HIGHLIGHTS

of agricultural research

VOL. 20, NO. 3/FALL 1973

Agricultural Experiment Station
AUBURN UNIVERSITY

DIRECTOR'S COMMENTS

RECENT CONCERN about food prices and food supplies has highlighted the importance of the United States' agricultural production. Various statements and expressions reported in the press, however, indicate a gross lack of understanding about food production, supply, and prices.

R. DENNIS ROUSE

The nationwide network of agricultural experiment stations has demonstrated a capacity not only to serve the local and immediate interest of the people of each state but also to provide, by a continuous and systematic concentration on applied and basic research, scientific discoveries vital to human health and nutrition.

Those who read these comments know that agriculture and related agribusiness are basic to our economy. They supply the food needs of this Nation and many peoples in other nations.

The people of these United States ate an average of 1,449 lb. of food in 1971. Never before have a people been fed so well and for such a small proportion of the wage earners' paychecks. An abundance of food is the strength of our Nation. Only with United States' style research and technology, backed up with the incentive of free enterprise system, can we continue to feed the ever-growing population of this Nation and provide a supply for export.

For the past several years and until recent months, our major concern was agricultural surpluses. Policies and programs were geared to reducing production and to increasing exports. With increasing ability to purchase abroad, agricultural exports made headlines as a potential solution to balance of payment problems. Then, almost overnight, we became concerned about high domestic food prices and shortages of agricultural products. Our concerns about surpluses rapidly changed to concerns about deficits.

Why the sudden change? A prime factor in our present shortage is the lack of appreciation by some people that agricultural production is still based on biological principles. Despite tremendous advances in know-how for producing feed and food, there is still a biological lag between the decision to produce more and the ability to produce more – we can't produce beef without first having the capacity to produce a calf. Then, there is the biological lag between the calf and the ready-to-cook product in the retail store.

A second factor is the economic principle of inelastic demand that prevails – the narrow range from insufficient supply to a surplus. The present shortage of certain foods emphasizes the unappreciated blessings of a surplus.

Incentive is a third factor in this supply picture. The outstanding productivity of the American farmer and his sense of competition in the free enterprise system made possible the abundant supply of food on the market at low prices that have existed in recent years. This has been accomplished through higher production per man by using the results of research and improved technologies.

Farm output per man has increased 3.1 times in the past 20 years, as compared with only 1.7 times in the manufacturing industries. Farmers accomplished this by making heavy investments in land, buildings, automation equipment, and chemicals. Even with this increased investment and productivity, the average income of farmers lags 17% behind non-farm people. Thus, farmers have not shared fully in the benefits of their productivity. At a time when Americans are concerned about supply and price of foods, it is important for people to appreciate that agricultural production is a biological process, that there is a narrow margin between deficit and surplus, and that the farmer must be provided a reasonable incentive to produce for others.

may we introduce . . .

Dr. Irvin T. Omtvedt, recently appointed Associate Director and Assistant Dean, Agricultural Experiment Station and School of Agriculture, comes from Oklahoma State University where he was a professor of animal science.

Dr. Omtvedt is a native of Wisconsin, and received his undergraduate training at the University of Wisconsin with a major in animal science. He received both the M.S. and Ph.D. degrees from Oklahoma State University with a major in animal breeding and genetics. His experience includes work as a fieldman for Wisconsin Livestock Improvement Association; assistant and associate professor and Extension specialist at the University of Minnesota; associate professor and professor of animal science, Oklahoma State University.

Dr. Omtvedt has authored or coauthored more than 90 research and other publications and has been major advisor on five Ph.D. theses and 12 M.S. theses. He is a member of numerous professional and honorary organizations. He and Mrs. Omtvedt have two children.

HIGHLIGHTS of Agricultural Research

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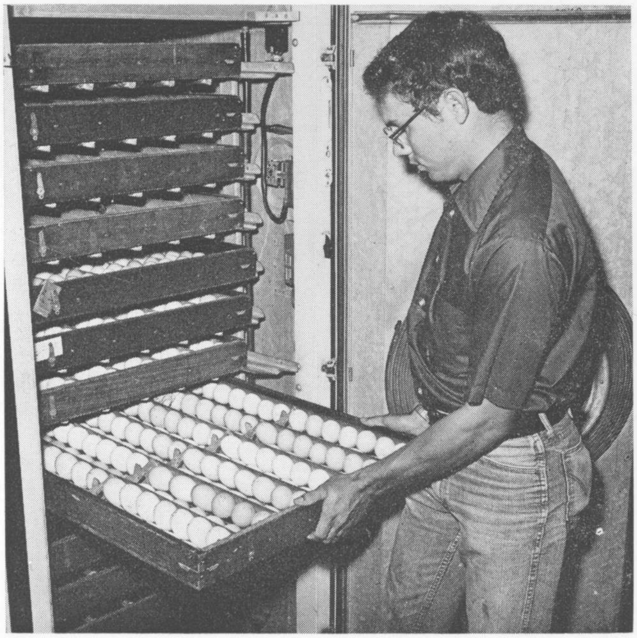
ON THE COVER. Candling detects infertile eggs, see story, page 3.



All infertile eggs and early dead should be removed from trays at 7 days of incubation.

ANALYSIS of HATCHABILITY PROBLEMS

G. R. McDANIEL, Department of Poultry Science

HATCHABILITY is usually identified as the number of chicks hatched from a given number of eggs.

If a hatchability problem arises, this information is not sufficient for a solution. First, it is necessary to know the *true* fertility. There is little one can do to improve overall hatch if he is obtaining an 80% hatch from eggs having an overall fertility rate of only 85% since a 5% differential in true fertility and hatch of fertile eggs is considered normal. On the other hand, if 95% of the eggs are fertile and only an 80% hatch is obtained, problems do exist that can be corrected.

True fertility may be established by using an egg candler. All infertile eggs and early dead should be removed from trays at 7 days of incubation, broken out, and time of death determined. A set of 35mm. slides[1] showing the developmental stages from day-old to hatching is available as an aid to hatcherymen in distinguishing fertile from infertile eggs.

Embryonic mortality exceeding "normal" (2-2.5% during 1-6 days of incubation) may be an indication that one of the following managerial factors should be checked:

1. Storage temperature – too high or too low.
2. Age of eggs – should not be held over 1 week.
3. Internal contamination – floor eggs or dirty litter in nest.
4. Improper temperature, humidity, and fumigation in incubator.
5. Nutritional.

Embryonic mortality between 6 and 18 days of incubation should be less than 1% although considerable mortality will occur during this stage if eggs are improperly handled. As an example, information in the tables are hatchability data collected from a flock where the eggs were improperly handled. This was a relatively young flock and hatchability had been unsatisfactory. Candling was performed at 7 days of incubation and all eggs that appeared clear were broken to determine true fertility, as shown below:

Classification	*Number*	*Per cent*
Total eggs checked	3,424	
Fertile	3,168	93.00
Dead at 1-6 days	81	2.56

Upon candling it was established that fertility was not as high as it should have been for a young flock; however, it was good enough to give a respectable hatch. Number of early dead (1-6 days) was not unusually high. After 21 days of incubation, a further analysis was made by breaking all eggs that did not hatch and classifying as to age at embryonic death. These data are presented below:

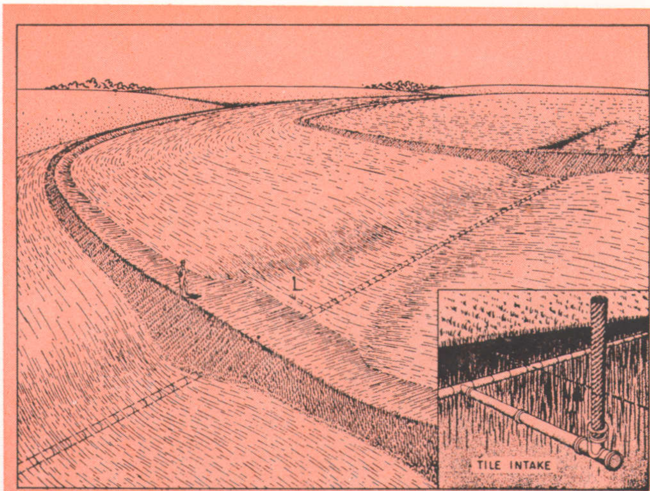
Number fertile eggs	3,168
Number chicks	2,804
Hatch of fertiles %	88.5
Per cent not hatching	11.5
Dead 1-6 da. %	2.5
Dead 7-14 da. %	2.8
Dead 15-18 da. %	1.9
Dead 19-21 da. %	1.6
Cull chicks %	1.5
Cracks %	1.2

As noted in the data, there was a spread (difference between hatch and fertile) of 11.5%. The embryonic mortality which occurred between 1-6 days and 19-21 days was considered normal and the spread should have been 4%. In other words, this flock should have received a hatch of 95% of fertile or 89% of total eggs set.

Referring to the analysis data for possible improvements, the 1.2% cracks occurred after traying and was probably a result of rough handling during setting and transferring. The mortality which occurred between 7-18 days (4.7%) was excessive and most eggs appeared to be contaminated. The 1.5% cull chicks was excessive and was probably a result also of contamination. To correct the contamination problem, nests were cleaned and new litter added.

One of the simplest ways to determine if problems exist in the incubator is to collect eggs from clean nests and set immediately. Check fertility and calculate the per cent hatch of fertile eggs. If a spread of 5% or more exists, the problem is in the incubator. If a good hatch is obtained by this method as compared to the regular handling methods, the problem is outside the hatchery and concentrated efforts should be made to ensure proper egg handling procedures.

[1] Address and price of slides available from author.



IMPOUNDMENT TERRACES REDUCE SOIL EROSION

EUGENE W. ROCHESTER and CHARLES D. BUSCH
Department of Agricultural Engineering

VARIOUS CONSERVATION practices have been used for years by farmers to stop soil erosion caused by rainfall.

Early efforts included terraces on the contour. Through contour terracing came odd-shaped cropping areas and short rows – no trouble for the horse and plow but a real problem for multirow tractor farming. With increased use of the tractor, contour terraces were modified to make them parallel. Parallel terracing usually meant reshaping of the land surface to get proper drainage and in many cases, the addition of vegetated waterways to convey water down slope.

These modernized conservation changes have created new problems. In erosive soils, waterways are difficult to maintain. Many waterways quickly convert to ditches by untimely rains occurring shortly after construction before proper vegetation can be established. Waterways established with vegetation are regularly bombarded by tractor traffic of cultivavation, by herbicides from fields, and by sand blasting from particles carried with runoff water. Consequently some waterways fall into disrepair, forming uncontrolled field ditches. Ditches break fields into segments resulting in shorter rows and less efficient farming, many times removing valuable land from production. Man-made concentrations of water from ditches can cause almost as many problems as having no conservation practices.

FIG. 1. Parallel terraces crossing old drainage channels (illustration compliments of USDA Soil Conservation Service).

Latest effort in the battle against soil erosion is the elimination of troublesome waterways by extending terraces across the drainage channel, forming impoundment areas as shown in Figure 1. The impoundment areas collect the excess water and slowly discharge it through surface inlets to an underground pipe system.

The big advantages of impoundment terraces include elimination of waterway maintenance and an increase of continuous row length from rows extending across old waterway locations. The public benefits too. During the time water is ponded in the terraces, sand and silt particles which were picked up by the moving water are settled out of suspension. This means cleaner water discharged from the field. The public gains by having cleaner streams while the farmer maintains valuable soil on the field. In most cases the in-field movement of soil from steep slopes to the impoundment area actually improves the land slope in the field.

The design of impoundment terraces includes planning the storage volume and outlet size to take care of runoff from most storms. The larger the storage volume, the smaller the required discharge rate. Usually a "safety valve" or overflow area is provided at some location on the terrace to discharge water if storage volume is exceeded. The overflow location is selected to minimize potential damage to the terrace and to the field. The pipe outlet system is designed sufficiently large to remove standing water within a period of 24 to 48 hours to prevent damage to crops. Perforated pipe is buried beneath the impoundment area to provide soil drainage and thus shorten the waiting period before traffic can safely cross the impoundment area. Two impoundment terraces located on the Agricultural Engineering Research Unit are shown in Figure 2.

Many farmers are finding impoundment terraces useful and economical. Over 100 systems have been installed in Alabama. Even though they show promise as an erosion control practice, impoundment terraces are not desirable for all Alabama cropland. Topography, soil erodibility, and cropping practices should be considered when selecting impoundment terraces or any erosion control practice.

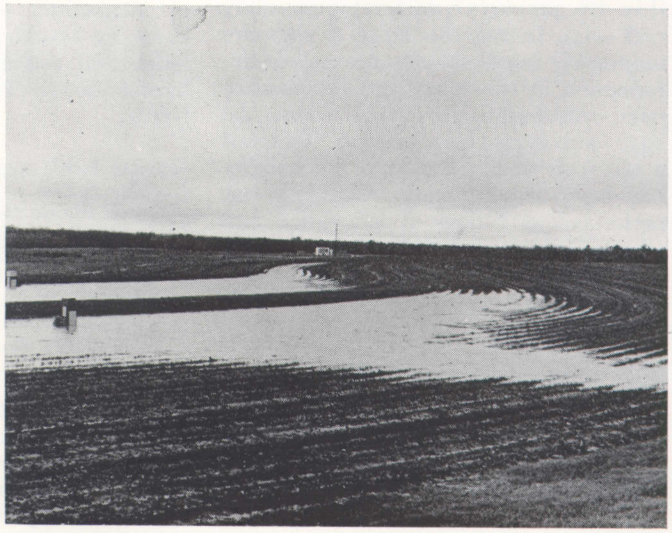


FIG. 2. View of impoundment terraces shortly after a 5.7-in. rainfall.

Young crossbred bulls like these have made economical gains when put in feedlot at 180 days and finished by 13 months old.

PUSHING YOUNG CATTLE TO SLAUGHTER SIZE FOR FEED EFFICIENCY

W. B. ANTHONY, *Dept. of Animal and Dairy Sciences*

PUSHING BEEF CATTLE to slaughter size and grade as fast as possible offers chances for feed savings. Young cattle are efficient users of feed energy, almost equal to any meat producing animal, but traditional systems of growing and finishing do not take advantage of this.

A good example of age differences shows up in an animal's daily maintenance requirement. An 800-lb. steer requires 6.47 megacalories of feed energy per day, as compared with 3.85 megacalories for a 400-lb. calf. If the 800-lb. steer gains 2 lb. daily, energy cost of gain is 4.45 megacalories. When the 400-lb. calf gains 2 lb. per day it requires only 2.64 megacalories of feed energy. Thus, pushing for rapid growth while animals are young offers opportunities for conserving feed energy.

Research Shows Potential Advantages

Data from the nutrition research herd at Auburn provide evidence of potential with young cattle. Crossbred calves are weaned at 180 days and continued on a drylot ration until they reach slaughter weight at about 13 months old. The calves are creep fed whole corn while nursing and their dams are fed a waste-containing ration. The male calves are left intact and continued on test to 13 months of age. Feed efficiency after weaning of two sets of these bull calves is reported here.

Set 1. This group of bull calves was placed in drylot at weaning and fed a corn-silage-protein supplement ration. One group received this mixture prepared daily. For the second group, the same mixture was ensiled before feeding. Performance data are summarized in the table.

The ration energy utilized by the cattle was calculated using energy values for ingredients published by the National Research Council. Energy efficiency of the test cattle was essentially the same as predicted from the NRC standard. Feed dry matter per unit of gain averaged 6.36 lb., which confirmed that young animals grown rapidly to slaughter weight have relatively low feed requirements.

ENERGY UTILIZATION BY CHAROLAIS-CROSS CALVES AND PERFORMANCE FROM 180 TO 390 DAYS OF AGE

Item of measure	Result	
	Pen 1[1]	Pen 2[2]
Calf performance		
180-day weight, lb.	446	449
Final weight, lb.	1,053	1,110
Total gain, lb.	607	661
Average daily gain, lb.	2.85	3.07
Average daily feed consumption		
Corn	14.93	13.79
Corn silage	6.56	5.98
Auburn 65 supplement	.55	.49
Cottonseed meal	1.47	1.24
Coastal hay	1.57	1.78
TOTAL FEED	25.08	23.28
Energy use		
NRC requirement for maintenance, megcal.	6.16	6.35
Feed required for maintenance, lb.	9.07	9.37
Ration remainder for gain, lb.	16.01	13.91

[1] Fed corn-silage-supplement ration prepared daily.
[2] Fed same ration as Pen 1, except it was ensiled before feeding.

Set 2. In this test 14 bull calves were on a feedlot ration of ground corn, corn silage, and supplement. The corn silage portion of the ration was restricted to 6 lb. per head daily.

Fast Gain, Low Feed Requirement

Average weight of the animals when weaned at 180 days was 427 lb. From 180 to 390 days they gained rapidly, 3.18 lb. per head daily, and used 6.75 lb. of feed per lb. of gain. The energy density of this diet for maintenance was 0.72 megacalorie per lb. Therefore, feed requirement for maintenance was 9.66 lb., leaving 11.3 lb. to support gain. Gain was considerably above the expected rate of 2.55 lb. per day, further supporting the theory that young cattle are efficient converters of feed to beef.

These data clearly illustrate the economics of feeding young cattle for rapid growth. The economic advantage comes from (1) reduction in maintenance cost, and (2) a reduced energy cost of gain. The improvement in feed efficiency for the young cattle justifies considerable effort and expenditure to ensure that the young cattle receive all the high quality feed they will consume early in life.

FACTORS AFFECTING USE of LANDSCAPE PLANTS in ALABAMA

FRED PERRY, *Department of Horticulture*

A study of 104 homeowners and 26 apartment complexes in seven metropolitan areas in Alabama was conducted to determine what motivates homeowners to buy plants, lawns, and related products.

Survey Sample

An adult member of each household from each home sampled in the seven areas was personally interviewed. Socioeconomic characteristics of the homeowners, characteristics of the house and lot, and landscape expenditures of the family were recorded. Homeowners were questioned concerning their attitudes towards landscaping, their use of landscape plantings and lawn materials, their sources of technical information used, who made the plant purchases, where they were made, who maintains the landscape, and other landscape related activities.

Ratings

Homeowners rated beautification as the most important reason for having landscape plantings. Closely following were increased property value, neighborhood pride, shade, and privacy. Environmental factors other than erosion control were generally ranked lower in importance. The most important sources of technical information named were their own knowledge and experience (36%) and nurserymen (24%), see figure.

Purchases Made

Total purchases of plants for outdoor use in Alabama was $4 million by single unit homeowners in 1970, and over half of the decisions regarding these purchases were made by the wife. Approximately 68% of these purchases were made from nurseries and garden centers, 26% from chain stores, 2% from mail order, 1% from florists, and 3% from all other sources.

Purchases in Relation to Income

The amount of plant purchases in relation to income and home value are shown in the table. Families with less than a high school education were generally in the lower income group and lived in homes costing less than $25,000. People with at least a high school education earning over $10,000 per year and living in homes of $25,000 value or more, account for the greatest portion of the plant purchasing public.

Amount of Purchases in Relation to Income, and Home Value

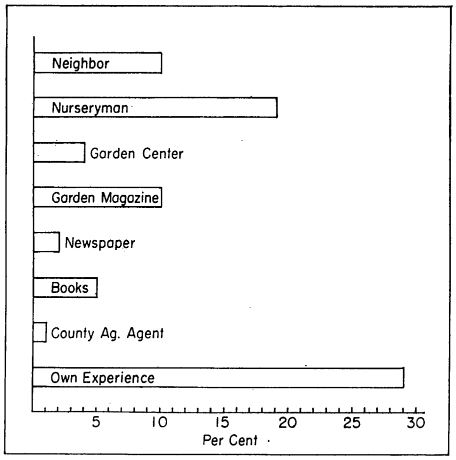
Amt. of purchases	Income	Home value
$ 40	Under $10,000	Under $25,000
$228	Above $10,000	Above $25,000

Sale of Nursery Crops

The sale of nursery crops for Alabama included in the study amounted to almost $6 million, according to the 1969 Agriculture Census. Alabama's sales amounted to 13% of the total sales of the eight Southeastern States. There were 381 firms producing and selling nursery products in 1972, an increase of 350% over 1969. However, these data may under estimate the importance of the industry since there are numerous small nursery oriented businesses not included in the Agriculture Census.

Population Increase

During the period of 1960-1970 the population in Alabama increased 5.4%, while the number of single unit family homes increased 16.9%. In the eight Southern States, population increased 15% and household units increased 27%, which was considerably greater than the increase for the Nation during the same period. Because of the continued population growth and home building in the Southeast, the demand for nursery products is expected to increase even higher than it is at present. The development of shopping centers, industrial parks, and an increase in land use for recreational and institutional purposes should also contribute to the increased demand for these products. There is probably no period in time when there has been a greater awareness of ecological surroundings. This emphasis on environment offers an unequalled opportunity to the plant industry to further educate the buying public and to inform them on the materials and methods available to them for the improvement of their outdoor environment.



Sources of information on landscape plantings.

COSTS and RETURNS of FOUR CROP and BEEF PRODUCTION SYSTEMS

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LAVERN BROWN, *Lower Coastal Plain Substation*
C. C. KING and E. M. EVANS, *Dept. of Agronomy and Soils*
W. B. ANTHONY and R. R. HARRIS, *Dept. of Animal and Dairy Sciences*

A COW-CALF PROGRAM reflecting different combinations of forage and management practices was initiated on the Lower Coastal Plain Substation in November 1969 in an attempt to provide some of the answers farmers need to get maximum returns on farm investments.

The study consists of four treatments in managing cow-calf herds on relatively small acreages to determine which system will produce the highest net return. The treatments range from an intensively managed row crop-cattle combination to a rather casual grazing program similar to that now being practiced in the area.

System A

This system consists of a row crop-cattle combination of 45 acres of productive land, a 3-acre holding pen, and 30 brood cows. During the summer 20 acres are used to grow corn for silage, 20 acres are used for soybeans, and 5 acres are planted to summer annuals for creep grazing. The cows are maintained in the holding area and fed silage during the crop season except for days when they are used to utilize surplus forage in creep area. After corn and beans are harvested, the entire 45 acres are planted to cool season annuals. When grazing is ready, the cows and their calves are turned onto it. Any excess forage is harvested as silage. As planting time approaches cattle are moved to the holding area; cool season annuals are plowed under, and the area goes back into 20 acres of corn, 20 of soybeans, and 5 of creep grazing.

System B

This system consists of a herd of 30 cows and 45 acres under a more familiar management system. Summer grazing for cows and their calves is provided by 30 acres of permanent Coastal pasture. Cool season grazing is provided by 15 acres of fescue and 15 acres of the Coastal pasture overseeded with a mixture of arrowleaf and crimson clover. Hay harvested from the area and 1 lb. per head daily cottonseed meal is provided when necessary.

System C

Thirty cows are managed under System C on 40 acres of permanent Coastal pasture with any excess forage being taken off as hay. During the winter these cattle receive Coastal hay and a liquid protein supplement.

System D

This system also contains a 30-cow herd. In a similar manner, these cattle are maintained on 30 acres of permanent Coastal pasture with the excess forage going into hay. This herd receives only Coastal hay as supplementary feed during the winter months.

Analytical Procedure

All calf weights were adjusted by age of dam and sex of calf. Sale value of calves was the adjusted weaning weight minus actual shrink multiplied by market price of calf at time of weaning. Total receipts from each system also included the value of crops such as, soybeans, corn, and hay that was harvested and not fed.

The cash expenses included all items purchased, such as feed, seed, fertilizer, gas, oil, and seasonal labor plus an interest charge on operating capital. The non-cash expenses included depreciation charge for all capital items, such as machinery and silos, and an interest charge on these capital items. Also included in non-cash expenses was an interest charge on the breeding livestock.

System A for 1970-72 had the highest gross returns of any system because of sale of crops and heavier weaning weight of calves (see table). This system had almost double expenses of the other systems but still had the highest net returns ($59.16 per acre) of any system. This net return is the return to operator's labor, management, and land.

System B with net return of $54.25 per acre had the highest return of any system that did not include soybeans. This net return indicates allotting an additional half acre per cow and providing winter grazing of fescue and clover were profitable. This increased the weaning weight of the calves about 100 lb. per calf over systems C and D which did not have winter grazing.

System D with a net return of $31.46 compared to $21.74 for system C indicated that feeding a liquid protein supplement during the winter was not a profitable practice under the circumstances of this experimental work. This practice increased weaning weights of the calves but the extra expense more than offset the extra pounds of calves.

TWO-YEAR AVERAGE OF COSTS AND RETURNS BY SYSTEM

Item	Type of system			
	A	B	C	D
Calf performance and sale data				
Number weaned	26.5	28	27	27.5
Adjusted sale weight (adj. weaned weight)	594.0	516	414.5	392.0
Average sale price per cwt.	30.54	31.36	32.74	33.53
Average adjusted sale value	181.36	161.82	135.66	131.45
Receipts				
Value of calves	$4,808.41	$4,528.29	$3,667.94	$3,607.36
Value of soybeans	2,166.30	0	0	0
Value of surplus hay	286.75	532.00	0	0
Value of corn	678.00	0	0	0
Total receipts	$7,939.46	$5,060.29	$3,667.94	$3,607.36
Expenses				
Cash expenses, including costs of producing crops, hay and pasture	$3,833.85	$1,665.30	$2,163.81	$1,815.01
Non-cash expenses, including depreciation, interest, taxes and insurance	1,443.20	953.55	851.70	851.70
Total expenses	$5,277.08	$2,618.85	$3,015.51	$2,663.35
Return to operator's labor, land and mgt.	$2,662.38	$2,441.44	$ 652.43	$ 944.01
Per acre return to operator's labor, land, and mgt.	$ 59.16	$ 54.25	$ 21.74	$ 31.46

Poultry Litter Materials – Scarce and Expensive

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DISAPPEARANCE OF the familiar sawdust piles along Alabama's roadways reflects a serious problem facing poultry producers – a growing shortage of litter material. Such a shortage means higher cost of litter, which adds to the already increasing production expense.

Pine shavings and sawdust are preferred litter materials. Until recently, these by-products of wood-using industries were plentiful and relatively inexpensive. But not any more. Changes in methods by wood-using industries reduced amounts of sawdust and shavings available at the same time that poultry production was increasing in the State.

Broiler production increased at the annual average rate of 6½% during the 1963-72 decade. Expansion was greatest in areas where production was already concentrated. While litter needs were increasing and volume of shavings and sawdust were decreasing, wood technologists were developing newer uses for the by-products in manufacturing. Together these developments have drastically reduced supplies of shavings and sawdust available for litter material. The result is that poultrymen are having to pay higher prices.

Poultrymen have tried at least two dozen substitute litter materials. Rice hulls, peanut hulls, and cane pomace have been used successfully, but neither equals pine shavings or sawdust. Neither of these three substitutes is produced in volume in areas where broiler growing is concentrated. This results in long-distance hauling that, coupled with bulkiness, makes transportation cost so high that use of the materials is prohibitive.

The imbalance between supply and demand was prevented from becoming critical because most broiler growers were able to shift to annual litter replacement rather than changing it after each batch of chickens raised. Even with this change, litter supply remains short in some areas year round and in many areas during winter months.

Information from poultrymen in counties where approximately 87% of the State's output of broilers was grown illustrates needs. About 66 cu. ft. of litter material is needed for each thousand broilers grown, according to the producers. This includes amount used for breeder hens and pullets, as well as for growing broilers. In 1972, poultrymen in Alabama would have needed 23.4 million cu. ft. of litter material for the 399.3 million broilers grown. Area and county needs are shown on the map.

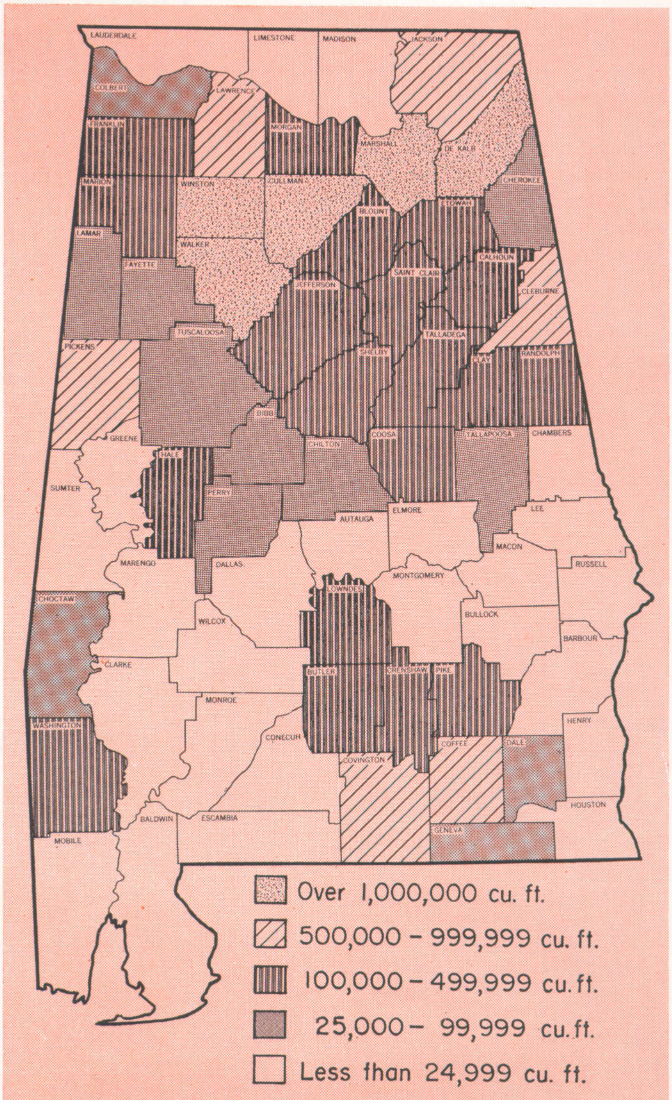
Saw mills, planer mills, and various wood-working plants were named as major sources for litter materials. Procurement was reported as follows: 17% purchased and hauled direct from source, 28% purchased direct from source but depended on someone else for hauling, and 55% bought from a dealer. All dealers operated on a purchase-resell basis.

Dealers hauled materials up to 92 miles. Average length of haul for 18 dealers was 51.5 miles. Size of truck bed used in hauling varied from 14 ft. × 7 ft. × 32 in. to 40 × 8 × 8 ft. The larger ones were used for long-distance hauling, and in combination with a redistribution point where materials were transferred to smaller trucks for delivery to poultry houses. A tractor equipped with front-end loader was the most common machine used to load trucks at the source and at redistribution points. A drag gate was commonly used for unloading materials in poultry houses.

Cost of pine shavings and sawdust varied among areas and by seasons. Prices at the sources varied from 0 to $11 per load. In 1972, poultrymen paid dealers an average of $26.70 per load (about 360 cu. ft.).

Poultrymen used approximately 10.3 loads per year per 10,000 sq. ft. of floor space. Litter cost was 7.4¢ per cu. ft., or $275 annually per 10,000 sq. ft. of house. Chick placement rate was such that litter cost was approximately 0.4¢ per bird.

The search is continuing for a suitable material that could be available year-round at a reasonable cost. One potential material, a by-product of the newsprint industry in Alabama, was tried at Auburn. Broilers grown on it performed as well as those grown on usual litter. Samples of the experimental material shown to poultrymen and litter dealers created interest. However, methods of handling and costs have not been worked out.



Volume of litter materials used in 1971, based on current use rate and numbers of broilers and hatching-egg flocks.

SERICEA-GRASS MIXTURES for the TENNESSEE VALLEY

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Tennessee Valley Substation

TALL FESCUE or orchardgrass planted with sericea lespedeza not only increases total forage yield but extends the productive season by 3 months and increases overall forage quality.

Results of a 3-year experiment on Decatur clay at the Tennessee Valley Substation show that a grass-sericea combination is superior to sericea alone.

Individual plots of Serala and Interstate sericea were planted in April and Kentucky 31 tall fescue or Boone orchardgrass was overseeded in October 1969. The grasses were fertilized annually with 0, 80, or 160 lb. N per acre. One-half of the N was applied in late February and the remainder in early September. Forage harvesting began in April and ended in November.

Results

Total forage yields of Serala were higher than Interstate sericea, see table. Overseeding tall fescue or orchardgrass on Serala without applying N had no effect on total yield but the grass-Interstate mixtures at zero N produced less than Interstate alone. Nitrogen increased the yield of all grass-sericea combinations. Total yields were highest on Serala-grass, averaging about 5 tons per acre when 160 lb. N per acre was applied.

THREE-YEAR AVERAGE TOTAL FORAGE YIELDS OF SERICEA-GRASS MIXTURES AS AFFECTED BY RATE OF NITROGEN

Sericea	Grass	Dry forage yield per acre		
		0 N	80 lb. N	160 lb. N
		Lb.	*Lb.*	*Lb.*
Serala	None	8,520	....	....
	Tall fescue	8,700	9,270	10,170
	Orchardgrass	8,220	8,550	9,840
Interstate	None	7,420	....	....
	Tall fescue	6,690	8,660	8,910
	Orchardgrass	5,900	7,760	8,500

Seasonal distribution of forage was more important than total yield. Tall fescue extended the productive season of sericea by about 3 months when 160 lb. N per acre was applied, Figure 1. Orchardgrass made somewhat more spring growth but less autumn growth than tall fescue. When grass was not fertilized with N, very little forage was obtained. This indicates that although sericea is a legume, it furnishes little N to associated grasses. Nitrogen-fertilized grass depressed spring and early summer production of sericea but had no effect in late summer when grasses made little growth.

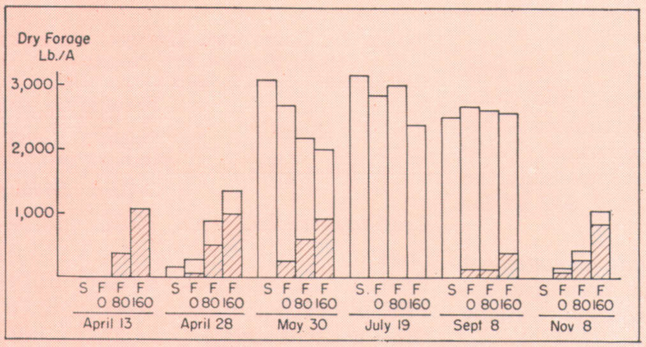


FIG. 1. Seasonal growth in 1972 of Serala sericea (S) and sericea-fescue (F) as affected by rates of nitrogen (0, 80, 160 lb. per acre). Fescue growth is shown in cross-hatched areas and sericea in plain areas.

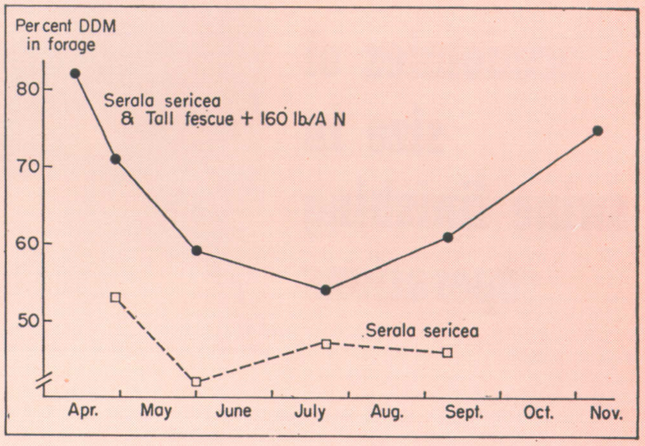


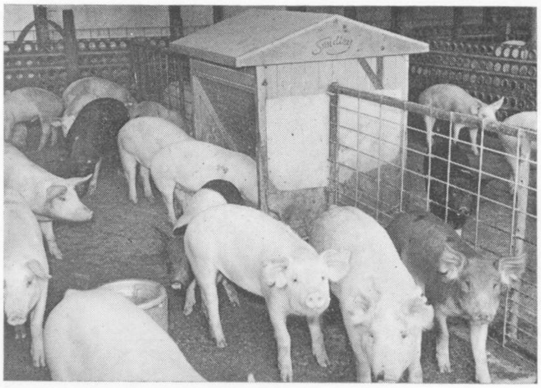
FIG. 2. Digestible dry matter (DDM) of forage over the growing season, 1972.

Stands of both sericea varieties persisted well in association with grasses at all rates of N. Both tall fescue and orchardgrass maintained excellent stands in sericea when fertilized with 160 lb. N per acre. At 80 lb. N per acre grass stands were reduced about 40% in Serala but none in Interstate. When N was not applied, grass stands were sharply reduced on Serala and to a lesser extent on Interstate.

Forage quality as measured by digestible dry matter (DDM) was improved over the entire season by growing tall fescue in association with sericea and fertilizing with N, Figure 2. DDM of Serala sericea averaged 47% for the year as compared to 60% for non-nitrated fescue-sericea and 67% for fescue-sericea with 160 lb. N. per acre. DDM of orchardgrass was similar to that for tall fescue. DDM of Serala sericea was similar to that determined in other tests for Coastal bermudagrass. The improved forage quality of the grass-sericea sward as compared to sericea alone should result in improved animal performance.

Results of this experiment show that tall fescue or orchardgrass can be grown successfully in Serala sericea to extend the productive season and improve forage quality. To utilize forage, grass can be grazed from March until May. Rapid late spring and summer growth of sericea can be cut for hay. As sericea growth ceases in late summer, autumn growth of tall fescue can be grazed until November or December.

economies of size in swine finishing operations



TONY A. OTTS, *Dept. of Agricultural Economics and Rural Sociology*

FINISHING OPERATIONS are gaining popularity among Alabama swine producers. One reason is the increased availability of top quality feeder pigs through organized pig sales in recent years. Also contributing to popularity of finishing operations is the lower labor requirement and less initial capital investment than for other hog enterprises.

The increasing quality of available feeder pigs has been accompanied by greater demand and higher prices. The higher prices make it even more important that finishing operations be as efficient as possible.

Economy of size is an important question for producers interested in expanding swine finishing operations. It seems logical that growth in size of operation should reduce certain unit costs of production. For example, buying feed at quantity discounts or operating a feed mill on the farm should give savings. Non-feed variable costs, such as hauling, electricity, and telephone expenses, and fixed costs like depreciation and taxes on buildings should be lower on a per hog sold basis for larger operations.

Possibilities of size economy were investigated by using farm data collected on several finishing operations for the year 1971. Farmers were personally interviewed in all sections of the State. Size of operations ranged from 922 to 7,400 hogs sold per year. For evaluation purposes, the farms were divided into large (over 1,500 hogs sold per year) and small (under 1,500 sold per year) categories.

The year 1971 was not a good year for hog farmers. Average price for market hogs was $18.78 per cwt. The highest monthly average was $21.38, reported by the Selma market. Thus, hog producers received extremely low prices that year.

TABLE 1. AVERAGE COST AND RETURN FOR FINISHING OPERATIONS IN ALABAMA, 1971

Item	Result/pig sold	
	Small producer	Large producer
	Dollars	*Dollars*
Returns		
Gross sales	42.07	40.89
Inventory change	1.84	1.21
Gross returns	43.91	42.10
Cost		
Feed	23.03	21.14
Non-feed variable		
Feeder pigs	14.26	17.61
Veterinary	.31	.39
Hauling	.93	.63
Electricity	.13	.06
Telephone	.05	.01
Supplies	0	.05
Repairs	.05	.18
Interest on operating capital	.20	.35
Total variable	15.93	19.28
Fixed		
Capital depreciation	2.22	1.20
Insurance, interest, taxes	1.78	.94
Total fixed	4.00	2.14
TOTAL COST	42.96	42.56
Returns to labor and mgt./pig sold	.95	—.46
No. of producers	*4*	*4*
Pigs sold, average	*1,173.0*	*3,240.5*

Results were somewhat as expected under prevailing low prices of that year. Gross returns showed little difference between small and large producers, Table 1. Total cost per hog was essentially the same, $42.96 for small and $42.56 for large producers.

Returns to labor and management were practically zero for both size operators, with large producers actually showing a negative return. Thus, the expected advantages for larger size operations were not present in the findings. However, closer observation explains this finding and identifies definite cost savings possible through larger size of operations.

Fixed cost was $4 per hog sold for the small group and $2.14 per hog for the large operations. Thus, there was a $1.86 per hog difference in favor of the large group.

Among non-feed variable costs, electricity, hauling, and telephone expenses were also less for the large size group. However, total non-feed variable costs were $3.35 per hog more for large producers – $19.28 as compared with $15.93 for the small operations. Reason for this was that large producers averaged paying more for feeder pigs than smaller operators. However, the higher price paid per pig was primarily by the single, largest producer. The extra $3.52 per pig paid by large producers appears to be an unnecessary expense.

When feeder pig prices were equalized among groups, results were as illustrated in Table 2. Such an adjustment is not unreasonable since larger farmers should certainly be able to buy feeders as cheap as smaller operators. Therefore, a price of $14.66 per feeder pig was used for both groups in the computations.

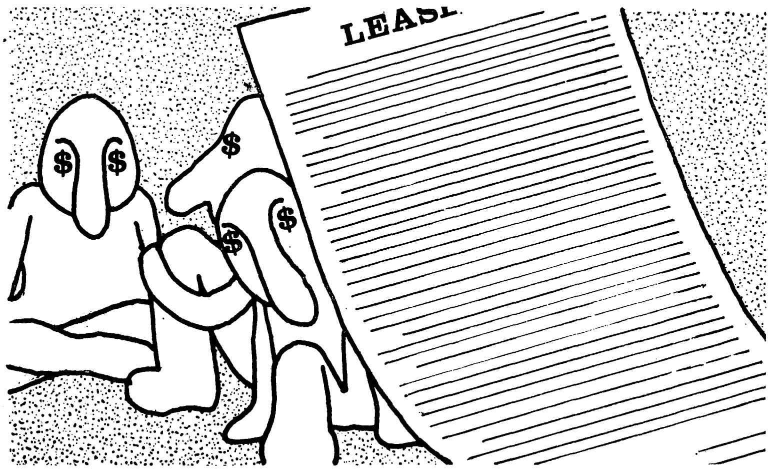
With pig purchase price the same, total cost per pig was $45.19 for small producers and $40.66 for large ones. With sales remaining as previously presented, adjusted returns to labor and management per hog sold were minus $1.28 for the small operations and plus $1.44 for the large group, a complete reversal of actual findings. This indicates possible advantages or economies of size based on information from the eight swine producers in the study.

Available information indicates that size efficiences are possible in hog production, but only if good management is followed. In the operations studied, poor management in buying feeder pigs was costly.

TABLE 2. COSTS AND RETURNS ADJUSTED FOR FEEDER PIG PRICES

Item	Results/pig sold	
	Small producer	Large producer
	Dollars	*Dollars*
Gross returns	43.91	42.10
Costs		
Feed	23.03	21.14
FEEDER PIGS	16.49	15.71
Other non-feed variable	1.67	1.67
Fixed	4.00	2.14
TOTAL COST	45.19	40.66
Return to labor and mgt./pig sold	—1.28	1.44

HIDDEN COSTS MAY LURK IN TRADITIONAL FARM LEASES



HOWARD A. CLONTS, JR., *Department of Agricultural Economics and Rural Sociology*

HIDDEN OR OVERLOOKED costs in farm lease arrangements may cause farmers to fall short of their profit goals. This is a frequent occurrence when farms are operated along traditional share-lease lines.

Although numbers of tenant farms are declining in Alabama, part-owner farms are increasing. In fact, some of the State's largest farms are part-owner, part-tenant operations. Most part-owner farms involve cash-lease arrangements, although many use share-lease agreements.

Many factors associated with share-lease farming may prevent maximum profit for a given farm. The most serious of these is division of management responsibilities based on shared investment.

Research in the Tennessee Valley Area indicated the most common lease terms to be ¼ of all cash crops as rent to the landlord. Livestock shares were reported to be ½ to each party. With crops, landlords furnished all real estate, ¼ of such variable costs as seed, fertilizer, and lime, and ½ of necessary chemical costs. Tenants furnished the remainder of these items plus all labor, machinery, and machinery operating costs.

There were variations in proportions of shared income and costs. For example, some farms reported landlord shares equal to ¼ of cotton, ⅓ of corn, ¼ of soybeans, and ½ of cattle. In some instances, soybean returns were reduced to 1/5 of the crop value.

Wide share variations provide even more incentive for landlord and tenant to disagree on crop and farm plans. A landlord receiving ¼ of the cotton but only 1/5 of the soybeans may insist on planting all land to cotton, even if leasing is necessary and allotment lease prices are at subsidy payment levels. A tenant may prefer the opposite since he, like the landlord, is seeking to maximize returns to his own investment, not whole-farm investment. In some cases reported, tenants paid the total cost of leasing additional crop allotments.

In the northern Alabama study, average costs for several enterprises were calculated on the basis of contributions by landlords and tenants. A typical farm situation was used to compare the various tenure arrangements. Cost and return distributions made on basis of traditional share arrangements, given in the table, show inequities in these lease arrangements.

In all situations, returns to the whole farm operation were significantly less under share arrangements than under an owner-operator or cash-tenant plan. Whole farm returns dropped significantly when returns to either tenant or landlord were maximized.

Although customary arrangements specified that landlords would receive ¼ of crop value, the actual net return exceeded 30% for all enterprises and 50% in two cases. Costs borne by landlords were below 20% of the total for all cash crops and approximately 50% for cattle expenses.

These data clearly show the problems encountered when tradition is followed without regard to changing economic conditions and resource values. True costs and returns are hidden under a mask of tradition that may not be "always right."

Lease agreements generally used evolved through trial and error. There are indications that neither party fully understood the lease conditions nor knew the true value of either party's contributions. In this study, inequities directly related to production resources of the landlord gave him a competitive advantage. Heavy investments by tenants in farm equipment were not proportionally rewarded. Thus, a tenant would have incentive to exploit land resources and landlords would exploit the labor resource.

Successful farming requires good management and efficient use of all resources. Inequitable lease arrangements, whether cash or share types, do not allow realization of that goal. Customary types of agreements may have to be abandoned in favor of leases that provide for the division of returns based on dollar value of inputs from both tenant and landlord. Such a system would allow tenants to recover, within a reasonable time, their heavy investments in machinery and other necessary production inputs.

PROPORTIONAL DISTRIBUTION OF COSTS AND NET RETURNS BETWEEN LANDLORD AND TENANT BY SELECTED ENTERPRISES, TENNESSEE VALLEY, ALABAMA, CASE STUDY, 1971[1]

Enterprise	Cost distribution		Net return distribution	
	Landlord	Tenant[2]	Landlord	Tenant
	Pct.	*Pct.*	*Pct.*	*Pct.*
Soybeans	16.1	83.9	38.1	61.9
Cotton, solid plant	13.8	86.2	46.6	53.4
With leased allotment	15.6	84.4	58.8	41.2
Cotton, skip row	14.8	85.2	39.1	60.9
With leased allotment	16.1	83.9	42.6	57.4
Beef cow-calf herd[3]	49.3	50.7	50.5	49.5
Pasture	58.6	41.4	------	------
Hay	48.2	51.8	------	------

[1] Opportunity cost for landlord's land investment and value of tenant operator's labor and management not included.

[2] Tenants pay all costs for labor and cropland expansion, plus half of purchased feed.

[3] Excludes all pasture and feed costs.

FERTILITY INDEX
Adds Meaning to
SOIL-TEST REPORT

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FOR A SOIL TEST to serve as a reliable basis for fertilizer and lime recommendations, it should show the degree of deficiency of each nutrient and amount needed to produce maximum yield. This involves more than a simple measure of soil content because needs vary for different soils and different crops. Much research is required to calibrate soil test levels to crop growth.

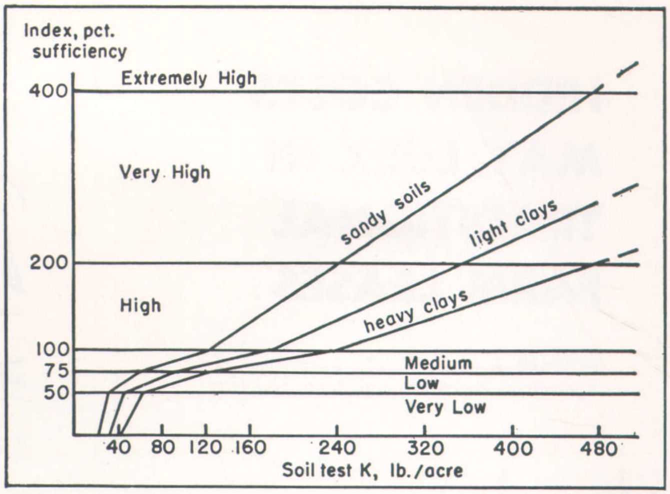
Most laboratories use some type of rating system, such as Low, Medium, and High, in which the terms are often not well defined. Others report soil test results in pounds per acre or parts per million. This can be confusing because of wide variation in amounts of the different elements found in soils and variations in requirements among crops. For example, 50 lb. of phosphorus, 80 lb. of potassium, 25 lb. of magnesium, and 300 lb. of calcium per acre should be found in soils for peanuts. Including amounts extracted by soil tests on reports would be confusing to growers not familiar with calibration information.

The Auburn University Soil Testing Laboratory uses a rating system of "Very Low, Low, Medium, High, Very High, and Extremely High." Since 1970 the laboratory has used a fertility index along with these ratings. This index, an expression of per cent sufficiency, gives a more complete picture of the soil's fertility condition than the rating alone. It is used for phosphorus, potassium, magnesium, and calcium and is reported to the nearest 10% from 0 to 9,900. An index of 100 for a particular element means that the soil contains enough of that element to produce top yields without further addition. The relationships among fertility index, soil-test ratings, anticipated yield, and rates of fertilizer recommended are presented in the table.

Objectives of the index include (1) to report all nutrients determined on a "percentage sufficiency" basis so that results can be easily understood by growers, and (2) to provide a convenient system that can be used in keeping records of soil fertility buildup or depletion. The index below 100 indicates percentage of maximum yield that can be expected without adding fertilizer containing the element. Above 100, the index indicates the margin of adequacy or the degree of excess, as shown for potassium in the graph.

Including the Very Low, Very High, and Extremely High ratings along with per cent sufficiencies is one of the most important aspects of this system. Index numbers below 50 indicate the need for large applications of fertilizer to build soil fertility. On the other hand, many Alabama soils have been fertilized with phosphorus continuously for 100 years. Many lawns, shrubs, and garden areas have received extremely high rates, and phosphorus has accumulated to levels where no benefit from applications could be expected for many years. In fact, excessive phosphorus frequently causes problems with iron or zinc deficiency. On samples for gardens, lawns, and shrubs in 1970-71, 25% were Extremely High and many had index values of 2,000 to 4,000, which are 20 to 40 times the soil levels considered adequate.

In 1970-71, 25% of all samples received by the laboratory for cotton were Very High in phosphorus, with index values of over 200. It was recommended that no phosphorus be applied to them until the level drops below 200. Such high index values have helped convince farmers and home owners to use fertilizers without phosphorus on a trial basis. Farmers are urged to follow the recommendations on strips in their fields when they are reluctant to abandon rates and grades of fertilizers that have produced good crops in the past. They are also urged to use the index values in keeping records of soil fertility buildup or depletion.



The fertility index up to 100 indicates expected yield at different soil-test potassium levels without adding the fertilizer element on different types of Alabama soils.

RELATIONSHIPS AMONG FERTILITY INDEX, SOIL-TEST RATINGS, RELATIVE YIELD, AND RECOMMENDATIONS BASED ON SOIL TESTS

Fertility index*	Soil-test rating	Relative yield of crop	Recommendations
0- 50	Very Low	<50%	Large applications for soil building purposes
60- 70	Low	50-75%	Annual application to produce maximum response and increase soil fertility
80- 100	Medium	75-100%	Normal annual applications to produce maximum yields
110- 200	High	100%	Small applications to maintain soil level. Amount suggested may be doubled and applied in alternate years.
210- 400	Very High	100%	None until level drops back into *high* range. This rating permits growers, without risk of loss in yields, to benefit economically from high levels added in previous years. Where no P or K is applied, soils should be resampled in 2 years.
410-9,990	Extremely High	100% ?	Used for P on samples from lawns, gardens, and shrubs. A warning is added that P is excessive and further additions may cause Fe or Zn deficiency.

* Fertility index is per cent sufficiency expressed to the nearest 10%.

Silage + High Moisture Corn Makes Good Steer Ration

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SINCE THE MID 1950's, corn silage has been used in Alabama as a major component of growing and finishing rations for yearling beef steers. However, gain has been low on such rations. Results from early Alabama studies showed that yearling cattle probably would gain less than 1.5 lb. daily unless the corn silage was supplemented with energy and protein. The most practical supplement to a full feed of corn silage, as indicated in preliminary research, was 2 lb. of corn and 1.5 lb. cottonseed meal (CSM) daily.

During the early 1960's, technology and equipment became available for preserving corn with a moisture content of 25-30%. This high-moisture (HM) shelled corn proved to be an excellent supplement for feeding with silage.

Results from one experiment indicated that corn might be more efficiently utilized when fed at a rate of 4 lb. instead of 2 lb. per head daily. Therefore, a test was begun in 1968 at the Tennessee Valley Substation, Belle Mina, to determine animal response from feeding either 2 or 4 lb. of rolled HM corn in addition to a full feed of corn silage and 1.5 lb. CSM.

Stocker beef steers confined to pens in a pole-type barn were used in these feeding trials. During each of 5 years, 12 steers were assigned to each of two treatments: corn silage full fed plus 2 lb. HM corn, and corn silage full fed plus 4 lb. HM corn daily. Cattle were fed once daily during the 134-day growing phase. Corn and CSM were fed in one trough and silage in an adjacent one.

At the end of the growing phase, both treatment groups were changed to the same finishing ration. The blended finishing mixture consisted of 74% rolled HM corn, 15% grass hay, 10% CSM, and 1% salt. All cattle were full-fed this mixture for an average of 79 days and then sold, slaughtered, and certain carcass data collected.

USE OF HIGH MOISTURE SHELLED CORN WITH CORN SILAGE IN STEER GROWING-FINISHING RATIONS, TENNESSEE VALLEY SUBSTATION, 1968-73

Performance measure	Result, by growing ration	
	Corn silage + 2 lb. HM corn[1]	Corn silage + 4 lb. HM corn[1]
Growing phase		
Initial steer weight, lb.	509	509
Final steer weight, lb.	746	772
Days (Nov. 15-Mar. 28)	134	134
Average daily gain, lb.	1.77	1.96
Corn silage eaten daily, lb.[2, 3]	35.3	33.3
Finishing phase		
Final weight, lb.	929	942
Days (Mar. 29-June 15)	79	79
Average daily gain, lb.	2.32	2.15
Feed/cwt. gain, lb.	1,103	1,148
Combined growing-finishing		
Gain, lb.	420	433
Days (Nov. 15-June 15)	213	213
Average daily gain, lb.	1.97	2.03
Total dry matter/cwt. gain, lb.	786	778

[1] Average moisture content was 26%.
[2] Silage contained an average of 30% grain (dry matter) and 29% dry matter at harvest.
[3] Both groups were fed cottonseed meal at rate of 1.5 lb. per head daily. Other feed was the 2 or 4 lb. HM corn per head.

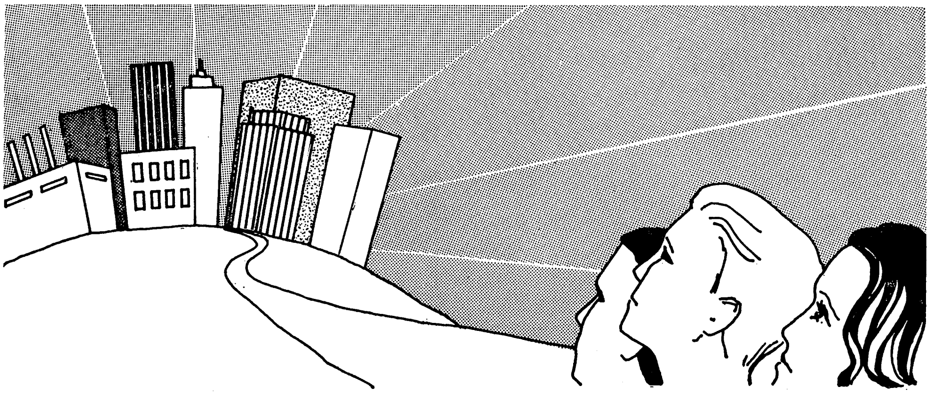
During the growing phase (November 15-March 28) steers fed the higher rate of corn gained 11% faster, 1.96 vs. 1.77 lb. per day. These steers also were slightly more efficient in converting feed into gain (716 vs. 737 lb. of dry matter per cwt. of gain). Daily feed consumption was similar, as shown by data in the table. Even though feed cost per unit of gain was slightly more expensive for the steers that were fed 4 lb. of corn, their return above feed cost was greater than for steers fed 2 lb. per day ($52 vs. $49 per head for growth phases, based on appraised market value). Price of corn averaged around $1.35-$1.40 per bu. during this period.

Steers that were fed 2 lb. of corn during the growing phase gained faster and more efficiently during feedlot finishing (March 29-June 15) than comparable steers getting 4 lb. of corn daily. Carcass grade averaged low Choice in both treatment groups and there were no important differences in dressing percentage, yield grade, degree of marbling, backfat, and ribeye area.

Total feed consumption during the 213-day combined growing-finishing experiment differed between the groups. Steers fed at the rate of 2 lb. daily in the growing phase consumed a total of 1,745 lb. of corn and 4,711 lb. of silage. Those fed at the 4-lb. rate ate 1,960 lb. of corn and 4,461 lb. of silage each. Thus, steers fed corn at 4 lb. daily during the growing period consumed 215 lb. more total corn than their counterparts. However, that amount of corn replaced 93 lb. of other feed and also resulted in an additional 13 lb. of gain.

Gains during the entire 213-day period were similar under the two feeding plans (420 vs. 433 lb.). Efficiency of converting dry matter into gain, however, favored the higher rate of corn feeding during the growing phase (778 vs. 786 lb. per cwt.).

As shown by results from this experiment, high-moisture shelled corn is an efficient feed ingredient for cattle growing-finishing rations. Full feeding of corn silage with either 2 lb. or 4 lb. of HM corn plus protein supplement resulted in efficient and economical animal performance. Whether the higher rate of corn will be profitable depends on price of corn relative to other feedstuffs.



Where Do Rural Youth Want To Live?

J. E. DUNKELBERGER and JANICE CAIN
Dept. of Agricultural Economics and Rural Sociology

MUCH IS HEARD today about the exodus of young people from their home communities. The reality of this migration is clearly documented by the 1970 U.S. Census which shows population decline for many small towns and rural areas. If this trend were to continue, one wonders whether some areas won't eventually be completely abandoned.

Although reasons for this geographic redistribution of young people are well known, it is not clear whether this movement is made by desire or merely because of poor living conditions and lack of employment opportunities. If public policy were implemented to make rural America a more desirable place to live, would young people choose to live there?

A 1972 survey conducted among youth residing in northeast Alabama showed that more than half (63%) wanted to live in cities. To obtain the residential preferences of these rural youth all seniors attending a sample of 15 high schools located in Cherokee, DeKalb, Jackson, and Marshall counties were questioned. Forty per cent of these youth wanted to live in a small city, and an additional 23% in a large city. Twenty-two per cent desired living in the open country, while 7 to 8% desired to live either in a small town or on a farm. Girls were more likely than boys to want to live in either a large or a small city. Boys were more oriented toward living in the open country (27%) compared to girls (18%).

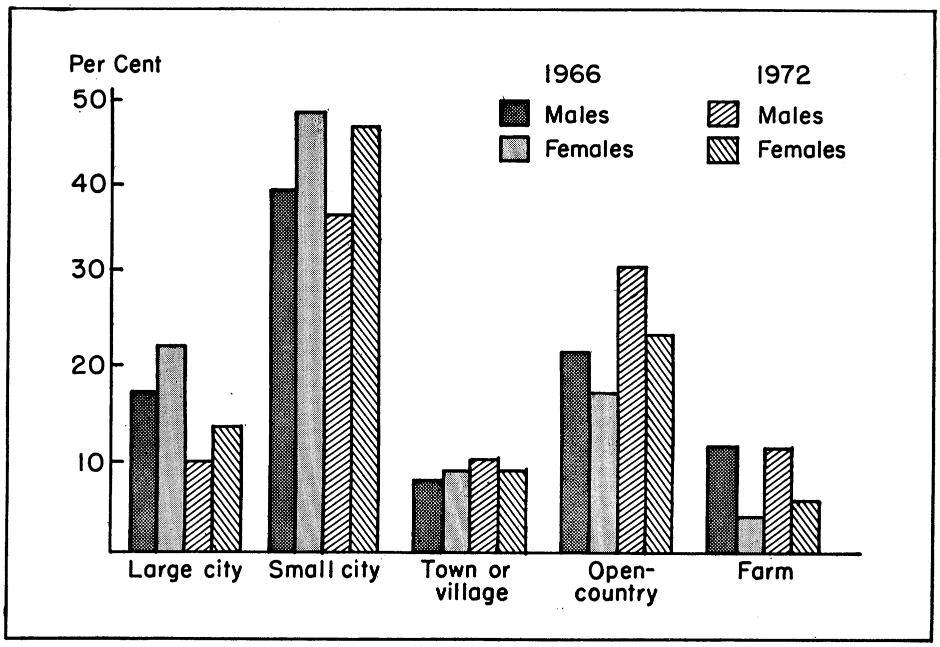
Desiring something and actually expecting to obtain it are not the same things. Therefore, these young people were asked where they actually expected to live after they leave their parents' homes. A majority of these youth (70%) indicated they expected to live in the same type place as desired. Expected and desired residence consistency was more common among boys than girls (75% versus 65%).

How certain are youth that they will actually live in the type place they expect? Three-fourths of the young people expecting to live on a farm felt sure that they would do so. The complementary nature of farming as an occupation and the farm as a place to live explain this high rate. On the other hand, youth expecting to live in the open country but not on a farm felt least certain of actually doing so. Boys in every residence category were more sure of their future residence than were girls. A large difference was observable, however, only among those expecting to live in a town or village. Boys were much more certain of doing this than were girls.

Twenty per cent of both boys and girls expected to live in a larger place than they wanted. Such a finding suggests a realization by some young people that conditions are not favorable for them in smaller places. This difference is an indication of their negative assessment of the rural area and small town as a place where they can make a livelihood for themselves and obtain the services associated with a "good" life.

The lack of job opportunities is usually ranked high as the reason youth leave rural areas. Each young person was asked to indicate how important the place they now lived (either farm, open country, or town) would be in preventing them from attaining the job they most wanted. Phrasing of the question was such that only those persons seeing the rural area providing little opportunity for them would rate this as "important." Even so, a high proportion of these youth gave such a response. Fifty per cent of the girls and 36% of the boys indicated this was an important factor.

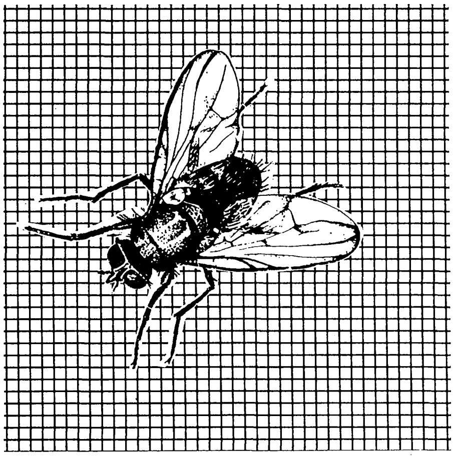
Are high school students in rural areas and small towns more urban or city oriented today than in the past? Findings from a 1966 survey conducted in the same northeast Alabama area suggest that they may be *less* urban oriented (see figure). Fewer boys and girls (8% each) expected to live in a large city in 1972 than they did in 1966. There was a definite trend toward the open country, although there was little change with respect to the proportion desiring to live on farms or in towns or villages. Nine per cent more boys and 7% more girls expected to live in the open country.



Place of residence expected by high school seniors, 1966 and 1972.

PREDATORS of the HORN FLY in the PIEDMONT of ALABAMA

JOHN R. BOURNE[1] and KIRBY L. HAYS
Department of Zoology-Entomology



EXCEPT FOR MAN and some of the large carnivores, life is a grim task of eat or be eaten.

The predator kills and eats his prey at the first meeting. Thus, the predator must have some way of catching and overcoming the prey. One often thinks of predators in terms of wolves, tigers, or eagles which are cunning, swift, fierce, animals often referred to as villains in children's stories. However, not all predators are swift, cunning or fierce. For example in the insect world some predators feed only on non-motile or slow moving prey such as eggs, larvae, and pupae. The predator and his prey are closely interrelated and each may even be responsible for controlling numbers of the other in a properly functioning ecosystem. This may be an aspect in the life of the horn fly, an important pest of cattle.

The Horn Fly

The horn fly is parasitic on cattle. The adult sucks blood and it is on the animal most of the time, leaving only to lay eggs or disperse to another animal. The female horn fly lays her eggs only in freshly passed cow manure still warm from the body heat of the cow. The eggs embryonate in the cow manure, the larvae live in it, and the pupae form in or under the feces pile.

Field Observations

Field observations at the Main Station at Auburn and the Piedmont Substation (Camp Hill), revealed that several species of insects prey upon the various stages of the horn fly in the Piedmont section of Alabama. The pigmy cricket, *Nemobius fasciatus* (DeGeer), was found in 60% of the dung piles investigated. The large rove beetles, *Ontholestes cingulatus* (Grav.), and *Staphylinus maculosus* (Grav.) were found in cow feces in mixed conifer-hardwood stands in Piedmont pastures. The hydrophilid beetle, *Sphaeridium scarebaeoides* (L.), two species of tiger beetles, *Tetracha carolina* (L.) and *T. virginica* (L.), and fire ants, *Solenopsis* sp., were seen foraging in piles of feces. Specimens of each of these insects were brought to the laboratory and observed to determine their effects on various stages of the horn fly.

Under laboratory conditions the pigmy cricket displayed a decided preference for horn fly pupae, especially the newly formed ones, over alfalfa and clover, their reported food plants. When these crickets were placed in petri dishes with cow feces containing horn fly eggs, the crickets foraged continuously for the eggs and predation always exceeded 90% of the exposed and partly exposed eggs. No feeding occurred on egg masses that were completely buried. Predation could not be confirmed in the field; however, crickets were observed moving to freshly passed feces from a distance of several feet.

Field observations revealed that both of the large rove beetles, *Ontholestes cingulatus* and *Staphylinus maculosus*, inhabit, during some part of their life cycle, the microenvironment of the larval horn fly. The male and female *O. cingulatus* copulated on the top of a fresh dropping and the female oviposited in the feces. The adults fed on adult flies which came to the feces in the field. In the laboratory the adults of *O. cingulatus* fed on almost any fly offered, but also ate pupae of the horn fly. One pair of these beetles would often consume 24 horn fly pupae in 20 hours. The first-instar horn fly larvae were often preyed upon by the beetle larvae and up to 42% of the horn fly larvae were eaten.

As many as 30 larvae of the hydrophilid, *Sphaeridium scarabaeoides,* were removed from a dung pile 6 days old. These larvae fed on any dipterous larvae in the feces including horn fly larvae. The percentage of predation on 20 horn fly larvae varied with the temperature. In the laboratory no predation was observed at 40°F. while 95% predation was observed at 80°F.

The tiger beetles, *Tetracha carolina* and *T. virginica* are nocturnal, but during the day hid under piles of cow manure in the open pasture. As many as 6 beetles were sometimes found under a single pile of feces. No feeding was observed in the field but 8 tiger beetles ate 95 pupae during a 24-hour period in the laboratory.

Fire ants, *Solenopsis* sp., have been observed on many occasions removing fly larvae and pupae from piles of cow feces in nature. No attempts were made to determine the effects of this ant on the horn fly in the laboratory .

Smaller rove beetles of the genera *Philonthus* and *Aleochara* were observed on feces in the field and fed on horn fly eggs in feces in the laboratory. Also immature lady bird beetles, reduviid bugs, and field crickets were seen in piles of feces but their role in the total predation on the horn fly is unknown.

[1] Former graduate assistant, Department of Zoology-Entomology.

Pasturing pecan orchards, a common practice in Alabama's production areas, increases the possibility of contaminated pecans.

Manure Contamination of Pecans Likely if Orchards Grazed

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IT NOW APPEARS that the longtime tradition of grazing cattle in pecan orchards is, from sanitary aspects, an unwise one. Manure contamination of the nuts is a likely result of this management.

The Food and Drug Administration has shown increasing concern over food sanitation. Food items, including shelled pecans, have been seized and destroyed because of bacterial contamination.

Fecal contamination of foods and water is indicated by presence of *Escherichia coli* (*E. coli*), an intestinal inhabitant of warm blooded animals. This organism is not necessarily harmful, but its presence in foods shows that contamination may have occurred and that more harmful bacteria, such as *Salmonella*, may be present. Even if no disease producing organisms are present, however, fecal contamination of foods is unappealing and should be avoided.

Grazing cattle in pecan orchards increases the possibility of contamination, especially when year-round growth of pasture plants is maintained. In cases of mechanically harvested orchards, dried manure may be harvested along with the pecans. The authors have observed clumps of manure mixed with pecans in large bins of harvested nuts. Some growers avoid this by removing the cattle several weeks prior to harvest, disking the manure under, and then smoothing the land for mechanical harvesting.

Even disking the orchard does not automatically remove the possibility of contamination, however. *E. coli* can also persist in the soil once it has been introduced, although the length of this persistence under Southern conditions is not known. Complete elimination of cattle from orchards may not remove all possibility of contamination since non-grazed orchards can be contaminated by wildlife.

Samples of hand harvested and machine harvested pecans from grazed and non-grazed orchards in 1970 and 1971 were evaluated for the presence of *E. coli*. Higher values for 1970, given in the table, may have resulted because that year was a "wet year," whereas 1971 was dry.

Initially it was thought that mechanically harvested pecans from grazed orchards would have a higher incidence of *E. coli* contamination than hand harvested nuts from grazed orchards. This was not the case. However, grazed orchards were found to have a much higher degree of contamination than non-grazed orchards.

Elimination of cattle from pecan orchards only lessens the possibility of bacterial contamination, it does not eliminate it. Thus, it appears that the pecan shelling industry must ensure that their decontamination procedures are efficient enough to keep contaminated nutmeats off the public market. Growers, however, should take the responsibility of keeping their products clean enough so that the sheller is not faced with an impossible decontamination problem.

EFFECTS OF CULTURAL AND HARVEST METHODS ON *E. coli* CONTAMINATION OF PECANS

Year	Grazed orchards		Non-grazed orchards		Hand harvest		Machine harvest	
	No. of samples	Per cent positive	No. of samples	Per cent positive	No. of samples	Per cent positive	No. of samples	Per cent positive
1970	11	36	15	6	21	19	5	20
1971	45	20	30	3	60	6.6	15	6.6

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