HIGHLIGHTS

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AUBURN UNIVERSITY

DIRECTOR'S COMMENTS

E. V. Smith

IN THIS ISSUE of Highlights, coming as it does at the beginning of a new decade, I intend to use the personal pronouns, we and I, more often than professional agricultural workers are prone to do. I do this for a very special reason. I am convinced that it is time that we, as farm leaders and agribusinessmen and professional agricultural workers, speak out pridefully of agriculture's importance in urban, industrial America.

As this is being written, Biafra's surrender to Nigeria is front page news. The same stories report European and American plans to aid four million hungry Ibos. America's contribution of food and medicine will amount to a reported eighty million dollars.

The January issue of a leading farm magazine reports "Food stamps are going to be the big weapon against hunger and malnutrition. That much became clear when the dust had settled following the recent White House Conference on Nutrition and Health.

"Amount of stamps this fiscal year is almost double that of last year. The amount will double again next year, by all signs. Ultimately, President Nixon told the conference, the stamp program should be expanded to $2.5 billion annually. This would be more than seven times last year's spending."

Surely Americans generally must take pride in our country's concern for the hungry, both at home and abroad. Probably few besides those of us actually in agriculture realize, however, that even America could not hope to succeed in these humane objectives but for her productive agriculture.

This is a story that we need to tell pridefully, but not boastfully. All too frequently, however, we find ourselves pushed into a defensive apologetic position. For example, when representatives of the wheat growers appeared before the Agricultural Appropriations Subcommittees of the Congress, they began their testimony by sympathizing with the Committees that so few of their fellow members have rural constituencies. They appeared to apologize for the productive capacity of their commodity. Might they not better have reminded that our "surplus" of wheat 2 years previously enabled America to save millions in India from starvation?

The contributions of agricultural science to almost every facet of the "good life" in America are easily documented. Yet we agricultural scientists, too, tend to be apologetic. The challenge of the 1970's to all of us is that we not only continue the good work but that we be more aggressive in telling our story.

look for these articles

may we introduce . . .

Dr. William M. Warren, author of the story on page 11 that relates history of the Department of Animal Science, has been head of that department for more than 12 years. He joined the Auburn staff in 1955 as associate animal breeder and associate professor, and was promoted to department head July 1, 1957.

The Bancroft, Michigan, native did his undergraduate study at Michigan State, receiving the B.S. Degree in 1940. Following distinguished service as an officer in the U.S. Marine Corps (recipient of Presidential Unit Citation and Purple Heart), he completed his M.S. Degree at Texas A&M in 1948 and received the Ph.D. from University of Missouri in 1952. He was on the faculty at Texas A&M before coming to Auburn.

Work of the department under Dr. Warren's leadership has continued and expanded its tradition of service to all phases of Alabama's livestock industry through high quality teaching and research programs. Dr. Warren's national reputation is evidenced by his demand for judging livestock shows and speaking to various groups interested in livestock production.

HIGHLIGHTS of Agricultural Research

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COVER PHOTO. Fungicide application pays in some years, as shown by comparison of fungicide-treated row (right) and untreated one (left). See related story on page 3.

Fungicide-Herbicide Combinations Being Evaluated for Cotton

G. A. BUCHANAN and A. J. KAPPLEMAN, JR.,* Dept. of Agronomy and Soils

Common name	Trade name
fluometuron	Cotoran
diuron	Karmex
prometryne	Caparol
trifluralin	Treflan
phorate	Thimet
disulfoton	Di-Syston
chloronitropropane	Lanstan
PCNB + Terrazole	Terraclor Super X

DURING THE PAST few years, various researchers have found that certain pesticides applied together interact to cause greater injury to cotton than when either pesticide is used alone. An example is phorate and disulfoton, systemic insecticides applied with diuron or monuron, which interact to reduce stands of cotton.

Because of possible injury from certain herbicides with insecticides, Auburn University Agricultural Experiment Station in 1967 began studying also the interaction of herbicides and fungicides. There is already widespread use of herbicides, and fungicide application is rapidly becoming a routine practice as well.

Effectiveness of herbicides for controlling weeds in cotton is well documented. The performance of fungicides is more difficult to assess, however, because occurrence of seedling diseases cannot be predicted for any given season. In some years, an appropriate fungicide treatment has increased cotton seedling survival by 40-45%. (See cover photo.)

Herbicides are applied just before, at, or soon after planting. Fungicides for control of cotton seedling diseases are applied either as seed treatment, overcoats, or in-furrow treatments at planting. Consequently, both chemicals are present and may affect germination and early growth. Since little was known about actions of these chemicals in the presence of the others, their effects on cotton seedling growth were first studied in the greenhouse.

Three herbicides (trifluralin, prometryne, and fluometuron) and two fungicides (chloronitropropane and PCNB + Terrazole) were evaluated. Trifluralin was surface applied and then incorporated throughout the soil, whereas the fungicides were only incorporated into the top 1½ in. of soil. Prometryne and fluometuron were applied as preemergence sprays to the soil surface.

Trifluralin as a preplant incorporated treatment reduced both plant height and dry weight of cotton seedlings at 7 weeks of age, as shown in the table. Plants treated preemergence with prometryne were as tall as untreated plants, but they were spindly and dry top weight was considerably less. Preemergence treatment with fluometuron at 2 lb. per acre had no effect on plant height or weight of seedlings.

Fungicides used (chloronitropropane and PCNB + Terrazole) did speed emergence and early growth. But, since seedling diseases were not a problem, differences between treated and untreated plants were not measured by height or weight at 7 weeks.

Chloronitropropane and PCNB + Terrazole did not modify effect of trifluralin on seedling height and weight. Both plant height and weight of cotton seedlings grown on soils treated with trifluralin plus either fungicide were almost identical to those of plants grown on soils treated only with trifluralin. Adding either fungicide to prometryne or fluometuron had no effect on these herbicides. When prometryne was applied to soils containing incorporated trifluralin, weight of seedlings was reduced below that of cotton grown on soils to which either herbicide was added alone.

Seedling weight was not affected by addition of fluometuron to soils previously treated with trifluralin. However, weight of seedlings was greater following treatment with this combination than treatment with trifluralin alone. Results with three-way combinations were similar to those of two-way combinations. Any combination including both trifluralin and prometryne caused greater injury than when either was used alone.

Only a limited number of pesticides was studied, and one combination of herbicides reduced seedling growth. Fungicides did not injure cotton when applied either alone or in combination. However, adding either of the fungicides with the herbicides did not lessen adverse effect from the herbicides. Thus, there does not appear to be any fungicide-herbicide interaction, as with certain organic insecticides and herbicides.

Since many pesticides and pesticide combinations are used on cotton, effects both individually and as combinations need to be determined. Until results are available, care should be exercised when applying more than one.

INFLUENCE OF VARIOUS HERBICIDES, FUNGICIDES, AND HERBICIDE-FUNGICIDE COMBINATIONS ON HEIGHT AND DRY TOP WEIGHT OF COTTON AFTER 7 WEEKS

Pesticide treatment, lb. per acre	Plant height at 7 weeks	Dry plant weight at 7 weeks
	mm.	*mg.*
Check (no herbicide or fungicide)	197	59
Trifluralin, 0.75	173	46
Trifluralin, 1.50	142	39
Chloronitropropane, 1.0	208	61
PCNB + Terrazole, 1.25	203	60
Prometryne, 3.0	197	38
Fluometuron, 2.0	209	52
Trifluralin + chloronitropropane, 0.75 + 1.0	173	49
Trifluralin + chloronitropropane, 1.50 + 1.0	143	38
Trifluralin + PCNB + Terrazole, 0.75 + 1.25	172	45
Trifluralin + PCNB + Terrazole, 1.50 + 1.25	144	38
Trifluralin + prometryne, 0.75 + 3.0	174	31
Trifluralin + prometryne, 1.50 + 3.0	155	30
Trifluralin + fluometuron, 0.75 + 2.0	182	42
Trifluralin + fluometuron, 1.50 + 2.0	160	38
Chloronitropropane + prometryne, 1 + 3.0	200	36
Chloronitropropane + fluometuron, 1 + 2.0	220	55
PCNB + Terrazole + prometryne, 1.25 + 3.0	199	37
PCNB + Terrazole + fluometuron, 1.25 + 3.0	214	56
Trifluralin + chloronitropropane + prometryne, 0.75 + 1 + 3.0	172	29
Trifluralin + chloronitropropane + fluometuron, 0.75 + 1 + 2.0	189	45
Trifluralin + chloronitropropane + prometryne, 1.50 + 1 + 3.0	148	25
Trifluralin + chloronitropropane + fluometuron, 1.50 + 1 + 2.0	163	38
Trifluralin + PCNB + Terrazole + prometryne, 0.75 + 1.25 + 3.0	172	31
Trifluralin + PCNB + Terrazole + fluometuron, 0.75 + 1.25 + 2.0	190	48
Trifluralin + PCNB + Terrazole + prometryne, 1.50 + 1.25 + 3.0	146	29
Trifluralin + PCNB + Terrazole + fluometuron, 1.50 + 1.25 + 2.0	161	37

* Coop. USDA, ARS.

Beef Production Costs and Returns From Four Grazing Systems

SIDNEY C. BELL, *Dept. of Agricultural Economics and Rural Sociology*
L. A. SMITH, *Black Belt Substation*

THE BLACK BELT is Alabama's major beef cattle producing area, using primarily the brood cow and calf system. But increasing production costs, especially for labor, are putting the squeeze on this production method. Such conditions are making it more essential to have a grazing program that will reduce winter feeding if net returns are to be increased, or even maintained.

With the objective of reducing winter feeding to the brood cow, two allocations of fescuegrass were compared with a dallisgrass-white clover grazing system in a 4-year test. Each of these three treatments at the Black Belt Substation used 2 acres of land per cow and calf. A fourth treatment consisted of 1 acre per cow of Coastal bermudagrass overseeded with caley peas. Four 2-acre grazing paddocks were used for each treatment, except the Coastal pastures had three 2-acre lots.

The four treatments were:

1. 2 acres dallisgrass, white clover, and caley peas;
2. 1 acre of Coastal bermuda and caley peas;
3. 1½ acres of dallisgrass, white clover, and caley peas, plus ½ acre fescue;
4. 1 acre dallisgrass and white clover, plus 1 acre of fescue.

Fescue paddocks were cross-fenced so grazing could be controlled. The fescue was rested from August 1 to December 1. Phosphorus, potassium, and lime were applied according to soil test. Nitrogen was supplied to Coastal bermuda in three applications, 40 to 50 lb. each time. Fescue received 50 lb. of nitrogen in the fall and 50 lb. in late winter. Surplus forage was cut for hay and fed to cows in winter and when grazing was short in fall.

Cows were fed 2 lb. of 41% cottonseed meal per head daily during winter while in drylot. Cows grazing fescue did not receive protein supplement. None of the calves were creep fed.

Records of all inputs and sales were used in an economic analysis. Costs and returns for the four different treatments are given in the table.

Treatment number 2, the Coastal plot, had much higher gross returns than any of the other treatments. This was because two cows were maintained for each 2-acre plot, whereas other plots had only one cow. Annual costs were also much higher for this treatment, primarily because of the high expense for hay and protein supplement. Cows in treatment number 2 were fed hay 144 days per year, as compared with 108 days for treatment 1 and 80 days each for treatments 3 and 4.

When comparing returns above annual or cash costs each year, treatment 2 looked fairly good, with approximately $10 advantage over the other three treatments. But non-cash costs per acre were much higher for treatment 2 because of the increased investment for the extra cow maintained on Coastal paddocks.

On the basis of per acre returns to operator's labor and management, there wasn't a great deal of difference between the four pasture combinations, but treatment 1 was slightly higher than the others. When comparing returns to operator's labor and management on a per cow basis, again treatment 1 was highest. It was followed closely by treatment 3, with Coastal bermuda being much lower than any of the three combinations involving dallisgrass or dallisgrass and fescue.

In this 4-year test, fescue did not serve as a good substitute for winter feeding of hay for maintenance of the brood cow and calf. Dallisgrass, white clover, and caley peas without fescue gave highest returns. As the proportion of dallis decreased and fescue increased, net returns declined.

FOUR-YEAR AVERAGE OF COSTS AND RETURNS BY TREATMENT

Item	Treatment number 1	2	3	4
	Dol.	*Dol.*	*Dol.*	*Dol.*
Final corrected market value	122.59	225.94	122.82	121.44
Value of excess hay @ $20/ton	10.28	5.69	6.67	4.60
TOTAL RETURNS	132.87	231.63	129.49	126.04
Annual costs				
Fertilizer (mixed)	12.90	12.02	10.88	10.36
Ammonium nitrate	----	29.15	5.22	10.44
Haul and apply ammonium nitrate @ $7.50/ton	----	3.21	.56	1.12
Seed—caley peas @ $.08/lb. and Regal clover @ $1.10/lb.	7.62	8.40	6.02	4.01
Hay expenses				
Cut, rake, and bale @ $.20/bale	11.31	16.53	7.72	6.91
Hauling @ $2.10/ton	3.69	5.82	2.37	1.88
Feed				
Hay @ $25/ton	.50	20.72	4.31	4.85
Protein supplement	7.76	20.05	5.31	3.70
Salt	.90	1.80	.90	.90
Veterinary @ $2.00/cow unit	2.00	4.00	2.00	2.00
Commission, yardage, and hauling	4.13	8.25	4.13	4.13
Electricity @ $1.00/cow	1.00	2.00	1.00	1.00
TOTAL ANNUAL COSTS	51.81	131.95	50.41	51.31
Returns above annual costs per plot	81.06	99.68	79.08	74.73
Returns above annual costs per acre	40.53	49.84	39.54	37.36
Non-cash costs per acre				
Pasture depreciation	4.00	5.00	4.00	4.00
Bull charge @ $8.00/cow	4.00	8.00	4.00	4.00
Interest on investment @ 6%[1]	17.10	23.10	17.10	17.10
Depreciation on buildings, fences, machinery, and equipment	2.75	2.75	2.75	2.75
Taxes, property	.50	.50	.50	.50
TOTAL NON-CASH COSTS	28.35	39.35	28.35	28.35
Returns to operator's labor and mgt./acre	12.18	10.49	11.19	9.01
Returns to operator's labor and mgt./cow	24.36	10.49	22.38	18.02

[1] Prices used for capital investment were: cow—$200/head, land—$150/acre, buildings and fences—$15/acre, machinery and equipment—$20/acre.

Soil Fertility for Continuous Corn Silage

CLYDE E. EVANS and C. COOPER KING, JR., *Department of Agronomy and Soils*

CORN GROWN FOR SILAGE has higher fertility requirements than corn grown for grain only. For silage, all the above-ground portions of the plants are harvested thus removing more total nutrients from the soil. For example, 20 tons of silage per acre contained 170 lb. N, 20 lb. P, and 170 lb. K in the stalk, leaves, and ears. It has been suggested in the past that corn for silage not be grown on the same land continuously because of high nutrient removal, but that it be rotated with a non-silage crop to reduce soil fertility depletion.

In 1965, an experiment was started at Auburn to study the effect of growing corn silage continuously on a sandy soil. The principal objectives were to measure yields at different rates of N, P, and K and to study the effect on soil test values.

The soil had been well fertilized in the past and was in a good state of fertility. The soil pH was 6.2. Soil phosphorus was "very high" and potassium was "medium." The data reported here are for a full-season corn hybrid, Florida 200A. A short-season hybrid, DeKalb 805, was included in the experiment with essentially the same trends; only total yields were less.

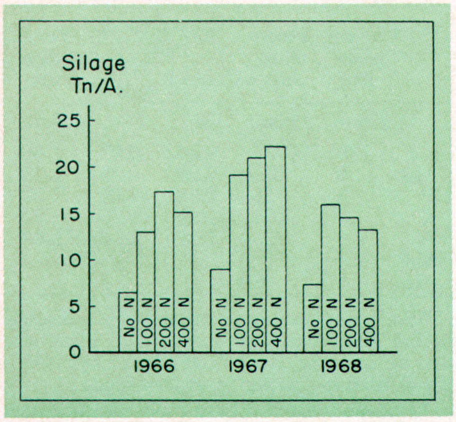

FIG. 1. Response of corn to N. Yield at 35% D.M.

The yields as affected by rate of N from ammonium nitrate during a 3-year period 1966-68 are shown in Fig. 1. In 1965 drought caused such poor stands that yields were not meaningful. In both 1966 and 1967, corn silage yield was increased by both 100 and 200 lb. N per acre. In 1968 overall yields were lower because of dry weather; however, yields were highest at 100 lb. N. Annual soil tests revealed changes in soil pH as a result of N rate. By the fourth year of treatment soil acidity had increased to a critical level of pH 5.3 on plots receiving 400 lb. N. In June 1968, plants growing on these plots had severe calcium and magnesium deficiency symptoms. Root systems were small with short stunted roots typical of aluminum toxicity. At 200 lb. N, soil pH was near the critical value and a few plants were showing deficiency symptoms. The decreased yield in 1968 at 200 and 400 lb. N was attributed to severe soil acidity resulting from N treatment. Adequate liming would have corrected this adverse condition.

Silage yield as influenced by potassium treatment is shown in Fig. 2. The yield pattern was similar for each of the 3 years. There was a yield increase to 100 lb. applied K (120 lb. K_2O) each year.

Soil Test Values in 1965 and 1968

	Soil pH			*Soil test K*	
	1965	*1968*		*1965*	*1968*
0 N	6.2	6.0	0 N	80	66
100 lb. N	6.2	5.7	100 lb. K	80	79
200 lb. N	6.2	5.6	200 lb. K	80	90
400 lb. N	6.2	5.3			

The effect of K rate on soil test K values can be seen in the table. The beginning soil test K value was 80 lb. per acre, which is the breaking point for "medium" and "high" for this soil. With none applied for 4 years the value decreased to 66 lb., and with 200 lb. applied K the value increased to 90. The 100-lb. rate of K maintained the original soil test K level and was the rate

at which there was an economic yield increase.

Soil test phosphorus was very high and applied P had little or no effect on yield or soil test values. For this reason, the phosphorus information is not included.

The results of this experiment show that on this sandy soil, pH values may change quite rapidly and reach critical levels with resultant yield decreases of corn silage. These changes can be detected by soil tests and corrected before they reach critical levels. A program of regular soil testing is very important under intensive cropping such as silage production.

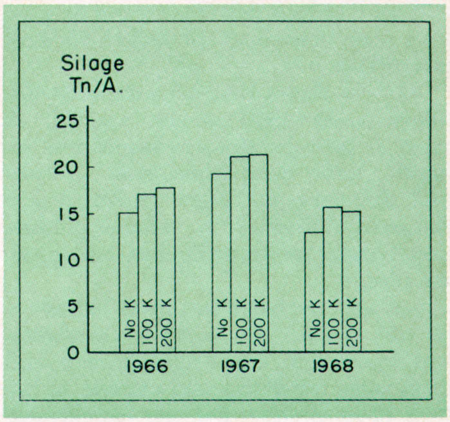

FIG. 2. Response of corn to K. Yield at 35% D.M.

Eastern cottonwood is a fast growing tree when planted on a suitable site as shown by this 5-year-old planting.

The GROWTH of COTTONWOOD in ALABAMA

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EASTERN COTTONWOOD (*Populus deltoides* Bartr.) is perhaps the fastest growing tree in North America when planted on a moist fertile site.

Studies were conducted to determine the fertility requirements and feasibility of growing cottonwood on low fertility sites with fertilization and cultivation.

Cottonwood occurs throughout Alabama as single trees or small groves but extensive pure stands are rare except in the flood plain of the lower Alabama and Tombigbee rivers. In Baldwin, Clarke, and Monroe counties eight cottonwood stands were selected for study. The stands ranged from 6 to 9 years old and were at least 2 acres or more in area. Five were natural stands and three were plantations.

Table 1 shows tree measurements obtained from eight stands studied. A range of growth rates was found even on highly fertile flood plain soils. A twofold difference in height growth and a threefold difference in volume production existed between the best and poorest sites.

Soil analyses were not good indicators of site quality. A positive correlation was found between height growth and extractable potassium and calcium in the 0 to 12-in. profile. But the correlations, while significant, were too low to be useful in predicting tree growth. If one apparently atypical stand were omitted from the data, an equation could be computed for relating height growth to extractable potassium in the 0 to 12-in. profile: (1) tree height (ft.) at age 6 = 0.48 (p.p.m.K.) − 0.50. This equation explained 94% of the variation in tree height in the seven stands for which it was derived.

Foliar concentrations of potassium, calcium, and phosphorus were significantly related to height growth and the following equation was derived:

(2) Tree height (ft.) at age 6 = 28.94 + 6.45 (% Ca upper foliage) + 17.68 (% K upper foliage) + 18.90 (% K lower foliage) − 179.29 (% P upper foliage).

TABLE 1. A SUMMARY OF TREE MEASUREMENTS FROM EIGHT COTTONWOOD STANDS IN THE ALABAMA AND TOMBIGBEE RIVER FLOOD PLAINS

Stand	Age	Ht.	DBH	Basal area	Volume
No.	*Yr.*	*Ft.*	*In.*	*(Ft.²/A)*	*(Ft.³/A)*
1*	7	72	6.8	104	2,566
2*	8	66	5.7	89	2,034
3	7	58	4.0	102	2,116
4	9	61	4.8	80	1,806
5	8	60	4.0	103	2,434
6	7	49	2.4	88	1,872
7	8	56	3.8	80	1,581
8*	6	32	1.3	82	864

* Indicates plantation.

The terms "upper foliage" and "lower foliage" refer to leaf samples taken from the upper or lower half of the tree crown. Equation (2) accounted for 76% of the variation in tree height on all stands studied. Both soil and foliage data suggested that potassium and calcium supplies were limiting cottonwood growth. Evidently, the phosphorus supply was more than adequate on all sites sampled and phosphorus accumulated in the leaves when growth was restricted by some other factor.

To obtain an estimate of the fertilizer requirement for cottonwood on infertile soils, a moist creekbottom site was selected in the Coastal Plain in Lee County. The site was cleared and disked to remove all existing vegetation. Fertilizer treatments were: N − 8 oz. ammonium nitrate per tree; N plus P (100 lb./A P_2O_5) plus K (100 lb./A K_2O); NPK plus lime (2,500 lb./A); control. The P, K, and lime were applied and disked before planting. Nitrogen was placed at 8-in. depth 6 in. from trees after planting. Each treatment was replicated four times and half of each replicate was cultivated to maintain essentially weed free conditions during the first growing season. Cottonwood cuttings, 20 in. in length, were planted at 10 x 10 ft. spacing.

As expected, cottonwood responded to fertilization but the response was short-lived. At the end of the first growing season, fertilization produced a highly significant increase in height growth but the effect had disappeared after 3 years. A comparison of soil and foliage analyses from the Lee County study with data obtained from the river flood plains is shown in Table 2. Fertilization increased N, P, and K in the foliage of the Lee County trees to a level above that of the average found in trees growing in flood plain soils. However, calcium levels were far below the average for flood plain sites. Perhaps with continued cultivation and repeated fertilization the growth of cottonwood on the Lee County site could have been maintained comparable to growth on the flood plain soils. However, the costs of such practices would be prohibitive.

During the course of the study several areas were visited where soils of low fertility were planted to cottonwood. All of these plantations were cultivated during their first growing season and most grew well the first year. But, invariably, growth all but ceased in 2 to 4 years. Unless the landowner is willing to apply repeated, heavy applications of fertilizer and cultivate regularly for 2 to 3 years, the planting of cottonwood is not recommended except on major river alluvium and, perhaps, moist Black Belt soils. Even on these recommended areas, cultivation for the first year is necessary and possibly some fertilization.

TABLE 2. A COMPARISON OF SOIL AND FOLIAR NUTRIENTS BETWEEN FLOOD PLAIN SITE AND COASTAL PLAIN SITE

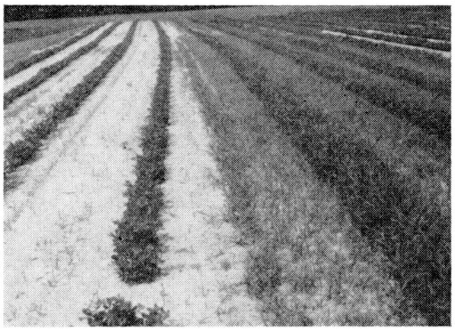
	Soil analysis[1]		Foliage analysis[2]		
	Coastal plain site	Flood plain site	Coastal plain site: Control	Coastal plain site: NPK + lime	Flood plain site
	p.p.m.	*p.p.m.*	*Pct.*	*Pct.*	*Pct.*
Ca	180	3,905	0.84	0.97	2.66
Mg	6	201	0.26	0.35	0.29
P	3	11	0.34	0.62	0.20
K	4	109	1.24	1.90	1.22
N	----	------	1.37	2.94	2.08
Soil pH	5.3	6.4			

[1] Soil analyses based on samples collected before fertilization on the Coastal Plain site and an average of all flood plain sites. Only the 0 to 6-in. profile is represented.

[2] Foliage analyses based on samples collected after the first growing season on Coastal Plain site. Flood plain data represent the average of all stands sampled.

Vernolate Incorporation Methods on Peanuts

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



Incorporation methods affect weed control.

VERNOLATE (vernam) has, in the past few years, become a widely used herbicide for weed control in peanuts and soybeans. It is applied preplant and controls a broad spectrum of annual grasses and several broadleaf weeds. It is not effective against morningglory and Florida beggarweed but has excellent activity against nutsedge.

Most early studies with vernolate were with disk incorporation; however, several researchers have shown that other methods of application and incorporation proved as satisfactory, if not better, than conventional disking. Research has been conducted at the Auburn University Agricultural Experiment Station during the past 2 years comparing various methods of application and incorporation of vernolate and benefin.

Treatments studied included incorporation with a disk harrow, incorporation with a power-driven rotary cultivator, sub-surface injection with a knife injector, knife injection plus cultipacking, and injection with subsurface sweeps.

Subsurface treatment, as opposed to incorporation, does not imply mechanical mixing of the surface soil and herbicide. The band or swath is applied underground and covered with soil which flows over or past the spray orifice. All tools were operated at 3.5 m.p.h. and 3 in. deep. The herbicide was applied in 20 gal. of water per acre.

In 1967 early annual grass control was acceptable with all methods of application when 2.0 or more lb./A. of vernolate was used. At the time of the second weed control evaluation (19 July), however, the "inject" treatment at 2.0 lb./A. was the poorest of the four treatments. Broadleaf weed control was in general much poorer than control of annual grass; however, the same patterns with treatment were evident.

In 1968 application with subsurface sweep injector was included along with the tools evaluated in 1967. All methods of application gave acceptable control of yellow nutsedge. Crabgrass control was essentially complete at all rates and with all methods of application. Stands of peanuts were not significantly affected; however, application with the subsurface injector resulted in slightly less injury to the peanuts than did application with the other tools. Although vernolate applied with the injector has given excellent results, two serious problems were encountered in field usage: (1) dragging of trash and (2) nozzle stoppage. This indicates that for the injector to work properly, a well prepared seedbed free of trash and crop residue must be provided. Also, extreme care should be exercised to ensure against nozzle stoppages.

TABLE 1. INFLUENCE OF VARIOUS METHODS OF APPLICATIONS OF VERNOLATE AND BENEFIN ON CONTROL OF ANNUAL GRASSES, BROADLEAF WEEDS, AND NUTSEDGE IN PEANUTS, 1967

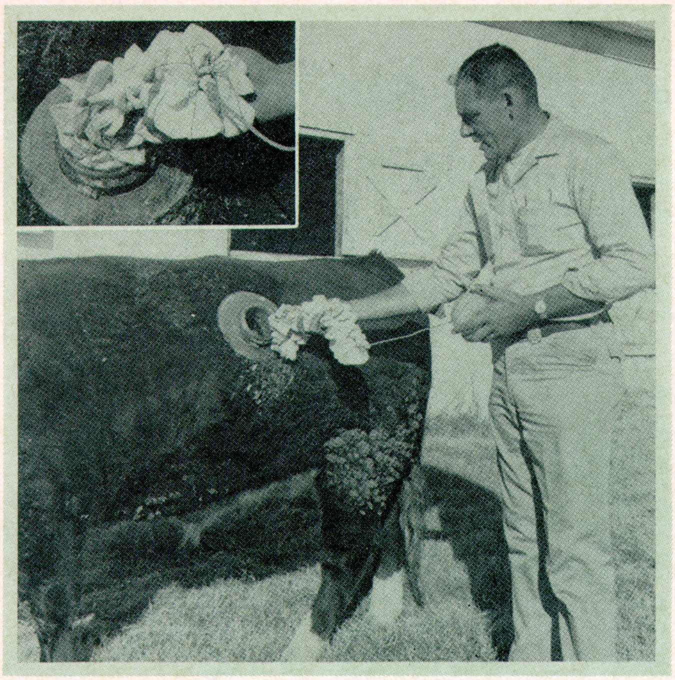
Application equipment	Control[1]					
	Annual grasses		Broadleaf		Nutsedge	
	6/14	7/19	6/14	7/19	6/14	7/19
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Disk harrow[2]	91	75	52	32	65	75
Rotary tiller[2]	95	65	55	32	77	70
Knife injector[2]	66	35	28	12	20	10
Knife + cultipacker[2]	75	22	10	0	56	45
Disk harrow[3]	93	83	67	25	68	71
Rotary tiller[3]	100	91	52	40	71	86
Knife injector[3]	83	56	38	0	52	42
Knife + cultipacker[3]	92	86	42	10	88	71
Disk harrow[4]	98	95	72	49	90	92
Rotary tiller[4]	100	97	82	92	97	93
Knife injector[4]	98	95	62	71	75	91
Knife + cultipacker[4]	98	86	55	27	87	72
Disk harrow[5]	83	82	5	0	0	0
Knife injector[5]	15	12	0	0	0	0
Check	0	0	0	0	0	0

[1] 0 = No control; 100 = complete control.
[2] Vernolate 1 lb./A. [3] Vernolate 2 lb./A. [4] Vernolate 3 lb./A. [5] Benefin 1 lb./A.

TABLE 2. INFLUENCE OF VARIOUS METHODS OF APPLICATION OF VERNOLATE ON CONTROL OF ANNUAL GRASSES AND NUTSEDGE IN PEANUTS, 1968

Application equipment	Control[1]			
	Annual grasses		Nutsedge	
	6/24	7/24	6/24	7/24
	Pct.	*Pct.*	*Pct.*	*Pct.*
Disk harrow[2]	100	70	71	66
Rotary tiller[2]	98	85	76	76
Knife injector[2]	100	87	91	83
Knife + cultipacker[2]	100	85	92	87
Subsurface sweep injector[2]	100	80	95	73
Disk harrow[3]	100	80	85	76
Rotary tiller[3]	100	81	80	73
Knife injector[3]	100	88	98	93
Knife + cultipacker[3]	100	92	97	93
Subsurface sweep injector[3]	100	88	100	92
Check	0	0	0	0

[1] 0 = No control; 100 = complete control.
[2] Vernolate 2 lb./A. [3] Venolate 3 lb./A.



Digestibility of individual plants can be measured with the system used at Auburn. Small nylon bags containing forage samples (inset) are placed in the rumen of steers fitted with fistulas, and digestibility is determined on basis of amount of undigested material remaining in the bags after 24 hours in the rumen.

Lowering Tannin Content Improves Quality of Sericea Lespedeza Forage

E. D. DONNELLY, *Department of Agronomy and Soils*
W. B. ANTHONY, *Department of Animal Science*

HIGH TANNIN CONTENT was long suspected to be a major reason for low nutritive value of sericea lespedeza. This was confirmed by Auburn research showing adverse effects of tannin on digestible dry matter of sericea.

These results suggest that varieties low in tannin would have higher nutritive value than normal varieties with high tannin content. Plants meeting the low tannin requirement have been developed at Auburn University Agricultural Experiment Station, and their advantages were apparent in digestibility trials.

Unique Test Method Used

For a digestibility study of individual plants, 200 low-tannin plants and 60 that were high in tannin were cut May 13 and July 23, 1968. The plants were dried at 50°C and ground through a 20-mesh screen. Two grams of the ground material from each plant were placed in each of six nylon bags.

Steers with fistulas (openings) in the rumen were used to measure digestibility. Two bags of forage from each plant were placed in the rumen of each of the three fistulated steers. (This made a total of six samples from each plant for each cutting, or a total of 12 for the two cuttings.)

After 24 hours in the steer rumen, the bags were removed and digestible dry matter content determined on the basis of undigested matter remaining in the bags. The fistulated steers were maintained on feed composed of 40% sericea hay balanced for protein and minerals.

As shown by data in the table, plants classed as being high in tannin were much higher at both cuttings than the low-tannin plants. The increase in tannin content between first and second cutting was less for low-tannin plants than for high-tannin ones. Low-tannin plants averaged 2.7% tannin for both cuttings, whereas high-tannin plants had an average of 6.2%.

Low-tannin plants averaged 65% digestible dry matter for the two cuttings and high-tannin ones only 58%. This was a 12% average increase in total digestibility in favor of the low-tannin plants.

High-tannin plants did not differ in digestible dry matter content between the two cuttings, even though content of tannin went up considerably from first to second cutting. Digestibility of low-tannin plants did not change between cuttings either, and these plants showed relatively little increase in tannin content from first to second cutting.

An important relationship was found between forage tannin and forage quality. Apparently when sericea tannin reaches a certain level, nutritive value of forage is seriously impaired.

Findings Appear Important

Results obtained indicate the existence of a tannin "threshold" between the low- and high-tannin groups of sericea plants that is critical in relation to digestible dry matter. The Auburn findings clearly show the adverse effect of tannin content on digestible dry matter of sericea, and suggest that varieties low in tannin would have higher nutritive value than normal, high-tannin types.

It is evident that much progress can be made in improving forage quality by changing the genetic makeup of sericea to eliminate undesirable components. The techniques being used in this study permit studying digestibility of individual sericea plants before they are put into a new variety. This should speed up the development of improved forage varieties, since only highly digestible lines will be combined in new varieties.

Seed of the low-tannin sericeas described are not available commercially.

TANNIN CONTENT AND DIGESTIBLE DRY MATTER CONTENT OF LOW- AND HIGH-TANNIN SERICEA PLANTS, 1968*

Sericea tested	Tannin content		Digestible dry matter	
	Range	Mean	Range	Mean
	Pct.	*Pct.*	*Pct.*	*Pct.*
High-tannin				
First cutting	3.5-7.0	5.2	45-68	59
Second cutting	5.7-9.4	7.3	52-67	58
Mean	4.6-7.6	6.2	53-64	58
Low-tannin				
First cutting	1.5-3.4	2.5	50-72	64
Second cutting	2.0-4.0	2.9	58-71	65
Mean	1.8-3.4	2.7	56-69	65

* For low-tannin data, 200 plants were studied for tannin and 183 for digestibility; high-tannin data are from 60 plants.

Woodwaste vs. Oyster Shell in fattening rations

WASTE PRODUCTS TESTED AS ROUGHAGE SOURCE

W. B. ANTHONY, *Dept. of Animal Science*
J. G. STARLING, *Wiregrass Substation*
J. P. CUNNINGHAM, JR., *Dept. of Animal Science*

CATTLE DEVELOP rumen parakeratosis when fed for an extended period on low fiber rations. This condition results in reduced feed efficiency and contributes to development of liver abscesses. In addition, the rumen is lost to the packer as a source of tripe.

Research at Auburn has shown that rumen parakeratosis is prevented by including roughage in the fattening ration. These results also revealed that severe cases can be repaired by adding roughage to a low fiber diet ahead of slaughter. Changing from a low fiber to a high fiber ration 8 days before slaughter greatly reduced incidence of rumen parakeratosis.

Although hay and silage are the usual roughage sources for livestock, sawdust (woodwaste) and oyster shell have been effectively used. Woodwaste was better than oyster shell in the tests.

Both lambs and cattle have been fattened for slaughter on rations containing 2.5% of either oak sawdust or oyster shell. Oak sawdust was also used at the 10% level. Results were compared with those of other animals fed the high energy, low fiber, basal mixture shown below:

Ingredient	*Per cent*
Ground shelled corn	71.0
Salt, trace mineralized	1.0
Cottonseed meal (41%)	12.5
Defluorinated phosphate	0.5
Cane molasses	10.0
Condensed fermented corn extractives	5.0
Vitamin A	4,847 IU/lb.
Vitamin D	1,212 IU/lb.
Aureomycin	70 mg./day/animal

Both lambs and steers made the best daily gain when fed the basal mixture with 2.5% oak sawdust, as shown below. (Feed efficiency figures are pounds feed per pound of gain.)

Ration	Daily gain, lb.		Feed efficiency	
	Lambs	Steers	Lambs	Steers
Basal	0.32	2.42	6.48	7.45
Basal + 2.5% oyster shell	.41	2.36	5.36	6.76
Basal + 2.5% oak sawdust	.47	2.47	5.32	7.74
Basal + 10% oak sawdust	.38	2.38	6.68	7.98

Oak sawdust has been successfully used as a roughage in sheep and cattle fattening rations at Auburn. Best gain by steers was made when 2.5% sawdust was added to the high energy, low fiber basal ration, but rate of gain and feed efficiency were good when the fattening feed contained as much as 10% oak sawdust.

Feed efficiency for lambs was best for the basal with 2.5% oak sawdust. In contrast, cattle gained most efficiently on the oyster shell ration. Cattle on this ration consumed a little less feed than on other feeds, and this could be partially the cause for improved feed efficiency. Replacing 10% of the ration with sawdust did not appreciably lower feed efficiency for either lambs or steers. Therefore, the basal feed with 10% oak sawdust produced lower cost gains than the basal ration.

Rumen parakeratosis did not occur in any lambs, but incidence was high for cattle fed the basal ration plus either 2.5% oyster shell or 2.5% oak sawdust. The condition was least severe in cattle fed the basal diet plus 2.5% oak sawdust. Adding 10% sawdust did not completely eliminate rumen parakeratosis, but only mild cases were noted.

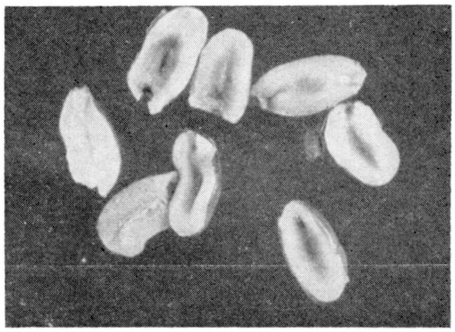
In a later feeding trial cattle were fattened on a combination of ground shelled corn and oak sawdust pellet. The pellet was formulated to supply essential roughage, protein, minerals, and vitamins, as listed:

Ingredient	*Amount, pct.*
Woodwaste (oak sawdust)	47.0
Cane molasses	33.0
Cottonseed meal (41%)	11.5
Urea	3.5
Defluorinated phosphate	2.5
Salt, trace mineralized	2.5
Vitamin A	2,500 IU/lb.

Feeding rate of the pellets was 8 lb. per head daily. Cattle on the ground shelled corn-oak sawdust pellet ration had better performance than comparable animals fed a conventional roughage-containing fattening feed.

PEANUT FERTILIZATION RESULTS

DALLAS HARTZOG and FRED ADAMS
Department of Agronomy and Soils



Hollow-heart is caused by boron deficiency.

IDEALLY, THE FERTILIZER requirements of a crop would be determined on each field; practically, of course, this cannot be done. The best approach is a soil testing program founded on experimental data from well-designed field experiments located on soils that are representative of the area.

A soil testing program for peanuts based exclusively on field experiments at the Wiregrass Substation at Headland is not adequate for the entire peanut-producing area of southeast Alabama. This one site does not encompass the necessary range in soils, weather, and other factors that affect peanut yields. This was recognized early, and many lime and fertilizer experiments were located on farmers' fields throughout the Wiregrass Area prior to 1953. A new series of cooperative experiments on farmers' fields was started in 1967 throughout the peanut area to encompass a range of conditions. These experiments have been concerned primarily with phosphorus, potassium, calcium, and boron. A summary of the experiments conducted during the 1967-69 period is given in the table.

A general practice of farmers is to fertilize peanuts directly each year. Auburn University tests have shown that the best practice is to fertilize the crop preceding peanuts, preferably corn. In seeking additional information on this practice, a total of 17 experiments have been conducted on different fields. Either phosphorus and potassium or just potassium fertilizer was added directly to the peanut crop. Soils ranged in soil test values from "low" to "high" and most yields ranged between 1 and 2 tons/A. In only one case of the 17 was there a yield increase from fertilizer. Certainly, fertilizing the peanut crop directly on these fields was not a profitable practice. Fertilizer added to other crops in the rotation was adequate for maximum peanut yields.

Of the 17 experiments in which gypsum was topdressed at blooming time, yields and sound mature kernels were increased in only two cases. Both soils tested "low" in calcium. It has been reported that large-seeded peanuts require more calcium than medium-seeded peanuts. However, Florigiant and Early Runner varieties have not been adequately tested in this regard. The experiments reported here showed no difference in their calcium requirements. Neither variety showed an increase in yield or percentage sound mature kernels from the addition of calcium on soils with soil test calcium above 200 lb./A.

The penalty to the farmer for boron-deficient peanuts is about a 50% reduction in the sale price of his peanuts. The visual symptom of boron deficiency is a form of internal damage known as "hollow-heart." Of the ten experiments with boron, four responded to boron fertilizer, not by yield increases but by elimination of "hollow-heart." All experiments were checked for the incidence of hollow-heart. It was found in several experiments but only where the soil test boron was "low" and the farmer had not added boron in any form.

Since a routine soil test does not include boron, it is a good practice to add boron to all peanut fields. It can be supplied either in fertilizer, in dust or spray for leaf-spot control, or in gypsum topdressing. A rate of 0.3 to 0.5 lb./A of elemental boron is adequate. Higher rates may be toxic to the plants, especially if applied in the row.

Four magnesium and two zinc fertilizer experiments have been conducted. No beneficial effect was received from either nutrient.

The application of fertilizer directly to peanuts has never been very profitable. The peanut plant appears to be highly efficient at obtaining nutrients from the soil. It is much more efficient, for example, than cotton. The soil fertility level at which direct fertilization of peanuts is profitable is not clearly defined, but it apparently does not occur on soils that are "medium" or "high" in fertility. It is advisable to grow peanuts in rotation with other crops, preferably grass or grain. In addition to more efficient fertilizer use, rotations offer advantages in control of weeds, leaf-spot, nematodes, diseases, and probably insects.

As a result of these and other recent experiments, fertilizer recommendations by the Auburn University Soil Testing Laboratory were revised for 1970. Phosphorus and potassium fertilizers are no longer recommended on soils testing "high" in these nutrients.

RESULTS OF PEANUT FERTILIZER EXPERIMENTS ON FARMERS' FIELDS, ALABAMA, 1967-69

Material applied	Total exper.	Respond to fert.	Yield per acre		Soil test values[1]		
			Highest	Av.	Nutrient	Lowest	Highest
	No.	*No.*	*Lb.*	*Lb.*		*Lb./A.*	*Lb./A.*
Phosphorus and					P	20(L)	57(H)
Potassium	8	1	3,930	2,790	K	46(L)	110(M)
Potassium	9	0	3,680	2,180	K	52(L)	144(H)
Calcium (as gypsum)	17	2	3,350	2,190	Ca	144(L)	484(H)
Boron	10	4	3,340	2,330	B[3]	0.07	0.22
Magnesium	4	0[2]	2,860	2,350	Mg	15(L)	54(H)
Zinc	2	0	2,710	2,610	Zn[3]	2.5	5.0

[1] L means low; M means medium; H means high.
[2] Magnesium decreased yield and per cent sound mature kernels in one experiment because it aggravated a calcium deficiency.
[3] Insufficient data to rate soil fertility level for boron or zinc.

A History of Animal Science at Auburn University

W. M. WARREN, *Department of Animal Science*

DEVELOPMENT at Auburn University of teaching curricula and research programs in animal agriculture closely paralleled expansion of the livestock industry in Alabama.

Before 1907, when a separate Animal Industry Department was established, the meager teaching or experiments in the field were done in the Agriculture Department. The 1907 catalog contained the first formal listing of courses related to livestock. Courses dealing with beef cattle, dairy cattle, swine, sheep, horses, and mules were taught under the Animal Industry Department name.

Years later, the name and composition of the department were changed to Animal Husbandry and Dairy Department; then to Animal Husbandry, Dairy, and Poultry; and in 1922 reverted again to Animal Industry Department. In 1930, it was divided into the three departments of Animal Husbandry and Nutrition, Dairy, and Poultry. The name Animal Science Department was adopted in 1961.

The following have served as administrative heads of the department prior to the present administration: Dan T. Gray, M.S., 1907-12; Jesse M. Jones, B. Agr., 1913 (January-September); George S. Templeton, B.S., 1913-20; J. C. Grimes, M.S., 1920-50; and W. D. Salmon, Sc.D, 1950-57.

By 1920 courses were offered in breeds of livestock, livestock judging, dairy cattle management, horse and mule management, beef cattle production, swine production, milk production, genetics, animal breeding and herd book studies, and poultry.

The Department was housed in the Agricultural Building (Comer Hall) until it burned in 1920. A war-surplus airplane hangar then provided offices, laboratory space, and a judging arena until the present Animal Science Building was begun in 1928.

The first graduate level courses ever offered in the department were listed in the 1922-23 catalog. In 1952 the departments of Animal Husbandry and Nutrition, Mathematics, and Zoology-Entomology received approval of their proposals for offerings leading to the Ph.D. Degree.

The Agricultural Experiment Station of Auburn University (then Alabama A & M College) was established under State law in 1883. Various demonstrational experiments were conducted and 12 bulletins related to livestock production were published in the period 1890-1907. During 1907-20, experiments were conducted with beef cattle, hogs, sheep, and dairy cattle fed on various Alabama-grown feeds. One of the first publications was Production Bulletin 143, *Feeds Supplementary to Corn for Southern Pork Producers*, by Dan T. Gray, J. F. Duggar, and J. W. Ridgway.

Basic research in animal biochemistry and nutrition was started in the Animal Industry Department by W. D. Salmon in 1922. This first laboratory was in the airplane hangar mentioned previously. In 1930 the first wing of the present Animal Science Building was completed. An additional wing was added in 1961, and the departments of Animal, Dairy, and Poultry Science are housed in this building.

Also completed in 1961 were abattoir and meats laboratory facilities and a livestock arena, which make possible teaching and research on meat technology and accurate evaluation of carcasses of experimental animals.

Other research facilities of the department at Auburn include: laboratories and feed handling facilities for beef cattle and swine, plus pasture and crop land (1,000 acres for beef cattle and 250 for swine); and reproductive physiology laboratories, animal housing, feed storage, and 250 acres of land.

In addition to facilities at Auburn, the substations are used for considerable research with beef cattle and swine in cooperation with substation personnel. Several pasture and forage utilization experiments at substations are done in cooperation with Department of Agronomy and Soils.

Research by the Department of Animal Science has made many contributions to the development and improvement of animal agriculture and to increased biological knowledge. Some of the more important studies related to effects of minerals on growth, reproduction, and lactation. Determinations of the vitamin content of foods and feedstuffs were made and the results led to a separation of what was then called vitamin B into two active fractions. It was proved that both were required for animal growth.

Other work established that (1) a deficiency of one of the factors of the vitamin B complex resulted in cataract of the eyes, (2) a potassium deficiency caused myocardial degeneration, (3) a choline deficiency resulted in liver cancer in rats, and (4) a deficiency of zinc caused parakeratosis in swine. The latter discovery provided the basis for preventing a disease that was costing the swine industry huge sums of money annually.

The feasibility of finishing market hogs in confinement was demonstrated, and economical and nutritional rations were formulated. Various forage crops were evaluated for the breeding herd. A classic study on selection for efficiency of gain in Duroc swine was done by J. C. Grimes and G. E. Dickerson.

Current swine breeding research is aimed at developing systems of breeding for production of meat-type hogs. Significant improvement has been obtained in sow performance, growth rate, and carcass desirability. Market hogs produced in these breeding programs command a premium based on yield of lean cuts. A swine evaluation program measuring total performance in economically important traits has stimulated interest in improving the swine industry.

Determinations of nutritive values of most forages for beef cattle have provided the basis for recommended rations for the beef brood herd and for developing stocker steers. Many steer fattening rations have been evaluated, and economically sound production programs have been developed.

The major effort in beef cattle breeding research has been the development and evaluation of within-breed selection and crossbreeding programs to improve total performance. Progeny tests have proved that selection is an effective method for improving efficiency of production. A prospective sire evaluation program has been popular and effective.

Reproductive physiology has been the subject of important research with sheep and swine. A systematic research program in animal biochemistry and nutrition, animal breeding, physiology of reproduction, meats, and animal management in controlled environments will be continued and expanded.

Continuing importance of animal agriculture in Alabama indicates the magnitude of the teaching and research obligations charged to the Department of Animal Science. The 19 academic members of the current staff are especially well qualified to conduct these vital research and teaching programs.

Formula Pricing Of Milk

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

FORMULAS ARE USED in determining Grade A milk prices in almost all U.S. markets.

More than 90% of Grade A milk marketed is priced, usually by formulas, either under federal or state marketing orders. These marketing agencies use formulas to determine the amount dealers pay producers for milk used in Class I products such as homogenized milk, cream, skim milk, and chocolate milk. Class I prices are established for local markets. Grade A milk in excess of Class I or fluid needs is used in manufactured products such as ice cream, cheese, and butter. Farmers are paid a lower price for milk used for these products. Prices for milk in the latter uses vary little throughout the country.

Regulatory prices for milk used in fluid consumption began during the depression of the 1930's. Early in the decade state legislatures established milk control boards with authority to fix producer and consumer prices. Federal participation in milk pricing came in a series of acts through the decade. Federal legislation enabled the Secretary of Agriculture to issue milk marketing orders and to determine prices paid for producer milk.

Problems in establishing milk prices are numerous, dynamic, and political. Milk is bulky and perishable. It is a raw material used in various products, each with its own price structure. Milk for fluid use is subject to approval by health authorities. It is separate from manufacturing grade milk. In addition, political and geographic boundaries affect the size of the market and pricing system.

Types of Formulas

Many plans and mechanisms have been used in determining prices. There are basically two types of fluid milk pricing formulas. One type bases prices on the average price paid producers for manufacturing grade milk plus a differential. Average price paid for manufacturing grade milk in Minnesota and Wisconsin is commonly used as the basic price. The differential varies among markets by production and marketing conditions. Size of the differential represents the amount above manufacturing milk prices needed to provide an adequate supply to the local market. A total of 61 federal milk orders were using this type of Class I pricing formula in 1969.

The Class I price, as calculated by the formula, in the Chicago Federal Order in January 1970 was $5.83 per cwt. of milk testing 3.5% butterfat. Of this, $4.63 was the basic formula price (December price for manufacturing grade milk in Minnesota and Wisconsin), plus a differential of $1.20. The differential was as much as $3.00 in some markets in January. The differential usually increases with distance from Chicago.

The second type of formula bases Class I prices on general economic indicators. An economic index formula was first made effective for the Boston, Massachusetts, market in 1948. Interest in use of economic formulas spread rapidly, and variations of these formulas are now being used in a number of milk markets. Although different economic formulas are used among markets, components of the formulas include such factor indices as the wholesale price index, consumer price index, per capita income, feed and labor costs, and prices of milk for manufacturing uses.

Some studies have concluded that economic formulas have proved more satisfactory in areas where a relatively small volume of milk is manufactured. The Chicago pricing formula is generally used in areas where there is a substantial volume of milk in excess of fluid uses. However, in 1969 the National Milk Producers Federation proposed an economic formula to be used for all federal orders. Public hearings on the proposal are to be held early this year.

In recent years, producer marketing associations in many markets have bargained with milk dealers for Class I premiums above formula prices. Class I premiums are being paid above federal order minimum prices in about 72 markets throughout the country.

A Formula for Alabama?

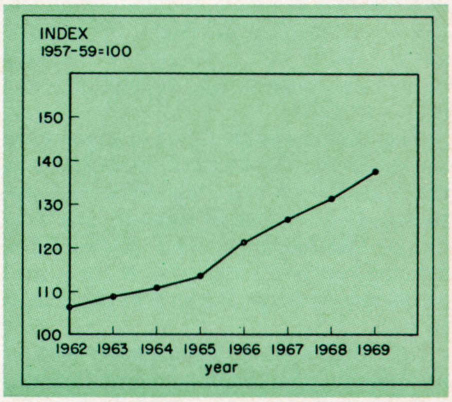
Alabama milk prices to producers, distributors, and consumers are fixed by the State Milk Control Board. Under the milk control law, public hearings are required before any change can be made in milk prices. Over the years this method of pricing has proved time-consuming, costly, and generally unsatisfactory.

In 1967 the Milk Control Board requested the Alabama Agricultural Experiment Station to prepare a formula to price Class I milk marketed by licensees of the Board. Following the request a formula was prepared and presented at public hearings of the Board. The formula could make automatic adjustments either up or down in producer prices, as well as wholesale and retail prices of milk products.

The formula is an economic index and changes in the index result from changes in economic factors composing the formula. It is comprised of four basic components. Each component is given equal weight in determining a Composite Formula Index as follows:

Formula component	*Weight in composite formula index* *Per cent*
Consumer price index	25
Index of average weekly earnings in manufacturing industries in Alabama	25
Index of average prices received by farmers for manufacturing grade milk in Minnesota and Wisconsin	25
Index of dairy feed and farm labor in Alabama	25
Composite formula index	100

Base period for each of the indices was 1957-59. The average composite index for the base period was 100. Since then, most of the indices have risen (only feed prices are lower), Figure 1. The Composite Formula Index was 142.6 in December 1969. Class I prices generated by the formula would depend upon price in effect when the formula was initiated. At the time the formula was presented at public hearings in 1968, it indicated the need for a price increase comparable to action later taken by the Board. However, the Board did not adopt the formula. Because of continuing rises in price levels in 1969 that affect the formula, it has indicated the need for further price increases of milk.



This chart shows the proposed composite formula index for pricing Class I milk in Alabama, 1962-69.

Biology and Control . . .

TOBACCO THRIPS on PEANUTS

MAX H. BASS and ROY J. LEDBETTER[1]
Department of Zoology-Entomology

TOBACCO THRIPS is the primary species of thrips attacking peanuts in Alabama. This pest occurs on peanuts every year. Thrips damage to peanuts is sometimes called "possum ears" or "pouts" and is most evident when the plants are in the seedling stage. Thrips rasp the upper surface of the developing leaflets and as the leaflets unfold they have a scarred or deformed appearance. Where infestations are severe, stunting occurs and the damaged peanuts recover slowly and perhaps incompletely. Thrips damage usually disappears or becomes less acute concurrently with increased rate of growth of the plants.

In Alabama the average female tobacco thrips lives about 33 days and deposits about 54 eggs. Immature thrips undergo three developmental stages. These are first instar nymph, second instar nymph, and propupa. The first instar nymph hatches from the egg after an incubation period of 5 days. This stage lives for about 2 days, after which it molts and changes into the second instar nymph. The second instar changes into the inactive propupal stage after about 3 days. The propupal stage lasts about 3 days and when this stage molts the adult emerges. About 2 days after emergence as an adult the thrips mates and is ready to begin laying eggs. The average time from egg to adult is 13 days; from egg to egg is 15 days.

Eggs are most often deposited between young, unopened leaflets. When these eggs hatch, the first instar nymphs emerge and begin feeding immediately by rasping and sucking the juices from the terminal leaflets. The two nymphal instars are passed on these terminal leaflets and then the insect drops to the ground where the inactive propupal stage is passed. Four forms of the adult thrips exist. These are long-winged and short-winged males and females.

FIG. 1. First instar nymph of tobacco thrips magnified 60x.

In Alabama the tobacco thrips is inactive from mid-December to early March. During the early spring, thrips become active and populations begin to build up on alfalfa, sweet clover, Carolina crane's bill, black medic, henbit, broomsedge, cotton, and seedling corn. During mid-May, when peanuts are in the seedling stage, thrips begin to migrate into peanut fields. From about June 1 to August 1, five overlapping generations, occur on peanuts in Alabama. When peanuts became mature, woody, and undesirable as a food, dispersion to other food hosts occurs. Late summer hosts of thrips are southern fieldpeas, grain sorghum, sudan grass, soybeans, alfalfa, and johnsongrass. Early fall hosts include volunteer peanuts (after harvest), second growth cotton, shepherd's purse, and lespedeza. Late fall and early winter hosts are volunteer peanuts, goldenrod, wild onions, and mustard.

Recent studies have yielded contradictory evidence concerning the economic damage resulting from thrips infestations on peanuts. As a result of tests conducted at Beltsville, Maryland, it was concluded that thrips reduce the yield of peanuts as much as 37%. In other studies conducted in Maryland and Virginia, substantial peanut yield increases occurred as a result of thrips control. However, research workers in several states have reported good control of thrips with various insecticides with no resulting yield increases.

[1] Dr. Ledbetter is now Extension Entomologist, Auburn University.

At Auburn several non-systemic insecticides, including DDT, toxaphene, malathion, and carbaryl have given good thrips control but have not resulted in increased peanut yields. However, in one 5-year study, peanut yields were significantly increased for 3 out of the 5 years by controlling thrips with applications of the systemics disulfoton or phorate at planting time. These two materials were most effective at the rate of 1 lb./A (10 lb. of 10% or 7 lb. of 15% granules per acre) applied 2 in. to the side of the seed at planting. During the 5-year test period peanut yields were increased an average of 200 lb./A each year.

It would appear that under certain conditions of soil and climate, and probably during most years, thrips may damage peanuts to such an extent as to reduce yields. More research is needed to determine exactly what factors control the degree of thrips damage and how these factors may be manipulated to the advantage of the peanut grower.

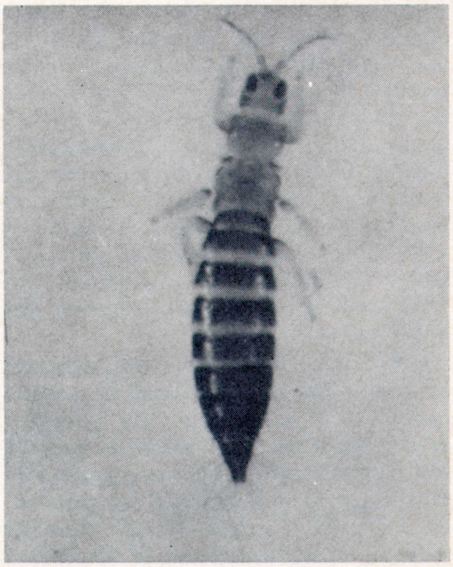
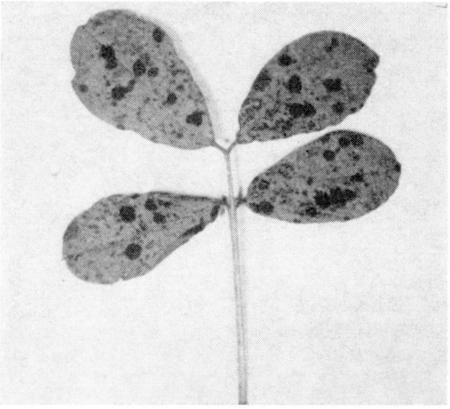


FIG. 2. Adult tobacco thrips magnified 40x.



Peanut leaf severely infected with leaf-spot fungi.

AEROBIOLOGY and PLANT DISEASE INTERACTIONS

J. A. LYLE, *Department of Botany and Plant Pathology*

Aerobiology is concerned with the distribution of living organisms in the atmosphere and with some of the consequences of their distribution.

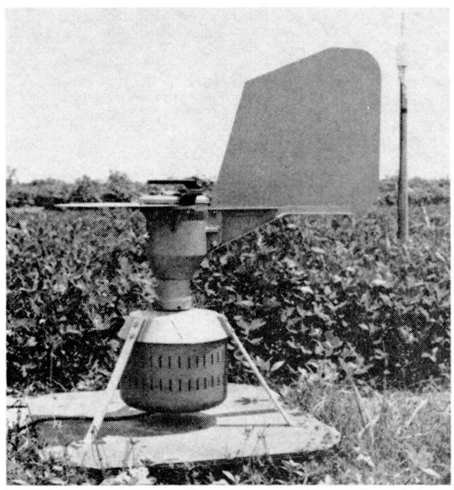
This offers a unique challenge to the biologist, especially the plant disease investigator who has practical need for information regarding the short- and long-distance dissemination of plant disease agents (pathogens).

Wind is perhaps the most important means of dissemination for these pathogens. Some pathogens are not especially adapted to aerial dissemination, but many destructive ones are principally dependent upon wind for distribution. These can cause widespread epidemics. This is true if dense populations of susceptible hosts are available and environmental conditions are favorable for disease development. Wind dissemination of fungal spores has been investigated more extensively, probably because these spores are easier to study and better adapted to spread by wind than are other pathogens. Many fungi not only produce large numbers of spores, but also possess special mechanisms for releasing them into the air. Furthermore, fruiting bodies of many fungi are the result of reproductive processes and often produce the first or primary inoculum of a growing season. Therefore, they present a double threat to crop plants, and wind is the major means in effecting this threat.

Information about local dissemination of pathogens is often used in control measures. For example, the effectiveness of fungicide applications to prevent fruit and leaf diseases of many plants depends upon proper timing of spray schedules. These schedules should coincide with the vulnerable phase of the pathogen's life cycle – the time when spores are released and infection expected. Each situation requires specific investigation, since spores of different fungal pathogens vary greatly in their capacity to resist desiccation, sunlight, and other unfavorable environmental conditions. Thus, they vary in the distances they may be borne by the wind without losing viability.

The fact that spores of plant pathogens are spread by wind is only the initial phase in aerobiological investigations of plant diseases. What time during the year are they spread? Are these spores viable and capable of infection after wind dissemination? How long will they remain viable on the host plant if environmental conditions are not favorable for immediate germination and entrance into the host? Is the host plant in a susceptible stage of growth? Are weather conditions favorable for rapid multiplication and spread if initial infection occurs? Is the pathogen a virulent race? These are only some of the important questions which must be answered if the disease problem is to be studied in detail.

It is obvious that meteorological investigations are of utmost importance in studies on relationships between wind dissemination of pathogens and the epidemiology of plant diseases. Included are: direction, height, and velocity of air mass movements, and the time when they occur; amount, duration, and extent of rainfall; temperature after infection has taken place; duration and extent of atmospheric humidity; dew; evaporation; and a number of other factors must be studied. Weather forecasts have been used as a guide to recommendations for fungicide applications in control of apple scab, late blight of potatoes, and other diseases. Such forecasts are also being developed in the southeastern United States to aid the peanut grower in controlling leafspot fungi (see photo). Applied and fundamental investigations are being conducted in Alabama, Florida, and Georgia to pinpoint and better understand the relation of specific aerobiological factors to development and severity of leafspot diseases affecting the peanut plant. Data obtained to date reflect relationships between spore levels, incidence of infection to rainfall, relative humidity, temperature, and time (see photo). It has been shown that spore level in descending order of importance is correlated with (1) rainfall, (2) maximum temperatures, and (3) minimum relative humidity, while incidence of infection is correlated with (1) minimum relative humidity and (2) minimum temperature. The ultimate goal is maximum yield with economical disease control.



Apparatus for trapping windborne fungal spores (foreground) and an anemometer for recording wind velocity (right background).

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HIGHLIGHTS of Agricultural Research

1969

HIGHLIGHTS with this issue enters its 17th 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.

If you keep a file of Highlights, you may obtain limited issues for the past 4 or 5 years by writing the Station. Listed below are the articles published in last year's four issues.

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Recent Tenure Adjustments in . . . Alabama's Tennessee Valley

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NEARLY HALF of all farm operators in the Tennessee Valley area of Alabama have a farm lease agreement. A recent survey of farmers in the redlands area of the Tennessee Valley in Colbert, Lauderdale, Lawrence, Limestone, and Morgan counties indicated that 49% of all farm operators leased at least part of their farms. An even more striking fact is that 72% of all land in farms in this area is operated by someone who rents all or a portion of the land farmed. The proportion of farm land operated by full or part tenants is somewhat higher than the 59% reported in 1960, Table 1. Also, strange as it may appear, the proportion of farm operators who rent all the land they farm – full tenants – has risen during the last decade. Full tenants now account for over 25% of all farm operators in the area surveyed – 4% above the 1960 level.

The rapid increase in farm tenancy is due to several factors. Rising land prices and interest rates have made land purchases prohibitive to many farmers; yet, modern technology and mechanization require the use of increased acreage. Consequently, leasing is being used by more and more farmers as a means to efficiently utilize their land and capital resources.

Land Ownership

Land ownership patterns have also changed considerably over the past 10 years. In 1960, 51% of all landowners in Alabama were classified as nonoperators.[1] In the recent Tennessee Valley survey, 37% of the owners were nonoperators who, coincidentally, owned 37% of the land, Table 2.

TABLE 1. PROPORTION OF FARM OPERATORS AND ACRES OF FARMLAND BY TENURE, TENNESSEE VALLEY, ALABAMA, 1960 AND 1969[1]

Tenure	Farm operators		Acres farmland	
	1960	1969	1960	1969
	Pct.	*Pct.*	*Pct.*	*Pct.*
Full own.-op.	54	51	41	28
Part own.-op.	25	24	43	58
Full tenant	21	25	16	14
Total	100	100	100	100

[1] 1960 census data based on totals for all farms in the five-county area.

Part owners achieved the biggest increase in acres owned and appear to be rapidly overtaking full owners as the largest tenure class. Although full owner-operators still represent the largest tenure class, they do not own the largest farms nor do they farm full time. Only 24% of all full owners were full-time farmers, whereas 69% of all part owners farmed full time. Also, part owners' farms were considerably larger than those of the former group. Most full owners had small farms which were operated in evenings and on weekends after completion of a full-time job off the farm.

TABLE 2. PROPORTION OF OWNERS AND ACRES OF FARMLAND OWNED BY TENURE, TENNESSEE VALLEY, ALABAMA, 1960[1] AND 1969

Tenure	Farm owners		Acres farmland	
	1960	1969	1960	1969
	Pct.	*Pct.*	*Pct.*	*Pct.*
Full own.-op.	40	43	37	35
Part own.-op.	9	20	16	28
Nonop.	51	37	47	37
Total	100	100	100	100

[1] Percentages based on totals for Alabama rather than Tennessee Valley.

Tenants and Leasing

One big difference between tenure and leasing arrangements now and in years gone by is the fact that the majority of tenants do not live on the rented acres. Landlords no longer furnish living quarters for most renters, but rental rates remain unchanged. Perhaps landowners and renters are using this procedure as a means to effectively increase rental rates.

The modern tenant bears virtually no resemblance to the stereotype many people visualized years ago. Today's tenant is more affluent, more efficient, and more ambitious than many people believe. In many cases they are the leading farmers in the county or State. Although 52% of all the tenants surveyed had a crop or livestock share arrangement, 48% had a cash lease. Numerous tenants are now renting land from multiple sources, and most are able to pay cash rents on at least one farm. In fact, a majority of the cash renters paid their rent in advance.

Thus, we can observe how the decade of the "soaring sixties" has changed agriculture in one area of Alabama. Rapid and highly significant changes in the tenure structure have occurred, and there are strong indications these trends will continue into the coming decade.

[1] Clonts, H. A. and J. H. Yeager. 1964. Rural Land Ownership and Use in Alabama, Auburn Univ. (Ala.) Agr. Exp. Sta. Bull. 356.

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