highlights
of agricultural research

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AGRICULTURAL EXPERIMENT STATION
R. DENNIS ROUSE, Director

AUBURN UNIVERSITY
AUBURN, ALABAMA

DIRECTOR'S COMMENTS

THE DEDICATION of the E. V. Smith Research Center to the farmers of Alabama on November 9 is destined to be a signal event in the history of Alabama and a memorable occasion for Dr. E. V. Smith.

I am proud and pleased that both houses of the Alabama Legislature honored Dr. E. V. Smith by naming this Center: The E.V. Smith Research Center, Agricultural Experiment Station, Auburn University. It is an appropriate recognition of Dr. Smith's many years of dedication to improving the agriculture of Alabama, the South, and the Nation through the research of the Agricultural Experiment Station and the teaching of the School of Agriculture. Dr. Smith joined Auburn University in 1931 and retired in 1972, serving the last 21 years as Dean of the School of Agriculture and Director of the Agricultural Experiment Station. Dr. Smith always had a genuine concern for his students and staff and for those involved in agriculture and related industries. As Dean and Director Emeritus, Dr. Smith continues to be of service and an inspiration to me as we all work to improve Alabama agriculture.

R. DENNIS ROUSE

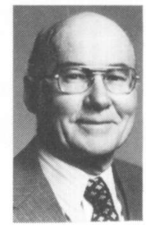
This Center represents a commitment by the State of Alabama and Auburn University to continue to provide the knowledge base required for a productive agriculture in our State. Agriculture has always been important to Alabama and all indications are that it will become ever more important as world population continues to increase. Much of the land in prime agricultural areas of this Nation is being fully utilized to produce our food and fiber and to help offset our flow of dollars overseas. Another important factor is the future production on some of the land in irrigated areas as salt levels build up and underground water levels continue to decline. The loss of agricultural land by encroachment of urban and industrial developments must also be considered. All of these point to the likelihood of greater demands on Alabama lands for agriculture, forestry, and outdoor recreation and the need for a stronger knowledge base on how to most effectively manage these lands.

The agricultural needs of this nation can only be met by a steady and increasingly complex program of agricultural research. The investment that farmers must make today in production and marketing is too great to leave management and technology to chance. The kind of sound, proven information that farmers of today and tomorrow must have as a basis for decision making can only be obtained through a forward looking imaginative research program. The facilities at the E. V. Smith Research Center make it possible to have this kind of program. This new capability will make it possible for our present scientists to carry on a more efficient and effective research program and thus provide better and clearer answers for questions that limit the efficient production and marketing of quality products or the maximum use and conservation of our lands. But an even more far-reaching benefit will be our ability to attract and retain scientists trained specifically in areas requiring a high degree of specialization. Such scientists benefit our total research program in two very important ways in addition to their own productivity. Because of their special competence, they add additional capabilities to the remaining research faculty and because these scientists usually have special teaching interests they improve our teaching program through joint appointments.

For these reasons, all of Alabama has reason to be excited about the added capabilities that these facilities bring to Alabama.

may we introduce . . .

Dr. W. B. Anthony, professor of animal and dairy sciences, who is senior author of the story on page 3 dealing with grain feeding of grazing steers. A joint teacher-researcher in the School of Agriculture and Agricultural Experiment Station since 1953, his area of specialization is ruminant nutrition.



Although best known for his pioneering work in developing methods of using animal waste in feeds, an accomplishment that brought him worldwide recognition, Anthony has also made numerous research contributions in other areas of beef cattle nutrition. He has made several foreign trips, under sponsorship of the U.S. Feeds Grain Council, to share his expertise in beef nutrition, especially waste feeding, and visitors from around the world have visited Auburn to learn about his findings.

A native of Waco, Texas, Anthony did his undergraduate study at University of Illinois, received his M.S. from Texas A & M, and holds a doctorate from Cornell University. He holds membership in numerous professional and honorary organizations.

HIGHLIGHTS of Agricultural Research

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Information contained herein is available to all without regard to race, color, or national origin.

ON THE COVER. Director Emeritus E. V. Smith (right) and Director R. Dennis Rouse at the E. V. Smith Research Center.

FEEDING GRAIN TO GRAZING STEERS

W. B. ANTHONY, Dept. of Animal and Dairy Sciences
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S. C. BELL, Dept. of Agricultural Economics and Rural Sociology
L. A. SMITH and H. W. GRIMES, Black Belt Sub.

FEEDING GRAIN to yearling beef steers on clover-grass pastures had some positive effects in Auburn University Agricultural Experiment Station tests. Gains per acre and per steer were high, and steers came off pasture finished for slaughter.

But there's another side of the results that must be considered. Cost per pound of gain was higher and feed efficiency poorer than when steers were grown out on pasture and later finished in feedlot.

Pasture Combinations Compared

Three grass-clover pasture combinations were used in the 4-year experiment on Eutaw soil at the Black Belt Substation: (1) dallisgrass-Regal ladino clover, (2) half of the paddock in dallisgrass-Regal and the other half in Kentucky 31 fescue-Regal clover, and (3) a mixture of dallisgrass-fescue-clover. Paddocks were 2 acres in size, each stocked with 3 steers.

Soil test recommendations were followed for P, K, and pH. All pastures containing fescue received 60 lb. N per acre in fall and spring. The dallisgrass-clover pastures were not nitrated. Surplus forage was harvested as hay, and value of this hay above harvest costs was credited to each treatment.

Grazing steers were fed free choice shelled corn. In addition, hay was fed in midwinter when quantity of forage was inadequate.[1] Liquid supplement (Pro-Lix) was fed free choice on all treatments until March 15.

Test steers averaged 500 lb. when purchased in the fall. They were implanted with DES in November and again in March. Pastures were stocked in mid-November each year. Steers fed on pasture remained on pasture until they reached an apparent Choice grade. At this time they were sold to a local packing plant and carcass data obtained. The grazing season averaged 9 months for all pastures.

High Gains Recorded

GRAIN FED ON PASTURE. Gain for groups of steers receiving grain on pasture ranged from 534 to 571 lb. each (4-year average). Gain per acre ranged from 801 to 856 lb., and average daily gain 1.96 to 2.08 lb. The pastures containing fescue produced slightly more weight gain, table 1.

The system having the half paddock of fescue-clover supported slightly better animal performance than the mixture of dallisgrass-fescue-clover. However, the mixture of all three crops required less hay and protein supplement during midwinter. Also, more surplus hay was harvested from paddocks containing all three crops, table 2.

TABLE 1. PERFORMANCE OF STEERS FED CORN ON PASTURE

Pasture treatment	Grazing days	Weight gain		
		Per steer	Per acre	Average per day
	No.	*Lb.*	*Lb.*	*Lb.*
Dallisgrass-Regal clover	272	534	801	1.96
Half paddock each dallis-clover and fescue-clover	274	571	856	2.08
Dallis-fescue-clover	272	550	825	2.02

TABLE 2. SURPLUS HAY HARVESTED AND HAY AND SUPPLEMENT FED WITH STEERS FED GRAIN ON PASTURE

Pasture treatment	Surplus hay per steer	Hay fed per steer	Liquid supplement per steer
	Lb.	*Lb.*	*Lb.*
Dallisgrass-Regal clover	1,423	569	189
Half paddock each dallis-clover and fescue-clover	1,169	326	141
Dallis-fescue-clover	1,882	257	123

TABLE 3. COMPARATIVE PERFORMANCE OF STEERS FED GRAIN ON PASTURE AND THOSE DRYLOT FED AFTER GRAZING

Pasture treatment	Carcass grade	Feed per lb. gain	Feed and pasture cost per lb. gain
		Lb.	*Dollars*
Fed grain on pasture			
Dallisgrass-Regal clover	Low Choice	8.73	33.14
Half paddock each dallis-clover and fescue-clover	Low Choice	8.05	32.00
Dallis-fescue-clover	Low Choice	8.09	32.65
No grain on pasture			
Fed in drylot after grazing	Low Choice	6.38	27.27

DRYLOT FED AFTER GRAZING. At the end of the grazing season, a group of steers that had not received grain while on pasture were finished in drylot. Length of feeding period averaged 114 days over the 4 years. Average gain per steer in feedlot was 296 lb. These steers had gained an average of 379 lb. each while on pasture. This gain combined with feedlot gain totaled 675 lb. per steer. Daily gain over the pasture-feedlot period averaged 1.54 lb. Data for USDA carcass grades, feed efficiency, and feed and pasture costs per pound of gain for supplemented and non-supplemented steers are compared in table 3.

Two points summarize major findings of the study:

(1) When feeding grain free choice on pasture, fescue in the pasture mixture improved feed efficiency and reduced cost of gain over dallisgrass-Regal clover pasture.

(2) Steers grazed without grain on pasture but finished in drylot utilized more forage and required less feed per pound of gain, and feed cost per pound of gain was less.

[1] In another phase of the project, steers on similar pasture treatments got supplemental feeding only in winter when forage was inadequate. Results of this phase were reported in the Summer 1978 issue. The present article reports results for cattle full fed concentrate on pasture and compares these results with performance of steers finished in drylot after grazing without supplemental grain.

LIQUID PROTEIN DIETS METABOLIC CONSEQUENCES

ANNA J. SVACHA and KATHRYN L. HARTZOG
Department of Home Economics Research

OBESITY among Americans has reached epidemic proportions. Recent national surveys have shown that over 70 million people in the United States are overweight.

Today obesity is considered a serious public health problem because of its association with increased incidence of diabetes, cardiovascular problems, and other chronic diseases.

A liquid protein diet is the most recent, popular weight reduction fad. The diet as outlined in "The Last Change Diet" by R. Linn consists of 4 to 6 oz. daily of a liquid protein product made from gelatin or collagen from horns, hooves, and hides with the essential amino acid, tryptophan, added. Some products have added saccharin, preservatives, flavorings, color, and B vitamins. The diet supplies about 300 calories per day and no other food is eaten. Persons using liquid protein are advised to take vitamin-mineral supplements plus potassium and to be under a doctor's care.

Since July 1977, the FDA has received reports of 58 sudden deaths from heart failure associated with the use of liquid protein diets. Sixteen of the deaths occurred in women between the ages of 23 and 51 years who had no history of heart disease. They had been on the diet 2 to 8 months with a range of weight losses from 20 to 139 pounds. The majority was under medical supervision and had taken prenatal vitamin and mineral supplements. All were feeling well and pleased with their successful weight loss.

The exact mechanism of the deaths which occurred remains unknown and is under continued investigation by the FDA and Center for Disease Control. The FDA will not ban liquid protein at this time, but is expected to propose a warning label for all products in which more than 50% of the calories come from protein.

Since liquid protein had not been tested in laboratory animals for safety or metabolic effects, two preliminary experiments were conducted by the Department of Home Economics Research, Auburn University Agricultural Experiment Station, (1) to investigate its biological value for growth and nitrogen balance, and (2) to examine the physiological and metabolic consequences of feeding the product to obese rats in the same manner prescribed for humans.

In the first experiment Predigested Liquid Protein[1] (LP) was used to formulate an 8% protein diet adequate in all other known essential nutrients. The control diet was similar except that casein was used in place of LP. The diets were allowed ad libitum to two groups of young adult male rats for 22 days. Rats given LP had an initial 10% weight loss, but then were stable for the remainder of the experiment. The control animals grew at a steady rate with a 52% total increase in body weight. These rats ate nearly twice as much food as the LP group. Nitrogen balance on days 6-7 was slightly negative for rats on LP and positive for the control.

In a second study, obese rats were given amounts of LP equivalent to their daily protein requirement (as prescribed for humans) plus vitamins and minerals. After 11 days, rats eating LP had lost over 21% of their initial weight and were nervous and difficult to handle; the control group weight gain was 8%. Heart and liver weights of LP rats were significantly lower than those of the controls. Although plasma calcium concentration was significantly depressed in LP rats, magnesium and potassium were not significantly different from control levels.

[1] Nature Made® Nutrition Products, Los Angeles, California 91331.

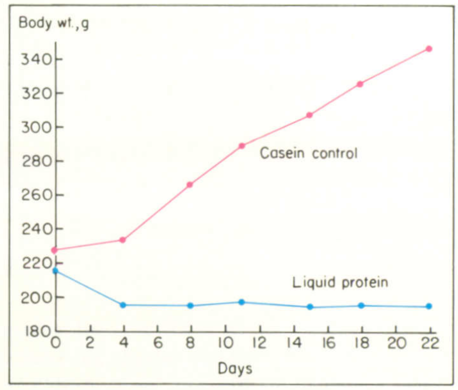


FIG. 1. Growth of rats fed liquid protein or casein as sole protein source in otherwise adequate diets, experiment 1.

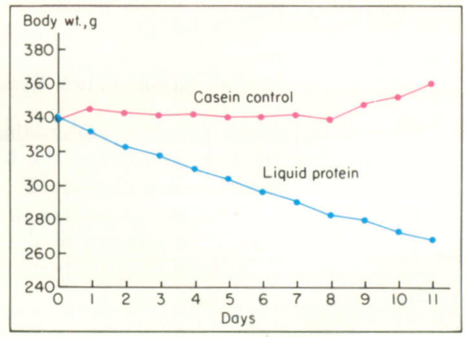


FIG. 2. Effect of liquid protein given to obese rats as prescribed for humans compared to casein control diet, experiment 2.

Since the biological value of predigested liquid protein was not sufficient to support growth in young rats on an otherwise adequate diet and resulted in loss of vital organ weight, its use by humans may well be considered questionable. Until additional data are available, liquid protein diets should be undertaken with caution and only under a doctor's care.

EXPERIMENT 1. EFFECT OF LIQUID PROTEIN ON GROWTH, FEED INTAKE, NITROGEN BALANCE, AND LIVER WEIGHT OF MALE RATS[1]

Protein source	Body wt. change	Feed intake	Nitrogen balance	Liver wt.
	Pct.	*g*	*g/2da*	*g*
Casein	52	489	0.37	13.2
Liquid protein	−10	297	−0.03	6.7

[1] Av. initial wt. 223 g. Values are means of 10 rats per treatment. All LP values are different from the casein control at the 0.01 level.

EXPERIMENT 2. EFFECT OF RESTRICTED LIQUID PROTEIN INTAKE ON BODY, LIVER, AND HEART WEIGHTS AND PLASMA ELECTROLYTES IN MALE RATS[1]

Diet	Body wt. change	Liver wt.	Heart wt.	Plasma		
				Ca	Mg	K
	Pct.	*g*	*g*	*mg/dl*	*mg/dl*	*mg/dl*
Casein	8[a]	12.5[a]	1.1[a]	11.8[a]	2.6[a]	7.4[a]
Liquid protein	−22[b]	7.1[b]	0.9[b]	10.9[b]	2.7[a]	6.8[a]

[1] Av. initial wt. 341 g. Values are means of 10 rats per treatment, those not followed by the same letter are different at the 0.05 level.

SOME WEEDS MAKE NUTRITIOUS FORAGE

S. C. BOWORTH, C. S. HOVELAND, and G. A. BUCHANAN, Department of Agronomy and Soils

WEEDS ARE GENERALLY considered undesirable in pasture, hay, and silage. But recent research challenges this view. Many weed species were found to be nutritionally equal or even superior to some cultivated forage species.

Digestibility and protein and mineral content of warm- and cool-season weeds were compared with cultivated forage species in a 2-year Auburn University Agricultural Experiment Station study. Samples were collected at three stages of maturity from field plots at Auburn and their forage quality determined (see table).

Digestibility

Digestibility of weed species was generally high. At the vegetative stage of maturity, all warm-season weeds were more digestible than Millex 23 pearlmillet or Coastal bermudagrass. Cool season weeds also had high digestibility at the vegetative stage. At this stage, Virginia pepperweed had the highest digestibility and cutleaf evening primrose and curly dock were lowest. Other cool-season weeds had digestibility similar to rye, tall fescue, ladino clover, and hairy vetch.

As with forage crops, digestibility of weeds and cultivated forages declined with increasing maturity. At the heading stage, many grass weeds had lower digestibility than cultivated grasses. However, digestibility of Coastal bermudagrass declined to a lower level than any of the weeds studied, except crowfootgrass.

Nutrient Content

Both weed and forage species at the vegetative stage had crude protein levels adequate for maintenance and growth of high producing cattle. Among the warm-season species, crude protein levels were usually higher in broadleaf weeds than in grass weeds or cultivated grasses. Cool-season broadleaf weeds had the widest range of crude protein levels, ranging from 19% for Carolina geranium (cranesbill) to 32% for Virginia pepperweed. Crude protein content of both weeds and cultivated forages declined with increasing maturity.

Both warm- and cool-season weed and forage species contained enough calcium for moderate producing cattle. Warm-season broadleaf weeds were high in calcium. Such weeds as sicklepod, tall morningglory, Florida beggarweed, prickly sida, Carolina geranium, cutleaf evening primrose, wild rye, and little barley were low in phosphorus. These species contained sub-optimum phosphorus levels for high producing cattle.

Magnesium content of warm season weeds was adequate. All cool-season weeds and cultivated grasses were low enough in magnesium to be considered possible inducers of grass tetany if used as the sole source of feed. Henbit at 0.4% and primrose at 0.3% were unusually high in magnesium. Potassium levels of both weeds and cultivated forages were well above nutrient requirements.

DRY MATTER DIGESTIBILITY AND CRUDE PROTEIN CONTENT OF WARM-SEASON AND COOL-SEASON WEEDS AND FORAGE SPECIES AT THREE STAGES OF MATURITY

Species	Digestibility			Crude protein		
	M1*	M2	M3	M1	M2	M3
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
WARM-SEASON WEEDS AND FORAGES						
Broadleaf weeds						
Sicklepod	84	76	71	22	14	17
Tall morningglory	82	----	76	20	----	14
Florida beggarweed	74	65	55	22	17	13
Prickly sida	80	70	56	17	18	12
Bur gherkin	----	75	79	----	17	14
Redroot pigweed	73	71	64	24	17	11
Jimsonweed	72	66	59	25	21	17
Grass weeds						
Fall panicum	72	63	54	19	9	7
Yellow foxtail	73	66	57	18	12	14
Crabgrass	79	72	63	14	8	6
Crowfootgrass	67	54	43	16	8	8
Cultivated forages						
Pearlmillet	59	60	60	17	6	8
Coastal bermudagrass	58	51	43	16	10	8
COOL-SEASON WEEDS AND FORAGES						
Broadleaf weeds						
Carolina geranium	78	70	68	19	14	11
Cutleaf evening primrose	72	69	52	21	14	11
Henbit	----	78	75	----	20	16
Virginia pepperweed	86	72	63	32	26	17
Curly dock	73	54	51	30	19	16
Grass weeds						
Wild rye	80	74	60	23	19	7
Cheatgrass	81	69	61	23	18	14
Little barley	82	78	62	24	18	14
Cultivated forages						
Rye	79	81	70	28	24	13
Tall fescue	78	73	67	22	16	12
Ladino clover	81	85	83	27	22	23
Hairy vetch	80	77	77	30	29	26

* M1, vegetative stage; M2, flowering stage in broadleaf weeds, booting in grasses; and M3, fruiting stage in broadleaf weeds, heading in grasses.

Value of Weeds

Even though many weed species are as nutritious as cultivated forages, some are unpalatable and would not usually be consumed by grazing animals. Sicklepod, coffee senna, hemp sesbania, prickly sida, jimsonweed, crowfootgrass, primrose, curly dock, and cheatgrass are examples of unpalatable weeds. However, these weeds could become a part of the animal's diet in hay or silage.

Many weed species commonly found in pasture, hay, and silage may be as high in nutritive value as cultivated forages if consumed at an immature stage. In some cases, overall forage quality may be enhanced by weed infestations such as crabgrass in Coastal bermuda hay. Only if a weed species lowers the quality and yield of forage in a field does it become practical to control it. Thus, infestations of many weed species may not lower the quality of commonly grown forage grasses.

Nitrogen Not A Factor in Cotton Weed Competition

JOE STREET and G. A. BUCHANAN
Dept. of Agronomy and Soils

DECIDING ON NITROGEN RATE for cotton can be done largely on the basis of economics. The old concern about high N rates giving weeds a competitive advantage was put to rest in recent Auburn University Agricultural Experiment Station research. Even though cotton growth is slow during the first few weeks of the growing season, higher rates of nitrogen did not increase the time that weed-free maintenance was required for top yields.

The experiment to determine how nitrogen affects weed competition with cotton was begun in 1969 in central Alabama. The experimental area, a Lucedale sandy loam soil, contained a natural infestation of both annual grass and broadleaf weeds at an estimated density of 200-300 per square yard. Large crabgrass, crowfootgrass, and goosegrass were the primary grass weeds. Broadleaf weeds present included redroot pigweed, tall morningglory, prickly sida, and sicklepod.

Deltapine 16 cotton was planted in 42-in. rows. Nitrogen (ammonium nitrate) was applied prior to planting in a single application. Rates tried were 0, 60, and 90 lb. per acre. Production practices followed were those designed for maximum production.

Two series of experiments were used to gain a clear picture of the relationship of weeds with cotton. In the first series, cotton was maintained weed-free for various intervals after planting and then left uncultivated the remainder of the growing season. This treatment indicates the point in the development of cotton when it is sufficiently competitive to satisfactorily interfere with growth of weeds.

TABLE 1. YIELD OF COTTON WITH VARIOUS PERIODS OF WEED-FREE COMPETITION AT THREE NITROGEN LEVELS

Weeks of weed-free maintenance[1]	Per acre yield of seed cotton at 3 N rates		
	0 N	60 lb. N	90 lb. N
	Lb.	*Lb.*	*Lb.*
2	117	86	257
4	1,661	2,301	2,533
5	1,960	2,321	2,679
6	2,161	2,979	2,958
7	2,112	2,939	2,863
8	2,643	2,962	3,167
10	3,348	3,491	3,723
12	3,183	3,221	3,619
15	3,259	3,512	3,631
Full season	3,063	3,435	3,663

[1] Weed-free maintenance indicates that cotton was kept free of weeds for the specified interval and no additional weed control was performed the remainder of the growing season.

In the second series, weeds were allowed to compete for various intervals before removal to indicate how long weeds can compete before reducing cotton yields. Such information is useful in planning post-emergence weed control programs.

Previous research had shown a requirement for 6 to 9 weeks of weed-free maintenance when recommended nitrogen rates were used. Weed competition for as little as 5 weeks had caused lowered cotton yields.

In the experiments reported here, the weed-free requirement ranged from 6 to 10 weeks over the 3-year period, table 1. Although the interval required to obtain maximum yield varied from year to year, it was not affected in any year by the rates of nitrogen used in this experiment.

In only 1 year (1970) did the rate of nitrogen application affect the interval required for weed competition to reduce cotton yields, table 2. At the 0 and 60 lb. N rate, weeds could compete for 6 weeks before reducing yields, but at the 90-lb. N rate there was no reduction before 7 weeks of competition.

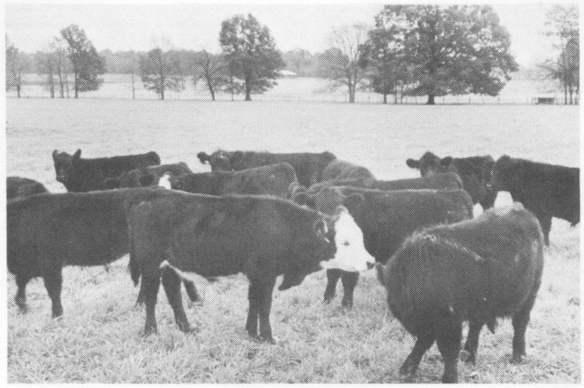
Cotton height and stem diameter were less reliable indicators of competition than was yield of seed cotton. However, the response of these measures to competition was similar to yield response.

TABLE 2. YIELD OF COTTON WITH VARIOUS PERIODS OF WEED COMPETITION AT THREE NITROGEN LEVELS

Weeks of weed competition[1]	Per acre yield of seed cotton at 3 N rates		
	0 N	60 lb. N	90 lb. N
	Lb.	*Lb.*	*Lb.*
2	3,545	3,429	4,190
4	3,339	3,375	4,027
5	3,379	3,089	3,823
6	3,246	3,003	3,677
7	2,567	2,295	3,190
8	1,987	1,712	2,103
10	1,460	1,346	1,980
12	1,104	939	1,001
15	566	444	667
No weed control	183	337	282

[1] Weed competition indicates that weeds were allowed to compete for the specified interval and then removed and the cotton kept weed-free the remainder of the growing season.

The experiments described indicate that currently used rates of nitrogen do not alter the competitive relationship of weeds with cotton. Cotton is sufficiently competitive after 6 to 10 weeks to effectively suppress further weed development.



Producer profits can normally be increased through stocker enterprises which carry calves such as these to heavier weights.

ECONOMIC OUTLOOK and ALTERNATIVES in the BEEF STOCKER ENTERPRISE

NEIL R. MARTIN, JR. and SIDNEY C. BELL
Department of Agricultural Economics and Rural Sociology

COW-CALF is the predominant beef cattle enterprise in Alabama and the Southeast. This enterprise has occurred over a period when economic analyses have shown that producer profits can normally be increased through stocker enterprises which carry calves to heavier weights. Current and projected price relationships have stimulated new interest in stocker enterprises, particularly those operations utilizing winter grazing systems.

The normal time for acquiring calves for a winter stocker program is the month of November. A weight range of 350 to 500 lb. is typical of weaned calves that are readily available from cow-calf enterprises in the fall. Stockers remain on the farm from 4 to 7 months, gaining 1.5 to 1.75 lb. per day. Thus, sale weights range from 600 to 800 lb.

Current estimated production costs are $33.71 per 100 lb. of weight gain in a stocker program following recommended practices in Alabama. These costs include: $16.38 for production of winter grazing, $2.89 for supplemental hay feeding, $4.40 for interest on operating capital, $6.47 for other direct expenses excluding labor, and $3.57 for fixed costs other than land charges. Thus, if selling price is at least as great as purchase price and selling price is in excess of $33.71 per 100 lb., a winter stocker program becomes a potentially profitable enterprise. The table shows that average prices for Choice steers in Alabama during the most recent 10-year period are sufficient to stimulate interest in stocker activity even with current costs. Ten-year average prices for Good steers provide less profit potential, but are still sufficient to cover variable cost of producers already in control of facilities and equipment.

Average prices over the past 10-year period fail to show the considerable amount of variability in annual net returns resulting from price variability and changing price margins (purchase price minus selling price on initial weight). For example, price relationships for Choice steers purchased in the fall of 1977 and sold in the spring of 1978 and current production cost would result in a return to land, labor, and management of just over $111 per head. However, Good steer prices for fall 1973 and spring 1974 would result in a loss of almost $83 per head.

Current prices and expected prices during the next 3 to 5 years for stocker and feeder steers are in excess of $50 per 100 lb., resulting in estimated returns of near $20 above cost for each 100 lb. of gain. However, a negative price margin of at least $10 for each 100 lb. of initial weight exists and is expected to persist as long as selling price continues substantially above cost of gain. As a result of these expected cost and price relationships, estimated net returns to land, labor, and management from winter stocker programs are in the $30 to $50 per head range. Thus, numbers of beef calves in winter stocker enterprises in Alabama should increase.

STOCKER AND FEEDER STEER PRICES IN ALABAMA, 1968-1978

Year (fall/spring)	Fall price of 350-500 lb. steers		Spring price of 600-800 lb. steers		Price margin (spring minus fall)	
	Choice	Good	Choice	Good	Choice	Good
	Dollars/cwt.		*Dollars/cwt.*		*Dollars/cwt.*	
1968/69	27.8	25.5	31.8	28.9	+4.0	+3.4
1969/70	33.1	30.4	29.5	27.6	−3.6	−3.2
1970/71	33.4	30.8	29.1	26.8	−4.3	−4.0
1971/72	39.6	35.8	35.5	33.0	−4.1	−2.8
1972/73	49.7	44.4	47.6	43.3	−2.1	−1.1
1973/74	53.3	49.7	34.6	31.6	−18.7	−18.1
1974/75	23.4	19.5	28.5	24.1	+5.1	+4.6
1975/76	28.7	23.4	38.7	32.6	+10.0	+9.2
1976/77	32.6	27.8	36.2	32.5	+3.6	+4.7
1977/78	38.4	33.3	52.5	48.3	+14.1	+15.0
AVERAGE	36.0	32.1	36.4	32.9	+.4	+.8

Land used for the winter grazing activity is usually capable of row-crop production. Therefore, stocker programs extending past mid-March are in most cases competitive with crop alternatives for land, labor, and capital resources.

Soybeans are grown in all areas of Alabama and serve as a competitive enterprise example for use in analyzing the economic consequences of varying the length of winter stocker enterprises. Net returns to land, labor, and management were estimated for alternative beef stocker and soybean enterprise combinations. Beef prices from $50 to $70 per 100 lb. and daily rates of gain of 1.5 and 1.75 lb. were analyzed. Soybean costs and returns reflected recommended practices, a 30 bu. per acre yield, and a price of $5.50 per bu. Other major assumptions were: fertilizer application for winter grazing eliminates fertilizer application for soybeans planted on the same land, a stocker enterprise of up to 4 months has no effect on soybean yield, soybean yield is reduced 20% for late planting caused by a 5.5-month stocker enterprise, and a stocker program extending to 7 months eliminates crop activity on land used for winter grazing.

This analysis indicated that a stocker program extending from 5 to 6 months combined with soybeans is generally most profitable. Stockers alone become most profitable only when price margins are extremely favorable and daily gain is 1.75 lb. A 4-month stocker program combined with full season soybeans is only second or third most profitable in all cases considered.

LEFT: The classical elegance of Putto (statue) seems at home in a colorful bed of impatiens backed by Florida flame azalea and catawba rhododendron. CENTER: Dwarf yaupon combines with southern magnolia to define landscape spaces and give privacy to a dining area. RIGHT: Snowflake oakleaf hydrangea, discovered near Birmingham, can be used in many natural settings, such as a combination planting with sweetshrub.

Native Plants Valuable for Home Landscape

HENRY P. ORR, Department of Horticulture

LANDSCAPING WITH PLANTS native to Alabama can give special meaning to the home landscape. Not only do such plants add interest and beauty, they also can add tremendously to the value of the home. A bonus is their low maintenance requirements.

Among the valuable native plants are ground covers such as partridge berry, small shrubs like indian currant, larger shrubs such as sweetshrub and Alabama croton, small trees like flowering dogwood and yaupon, and a multitude of large trees, including red maple, white oak, and Virginia pine. Others are listed in the table.

A study of native plants underscores what the famous naturalist William Bartram saw in traveling through Alabama in 1773. Specimens of many native Alabama plants went back to England to rich patrons before their landscaping value was recognized here.

Ralph Hammond, in his *Ante-bellum Mansions of Alabama*, says that "in a material sense, the history of man can be traced by the buildings he left behind." After investigating the plantings around many of the historic homes of Alabama, one may also say that much of Alabama's culture can be traced by the plantings cultivated and developed around these old home sites. Many of the plants used are found to be native plants.

The contemporary house, made of old brick, stone, or stained wood and placed in a wooded area, can be effectively landscaped with native plants. On a well preserved site, only a minimum of plants will be needed to supplement those already existing. Some may be needed to soften the lines of the house, others for screening, some for enhancing views, and others for decorative use.

Several Alabama nurserymen are producing greater numbers of a wider choice of native species to meet the growing market demand. These container and field grown plants can be established more easily than those dug from the wild.

PARTIAL LIST OF NATIVE, WOODY PLANTS FOR LANDSCAPE USE

Common and scientific name	Landscape value
Ground covers	
Partridge berry (*Mitchella repens*)	ground cover, rose flowers, red fruit July-Jan., evergreen
Low shrubs (2-4 ft.)	
Southern bush-honeysuckle (*Diervilla sessilifolia*)	yellow flowers July, deciduous
Indian currant (*Symphoricarpos orbiculatus*)	purplish-red fruit Sept.-on, deciduous
Small shrubs (4-6 ft.)	
Strawberry bush (*Euonymus americana*)	green stems, red fruit Sept.-on, deciduous
Oakleaf hydrangea (*Hydrangea quercifolia*)	white flowers May-June, excellent fall color, deciduous
American snowbell (*Styrax americana*)	white flowers Mar., very fragrant, deciduous
Piedmont rhododendron (*Rhododendron minus*)	rose-pink flowers May, evergreen
Medium shrubs (6-10 ft.)	
Bottlebrush buckeye (*Aesculus parviflora*)	white flowers June-July, deciduous
Red buckeye (*Aesculus pavia*)	red flowers Mar.-Apr., deciduous
French mulberry (*Callicarpa americana*)	purple fruit Sept.-on, deciduous
Common sweetshrub (*Calycanthus floridus*)	maroon flowers Apr., yellow fall color, deciduous
Pinxterbloom (*Rhododendron periclymenoides*)	pink flowers Apr., fragrant, deciduous
Alabama croton (*Croton alabamensis*)	foliage silver underneath, scattered orange fall color, evergreen
Mountain laurel kalmia (*Kalmia latifolia*)	pink flowers Apr., evergreen
Catawpa rhododendron (*Rhododendron catawbiense*)	lilac-purple flowers May-June, evergreen
Large shrubs or small tree (10-25 ft.)	
Eastern redbud (*Cercis canadensis*)	rose-pink to lavender flowers Feb., deciduous
White fringetree (*Chionanthus virginicus*)	white flowers Apr., deciduous
Flowering dogwood (*Cornus florida*)	white flowers Mar.-Apr., red fruit Oct.-on, excellent fall color, deciduous
Carolina silverbell (*Halesia carolina*)	white flowers Apr., deciduous
White swamp azalea (*Rhododendron viscosum*)	white flowers June-July, deciduous
Farkleberry (*Vaccinium arboreum*)	white flowers Apr., black fruit Sept., deciduous
Loblolly bay (*Gordonia lasianthus*)	white flowers June, evergreen
Yaupon (*Ilex vomitoria*)	red fruit Oct.-on, evergreen
Southern waxmyrtle (*Myrica cerifera*)	gray fruit Oct.-on, fragrant foliage, evergreen

A MODIFIED SKIP-ROW CULTURAL SYSTEM FOR COTTON PRODUCTION

W. T. DUMAS, Dept. of Agricultural Engineering

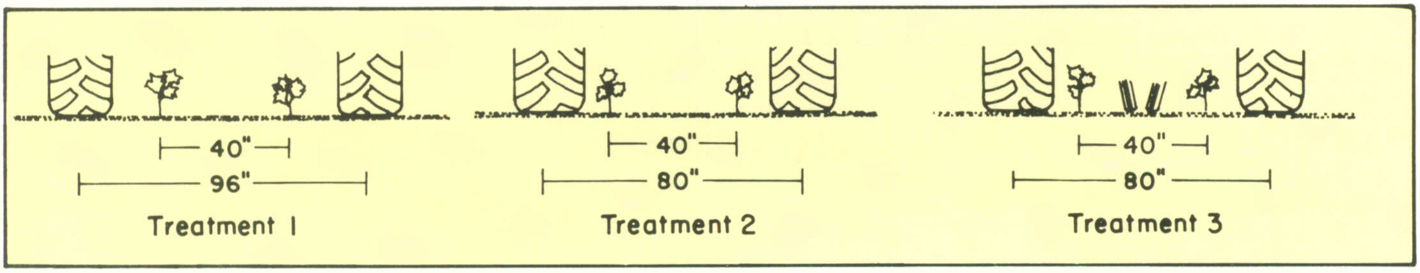


FIG. 1. Treatments in modified skip-row controlled traffic study.

MANY OF THE sandy loam soils in the southeast are easily recompacted and are subject to hardpan formation. Research has shown that cotton roots cannot grow well through very strong hardpans. However, cotton roots will grow in the root zone of loosened soil, if it is not recompacted by traffic.

Results of National Tillage Machinery Laboratory research have shown that the edge of the tractor wheel must run at least 12 in. away from the subsoil slot or the slot will be closed by compression from the wheel. This is not possible with the present row spacings, tractor wheel spacings, tire widths, and steering inaccuracies. In general, current cultural practices ignore the soil compaction problem.

A cultural system to control compaction producing forces is needed. One system known as the "Modified Skip-Row Controlled Traffic Cultural System for Cotton Production" has been tested the past 2 years by agricultural engineers from the Auburn University Agricultural Experiment Station.

The test was conducted at the Agricultural Engineering Research Unit, at Marvyn, on a sandy loam soil and consisted of three treatments. The treatments are shown in figure 1.

All plots were planted in a modified skip-row pattern consisting of two 40-in. rows centered on a swath width of 96 in., figure 2.

In treatment 1, a four-wheel tractor with 96-in. wheel spacing was used for all operations from primary tillage through harvesting. In treatment 2, all operations were conducted with a four-wheel tractor that had wheels spaced 80 in. apart. Treatment 3 was the same as treatment 2 except for additional late season and inter-row traffic from a tricycle high-clearance sprayer, which has a rear wheel spacing of 80 in.

Primary tillage for all plots consisted of disking with a disk harrow and then bedding with a two-row ripper-bedder. A Lilliston rolling cultivator was used to condition the beds and to incorporate 1 pt. of Treflan per acre prior to planting. Fourteen lb. per acre of DPL-16 cottonseed were planted and 250 lb. per acre of 8-24-24 fertilizer was banded beside the rows. All plots received three sweep cultivations and two applications of MSMA as a directed spray. The plots were side-dressed with ammonium nitrate at the rate of 80 lb. of nitrogen per acre. Eleven insecticide applications were made in 1976 and 13 in 1977 to control insects.

Yield data were obtained by mechanically harvesting 130 row ft. of each plot, see table.

As shown in the table, the plots trafficked with a 4-wheel tractor having 96-in. wheel spacing (treatment 1) averaged a yield of 2,030 lb. of seed cotton per land-acre, compared to 1,847 lb. per acre from plots trafficked with a 4-wheel tractor with 80-in. spacing (treatment 2). The plots receiving 80-in. tractor traffic plus inter-row traffic from a tricycle sprayer yielded 1,637 lb. per acre (treatment 3).

Control of machinery traffic reduces compaction and increases yield of seed cotton on soils where compaction is a problem. Where traffic was controlled with a wide wheel tractor (treatment 1) the average seed cotton yield was 9.9% higher than that of the conventional practice (treatment 2) where an 80-in. wheel spaced tractor was used, and 24% higher than treatment 3 that included inter-row traffic from a tricycle high-clearance insecticide sprayer.

YIELDS OF SEED COTTON

Treatment	Pounds seed cotton per land-acre		
	1976	1977	2-yr. av.
1 Tractor with front and rear wheels spaced 96 inches	2,143	1,917	2,030
2 Tractor with front and rear wheels spaced 80 inches	1,958	1,735	1,847
3 Tractor with front and rear wheels spaced 80 inches plus tricycle sprayer with rear wheels spaced 80 inches	1,763	1,511	1,637

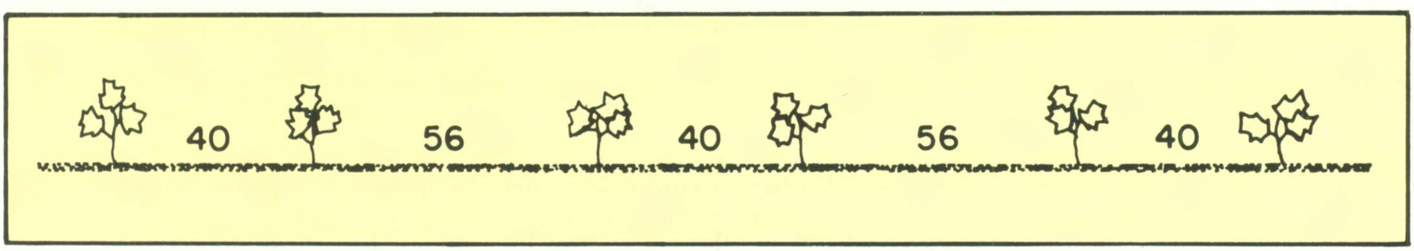


FIG. 2. Row pattern used in the test.

Improvement of Fungicide Performance through Electron Microscopy

V. C. KELLEY and P. A. BACKMAN
Department of Botany and Microbiology

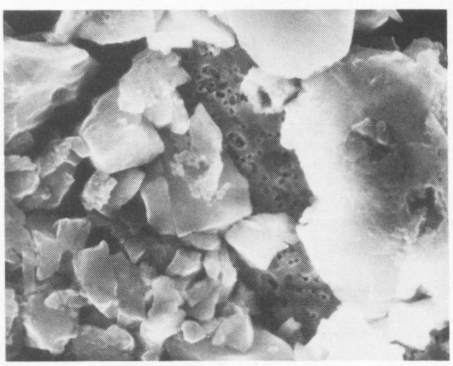


FIG. 1. Fungicide particles produced by wet-mill process. 3,300x.

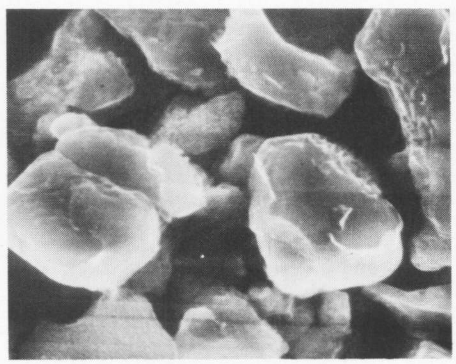


FIG. 2. Fungicide particles produced by air-mill process. 3,300x.

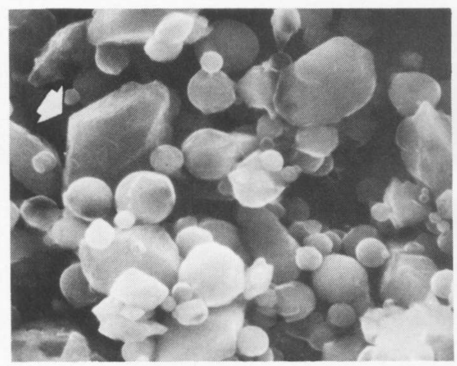


FIG. 3. Fungicide particles produced by molten process. 3,300x.

FUNGICIDES USED in agriculture almost always consist of finely-ground particles suspended in water for application by the farmer. The fungicide may be formulated as a flowable (F, already suspended in water), or as a powder (WP, ready for suspension in water).

Knowledge of the physical structure of fungicide particles as viewed with the scanning electron microscope (SEM) can be useful in preparing more effective fungicides. At magnifications in the range of 5,000x, the individual fungicide particles may be evaluated on the basis of size, shape, and surface irregularities. Physical data can then be related to biological activity in the field.

The effectiveness of fungicides in many cases has been increased by a reduction in the particle size, and it is known that activity can be altered by the process used to produce small particles. Flowable sulfur preparations are commonly prepared by three different methods of achieving small particle size. They may be reduced in size in an air stream (air-milling), by a grinding process in a liquid matrix (wet-milling), or by spraying molten sulfur into cooling liquid (molten process). In field tests, effectiveness of flowable sulfur formulations in controlling leafspot disease was in the order of wet-mill > air-mill > molten process.

SEM studies of the physical structure of particles resulting from the three processes showed that the wet-mill shattered the fungicide into more angular particles, figure 1, that varied in size from very small to moderately large. The air-mill process produced particles with smoother edges, figure 2, and of a more uniform, moderate size. The molten process produced a more nearly spherical particle, figure 3, that had no extreme size variation and was smaller than the average size produced by either of the other two processes. The molten preparation also contained rhomboid crystals, figure 3, arrow, representing regrowth of a type of sulfur crystal that is not desirable because of reduced fungicidal activity. On the basis of these studies, the greater fungicidal activity of the wet-milled product would appear to be related to two properties, i.e., the shattered, angular form of the particles and the broad range in size of the particles.

SEM studies are now underway to determine the effects of heat and rainfall on the loss of particles from the leaf surface, and the structure of the particles that are left. By minimizing loss due to rainfall and optimizing particle erosion by other factors, the performance of sulfur fungicides as well as the complex organic fungicides can be improved.

In this period of severe government restrictions on registration of new fungicides, enhancing the effectiveness of materials that are already registered must be a major goal of agricultural research.

Fuel Oil vs. Water in Sprays For Pine Bark Beetle Control

L. L. HYCHE, Dept. of Zoology-Entomology

THE PINE BARK BEETLE complex – the black turpentine beetle, the southern pine beetle, and *Ips* engravers – often seen in forest stands, constitutes a seemingly ever-present threat to pine stands around homes, in parks, and generally throughout urban areas. Pines growing in such high-use areas are generally very susceptible to attack, and attempts to prevent loss of prized trees are further complicated by the habits of the beetles. Attacking adults quickly bore into the tree's vital inner bark where they construct tunnels and lay eggs. Beetle development progresses rapidly and trees often die before the infestation is discovered. Girdling and/or action of blue stain fungus, which some beetle species introduce, is responsible for mortality in pines. Except for a brief period when adults are in flight and seeking suitable material to attack, beetle development and all life stages, including parent adults, eggs, larvae, pupae, and new brood adults are hidden and protected in the inner bark of infested trees, see figure. Thus, control becomes a matter of destroying beetles and beetle brood under the bark quickly to prevent: (1) tree mortality, in case of black turpentine beetle infestations; or (2) spread to uninfested trees, if the infestation is by southern pine beetle or *Ips* engravers.

One standard recommendation for destruction of bark beetles is to spray infested boles with an effective, approved insecticide (at present lindane, the gamma isomer of BHC) mixed in No. 2 diesel fuel oil. The recommendation usually continues with the warning that oil is phytotoxic to some plants and injury to lawn grasses and foliage of ornamental plants may result from its use; thus, water is recommended as the alternative to oil as the carrier for the insecticide. The suggestion is that oil sprays are better, but that water sprays are also effective, though perhaps less so. In recent research conducted at the Auburn University Agricultural Experiment Station a closer look was taken at the relative effectiveness of water vs. fuel oil sprays for fast destruction of pine bark beetle broods.

BHC is known to be effective in control of pine bark beetles when applied in fuel oil. Dichlorvos (an organophosphorus compound) in fuel oil has recently proven equally effective. Thus, these materials were selected for comparing the efficiency of oil and water sprays in bark beetle control. *Ips* engraver beetles were used as test insects in the evaluation.

COMPARISON OF EFFECTIVENESS OF FUEL OIL AND WATER INSECTICIDAL SPRAYS FOR DESTRUCTION OF *Ips* ENGRAVER BEETLE BROODS

Treatment	% Mortality at 48 hours after treatment[1]	
	All *Ips* forms[2]	Parent adults
BHC in fuel oil	71	98
BHC in water	23	57
Dichlorvos in fuel oil	88	98
Dichlorvos in water	32	57
Fuel oil alone	42	76
Check	4	17

[1] Mean of two tests of five replications each.
[2] Larvae, pupae, attacking or parent adults, and new brood adults combined.

Pine bolts were cut from heavily infested trees containing all stages of *Ips* development and treated, using standard recommended procedures; i.e., bark was sprayed to the point of runoff using an established effective rate of the appropriate insecticide in oil or water. For further comparison, a treatment of fuel oil only and an untreated check were included. Following treatment, test bolts were held for 48 hours then peeled and *Ips* mortality determined.

Results of the tests are presented in the table. Peeling of infested bolts revealed that some kill of all beetle forms was obtained with both oil and water sprays of either insecticide after only 48 hours. However, mortality in the oil-insecticide treatments was approximately three times that occurring where water was used as the carrier. Also, brood kill in bolts treated with fuel oil alone exceeded that of either insecticide-water treatment.

Mortality of original attacking parent adults was somewhat higher in all treatments than that obtained when all beetle forms were considered. Natural die-off, as indicated by the 17% mortality in check bolts, begins following completion of egg laying, and makes the higher kill percentages deceiving. Still the pattern of effectiveness was the same; adult mortality in oil-insecticide treatments (98%) was almost two times that obtained in water-insecticide treatments (57%). Again, mortality (76%) in bolts treated with fuel oil only exceeded that occurring in the water-insecticide treatments.

The use of BHC and dichlorvos in these tests does not constitute a recommendation of either for bark beetle control; at present, neither is approved for this use. Their established effectiveness made them appropriate materials for use in comparing the effectiveness of oil and water sprays. From results obtained, it appears evident that oil sprays are superior to water sprays for prompt and rapid destruction of bark beetle brood occurring under the bark of pine.

New brood adult Ips engravers in the inner bark of pine.

Hose Tow Irrigators: An Alternative Method

EUGENE W. ROCHESTER, Dept. of Agricultural Engineering

ALABAMA FARMERS utilize two types of field crop irrigators. The center pivot is utilized for fields which can accommodate large acreage circles and which do not have above ground obstacles such as power lines or structures. Small towable pivots are providing additional flexibility for irregular fields.

In locations where the pivot cannot be utilized, or when additional portability is desirable, many farmers are using cable towed travelers. However, the additional flexibility requires additional labor and energy requirements.

Recently an alternative to the cable towed irrigator was introduced to the U.S. market. This alternative, the hose tow irrigator, reportedly has improved flexibility and requires less labor than the cable towed traveler.

The new system utilizes a semi-rigid polyethylene pipe to convey water to the sprinkler and also to tow the sprinkler through the field. A hose reel turns continuously to roll up the hose and thus pull the irrigator through the field. To date at least two manufacturers (Long and Hudig) are offering this type irrigator to U.S. farmers. Since little information is available about the characteristics of the irrigators, a study was initiated by the Auburn University Agricultural Experiment Station. The study seeks to evaluate energy and labor requirements and application uniformity of the irrigators.

The two brands being tested are similar in operation but have several important differences, including hose size and length, drive mechanism, and layout technique, table 1.

The Hudig Irromat has several hose lengths to a maximum of 1,247 ft., while the Long NuWay has a 850 ft. hose.

Tests at Auburn are being conducted on the NuWay and the longest Irromat (1,247 ft). Table 2 provides examples which illustrate some of the operational characteristics of these machines. The Irromat uses lower flow-rates and narrower, but longer travel lanes to irrigate more land per lane. However, the NuWay with less hose length and greater hose diameter requires less inlet operating pressure (approximately 130 lb. sq. in. compared to 160) and thus less energy per volume of water applied.

Another important consideration is the labor requirement to move these machines from one lane to another. Travel lane changing is accomplished by somewhat different methods but both machines can be moved by one person utilizing a tractor. Although moving time can vary considerably, the change can usually be accomplished in 30 to 45 minutes. Additional duties such as moving portable pipe or priming a pump would naturally increase this time.

A critical factor affecting application uniformity is the variation in travel speed as the sprinkler is pulled toward the reel. The two machine components that cause speed variation are changes in drum speed and in effective reel diameter. Drum speed change is caused by change in force requirements to turn the reel and generally causes a speed increase as the sprinkler approaches the reel. Both the turbine and the piston exhibit this characteristic but speed changes on level ground were found to be small. The second component, effective diameter, changes as the number of wraps of hose changes. For example, the 4.5 in. outside diameter hose will increase speed by 11% for each wrap on the 6.2 ft. reel. The 1,247 ft. Irromat has five wraps while the shorter NuWay has three wraps. The effect of five wraps is to increase speed (and decrease total application) by 44% from beginning to end. This change causes either over-watering at the beginning, or under-watering at the end or both and emphasizes the need for additional speed control which is being implemented on the Irromat.

In summary, these irrigators offer an alternative which can be particularly useful in irrigating fields. Such factors as dependability and cost will have a major impact on their utilization. But just as important are such factors as power, energy, and labor requirements along with application uniformity. Additional results on these topics are forthcoming.

TABLE 1. SOME SIGNIFICANT VARIATIONS OF THE TWO IRRIGATORS TESTED (FALL 1978)

Irrigator	Hose		Drive mechanism	Hose reel design
	Inside diameter (in.)	Maximum length (ft.)		
Irromat (110/380)	3.5	1,247	piston	2-wheel trailer
NuWay	4.5	850	turbine	4-wheel wagon w/swivel

TABLE 2. APPROXIMATE CONDITIONS REQUIRED TO APPLY ONE INCH OF WATER ON ONE TRAVEL LANE

Machine	Lane width (ft.)	Lane[3] length (ft.)	Lane area (acres)	Initial sprinkler pressure (psi)	Orifice size (in.)	Initial sprinkler flowrate[4] (gpm)	Travel time (hr.)
Irromat	270[1]	1,320	8.2	85	1.51	400	8.5
Irromat	300[2]	1,320	9.1	85	1.51	440	9.3
NuWay	300[1]	1,000	6.9	95	1.66	560	5.7
NuWay	330[2]	1,000	7.6	90	1.66	545	6.3

[1] Travel lane width for not more than 10 mph winds for indicated sprinkler pressure (Sprinkler Irrigation 4th Ed. 1975. Sprinkler Irrigation Association).
[2] Travel lane width for not more than 5 mph winds.
[3] Lane length recommended by manufacturer.
[4] Based on sprinkler manufacturer specifications for the Rainbird 205 (Irromat) and Nelson 200 (NuWay).

New Systemic Fungicide Controls Fusiform Rust

W. D. KELLEY, Dept. of Botany and Microbiology

STATE AND COMPANY-OWNED forest nurseries in the southeast annually produce hundreds of millions of pine seedlings for use in reforestation. The three state-owned nurseries in Alabama (Hauss, Miller, and Stauffer) alone produce more than 60 million seedlings annually for reforestation in Alabama. Forest nurseries are intensively managed; thus, damage and/or loss from diseases, insects, and weeds is kept at a minimum.

Fusiform rust, caused by *Cronartium fusiforme*, is the most serious disease of loblolly and slash pines in forest nurseries. Since 1942, this disease has been controlled by frequent applications (2-3 per week) of the contact fungicide ferbam during the spore release period (April-June). Although effective, such contact fungicides have disadvantages. Frequent applications are necessary, they are washed from the foliage by rain, and new growth that occurs between applications is not protected. In addition, spores of *C. fusiforme* occur in greatest numbers following periods of rainfall when it is often not possible to maneuver spray equipment in the field.

In contrast, systemic fungicides are active inside the plant. Thus, they are not washed off by rain; they are mobile within the plant, providing protection of new tissue as it is produced; and they may eradicate infections that occurred prior to application of the systemic. This article reports results of tests by scientists in Auburn University's Agricultural Experiment Station, using two systemic fungicides, bayleton and Bay-Kwg.

Seeds of loblolly pine (Family 11-23) known to be highly suspectible to fusiform rust were germinated in vermiculite and seedlings were transplanted into flats in the greenhouse. Treatments were: (1) Untreated control; (2) bayleton soil treatment (1.8 or 4.5 lb. per acre applied pre-plant incorporated); (3) bayleton foliar spray (one application of 0.5 lb. per acre either 21, 14, or 7 days before inoculation with *C. fusiforme* or 2 or 7 days after inoculation); (4) Bay-Kwg soil treatment (1.8 or 4.5 lb. per acre applied pre-plant incorporated); and (5) Bay-Kwg foliar spray (one application of 0.5 lb. per acre either 21, 14, or 7 days before inoculation with *C. fusiforme* or 2 or 7 days after inoculation).

Seedlings were transported to the USDA Forest Service Rust Testing Center near Asheville, N.C., and were inoculated with *C. fusiforme* 40 days after being transplanted. Inoculum density and environmental conditions were optimum for infection and disease development. Each seedling was examined for rust falls after 36 weeks; only definite stem swellings were counted as galls.

In the untreated controls, 32% of the seedlings were galled (see table). Seedlings were free of galls in flats treated with bayleton, except when it was applied as a foliar spray 21 days before inoculation; even here, only 1% developed galls. Bay-Kwg was not effective against fusiform rust at the rates tested.

The data indicate that: (1) Bayleton, applied pre-plant incorporated at a rate of 1.8 lb. per acre, provided complete protection for at least 40 days; and (2) a foliar spray with bayleton at a rate of 0.5 lb. per acre gave acceptable control for 21 days after application and eradicated all infections that occurred 7 days prior to application.

Bayleton currently is being tested in nursery field plots in Alabama, Mississippi, and Georgia for control of fusiform rust. These data should provide sufficient information to obtain a label allowing its use against fusiform rust.

INCIDENCE OF FUSIFORM RUST ON LOBLOLLY PINE SEEDLINGS TREATED WITH SYSTEMIC FUNGICIDES

Treatment	Rate (pounds active ingredient) per acre	Method[1] and time[2] of application	Seedlings with galls (percent)
Untreated control	---	----	32
Bayleton	1.8	PPI	0
Bayleton	4.5	PPI	0
Bayleton	0.5	FS (−21 days)	1
Bayleton	0.5	FS (−14 days)	0
Bayleton	0.5	FS (− 7 days)	0
Bayleton	0.5	FS (+ 2 days)	0
Bayleton	0.5	FS (+ 7 days)	0
Bay-Kwg	1.8	PPI	35
Bay-Kwg	4.5	PPI	26
Bay-Kwg	0.5	FS (−21 days)	23
Bay-Kwg	0.5	FS (−14 days)	34
Bay-Kwg	0.5	FS (− 7 days)	29
Bay-Kwg	0.5	FS (+ 2 days)	22
Bay-Kwg	0.5	FS (+ 7 days)	32

[1] PPI = pre-plant incorporated; FS = foliar spray.
[2] − days = days before inoculation with *C. fusiforme;* + days = days after inoculation.

EFFECTS
Of Seed Treatment Fungicides On Rhizobium Inoculants

P. A. BACKMAN, Dept. of Botany and Microbiology

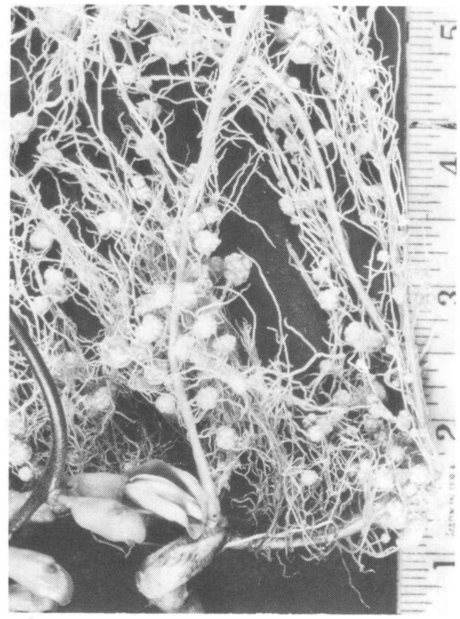
FARMERS ARE well aware of the need to secure adequate crop stands through the use of fungicidal seed treatments. If they grow legumes, they also are aware of the frequent need to improve nitrogen fixation through the application of *Rhizobium* inoculum. However, farmers growing legumes frequently have omitted seed treatment fungicides for fear that they would damage the seed-applied Rhizobia. For the past several years work has been conducted by Auburn's Agricultural Experiment Station to determine which fungicides are damaging to legume nodulation, and which are safe.

One way to prevent fungicide damage to *Rhizobium* inoculum is to use granular inoculants. Granular applicators drop the inoculant near the seed during the planting operation; thus, the *Rhizobium* inoculum does not contact the treated seed as happens in the usual hopper-box application method (fungicide and inoculum mixed together in the seed hopper). This procedure has worked well for peanuts and is showing promise in soybeans. The drawbacks are that the inoculum is more expensive and the planter must be fitted with a granular applicator.

A second approach is to test seed treatment fungicides to determine if they are damaging to Rhizobia. Compatible combinations of fungicides and *Rhizobium* could then be mixed in the seed hopper with resulting good stands and nodulation. Tests to determine toxicity of fungicides to soybean *Rhizobium* (*R. japonicum*) indicate that thiram (Arasan®) was least toxic, followed by PCNB (Terracoat®), captan (Orthocide®), and carboxin (Vitavax®), table 1. These survival tests supported nodulation tests conducted in the greenhouse. In contrast, thiram was most toxic and PCNB least toxic when tested on inoculum causing nodulation in peanuts, pigeon peas, and cowpeas (*Rhizobium* spp.).

Results from an evaluation of individual strains of *Rhizobium* for sensitivity to fungicides, table 2, indicate that there are *Rhizobium* strains available that will tolerate each of the common commercial fungicides, and that some are tolerant to more than one fungicide (strains 3 and 4, table 2). Nodulation levels for some of the *Rhizobium*-fungicide combinations were sometimes found to be higher than the control (no fungicide). A possible explanation for this is that the presence of the fungicide resulted in more *Rhizobium* inoculant sticking to the seed coat.

Overall, the data indicate that some fungicides are less damaging than others to *Rhizobium*, and that strains of *Rhizobium* which will tolerate almost any of the common fungicides are already available. When these strains are made commercially available, seed treatment recommendations may reflect compatible *Rhizobium*-fungicide combinations.



Typical legume showing rhizobium nodulation.

TABLE 1. EFFECTS OF SEED TREATMENT FUNGICIDES ON SURVIVAL AND NODULATION OF SOYBEANS AND PEANUTS* TREATED WITH COMMERCIAL *Rhizobium*

Fungicide	Soybeans		Peanuts	
	Survival	Nodulation**	Survival	Nodulation**
	Percent			
PCNB	57	84	69	80
Captan	67	86	33	38
Thiram	90	100	11	38
Carboxin	73	88	58	35

* Means of 10 replications.
** Percent of untreated control nodulation.

TABLE 2. EFFECTS OF SEED TREATMENT FUNGICIDES ON NODULATION OF PEANUTS BY SINGLE STRAINS OF *Rhizobium**

No.	Rhizobium strain	Fungicide				Mean
		Carboxin	Captan	Thiram	PCNB	
1	LX-715	12	18	22	67	30
2	LX-716	32	15	5	86	34
3	LX-717	>100	>100	38	51	72
4	LX-718	24	38	>100	>100	65
5	LX-719	30	39	35	78	45
	Mean	40	42	40	76	

* All numbers reflect means of 10 replications, and represent % of untreated control nodulation.

These data were developed through grants from the Alabama Peanut and Soybean Producers Associations and a grant from A.I.D. (CSRS-701-15-18).

INCOME TAX MANAGEMENT

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TAX MANAGEMENT is an important part of good farm business management. The objective of most farm business managers is to minimize income taxes while maximizing after-tax income. Thus, farm managers must have a knowledge of the tax consequences of the farm.

Managing a modern farm business requires a large investment of capital and the handling of large sums of money annually. Tax consequences of farm business decisions have a greater impact on cash flow and net income as farm businesses become larger.

The farm manager is constantly making decisions during the year that affect the amount of income tax to be paid and the amount of cash available for operation of the business. To make wise decisions in the framework of minimizing income tax while maximizing after-tax income, he or she must understand the tax consequences of various farm taxes throughout the year.

Standard Deduction Increased

In general, standard deductions for 1977[1] and later years for individuals who do not itemize their deductions have been increased. In the past the standard deduction was 16% of adjusted gross income, but had minimum and maximum levels. The new standard deductions (zero bracket amount) are flat sums: $3,200 for married persons filing joint returns, $1,600 for married persons filing separate returns, and $2,200 for single persons and heads of households. Individuals who itemize their deductions will be unaffected by this change.

New Jobs Credit

The Tax Reduction and Simplification Act of 1977 contains a new job tax credit provision that affects farmers.

Farmers and other business employers may be able to earn as much as $2,100 of tax credit per additional worker hired in 1977 and 1978. Each employer is subject to specific limitations when computing the tax credit, and the amount of credit claimed must be deducted from wages claimed as a business expense. If you hired additional employees in 1978 be sure to check this new job tax credit to determine if you have any credits.

Reducing Income Fluctuation

When a preliminary check of income indicates a probable net taxable income less than the amount allowed by the personal exemptions ($750 per person including dependents) and standard deduction (zero bracket amount as indicated above), consider selling such additional items as cull cows and timber to increase your income to the amount of the total deductions and exemptions.

Since exemption and deduction are allowed annually, those not absorbed by current income are automatically lost. Unused exemption credits cannot be carried forward and applied against income of another year.

The following example illustrates this principle:

John and Mary Jones have two children:

Net income			
First year	*Second year*	*Average income*	*2-year tax*
0	$12,400	$6,200	$898*

Jim and Jan Smith, also with two children:

Net income			
First year	*Second year*	*Average income*	*2-year tax*
$6,200	$6,200	$6,200	0*

* Using 1977 tax tables and general tax credit.

Net Operating Losses

Farmers often pay more taxes over a period of years than required by law because they fail to take advantage of net operating loss provisions. If a farmer has a net operating loss in a given year, such loss can be used to reduce net farm income of other years.

A net operating loss is usually the excess of expenses over income as reported on schedule F (Farm Income and Expense). In some cases adjustments must be made to this figure. If you have a net operating loss, you may carry the loss back 3 tax years and possibly obtain a tax refund or elect to carry it forward to reduce tax liability in future years.

Investment Credit

Probably the most effective tax management tool of all is the 10% investment credit, because it reduces tax on a dollar-for-dollar basis. The Tax Reform Act of 1976 has extended the investment credit for 4 additional years. Thus, the credit will be available for all qualified property purchased through 1980.

If you acquire new or used depreciable property, such as machinery, equipment, or breeding livestock for use in your farm business, you probably qualify for the investment credit. In order to qualify, the property must be depreciable, must have a useful life of at least 3 years, and must be placed in service during the year. However, the property must have an expected useful life of 7 years or more to qualify for the 10% credit on the entire investment. If the useful life is 5 or 6 years, only two-thirds of the investment qualifies for the credit. For property with a useful life of 3 or 4 years, the credit is allowed on only one-third of the investment. The useful life used for computing the investment credit must be the same as the life used for calculating depreciation.

A number of different types of farm property qualify for the investment credit. In general all tangible business property except buildings or structural components will qualify. This includes machinery, equipment, trucks, automobiles, fences, and storage facilities such as silos and grain bins. Also, breeding and dairy livestock and income producing orchards and groves qualify for the investment credit.

The credit is claimed the year the asset is purchased and placed in service; however, the item doesn't have to be completely paid for in that year. If you finance the purchase of the item you are still entitled to claim the investment credit.

The amount of the credit that can be used in any year is limited to the income tax liability shown on your tax return, or $25,000 plus 50% of the tax liability in excess of $25,000, whichever is less. Under prior law the credit earned in the current year was used first and then any excess was carried back or forward. The Tax Reform Act of 1976 made a change in this procedure. Under the law carryover credits are used first, then credits earned in the current year, and finally carryback credits.

[1] Some of the tax provisions discussed may be changed by the 1978 Tax Act.

EGG SHELL QUALITY AFFECTS HATCHABILITY

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SHELL QUALITY OF EGGS from broiler breeder flocks is receiving special attention. Hatcherymen and producers are concerned about economic losses resulting from breakage during gathering, setting, traying, and transferring. However, there is more to the problem than that.

Recent research at Auburn University Agricultural Experiment Station found that the loss due to cracks and breakage may be relatively small compared to the overall effect of poor shell texture as it affects hatchability. The data show that eggs with poor shell quality may survive the handling process and still fail to hatch.

It is well documented that shell quality in young flocks is relatively good, but begins to decline as the flock ages. This decline in shell quality is probably the one factor most responsible for reduction in overall hatchability of eggs from older flocks.

Hatchability differences in eggs from two flocks, one about 34 weeks old and the other approximately 52 weeks, are shown in the table. The differences are given in relation to specific gravity, a factor used to measure quality. Only 4.5% of the eggs from the young flock were below 1.080 specific gravity, whereas 26% of those from the older flock were below the 1.080 figure.

Eggs having a reading below 1.080 fall into a category of problem hatching, and the problems increase proportionately as the specific gravity of the eggs continues to decline below this point. On the other hand, eggs above 1.080 do not necessarily show an increase in hatchability.

It appears that the aging process of the hen has little direct effect on hatchability. Eggs with good shell quality from old breeders hatch almost as well as those from young hens. The Auburn findings indicate that the decline in hatchability of older breeders is a direct result of lowered shell quality.

In this study, all factors contributing to hatchability were kept as near equal as possible between the two flocks. Eggs from both flocks were collected 5 times per day, held in storage at 55-60°F and 85% relative humidity, and set within 7 days of lay.

Special attention was given to handling the eggs since poor handling compounds the problems associated with poor hatches, particularly when eggs are from old flocks and have poor shell quality. Also, eggs from older flocks are more susceptible to microorganism penetration than eggs with good shell quality.

The amount of moisture that evaporates from an egg affects hatching potential and chick quality, and poor shell quality speeds up evaporation rate. Eggs with a specific gravity below 1.080 have greater moisture evaporation and should not be held for extended periods nor at improper holding temperatures and humidity.

There are no simple solutions to the hatchability problem. As birds get older, shell quality is certain to decline. Therefore, the "management belt" must tighten with increasing age of breeders to avoid serious hatchability declines. The following practices will help offset the decline in hatchability brought on by lowered shell quality:

1. Provide clean litter on the floor and in nests. As egg shell quality declines, the inside of the egg becomes more vulnerable to contaminants from the litter, nest, and equipment.

2. Set eggs as often as possible. If they must be held longer than 5-6 days, give preference in the setting schedule to eggs from older hens.

3. Temperature of the egg holding room should be approximately 60°F, with relative humidity of 85%. This combination reduces the amount of moisture evaporating from eggs with poor shell quality.

4. Since Auburn research found that embryos develop slower in eggs with poor shell quality, setting eggs from older hens 5-6 hours earlier than normal will result in a few more chicks.

RELATIONSHIP OF FLOCK AGE AND EGG SHELL QUALITY ON HATCHABILITY

Specific gravity	Results, by age of flock			
	34-week-old flock		52-week-old flock	
	Pct. of eggs	Pct. hatch	Pct. of eggs	Pct. hatch
1.065*	----	----	1	78
1.070*	----	----	7	81
1.075*	4	90	18	87
1.080	19	94	36	93
1.085	32	92	25	93
1.090	26	95	11	92
1.095	14	90	2	90
1.100	4	95	----	----

* Although eggs with these specific gravity readings may visually appear to have good shell texture, they do not hatch well.

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