VOLUME 14, NO. 2 SUMMER 1967

HIGHLIGHTS

OF AGRICULTURAL RESEARCH

COCCIDIOSIS . . .
control drug tested,
see story on page 5

AGRICULTURAL EXPERIMENT STATION
AUBURN UNIVERSITY

HIGHLIGHTS *of* Agricultural Research

A Quarterly Report of Research Serving All of Alabama

VOLUME 14, NO. 2 SUMMER 1967

In this issue . . .

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Auburn, Alabama

New and Timely PUBLICATIONS

Listed here are timely and new publications reporting research by the Agricultural Experiment Station.

Bul. 358. Costs of Packing Fresh Peaches in Chilton County, Ala., presents detailed cost data from packing sheds using both crates and baskets.

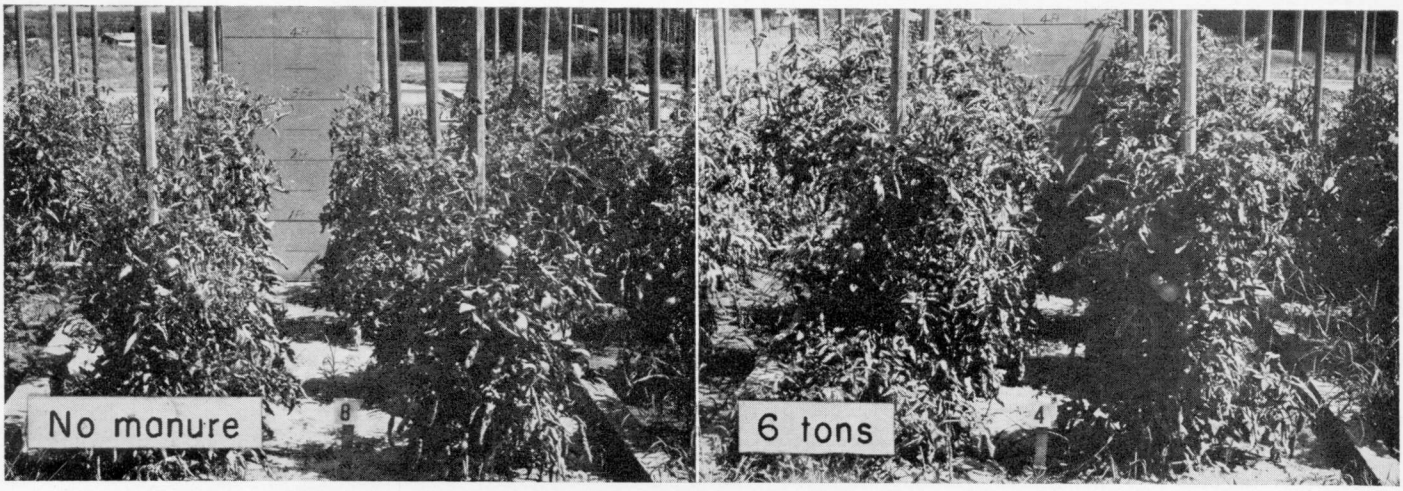
Bul. 371. Size Adjustments of Alabama Grade A Milk Producers relates how producer numbers and size of operations have changed since 1959.

Cir. 151. Sorghum-Sudan Hybrid vs. Johnsongrass Pasture for Dairy Cows compares the two summer forages, giving results learned in Black Belt Substation tests.

Prog. Rept. 84. Rainfall Distribution in Alabama presents seasonal rainfall patterns for five areas of Alabama based on records from 150 stations.

Prog. Rept. 88. Effect of Several Insecticides and Application Schedules on Cotton Insect Control gives comparative results with different insecticides in Wiregrass Substation trials.

Free copies may be obtained from your County Extension Chairman or by writing the Auburn University Agricultural Experiment Station, Auburn, Alabama.



EFFECT of POULTRY MANURE on TOMATO PRODUCTION

W. A. JOHNSON and L. M. WARE*
Department of Horticulture

With an expanding Alabama poultry industry in recent years, large amounts of manure combined with litter are available as source of organic materials for vegetable production.

In research work at Auburn, poultry manure was applied in 1962 and 1963. The immediate effects were studied in these years and residual effects in 1964, 1965, and 1966. Treatments used and yields are given in the table.

Results show that large yield increases of marketable tomatoes can be expected from annual applications of different kinds of poultry manure. The increases in average marketable yields were significant for each kind of manure over the no-manure treatment. The difference between yields from 3 and 6 tons of broiler manure was consistent but not significant. There was no important difference between yields from 6 and 9 tons and little difference between yields from 6 tons of 2-brood and 6 tons of 5-brood manure. Three tons of cage hen manure did not increase total yield over no manure, but marketable yield was significantly greater than that from the no-manure treatment. The percentage of marketable fruit was significant in the treatments of 6 and 9 tons of broiler manure.

To measure the residual effects of manure, the test was continued for 3 years after the last applications in 1963. In 1964 and 1965 increases were obtained from the residual effects of broiler manure, but only the increase from the 9-ton rate was significant. No important increase was obtained in 1966.

During the 2 years in which manure was applied, 1 ton of broiler manure increased yields 103 bu. per acre when applied at the 3-ton rate, 67 when applied at the 6-ton rate, and 44 bu. per acre at the 9-ton rate. The additional increases per ton from the 3 years of residual effects were 15 bu. from the 3-ton rate, 19 from 6-ton rate, and 26 bu. per acre from the 9-ton rate.

To determine effect of manure on keeping quality and taste of fruit, 6 samples of ripe tomatoes and 6 of mature green tomatoes were collected in 1966 from another test receiving 6 tons of broiler manure and from no-manure treatment. Results on keeping quality and taste tests showed no difference between treatments. The samples were placed in an air conditioned room at 72° F. for 3 weeks. Average loss for ripe tomatoes from the manure treatment was 8.7% at the end of 2 weeks and 14.6% after 3 weeks as compared with 7.5 and 26.6% for the no-manure treatment. For mature green fruit, the respective losses were 40.3 and 48.3% for the manure treatment as compared with 36.4 and 47.6% for no manure. Results from a similar test with mature green fruit grown in the fall of 1966 showed no differences in keeping quality or taste because of treatments. These results are contrary to the opinion of some people in the trade channels.

* Professor Emeritus.

Effects of Kinds and Rates of Poultry Manure on Production of Tomatoes

Poultry manure treatments[1]			Yields per acre								
			Marketable yields					Total yields			
Kind	Broods	Rate/ acre	Manure applied 1962-63		Residual years			Manure applied 1962-63	Residual years		
					1964	1965[2]	1966		1964	1965[2]	1966
	No.	*Tons*	*Bu.*	*Pct.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Broiler	0	0	671c[3]	67.5bc	445b	601b	388	995b	681c	869b	559
Broiler	5	3	980ab	70.0b	551ab	684b	385	1401a	795ab	939ab	584
Broiler	5	6	1073a	75.6a	561ab	745ab	456	1420a	834ab	988ab	651
Broiler	5	9	1064ab	74.6a	607a	846a	466	1427a	929a	1066a	673
Broiler	2	6	981ab	69.3bc	536ab	718ab	398	1414a	843ab	977ab	601
Hen	Cage	3	806b	72.3ab	469b	727ab	407	1115b	755bc	969ab	597

[1] All treatments received 1500 lb. of 8-8-8 per acre.
[2] Yields in 1965 reflect year of excellent growing conditions for tomatoes, no leaching rains occurred.
[3] Figures with letters that are different are significant at the .05 level.

How 2,4-D controls wolftail is illustrated here. Dallisgrass is reestablishing on plot treated twice with 3 lb. per acre active 2,4-D per application (right). Untreated plot (left) had dense stand of wolftail.

CONTROLLING WOLFTAIL in PASTURES

EARL R. BURNS and G. A. BUCHANAN
Dept. of Agronomy and Soils

Large pasture areas in the Black Belt and Lower Coastal Plain are infested with wolftail. A member of the sedge family (scientific name, *Carex Cherokeensis*), wolftail is highly competitive with such forages as dallisgrass and white clover. It may completely crowd out desirable forage species when pasture growing or grazing conditions are poor.

In efforts to prevent wolftail from reducing value of pastures, experiments were begun in 1963 to find control methods for the pest. Of more than 20 herbicides evaluated, only 2,4-D, MSMA, DSMA, and dalapon gave any promise of solving the problem. DSMA and MSMA have not been cleared for use on pastures and dalapon must be used at high rates for wolftail control. Thus, 2,4-D emerged as the most promising herbicide for the purpose.

At the Black Belt Substation, single applications of 2 and 3 lb. of active material per acre of 2,4-D applied in March gave good control. Putting on 1, 2, or 3 lb. in March and again in June also proved effective.

In another experiment – on the Lambert Farm near Camden – single applications of 1 or 2 lb. of 2,4-D in March were not effective. However, additional applications in June or August resulted in good wolftail control. Lack of control by early applications at the Lambert Farm is attributed to the extreme drought from time of treatment until early June. This probably caused poor absorption and translocation of 2,4-D. At time of the second application, moisture conditions were favorable for wolftail growth; consequently, better control was obtained. Similar results were observed when 2,4-D was applied in May and August.

DSMA and MSMA gave fair wolftail control when applied during periods of hot dry weather. On the other hand, these herbicides applied when growing conditions were favorable failed to give any appreciable control. Although dallisgrass will tolerate several applications of 2,4-D, a single application of DSMA or MSMA causes substantial injury. Dalapon failed to control wolftail when applied at rates as high as 20 lb. active per acre. Substantial injury to dallisgrass, johnsongrass, and white clover occurred at all rates of dalapon, DSMA, and MSMA.

Wolftail was not eradicated by any of the treatments described, but good control was evident in all cases where 2,4-D was applied to actively growing plants at 2 lb. or higher rates. Dallisgrass was not injured by any of the rates of 2,4-D used and appeared to be reestablishing on plots where wolftail was controlled.

Little white clover was present in the heavily infested areas. Clover that was present did not appear to be injured by any of the 2,4-D treatments. However, it is known that clovers have only moderate tolerance to this herbicide. In areas where wolftail occurs with clovers, herbicide injury to the clover may be minimized by delaying 2,4-D application until after the peak growing season of the clover.

Limited regrowth of young wolftail plants from partially killed rhizomes indicates good control may be expected from a single application of 2,4-D. To completely eradicate a severe infestation of wolftail, however, 2,4-D must be applied once or twice a year for 2 to 3 years. The relatively low cost of 2,4-D makes this a desirable control method.

Control of Wolftail with Herbicides

Herbicide rate, lb. active/acre[1]	Date of application	Wolftail plants per 2 sq. ft.[2]	
		Black Belt	Lambert Farm
		No.	*No.*
2,4-D amine			
1	Mar.	58	80
2	Mar.	31	65
3	Mar.	16	—
1	Mar.-June	19	13
2	Mar.-June	10	6
3	Mar.-June	8	10
3	Mar.-Aug.	—	16
2	May	—	21
3	May-Aug.	—	10
5	May	—	16
Dalapon			
7.5	Mar.	90	41
15.0	Mar.	115	18
7.5	May	—	70
15.0	May	—	36
20.0	May	—	42
DSMA			
6	May	—	17
6	Aug.	—	44
MSMA			
6	May-Aug.		42
Check		134	150

[1] All sprays contained 0.5% surfactant.
[2] Number of plants is actually number of tillers arising from unkilled plant material. It is indicative of degree of wolftail control. Plant counts made January 1966.

A NEW DRUG for Controlling Coccidiosis in CHICKENS

S. A. EDGAR and C. FLANAGAN
Department of Poultry Science

BONAID*, a new word in the poultry industry, denotes a recently developed drug for the control of coccidiosis in chickens.

This drug (buquinolate, a quinoline derivative) has proved more effective in controlling this age-old disease in broilers than certain drugs on the market.

Bonaid has certain distinct advantages over other drugs in that (1) it is more effective against the five least pathogenic species of coccidia than drugs currently available to poultry producers, (2) it is non-toxic to the host, and (3) in field trials birds fed this compound usually made weight gains and feed conversions superior to those of birds fed one of the most widely used coccidiostatic drugs.

Research at the Auburn University Agricultural Experiment Station revealed the drug not only prevented almost 100% the effects of severe infection caused by each of the nine species of coccidia that infect chickens but was highly effective in blocking the life cycles of most species. This last is important because it is unlikely that resistance of the parasites to the drug will occur when it is fed repeatedly to broiler flocks on the same farm. There is evidence that the parasites have developed some resistance to the most commonly fed drugs at the present time.

* Bonaid® Noraid/Norwich Animal Industry, Inc., subsidiary of the Norwich Pharmacal Company. Partial support of this study by the Norwich Pharmacal Company is gratefully acknowledged.

Results of a trial to illustrate its effectiveness in blocking coccidial development of five species individually and eight combined as measured by oocyst output are summarized in Table 1. The drug resulted in 95% or better reduction, except *Eimeria tenella* (60%), in oocyst production.

When the drug was removed from the ration, the parasites continued development and infected chickens passed oocysts of respective species in their droppings as though they had been inoculated at the time of drug removal. Microscopic examination of intestinal host tissues at the usual site of infection for each of the species revealed that the drug inhibits development of the first endogenous stage of the parasite (schizogony), but the mode of action is not presently known. The infective stages (sporozoite) of most of the parasites remain dormant in the infected epithelial cells deep in the crypts between villi as long as the drug is present in the ration. The longer birds are fed this drug after ingestion of infective oocysts, the less chance there is of relapse after drug removal, until such time when there is no relapse. The ultimate disappearance of relapse is believed to occur because of the continuous normal sloughing of the epithelial cells lining the digestive tract which the sporozoites parasitize. A few of the parasites undergo complete development in the presence of 0.00825% buquinolate in the ration. The fact this occurs should not present a problem before marketing of broilers. In blocking most species so completely there will be little opportunity for seeding of the litter with oocysts that would provide exposure.

Buquinolate was highly effective in four field trials where coccidiosis caused by one or more species occurred in previous flocks on each farm. Results comparing buquinolate with other coccidiostats are summarized in Table 2. With the exception of Trial 4, buquinolate-fed birds averaged greater weights and point spreads than flocks fed reference drugs. There was no visual evidence of coccidiosis in any of the houses during the course of trials. Representative birds fed buquinolate and sacrificed during the trial revealed no gross or microscopic evidence of coccidial infection.

Thus, it has been shown that buquinolate is a broad spectrum coccidiostat, effective against all species of chicken coccidia and should receive wide usage by poultrymen. In battery trials it was less effective than amprolium in controlling the disease caused by three species in turkeys.

TABLE 1. SUPPRESSION OF OOCYST PRODUCTION IN COCCIDIA-INFECTED CHICKENS FED BUQUINOLATE, EXPERIMENT 75-T-2, AUBURN UNIVERSITY, AUGUST 1966

Treatment	Inoculated with[1]	Oocyst production/bird during an 8-day collection[3]	Oocyst production suppression	Total oocysts/bird during 24-hr. collection[4]
		mil.	%	*mil.*
1	150,000 *E. acervulina*	767.9	0.0	0.5
2[2]	150,000 *E. acervulina*	34.1	95.6	69.7
3	150,000 *E. mivati*	765.0	0.0	0.5
4	150,000 *E. mivati*	16.2	97.9	176.0
5	15,000 *E. maxima*	47.7	0.0	0.7
6	15,000 *E. maxima*	0.7	98.5	4.4
7	3,000 *E. necatrix*	12.6	0.0	0.0
8	3,000 *E. necatrix*	0.3	97.6	6.4
9	1,500 *E. tenella*	43.0	0.0	0.4
10	1,500 *E. tenella*	17.4	59.5	2.9
11	8 species	112.8	0.0	3.0
12	8 species	1.0	99.1	3.6

[1] Four replicates of 4, 8-week-old WR Crosses, mixed sexes, infected per species of coccidia. Pens designated "8 species" received 1,400 sporulated oocysts each of *E. tenella, E. brunetti,* and *E. maxima;* 2,800 each of *E. necatrix, E. praecox, E. hagani, E. mivati,* and 4,200 each of *E. acervulina* per bird.

[2] 0.00825% buquinolate in feed from D−2 to D+12 days (2 days before through 12 days after inoculation) to even numbered treatments.

[3] From 96 through 288 hours after inoculation when 99+% of oocysts of all species of chicken coccidia are passed.

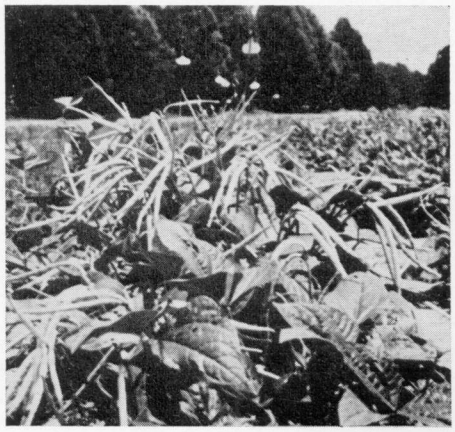
[4] Oocysts collected for a 24-hour period 8 days after removal of drug, D+20.

TABLE 2. COMPARATIVE EFFICACY OF BUQUINOLATE AND OTHER COCCIDIOSTATS FOR THE CONTROL OF COCCIDIOSIS IN BROILERS

Medication[1]	Average at market	
	Wt.	Feed conv. after cond.
	lb.	*lb.*
1[2]-buq. 0.00825%	3.60	2.34
Drug A-35 days and Drug B-36-61 days	3.43	2.48
2-buq. 0.00825%	3.62	2.18
Drug B	3.40	2.28
3-buq. 0.00825%	3.09	2.22
Drug C	3.00	2.20
4-buq. 0.00825%	3.31	2.30
Drug C	3.31	2.30

[1] Birds on Trials 1 and 2 fed drugs A and B received arsanilic acid but buq. fed birds no arsenical. Buq. fed birds in trials 3 and 4 received arsanilic acid and those fed drug C received 3-nitro. Arsenicals were fed at usual levels and time. The three drugs A, B, and C are widely used by industry.

[2] Market age, Trial 1-63 days, 2-62, 3-53, and 4-60, 3,400 to 6,000 birds per house.



This type of concentrated set of pods is essential for machine harvest.

Breeding SOUTHERN PEAS *for* MACHINE HARVEST

SAM T. JONES
Department of Horticulture

Southern peas, also known as field peas, southern field peas, and cowpeas, has recently become an important crop in the Southern States.

Between 1950 and 1960, the frozen pack increased more than 13 fold, Table 1. This was followed by further increase of 56% from 1960 to 1965. The latter increase was only in part offset by a slight decrease in the canned pack. A continued increase in demand for southern peas is predicted by most processors. However, further expansion in the processed pack is presently being limited by insufficient market supplies of the raw product. Cost of hand harvesting and labor shortage have limited growers' interest.

Table 1. Processed Pack of Southern Peas, U.S., 1950-65[1]

Year	Canned (all size cans)	Frozen
	Cases	*Pounds*
1950	1,823,000	1,280,000
1955	2,171,000	10,227,000
1960	1,973,000	16,678,000
1965	1,749,000	26,037,000

[1] The Almanac of the Canning, Freezing, Preserving Industries.

In 1961 a breeding project was begun by Auburn University Agricultural Experiment Station. Its principal objective was development of southern pea varieties for mechanical harvest. Similar programs got underway at other Southeastern State Experiment Stations. Performance of some newly released varieties and breeding lines are given in Table 2. When once-over methods are used, yields are lower than when three or more hand harvests are made.

During the 2-year period 1965-1966, actual yields of green peas in the hull obtained at one harvest varied from 1,356 to 3,386 lb. of the cream types, 1,120 to 4,006 of blackeye types, and 1,396 to 3,782 of crowder types. Although Knuckle Purple Hull and Giant Blackeye produced the largest single harvest yields for crowder and blackeye types, the plant type in each case prohibits mechanical harvesting. The breeding objectives of bush type and concentrated set have been at least partially achieved in such varieties as Mississippi Silver, Floricream, Dixiecream, and breeding lines Ala. 91-6-7 and 91-6-4. Concentration of set, so important in once-over harvest methods, has been achieved to a relatively high degree in breeding line Ala. 91-7; 82% of its pods were ready for a single harvest. However, vinyness may still be a problem with this line. Princess Anne is an excellent bunch type that can be handled well with available machinery, but produces yields lower than desirable under current cultural systems. Research is now in progress to determine plant populations, row spacing, and fertilization methods for increasing yields of the extreme bush types for harvest by once-over methods.

Virus diseases of southern peas are becoming an increasing problem as planting dates are beginning to be scheduled from early to late in the same area. Plantings made late in the season may become heavily infected. The viruses are transmitted by insects through successive crops, resulting in a disease build-up. At least three viruses are known to be in Alabama, based on a survey of southern pea fields made last summer by graduate students in the departments of Botany and Plant Pathology and Horticulture.[1] Sources of resistance to these viruses are known and attempts are being made to incorporate resistance into promising breeding lines for machine harvest.

Resistance to cowpea curculio is also being sought. In preliminary 1966 tests, breeding line Ala. 8 showed considerable resistance to the insect[2]. For comparison Knuckle Purple Hull was damaged 43% and Ala. 8 only 6%.

The important characteristics of seed texture and taste, processing, and other quality factors must be determined before any line is considered. Preceded by much testing, only those lines regarded as acceptable in all characteristics and superior in one or more, such as suitable for machine harvest, will be released.

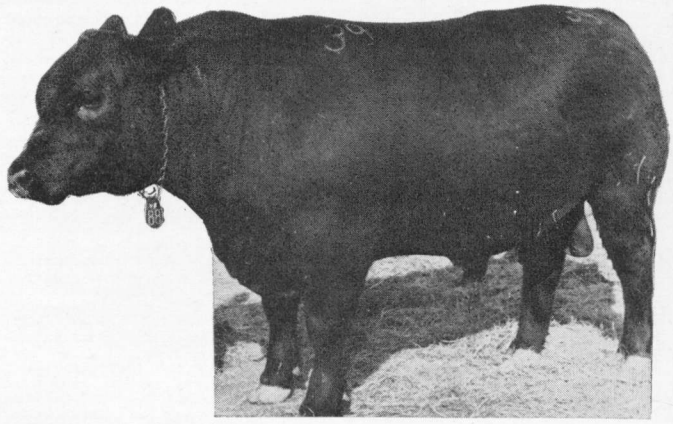
[1] Under direction of R. T. Gudauskas, Dept. of Botany, Plant Pathology, and the author.

[2] Tests conducted by T. Don Canerday, Dept. of Zoology-Entomology.

Table 2. Yield of Different Varieties of Southern Peas Using Once-Over Harvest Methods

Variety	Yield per acre				Portion at one harvest	Kind of pea
	1965		1966			
	Clanton	Cullman	Cullman	Auburn		
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Pct.*	
Knuckle Hull	3,782	2,480	1,396	----	----	Crowder
Ala. 91-6-7	3,584	2,851	----	1,368	46	Blackeye
Ala. 91-7	2,376	2,042	----	2,261	82	Cream
Ala. 91-6-4	2,475	3,447	----	----	----	Blackeye
Ala. 99-55	3,069	3,212	----	----	----	Blackeye
Princess Anne	2,039	----	1,120	----	----	Blackeye
Floricream	1,881	----	----	2,024	47	Cream
Dixiecream	3,386	----	----	2,152	44	Cream
Ala. 8	2,831	----	1,356	----	----	Cream
Ala. 201-2-3	----	3,326	----	----	----	Blackeye
Giant Blackeye	----	4,006	----	----	----	Blackeye
Miss. Silver	----	----	----	3,049	65	Crowder

relationship of PERFORMANCE RECORDS *to* SALE PRICE *of* TESTED BULLS



TROY B. PATTERSON and JOHN A. McGUIRE
Department of Animal Science

PERFORMANCE TESTING of beef cattle was begun in Alabama in the fall of 1951. Seven breeders and the Auburn University Agricultural Experiment Station consigned 21 bull calves to the test.

Records show that 20 bulls completed this first test, making an average daily gain (ADG) of 1.80 lb. Bulls from this test were not sold at auction. Beginning the following year and continuing to date a sale has been held in conjunction with each performance test.

In the subsequent 15-year period, 1952-53 to 1966-67 inclusive, 1,100 bulls completed the test and of these 860 were sold. Records of these 860 animals were analyzed in a study concerning relationship of performance records to sale price of tested bulls.

Minimum Requirements Added

During early years of the performance test there were no minimum performance requirements for bulls entering the test. Beginning with the 1960-61 test, minimum conformation score (CS) and weight per day of age (W/DA) entry requirements were established. Effect of these entry requirements on subsequent performance is shown by the following results:

	Average performance	
	1953-59 (7 years)	*1960-67 (8 years)*
Number of bulls	344	516
ADG, lb.	2.24	2.45
W/DA, lb.	2.05	2.28
CS[1]	11.9	12.7
Price, dollars	407.19	588.45

[1] Scoring system: 11=high Good, 12=low Choice, 13=Choice, and 14=high Choice.

Not only was W/DA increased from 2.05 to 2.28 lb. at end of test, but these select bulls gained about 0.2 lb. per day faster while on test. There was an average increase of ⅓ grade in CS, which was expected since lower scoring bulls were excluded.

The difference in sale price of $181.26 could have been caused by several factors. The beef cattle industry has become more important in the State, and producers are more concerned about factors that influence the economics of beef cattle production. An on-the-farm performance testing program begun by the Extension Service of Auburn University created more interest in and demand for bulls with better records. Economic conditions have been more favorable, and this stimulates higher prices for purebred bulls. Probably of greatest importance is that higher quality bulls with better performance records command higher prices.

There was considerable variation in performance of individual bulls within each test year. The fastest gaining bull ever tested was a Charbray that gained 515 lb. in 140 days, or 3.68 lb. per day. Second fastest was an Angus that gained 472 lb. on test for ADG of 3.37 lb. The highest W/DA was 3.07 lb., made by a Charbray bull.

Buyers Consider Record

Evidence that buyers consider records carefully in selecting bulls for their specific needs is indicated by a special analysis of the data. The method used (called partial standard regression) permits measuring the effect of one trait on another with all other traits held constant. For example, it permits measuring effect of ADG on selling price when W/DA and CS are held constant.

Results indicate that buyers paid an additional $20.59 for each 0.1 lb. increase in ADG. By the same method it was determined that buyers paid an additional $41.13 for each 0.1 lb. increase in W/DA and $95.93 for each ⅓ increase in CS. For example, the average bull during the last 8 years made 2.45 lb. ADG, had W/DA of 2.28 lb., graded 12.7, and sold for $588.45.

Expected selling price for different combinations of performance levels is given in the table. To illustrate, a bull with 2.00 lb. ADG, 2.00 lb. W/DA, and CS of 12 would be expected to bring $313. These expected prices are conservative at both extremes. The lowest selling bull during the 15 years brought $145. He had ADG of 2.43 lb., W/DA of 1.63 lb., and CS of 9 (low Good).

EXPECTED SELLING PRICE FOR TESTED BULLS WITH DIFFERENT PERFORMANCE LEVELS

Average daily gain	Price, by selected performance levels								
	Conformation score 12			Conformation score 13			Conformation score 14		
	Weight per day of age			Weight per day of age			Weight per day of age		
	2.0	2.5	3.0	2.0	2.5	3.0	2.0	2.5	3.0
2.00 lb.	$313	$519	$ 725	$409	$ 615	$ 821	$505	$ 711	$ 917
2.75 lb.	511	717	923	607	813	1,019	703	909	1,115
3.50 lb.	708	915	1,121	805	1,010	1,217	901	1,107	1,313

From a genetic improvement standpoint, a bull with a performance record of 3.5 lb. ADG, 3.0 lb. W/DA, and CS of 14 could easily be worth several times the value of $1,313 listed in the table. Several bulls have exceeded this price. The highest selling bull (shown in photo) brought $2,100. His record was 2.87 lb. ADG, 2.56 lb. W/DA, and CS of 14.

This analysis of sales records indicates that cattlemen use records in determining price they pay for a bull in the annual performance test sale.

Alabama's FEED GRAIN DEFICIT SITUATION

JAMES R. HURST, *Dept. of Agricultural Economics and Rural Sociology*

SPECIALIZATION in livestock and poultry production has brought about significant adjustments in Alabama agriculture since 1953. Most adjustments have resulted in more efficient and profitable use of agricultural resources.

Increase in feed grain utilization without corresponding increases in feed grain production have caused concern over growing grain deficits. In 1953 feed grain production almost equaled utilization, Table 1. The deficit increased to about 35 million bu. in 1966 and is estimated at over 55 million bu. by 1975. The increasing feed grain deficits are disturbing to some segments of agriculture. Yet can we afford to increase feed grain acreage and production as balanced against cost of imported grains from the the Corn Belt?

Acreage of corn, which accounts for 95% of feed grain production in Alabama, has declined steadily since 1954, Table 2. Per acre yields almost doubled between 1954 and 1965 to offset declining acreage. Other feed grains had corresponding trends in yields and acreage. Feed grain production has continued to average about 50 million bu. annually.

A large proportion of land taken out of grain in recent years has been marginal or low-producing row-crop land. Many acres of row-crop land have been diverted to forage crops and forestry.

The shift from row crops to forage crop production indicates efficiency because Alabama has a comparative advantage in forage and cattle production. Grain can be purchased from states that have an advantage in grain production.

Feed grain utilization was approximately 54 million bu. in 1953. Primarily because of increased poultry production, utilization increased 60% from 1953 to 1966. Utilization is estimated to increase 23% more and exceed 106 million bu. by 1975. By that time over 50% of the feed grain will be imported from other states, primarily in the North Central United States.

In 1953 a major portion of feed grain was fed to "work-stock," "family milk cows," and "meat hogs." (See chart.) In 1966 poultry (primarily broilers) accounted for about 56% of feed grain utilization. It is estimated that poultry will use over 60% of all grain by 1975.

Poultry production, concentrated primarily in northern Alabama counties, has been largely dependent on grain imported from the Corn Belt because of limited supplies of local corn. The major advantages of imported corn are: (1) availability of graded, shelled corn in adequate quantities throughout the year, and (2) more economical handling by receiving large shipments from low-cost water or rail transportation facilities.

Economies have accrued to Alabama from specialization in larger livestock and poultry enterprises. Large size enterprises have made it feasible to use more mechanization and other advanced technological developments to increase productivity and lower unit costs.

Larger volumes of grain imported from the Corn Belt and processed in the State assure more uniform and complete utilization of transportation, storage, and processing facilities. Savings result from storing grain in the Corn Belt, where there are adequate facilities, and shipping it to Alabama as it is needed. Storage of imported corn in Alabama would require extensive use of transportation only during the harvest season.

Land use adjustments that would bring about a substantial increase in grain production in Alabama would require bringing marginal land back into production. This would tend to lower grain yields. It could also reduce acreage in forage crops and cattle production, an enterprise in which we have advantages over other areas.

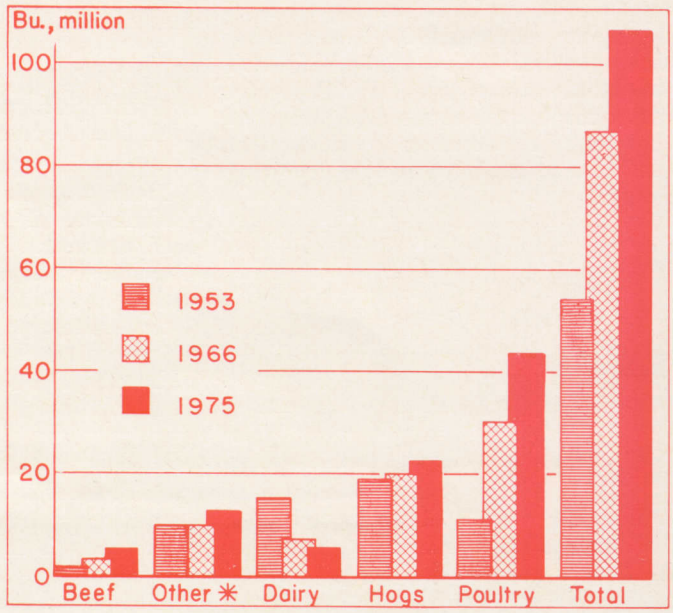
Most important, increased grain production in Alabama would require heavy investments in additional storage and handling facilities. Unless price-cost relationships change, the economic feasibility and desirability of becoming self sufficient in grain production is questionable.

TABLE 1. FEED GRAIN UTILIZATION, PRODUCTION, AND DEFICIT ALABAMA, 1953, 1966, AND 1975

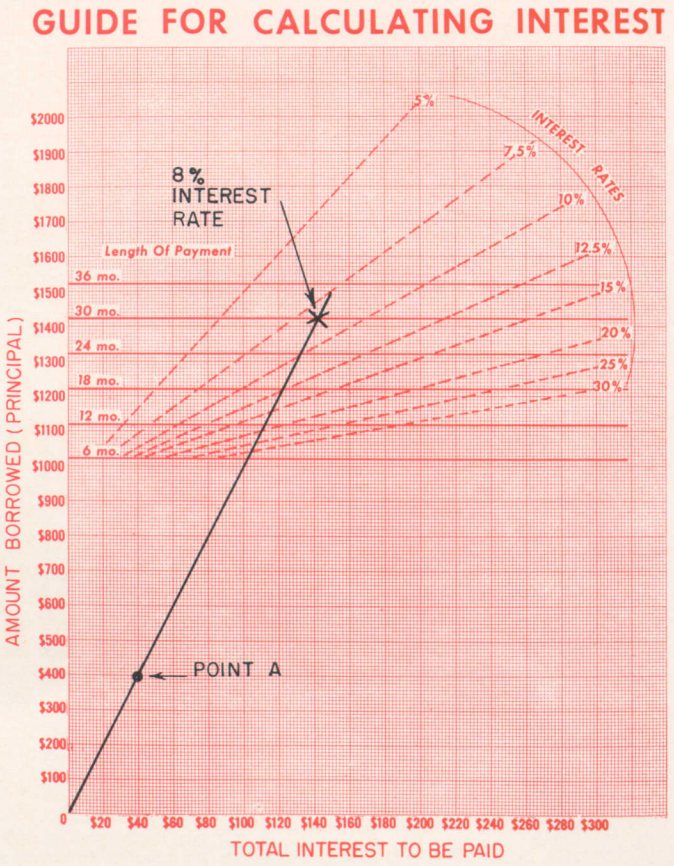
Year	Utilization	Production	Deficit
		Bushels (1,000)	
1953	54,538	53,544	994
1966	86,655	51,309	35,346
1975	106,458	51,082	55,376

TABLE 2. CORN ACREAGE, YIELD, AND PRODUCTION, ALABAMA, 1954-65

Years	Acreage	Yield	Production
	Acres (1,000)	*Bushels*	*Bushels (1,000)*
1963-1965	1,169	41	47,929
1960-1962	1,438	30	43,140
1957-1959	1,836	27	49,572
1954-1956	2,172	22	46,794
AVERAGE	1,643	28	46,004



Feed grain utilization by class of livestock, Alabama 1953, 1966, and 1975. *Includes horses, mules, sheep, and other miscellaneous grain-consuming animals.



High Interest Rate Paid on Durable Goods

BILL R. MILLER, *Dept. of Agricultural Economics and Rural Sociology*

TRUE INTEREST RATE paid is often two to three times as high as the quoted rate. Recent Auburn investigations reveal the wide difference between actual and stated rates, and also show that many people are unaware of interest rates being paid on consumer debts.

By description, true annual rate of interest is the amount of interest charged divided by amount of money borrowed for 1 year. This simple definition becomes more difficult to explain as the loan is repaid over periods greater or less than a year, with varying numbers of installments, as service charges are added, and when amount borrowed and interest charges are partially concealed by ordinary business practices.

The average consumer's difficulty in understanding interest rates was revealed by the Auburn University Agricultural Experiment Station survey of interest rate structure and attitudes toward use of credit. Results presented are from a random sample of the population in DeKalb, Cherokee, Marshall, and Jackson counties.

Of durable items bought and owned by the respondents (refrigerators, freezers, washing machines, radios, television sets, and stereo record players), almost half had been purchased on credit. In 90% of these credit purchases, buyers did not know or could not remember terms of credit. Lack of recall was not necessarily related to length of ownership, since the same results were noted for 1966 purchases (90% unaware of interest rate paid).

Annual interest rate was calculated on 17 items owned by rural persons and 8 items owned by urban sample members for which installment credit terms were known. All of the credit found was in installment loans. The formula used for calculation is one frequently used by the Federal Reserve System, as follows:

$$i = \frac{\text{interest charge}}{\frac{\text{principal}}{2}} \times \frac{\text{no. of payments}}{\text{no. of payments} + 1} \times \frac{1}{\text{no. of years}}$$

Interest charge was defined as total amount of money repaid minus the principal. Insurance charges on life and property were subtracted from total repayment when these were known. Service or account charges were not subtracted. Interest rate calculated in this way averaged 41% annually on items in the urban sample and 38% on purchases of the rural respondents.

In contrast to the calculated rates, 6% annual interest on charge accounts was expected by 47% of these interviewed, and only 29% expected higher rates. The remaining 24% said they had no idea what the rate might be.

Lenders in the area were also surveyed to obtain their quoted installment terms. Terms quoted by five banks were calculated to average 16% annual interest. Five durable goods dealers quoted rates that were calculated to average 22%, and one small loan company's rates when calculated averaged 37%. All other loan companies in the sample declined to give specific information.

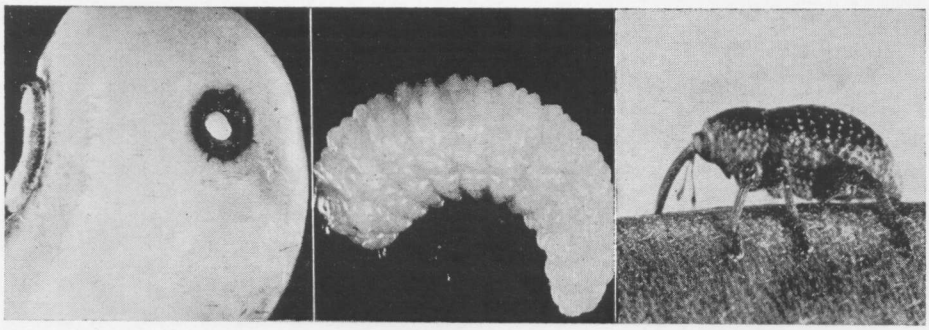
Quoted bank rates ranged from 6 to 8%. However, the installment method of repayment almost doubles the rate, primarily because amount of principal used in the lending period averages about half of the stated amount. Also, banks added service charges that brought final rate to about 16%.

The differences between calculated bank and store rates of 16 and 22% and the 38 to 41% paid by buyers are explained in part by the practice of discounts for cash. If an item listed for $100 could be bought for $85 cash, the consumer buying on credit with no down payment must pay not only the interest charge on $100, which may be 22%, but must consider the $15 discount to be a credit charge also. The net result may be an interest rate of 35 to 40%, depending on length of time the money is borrowed. Cash prices after discount or trade-in must be known if the consumer is to have all information about credit terms.

Important relationships between principal, interest charge, time, and number of payments may be seen in the chart developed for the study. Applicable to installment loans requiring weekly or monthly payments, the chart identifies the true interest rate.

The example shown on the chart ($400 borrowed, $40 interest charges, and 30 months length of loan) illustrates use of the chart for computations. A point is established where lines from the $400 and $40 amounts cross (marked point A). With a ruler or other straight edge running from point 0 at lower left corner through point A, a mark is made where the straight edge crosses the 30-month line (length of loan). This mark falls at a point representing about 8% interest (between 7.5 and 10%).

All other combinations of principal, time, and interest charge that appear along the straight edge represent the same interest rate read for the original problem. This means that you can first locate the mark for time and interest rate you desire and then read the combinations of principal and interest charge indicated along the straight edge.



The life cycle of the cowpea curculio may start inside a pea as shown at left. The larva remains there for about 13 days when it bores through the hull and drops to the ground and bores into the soil and pupates. The adult emerges from the soil in about 18 days. (From Station Bul. 246.)

Control of Lesser Cornstalk Borer and Cowpea Curculio on Southern Field Peas

MAX H. BASS and T. DON CANERDAY
Department of Zoology-Entomology

Southern field peas have two important insect pests, the cowpea curculio and the lesser cornstalk borer.

The cowpea curculio damages the developing peas in the pod and the lesser cornstalk borer destroys seedling peas.

Biology

The cowpea curculio is somewhat like the boll weevil. It is a small, black weevil with mouthparts at the end of a long snout. The adult female weevil uses its snout to eat through the hull of the pea pod and lays an egg inside the pea hull, frequently directly inside the developing seed. Green pods, half grown to mature, are most often attacked. Each female weevil usually lays about 100 eggs, one per puncture, during her lifetime.

The egg hatches in 3 or 4 days and if the larva is not already within a pea seed it makes its way to one and bores inside. The larva feeds for approximately 13 days inside the pea. At the end of this period the larva emerges from the pea seed, cuts its way out through the hull and drops to the ground where it bores into the soil and pupates. The adult emerges from the pupal cell in the soil and makes its way to the surface some 18 days later. The winter is passed in the adult stage.

In addition to depositing eggs within the peas and thus causing them to be "wormy" and unfit for human consumption, the adult also feeds by means of its long snout on pea seed. This causes them to be deformed and dwarfed.

The lesser cornstalk borer is primarily a pest of corn, but frequently attacks southern field peas and a number of other crops.

The insect overwinters as a larva or pupa in the soil, and emerges as an adult moth in the spring. Peas planted in sandy soils in June seem to be the main victim of this insect. The adult lays an egg on the stem of the seedling pea plant where the larva hatches and bores into the small stalk near ground level. It then bores up and down inside the stem causing the stem to weaken and the plant to fall over and die. The larva has usually matured by the time the plant dies and it then makes its way out of the withered stem and pupates in the soil.

Table 1. Percentage Reduction of Cowpea Curculio Damage to Southern Field Peas on Plots Treated with Various Insecticides

Treatment	Amount	Damage reduction
	Lb./a.	*Per cent*
Untreated check		0
Malathion	1.25 EC[3]	12
Diazinon	0.5 EC	20
Guthion[1]	0.5 EC	61
Toxaphene[1]	4.0 EC	73
Carbaryl	2.0 WP[4]	76
Endosulfan[2]	0.5 EC	84

[1] See text for restrictions on use.
[2] Not labelled for use on peas.
[3] Emulsifiable concentrate.
[4] Wettable powder.

Infestations of lesser cornstalk borers in southern field peas are sporadic, but when they occur they may reduce the pea stand by 30 to 50%. Lesser cornstalk borer damage is sometimes mistaken for one of several seedling diseases that may result in similar stand losses. Positive proof of damage by this insect can be obtained by examining damaged plants for the presence of the larva in the stem or for the presence of the exit hole if the larva has already left the stem.

Control

In experiments at the Auburn University Agricultural Experiment Station using 14 varieties of peas, 36% of the seed were damaged by the cowpea curculio when no control measures were used.

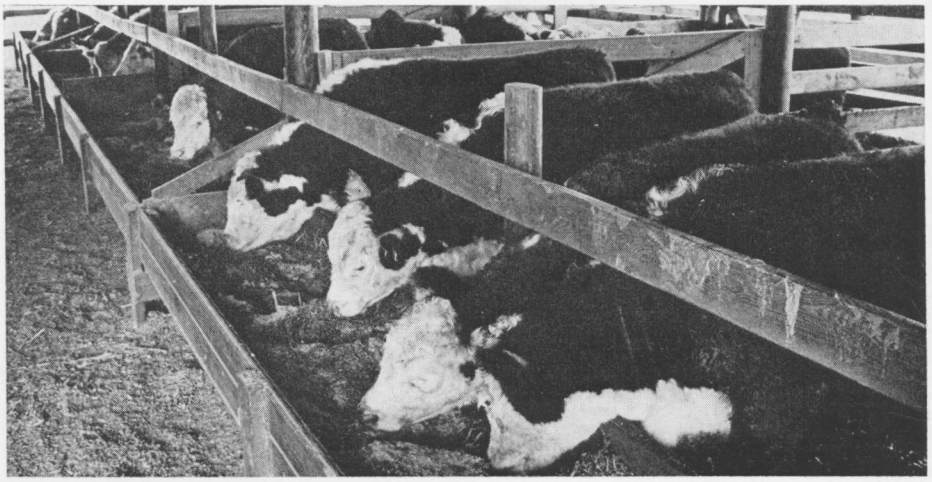
The cowpea curculio can be controlled with a number of materials, Table 1. This table presents results of a typical recent experiment and includes some materials that cannot be recommended for use on peas since they leave an undesirable residue at harvest. Of materials that can be used, carbaryl (2 lb./acre), toxaphene (3 lb./acre) or guthion (¾ lb./acre) give satisfactory results. One application should be made at first bloom and repeated 2-3 times at 5-7-day intervals. Guthion should not be applied more than 4 times per season and not within 7 days of harvest. There is no time limitations on toxaphene if only shelled peas are to be used. If snaps are to be used, toxaphene should be applied as a dust only, and not within 7 days of harvest.

Control of the lesser cornstalk borer is difficult since control measures must be initiated before visual signs of damage occur. Table 2 gives the results of a typical recent experiment on control of this insect and includes some insecticides that cannot be recommended for use on peas because of residue problems. For peas planted in June or later on sandy soils with a history of lesser cornstalk borer damage, control measures should be initiated as soon as pea plants emerge. Insecticides should be applied in a band directly over the row. Of materials that can be used, carbaryl (2 lb./acre), guthion (1 lb./acre) or diazinon (1 lb./acre) give acceptable control. One application should suffice.

Table 2. Per cent Stand Reduction by Lesser Cornstalk Borer after Treatment with Indicated Insecticide

Treatment	Amount	Stand reduction
		Per cent
Di-Syston*	1 EC[1]	31
Phorate*	1 EC	24
Untreated check		22
Imidan*	1 EC	20
Carbaryl	1 WP[2]	19
Toxaphene	2 EC	18
Dimethoate*	1 EC	16
Diazinon	1 EC	15
Heptachlor*	1 EC	14
Guthion	1 EC	12
Carbaryl	2 WP	11
Endrin*	1 EC	8

* Not labelled for use under conditions described in article.
[1] Emulsifiable concentrate.
[2] Wettable powder.



Beef steers at the Lower Coastal Plain Substation fed urea-containing silage are shown in the feedlot.

EVALUATION of UREA-CONTAINING SILAGES

R. R. HARRIS and BRADY ANTHONY, *Department of Animal Science*
V. L. BROWN, *Lower Coastal Plain Substation*

UREA CAN BE SUBSTITUTED for protein in the rations of ruminant animals.

Basically the rumen microorganisms of these animals use the urea to make their own protein. Since urea does not contain energy, some source of readily available energy must be provided or the transformation to protein will not occur. Starch is the ideal carbohydrate or source of energy for this purpose and it is usually supplied in an animal's diet in the form of corn, milo, or some other cereal grain.

The recent practice of adding urea to materials to be ensiled has received much publicity. The high cost and limited supply of the common oil meal protein supplements are reasons for emphasis on use of urea with crops that are to be ensiled.

Feed grade urea presently available commercially contains 45% nitrogen. Its "protein equivalent" is 281% (N × 6.25). One pound of urea is equivalent to 2.81 lb. of protein provided a readily available source of energy is present to cause maximum microbial action.

The dry matter content of silages varies, thus the protein equivalent of urea added to the green-chopped material will vary. However, the addition of 10 lb. of urea per ton of ensiled material will usually increase the protein content by about 4.75% (dry basis). For example, if corn silage is 8% crude protein (DM basis), the addition of 10 lb. of urea per ton of green material ensiled would increase the crude protein content to about 12.75% dry basis.

ANIMAL PERFORMANCE DATA—SORGHUM SILAGE WITH AND WITHOUT UREA, LOWER COASTAL PLAIN SUBSTATION, 1966

Item	Group II NK-300 + 100 lb. corn per ton	Group IV NK-300 + 100 lb. corn + 10 lb. urea per ton
Initial wt., lb.	592	592
Final wt., lb.	841	863
Gain, lb.	249	271
Days	152	152
A.D.G., lb.	1.64	1.78
Feed per steer, lb.		
Sorghum silage	5,166	5,075
Protein supplement	228	152
Ear corn	608	608
Daily feed, lb.		
Sorghum silage	34.0	33.4
Protein supplement	1.5	1.0
Ear corn	4.0	4.0
Feed/cwt. gain, lb.		
Sorghum silage	2,075	1,873
Protein supplement	91.6	56.1
Ear corn	244	224
Feed cost/cwt. gain[1]	$19.14	$16.75

[1] Based on following prices: silage No. II, $9.62 per ton; silage No. IV, $10.10 per ton; ground ear corn, $45 per ton; "Auburn 65" protein supplement, $80 per ton. The basic silage cost without corn or urea was $6.76 per ton for production, harvesting, and storage.

Experimental Results

Sorghum (NK-300) was grown in 1966 on the Lower Coastal Plain Substation, Camden, and was stored in concrete stave upright silos of about 50-ton capacity. The crop suffered from drought but produced 14.5 tons of green weight per acre that was 38.52% dry matter at time of ensiling. The dry matter of the silage contained 48.15% head – the stalk was shortened by lack of moisture thus increasing the proportion of grain or head.

Several treatments were used in an intensive silage utilization study but only two will be presented here. The control or basal silage (Group II) contained 100 lb. of ground shelled corn per ton of green material. The urea-containing silage (Group IV had 10 lb. of urea added per ton of green weight in addition to the same quantity of corn.

Two groups of six yearling beef steers each were fed these silages while confined to concrete-floor pens in a pole-type barn. The silages were full-fed. Cattle in Group II received 1.5 lb. of protein supplement and 4 lb. of ground snapped corn per head daily. Those in Group IV got 1 lb. of the protein supplement and the same quantity of corn. The "Auburn 65" protein supplement used contained 17.5% urea, 57.5% CSM, 12.5% ground corn, and 12.5% dicalcium phosphate. Animal performance data are given in the table.

Cattle that received "urea" silage gained slightly faster than those that received the basal silage (1.78 vs. 1.64 lb.). They also had slightly better feed conversion and thus their feed cost per cwt. of gain was a bit cheaper.

These data indicate that the addition of urea to a crop that is to be ensiled is probably a good practice. However, since these results are from a single test, they should be evaluated with that in mind. Observations from another test within the State still in progress would indicate that caution must be used in making silage which contains urea. In this latter test, urea-containing silage is not palatable.

If urea is to be added, it should not be used at a rate to exceed 2% of the dry matter. Experience indicates that the addition of urea at a rate of about 4% of the dry matter decreases palatability of the silage and consequently lowers animal performance.

High Humidity During Boll Opening Lowers Quality of Cottonseed

J. M. WOODRUFF*, C. S. HOVELAND, and F. S. McCAIN*
Department of Agronomy and Soils

QUALITY OF COTTONSEED for planting is largely determined by weather conditions during the time bolls are opening. Recent Auburn experiments show that high relative humidity during this period is the main reason for low quality of planting seed, often a serious problem in Alabama.

Effects of weather on cottonseed quality were studied in the laboratory under carefully controlled conditions. Mature green cotton bolls (Empire variety), 45 to 50 days old, were harvested at the cracking stage. These bolls were mounted on racks in chambers and exposed to different temperature, light, and humidity conditions during a 21-day period.

Relative humidities of 60, 70, 80, 90, and 100% were used at 86°F. In addition, bolls were exposed to temperatures of 77, 95, and 104°F. at relative humidities of 60, 70, 80, and 90%. Effect of light was studied in chambers receiving 2,000, 1,000, 500, and 50 foot-candles, all at a temperature of 95°. Light intensity on a bright day is around 10,000 foot-candles, but may be only 500 foot-candles in a thick stand of mature cotton.

After 21 days of boll exposure to test conditions, the seed cotton was ginned and the seed acid-delinted. Subsequently seed were germinated at 68°F. for 120 hours. For comparison, other bolls were dried at 95°F. to a seed moisture content of 7% (considered "ideal conditions"), ginned, acid delinted, and germinated similarly. These samples are labeled "check" in graphs.

Relative humidity had a pronounced effect on cottonseed quality, as shown by the graphs. Germination percentage and seed root growth decreased sharply as humidity went above 60% during the 21-day boll-opening period. Seed roots of deteriorated seed were shorter and thicker than those of more vigorous seed. Seed root elongation decreased from 1.7 to 1.1 in. as relative humidity increased from 60 to 70%. This indicates that a 10% increase in humidity had a considerable effect on seed vigor, even though germination percentage showed less response.

Boll rot increased with increasing relative humidity. Boll rots occurred on 5 to 15% of bolls at 70% humidity, on 25 to 40% at 80% humidity, and on 60 to 80% with relative humidity of 90-100%. Bolls noticeably damaged by boll rot were discarded and seed were not used in germination tests.

Seed content of free fatty acids is another quality indicator, with a high value in cottonseed indicating deterioration. In this experiment free fatty acid content increased rapidly as relative humidity went above 70% during boll opening.

Cottonseed obtained from bolls exposed to 60% humidity had a moisture content of 10%. This did not affect seed vigor, as indicated by results of germination and seed root elongation tests.

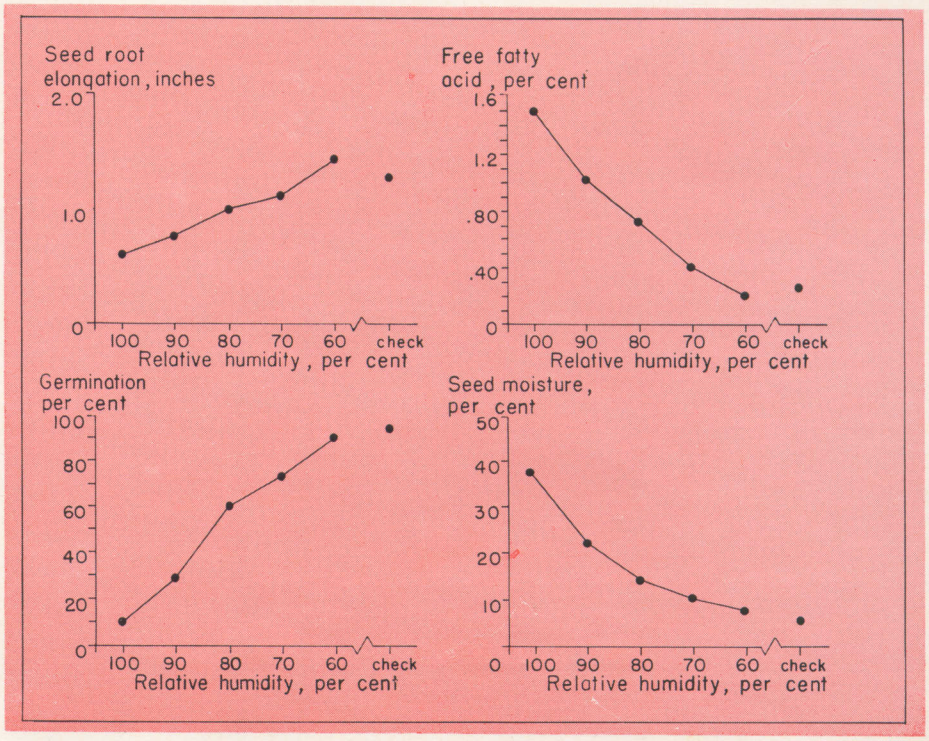
Raising temperature during the boll exposure period from 77 to 104° at constant relative humidities had little effect on seed quality. Higher temperatures slightly decreased seed moisture content and would be expected to favor seed quality. However, results of germination, seed root elongation, and free fatty acid tests did not indicate any quality improvement.

Increasing light intensity from 50 to 2,000 foot-candles at 95°F. and 80% relative humidity did not directly affect seed quality. As might be expected, higher light intensity speeded boll opening. Under field conditions light intensity increases are accompanied by rising temperature and decreasing humidity. Low temperature may also affect seed quality by increasing the time cottonseed are exposed to high humidity.

In this laboratory study cottonseed quality was reduced as relative humidity increased above 60% during boll opening. Since humidity in cotton fields often exceeds 70% during this time, this would readily account for poor quality cottonseed often produced in Alabama.

Another complicating factor is that relative humidity increases in lower plant zones as plants grow taller. Thus, when humidity is high, seed produced on lower bolls could be expected to be lower in quality than seed from upper plant parts.

Cultural practices that permit more sunlight to penetrate lower plant zones and allow more air circulation should increase temperature, lower relative humidity, and reduce seed deterioration.



Effect of relative humidity on percentage germination, seed root elongation, percentage free fatty acid content, and moisture content of cottonseed is illustrated by these graphs. Temperature of 86°F. was used with all humidity levels tried in the experiment. Check treatment had seed dried at 95°F. to 7% moisture, considered "ideal conditions."

* Resigned.

effects of feeding INSECTICIDE-SALT-MINERAL MIXTURES TO STEERS

V. L. BROWN, *Lower Coastal Plain Substation*
KIRBY L. HAYS, *Dept. of Zoology-Entomology*

All research in economic entomology should aim at insect control with the least possible insecticide applied in the most economical manner.

This approach has been evident in efforts to control the horn fly on cattle. Many devices have been developed, including self-sprayers and backrubbers, but cattlemen have wished for a material that could be fed to animals and control all parasites, both internal and external. Several such materials are appearing on the market. Some of the insecticides in such mixtures are supposed to kill insects on cattle, while others are supposed to kill immature stages of these insects while they are growing in cow manure.

To evaluate such insecticide materials, a 1965-66 study* at the Lower Coastal Plain Substation, Camden, investigated feeding insecticides to steers in salt-mineral mixtures. Degree of fly control and effects of such control on weight gain were measured.

Different Treatments Tried

Forty good quality grade steers (400 to 600 lb.) were divided into four equal groups on the basis of weight and grade. Antihelminthics were given for internal parasite control and each group of animals was placed on an 8-acre pasture of sorghum-sudan hybrid and Coastal bermudagrass.

In 1965, these test treatments were used:

Group 1 – salt-mineral mix; no attempt to control horn flies

Group 2 – salt-mineral mix; provided backrubber treated with 2% malathion

Group 3 – salt-mineral mix containing 2% phenothiazine

Group 4 – salt-mineral mix containing 5.5% ronnel

These treatments were used for the 1966 test:

Group 1 – salt-mineral mix; no horn fly control measure

Group 2 – salt-mineral mix; provided backrubber treated with 5% methoxychlor

Group 3 – salt-mineral mix containing 2% phenothiazine for the first 43 days and plain salt-mineral last 48 days

Group 4 – salt-mineral mix containing 2% phenothiazine

Horn fly population was determined weekly as an index. This was derived by counting horn flies on one side of each of the 10 animals and dividing by 10. Populations in excess of 100 per side could not be counted accurately and were considered to be uncontrolled.

The steers were removed to a catch pen and weighed at beginning and end of the 90-day test, and once or twice between times. The loose salt-mineral fed in 1965 was not conducive to determining consumption, but the block form used in 1966 permitted keeping consumption records.

Information Obtained

The pastures of sorghum-sudan and Coastal bermuda provided an excess of green forage in both 1965 and 1966, despite a prolonged drought during each year's test.

In both years, horn fly numbers were negligible on steers when they were placed on the plots. An increase in population could be seen 7 days later and in 2 weeks the flies were present on all the cattle. In 20 to 30 days horn fly populations were in uncontrolled numbers on all steers except those having access to the backrubbers. Animals that used the backrubbers treated with 2% malathion in 1965 were afforded only fair insect control, but the 1966 backrubber treatment of 5% methoxychlor enabled the cattle to live in almost complete freedom from horn flies.

All groups of animals in the 1965-66 test made satisfactory weight gains considering the drought and type of forage. In 1965, only steers receiving phenothiazine gained faster than the nontreated group. The following year, the nontreated group was outgained only by those that received treatment from the methoxychlor backrubber.

No treatment proved better or poorer than the untreated comparison. Therefore, these results lead to three conclusion: (1) feeding phenothiazine or ronnel does not result in increased weight gains, (2) horn fly control with a backrubber does not increase rate of gain to an important degree, and (3) steers on summer pastures of sorghum-sudan hybrid and bermudagrass can be expected to gain about 1½ lb. daily.

* This research was supported in part by a grant from Interstate Chemical Co., Kansas City, Missouri.

Degree of Horn Fly Control and Rate of Weight Gain of Steers Fed Insecticides in Salt-Mineral Mixtures, June 30-October 5, 1965, and June 16-September 15, 1966

Treatment	Initial weight	Total gain	Range in total gain	Average gain per day	Horn flies counted weekly, average	Daily consumption of mineral block per steer
	Lb.	*Lb.*	*Lb.*	*Lb.*	*No.*	*Lb.*
1965 test						
Salt-mineral only	476	148	100-230	1.51	NC[1]	---[2]
Salt-mineral + 2% malathion backrubber	478	137	95-185	1.39	38.7	---
Salt-mineral + 2% phenothiazine	476	166	110-210	1.69	NC	---
Salt-mineral + 5.5% ronnel	475	144	110-210	1.47	NC	---
1966 test						
Salt-mineral only	598	149	110-190	1.64	NC	0.62
Salt-mineral + 5% methoxychlor backrubber	590	158	130-185	1.73	1.7	.51
Salt-mineral + 2% phenothiazine first 43 days, no insecticide last 48 days	581	130	80-165	1.43	NC	.28
Salt-mineral + 2% phenothiazine	594	127	105-140	1.40	NC	.28

[1] No evident control.
[2] Loose salt-mineral mixture fed in 1965 could not be accurately measured.

Herbicides Affect Growth of Root Disease Fungus

R. RODRIGUEZ-KABANA, E. A. CURL, and H. H. FUNDERBURK, JR.

Department of Botany and Plant Pathology

INCREASED applications of herbicides to agricultural soils are a part of the rapid development of weed control in the past decade. In the United States alone, more than 300 million lb. of weed killers are applied per year to about 85 million acres.

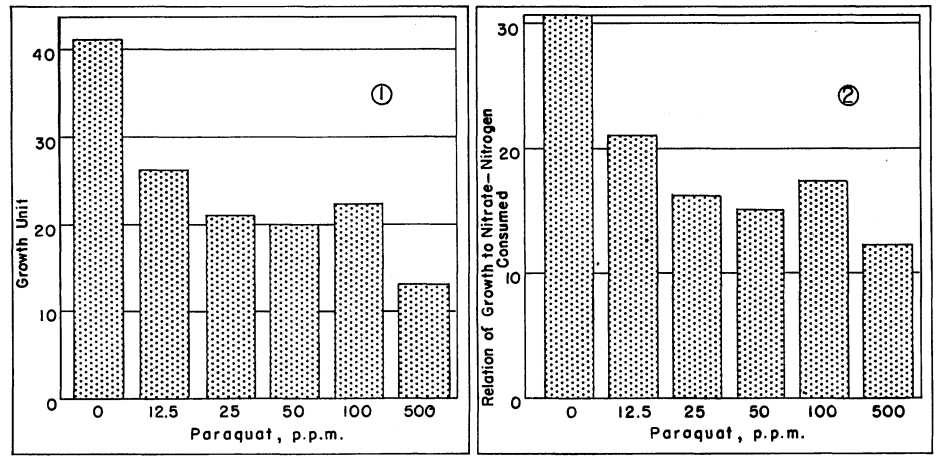
This is good because it provides the farmer with a means of reducing labor requirements and costs and increasing yields. However, any soluble organic material incorporated in field soil affects behavior of microorganisms present. While we enjoy the benefits of weed killers, it is important to know how certain organisms such as plant-disease fungi respond to these chemicals.

For 4 years research has been conducted in Auburn's Botany and Plant Pathology Department to determine effects of various herbicides on growth and behavior of several soil-borne plant parasitic fungi that are common in Alabama soils. One is the Southern Blight fungus (*Sclerotium rolfsii*), which causes root and stem rots in a wide variety of crop plants. This parasite seems to be present in all soils of the South where adequate organic matter is available. Among the herbicides tested against this fungus were paraquat and trifluralin (Treflan), two relatively new but chemically different compounds. Paraquat, developed primarily as a nonselective herbicide, is now being used as a post-emergence weed killer in various crops. Trifluralin is used for preemergence weed control in cotton and soybeans.

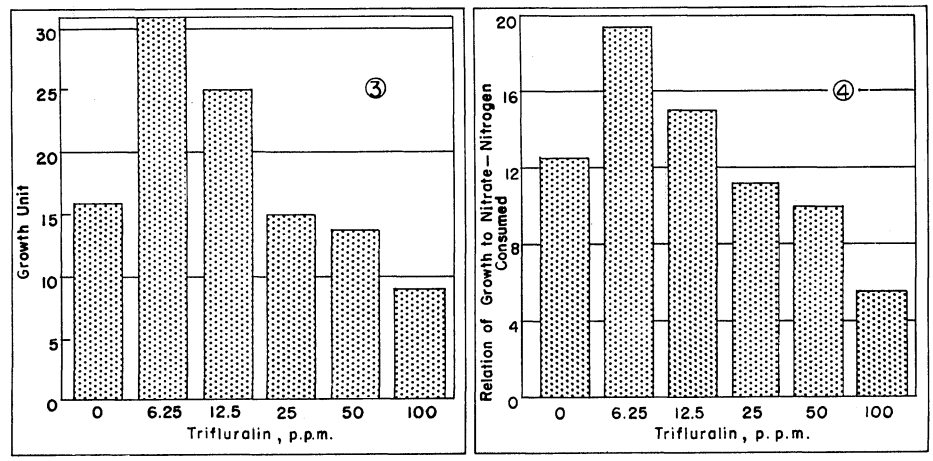
These chemicals were first tested for effect on growth and nutrient uptake by the Southern Blight fungus in flasks of nutrient solution. Growth was measured as total dry weight of matted filament (mycelium) produced by the fungus during various time intervals. Amounts of glucose, inorganic phosphorus, and nitrate-nitrogen taken up during these periods were determined by chemical analyses. Similar experiments were done in flasks of sterilized, herbicide-treated soil inoculated with the parasite. Growth in this case was measured by the amount of carbon dioxide (CO_2) produced by the fungus. In this case only nitrate-nitrogen in the soil was measured as an indication of effect on nutrient uptake. Various concentrations of both herbicides were tested, ranging from 12.5 to 1,000 p.p.m. (part per million) for paraquat and 6.25 to 100 p.p.m. for trifluralin. The lowest rates (12.5 and 6.25 p.p.m.) are about equal to field rates of the two compounds. For example, the recommended rate for trifluralin is 1 to 3 lb. per acre and incorporated in the upper 1 to 3 in. of soil. The higher rates in these experiments were used to determine the concentrations necessary to slow down growth of the fungus.

Results showed that all concentrations of either herbicide in nutrient-solution culture slowed down fungus growth. This inhibiting effect increased with increased concentrations of both. In soil the effect of paraquat on growth and on nitrate-nitrogen uptake was similar to that in the solution culture. For trifluralin, however, the fungus growth was stimulated at the two lower concentrations and inhibited by higher rates. Effect of trifluralin on nitrate-nitrogen uptake in soil showed a similar pattern – increased uptake at lower rates and reduced uptake at higher treatments.

Although much is to be learned about influence of herbicides on soil organisms, these experiments indicate probability of two opposite effects depending upon kind of herbicide and rates applied. Strong slow-down effects on a parasite, as demonstrated with paraquat, would be considered an added benefit along with weed control. Herbicides that stimulate parasite growth at concentrations near field rates should receive further study.



(1) Effect of several concentrations of paraquat in soil on growth of Southern Blight fungus over 22-day period. (2) Relation of growth to nitrate-nitrogen consumed; increased rates interfered with nitrate-nitrogen utilization.



(3) Effect of several concentrations of trifluralin in soil on growth of Southern Blight fungus over 21-day period. (4) Relation of growth to nitrate-nitrogen consumed; lower rates favored nitrate-nitrogen use and higher ones inhibited nutrient utilization.

Are ALABAMA MILK SUPPLIES ADEQUATE To Meet DEMAND?

LOWELL E. WILSON, *Department of Agricultural Economics and Rural Sociology*

LARGE ADJUSTMENTS have been made in milk supplies in Alabama, and throughout the Southeast during the past decade.

Between 1955 and 1966 the number of Grade A milk producers in the State declined from about 2,250 to 950, a 58% reduction. Yet, farm sales of Grade A milk increased about 60%. In 1966, Alabama producers marketed 662 million lb. of Grade A milk. Thus, average sales per herd in 1966 were more than four times the 1955 level.

In spite of the large production increase, Alabama is not a self-sufficient milk producing state, and it is unlikely to become one. Political boundaries, such as state borders, do not necessarily define economic marketing areas. Alabama is made up of several fluid milk markets, some of which include supply and distribution areas located in adjoining states. In 1966, 20.7% of total supplies received by Alabama distributors

Demand Projections

The primary factor affecting the milk consumption level is population. Increases in milk consumption will result mainly from population growth. To a lesser extent, income and price changes also affect milk consumption. In Alabama, population has been projected to increase 13% between the year 1960 and 1975, or about 8% above the present. Based on a study of demand for products of the fluid milk industry in the South, consumption estimates were obtained for Alabama for 1974, Table 1. Low and high levels of demand were

TABLE 1. PROJECTED DEMAND FOR PRODUCTS OF THE FLUID MILK INDUSTRY AT LOW AND HIGH LEVELS, ALABAMA 1974

Demand levels	Fluid milk products[1]	Nonfluid milk products[2]	Total
	Mil. lb.	*Mil. lb.*	*Mil. lb.*
Low	851.8	168.7	1,020.5

Supply Alternatives

Some milk supply alternatives are listed in Table 2 that would provide low and high levels of milk supply adequate to meet demand for milk products in 1974. It is assumed that average annual production per cow in 1974 will be 11,500 lb. This is a conservative production estimate, as production trends indicate that average production may be several hundred pounds greater.

Trend in Milk Production

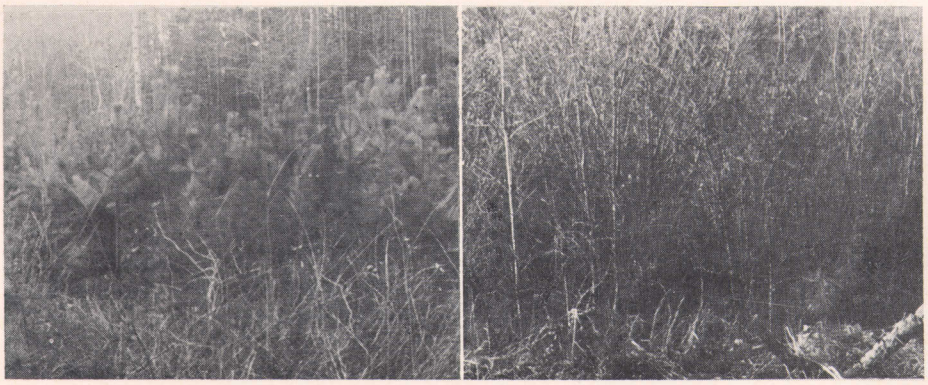
If by the mid 1970's average size of herd is 150 cows, about 600 herds could supply low level demand needs and 650 could provide high level demand requirements.

The trend in milk production is toward large scale production units. Dairymen who are not increasing size of operation and economic efficiency are leaving the business. Rising costs, especially labor, are primary forces causing expansion. Expensive equipment is needed to replace labor, and, to obtain efficient use of automated equipment, it is necessary to increase production per herd. Research at Auburn University Agricultural Experiment Station has indicated that a further decline in number of dairymen will continue, and size of herd and production efficiency will increase for those remaining. Milk distributors who purchase milk from out-of-state suppliers will continue to obtain these supplies. It is likely that a larger proportion of total milk supplies will originate from producers in adjoining states. If milk producers adopt production techniques similar to those being used in some areas of the United States, such as southern Florida and California, it is possible for less than 400 dairymen to adequately supply all markets in the State. However, milk production is not likely to expand beyond the amounts needed to serve the fluid milk market.

TABLE 2. MILK SUPPLY ALTERNATIVES TO MEET LOW AND HIGH DEMAND LEVELS, ALABAMA 1974

Cows per herd, av.	Herds needed in 1974[1]	
	Low level demand	High level demand
No.	*No.*	*No.*
100	887	974
150	591	649
200	444	487

[1] Average annual production per cow assumed to be 11,500 pounds.



Disked area at left shows pine regeneration 5 years after treatment. The check area at right shows the extent of hardwood seedlings and sprouts 5 years after cutting overstory timber.

SCARIFICATION Aids Natural Pine Regeneration In Upland Bottoms

SHERMAN WHIPPLE, *Department of Forestry*

SMALL STREAM BOTTOMS are some of the best timber growing sites in northern Alabama.

Because these sites generally have higher fertility and more favorable moisture than most surrounding land used for timber growth, they are readily inhabited by great numbers of plant species, including weed species. Many of these weed species grow in direct competition with the more commercially important trees.

Loblolly pine (*Pinus taeda* L.) one of Alabama's most valuable forest species, is in great demand for both pulpwood and sawtimber products. On the better sites, merchantable stands of pulpwood can be attained in 15 years and stands of sawtimber in less than 30 years. The problem in these moist and fertile sites is getting a fully stocked stand of desirable species, including pine, in view of severe competition from undesirable species. This problem is more obvious after the removal of merchantable timber.

Experiment Conducted

A study was begun in 1961 at the Fayette Experiment Forest, a unit of the Auburn University Agricultural Experiment Station, to test effects of varied seedbed conditions on the establishment of loblolly pine by natural seeding. The study was established on a 4-acre, narrow bottom area of the alluvial Mantachie soil. The bottomland averaged 132 ft. in width. Prior to beginning this study, the area contained a poorly-stocked stand of mixed species, including red maple, sweetgum, yellowpoplar, and loblolly pine. Except for a scattered few yellowpoplar and pine seed trees, all merchantable timber on the bottomland was cut in July 1960. Logs were skidded mostly with a mule, but a crawler tractor was occasionally used. The surrounding boundary of timber, which contained many loblolly seed trees, was left intact.

Three site preparation treatments, replicated six times, were applied during August 1961. Treatments were as follows: bulldozing, with mineral soil exposed; double-disking, with mineral soil seedbed prepared with a heavy farm type tractor and gang disk; and check, with all litter and vegetation left undisturbed after logging except for removal of large tops of felled trees.

Natural pine regeneration showed significant variations between treatments 4 years after establishment. Disking resulted in the greatest total number of seedlings, 3,603 per acre, see table. Bulldozing resulted in 2,395 seedlings per acre and the check in 895 per acre. Because of the heavy competition that was present, only trees 3 ft. or more tall could be considered as established. Stocking of established loblolly pine was unsatisfactory in the absence of site preparation (291 per acre, compared with 1,895 for disking and 562 for bulldozing).

Distribution of pine seedlings was excellent on both prepared sites but poor on check areas. Observations indicated that in the check areas pine regeneration occurred mainly in clumps where mineral soil had been exposed by skidding logs. There were striking differences between treated and untreated plots; however, no differences between disking and bulldozing could be readily observed.

NUMBER OF PINE AND HARDWOOD STEMS PER ACRE, BY SIZE CLASS AND TREATMENT, 4 YEARS AFTER TREATMENT

Height class	Treatment					
	Disked		Bulldozed		Check	
	Pine	Hardwood	Pine	Hardwood	Pine	Hardwood
Ft.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
Under 3	1,708	625	1,833	2,165	604	3,895
3 to 5	1,187	1,063	458	1,437	41	958
Over 5	708	895	104	958	250	3,833
TOTAL	3,603	2,583	2,395	4,560	895	8,686