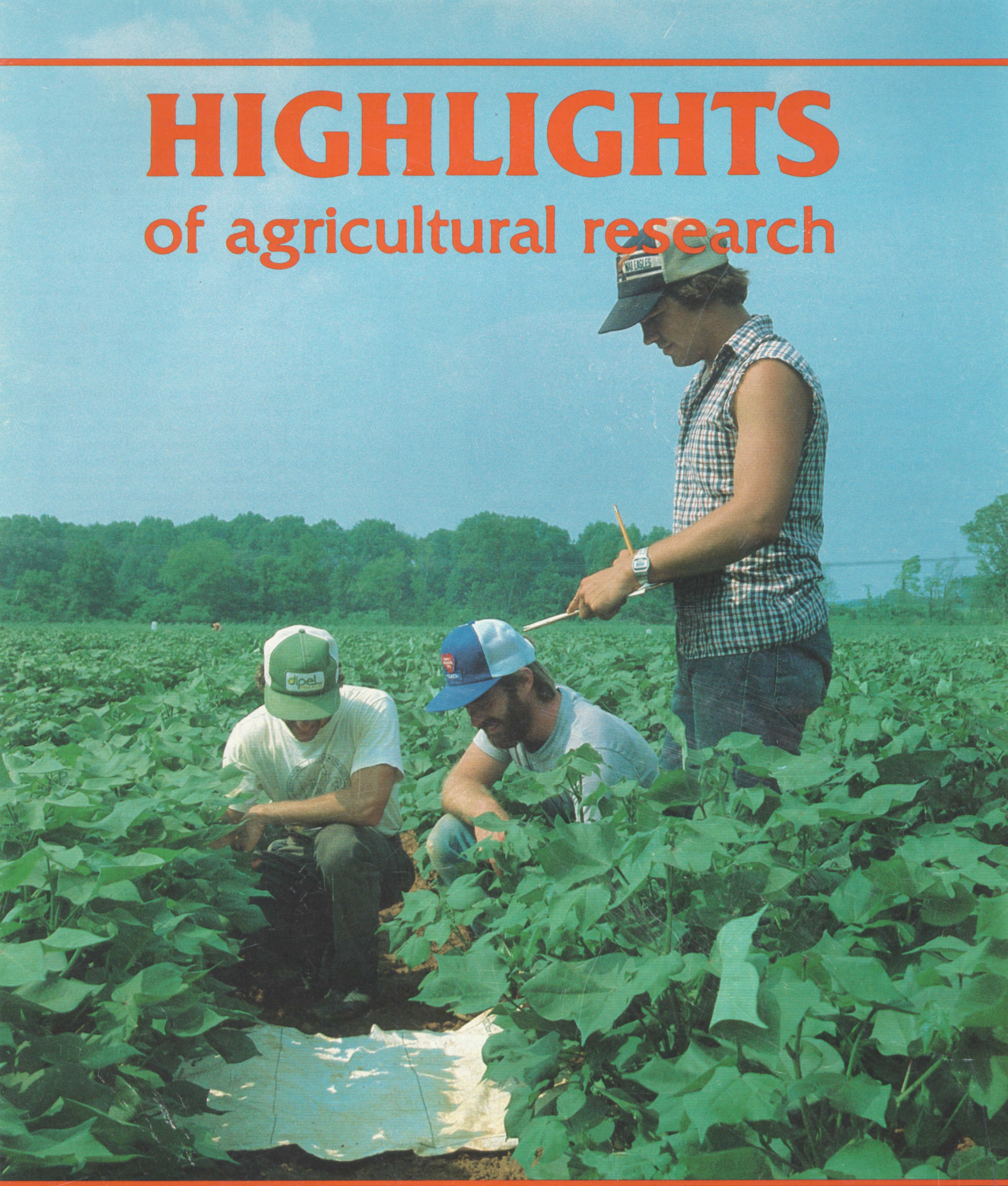
HIGHLIGHTS
of agricultural research



Vol. 30 No. 3
ALABAMA AGRICULTURAL EXPERIMENT STATION
GALE A. BUCHANAN, DIRECTOR

Fall 1983
AUBURN UNIVERSITY
AUBURN UNIVERSITY, ALABAMA

DIRECTOR'S COMMENTS

GENERAL ECONOMIC development is the efficient utilization of available resources to optimize production and development of goods and services. In Alabama, such economic growth depends to a large extent on development of agricultural and natural resources. Thus, the role of agricultural research is evident. Numerous opportunities have been identified that will depend on agricultural research for implementation.

GALE A. BUCHANAN

Forests in Alabama and the Southeast offer almost unimaginable opportunities for development. Unfortunately, we are hampered in realizing the full potential of our forests because of insufficient knowledge about regeneration, mechanization of harvest, development of improved genetic material, and other areas. The Southeast has the potential of becoming the wood basket of the free world provided we allocate sufficient research and extension resources to develop and utilize the technology needed by this vital industry.

Increases in timber production lead directly to more pulp and lumber mills and a host of related support industries. Each of these industries brings new jobs and opportunities for the citizens of this state.

The beef industry is already tremendously important to Alabama and the region, but we are far from realizing our potential. We can approach the potential contribution of this industry by capitalizing on the natural resources of the region, which include an adequate land base, a long and favorable growing season, and an abundant supply of water throughout most of the year. As our production of finished beef is increased to assure a steady and constant supply, slaughtering and processing plants will be forthcoming.

Poultry, which is already an $800 million industry in Alabama, is far from achieving its potential. Our mild climate and opportunities for utilization of solar energy can be translated into highly energy efficient operations. Increasing the production of feed grains would be another way of substantially improving the efficiency of the poultry industry. Further growth in poultry production will increase the opportunities for processing, thereby creating still more jobs and opportunities for Alabama citizens.

While the United States still imports over 70% of the fish consumed in this country, we have the potential in Alabama and the Southeast for increasing four to six times our current production of catfish and other aquacultural species. This budding new industry has grown to its current status in less than two decades. Because of the available supply of high quality fresh water and land, we have the potential for satisfying a major portion of the fish market that is now being met by imports.

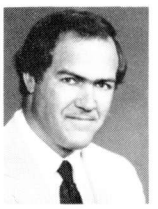
Alabama is capable of producing numerous species of vegetables and fruits. By developing effective marketing systems and better adapted cultivars, we can be competitive in a number of fruit and vegetable markets in the United States.

Most of the field crops adapted to Alabama have the potential of being integrated into multi-cropping systems that take advantage of our extended growing season over that of the Midwest. Developing this multi-cropping system to increase per acre productivity would offer advantages that would be expected to accrue from using capital assets for more than one crop per year.

The opportunities mentioned constitute a highly abbreviated list of those suitable for further economic development of agriculture in Alabama. I look forward to the future and the vital role that the Alabama Agricultural Experiment Station will play in the economic development of Alabama as sufficient funds are made available to fund this research.

may we introduce . . .

Dr. Richard L. Guthrie, newly appointed head of the Department of Agronomy and Soils. Guthrie joined the Auburn faculty June 13, coming from Washington, D.C., where he headed the soil survey classification divisions for the USDA Soil Conservation Service.



A native of Union Springs, Guthrie attended Auburn University, receiving the B.S. in 1962 and M.S. in 1965, both in agronomy and soils. He completed his education at Cornell University, receiving the Ph.D. in soil science in 1968.

Guthrie was with the Soil Conservation Service from 1971 until 1983, except for one year as soils specialist for the Alabama Cooperative Extension Service. He rose to the highest position in soil survey classification in the United States, with responsibility for both national and international programs.

As an Auburn student, Guthrie was honored with membership in Alpha Zeta and Gamma Sigma Delta, agricultural honoraries. He holds membership in the American Society of Agronomy, Soil Science Society of America, Soil Conservation Society of America, and International Society of Soil Sciences.

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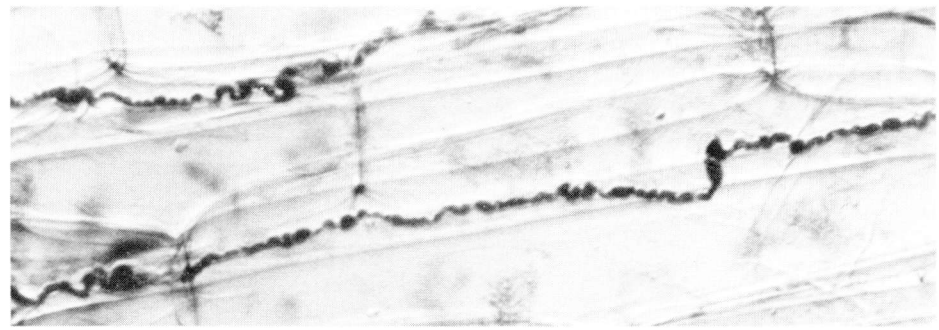
ON THE COVER. Controlling plant bugs in cotton continues to receive research emphasis. One such project is described in the story on page 5.



Seed Treatment Control of the Fescue Endophyte Shows Promise

M.J. WILLIAMS, P.A. BACKMAN, and R.A. SHELBY, Department of Botany, Plant Pathology and Microbiology, J.F. PEDERSEN, Department of Agronomy and Soils, D.M. BALL, Alabama Cooperative Extension Service

ABOVE: *Acremonium coenophialum* hyphae in tall fescue leaf sheath.

FUNGICIDAL TREATMENT of planting seed and pastures looks promising as a method of controlling the fungus that causes fescue toxicity of cattle grazing tall fescue. This is the latest research approach in Alabama Agricultural Experiment Station efforts to overcome the serious production losses by cattlemen who use tall fescue pastures in beef production.

Previous research identified *Acremonium coenophialum* as the fungus, or endophyte, living inside the grass that caused the disorder known as "fescue toxicity" or "summer syndrome." Almost all tall fescue pastures in the Southeast are infested with the fungus.

Cattle grazing infested pastures typically show symptoms of retained winter hair, rapid breathing, low grade fever, and easy excitation. In most cases, the end result has been poor weight gains. The fungus is also thought to adversely affect conception rates, calving interval, and lactation.

Since the only known means of fungus spread was through infected seed, the research first sought ways to eradicate the fungus from seed.

Storing seed on the farm and allowing it to age more than 1 year effectively eradicated the fungus from an infected seed lot. Though endophyte levels have been successfully reduced during storage, seed germination may also decrease. Therefore, stored seed should be checked both for viable endophyte levels and germination before they are used.

Fungicidal seed treatments would allow establishment of fungus-free tall fescue pastures from newly harvested seed. Liquid formulations of Bayton® at 8 oz. active ingredient (ai) per hundredweight of seed effectively eradicated the endophyte from infected seed in the greenhouse and a field planting at Guntersville, table 1.

Failure of the same treatments at the Black Belt Substation was probably due to uneven fungicide coverage and local environmental conditions. Use of dust formulations of Bayton gave better seed coverage, which resulted in eradication of the endophyte at all test sites. Use of these improved formulations should ensure acceptable control with all soil types and seed lots in Alabama.

Eradicating the fungus from established pastures is an important goal. Multiple foliar fungicide applications were not as effective as a single granular application of Tilt® in controlling the fungus in mature plants in the greenhouse or the field. Up to 6 lb. ai per acre of Tilt was necessary for eradication at the Black Belt Substation.

Treating infested pastures with a combination of foliar and granular Tilt or Bayleton significantly improved cattle gains, table 2. Detectable fungus in treated infested pastures was reduced approximately 50% 2 months after treatment, but the fungus reestablished to pretreatment levels 7½ months after treatment.

Because of the high rates of fungicide required and lack of long term control, eliminating fungus from established pastures does not appear economically practical. However, these fungicidal treatments do provide a method of eradicating the fungus from parent plants or breeder fields used to develop new and improved tall fescue cultivars.

Cattle producers can establish fungus-free tall fescue pastures by planting aged seed or new crop seed that have been identified clean by a diagnostic lab. Fungicides for seed treatment have not received E.P.A. approval. Fungicidal treatments for established pastures are not presently practical, but the introduction of legumes into tall fescue stands has been found to reduce or eliminate the harmful effects of the endophyte.

The Alabama Agricultural Experiment Station and the Alabama Cooperative Extension Service offer a fescue diagnostic laboratory for producers who wish to know the endophyte level in their tall fescue pastures and seed sources. Reports from the lab document the infection level of the sample and offer recommendations for controlling the endophyte present. Additional information concerning this service can be obtained from the local county extension office.

BELOW: Effect of storage time on viable *Acremonium coenophialum* in infected seed stored in north Alabama.

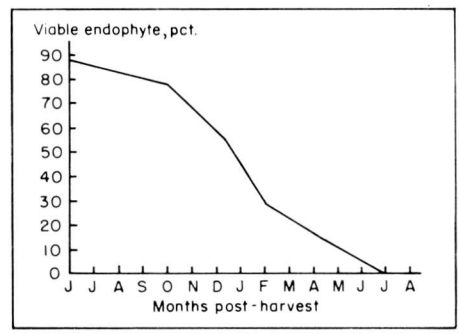


TABLE 1. EFFECT OF COMMERCIALLY APPLIED SEED TREATMENTS (LIQUID FORMULATIONS) ON VIABLE ENDOPHYTE IN TALL FESCUE SEED

Fungicide, rate/cwt.	Percent infection[1]		
	Greenhouse	Guntersville	Black Belt Sub.
Bayton-30F, 8 oz.	1.6	0	51.5
Bayleton 50WP, 8 oz.	1.6	3	47.5
Control	71.0	62	66.5

[1]Seedlings checked 2½ months after planting.

TABLE 2. EFFECTS OF FUNGICIDAL TREATMENT ON ENDOPHYTE LEVEL AND CATTLE PERFORMANCE AT THE PIEDMONT SUBSTATION, SPRING 1982

Fungicide, rate ai/acre	1982				1983	
	2-mo. posttreatment[1]		7-mo. posttreatment		3-mo. posttreatment	
	Pct. inf.	ADG[2]	Pct. inf.	ADG	Pct. inf.	ADG
Tilt, 3.5 lb.	39.5	1.49	61.2	1.23	22.5	2.09
Bayleton, 3.5 lb.	35.0	1.32	51.2	1.11	--	--
Infected control	81.7	.85	67.2	1.39	55.9	1.38
Non-infected control	2.3	1.30	3.8	1.47	6.2	2.54

[1]Infection level prior to treatment in 1982 and 1983 averaged 73%.
[2]Average daily gain.

Pinkeye Vaccines, Treatments Being Evaluated at Auburn

PAUL C. SMITH, JANET K. TOWNSEND, T.A. POWE, and T.R. HOOVER
Department of Animal Health Research and School of Veterinary Medicine

FIG. 1. Feeder calf with early pinkeye; note squinting and profuse tearing on side of face.

PINKEYE is a highly contagious disease of cattle that costs the U.S. beef industry an estimated $150 million or more annually.

Beef producers in the South raise approximately 10 million feeder calves each year, and more than 30% of these have pinkeye before they are weaned. A preliminary survey indicates that the calf loss averages $30 per animal. Therefore, the cost to Southern livestock producers, according to their own estimates, approaches $90 million annually. The economic magnitude of the problem explains why the Alabama Agricultural Experiment Station and School of Veterinary Medicine at Auburn University are conducting research on vaccine development and treatment.

The disease, referred to scientifically as infectious bovine keratoconjunctivitis (IBK), is caused by a bacterium, *Moraxella bovis*. The bacteria are spread primarily to susceptible cows and calves by face flies, horn flies, and direct contact with infected cattle. Dust, wind, and direct sunlight may be contributing factors. The highest incidence of IBK occurs in mid to late summer.

Symptoms of the disease include reddened eyes, copious tears down the side of the face, squinting and swelling of the eyes, figure 1, and severe ulcers of the cornea that sometimes cause rupture of the eyeball and subsequent blindness, figure 2. Once severe damage has occurred, healing may take 4 to 6 weeks. Severe scars are often left, which may cause blindness.

Standard treatments for IBK range from local applications of a wide variety of chemical preparations in the eye to the injection of antibiotics and sulfa drugs into the eye. With such treatments, it is difficult to maintain a therapeutic concentration of the drug in the tissues of the eye and continued retreatment is necessary.

Perhaps the most common one-time treatment used is the injection of corticosteroids and long-acting penicillin under the conjunctiva of the eye. However, penicillin resistant strains of the bacteria are becoming more common. Since much damage to the cornea has often been done before treatment, elimination of the bacteria only slightly improves a slow healing process.

None of the pinkeye vaccines marketed commercially prevents the disease. The Auburn studies related to vaccine development are oriented around the development of vaccines from pili (tiny protrusions from the cell wall) of the bacteria. These structures aid the bacteria in attaching to the structure of the eye and causing disease. They may also be responsible for the severe damage to the cornea. Antigens from the pili are being incorporated into artificial liposomes (lipid vessicles) and used as experimental vaccines.

FIG. 2. Severe scar and healing process causing blindness due to pinkeye.

Studies of the effect of non-virulent and low-virulent strains on resistance to the high-virulent strains of the bacteria provided the following preliminary findings: (1) animals with severe disease developed a high level of resistance, (2) low-virulent strain infections developed moderately high levels of resistance, (3) experimental vaccines of the liposome type offered some protection, and (4) non-virulent infections apparently caused no resistance to develop. Results are summarized below:

Treatment[1]	*Eyes resistant to experimental infection, pct.*[2]
Experiment 1	
Non-virulent strain[3] (8)	0
Controls (8)	0
Experiment 2	
Controls (4)	0
Low-virulent strain (4)	88
High-virulent strain (4)	100
Experiment 3	
Controls (3)	0
Experimental vaccine (6)	50

[1]Numbers in parenthesis are number of calves.
[2]0 = all eyes had clinical disease, no resistance; 100 = no eyes had clinical evidence of pinkeye, resistance.
[3]Non-virulent strains cause infection but no disease; low-virulent strains—infection but little incidence of disease; high-virulent strains—infection with severe disease.

Comparisons of several popular pinkeye treatments, see table below, indicate that (1) once severe lesions have developed in the eye, none of the treatments evaluated significantly enhanced healing when compared to non-treated controls, (2) topical antibacterial sprays and ointments are just as effective as the more popular penicillin-corticosteroids treatment, and (3) the "stick-on", black-patch type treatment may actually be detrimental.

PERCENT CLINICAL IMPROVEMENT OF CATTLE WITH PINKEYE FOLLOWING CONTROLLED TREATMENT[1]

Treatment[2]	Improvement 5 & 10 days posttreatment	
	5 days	10 days
	Pct.	*Pct.*
Controls (11)	16	44
Treatment A (40)	26	51
Treatment B (13)	22	41
Treatment C (10)	57	59
Treatment D (10)	47	61
Treatment E (10)	14	10

[1]Improvement based on numerical scores of graded lesion changes in the eye following each treatment.
[2]Numbers in parenthesis are numbers of animals; treatments were as follows:
A. Subconjunctival injection of penicillin, streptomycin, and corticosteroids.
B. Chloromycetin opthalmic ointment; topical application for 3 consecutive days.
C. Topical spray (Furazolidone); application for 3 consecutive days.
D. Tylan-Neomycin powder; topical application for 3 consecutive days.
E. Treatment A plus "stick-on" black-patch over the eye.

The tarnished plant bug *(Lygus lineolaris)* feeding on daisy fleabane *(Erigeron annuus)*.

IDENTIFICATION OF SOURCES OF PLANT BUGS INFESTING COTTON IN NORTHERN ALABAMA

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Department of Zoology-Entomology

PLANT BUGS are insects that feed on a wide variety of plants, often damaging young fruiting structures. The tarnished plant bug *(Lygus lineolaris)* feeds by sucking plant juices from terminals of cotton plants prior to squaring, and from young cotton squares. Feeding causes irregular plant growth patterns ("crazy cotton") and results in abortion of the cotton square ("blasting"). A large portion of the season's yields may come from these early squares; thus, growers often apply insecticides to protect the plants. Unfortunately, early season insecticide sprays may delay the build-up of large populations of arthropod predators, which are valuable for the control of the first and second generations of bollworms.

Research at the Alabama Agricultural Experiment Station shows it may be economically feasible to manage plant bug populations before they become economic pests by controlling certain alternate hosts. In California, infestations of *L. hesperus*, a closely related plant bug, in cotton are initiated by movement into cotton from alfalfa or safflower. Plant bug populations are manipulated on these alternate hosts to prevent large scale movement into cotton.

There is relatively little alfalfa and no safflower acreage in Alabama, but alternate hosts of the tarnished plant bug are present. Before the tarnished plant bug can be managed by manipulating these alternate hosts, the sources of infesting populations must be identified, and the time that alternate hosts support populations must be determined.

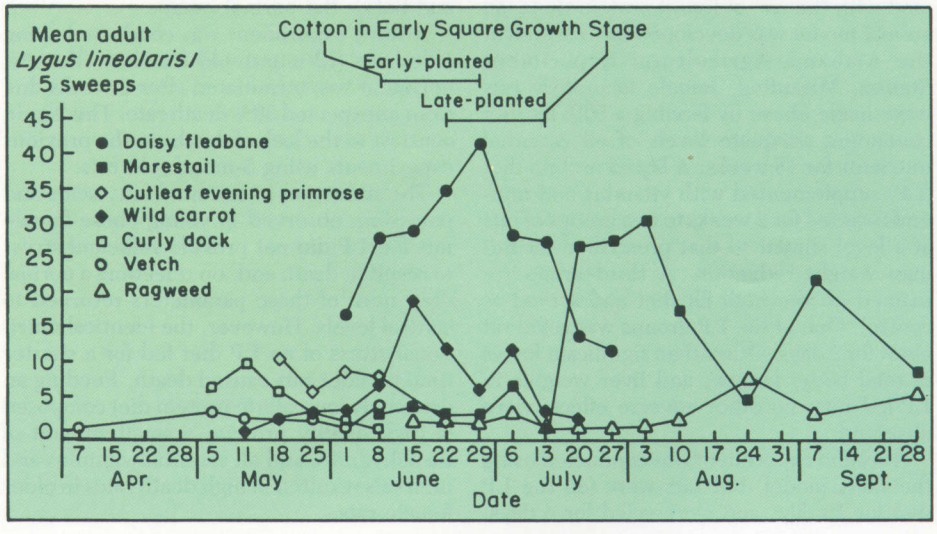
Seasonal abundance data taken in 1982 along roadsides and in old fields in Limestone County revealed there is a seasonal progression of weedy alternate hosts, right. Before planting cotton, populations were building on vetch *(Vicia* sp.), curly dock *(Rumex crispus)*, and cutleaf evening primrose *(Oenothera laciniata)*. As those hosts matured, the population shifted to wild carrot *(Daucus carota)* and daisy fleabane *(Erigeron annuus* and *E. strigosus)*. Later in the season, composites such as marestail *(Erigeron canadensis)* and ragweed *(Ambrosia* sp.) supported the largest populations.

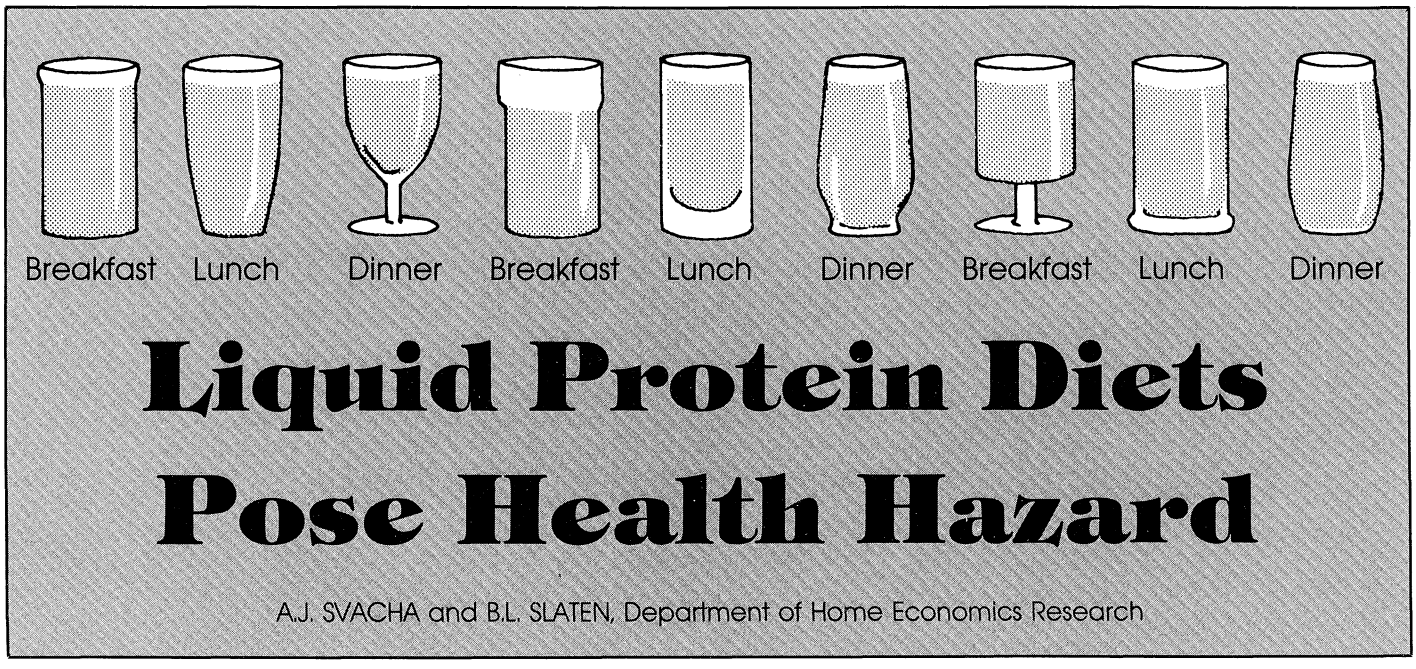
The time that both early and late-planted cotton was in the early square growth stage in 1982, and thus susceptible to economic damage, is indicated at the top of the accompanying graph. Most plant bugs that infested cotton during that time span appeared to have moved from daisy fleabane, with populations from wild carrot and cutleaf evening primrose also contributing. The large populations on marestail occurred too late for movement from this host to have caused economic damage to cotton.

A careful look at the graph may help explain why early-planted cotton traditionally has smaller plant bug populations than does late-planted cotton. As early-planted cotton began to square, plant bug populations on the alternate hosts were increasing. The alternate hosts may have been acting as a trap crop at that time, attracting and holding the plant bugs. But from late June through mid-July, populations on daisy fleabane and wild carrot were decreasing. Marestail did not develop large populations until late July. It was during this time span (late June to mid-July) that large populations could have moved into cotton. Late-planted cotton would be both attractive to the plant bugs, which prefer young flower buds for feeding, and susceptible to economic injury.

The Tennessee Valley in northern Alabama supports a dense population of certain of these alternate hosts along roadsides. A large percentage of these hosts was destroyed in 1982 by mowing at the time they supported a large plant bug population. This mowing may have initiated large-scale plant bug movement into cotton while the crop was susceptible to economic injury. Experiments are currently underway to determine if careful, coordinated timing of such cultural practices by entomologists, agronomists, and roadside management personnel can be an effective area-wide pest management tactic.

Seasonal abundance of adult tarnished plant bugs on weedy alternate hosts in northern Alabama, 1982.





Liquid Protein Diets Pose Health Hazard

A.J. SVACHA and B.L. SLATEN, Department of Home Economics Research

OBESITY and associated chronic health problems, such as high blood pressure and diabetes, continue to be a leading public health concern in the United States. Associated with concerns about obesity is a strong interest in diets, which also leads to other health problems.

Extremely low calorie, high protein diets are the most popular weight reduction treatments advocated by some physicians and most food faddists. Unfortunately, such diets are potential health hazards. In fact, the use of some of these diets has resulted in unexplained sudden death from heart arrhythmias. The best documented cases of death from such diets occurred in women aged 32-51 years. Deaths followed successful weight loss using liquid protein with and without vitamin and mineral supplements.

To investigate metabolic changes associated with the use of liquid protein diets, an animal model was developed for research at the Alabama Agricultural Experiment Station. Weanling, female laboratory rats were made obese by feeding a 50% fat diet containing adequate levels of all essential nutrients for 18 weeks. A liquid protein diet (LP) supplemented with vitamins and minerals was fed for 2 weeks to two groups of rats at a level similar to that prescribed for human weight reduction. A third group remained on the high fat diet and served as control. One of the LP groups was refed rat chow for 2 days. Other than significant losses of total body, kidney, and liver weights in LP-fed rats, no other adverse effects were observed.

A second experiment was conducted using the same model, but rats were fed the LP diet for 28 days and were refed for 4 days. Half the rats refed rat chow exhibited digestive tract abnormalities, including distended, impacted intestines and ruptured stomach linings. The LP group lost approximately 20% of their body protein, which was partially restored during refeeding. Mean body fat loss was more than 80%. Loss of heart weight was not significant; however, liver and kidney losses were significant.

In rats fed the LP diet, no significant changes occurred in essential fatty acids (linoleic and arachidonic) found in the heart. Serum essential fatty acids decreased to about 50% of the control levels. Carcass linoleic acid dropped 66%, while the arachidonic acid level was not significantly changed. Analysis of blood electrolytes indicated normal calcium, magnesium, and sodium levels among the LP and LP-refed groups. However, the mean potassium level of the LP group was lower than the control and below the normal range.

A third experiment was conducted using older rats (12-month-old females). This experiment was terminated after 2 weeks due to an unexpected 30% death rate. This was in contrast to the lack of deaths in the previous experiments using 5-month-old rats.

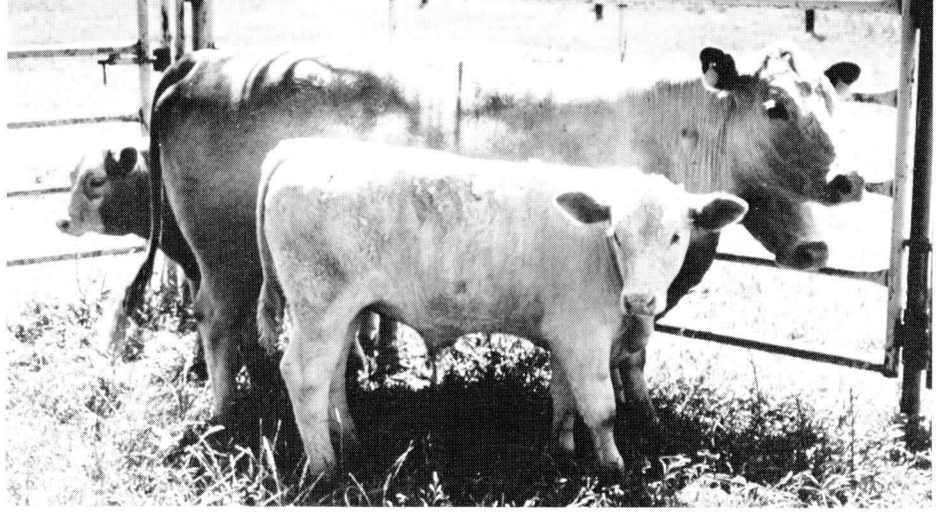
The reduction in essential fatty acids and potassium observed in young obese female rats fed LP did not provide sufficient stress to result in death and, on refeeding a normal diet, most of these parameters returned to control levels. However, the identical nutritional stress of an LP diet fed for a shorter time to older rats caused death. Feeding an extremely low calorie protein diet composed of high quality protein, a small amount of carbohydrate, and all essential vitamins and minerals resulted in high death rates in older female rats.

The use of extremely low calorie protein diets (< 800 kcal) for weight reduction is controversial among clinicians. Such diets should not be used even under strict heart and electrolyte monitoring by a physician unless the individual is more than 30% above the ideal body weight and has no other health problems.

Implications for the use of liquid protein diets by humans are that with healthy young women taking adequate vitamin-mineral supplements, there appears to be no major adverse effects over a short time. For women over 30 years of age, however, significant risk of death is associated with liquid protein reducing diets even for short periods.

EFFECTS OF A LIQUID PROTEIN DIET FED TO OBESE FEMALE RATS FOR 4 WEEKS FOLLOWED BY REFEEDING FOR 4 DAYS

Measurement	Control	Liquid protein	Liquid protein refed
Body wt., g	334	194	233
Body protein, g	49	38	44
Body fat, g	118	22	27
Heart wt., g ...	0.87	0.77	0.80
Liver wt., g ...	9.3	5.6	9.3
Kidney wt., g ..	2.0	1.5	1.7
Heart fatty acids, mg/g			
Linoleic acid ..	0.91	1.17	1.95
Arachidonic ...	2.14	1.70	1.74
Serum fatty acids, mg/dl			
Linoleic	7.3	2.9	8.5
Arachidonic ...	21.2	10.3	9.7
Carcass fatty acids, mg/g			
Linoleic	0.44	0.15	0.32
Arachidonic ...	0.05	0.08	0.09



Parasites Affect Nutrition of Livestock in Hidden Ways

J.C. FRANDSEN, USDA Regional Parasite Research Laboratory
and School of Veterinary Medicine

LOW-LEVEL INFECTIONS by nematodes (roundworms) and coccidia are extremely common in cattle, sheep, goats, and pigs. Since the animals appear to be healthy, it is difficult to believe that the parasites are doing any appreciable harm. Yet, studies at Auburn University and elsewhere have shown clearly that such low-level infections may cost the farmer dearly in terms of his returns on the money invested in feed and management.

Infections by nematodes alone can reduce the digestibility of the nutrients in the feed, making a lesser proportion of them available to the host animal. Consequently, a diet that would be adequate for an unparasitized animal becomes inadequate for a parasitized one. Additionally, these low-level infections can reduce the animal's appetite and lessen its ability to absorb the feed it does consume.

Nematodes can reduce carcass quality by reducing the proportion of protein in weight gains. Furthermore, they can reduce the rate of bone mineralization in growing animals. Studies in Scotland have demonstrated that with sheep, this defective bone mineralization in lambs results in adult sheep with weak skeletons—sheep undesirable for wool production or breeding stock because of their likely susceptibility to injury or disease.

Coccidia are one-celled, intestinal parasites that occur both as low-level infections producing no obvious signs of disease, and as high-level ones producing coccidiosis (scours) in ruminants, baby pigs, and poultry. Low-level infections are extremely common in ruminants (cattle, sheep, and goats) and are often considered harmless to the animal, at least in the absence of stress produced by severe weather or disease.

Recent Auburn research, however, has shown that when an animal with low-level infections of coccidia also has a low-level, symptomless infection by nematodes, the effects of the coccidial infections can be of considerable concern. Goats harboring low-level infections of both nematodes and coccidia at the same time suffered a reduction in bone-hardening (mineralization) significantly greater than that suffered by those infected only with nematodes.

Experiments with laboratory animals demonstrated that double, low-level infections by two parasites together produce a number of effects greater in magnitude than when each kind of parasite occurs in the absence of the other. Among these effects are loss of appetite, reductions in daily live weight gains beyond those explained by the loss in consumption which accompanies loss of appetite, and reductions in the apparent digestibility of the nitrogen required by body proteins. This loss of nitrogen digestibility was accompanied by increased losses of this essential nutrient in the urine and feces. Consequently, low-level double infections of nematodes and coccidia in livestock may produce a significant drain on the cost efficiency of production.

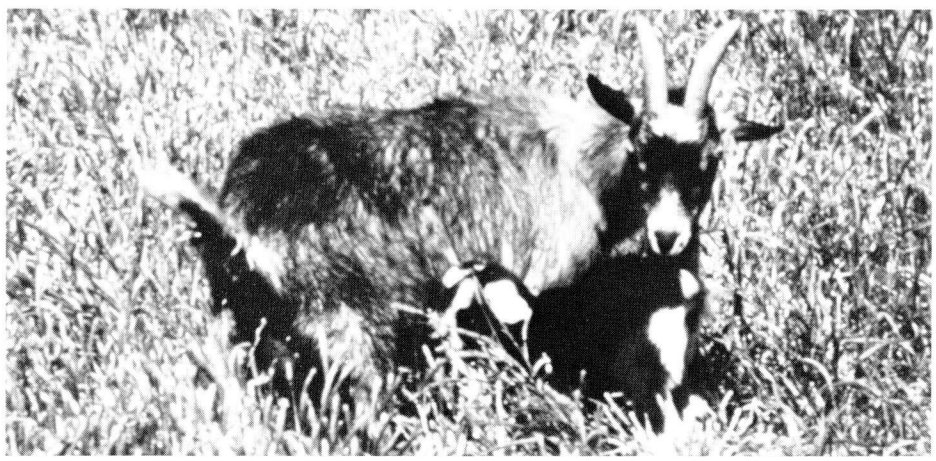
The scientist's job in learning to understand how infections by parasites affect an animal's nutrition is made more difficult by the ways in which minute changes in the trace element content of the diet affect the factors being studied and the animal's resistance to the infections. In addition, researchers are just beginning to appreciate how changes in the dietary levels of one trace element can affect the availability or influence of another. For example, animals require the trace element selenium to maintain their resistance to disease. Yet, the effects of selenium are strongly influenced by the levels and availability of vitamin E in the diet.

The presence of high levels of certain other trace elements, including silver, cobalt, and tellurium, also can counteract the effects of selenium, producing signs of selenium deficiency even when its level in the diet is "adequate."

Zinc is another trace element required for maintaining resistance to infection and disease. Dietary protein influences the availability to the animal of both selenium and zinc, since neither is absorbed well when the protein level is low.

When goats on a diet low in both selenium and protein were infected with the threadworm *Trichostrongylus colubriformis* and then injected with a preparation containing selenium and vitamin E, it was found that the injections favorably influenced live body weights and the animals' immune status. All of the animals had naturally acquired infections by coccidia, and these appeared to be more severe in the control goats which did not receive the selenium and vitamin E.

Obviously, the importance to the farmer of the interactions between parasites and the nutrition of his stock is just beginning to be appreciated. As profitable animal production becomes increasingly dependent on efficient conversion of feed to meat and by-products, a thorough understanding of these interactions will become increasingly important.



Cryptosporidiosis

A Newly Recognized Human Disease

W.L. CURRENT, Department of Zoology-Entomology

CRYPTOSPORIDIOSIS, until recently, was considered to be a rare infection in animals, and in man it was thought to be the result of a little-known opportunistic pathogen outside its normal host range. The concept of cryptosporidiosis has changed within the past 2 years to that of an important cause of gastroenteritis and diarrhea in several animal species, especially calves, lambs, and humans. In immunocompetent humans (persons with normal immune function), *Cryptosporidium* may produce a short-term, flu-like gastrointestinal illness. This contrasts sharply with the severe prolonged diarrhea in immune deficient individuals who contract cryptosporidiosis, especially those with the recently described acquired immune deficiency syndrome (AIDS). Cryptosporidiosis has now joined the list of more than 150 zoonoses, those diseases, the agents of which are naturally transmitted between other vertebrate animals and man.

The Organism

The causative agent of cryptosporidiosis is a small (2-6 μm) protozoan parasite which may inhabit intestinal cells of a variety of animals and man. *Cryptosporidium* is similar to most coccidian parasites in that its life cycle includes several generations of asexual multiplication within intestinal cells followed by a sexual phase which culminates in the formation of oocysts, the highly resistant stage that transmits infection from one host to another.

The Disease in Calves

Cryptosporidium is now recognized as a significant cause of scours (diarrhea) in 1- to 2-week-old calves. Clinical symptoms usually include fever, watery yellow diarrhea, dehydration, and rough coat. By itself, *Cryptosporidium* usually produces non-fatal diarrhea, but in combination with other enteropathogens, mortality may reach 90% in young calves. Since an effective medication has not been identified, supplemental fluid therapy may be the best treatment.

The Disease in Humans

Recent investigations at Auburn have shown that calves with diarrhea are a source of human infection. Twelve of 18 immunocompetent individuals who had direct contact with infected calves in three separate facilities near Auburn contracted cryptosporidiosis. Three of the 12 were asymptomatic and nine had episodes of watery diarrhea and abdominal cramps that lasted 1 to 10 days. Other symptoms experienced by these individuals included low-grade fever, nausea, loss of appetite, and headache—symptoms similar to those associated with influenza illness.

In contrast to the short-term, flu-like, gastrointestinal illness it produces in immunocompetent individuals, *Cryptosporidium* may produce severe, persistent diarrhea in immune deficient persons. Since 1980, 44 cases of prolonged cryptosporidiosis in immunodeficient individuals have been reported to the Centers for Disease Control. Three were patients undergoing immunosuppressive chemotherapy, three were children with hypogammaglobulinemia, and the remaining 38 were classified as having AIDS.

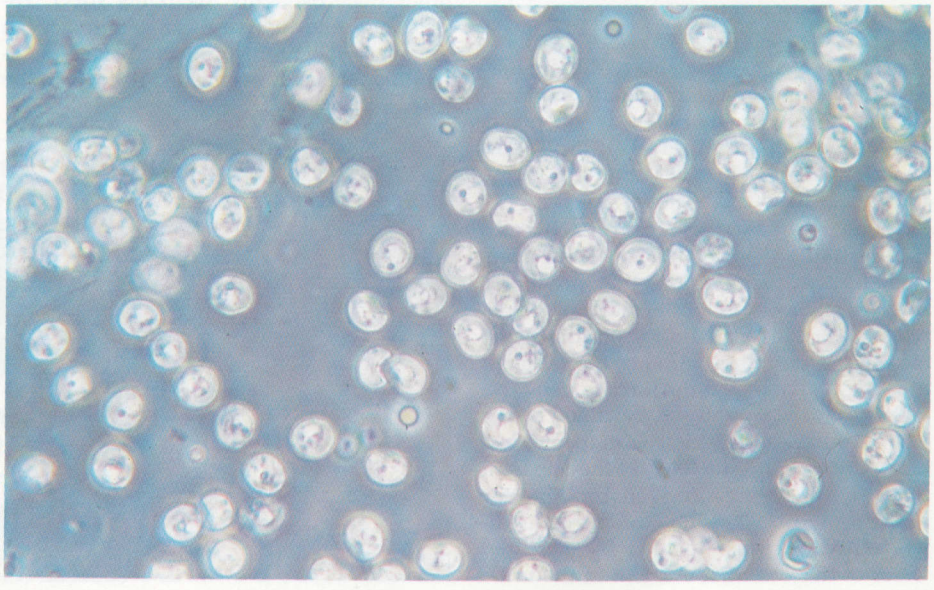
Immune deficient patients, especially those with AIDS, may have extensive fluid loss; 3 to 6 qt. per day is common, and as much as 4.5 gal. of watery stool per day has been reported. The finding of cryptosporidiosis in immune deficient patients usually carries an ominous prognosis since a variety of therapies have proven uniformly unsuccessful in arresting this life-threatening disease.

Epidemiology

Studies of experimental infections in laboratory and farm animals have clearly demonstrated that cryptosporidiosis is transmitted by oocysts which are infective at the time they are passed in the feces. Man and susceptible animals such as calves, rodents, puppies, and kittens become infected by exposure to fecally contaminated environmental surfaces, food, and water.

Recent studies at Auburn have shown that calves, and perhaps other companion animals, serve as potential sources of human infection and it has been concluded that *Cryptosporidium* may be an unrecognized cause of gastroenteritis in people who have contact with infected animals. The far reaching implications of this zoonosis are presently realized in the immune deficient patient whose stool volume may reach 4.5 gal. per day before death, and it will undoubtedly be realized when future studies probe into developing countries—societies that are primarily agricultural, where veterinary public services and food hygiene practices are inadequate. Since cryptosporidiosis carries an ominous prognosis in immunodeficient individuals, it may prove to be a serious illness in children with impaired immune function because of protein-energy malnutrition.

It is obvious that calves are not the source of infection for humans in an urban setting. Companion animals such as rodents, kittens, and puppies are implicated as reservoir hosts because they can be infected easily with human isolates of *Cryptosporidium* and natural infestations in these animals have been reported. Human to human transmission is also highly probable and may occur through direct or indirect contact with contaminated feces.



Oocysts (infective stage) of *Cryptosporidium* obtained from feces of an infected human.

Swine Breeding Stock Selection Affects Carcass Composition of Offspring at 300 Lb.

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MARKETING PIGS at weights heavier than the usual 210 to 240 lb. could offer some advantages to meat packers and consumers. But such problems as increased feed consumption, poorer feed efficiency, and greater fat deposition as pigs reach heavier weights have caused producers to continue marketing at the standard 220-lb. weight.

Little is known about the relationship between methods of selection of swine breeding stock and growth and carcass traits of their offspring slaughtered at heavier than normal marketing weights. Therefore, the Alabama Agricultural Experiment Station began research to determine the effect of selection for four different traits on growth and carcass traits of progeny grown to 300 lb.

The traits selected for study were rate of growth (number of days to reach 230 or 300 lb.) and ultrasonically measured backfat thickness at 230 and 300 lb. Comparisons made were from offspring of boars and sows that required the most and fewest days to reach the specified weights and those with lowest or highest backfat thickness measurements at the specified weights.

A total of 250 crossbred barrows from 52 purebred Duroc or Landrace boars and out of 75 purebred Duroc or Landrace sows was used in the study. The pigs were farrowed in a central farrowing house and moved to an open-fronted, sow-pig nursery at 10 to 14 days of age. All pigs were vaccinated for atrophic rhinitis and erysipelas. The boar pigs were castrated at 21 days and the litters weaned at 35 days of age.

Backfat thickness at 230 and 300 lb. was the thinnest in pigs from parents selected for low backfat; it was thickest in pigs selected for fast growth rate or high backfat thickness, table 1. The pigs from parents selected for slower growth were intermediate in fat thickness to pigs from the high and low backfat thickness lines.

Growth rate to 300 lb. did not differ significantly among the progeny of parents selected for slow growth or low or high backfat, but the progeny of the faster growing parents took the fewest days to reach 300 lb. The selection lines did not differ significantly in the number of days required to weigh 230 lb., but the fewest days were taken by offspring of the parents selected for fast growth and the most by the offspring of the parents selected for slow growth.

Offspring of low backfat thickness or slow growth selected parents had longer carcasses than offspring of parents selected for fast growth or high backfat thickness, table 2. The offspring of the low backfat thickness selected parents were also the leanest, had the largest loin eye areas, and produced the largest amount of muscle at 300 lb. of the four selection lines studied. In contrast, the offspring of the high backfat thickness selected parents were the fattest, had the smallest loin eye areas, and produced the least amount of muscle at 300 lb.

Lean tissue growth rate combines carcass composition with growth rate. This combined trait shows that offspring of low backfat thickness and fast growth selected parents did not differ significantly from each other in the daily deposition of lean tissue, table 3. But these two groups deposited significantly more muscle per day than did the offspring of parents selected for slow growth and high backfat thickness. These results suggest that selection of breeding stock on the basis of growth or backfat thickness does have influence on carcass traits and lean tissue growth rates for pigs slaughtered at 300 lb.

TABLE 1. LIVE ANIMAL TRAITS, BY SELECTION LINE

Parents selected for	Offspring performance for			
	Days to 230 lb.	Backfat at 230 lb.[1]	Days to 300 lb.	Backfat at 300 lb.[1]
		In.		*In.*
Fast growth	176.6	0.80	215.2	0.98
Slow growth	187.1	.73	229.0	.87
Low backfat	182.1	.64	220.9	.76
High backfat	182.1	.84	224.9	1.04

[1]Measured ultrasonically at approximately the 10th rib.

TABLE 2. CARCASS TRAITS AT 300 LB., BY SELECTION LINE

Parents selected for	Offspring performance for			
	Length	Av. backfat	Loin eye area	Est. muscle
	In.	*In.*	*Sq. in.*	*Lb.*
Fast growth...	34.3	1.36	5.55	97.4
Slow growth ..	35.1	1.28	5.33	98.5
Low backfat...	35.4	1.17	5.70	101.0
High backfat ..	34.3	1.41	5.25	95.9

TABLE 3. LEAN TISSUE GROWTH PER DAY TO 300 LB., BY SELECTION LINE

Parents selected for	Lean tissue growth rate/day
	Lb.
Fast growth	0.459
Slow growth.....	.432
Low backfat	.461
High backfat.....	.430

Precision Trimming Before Treating Saves Money for Wood Post Manufacturers

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Department of Forestry

TRIMMING wood posts exactly to the desired length before treating with preservative offers substantial savings in manufacturing cost. That cost-reducing tip came from results of a 1982 study by the Alabama Agricultural Experiment Station.

The company studied has been producing posts from southern pine thinning materials and other small-sized timber (top diameter of 2 to 6 in.), including portions of tree tops extracted from company-owned timberlands. Workers contracted by the company to harvest post materials were following the common practice of cutting to leave about 3 to 6 in. for trimming. There seems to be no justification for this, other than to allow for some inaccuracy of the in-woods, cut-off procedure using standard power chain saws.

The economic benefits from the elimination of the excess wood materials representing trimming allowance were calculated in the research. The benefits accrue as operating cost savings in terms of treatment cylinder space and preservatives used, as well as freight weight and space. Also, these wood trimming materials can potentially be converted into saleable chips, particularly when trimming is done at the plant site.

On the basis of a daily output of 2,000 posts, the expected total before-tax annual operating cost savings and added net revenue or cash inflows from trimming of these excess wood materials was estimated to be about $48,700. There is a 5% chance that the expected amount may exceed $69,200 or may be less than $28,200, according to normal statistical procedures.

The breakdown of the expected annual cash inflows for precision trimming is as follows:

Wood chip revenue—$6,550 (14%). This represents the net revenue from wood chips converted from 10,135 cu. ft. of trims that are expected to be generated annually at the production level specified (2,000 posts per day).

Opportunity cost of treating cylinder space—$4,050 (8%). This is equivalent to the annual net revenue derived from the production and sale of about 17,000 additional posts. It was assumed that the output of treated posts per cylinder load could be increased by an amount equivalent to the volume of trims which would be eliminated by trimming prior to treatment. The basis for making such an assumption is that one tram load of posts could be added to the usual load per cylinder if the posts were properly trimmed and bundled, thus allowing better end-to-end loading of trams in the cylinder.

Savings on wood preservatives—$21,000 (43%). This is the sum total of expected annual net savings from preservatives normally consumed by trims. The company currently produces about 500,000 posts annually, of which approximately 21%, 70%, and 9% are treated with creosote, pentachlorophenol, and chromated copper arsenate, respectively.

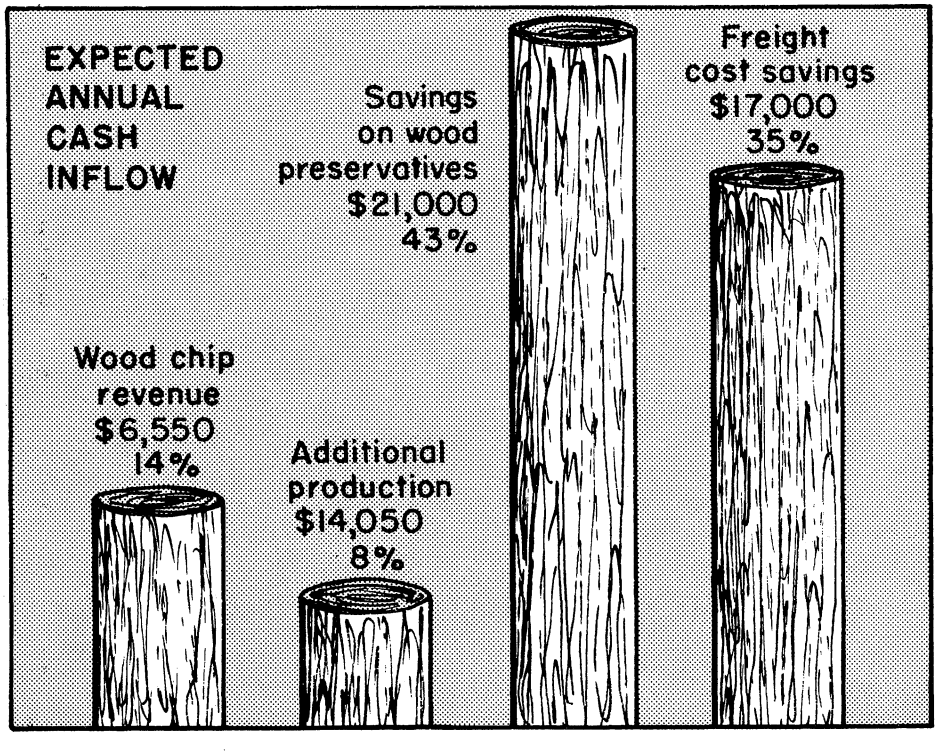
Freight cost savings—$17,100 (35%). This accrues when the added production of 17,000 posts is shipped by the company directly (as it is doing now with almost 90% of its output) to customers located up to 600 miles away, using its own trucks and charging freight at the current delivery rate.

The major factors that significantly affect the level of annual cash inflows from trimming were found to include production output, wholesale price markup, chip price, and freight rate. Before-tax annual cash inflows are expected to increase by approximately $24.34, $403.00, $245.00, and $218.00 for every unit increase in the daily output, percent wholesale price markup, chip price, and percent change in freight rate, respectively.

Based on the expected annual cash inflows, the maximum rational investment, or investment break-even point (i.e., the present value of annual cash inflows), for implementing proper trimming of wood post materials was estimated to be $244,415 (assuming a 15% discount rate and 10-year investment life). Therefore, if the trimming of posts to the desired lengths either in the woods or at the plant site can be implemented by investment of less than $244,415, the study mill can improve its profit.

It was estimated that a fixed capital investment of $85,500 to $99,000 would be required for establishing the necessary in-plant trimming facility. Based on the estimate of annual cash inflow, such a facility would have a payback period of 2-3 years and a positive net present worth of approximately $145,000. Therefore, the investment would be desirable.

Precision trimming of wood posts before treating can result in cash inflows in four different areas.



ANHYDROUS AMMONIA IMPROVES HAY QUALITY FOR CATTLE

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Black Belt Substation

ANHYDROUS AMMONIA has been used for many years as an economical source of nitrogen fertilizer for soil application. More recently, experiments have shown it can be added to silage to reduce spoilage and to increase the crude protein content. Research conducted at the Alabama Agricultural Experiment Station, as well as other research stations in the United States and Canada, shows that anhydrous ammonia dramatically improves the feeding quality of dry roughage as well.

Over-mature johnsongrass was harvested at the Black Belt Substation, Marion Junction, during the last week of September 1982, and was rolled into round bales weighing 600 to 800 lb. The bales were divided into three groups: (1) stored outside, uncovered, (2) stored in a building, and (3) covered with plastic and ammoniated. In the third group, several bales were placed inside large polyethylene bags of the type used in "sausage silo" systems. The bags were sealed, and anhydrous ammonia was injected into the middle of the bag at the rate of 3 lb. ammonia per 100 lb. of hay (60 lb. per ton). The injection hole was taped, and the bales remained in the bags until 3 to 7 days before being fed. Bales in groups 1 and 2 were not ammoniated.

Beginning December 21, a 34-day drylot feeding trial was conducted using 24 head of steers averaging 635 lb. The steers were divided into three groups, and the hay was offered free-choice in feeders. Water, salt, and minerals were available at all times.

Results from this experiment are summarized in table 1. Ammoniation doubled the crude protein value of the hay and reduced the cell wall constituents (cellulose, lignin, and bound protein). The ammonia works by combining with water in the plant cells which causes swelling and breaking of the lignin-cellulose bonds in plant fiber. This results in increased digestibility and intake by the animal and thus greater consumption of total digestible nutrients (TDN).

Crude protein is calculated by determining the percent nitrogen and multiplying by 6.25. It is emphasized that this ammoniation procedure is the addition of nonprotein nitrogen (NPN) and not formation of natural protein. Added NPN from anhydrous ammonia or urea may not be totally utilized if the ration the animals receive does not contain a good level of energy such as that found in silage and grains. Animal refusal of the stemmy hay was not different among the three treatments, but ammoniation and inside storage did reduce storage losses.

Storing the hay inside a building and ammoniation resulted in increased consumption of 10.1% and 17.6%, respectively, over outside storage of hay. Steers fed the untreated hay stored outside lost 0.58 lb. per day, those fed untreated hay stored inside essentially maintained their weight, and those fed ammoniated hay gained 0.6 lb. per day.

Based on intake and performance, the TDN value of the hays were calculated. Compared with hay stored inside, which had an estimated TDN value of 42%, exposure to the weather reduced the TDN by 8 percentage units, and ammoniation increased the estimated TDN by 9 percentage units. These data show clearly the beneficial effects on animal performance of ammoniation and storing hay inside.

After completion of the study, the economics were compared, table 2. The figures in table 2 represent the relative costs for steers to gain 0.59 lb. per day for 80 days with storage loss and feed refusal considered. Thus, if a storage facility is available, the economics of ammoniation and inside storage are about the same. However, ammoniation dramatically improves hay quality, animal gains, and the economics compared to the conventional outside storage of large bales.

Ammoniation can be done successfully on virtually any type of forage package (square or round bales, stacks). It is less labor-intensive to simply cover stacks of hay with sheet polyethylene than to place the hay in bags as done in this study. In calculating economics in this test, costs were based on the sheet polyethylene rather than bags.

TABLE 1. EFFECTS OF AMMONIATION ON POOR-QUALITY JOHNSONGRASS HAY

Item	Untreated-stored outside	Untreated-stored inside	Ammoniated polyethylene
HAY ANALYSES (DM[1] basis)			
Crude protein, pct.	5.5	7.5	12.2
Cell wall constituents, pct.	84.5	81.3	75.5
Hay DM when fed, pct.	72.1	88.5	76.6
DRY MATTER LOSSES FROM BALING TO FEEDING			
Storage and handling loss, pct.	10.6	0.0	0.5
Animal refusal[2]	27.7	24.2	23.7
Total DM loss, pct.	38.3	24.2	24.2
ANIMAL PERFORMANCE			
No. animals	8	8	8
Daily DM intake, lb.	12.9	14.2	15.2
Increased intake, pct.	--	10.1	17.6
Av. daily gain, lb.	(-) .58	.07	.59
Est. hay TDN, DM basis, pct.	34	42	51

[1]DM = dry matter.
[2]This was mature, stemmy hay. Refusal was mostly stems.

TABLE 2. ECONOMICS OF AMMONIATING HAY AS COMPARED TO UNTREATED HAY STORED OUTSIDE OR INSIDE

Item	Untreated-stored outside	Untreated-stored inside	Ammoniated
Supplement required to equal performance of ammoniated hay			
Shelled corn, lb. per day	3.25	1.50	--
Cottonseed meal, lb. per day	.70	.35	--
Total cost to feed 1 ton of hay plus supplement, dol.[1]	60.50	47.25	53.24[2]

[1]Hay charged at $40 per ton (field value if sold when baled); corn at $3.10 per bushel; cottonseed meal at $182 per ton. No charges were made for the storage building or labor to store hay inside.
[2]Ammoniation costs per ton: 60 lb. anhydrous ammonia - $7.06; polyethylene - $3.28; clay gravel to hold polyethylene - $0.92; estimated labor costs - $1.98; total - $13.24.

Planting Date and Row Spacing Affects Growth and Yield of Soybeans

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CHOOSING VARIETIES and deciding when to plant is more complicated for soybeans than for other crops. This is because of two factors:

(1) Soybeans are strongly photoperiodic, which means that flowering and reproductive growth are initiated in response to day length.

(2) Different groups of varieties respond to different day lengths, making them suitable for different management systems.

Therefore, time of planting must be correlated with maturity group of soybean varieties for best results. This is especially critical in the South because almost all varieties grown in the region are of the growth type (determinate) that cease vegetative growth when flowering begins.

South Alabama plantings are often made from late April to early May to take advantage of better moisture conditions for stand establishment. Some varieties planted at this date produce shorter plants and lower yields because of the photoperiodic response. Previous Alabama Agricultural Experiment Station research[1] indicated that May 20 to June 10 was the optimum planting time at Fairhope. Plant heights and yields were similar unless planting date was more than 14 days before or after June 1.

The current study, at the Brewton Experiment Field, was done to evaluate the effect of planting date and row spacing on two soybean varieties from each of three maturity groups, table 1. The beans were planted in 36-in. rows in 1981, but 18-in. row width was added in 1982 to learn how narrow rows affected early and late plantings. Narrow rows appeared desirable because beans from some planting dates were not tall enough to provide complete canopy closure at the 36-in. spacing.

Late May planting gave the highest average yield for all varieties for the 2 years, 52 bu. per acre. Late April planting was about the same (50 bu.), but early June planting dropped to 40 bu. and late June planting to 29 bu. per acre.

Results indicate that early varieties are best when planted early—an interaction between variety and planting date. Thus, Group VI varieties are best for April planting. This was particularly true in 1982 when Coker 156 and Davis produced 56 and 53 bu. per acre, respectively, from April 14 planting.

Plantings delayed until June call for a Group VII or VIII variety. However, drought conditions like those in 1981 (only 0.5 in. of rainfall September 10-October 10) can seriously reduce yields of even these varieties planted late. That year, varieties Foster and Hutton yielded only 23 bu. per acre when planted June 23. Such late dry periods are not uncommon in south Alabama.

Despite the severe drought stress during pod fill on the late maturing varieties, Group VII and Group VIII beans performed well during 1977-81 at Brewton. In fact, varieties of these groups represented the top yielding 10 varieties from late May and early June plantings in 90% of the cases.

A late maturing variety requires a shorter day to start flowering than does early maturing varieties, but there are exceptions. Davis, for example, matures with Group VI varieties but its flowering time is delayed to that of Braxton and Ransom (Group VII varieties).

Average plant height of Davis was taller than the other Group VI variety, Coker 156. However, Davis' height was similar to Braxton, Foster, and Hutton in 1982 but shorter than Braxton and Foster in 1981. Therefore, when planting is late and time for making vegetative growth is limited, a late variety is preferred because it will make a taller plant than an early variety, table 2.

Advantage of narrow rows was shown by the 1982 results. The 18-in. rows were more productive than 36-in. rows when all planting dates were averaged. June plantings showed the greatest response to narrow rows, with yields being 4.4 bu. per acre more for 18-in. than 36-in. rows.

TABLE 1. YIELD OF DIFFERENT SOYBEAN VARIETIES PLANTED AT VARIOUS DATES, BREWTON EXPERIMENT FIELD, 1981-82

Variety	Yield/acre[1], by planting date					
	April		May		June	
	14	28	12	26	8	23
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Group VI						
Coker 156	48	54	52	48	37	23
Davis	49	52	50	51	39	34
Average	48	53	51	50	38	29
Group VII						
Braxton	44	48	51	53	44	33
Ransom	41	45	50	56	44	31
Average	42	47	51	54	44	32
Group VIII						
Foster	48	50	50	56	41	31
Hutton	47	47	46	49	40	24
Average	48	49	48	42	40	27
AVERAGE	46	50	50	52	40	29

[1]Computed on basis of 13% moisture.

TABLE 2. PLANT HEIGHT OF DIFFERENT SOYBEAN VARIETIES PLANTED AT VARIOUS DATES, BREWTON EXPERIMENT FIELD, 1981-82

Variety	Plant height, by date of planting						Av.
	April		May		June		
	14	28	12	26	8	23	
	In.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
Group VI							
Coker 156	23	26	29	28	29	22	26
Davis	30	29	34	36	32	28	31
Group VII							
Braxton	30	30	36	36	36	28	32
Ransom	23	22	31	33	35	26	28
Group VIII							
Foster	30	30	36	36	35	29	33
Hutton	26	27	33	33	34	28	31

[1]W.C. JOHNSON. 1966. Planting Time Affects Performance of Soybean Varieties. *Highlights of Agricultural Research*, Vol. 13, No. 1.

Effects of Consumer Wear on Upholstered Furniture

C.L. WARFIELD, Department of Home Economics Research

HOW LONG CAN YOU expect an upholstered chair to last? What does a chair look like after 2 years of "normal wear"? How satisfied are people with the performance of cotton print upholstery fabrics? These are a few of the questions that led to a consumer wear study of upholstered chairs by home economics researchers at the Alabama Agricultural Experiment Station.

This study involved 60 families in Montgomery and Elmore counties in Alabama. The selected families had all participated in an earlier survey of consumer attitudes and expectations for the performance of upholstery fabrics. Each family received one occasional chair upholstered in a cotton print fabric. They were told to use the chair as if it were their own for 2 years.

Eighteen of the 60 families were two-member households. Twenty-six had three or four members, and 16 families had five or more members. The annual incomes ranged from less than $10,000 to more than $30,000. The majority were in professional or managerial occupations, followed by blue collar workers.

Researchers visited the homes periodically to monitor the type and extent of wear. In addition, 16 chairs were placed in high use areas of Auburn's Spidle Hall so researchers could monitor wear on a continual basis.

There were two styles of chairs and four 100% cotton print upholstery fabrics used in the study, see figure. Laboratory analysis indicated that these fabrics differed in weight, thread count, finish, and weave type, factors which are believed to have an effect on fabric performance in actual use.

Chairs were evaluated for soiling, color change (other than soiling), cushion malformation, seam problems, noticeable wear problems, and structural problems. Soiling was the most obvious appearance change found. Though some spotting was observed, most soiling consisted of rubbed in soil or dirt in combination with body oils. Chair arms suffered most from this soiling, but the tops of the high-backed chairs also exhibited this problem.

With repeated cleaning, the darker fabrics lightened slightly, especially on the arms. The beige fabric became dull and the pattern became less distinct after heavy wear. However, none of the chairs seemed to show any color change caused by exposure to sunlight.

Many cushions became malformed early in the wear period, attributed to a failure of the adhesive bonding between two layers of foam. The study also identified several other problems related to production methods, which have since been addressed by the manufacturer so that subsequent chairs should not exhibit these problems.

The chairs in the consumer wear study were returned to Auburn for analysis. Some looked like new, while the appearance of others bore little resemblance to the original fabric. The chairs placed in Spidle Hall tended to be midway between the extremes in use.

Preliminary data analysis has not provided "the" answer for all of the questions initially asked, but has revealed some valuable information. As expected, "normal wear" is anything but standard. Though family size played a role in the wear observed, some two-person families had chairs with wear patterns as severe as in some larger families. Age of family members was not always a predictor of amount of wear.

Initial fabric characteristics affected the performance. The lightest weight fabric (d), see figure, was the only fabric to show tearing or splitting from heavy use. It was a plain weave beige chintz weighing 4.1 oz. per square yard with a 61-lb. warp breaking strength. The navy sateen fabric (c) was the heaviest weighing 6.9 oz. per square yard and having a warp breaking strength of 150 lb. It also showed soil the least.

The rust plain weave sheeting fabric (a) weighed 6.4 oz. per square yard and had a 121-lb. warp breaking strength. The green sateen fabric (b) weighed 6.7 oz. per square yard and had a warp breaking strength of 122 lb.

Although three of the fabrics had a soil repellent finish, there were no noticeable differences in the degrees of rubbed-in soil between the four fabrics. Efforts to clean the heavily soiled chairs by usual consumer methods were generally ineffective. Periodic cleaning before the chair becomes heavily soiled is the best recommendation for retention of original fabric appearance.

Some outstanding features of these chairs were their comfort and sturdiness. The consumers have overwhelmingly responded that they have been very satisfied with their chairs and would like to buy one like it. However, most underestimated the retail cost of such a chair. Estimates ranged from $99 to $300, while actual costs were from $259 to $299.

Work is underway to develop a laboratory method to produce the kind of wear observed on these chairs. Such a method would give manufacturers a less expensive means to evaluate probable use performance. Wear studies, though informative, are time consuming and expensive.

Upholstered chairs used in the consumer wear study.

Structural Wood Panels for Housing from Southern Hardwoods

E.J. BIBLIS, Department of Forestry

ALTHOUGH THE SOUTH is known for its southern yellow pine, there are actually more hardwoods than pines in Southern forests. The growing stock (5-in. and larger diameter) of all hardwoods in the South totals 104.3 billion cu. ft., 52% of the total Southern forests. Southern oaks (non-select) make up about 29% of all hardwood growing stock, while sweetgum and yellow poplar represent 12% and 7%, respectively.

Despite the abundance of hardwoods, southern yellow pine is the main raw material for pulp and paper, lumber, plywood, poles, particleboard, and fiberboard. Approximately 50% of the United States' softwood plywood for sheathing used in housing is manufactured from southern yellow pine. To satisfy the needs for housing, demand for the sheathing panels will surpass current production levels by 3 to 4 billion sq. ft. (3/8-in. basis) per year.

During the last 10 years, several technical developments in the forest products and housing industries have provided incentives for developing non-veneered structural wood panels to replace plywood sheathing in house construction. Major interest has been in waferboard and oriented strand board (OSB).

Development of such products could provide an expanded market for Alabama's abundant hardwoods. The potential for such development appears good, according to preliminary results from Alabama Agricultural Experiment Station research.

The results presented here are from an ongoing study concerning oriented flakeboard from southern hardwoods. Specifically, the data are on certain properties of 3-layered oriented boards fabricated from a mixture of red oak (35%), white oak (12%), sweetgum (30%), and yellow poplar (20%).

Panel Fabrication and Testing

Twenty panels, 4 ft. by 8 ft., ½-in. thick, with 3 layers cross-oriented, were fabricated in a pilot plant. Following are the variables used for fabrication of these panels:

Raw material: Debarked logs, 8 ft. long, less than 9 in. diameter.

Flaker (PRZ-28 Hombak) drum-type machine.

Particle size: 0.025 in. thick, 70 mm long, variable width.

Removal of fines: Passing screen 1/16 in.

Particle moisture (MC): 4-5% dry; 9% out of blender.

Resin: Liquid phenol-formaldehyde, 6% solids (Reichhold No. 22-743).

Wax: Emulsion, 1% solids.

Mat formation: 1/8 in. each face and back layers, oriented parallel to panel length, ¼ in. thick core oriented perpendicular to faces.

Hot pressed: At 420°F for 6 min.

Desired density: 42 to 48 pcf.

Board size: 53 in. by 102 in. trimmed to 48 in. by 96 in.

Six panels were selected for this testing from the 20 fabricated panels. Panels were selected to represent the density variation among all fabricated panels, and were used to obtain specimens for evaluation of the following properties at three moisture (MC) conditions: Flexure with spans parallel to face particle orientation, plate shear modulus, and edgewise shear strength. The three test conditions were the original (65% relative humidity, 72°F), water soaked (48 hours), and cycled (soaked and reconditioned to original).

Results and Conclusions

Test results presented in the table provide a comparison of the OSB with ½ in., 3-ply southern pine plywood tested under the same conditions. Results indicate that the flexural properties of the oriented boards are lower than commerical CDX southern pine plywood; however, in plate shear modulus and edgewise shear strength, they are considerably higher than those of southern pine plywood.

These preliminary findings indicate that appropriate mixtures of high and low density hardwoods can be used to fabricate commercially acceptable OSB ½ in. thick for sheathing in housing. Availability, cost of wood, and manufacturing labor cost all favor manufacturing of such panels from hardwood mixtures rather than pine plywood.

STRENGTH PROPERTIES OF 3-LAYERED OSB AND COMMERCIAL SOUTHERN PINE PLYWOOD

Panel type and moisture condition	Density pcf	Flexural parallel[2]		Plate shear modulus	Edgewise shear strength
		MOE	MOR		
		P.s.i.	*P.s.i.*	*P.s.i.*	*P.s.i.*
½ in. 3-layer OSB (50% southern oaks, 30% sweetgum, 20% yellow poplar)					
Original moisture condition	44.9	1,091,650	5,848	172,066	1,525
Cycled		785,570	4,430	121,758	1,046
Reduction, pct.		*28.0*	*24.3*	*29.2*	*31.4*
½-in., 3-ply southern pine plywood					
Original moisture condition	37.0	1,450,000	7,170	81,600	970
Cycled		1,339,000	5,504	65,300	780
Reduction, pct.		*7.7*	*23.2*	*19.9*	*19.6*

[1]Original = conditioned to 65% relative humidity; cycled = 48 hours soaked and reconditioned to original.

[2]Specimens were 6 in. wide, tested over 24-in. span with face orientation along the span.

Use of Broiler Litter in Swine Finishing Diets

T.J. PRINCE, Department of Animal and Dairy Sciences

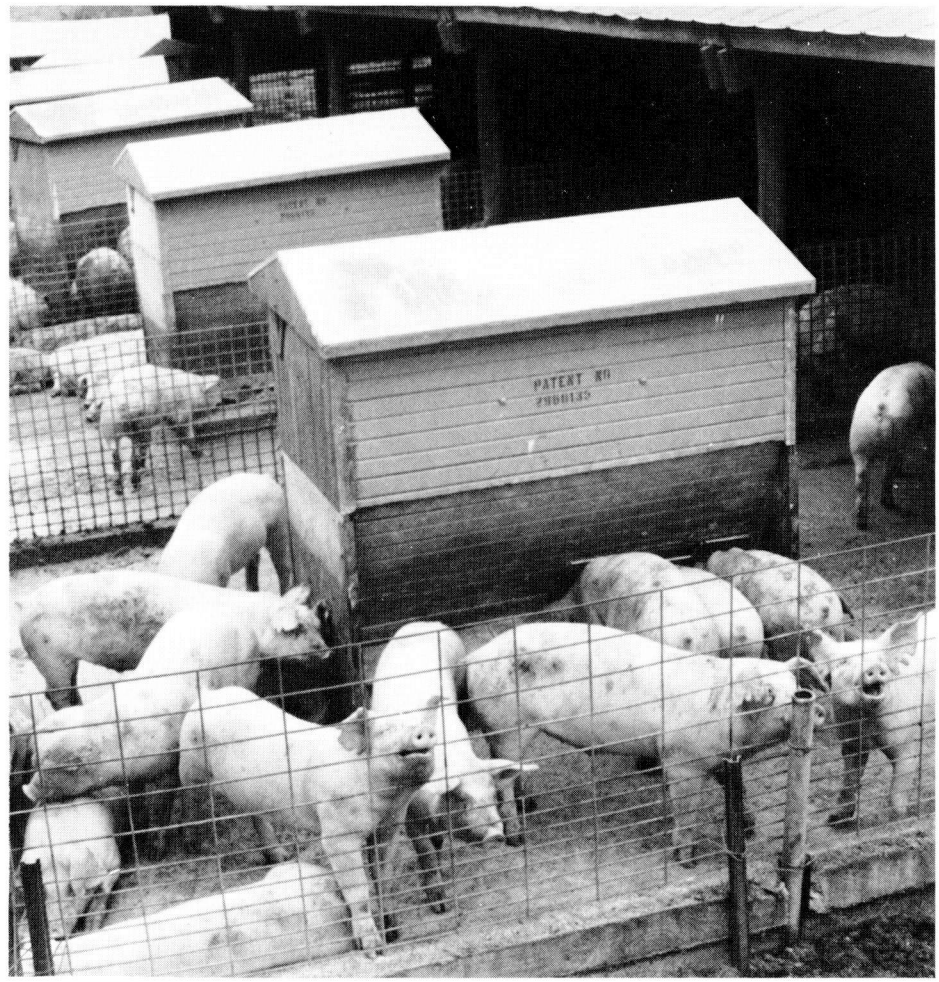
THE POULTRY INDUSTRY in Alabama produces approximately 1.5 million tons of poultry waste annually. Until the last decade, the majority of this waste was used as a fertilizer for land application. In many cases, the plant nutrient value of poultry waste was not sufficient to cover the costs of handling and spreading. Therefore, alternative uses have been investigated. Since Alabama is a grain deficient state, an attractive alternative use for poultry waste is as a feed ingredient in livestock diets.

Broiler litter is a solid waste primarily composed of bedding material (usually wood shavings), feces, and wasted feed. The litter is highly variable in nutrient composition because of the number of batches of broilers fed on the litter, the amount of dirt included when the house is cleaned, the amount of shavings used, environmental conditions, and other management practices. Litter is high in crude protein (20 to 25%) but up to 50% of the protein may be non-protein nitrogen. The fiber level is also high because of the wood shavings. Ash or mineral content varies with the amount of dirt that contaminates the litter but will generally be 15% or more.

Previous research by the Alabama Agricultural Experiment Station has shown that broiler litter can be used economically in cattle diets as a source of energy and/or nitrogen. However, the value of broiler litter in swine diets is not known. Therefore, the objective of this experiment was to determine the nutritional and economic value of broiler litter as a feedstuff for swine.

Finishing pigs were used for this study because of their ability to digest higher levels of fiber than young growing pigs. Ninety-six crossbred pigs averaging 132 lb. were used in four replications of eight pigs per pen. The pigs were fed either a control diet consisting of a 14% protein, fortified corn and soybean meal diet, or the control diet with either 20% or 40% added broiler litter. The litter was obtained from a commercial broiler farm and had been deep-stacked before collection. The litter contained 15.5% crude protein, 20.9% crude fiber, and 31.7% ash. The diets were fed for 28 days, the pigs were weighed weekly, and the feed consumption determined.

Pigs fed the litter diets consumed more feed per day than those fed the control diet, see table. This is likely because of an attempt by the pigs to increase their energy intake on the higher fiber, lower energy diets. However, even though intake was increased, average daily gains were significantly lower for litter-fed pigs. Daily gains were decreased by 15% and 23% on the 20% and 40% litter diets, respectively. The combination of higher intake and lower gain of the litter diets resulted in a highly significant decrease in feed efficiency.



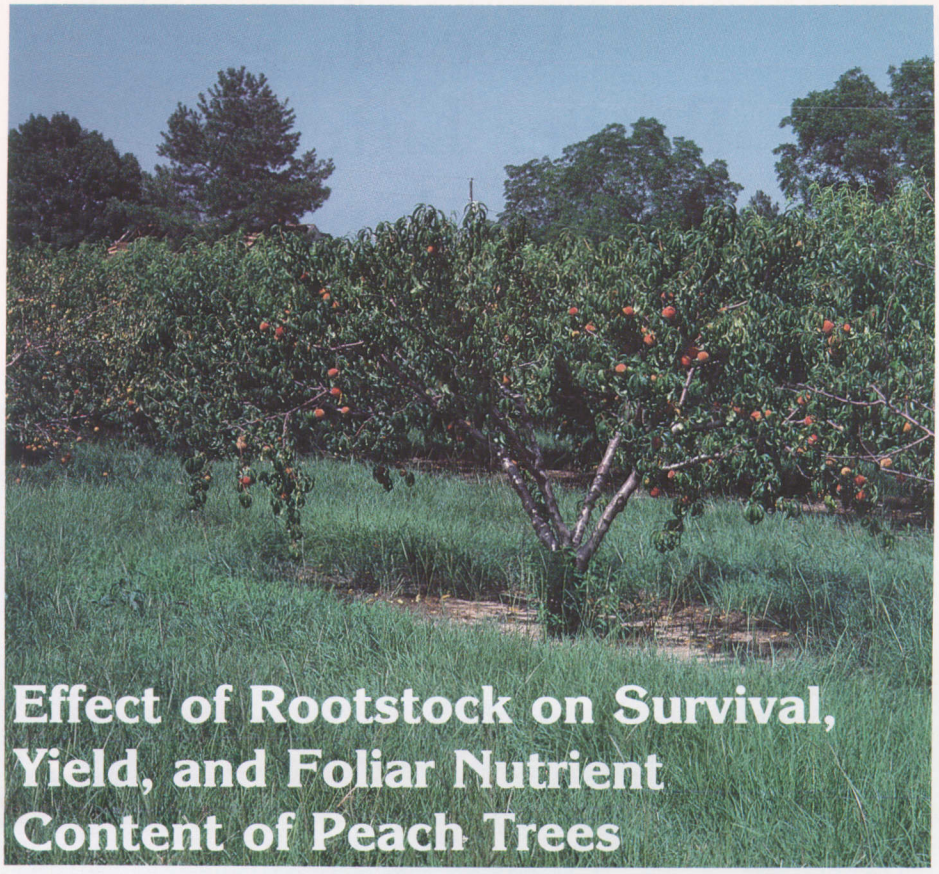
Economic analysis of the performance of pigs on the three diets was also conducted. Cost of each diet was determined using market price of the ingredients at the time of the study. Since the cost of broiler litter in many areas of Alabama is low, no charge for it was added to the litter diets. As can be seen from the table, even though litter was considered a free ingredient, there was no economic advantage to feeding diets containing broiler litter. Increased labor in handling, mixing, and storage of litter and the cost of holding slower growing pigs for longer time until marketing would further decrease the value of litter as a swine feed.

The results of these experiments show that broiler litter has little or no nutritional value for finishing swine and cannot be economically substituted in swine rations.

EFFECT OF FEEDING BROILER LITTER ON PERFORMANCE AND COST OF GAIN IN FINISHING SWINE

Item	Level of litter in diet		
	0%	20%	40%
Av. daily feed, lb. . . .	5.41	5.74	5.85
Av. daily gain, lb. . . .	1.48	1.26	1.14
Lb. feed/lb. gain	3.68	4.64	5.15
Cost of gain, ¢/lb.[1] . . .	29.4	30.9	29.4

[1]Does not indicate cost of litter.



Redhaven peach tree variety on Siberian C rootstock after 5 years in the orchard.

Effect of Rootstock on Survival, Yield, and Foliar Nutrient Content of Peach Trees

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CHOOSING AN UNADAPTED rootstock can wipe out a peach planting in just a few years. This was the finding from an Alabama Agricultural Experiment Station comparison in which trees on Siberian C rootstock suffered heavy death losses.

Since rootstock is known to influence scion variety performance, the study at the Chilton Area Horticulture Substation focused on peach tree nutrition. It was organized to determine if rootstock had an effect on nutrient status of the scion, and possible relationship to tree livability and yield.

Low calcium content of peach trees has been linked to peach tree short life (PTSL), a disease syndrome that causes premature tree death. Death from PTSL is usually attributed to cold injury or bacterial canker, or both, but such factors as nematodes, time of pruning, or soil pH may predispose trees to such injury. Thus, rootstock's possible implication in PTSL was investigated in the study.

The rootstocks chosen for the study were Lovell, Halford, Siberian C, NA-8, Nemaguard, Harrow W-208, Rutgers Red Leaf (NRL-4), and NC 152-AI-2. Loring and Redhaven cultivars, each in a separate orchard, were evaluated on each rootstock. Six trees of each cultivar/rootstock combination were planted in each of four test blocks (replicates). The sites were fumigated with DBCP prior to planting and in the fall of 1976, 1977, and 1978.

Soil samples were taken in February 1981 showing that both orchards were uniform in soil nutrient content with high levels of calcium (Ca), potassium (K), and phosphorus (P). The average pH was 6.4 for the Loring orchard and 6.3 for Redhaven. Leaf samples were taken from each cultivar/rootstock plot and analyzed for nitrogen (N), P, K, Ca, magnesium (Mg), and manganese (Mn) content.

After 6 years in the orchard, Redhaven on Siberian C or NA-8 showed greatest tree loss, followed by Loring on Siberian C. Cold injury was the primary cause of death. Siberian C was developed in Canada as a cold hardy rootstock, but it has not survived well in the Southern United States. Whether low Ca content of scions on Siberian C was involved with the large death losses could not be determined. However, other studies have indicated that Ca may play a role in PTSL.

Varietal yield differences were observed with Loring producing more fruit per tree than Redhaven after 6 years in the orchard, see table. Rootstock had little effect on fruit yields of Loring per tree. Highest yields of Redhaven were obtained with NA-8, but this rootstock also had a high number of deaths. Redhaven on NRL-4 and Nemaguard also had good yields, while yields of Redhaven on Siberian C were unacceptable.

Results of nutrient analysis were similar for both Loring and Redhaven. Foliar Ca content was consistently lower for trees on Siberian C than for trees on other rootstocks. During the normal sampling period (June-July), Ca content of foliage from scions on Siberian C was below the level considered adequate for growth (1.50%). There were no differences in foliar Ca content among the other rootstocks.

Foliar K content was highest with Loring on Lovell and Redhaven on NRL-4 and lowest when either cultivar was on Siberian C. While K levels were lower for trees on Siberian C than for trees on other rootstocks, they were still well above adequate growth quantities. Potassium has been reported to influence fruit yield but foliar K content was not found to be associated with either yield or tree survival in this study. Low K content of trees on Siberian C probably reflects their observed low Ca levels. Amounts of Ca, K, and Mg are often related to one another in a plant, and the level of one element may influence the level of another.

In summary, rootstocks were found to have an effect on foliar nutrient levels, but differences due to rootstocks were small except with Siberian C. Cultivars on Siberian C had lower Ca and K levels than those on other rootstocks. Tree loss was also greatest with Siberian C and was associated with foliar Ca content. Results of this study indicate that Siberian C is an unsuitable rootstock for this area, and NA-8 is questionable.

EFFECT OF ROOTSTOCK ON YIELD AND SURVIVAL OF TREES AFTER 6 YEARS IN THE ORCHARD

Rootstock	Yield per tree		Live trees August 1981[1]	
	Loring	Redhaven	Loring	Redhaven
	Lb.	*Lb.*	*Pct.*	*Pct.*
Lovell	205	131	96	96
Halford	226	115	96	92
Siberian C	220	32	63	21
NA-8	214	157	96	63
Nemaguard	234	147	100	96
Harrow W-208	258	--	96	--
NRL-4	228	152	83	100
NC 152-AI-2	186	129	100	96

[1]Percent of 24 trees established in 1976.

Parental Care of Fledgling Mourning Doves

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MOURNING DOVE HUNTING is a traditional social and recreational activity that accounts for an estimated harvest of some 3 million birds in Alabama each year. To allow such liberal harvests annually, it is necessary to ensure that the reproductive potential of the mourning dove is maximized. One way to help achieve this goal is to learn more about the reproductive behavior of this species. By doing so, we can be sure that man's activities, including hunting, do not adversely affect the species' productivity.

Mourning doves lay two eggs per clutch, incubate the eggs for 14 days, and brood the young for approximately 15 days before the fledglings leave the nest. The nestlings and fledglings are fed by regurgitation. In this way, mourning doves appear to be able to maintain almost continuous production during the breeding season (February through September) and each pair may raise 5 or 6 broods per year.

Little information is available on the length of time mourning dove fledglings are dependent on parental care after leaving the nest. This information could be particularly important late in the breeding season when parents might be killed during hunting seasons. Alabama Agricultural Experiment Station researchers investigated the length of time fledgling mourning doves were dependent upon a parent(s) for food, and the extent that fledglings were brooded by, or roosted with, parents.

Mourning dove nests were located in east-central Alabama from March through October 1980-81. Thirty-five nestlings were equipped with radio transmitters, and 34 nestmates were marked with colored wing tags, right. Nestlings-fledglings were located and observed for approximately 2 hours, 3 times daily, at 12, 15-21, 24, 27, and 30 days of age. Roost checks were conducted one-half hour after dark on those and other days. The type and/or duration of observed feeding, brooding, and roosting interactions between parents and nestlings-fledglings were recorded, above.

Mourning dove fledglings were fed consistently by parents until they were 21 days old. Parental feedings declined gradually in frequency, number, and length until little feeding occurred by the time fledglings were 30 days old.

Male parents were primarily responsible for feeding the young after they left the nest (at approximately 15 days of age). They fed their fledglings with some regularity until they were 27 days old. Parents also occasionally (6.5% of all parental feeding observations) fed unrelated fledglings in addition to their own.

Female parents fed their fledglings infrequently after they reached 16 days of age, probably because of the female's energetic needs relative to the start of a new nesting cycle. However, in two instances when a male parent disappeared, female parents fed their fledglings until they were 27 to 31 days old.

Fledglings began feeding themselves at 17 days of age and the behavior gradually increased in frequency, efficiency, and duration as the fledglings became older. Fledglings were feeding entirely on their own by 30 days of age. Fledglings apparently could, if necessary, rely on their self-feeding capabilities for survival by 18 to 21 days of age if adequate food was present within 55-220 yd. of their nest tree.

Brooding and roosting interactions between young and parent mourning doves varied considerably with nestling-fledgling age-class. Female parents did most of the brooding when nestlings were 12 days old. At 15 days of age, however, fledglings apparently could maintain their own body temperature, and parental brooding was greatly reduced in frequency and duration. Fledglings roosted most often (48% of the days observed) with parents at 15 days of age. By 17 days of age this roosting behavior became infrequent. Nestmates roosted together consistently until they were 24 days old, but by 30 days of age they had gone their separate ways.

Parent-fledgling feeding interaction.

These findings suggest that mourning dove fledglings can survive independent of parental care by the time they are 18 to 21 days old even though some feeding and roosting interactions occur thereafter. Fledgling feedings and adoptions by "foster" parents appear to help compensate for the possible loss of either or both parents through predation, accidents, or hunting.

Nestlings with radio transmitter and wing tag attached.

Growing-Finishing Method, Breed of Sire Affect Steer Postweaning Performance

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L.A. SMITH, H.W. GRIMES, and J.L. HOLLIMAN
Black Belt Substation

PUTTING STEERS into the feedlot immediately after weaning was more profitable than using a stockering period ahead of finishing in Alabama Agricultural Experiment Station research.

The same crossbreeding project at the Black Belt Substation also proved that breed of sire has more effect than breed of dam in performance of offspring from weaning to finishing. Limousin-sired steers gained faster and produced heavier and better carcasses than steers from Hereford bulls.

Two management systems for growing steer calves to slaughter weights were used. In system I, steers were placed directly in the feedlot at weaning where they were full-fed a 30% roughage-70% concentrate ration for an average of 191 days.

Steers on system II remained on permanent pasture of dallisgrass and tall fescue after weaning for an average of 117 days. Hay, corn, and cottonseed meal were fed on pasture when necessary. As soon as winter grazing became available, the steers were transferred to winter annual pasture of wheat and ryegrass mixture for an average of 114 days. In the first 2 of the 4 years, dry and cold weather delayed grazing until January 20 and March 7, respectively.

Following winter grazing, the steers were placed in the feedlot and fed the same ration used in system I for an average of 75 days. System II required an average of 306 days postweaning, 115 days longer than system I. Overall performance was acceptable for both systems, table 1.

Average daily gain (ADG) for the permanent pasture-supplement phase was only 1.09 lb. This poor performance would have had less overall effect if winter grazing had been available earlier or if cows had been bred to calve later so that calves were weaned about the time winter grazing became available.

The average weaned date for calves in this study was September 11, about 2 months before the earliest date that winter grazing was ready. Thus, the long time on dallisgrass and fescue grazing, when gains were low, extended the time necessary for calves to be grown out and finished.

Good gains were made on winter grazing (ADG 2.32 lb.), but the grazing period only averaged from January 6 to April 30. Thus, having a longer winter grazing period and a shorter permanent pasture period would have improved performance in system II and probably increased profit.

ADG for the feedlot phase was 2.95 lb., which allowed system II steers to be finished in only 75 days. Steers that went directly into the feedlot at weaning gained at the rate of 2.73 lb. per day, which was good considering their excellent weaning weights and number of days on feed. Steers in system II were heavier at the same quality grade than those of system I because of the age difference.

Profits shown in table 1 are based on seasonally adjusted prices less the initial cost of the steers and feed and pasture charges. There were no charges made for interest, labor, or other variable costs; had these charges been made, the difference in favor of system I would have been greater. There were no significant differences in fat, yield grade, or quality grade due to system, so these traits were not a factor in the profit spread.

Steers by Limousin bulls gained faster, were heavier at slaughter, and produced heavier carcasses that had less fat and better yield grades than steers by Hereford bulls, table 2. Though not shown in the table, Limousin-sired steers gained faster in all postweaning phases than Hereford-sired steers: stockering phase, 1.94 and 1.75 lb., respectively; and feedlot phase, 3.02 and 2.62 lb., respectively. Despite the fact that the Limousin-sired steer carcasses had less fat, they graded the same (high Good) as steers sired by Hereford bulls.

Breed of dam made little difference in postweaning performance. Most of the differences in weight associated with breed of dam were differences that existed at weaning. The exception was steers out of ½ Charolais-½ Hereford cows that gained faster than the British-bred steers. These findings are in contrast to performance to weaning in which breed of dam was more important than breed of sire (reported in winter 1982 issue of *Highlights of Agricultural Research*).

There was a tendency for steers with some Angus breeding to be fatter, have poorer yield grades, and produce carcasses with higher quality grades.

The results can be summarized in three statements: (1) Steers that were stockered before finishing required 115 days longer, were 79 lb. heavier, and made less profit than steers that went directly into the feedlot. (2) Limousin-sired steers gained faster, produced carcasses that were heavier and had less fat, and finished with better yield grades than steers sired by Hereford bulls. (3) There were no consistent differences in postweaning performance or carcass traits associated with breed of dam.

TABLE 1. POSTWEANING WEIGHT, GAINS, AND PROFITS, BY SYSTEM

System and number of steers	Initial weight	Summer-fall pasture gain	Winter pasture gain	Feedlot gain	Post-weaning ADG	Final weight	Profit[1]
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Dol.*
I (41 steers)	604	--	--	521	2.73	1,125	70.20
II (41 steers)	591	128	264	221	2.00	1,204	44.13

[1]Return over initial value, pasture, and feed cost. No charges made for labor, interest, or variable cost. Selling price was seasonally adjusted.

TABLE 2. POSTWEANING WEIGHT, GAIN, AND CARCASS DATA, BY BREED OF SIRE

Breed of sire	Initial weight	Post-weaning ADG	Final weight	Carcass weight	Fat thickness	Yield grade[1]	Quality grade[2]
	Lb.	*Lb.*	*Lb.*	*Lb.*	*In.*		
Hereford (53 steers)	587	2.23	1,095	666	0.55	3.1	11.3
Limousin (29 steers)	608	2.55	1,234	766	.42	2.7	11.1

[1]Yield grade: 1 = leaner, 5 = fatter.
[2]Quality grade: 10 = average Good, 11 = high Good, 12 = low Choice.

EVALUATION OF NEWCASTLE DISEASE VACCINATION METHODS UNDER COMMERCIAL CONDITIONS FOR BROILER CHICKENS

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ALTHOUGH VACCINATION against Newcastle disease virus (NDV) has been practiced by the poultry industry for several decades, many problems still exist. Outbreaks of NDV induced respiratory disease in broilers are common and result in decreased weight gain and feed efficiency and increased condemnation. Outbreaks arise because effective immunization is difficult. This is due to interference of vaccine virus immunizing capability by maternal antibody and to the young chicks' poorly developed immune system. Also, timing for initial NDV vaccination is difficult because the level of maternal antibody and period of its decline differ in individual chicks.

A study comparing the efficacy of three common NDV vaccination programs for commercial broilers was recently completed at the Alabama Agricultural Experiment Station. Parameters to evaluate the efficacy of each vaccination scheme were NDV antibody and challenge infection data as well as growth and performance data from flocks vaccinated by each method.

The study consisted of six separate experiments. Since the results for all experiments were similar, data from only one are presented here. Commercial companies in Alabama were selected for evaluation on the basis of their breeder and broiler NDV vaccination programs.

Broilers were chosen from companies revaccinating breeders with a single injection of an inactivated NDV vaccine at 20 weeks of age. Broilers were also chosen from companies currently using either the Beak-o-Vac® (Beak-o-Vac, Inc., Gainesville, Georgia) or Spra-Vac® (Select Labs, Inc., Gainesville, Georgia) machines at 1 day of age in the hatchery or by drinking water at 7 days on the farm for administration of NDV vaccine. The Beak-o-Vac machine simultaneously debeaks and vaccinates; whereas, the Spra-Vac machine is a small cabinet which showers birds with a coarse vaccine spray. In this trial, 60 broilers were obtained from each of two broiler producers.

The first company was vaccinating broilers on an alternating basis by either Spra-Vac or 7-day drinking water. One week the entire placement was vaccinated by Spra-Vac and on the alternate week by drinking water. The second company was vaccinating their progeny entirely by Beak-o-Vac.

Fifteen broilers vaccinated by one of the three vaccination methods (Spra-Vac, 7-day water, and Beak-o-Vac) were bled at 1, 7, and 35 days for NDV antibody. These birds were then infected by eyedrop at 35 days with virulent NDV. Another group of 15 birds that was vaccinated by each of the three methods was bled for NDV-antibody and challenged at 49 days.

Results indicated that regardless of the NDV vaccination method, there was no significant antibody response, table 1. However, significant resistance to NDV clinical infection was apparent at 35 days in all vaccinated groups. This immunity, however, decreased rapidly and was gone by 49 days.

TABLE 1. NDV ANTIBODY AND CHALLENGE RESULTS

NDV vaccine group	Mean NDV antibody				NDV challenged[1]	
	1 day	7 days	35 days	49 days	35 days	49 days
None	44	11	2	0	15/15	14/15
Spra-Vac®	26	15	10	2	2/15	10/15
Beak-o-Vac®	45	15	3	0	4/15	12/15
7-day water	24	16	7	0	4/15	11/15

[1]Number susceptible over total number of birds.

TABLE 2. BROILER PERFORMANCE DATA FOR COMMERCIAL FLOCKS VACCINATED AGAINST NDV BY THREE DIFFERENT METHODS

NDV vaccine group[1]	Week placed	Mortality	Total condemnation	Feed conversion[2]
		Pct.	*Pct.*	
Spra-Vac®	6/19	4.83	0.80	2.09
Beak-o-Vac®	6/26	5.21	1.15	2.06
7-day water	6/26	5.11	1.25	2.13

[1]Groups 1 and 3 were from the same broiler company and represented one entire week's placement for that company. Group 2 represented an entire week's placement for a nearby company.
[2]Pounds of feed per pound of gain.

Performance data for flocks, representing each company's entire weekly placement and vaccinated against NDV by one of three different methods, are in table 2. Broilers vaccinated by Spra-Vac had lower mortality and condemnation and better feed conversion when compared with broilers from the same company that were vaccinated by 7-day water route. When comparing flocks from the nearby company, broilers vaccinated by Spra-Vac had lower mortality and condemnation but poorer feed conversion than flocks vaccinated by Beak-o-Vac.

Since most producers would rather place vaccination with their hatchery employees than with the farmer, day-old vaccination seems more acceptable than water vaccination. In addition, the Spra-Vac machine seems destined as the program of choice for initial NDV vaccination over Beak-o-Vac for the following reasons: (1) some companies are switching to "blackout" environmentally controlled houses where debeaking is not necessary; (2) many companies are debeaking only a portion of the year; and (3) vaccination by Spra-Vac is faster and more labor efficient.

Effect of the Eye Fluke on the Growth and Survival of the Channel Catfish

Catfish eye infested with the eye fluke, a parasite that causes blindness of fish.

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Department of Fisheries and Allied Aquacultures

THE EYE FLUKE, *Diplostomum spathaceum*, is a digenetic trematode that lives in the lens of fish eyes and causes blindness and death of fish, including catfish. It is an important parasite with a world-wide distribution.

Life history of the fluke involves the typical digenean life cycle of egg hatching into a free-swimming form which invades a snail, undergoes division, and later develops into a free-swimming form which invades the fish and migrates to the eye lens. This form causes the lens to become cloudy and opaque resulting in a cataract-like condition which completely blinds the fish. Up to several hundred worms per lens have been reported.

The first reaction of fish farmers when finding that their fish are infested with eye fluke is to destroy the entire stock of infested fish. Since catfish have taste buds in their barbels and skin and do not need sight to feed, a study was undertaken at the Alabama Agricultural Experiment Station to see how infested blind fish could compete with normal fish in a production pond situation.

Results showed that blind fish did not survive, grow, or convert food as well as normal fish, but were within a satisfactory production range. The parasite in the lens of the eye would have no effect on the food quality of the fish, so fish farmers might reconsider destroying any future population infested with eye flukes.

Data on stocking and harvest are presented in the table. Two hundred normal and 200 blind fish were stocked together to determine if blind fish could compete for food with normal fish. Infested fish had an average of 54 worms per lens. Each population was fin-clipped, stocked into a 1/10-acre pond, and fed at a rate of 3% body weight (adjusted weekly) for a 7- to 8-month period. Feeding was started on March 5, 1982, 3½ weeks after the blind fish were stocked and 10 days before the normal fish were stocked (because of availability). The fish were fed daily except on weekends, and it was assumed that each fish in the mixed blind and normal population had an equal chance to eat the feed.

At harvest, 166 blind fish were recovered weighing 141.2 lb., while 199 normal fish were recovered weighing 146.1 lb. Regeneration of fins and spines had occurred to varying degrees, but the blind fish were readily identifiable. Survival was 83% for the blind fish and 99% for the normal fish. Both groups of fish were approximately the same size, but net weight gain for blind fish was 120.4 lb. and for normal fish 141.1 lb. Assuming that each group ate half the total of 307.5 lb. of feed added to the pond would give a conversion of 1.28 for blind fish and 1.08 for normal fish. Both of these conversion rates are well within the desirable range expected from a production pond.

Stocking data	*Blind*	*Normal*
Date	2-11-82	3-15-82
Number	200	200
Finclip	right pectoral	left pectoral
Weight	20.8 lb.	5 lb.
Av. weight	0.104 lb.	0.025 lb.
Harvest data		
Date	10-27-82	10-27-82
Number	166	198
Pct. survival	83	99
Total weight	141.2	146.1
Av. weight	0.85	0.74
Av. length	14.2 in.	14.0 in.
Max. length	16.0 in.	17.0 in.
Min. length	11.0 in.	10.0 in.
Net wt. gain	120.4 lb.	141.1 lb.
Total feed added to pond - 307.5 lb.		
Conversion	1.28	1.08

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