extensively evaluated for weed control in several agronomic crops by the Auburn University Agricultural Experiment Station since 1967. A major portion of this research has been evaluation of alachlor's potential for weed control in peanuts. At the Wiregrass Substation, Headland, Alabama, experiments have included studies on rates of application, methods of application, combination with other herbicides, and time of application in Early Runner peanuts.

Alachlor gave essentially full season control of annual grasses such as crabgrass, goosegrass, and crowfootgrass in all years except 1968, Table 1. In 1968, only the highest rate evaluated (4.0 lb./A.) provided appreciable grass control late in the season.

TM—Monsanto Company.

TABLE 1. INFLUENCE OF ALACHLOR ON WEED CONTROL AND YIELD OF PEANUTS

Herbicide, rate/acre	Weed control: Grasses[1] Early	Grasses[1] Late	Broadleaf weeds[1] Early	Broadleaf weeds[1] Late	Yield,[2] pounds
1967					
Alachlor(pre)[3], 1.0 lb.	100	100	56	27	1,497
Alachlor(pre), 1.5 lb.	100	98	66	52	1,325
Alachlor(pre), 2.0 lb.	100	100	75	62	1,606
Alachlor(pre), 3.0 lb.	100	100	88	71	1,606
Alachlor(pre), 4.0 lb.	100	98	96	81	1,569
Check	0	0	0	0	1,436
1968					
Alachlor(pre), 1.0 lb.	100	20	95	0	1,767
Alachlor(pre), 1.5 lb.	100	0	97	0	1,713
Alachlor(pre), 2.0 lb.	100	0	100	0	1,695
Alachlor(pre), 3.0 lb.	100	20	100	0	1,851
Alachlor(pre), 4.0 lb.	100	76	100	10	1,996
Check	0	0	0	0	1,871
1969					
Alachlor(pre), 2.0 lb.	73	69	73	52	....
Alachlor(pre), 3.0 lb.	96	95	97	85	....
Alachlor(pre), 4.0 lb.	91	99	97	92	....
Check	12	0	12	0	....
Alachlor(PPI)[4], 2.0 lb.	91	86	91	45	....
Alachlor(PPI), 3.0 lb.	96	91	98	65	....
Alachlor(PPI), 4.0 lb.	95	92	95	52	....
Check	12	0	12	0	....
1970					
Alachlor(pre), 1.5 lb.	73	64	63	18	2,378
Alachlor(pre), 2.0 lb.	98	85	86	66	2,459
Alachlor(pre), 2.5 lb.	100	81	94	54	2,268
Alachlor(pre), 3.0 lb.	100	95	96	80	2,250
Check	0	0	0	0	2,232

[1] 0 = no control; 100 = complete control.
[2] Pod weight of unshelled peanuts per acre.
[3] Pre indicates application was preemergence.
[4] PPI indicates application was preplant incorporated with a disk harrow.

Control of broadleaf weeds with alachlor has been less consistent and poorer than has control of annual grass weeds. Broadleaf weed control ratings made early in the growing season generally reflected substantial control; however, late season ratings were poor. In 1968, late season ratings indicated essentially no broadleaf weed control even at the highest (4.0 lb./A.) rate. Rates of 3.0 lb./A. or higher generally reflected either an acceptable or at least a substantial level of weed control. A requirement of 3.0 lb./A. or more for acceptable broadleaf weed control was particularly evident in the 1969 and 1970 experiments. Weeds not controlled by alachlor included the large-seeded broadleaf weeds such as sicklepod, morningglory, and cocklebur. Some control of Florida beggarweed and prickly sida has been observed, particularly early in the growing season. Pigweed, carpetweed, and Florida purslane are among those broadleaf weeds usually controlled.

In 1969, an experiment was designed to compare incorporation vs. normal preemergence application. Although both methods of application gave comparable results, late season broadleaf weed control was substantially better with preemergence application than with preplant incorporated application, Table 1.

The combination of alachlor with dinoseb (DNBP, Dinitro) was a particularly interesting treatment since advantage was taken of the contact action of dinoseb on the first crop of broadleaf weeds, Table 2. Delaying the application of alachlor also tended to increase the longevity of the herbicide treatment. This treatment combination looked encouraging in both 1969 and 1970. However, it is evident from the data that some broadleaf weeds which were not emerged at the time of herbicide application escaped and were present at the end of the growing season.

Postemergence applications of alachlor were not toxic to peanuts in an experiment in 1970. Although weed control was generally poor (weeds that were germinated at time of application were not killed), it illustrated the relative safety of the herbicide.

Peanuts have not been injured or yields reduced in the experiments reported in this article. Alachlor offers promise of aiding the farmer in his fight against weeds in peanuts.

TABLE 2. COMPARISON OF COMBINATIONS OF ALACHLOR AND DINOSEB AT CRACKING TIME FOR WEED CONTROL IN PEANUTS

Herbicide, rate/acre	Weed control[1] and injury[2] ratings: Grasses Early	Grasses Late	Brdlf. weeds Early	Brdlf. weeds Late	Crop injury Early	Crop injury Late	Yield,[3] pounds
1969							
Ala.+dino., 1.5+1.5 lb.	93	62	98	71	15	2	1,597
Ala.+dino., 2.0+2.0 lb.	90	72	92	61	0	2	1,551
Ala.+dino., 3.0+3.0 lb.	97	92	97	96	0	0	2,478
Check	0	0	0	0	0	0	1,520
1970							
Ala.+dino., 2.0+3.0 lb.	100	79	98	70	0	0	2,840
Ala.+dino., 3.0+4.5 lb.	100	95	100	86	0	0	2,986
Ala.+dino., 3.0+6.0 lb.	100	98	99	75	0	0	2,614
Check	0	0	0	0	0	0	2,640

[1] 0 = no control; 100 = complete control.
[2] 0 = no injury; 100 = complete kill.
[3] Pod weight of unshelled peanuts per acre.

THE COMPETITIVE POSITION OF CORN IN ALABAMA

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At a time when production of livestock and livestock products is increasing in Alabama, feed grain production might also be expected to increase. Such is not the case. While utilization of feed grains was going up in recent years, production was declining, Figure 1.

In 1970, Alabama's utilization of feed grains exceeded 4 million tons, of which only about 12% was produced in Alabama. A drought in 1969 and corn blight in 1970 contributed to low production in the last 2 years. But even if yields had been normal, production probably would have been only about 15-20% of total use.

Corn, which makes up 90-95% of total feed grains fed in Alabama, has been declining in both acreage and production, Figure 2. Despite higher per acre production in recent years, yields still average only about 30-35% as high as in the Corn Belt.

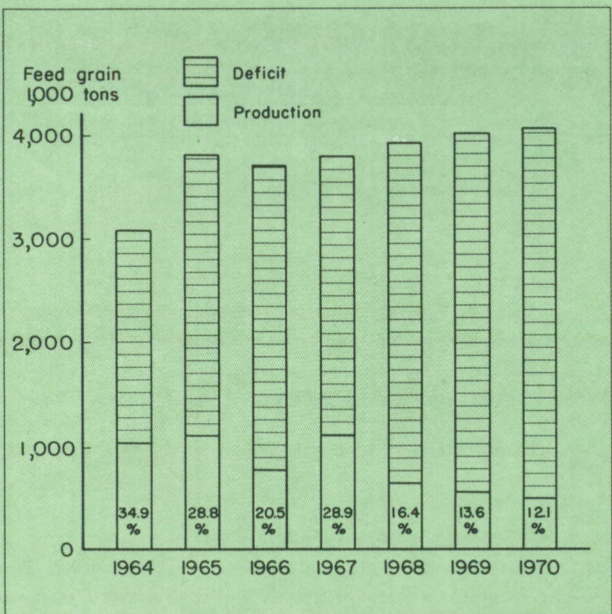

FIG. 1. Alabama's feed grain production, utilization, and deficit during 1964-70 is illustrated by the graph.

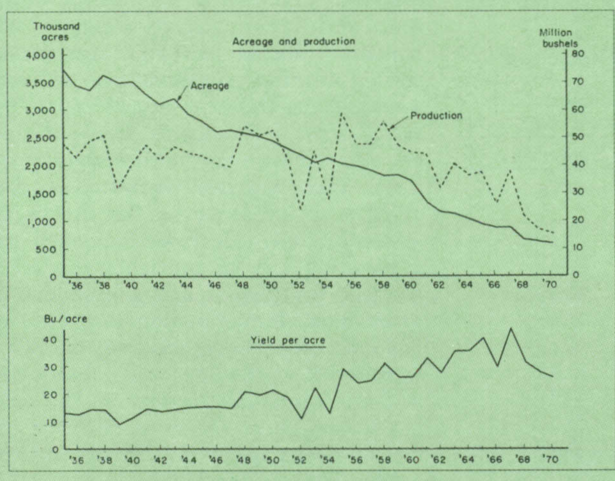

FIG. 2. Acreage of corn harvested for grain in Alabama is shown with production and yield per acre for 1935-70.

Declining acreage and production indicate the probable workings of the old law (or principle) of comparative advantage. This law holds that an area, state, or country will tend to specialize and produce those products for which it has an absolute or comparative advantage, or least comparative disadvantage.

Changes in production of selected Alabama farm products when compared with Illinois (chosen to represent the Corn Belt), indicate some underlying advantages and disadvantages, see table. Comparison with the Corn Belt is appropriate because, except for some specialized enterprises, it is the area with which Alabama is in most direct competition. It must be emphasized that these data only *indicate* possible advantages. More detailed information would be necessary to establish actual reasons for specific differences.

Corn is the most important feed grain in Alabama, so why does the State not produce more of its needs? Suggested answers are: (1) yields are low because of climate, soil, and other natural factors; (2) efficient cultural practices are not being applied by the average farmer; (3) costs are high relative to competing areas; and (4) Alabama has an absolute or comparative advantage for specializing in and producing products other than corn. Preliminary results of current Auburn research suggest a combination of answers 1, 2, and 4. Total costs per acre do not appear high relative to competing areas, and may even be lower on the average. However, net receipts per acre are low because of low average yields.

From results reported, it appears more profitable at this time in Alabama to put land, labor, and other resources into enterprises other than corn for grain and to purchase needed corn from the Corn Belt. This might be true even with general adoption of most efficient cultural practices to increase average yields.

Indications of Comparative Advantage and Disadvantage for Selected Agricultural Products, Alabama and Illinois, 1966-70 Compared with 1956-60

Crop	Index of change in production 1966-70/1956-60		Index of relative advantage (+) or disadvantage (−) for Alabama
	Ala.	Ill.	
	More favorable for Alabama		
Soybeans	+335	+51	+284
Broilers	+178	−93	+271
Eggs	+144	−34	+178
Sorghum silage	+ 38	−36	+ 74
Cotton	− 36	−84	+ 48
Peaches	0	−47	+ 47
Cattle and calves	+ 22	− 6	+ 28
Hay	+ 2	−24	+ 26
Wheat	+ 31	−24	+ 19
Fresh vegetables and melons	− 14	−29	+ 15
Milk	− 23	−30	+ 7
	Equal disadvantage		
Sorghum for grain	− 42	−42	0
	More favorable for Illinois		
Hogs and pigs	− 3	0	− 3
Oats for grain	− 71	−59	− 12
Wool	− 85	−38	− 47
Sheep and lambs	− 88	−39	− 49
Corn for grain	− 60	+48	−108

Fungicidal Control of Pecan Downy Leafspot

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STORAGE OF NUTRIENTS required for formation and early growth of pecans is largely dependent on amount and character of foliage and length of time it functions on the trees. Certain pathogenic fungi and insects cause defoliation of unsprayed Alabama pecan trees so that maturing nuts fill poorly and nutrient accumulation for the next nut crop is reduced. *Mycosphaerella caryigena*, the fungus that causes the downy spot disease, destroys chlorophyll in summer and incites leaflet abscission in the fall. Research has shown lower photosynthesis and transpiration in *M. caryigena* infected leaves. Studies on diseased trees have also shown that starch decreased rapidly in roots during early spring growth and starch and hemicellulose accumulation decreased during kernel development.

Experiments to evaluate fungicides for controlling downy spot were established in a commercial orchard near Auburn. Fungicides tested were: benomyl (Benlate 50W), dodine (Cyprex 65W), sulfenimide (Difolatan 80W), triphenyltin hydroxide (Duter 50W) (TPTH), and zineb (Parzate C 75W). Applications were made with an air-blast sprayer onto Stuart pecan, a cultivar highly susceptible to infection by *M. caryigena*.

In 1968, applications were made on a 2- or 3-week schedule starting with a prepollination spray (April 11) when leaves were ½ to ¾ in. in length. Evaluation of a second block of trees was initiated 3 weeks later (postpollination). In 1969, the value of starting sprays pre- or postpollination was investigated. However, rainy weather prevented prepollination applications until April 29 and postpollination applications until May 22. In 1970, sprayer breakdown delayed applications until April 28, which was postpollination. Leafspot data were taken from 12 compound leaves collected from each tree at a height 6 to 12 ft. from the ground during July and September.

Fungicides applied on a 2- or 3-week schedule, Table 1, were effective in controlling leafspot; however, dodine was significantly better than sulfenimide at 2-week intervals and both dodine and TPTH were better than sulfenimide at 3-week intervals. Zineb was equivalent to TPTH at 2-weeks, but leafspotting at 3-weeks was nearly three times greater. Benomyl applications during pre- and postpollination lowered leafspot incidence significantly during 1969, Table 2. Unfortunately, spraying operations during 1970 could not be started prepollination to confirm 1969 data. During 1970, no significant differences between fungicides were noted in postpollination applications. The three fungicides gave significant control of downy spot over unsprayed trees. Brown leafspot (caused by *Cercospora fusca*) and scab (caused by *Fusicladium effusum*) did not occur in sprayed plots. Only a trace of liver spot (caused by *Gnomonia caryae* var. *pecanae*) occurred in sprayed plots. All of these 4 diseases were prominent in unsprayed plots.

Pecan trees are sprayed with fungicides primarily for scab control on shucks of maturing nuts. From a practical viewpoint, fungicides selected for shuck disease control should also control foliage diseases. Commercial control of downy spot and other foliage diseases with benomyl[1], dodine, or TPTH was demonstrated in these experiments on a 3-week schedule. In the past Stuart pecan possessed some resistance to scab and growers delayed spraying until scab was evident. Such practice permitted a damaging scab incidence on the shucks and extensive downy leafspot incidence with a resulting loss of nutrients needed by the tree for current and subsequent nut production. Prepollination fungicide applications of benomyl, dodine, or TPTH, repeated 2 weeks later and subsequently at 3-week intervals throughout the growing season, gave the most effective control of pecan shuck and foliage diseases in the Auburn experiments.

[1] Benomyl is not registered for use on pecan.

TABLE 1. CONTROL OF DOWNY LEAFSPOT ON STUART PECAN WITH FUNGICIDFS IN MACON CO., ALABAMA, 1968

Treatments	Lb. per 100 gal.	Spots per compound leaf[1]	
		July	September
		No.	*No.*
2-Week interval			
Dodine	1.0	4.8 a	6.1 a
Sulfenimide	1.0	33.5 bc	35.6 abc
TPTH	0.4	11.6 ab	11.8 a
Zineb	2.0	16.3 ab	28.0 abc
3-Week interval			
Dodine	1.0	13.2 ab	18.1 ab
Sulfenimide	1.0	46.2 c	50.6 bc
TPTH	0.4	18.4 ab	22.9 ab
Zineb	2.0	50.1 c	58.4 c
Zineb (PPSO)[2]	2.0	87.1 d	101.1 d
Unsprayed	----	163.2 e	206.2 e

[1] Means followed by the same letter are not significantly different at the 1% level according to Duncan's Multiple Range Test.
[2] PPSO = prepollination spray omitted, zineb applied postpollination only.

TABLE 2. CONTROL OF DOWNY LEAFSPOT ON STUART PECAN WITH FUNGICIDES IN MACON CO., ALABAMA, 1969 AND 1970

Treatments	Lb. per 100 gal.	Spots per compound leaf		
		July 1969	September 1969	July 1970
		No.	*No.*	*No.*
Prepollination[1]				
Benomyl	0.4	0.1 a	1.1 a	----
Dodine	1.0	3.4 b	3.9 ab	----
TPTH	0.3	4.4 b	5.9 b	----
Postpollination[2]				
Benomyl	0.4	3.8 a	19.8 a	7.2 a
Dodine	1.0	110.0 c	126.6 b	8.0 a
TPTH	0.3	25.7 b	30.4 a	15.7 a
Unsprayed	----	----	153.0 c	205.1 b

[1] Means followed by same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.
[2] Means followed by same letter are not significantly different at the 1% level according to Duncan's Multiple Range Test.

Sorghum Grains Have Wide Range in Nutritive Value

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GRAIN SORGHUM (*Sorghum vulgare*) production has been small in Alabama. In 1961 about 14,000 acres of sorghum were harvested for grain. This acreage remained about the same until 1969 when about 17,000 acres of sorghum were harvested for grain. In 1970 about 22,000 acres were harvested. Average yields of grain per acre were 33 bushels in 1969 and 34 bushels in 1970. New varieties of sorghum offering higher production of more nutritious grain should interest more Alabama farmers in increasing grain sorghum production in the future.

Grain sorghum has been an important source of human and animal food for centuries. The Egyptians apparently were the first to produce sorghum grain for food. Sorghum originated in Ethiopia (East Africa) but has been widely grown throughout India and China. Over 13 million acres were planted and 740 million bushels of grain produced in the United States in 1969.

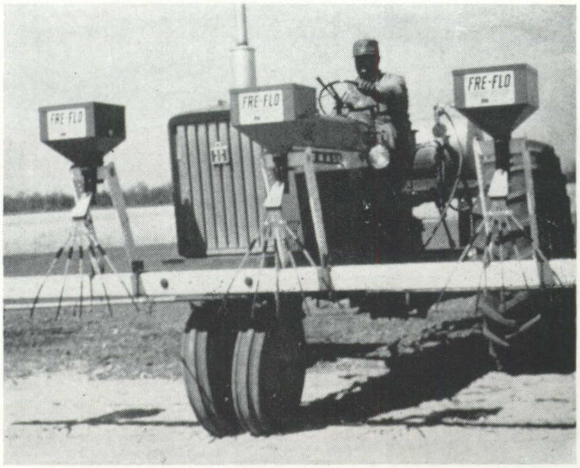
Hybrid grain sorghums were developed at the Texas Agricultural Experiment Station based on the work of Mr. J. R. Quinby and Mr. J. C. Stevens. Mr. Quinby, in 1955, predicted, "Since sorghum is the third most important grain crop in the world, being exceeded only by wheat and rice, the impact of the development of hybrid sorghum on world food supplies will be enormous in years to come and from now until eternity."

There is great variation in grain sorghums for characteristics such as seed hardness, color, starch, and digestibility. Also, there is great variation in the vegetative growth of sorghum plants. Through a program sponsored partially by the Rockefeller Foundation and the Agricultural Research Service, USDA, an extensive collection of sorghums was made. Over 12,000 stocks from 44 countries have been assembled and placed in a collection in India. It appears likely that from this reservoir of genetic material varieties of sorghum will be devised that produce higher yields of more nutritious grain than any varieties currently available. Many of these exotic types have been crossed with early dwarf varieties by the ARS and Texas geneticists to recover exotic characteristics on material with heights and maturities useful in the United States. Seed of these converted lines have been produced in Puerto Rico.

Auburn University animal scientists have determined the digestibility of approximately 1,000 strains in tests conducted under contract to the USDA. These strains were from conversion material that was produced by ARS geneticists in Puerto Rico. The digestibility was determined by placing small amounts of the seeds in nylon bags and placing these bags in the rumens of fistulated steers. Two bags of ground and two bags of whole seed were placed in the rumen of each of three steers maintained on a sorghum grain-containing ration. These bags remained in the rumen for 24 hours, after which time they were removed, washed, and dried. The weight loss of the sample while in the rumen was taken as a measure of grain digestibilty.

Digestibility for the 1,000 samples tested ranged from about 17% to 71% for ground grain with many of the samples in the range of 50% to 60%. Digestibility of whole grain was very low for all entries – usually 10% or less. Hardness of the strains differed considerably and seed of some strains were highly pigmented while others were white and pearly. The relationship of these factors to seed digestibility will be determined. Dry matter digestibility data will be made available to geneticists working to improve the nutritive value of grain sorghum.

The results show conclusively that there is a great range in digestibility among strains of sorghum grain. This great wealth of genetic material will permit geneticists to produce commercial varieties having improved digestibility and improved characteristics related to harvest, storage, and processing.



View of herbicide granule applicator used to apply treatments at the Agricultural Engineering Research Unit.

SPRAYS or GRANULES
Either Formulation Works

G. A. BUCHANAN, *Department of Agronomy and Soils*
W. T. DUMAS, *Department of Agricultural Engineering*

"Can herbicides be applied other than as a spray?"

The majority of herbicides are applied as a spray; however, there are certain advantages to applying herbicides in granular form. The main advantage of this type application is ease of application since no water is required. There are no pumps to prime and nozzles to unstop. The main disadvantage is the lack of versatility of the granular application equipment as compared to the sprayer.

Table 1. Control of Annual Grasses and Broadleaf Weeds in Cotton with Trifluralin Applied Either as a Spray or as a Granule (Agricultural Engineering Reseach Unit)

Herbicide	Rate per acre	Method of application	Weed control		
			Grass	Broadleaf	Injury rating
	Lb.		*Pct.*	*Pct.*	*Pct.*
Trifluralin	0.25	Spray	88	76	0
Trifluralin	0.25	Granule	97	82	0
Trifluralin	0.5	Spray	95	75	7
Trifluralin	0.5	Granule	98	76	0
Check	----	-------	0	0	0

Several herbicides have been applied during the past 3 years both as a spray and as a granule at the same rate in the same experiment. By including both it was possible to compare the relative efficacy of either formulation. Trifluralin, currently recommended and widely used for weed control in cotton, soybeans, and other crops, was applied both as a spray in 20 gal. of water per acre and as 2% granules incorporated with a disk harrow. Granules were applied with a tractor applicator as shown in the Figure. Application was made at 0.25 and 0.5 lb. of active ingredient per acre. Control of annual grass weeds with either the granule or spray was acceptable, Table 1. Although there was about the same control of broadleaf weeds, neither formulation gave complete control.

Chlorpropham and 2,4-D, a combination of herbicides currently being evaluated for preemergence weed control in corn, was evaluated both as a spray and as a granule at the Upper Coastal Plain Substation. Acceptable grass and broadleaf weed control was observed at all rates tested with either the spray or granule formulation, Table 2. Count of actual grasses and broadleaf weeds indicated slightly greater weed survival on plots treated with the spray.

Propachlor has been evaluated extensively for weed control in corn and other crops. In several experiments, propachlor has consistently given about the same weed control when applied either as a granule or as a spray, Table 3. In general, 4.0 lb. per acre or more gave acceptable grass control regardless of formulation. In most cases, broadleaf weed control was not acceptable with either formulation at any rate.

With the herbicides evaluated, herbicidal performance was similar with both the spray and granule formulations. Herbicides will perform when applied as a granule if care is taken to ensure uniform distribution at the recommended rate. To avoid excessive physical movement of granules, the seedbed should be left flat prior to application.

Table 2. Control of Annual Grasses and Broadleaf Weeds in Corn with 2,4-D Plus CIPC Applied Either as a Spray or as a Granule (Upper Coastal Plain Substation)

Herbicide	Rate per acre	Method of application	Weed control[1]	
			Annual grasses	Broadleaf weeds
	Lb.		*No.*	*No.*
2,4-D + chlorpropham	1 + 3	Spray	1	5
2,4-D + chlorpropham	1 + 3	Granule	13	48
2,4-D + chlorpropham	1.5 + 4.5	Spray	0	6
2,4-D + chlorpropham	1.5 + 4.5	Granule	9	64
Check	----	-------	107	692

[1] Number of annual grasses or broadleaf weeds per 160 ft. of row, 12-in. band.

Table 3. Control of Annual Grasses and Broadleaf Weeds with Propachlor Applied Either as a Spray or as a Granule (Wiregrass Substation)

Herbicide	Rate per acre	Method of application	Weed control[1]	
			Annual grasses	Broadleaf weeds
	Lb.		*No.*	*No.*
Propachlor	4.0	Spray	1	249
Propachlor	4.0	Granule	9	207
Propachlor	6.0	Spray	6	110
Propachlor	6.0	Granule	4	200
Check	----	-------	83	577

[1] Number of grasses or broadleaf weeds per 160 ft. of row, 12-in. band.

CORPORATIONS in AGRICULTURE

J. H. YEAGER, *Department of Agricultural Economics and Rural Sociology*

"Corporations threaten the family farm." You have probably read or heard someone make this statement. How important are corporations in American agriculture? What are the advantages and limitations of corporate organization as it applies to farms?

A corporation is an artificial being created under State law. It is a collective person or legal entity. Stockholders are the owners who may be few or many. Ownership is represented by shares of stock used as a basis for division of profits, authority, and degree of ownership.

Importance

Because of interest in corporate farming, USDA in 1968 conducted a survey of corporations in farming, see table. Data on almost 11,000 corporations having agricultural operations were obtained. Because of substantial under-reporting in California, data for this state are not available to date.

These 11,000 corporations operated more than 50 million acres. A major portion of this land was in eight mountain states where 70% of the acreage of this region was held by family corporations. Overall, almost two-thirds of the corporations studied were classed as family corporations.

Average acreage operated (county basis) was 4,598 acres. Not all corporations in agriculture were large in terms of acres operated. It was reported that 37% were less than 500 acres in size within any one county. In the Corn Belt, corporate units averaged about 900 acres or about three times the average of all commercial farms. In the Southeast, 44% of the corporation farms operated less than 500 acres. Almost 40% of all corporations had sales of less than $40,000 in 1968; however, 19% had sales of over $200,000.

Three out of five of the corporations included in the study carried on farming operations only; 16% had agribusiness interests that included farming plus manufacture or sale of farm supplies, or marketing, and processing of agricultural products; and 20% had farming plus business activities unrelated to farm inputs or marketing of farm products.

The study indicated that corporations in farming accounted for about 1% of all commercial farms. These corporations operated about 7% of the land in farms and their sales were 8 to 9% of all farm products. Corporate farming is increasing, according to the study, but probably not any faster than the increase in all incorporated businesses.

Selected Characteristics of Corporations Having Agricultural Operations, 47 States,[1] 1968

Item	All corporations
Number reported	10,998
Acres operated, 1,000	50,568
Acres per unit[2]	4,598
Distribution of acres operated, %	
Less than 100	9
100-499	28
500-999	19
1,000-1,999	15
2,000 and over	29
Year began operation as a corporation, %	
Before 1960	46
1960-66	45
1967-68	9
Gross sales of farm products, 1967, %	
Less than $20,000	20
$20,000-$39,999	17
$40,000-$99,909	27
$100,000-$199,999	17
$200,000-499,999	11
$500,000 and over	8

[1] Conterminous U.S. excluding California.

[2] County unit basis. Separate operating units within a county were combined and treated as one farm.

Source: Adapted from Scofield, William H., 1969. Corporations in Agriculture. Proceedings of North Central Workshop, Chicago, Ill.

Why Incorporate?

Perhaps there are several reasons for increased interest in the corporate form of business in agriculture. Farming situations differ and one must look at the many considerations involved in deciding on a form of organization and operation. Certainly, today's increased capital requirements that call for investments of $100,000 to $250,000 in farms are bringing pressure for change.

Under certain circumstances there may be income tax advantages in incorporation. Rather than accruing to a single individual, the tax advantages are passed along to stockholders.

Also, from an estate tax standpoint there can be advantages. A corporation in most cases is endowed with continuous life during the period of its charter. Thus stockholders may die and stock may be transferred, yet the corporation goes on. This does not ensure that sound management and financing will automatically take care of itself by incorporating. Organization and operation under sound business principles is equally or more necessary with a corporation than with a single proprietor or partnership family farm. However, upon the death of a partner or the single proprietor, the farm may be broken up and in some cases a sizeable estate tax liability is incurred.

Another consideration in incorporating is that liability characteristics of partnerships and sole proprietorships may be alleviated by corporate organization. Stockholders are liable only for shares of stock they own.

The corporation may not be the best form of organization for many farms. However, presently high capital requirements and prospects for their going even higher point to the need to evaluate the advantages incorporating might offer.

LAND USE PLANNING and ZONING

KEYS TO RURAL COMMUNITY DEVELOPMENT

HOWARD A. CLONTS
Department of Agricultural Economics and Rural Sociology

MR. AND MRS. HOMEMAKER built a dream home by the roadside in Countryside, U.S.A. Into it went their dreams, their hopes, and most of their savings. A few years passed, other homes were built; later a mixed development took place. An automobile graveyard was located down the road. A tavern opened nearby. Mr. and Mrs. Homemaker got a rude awakening. The old charm of the country home was gone. Also lost was a goodly part of the savings invested in the home. Residential values plummeted."[1]

Legislative Acts

In 1923 and 1935, the Alabama Legislature approved acts that enabled a municipal corporation to divide the territory in its limits into zones according to a comprehensive plan. To date no provision has been made to allow rural areas the same privileges. The above illustration is a frequent example of the plight of people in rural areas throughout much of the nation. Good, sound rural planning and zoning could prevent many such instances.

What Is Zoning?

Zoning is the power granted by the State Legislature to regulate under police powers, the height, bulk, and use of buildings, the use of land, and the density of population. Zoning was developed in crowded cities and its basic regulations were related to urban problems. In later years zoning was extended to urban fringes and then in many states to open country. Regulations under the enabling acts are justified on basis of promoting health, safety, morals, and general welfare of the public.

Planning for Rural Development

Incorporated rural communities already have at their disposal numerous tools for stimulating economic and social growth. Land use planning lies at the heart of any resource development program. Land use plans encourage new residential as well as commercial and industrial growth. However, mere encouragement of growth is not sufficient; it must be orderly. Zoning is the legal and administrative process with which the community protects itself against indiscriminant land use. Zoning cannot be used to correct past mistakes. Hence, it is important that growing areas act early to avoid badly mixed land uses.

The comprehensive plan is the basic guide for establishing zoning districts. This plan is a complete description of present land uses and projections of the best use in the future. Zoning starts with the established community then directs growth and prevents further deterioration.

Kinds of Zoning Districts

Several kinds of zoning districts may be formed. Most local ordinances include residential, business, and industrial zones. In states where open country zoning is permitted, agricultural, forest, recreation, and other special districts are established.

Since unincorporated rural communities in Alabama do not have the power to regulate land use, many are beginning to initiate incorporation proceedings. Communities with a population of 75 people living on contiguous areas may incorporate. However, responsibilities of incorporation often extend beyond the abilities of some communities. Public services are costly and government is often cumbersome. The best alternative for this situation is the privilege of rural areas or counties to zone land use. This privilege can be extended only by special enabling acts of the Alabama Legislature.

Changing Conditions

Alabama may be on the verge of more rapid growth in population, urbanization, and industrialization than in the past 10 years. Throughout the State evidence of change is appearing. A large proportion of the rural population is non-farm oriented. Highway traffic early and late in the day indicates large scale commuting to work and shopping areas. The open countryside in many areas is becoming less open.

The number of rural communities, both incorporated and unincorporated, has increased rapidly in recent years. Residents of these communities enjoy rural living. Most favor continued growth and progress. However, generally they prefer that surrounding areas grow in such a manner that maintains their relative comfort and appeal. To many of these people the concept of a rural community extends far beyond the narrow boundaries of a few houses located at the crossroads. The community includes the lands and neighbors a few miles away with whom associations are close. There is a need for some means to protect the desired environment, yet allow economic growth. If rural communities or counties are allowed the powers of land use planning and zoning, desired growth patterns may materialize.

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[1] Solberg, Earling D. "Zoning of Prospective Land Use Areas," *Talks on Rural Zoning,* U.S. Department of Agriculture, ERS, FED January 1960.

A History of Zoology-Entomology at Auburn University

F. S. ARANT, *Department of Zoology-Entomology*

COURSES IN ZOOLOGY AND ENTOMOLOGY were first taught at Auburn in 1872. By 1875 the area of natural science had been established, and in 1877 courses in zoology and entomology, taught by W. C. Stubbs, were offered in that area. Great emphasis was placed on museum collections and 30,000 specimens were catalogued by 1885. All specimens were destroyed by fire in 1887.

Considerable reorganization took place following the destruction of the Main Building by fire. Botany-geology developed under Dr. P. H. Mell and biology under Dr. G. F. Atkinson, widely recognized for his classic treatise on a plant nematode. In 1893-94 courses were taught in zoology, entomology, and plant pathology by J. M. Steadman. From 1896 to 1901, biology and horticulture were together and botany was still associated with geology. In 1902 biology and botany were combined and were separated from horticulture and geology. Biology courses included little zoology or entomology between 1896 and 1905. In 1906 entomology was recognized as a department, and courses were taught by W. T. Clarke, the first trained entomologist at Auburn. Clarke was succeeded in 1907 by Dr. W. E. Hinds. The Department of Entomology and Zoology came into being in 1916.

The office of Experiment Station Entomologist was established in 1896 by the Board of Trustees, and C. F. Baker was appointed to that position. He served only 2 years. This office was vacant until W. T. Clarke's appointment in 1906. Others who have served in this capacity, and concurrently as Head of the Department, include W. E. Hinds, 1907-23; F. L. Thomas, 1924; J. M. Robinson, 1924-49; and F. S. Arant, 1949 to date. In addition to his teaching and research activities, Hinds served as Entomologist for both the Extension Service and the State Board of Horticulture from 1920-23. Responsibility for their own entomological services was then assumed by the respective agencies, with W. A. Ruffin the first Extension entomologist, 1924-61.

F. E. Guyton joined the staff in 1921 and H. G. Good in 1924. They served 42 and 40 years respectively, and taught more students than any other faculty members in the history of the Department.

Although emphasis was on natural history, taxonomy, and museum work between 1877 and 1905, the earliest course descriptions also refer to control of insects destructive to vegetation. From 1907 to 1918 major emphasis was on entomology. Three courses in entomology and one in zoology were offered in 1918-19. Course offerings increased to 10 in entomology and 8 in zoology in 1930-31. The training was broadened in 1937-38 to include wildlife and in 1944-45 to include fish culture. The Zoological Sciences curriculum was established in 1952-53. In 1959-60 this was replaced by the Biological Sciences curriculum with a major in Zoological Sciences with options in zoology, entomology, fisheries management, and game management. The fisheries program became a separate department July 1, 1970. Seventy-nine courses are now taught in the Department to approximately 4,700 students from 16 curricula each year. There are 35 faculty members, 31 with Ph.D. or equivalent.

The graduate program in zoological sciences began about 1893. The first M.S. degree was awarded to A. L. Quaintence in 1894. Three M.S. degrees in entomology were awarded between 1925 and 1929 and three more in the early 1930's. The Cooperative Wildlife Research Unit was established under the leadership of H. S. Peters in 1936. Walter Rosene and D. N. Ruggles became the first graduate students in wildlife management that same year. They, together with E. A. Jones, received the M.S. in 1938. The first M.S. in zoology was awarded to Eugenia R. Moore in 1939; the first in fish management to J. R. Snow in 1948. The Cooperative Fishery Research Unit became operational in 1967.

A doctoral program in zoology was initiated in 1953. The first Ph.D. in zoology, with an option in fisheries, was awarded to A. K. R. Zobairi in 1955; in entomology to H. H. Tippins in 1957; in zoology to R. A. Carlton in 1958; and in game management to D. A. Arner in 1959. To date 69 doctorates, 265 masters, and 3 MACT degrees have been awarded to students in zoology-entomology. Graduate enrollment in the Department increased from 5 students in the fall of 1940 to 105 in the fall of 1969.

Graduates with advanced degrees are making significant contributions in their fields throughout the U.S. and in foreign countries as follows: in colleges and universities there are 155; in state agencies, 45; in federal agencies, 34; in foreign governmental agencies, 15; in industry, 16; and in private and miscellaneous enterprises, 17.

Although early research in the Department dealt to some extent with taxonomy and museum work, principal emphasis during the early 1900's was on agricultural insects and their control. Noteworthy research was done on rice weevil in corn, boll weevil, and Mexican bean beetle. The Department grew to include research programs on other insect pests of row crops, pasture crops, horticultural crops, livestock, man, and forests; insect taxonomy and systemics; chemical, biological, and integrated control; and relationships of insects to man and animals.

Early wildlife research was directed principally at farm game species such as Mourning dove and Bobwhite quail, but deer, waterfowl, and opossum received some attention. More recently, research has been directed toward ecology and management of forest game animals, particularly wild turkey and deer. Research has also been done on raccoon, beaver, cottontail rabbit, blackbirds, red jungle fowl, predators, and other species.

Fisheries research began in 1934 with experiments on fertilization and stocking rates in small farm ponds. Species used successfully were mainly bluegill, shell-crackers, and largemouth bass. Facilities were acquired and research expanded until now the program is one of the finest in the world on warmwater pond fish culture. A grant awarded in 1970 by A.I.D. enabled the Station to establish the International Center for Aquaculture and elevate the fisheries program to full departmental status.

Following the work of Stubbs and others on museum collections and Atkinson on nematodes, little research was done in zoology proper until the 1930's when research was initiated on poultry parasites. Active research programs have since been developed in physiology, genetics and mutagenetics, parasites, herpetology, ichthyology, ornithology, paleontology, coprophagy, and other areas.

CULLARS ROTATION
Valuable Research and Teaching Aid FOR SIXTY YEARS

E. M. EVANS and L. E. ENSMINGER, *Dept. of Agronomy and Soils*

TAKE THREE PARTS dried blood, add two parts kainit and one part superphosphate. . . .

A recipe for witch's brew? No, these weird materials represent a fertilizer treatment on the Cullars Rotation back in the year 1911. This rotation experiment, located on the Agricultural Experiment Station agronomy farm about the length of a football field south of Coach Ralph (Shug) Jordan's house, continues to fill reseach and teaching needs as it has for 6 decades.

The 3-year rotation experiment has not remained the same over this time span. Fertilizer materials, cropping practices, insect control measures, and crop varieties gradually change, and these must be incorporated into the experiment if it is to reflect current practices and keep its importance. For example, crotalaria was once considered a valuable crop for soil improvement and was used in the rotation. It is now classed as a noxious weed. Fertilizer nutrient sources used today are much more concentrated and sophisticated than dried blood and cottonseed meal that were once used.

Since the experiment was begun in 1911, there have been four major revisions of cropping systems and fertilizer practices – in 1923, 1931, 1956, and 1967. Currently, the cropping system is cotton, winter legume, corn, wheat, and soybeans.

This sandy, upland soil is quite responsive to fertilizer treatment. Large differences in growth and yield are evident when essential fertilizer elements are left out for a period of several years. Marked deficiency symptoms occur and are readily observed as being the result of imposed treatment.

- Potassium deficiency is pronounced on cotton and corn.
- Magnesium deficiency is evident on cotton and corn, and so is calcium deficiency on corn.
- Nitrogen deficiency is striking on cotton and corn, as is effect of low pH on wheat and soybean stands.
- Sulfur deficiency on cotton has been noted several times and, although not severe, indicates the need for secondary elements in a fertilizer program.

Students in soils and crops courses, like the class shown in the photo, regularly visit the rotation. In addition, recent visitors have included farmer groups from throughout the State and military officers from many nations in training at Fort Benning, Georgia, and Maxwell Field, Alabama.

Crop yields over the years have generally increased, reflecting improved crop varieties, fertility, and management practices. Yields from selected treatments for the 12-year cycle prior to the last revision are given in the table. Some of the highest per acre yields from individual plots were 3,551 lb. seed cotton in 1960, 120 bu. corn in 1960 and 1965, 87 bu. oats in 1959, and 57 bu. of soybeans in 1967.

In addition to such obvious results as deficiency symptoms and yields, this experiment supplies valuable information of a microbiological nature. Because many of the basic treatments have been maintained throughout the 60 years, most of the plots have reached a kind of "equilibrium state" chemically and biologically.

Individual treatment data are useful in soil test calibration and soils from certain plots are used for greenhouse and growth chamber experiments. Plant pathologists and nematologists are studying the incidence of pathogenic fungi and nematodes and relating these to fertilizer treatment. A study of soil enzyme activity as related to fertilizer and cropping history was recently published in an international journal.

Because of superior workmanship, many things increase in value as they become older. The Cullars Rotation seems to be such a masterpiece.

YIELDS OF CROPS FROM CULLARS ROTATION, 1956-67 AVERAGE

Fertilizer treatments[1] and factor studied	Yields per acre[2]				
	Winter legumes	Oats	Corn	Seed cotton	Soy-beans
	Lb.	*Bu.*	*Bu.*	*Lb.*	*Bu.*
LPK, legume nitrogen	14,623	18.7	77.3	2,206	35.3
LPK, no nitrogen	......	4.8	11.4	771	......
None, no fertilizer	......	1.6	2.3	118	......
LKN, no phosphorus	1,559	13.9	24.7	1,245	13.1
LPKN, complete fert.	12,878	38.5	84.2	2,349	34.1
LPN, no potassium	3,877	29.1	25.6	263	13.3
PKN, no lime	7,171	31.7	69.6	1,940	16.2
LPKN-S, no sulfur	13,231	40.9	84.1	2,208	32.8
LPKN+ME, minor elements	14,988	40.0	83.0	2,476	36.3

[1] L = lime by soil test; P = 88 lb. P every 3 years; K = 166 lb. K every 3 years; N = 120 lb. N to cotton and corn, and 60 lb. to oats.

[2] Legume yield is green weight. Yield of oats is 11-year average; 1963 crop was winter-killed. Soybean yield is 8-year average (cowpeas grown previously).

COMBINE ADJUSTMENTS and PEANUT DAMAGE

WILLIAM F. LALOR and KENNETH M. PENUEL
Department of Agricultural Engineering

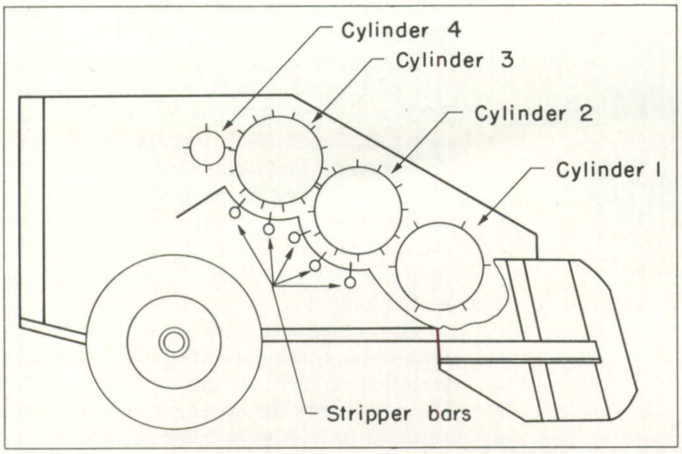

FIG. 1. The test combine showing the picking cylinders, the stripper cylinder, and the stripper bars.

MECHANICAL DAMAGE to peanuts is a matter of concern to producers, shellers, and processors. Research to eliminate the damage caused during harvesting is placed high on a list of research priorities by representatives of these three sections of the peanut industry. Damage-free peanuts would significantly reduce insect and fungus problems during storage and processing.

To aid peanut-combine operators and designers in eliminating combine damage, an experiment (sponsored by the Lilliston Corp., Albany, Georgia) was performed by AU Experiment Station researchers. Picking-cylinder speed, stripper-bar position (operator adjustments), and cylinder-tooth density (design variable) were changed and the results observed. The cylinder-speed settings were: (1) manufacturer's recommended speed, (2) 25% above, and (3) 25% below. Stripper-bar position settings, expressed as perpendicular distance from screen to tip of teeth, were: (1) 3.5 in., (2) 2.0 in., and (3) 0.0 in. The values of tooth density were: (1) normal and (2) half-normal. Combinations of the above variations of these factors gave an 18-treatment test that was replicated five times.

The cleaning and separating parts of the combine were removed and a collection box was attached behind the fourth cylinder, Figure 1, to collect samples. The stripper-bar adjustments on some cylinders were modified to obtain desired positioning for all bars. Half-normal tooth density was achieved by removing alternate teeth on the first three cylinders.

Visibly damaged nuts were removed by hand. Invisible damage was searched for by dyeing. Dye entered the shells at the point where the kernels were attached but none was found to enter due to invisible damage, hence all damage was classified as visible. Damage levels are expressed as per cent of the total number of nuts examined.

Figure 2 shows the effect of changing each variable level. The increases in damage caused by increasing cylinder speed and setting stripper bars to project into the cylinders were highly significant. The difference between damage at normal and half-normal tooth density was insignificant. There was no interaction between any of the factors, which shows that each adjustment affected damage done regardless of the setting of the other adjustments.

Results show that aggressiveness can be minimized by using the slowest possible cylinder speed *and* retracting the stripper bars as much as possible. At low cylinder speeds, such as used in this test, some clogging may occur and picking may be incomplete due to low cylinder speed and retracted stripper-bar position. Reduced aggressiveness must therefore be consistent with good machine operation and picking efficiency but only the degree of aggressiveness necessary to pick the nuts should be used.

Cylinder-tooth density, which is a design variable, requires more investigation. Our data led us to no constructive conclusion about this factor.

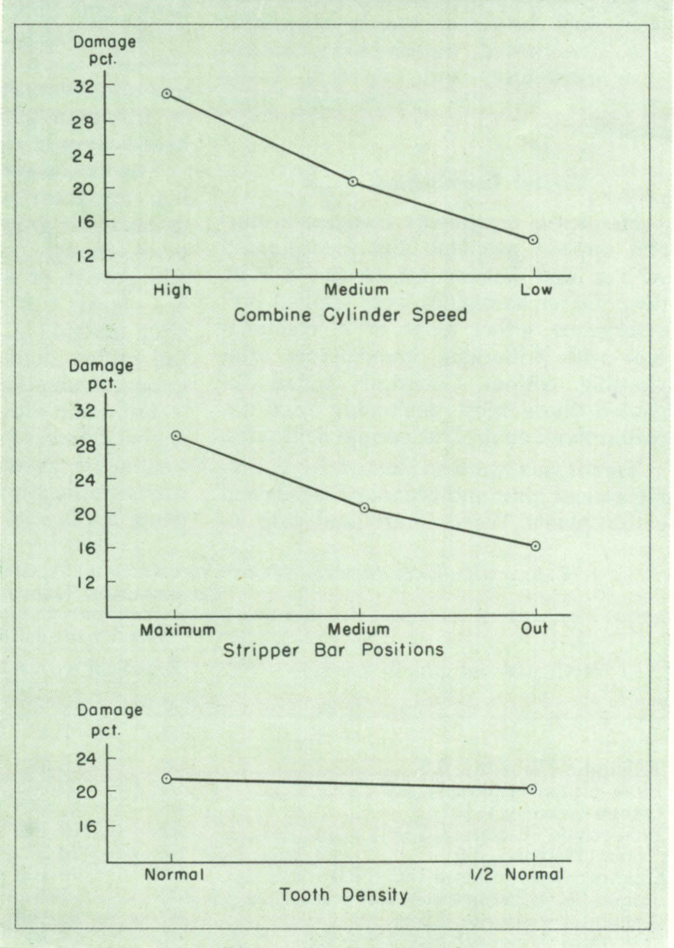

FIG. 2. Effect of changing the three variable levels on the visible damage done to the peanuts.

Herbicide Combinations for Cotton Weed Control?

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Department of Agronomy and Soils

EXTENSIVE USE of trifluralin and nitralin by Alabama farmers has resulted in good control of grass weeds. But continued use of these herbicides often aggravates problems with broadleaf weeds.

Because of this problem it was suggested that use of more than one herbicide might be needed for cotton weed control. This has been investigated at the Sand Mountain Substation since 1966, with single vs. dual applications of herbicides compared.

The experimental area was infested with such broadleaf weeds as prickly sida, jimsonweed, morningglory, cutleaf eveningprimrose, and pigweed. Large crabgrass was the predominant grass present.

Several Combinations Tried

Herbicidal treatments included trifluralin applied preplant and incorporated with a disk harrow set to run 4-5 in. deep. Other herbicides were applied preemergence, either alone or in combination with trifluralin, immediately after planting cotton. Chemicals tested included those most commonly used for cotton weed control, at normal field rates.

Treatments were evaluated by counting annual grass and broadleaf weeds and cotton plants. Weed control and crop injury ratings were made periodically throughout the growing season. Yields were taken from plots getting each herbicide treatment plus one or more mechanical cultivations as necessary.

At the first rating – 4-6 weeks after planting – most herbicides were giving acceptable grass control based on 4-year averages. However, results in the table show that early grass weed control with norea and chlorpropham was marginal. In some years, early season broadleaf control was marginal from prometryne, norea, and chlorpropham.

All combination treatments gave acceptable weed control most years. An exception was noted one year when norea + trifluralin gave only 72% control of broadleaves at the first rating.

The most meaningful weed control ratings are those made just before cotton reaches the growth stage where it competes enough to prevent establishment and growth of weeds. Previous research has shown this to be about 6-8 weeks after planting. Consequently, weed control ratings made in late season provide critical evaluation.

Trifluralin was most consistent against annual grasses of all single herbicide treatments, averaging 89% control at late season ratings over the 4 years. Preemergence application of fluometuron was the next most consistent against annual grasses.

Fluometuron gave by far the best control of annual broadleaf weeds (96%). Diuron and prometryne rated next, averaging 61% and 58%, but they had more year-to-year variation than fluometuron. Four-year average control of broadleaf weeds was poor with either norea or chlorpropham. Trifluralin alone had no effect on broadleaf weed populations late in the season.

The trifluralin plus preemergence treatment combinations gave essentially complete control of annual grasses. But for grass alone the combinations were not superior to trifluralin alone in most cases. Value of the combinations showed up against broadleaf weeds. Preplant trifluralin plus further treatment with fluometuron, diuron, or prometryne gave acceptable control of broadleaf weeds when rated toward end of the season. Trifluralin plus norea or chlorpropham did not give season-long control of annual broadleaf weeds.

Question Not Resolved

The major question remains: Should a grower use two herbicides for weed control in cotton at planting? Based on weed control data alone, it would be difficult to justify a full rate of both trifluralin and either of the two preemergence treatments. This is especially true with fluometuron. The major advantage probably lies in added insurance from the combination. The extremely consistent performance of trifluralin against annual grasses makes it particularly attractive in a herbicide combination treatment. Also important is that the combinations in many instances were slightly more consistent than a single herbicide.

This study in no way answers questions regarding relative merits of substituting a postemergence herbicide treatment or a cultivation for one member of the combination.

EARLY AND LATE SEASON WEED CONTROL FOR SELECTED PREPLANT, PREEMERGENCE, AND PREPLANT-PREEMERGENCE COMBINATION HERBICIDE TREATMENTS IN COTTON

Herbicide and rate, lb. per acre	Weed control 4-6 weeks after planting				Weed control 12-16 weeks after planting			
	Broadleaf weeds		Annual grasses		Broadleaf weeds		Annual grasses	
	4-year av.	Range	4-year av.	Range	4-year av.	Range	4-year av.	Range
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Trifluralin (Treflan), 0.5	26	0-66	91	76-100	0	0	89	67-98
Fluometuron (Cotoran), 2.0	96	92-98	96	91-100	96	95-96	68	43-90
Diuron (Karmex), 1.0	95	91-98	95	95-96	61	36-83	55	25-93
Prometryne (Caparol), 2.0	92	79-100	99	97-100	58	18-80	30	0-77
Norea (Herban), 3.0	83	74-87	85	68-100	33	0-80	38	0-85
Chlorpropham (Chloro IPC), 6.0	85	70-100	79	63-98	31	10-45	23	0-46
Trifluralin + fluometuron, 0.5 + 2.0	100	100	100	100	99	97-100	99	97-100
Trifluralin + diuron, 0.5 + 1.0	97	91-100	100	100	84	68-95	95	87-99
Trifluralin + prometryne, 0.5 + 2.0	99	97-99	99	96-100	88	77-93	93	78-98
Trifluralin + norea, 0.5 + 2.0	87	72-98	97	90-100	58	5-86	92	78-100
Trifluralin + chlorpropham, 0.5 + 3.0	94	82-100	98	91-100	52	40-63	95	90-99

Index to Articles Published in HIGHLIGHTS of Agricultural Research 1970

HIGHLIGHTS with this issue enters its 18th year of publication. It was established in 1954 for the purpose of reporting results of research by the Agricultural Experiment Station to Alabama farm families, agriculturally based business, and industry.

Animal and Dairy Sciences

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Biology of the Stunt Nematode

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STUNT NEMATODES (*Tylenchorhynchus* spp.) are among the many kinds of plant parasites associated with soybean plants. They feed primarily on the surface of young roots and, when present in sufficient numbers, stunt top growth and retard the root system. The ultimate result is yield reduction.

Nematode surveys have consistently shown the presence of stunt nematodes in soybean fields in the Southeastern United States. Research on the biology of these nematodes was begun by Auburn University Agricultural Experiment Station to determine how they cause disease in soybean plants (pathogenicity) and whether resistance occurs in commonly grown soybean varieties. Information from these studies may permit an economic evaluation of the importance of these nematodes to Alabama soybean growers.

Life Cycle Studied

Research on the life cycle of stunt nematodes revealed that 23 to 26 days were required for eggs to develop into mature adults. Male and female nematodes were found inside roots, but more commonly outside, and they moved randomly among the roots. Stunting effects on root cells and reduced emergence of soybean seedlings were observed 1 week after nematodes were placed in pots planted to soybeans. Death of tap and secondary roots occurred 70 days after the nematodes were added.

The number of nematodes present in the soil had a decided effect on amount of damage to the plants. Stunt nematodes caused reductions in number of pods per plant, dry weight of roots and tops, and weight of individual seeds, Table 1. The effects were particularly noticeable when large numbers of nematodes were present. These results indicate the extent of damage possible by a given number of stunt nematodes in a given area.

Variety Effects Measured

Several commercially available soybean varieties were evaluated to determine whether they may serve as good hosts for stunt nematodes. With equal numbers of nematodes added, numbers of the parasites were found to increase much more with highly susceptible plants than on a resistant variety.

Data in Table 2 suggest that varieties Hill, Bragg, Custer, and Dyer are among the most resistant; they harbored lower numbers of stunt nematodes. This corresponds with information known about resistance of these varieties to another parasite, the root-knot nematode. Field studies are now in progress to document these findings and to provide an estimate of the dollar loss growers suffer because of the stunt nematodes.

TABLE 1. EFFECT OF STUNT NEMATODES ON GROWTH AND YIELD OF LEE SOYBEANS

Performance measure	Result, by number of nematodes added per plant				
	0	125	500	1,000	2,000
Pods per plant, number	28.0	26.4	20.6	21.4	17.8
Root dry weight per plant, grams	1.10	.89	.42	.70	.65
Dry weight of tops per plant, grams	39.0	32.0	23.3	23.7	30.0
Weight of individual seed, grams	.175	.143	.158	.150	.144

TABLE 2. REPRODUCTION OF STUNT NEMATODES IN 15 SOYBEAN VARIETIES RECEIVING 1,000 NEMATODES PER PLANT

Variety	Susceptibility to root-knot nematodes	Final number of stunt nematodes per plant
Pickett	susceptible	9,083
Dare	susceptible	5,583
Harlee	susceptible	5,250
Hood	susceptible	5,250
Lee	susceptible	4,500
Jackson	resistant	4,125
Peking	susceptible	3,500
Dyer	resistant	3,375
Custer	resistant	3,333
Bragg	resistant	3,129
Hill	resistant	1,208

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