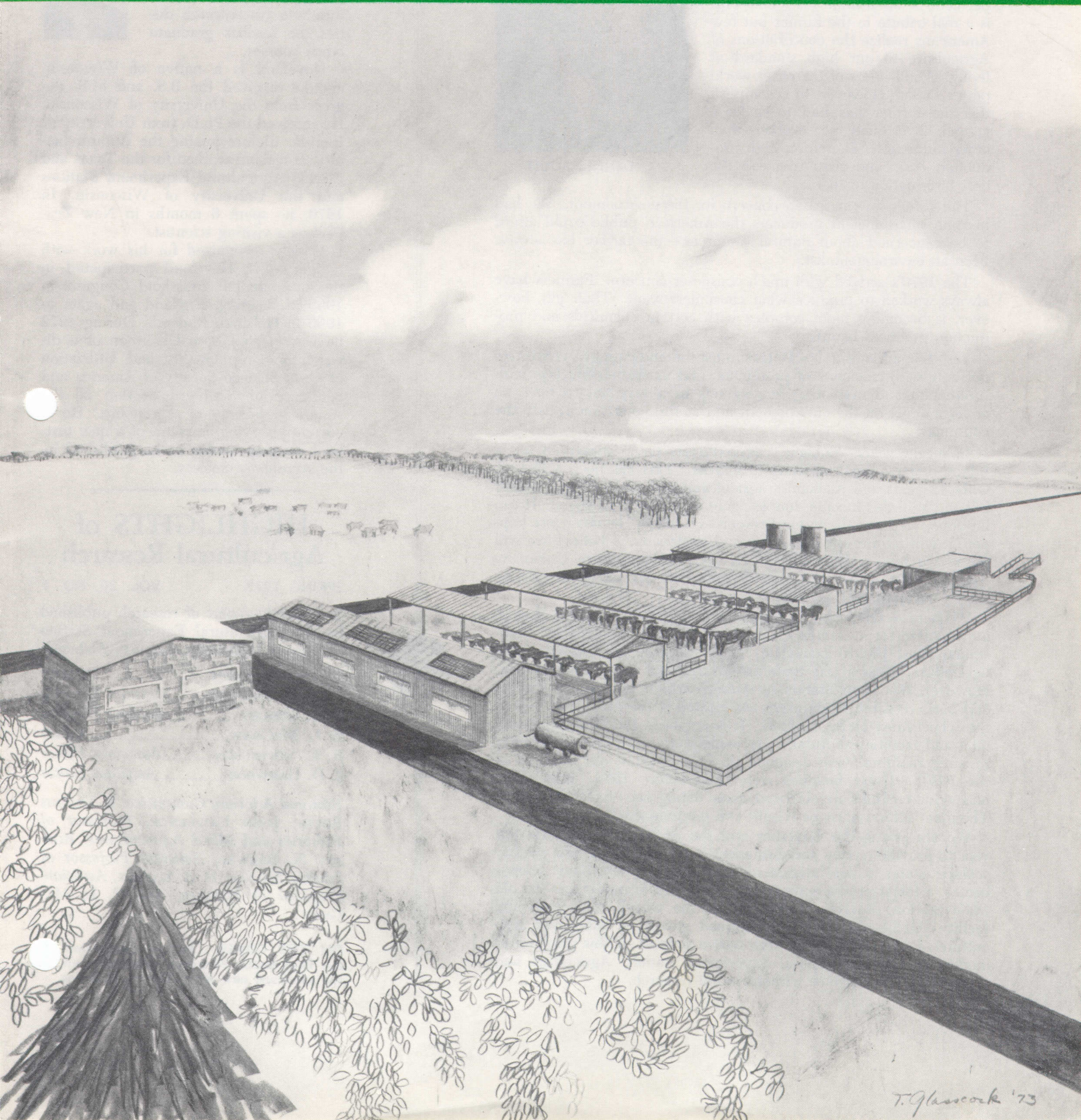
HIGHLIGHTS

of agricultural research

VOL. 20, NO. 1/SPRING 1973

Agricultural Experiment Station
AUBURN UNIVERSITY



DIRECTOR'S COMMENTS

AGRICULTURAL RESEARCH is increasingly complex. Until the early 1940's research was directed primarily toward problems of the subsistence farmer. Cash investments in farming were low. With increasing standards of living and shortage of labor, chemicals and machines were substituted for labor. Using research knowledge, the farmer increased productivity per man far more than that of the non-farm workers. As a result, in 1972, the average American spent only 15.6 per cent of his income for food. This is a real tribute to the farmer but few Americans realize the contributions of Agriculture to our high standard of living. The leaders of the other world power know! However, to accomplish this the farmer has had to make a greater investment per worker than other industries. Therefore, high production costs and risks required the best information available.

R. DENNIS ROUSE

The 1960's saw increased concern for the environment. We had become such efficient producers the American public could afford to be concerned about natural resources – the farmer has always been an environmentalist.

The 1970's arrived with much consumer concern. Farmers have always worked to produce what consumers want. Their job, however, is becoming more complex with certain chemicals and production practices banned.

Yes, the agricultural scientists must be increasingly concerned not only with efficiency of production and marketing but also with production and marketing of products in a way not to have an adverse effect on the environment and at the same time satisfy the consumer.

In recent years, Alabama's agriculturists have worked to see a billion dollar annual agricultural income. This has been achieved. Only 12 years ago Alabama's agricultural income reached one-half billion. Will this income double again in the next 12 years? It can be done; we have the natural resources needed. It won't just happen, it will require determination and leadership. I believe we will see a two billion dollar income by 1985. The Auburn University Agricultural Experiment Station System is dedicated to provide research information that will be required.

We believe the Alabama Agricultural Experiment Station System is structured for maximum efficiency in research productivity. Substations and Fields located to serve various soil, climatic, and agricultural areas of the State are an essential part of this system. However, the Main Station at Auburn where the project leaders and basic research laboratories are located is the hub. The hub of the wheel must be kept sound. It is apparent the field laboratory land and facilities at Auburn are inadequate and obsolete. Poultry research facilities were designed in 1924 to work on problems of the 1920's. Dairy facilities were built before 1930. Beef cattle and swine facilities are outdated, some dating back to World War I. The main station must be rebuilt and modernized.

We are asking the Governor and the Alabama Legislature this year to provide money and authorization to establish a new poultry science center, a new animal science center, a new plant science center, a forest products research center, and to modernize the old Main Station – to rebuild the hub of the wheel. This land and facility will be dedicated to continued growth of Alabama's agriculture. Let me encourage your active support of this program to modernize your Agricultural Experiment Station. Agriculture and Forestry cannot advance without sound research.

may we introduce . . .

Dr. Carl S. Hoveland, professor of agronomy and soils, is senior author of the article on page 3. Through his research work with the Agricultural Experiment Station, Dr. Hoveland has been instrumental in the development of year-round forage programs in Alabama and the rest of the South. In addition to his research duties, he teaches graduate crops courses.

Hoveland is a native of Wisconsin, and he received the B.S. and M.S. degrees from the University of Wisconsin. He received the Ph.D. from University of Florida. Before joining the Auburn faculty, Hoveland worked for the Texas and Florida Agricultural Experiment Stations and the University of Wisconsin. In 1970, he spent 6 months in New Zealand as a visiting scientist.

Widely recognized for his work with forage crops, Hoveland participated in the International Grassland Congress in 1960 in Reading, England and again in 1966 in Helsinki, Finland. During 1972 he was elected both Chairman of a division on Crop Quality and Utilization of Crop Science Society of America and Secretary of Southern Section of th American Society of Agronomy. He currently serving as editor of a new textbook on crop quality to be published by the Agronomy Society.

HIGHLIGHTS of Agricultural Research

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ON THE COVER. Artist's conception the Beef Cattle Nutrition Research Unit the proposed new Main Station facilities.

MANAGING SERALA SERICEA for FORAGE

C. S. HOVELAND and R. F. McCORMICK, JR.
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SERALA, a fine-stemmed sericea variety, is being planted on an increasing acreage for hay and grazing. Unfortunately, we have not known much about how to manage it. Recent research suggests that the productivity of this forage legume is influenced by cutting management.

In a 3-year experiment on an established stand of Serala sericea at the Plant Breeding Unit, forage was harvested at 3, 6, or 9-week intervals with stubble heights of 1½ or 4 in. Harvesting began in April and was terminated in June, August, or October to determine the effect on root carbohydrate storage and growth the following year.

Results

Forage yields were highest (over 4 tons/A.) when sericea was cut three times a year at 9-week intervals, see figure. Harvesting two hay cuts, one in June and one in early August, resulted in yields nearly equal to that from three cuts a year. Stubble height had little effect on forage yield or stand persistence when sericea was cut at the hay stage.

When sericea was cut every 3 weeks to simulate grazing, forage yields were one-half to two-thirds those obtained when cut at the hay stage (every 9 weeks), see figure. Yields declined each year when sericea was cut every 3 weeks from April to October, especially where a short stubble was used. Leaving a 4-in. stubble on plants cut every 3 weeks resulted in higher forage yields and better stand persistence than leaving a 1½-in. stubble. Also, a high stubble improved spring growth on a sward subjected to frequent harvesting the previous year. Spring growth and stand persistence were very different between the two stubble heights by the third year.

Reduced food reserves in the roots accounted for the reduced yields and stands of sericea cut frequently to a low stubble. There was 60% more stored food in roots of frequently-cut sericea with a 4-in. than a 1½-in. stubble. High stubble plants also maintained about twice as many live buds as short stubble plants, and this contributed to rapid recovery growth.

Grazing Effects

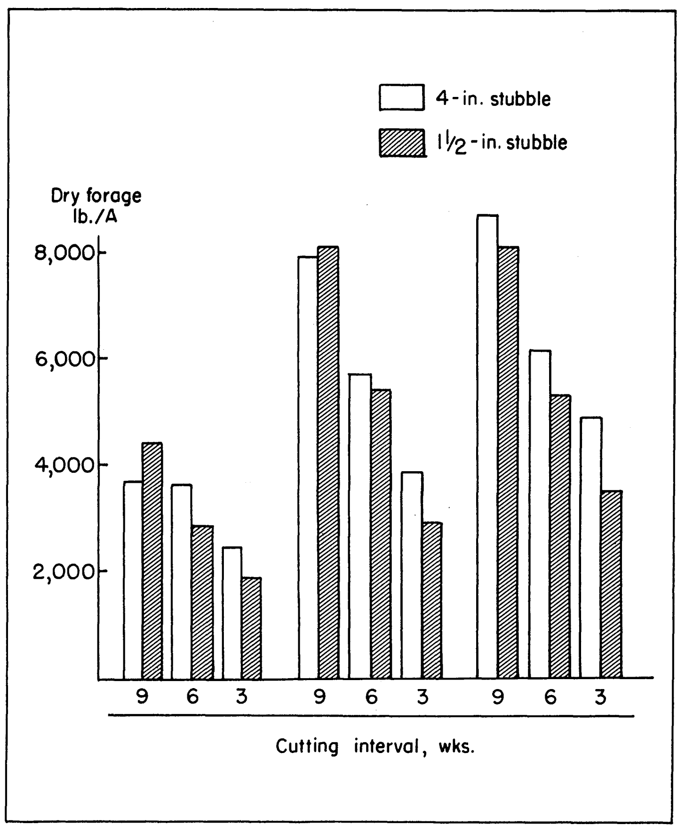
These results indicate that if sericea is to be grazed, it is essential to maintain a high stubble and permit plants to accumulate food reserves. Even so, Serala sericea productivity will be lower under grazing than hay production.

Stubble height had little effect on forage quality as measured by digestible dry matter (DDM), see table. However, frequent harvest resulted in forage with a higher DDM. Sericea conserved for hay should be cut at 12-14 in. height to ensure high DDM without damaging the stand or dry matter yield. In this study the 6-week growth had a higher DDM than 9-week forage, but the more frequent cutting reduced yields and stands. Under grazing, cattle will selectively graze the more nutritious portions of the plants. Therefore, grazed forage will always be considerably more nutritious than the same forage harvested for hay.

TABLE 1. SERALA SERICEA AVERAGE DIGESTIBLE DRY MATTER (DDM) AS AFFECTED BY MANAGEMENT

Harvest frequency	Stubble height	DDM in forage
Wks.	*In.*	*Pct.*
9	4	48
	1½	47
6	4	52
	1½	52
	4	52
	1½	55

Results of this experiment show that Serala sericea cut twice a year, once in June and once in August, can produce 4 tons of hay with no ill effect on stands or subsequent productivity. If Serala sericea is to be grazed year after year, no less than a 4-in. stubble should be maintained. Otherwise, stands and production can be expected to decline.



Three-year average forage yields for sericea at two stubble heights and three cutting intervals. Cutting was terminated on June 23 for the yields on the left, Aug. 4 for those in the center, and Oct. 6 for those on the right.

WHAT'S HAPPENING TO FARM INCOME?

J. H. YEAGER, Department of Agricultural Economics and Rural Sociology

ONE WAY TO MEASURE what's happening in Alabama agriculture is in terms of income changes. Just as with the proverbial elephant, however, there are many ways of looking at income. One standard way is the USDA Economic Research Service procedure that uses the following nomenclature as to kinds of farm income:

Realized gross farm income = cash receipts from farm marketings + government payments + the value of home consumption of farm products + gross rental value of farm dwellings.

Realized net farm income = realized gross farm income − farm production expenses.

Total net farm income = realized net farm income ± net change in farm inventories.

A net increase in inventory is considered as income and a net decrease is an expense. Thus, total net farm income reflects the overall situation for the year. If expenses are for items that increase inventory rather than for production of farm products sold during the year, this is reflected in the total net farm income figure.

Cash receipts from marketings by Alabama farmers in 1971 were over $810 million, an increase of more than 50% from 1961. Government payments also increased, although they were not as great in 1971 as during 1966-70. The value of home consumed farm products dropped almost 50% during 1961-71, but rental value of farm dwellings increased substantially. Including these items pushed realized Alabama gross farm income to $967.6 million in 1971, as shown below:

Item	Income, million dollars 1961	1971
Cash receipts from farm marketings	516.0	810.4
Government payments	19.5	60.9
Value of home consumption	49.5	23.0
Gross rental value of farm dwellings	27.9	73.3
Realized gross farm income	613.0	967.6
Farm production expenses	384.5	680.4
Realized net farm income	228.5	287.1
Net change in farm inventories	12.1	30.8
TOTAL NET FARM INCOME	240.6	317.9

SOURCE: *Farm Income, State Estimates,* 1959-71, ERS, USDA.

Expenses which had to be paid out of gross income went up a staggering 77% from 1961 to 1971 while gross farm income was increasing only 58%. At present, farm production expenses take about $2 of each $3 of realized gross income. Deducting production expenses left a realized net farm income of $287.1 million for Alabama farmers in 1971.

Some Alabama farmers increased their inventories of livestock, feed, seed, supplies, and other items while others had declining inventories. Adjusting for net change in inventory resulted in 1971 total net farm income of $317.9 million, up from $240.6 million in 1961. This is a 32% increase in 10 years, as compared with the U.S. average of 34% growth.

The substantial decline in number of Alabama farms and increases in production per farm during 1961-71 resulted in an 83% increase in total net income per farm. Alabama's net in 1971 averaged $3,830 per farm, compared with $6,049 for the Nation. There is little evidence that Alabama gained relative to the U.S. in this income measure during 1961-71, varying from 54% of the national average net farm income in 1967 to a high of 75% in 1963.

Farmers are depending more and more on income from nonfarm sources. In 1971, total personal income of the U.S. farm population was $15.6 billion from farm sources and $13.9 billion from nonfarm sources. This reflects a large change since 1961 when only 38% came from nonfarm sources. Per capita purchasing power of the farm population has shown considerable increase since 1961, with rising personal incomes from both farm and nonfarm sources.

Recent years have seen spectacular changes in sources of Alabama cash farm receipts from farm marketings. As late as 1955, almost 60% came from sale of crops. In 1971 some 65% of farm receipts were from livestock and livestock products (including poultry), as shown in the table. The 1971 figure was actually down from a high of 73% from livestock and products in 1969.

Broilers brought in more sales dollars than cattle and calves in 1971, but estimates for 1972 indicate cattle and calves exceeded broilers that year. The third major source of cash farm receipts to Alabama farmers in 1971 was cotton and cottonseed, while eggs ranked fourth.

The greatest percentage increase in cash receipts was for soybeans, with sales going from $6.7 million in 1961 to $47.1 million in 1971. Cash receipts from peanuts also registered a substantial increase. As has been the trend for several years, 1961-71 was a period of declining cash receipts from sales of cotton and cottonseed and corn.

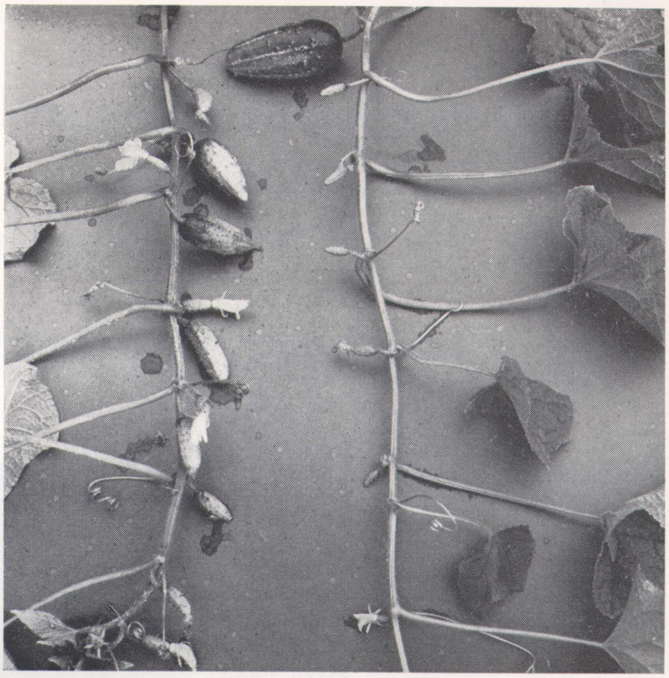
Changes among kinds of farm income in the past 10 years reflect major trends taking place and point to what can be expected in the farm income story in the years ahead.

CASH FARM RECEIPTS BY COMMODITIES, ALABAMA, 1961 AND 1971

Commodity	Cash receipts 1961	1971
	Mil. dol.	*Mil. dol.*
Broilers	87,532	170,999
Cattle and calves	85,508	157,950
Eggs	45,227	82,214
Dairy products	40,838	55,384
Hogs	40,490	53,917
Other	5,101	4,820
Total livestock and products	304,696	525,784
Cotton and seed	112,137	92,699
Peanuts	21,914	57,892
Corn	14,846	10,287
Soybeans	6,760	47,095
Fruits and nuts	12,486	16,625
Forest products	13,731	13,800
Greenhouse and nursery	9,333	13,157
Other	20,209	33,015
Total crops	211,416	284,570
Total from marketings	516,112	810,355
Government payments	22,679	60,901
TOTAL	538,791	871,256

SOURCE: *Farm Income,* ERS, USDA.

Untreated Southern Cross cucumber plant at right shows characteristic single-fruit development, whereas morphactin treated vine at left has many cucumbers developing.



machine harvest of cucumbers may be just around the corner

JAMES E. BARRETT III and HARRY J. AMLING
Department of Horticulture

ONCE-OVER MECHANICAL harvesting is a reality for many vegetable crops, but the pickling cucumber has resisted best efforts.

Major stumbling block has been a characteristic fruiting habit of cucumbers that results in growth of only one or two cucumbers at a time on a vine. Reason for this is that a developing seeded cucumber inhibits growth of other less developed fruit on a vine. Removing the oldest cucumber results in development of only the oldest remaining fruit. Thus, the only way to get high production is to harvest periodically, and this means hand harvesting. For example, periodically harvested plants at Auburn produced 10.7 fruits per plant but those harvested only once made just 2.0 fruit each.

Now there appears a good chance to solve this problem and permit once-over harvest. Chemical treatment may overcome the depressant effect so all cucumbers set on the vine can develop concurrently.

Since seedless (parthenocarpic) cucumbers do not exert the inhibiting effect, Auburn research has concentrated on use of growth regulators. The aim was to identify a regulator that would either induce seedless fruit or interfere with the depressant effect of developing fruit and allow all fruit that set to develop.

Not until 1971 when the growth regulating chemicals morphactins were first tried was there success against the crop depressant effect. Preliminary greenhouse experiments indicated that seedless cucumbers could be induced some times with a formulation of morphactin IT 3456 (containing 80% methylester of 2 chlorofluorenol-9-carbonic acid). However, the chemicals did not increase fruit set considerably in the greenhouse.

The study shifted to the field with a planting of Southern Cross cucumbers on August 20, 1971. Foliar applications of morphactin plus surfactant at 10, 20, and 40 p.p.m. were made approximately 5 days after bloom of first flower. Fruit set was increased 25, 53, and 34%, respectively, while vine length, number of nodes, and number of lateral branches were decreased.

On an August 30, 1971, planting of Southern Cross, fruit set was increased 37, 58, 49, and 48% by 10, 20, 40, and 80 p.p.m. morphactin, respectively, applied at bloom of first flower. Treatments applied 1 week before bloom decreased fruit set.

Largest fruiting increases came from morphactin applied 4-5 days after first bloom: 73, 76, and 95% for treatments of 20, 40, and 80 p.p.m.

Repeated applications starting 4 to 5 days after bloom of first flower did not alter results. Seedless fruit were induced in treatments where pollination was prevented, but where pollination was not prevented fruit was seeded. Seed cavity size of seedless fruit was decreased and in seeded fruit increased by morphactin treatments.

Variety differences in the table were found in 1972 when morphactins were applied 5 days after first bloom (as in 1971) to Southern Cross and Explorer. A second morphactin was also evaluated, morphactin IT 5732 (a formulation containing primarily 2-chloro-fluorenecarbonicacid (9)-methylester).

Both morphactins increased the number of fruit on Southern Cross plants with IT 3456 being most effective. However, there was no effect on fruiting by Explorer plants. Results are dramatically illustrated by the treated and untreated Southern Cross plants in the photo.

The morphactins appeared to slow growth of the oldest fruit while promoting set and development of more immature fruit. Harvest in 1972 was done when fruit on untreated plants reached harvestable size. Delaying harvest might have resulted in morphactin treated plants having many more fruit in the No. 1 and No. 2 sizes, which are most profitable.

EFFECT OF MORPHACTINS[1] ON NUMBER OF FRUIT PER PLANT BY GRADES, TWO VARIETIES

Treatment	Fruit per plant, by grades[2]					
	No. 0	No. 1	No. 2	No. 3	No. 4	Total
	No.	*No.*	*No.*	*No.*	*No.*	*No.*
Southern Cross						
Check (untreated)	0.60	0.63	0.75	1.30	0.18	3.46
Morphactin 1, 20 p.p.m.	3.33	2.75	1.25	.23	.03	7.59
Morphactin 1, 40 p.p.m.	2.95	2.25	.53	.13	.05	5.91
Morphactin 2, 20 p.p.m.	1.08	1.13	1.15	1.10	.10	4.56
Explorer						
Check (untreated)	.40	.58	.63	.45	.30	2.36
Morphactin 1, 20 p.p.m.	.65	.70	.50	.40	.13	2.38
Morphactin 1, 40 p.p.m.	.65	1.00	.55	.25	.18	2.63
Morphactin 2, 20 p.p.m.	.20	.33	.43	.73	.38	2.07

[1] Morphactin 1 was IT 3456 and morphactin 2 was IT 5732, provided by E. Merck AG, Dramstadt, Germany. Applied 5 days after bloom of first flower.

[2] Grades: 0 = fruit obviously set but less than 5/16 in. in diameter; 1 = less than 1 in.; 2 = 1 to 1½ in.; 3 = 1½ to 2 in.; and 4 = 2 to 2¼ in. diameter.

Longer Lasting Control of Peanut Leafspot by Use of Systemic Fungicides

E. M. CLARK, *Department of Botany and Microbiology*

LEAFSPOT OF PEANUTS, caused by the fungus *Cercospora,* is the most important disease that concerns every peanut grower. The effectiveness of fungicides used to control leafspot has been dependent on their capability of maintaining a protective film or coating on the leaf surface. Thus, when a *Cercospora* spore falls on the leaf, it comes in contact with the fungicide and is killed. The duration of protection depends largely on rainfall which washes the fungicide from the leaf. The recent development of systemic fungicides alters this situation.

To better understand how the different action of systemic fungicides affects the timing of spray applications the life cycle of the *Cercospora* fungus will be described briefly. First, under conditions of high humidity, fungus spores are produced on plant residue in the soil or on infected leaves. Subsequently, in dry or wet weather, the spores are transmitted to the leaf by wind, rain splash, or insects. Then, with moisture the spores germinate and, if the moisture continues for about 18 hours, the germ tubes penetrate the leaf – if the leaf dries before the penetration the spore is killed. After leaf penetration the germ tube branches, and grows between the cells and into the cells eventually killing them. In about 10 days a light chlorotic fleck can be detected at the infection site. Four days later the fleck has developed into an obvious leafspot. After another week of development the leafspot will produce new spores if subjected to an accumulated total of 24 to 48 hours of relative humidity close to 100%. Spores remain where produced until dislodged and disseminated to another site, and the cycle begins again. The disease cycle depicted in the following chart shows time relationships in the development of early leafspot of peanuts (*Cercospora arachidicola*). Late leafspot (*C. personata*) is similar, each part of the cycle taking about one quarter of the time longer.

The degree of control received from Benlate 50 W over the check is shown in this photo.

Non-systemic fungicides remain on the leaf surface while systemic fungicides penetrate cells. This difference influences both the time and frequency of spray applications for leafspot control. The most vulnerable part of the life cycle of the fungus is the period when the spore is resting on its new site. If a fungicide is present, the spore is killed. If the leaf is wetted, inducing spore germination, and then dries within a few hours, the spore dies. The non-systemic fungicide must be present on the leaf surface to kill the spore before the germ tube penetrates, see A on Figure. The systemic fungicide penetrates the leaf and has been found to be effective against the early stages of the fungus growing within the leaf. Consequently, it can be applied after infection has taken place, see B on Figure, and still be effective. The systemic fungicide has two additional advantages over the non-systemic: (1) Coverage does not need to be complete: If only one side of a leaf is sprayed, both sides are protected. (2) Once the material penetrates the leaf it cannot be washed off and so retains its effectiveness regardless of weather.

Two systemic fungicides presently are being tested in Auburn's research on peanut leafspot control, Benlate® 50W, and Topsin M® 70W. Benlate® 50W is widely available while Topsin M® 70W has not yet been registered for peanut disease control. Less research has been done on Topsin M® 70W than on Benlate® 50W, but tests show them to be very similar in effect.

To determine the effectiveness of systemic fungicides applied *after* infection had occurred, fungicides were sprayed on the leaves 72 hours after *Cercospora* spores were applied with the following results: Check (no fungicide applied) – heavy infection, Bravo® 6F (non-systemic fungicide) – heavy infection, Topsin M® 70W (systemic fungicide) – very light infection, and Benlate® 50W (systemic fungicide) – very light infection.

Experiments have shown that leaves sprayed with Benlate® 50W are protected from *Cercospora* infection up to about 6 weeks. However, new leaves which open after the fungicide is applied are easily infected indicating that the protective material is systemic but does not move into new growth.

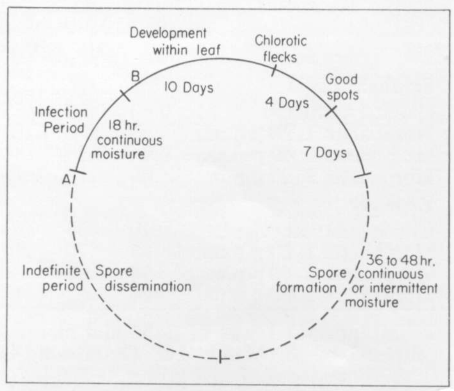
If a peanut grower is using Benlate® 50W to control leafspot he should consider the following factors in making a decision on whether or not to spray:

(1) *Cercospora* spores are probably present on the leaves, especially if a low level of infection already exists in the field.

(2) Very little new infection will occur unless the leaves are wet continuously by rain or dew for about 18 hours or more.

(3) The systemic fungicide can be applied within 72 hours of the beginning of the wet period and still give reasonable control.

(4) The amount of foliar growth of the plants since the previous spray must be considered. The fungicide is applied to protect new foliage, since old leaves probably are still protected by previous sprays.



This shows the time and moisture relationships in the life cycle of the peanut leafspot fungus.

DAIRY COW RESPONSES to ABRUPT RATION CHANGES

GEORGE E. HAWKINS
Dept. of Animal and Dairy Sciences

FEED COST represents about 50% of milk production costs. This makes it desirable to reduce feed costs whenever possible providing it can be done without hurting production.

Because dairy cows have requirements for energy, protein or nitrogen, minerals, and vitamins, but no requirement for a specific feed ingredient, it is possible to formulate satisfactory rations using different combinations of ingredients. Costs of the different rations would vary according to cost of individual ingredients. Minimum cost mixtures that did not reduce performance would therefore be expected to reduce feed cost and thereby increase the dairyman's profits.

Since prices of feed ingredients change, a study was conducted at Auburn to: (a) determine if changes in prices of feed ingredients would be large enough to produce major shifts in the makeup of rations formulated by the least-cost principle; and (b) determine the effect of the resulting changes in ration formulations on medium to high producing dairy cows when they were abruptly switched from one ration to the next.

Feeding Trials

Two trials were conducted, one with high and one with medium producing cows. Within trials cows were divided into a control and a test group. Rations were reformulated monthly and fed to the test group. Concentrate ingredients and percentages for the control group remained the same throughout trial 1 (135-days) and trial 2 (110-days). The only restrictions imposed on the test rations were: (a) using average composition values, the ENE must exceed 60 therms per 100 lb. of ration dry matter; (b) urea nitrogen must be 25% or less of total nitrogen in the ration; (c) molasses must be 10% or less of ration dry matter; and (d) crude fiber must be 13 to 18% range. The roughage was corn silage in trial 1 and chopped Coastal bermudagrass hay in trial 2. Roughage and concentrates were combined and fed as blended rations.

During a standardization period in which all cows were fed the same ration, cows used in trial 1 produced an average of 60.2 lb. of milk daily (41.4 to 79.2) and cows in trial 2 averaged 36.6 lb. (29.0 to 55.5). At the end of the standardization period the ration of cows assigned to the least-cost group was changed abruptly. Their ration was changed abruptly two other times during the experiment. The cows in the control group received the same ration throughout the experiment as that fed during the standardization period.

Change in ingredients is a characteristic of least-cost rations. This characteristic is illustrated by the variable amounts of several feed ingredients that were in the test rations at different times. The percentage ranges of each ingredient in the least-cost ration formulations were: citrus pulp, 0-30; corn gluten feed, 0-23; cottonseed meal, 0-4; fat, 0-2.8; hominy feed, 0-35; milo, 0-26; molasses, 0-6; oats, 0-17; soybean meal, 0-7; urea, 0-1.2; wheat shorts, 0-30; and wheat bran, 0-20.

Results

Data given in the table are averages for trials 1 and 2. As shown, the average crude protein contents of the control and least-cost rations were similar. However, crude fiber content of least-cost rations averaged higher than that of the controls. Ranges in crude protein and crude fiber contents of the least-cost rations were greater than for the control rations. This deviation in the least-cost rations probably resulted from differences between the actual composition of concentrate ingredients and the average values assigned to these ingredients. Average digestible energy was essentially the same for the control and the least-cost rations. Also, the average intakes of feed dry matter by cows were similar. Intake fluctuated more, particularly during trial 1, for cows fed least-cost rations than for those fed the control ration.

RATION QUALITY AND PERFORMANCE OF TEST COWS

Performance criteria	Control rations	Least-cost rations
Crude protein, % of DM	14.4[1]	14.4[2]
Crude fiber, % of DM	15.0[3]	16.8[4]
Digest. energy, %	66.6	67.9
DM intake/100 lb. wt.[5]	4.2	4.2
Mean body wt., lb.	1,211.0	1,202.0
Milk yield/cow, lb.[5]	49.1	45.0
Milk fat, %	3.29	3.44

[1] Range, 12.5 to 15.5 % of dry matter (DM).
[2] Range, 11.2 to 15.7 % of DM.
[3] Range, 12.8 to 17.5 % of DM.
[4] Range, 12.4 to 20.8 % of DM.
[5] Daily basis. Milk yield per cow averaged 50.1 lb. daily during standardization.

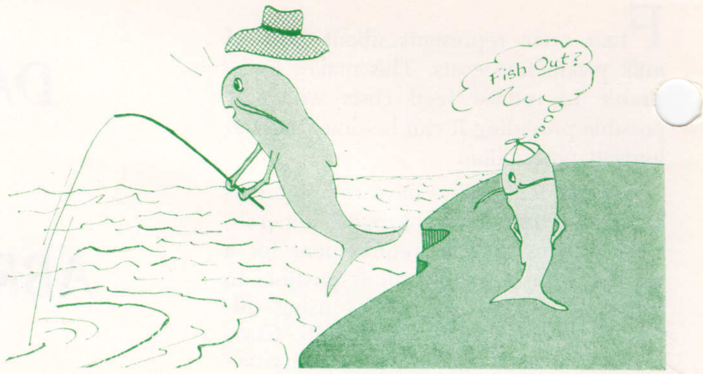
Cows fed the control ration produced more milk with a slightly lower fat content than cows fed the abruptly changed least-cost rations, see table, and the effect was greatest on highest producers. These relationships held for both trials. Production differences cannot be explained by differences in feed intake, digestibility of ration, or weight gains.

Adaptation

The concept of feeding least-cost rations has merit, but it is not practical to change abruptly from one low-cost ration to another. The change should be made gradually. Studies are in progress to determine the number of days needed to make the change from one formulation to the next without affecting milk production.

For any type of least-cost ration program, it would be wise to purchase ingredients on a guaranteed analysis basis because the chemical composition of a given lot of an ingredient may differ from the average composition for that ingredient.

Raise CATFISH for FUN and PROFIT - - or NEITHER



E. W. McCOY and J. E. RUZIC
Dept. of Agricultural Economics and Rural Sociology

Outdoor recreation demands of all types have been increasing with a growing population and rising incomes. Increased urbanization has simultaneously limited the number of people with direct access to their own recreational facilities. To cope with this increased demand, recreation complexes and facilities have and are being built in all sections of the U.S. The people of Alabama are meeting the demand by building additional State parks, golf courses, camp sites, and hunting preserves and by increasing fishing opportunities.

Increased fishing opportunities occur in two ways. The first is management of existing water to increase the amount of harvestable fish. This includes stocking of fish, fertilizing water, and maintaining water quality. The second is increasing water resources by constructing additional impoundments and farm ponds. The greatest increase by far has been in the number and acreage of farm ponds. Most of the farm ponds have been stocked with bass and bream; however, a shift to catfish has taken place during the last few years. In 1965 there were less than 50 public fishout ponds stocked primarily with catfish. By 1970 the number had increased to approximately 700.

Pond Types

Public fishout ponds are generally of two types. Some are opened for a short period for fishing; then they are drained and the remaining fish are harvested and sold to commercial buyers. Other ponds are harvested by fishout only. In either case production methods are similar. Fingerling catfish are stocked in the pond and fed until they reach catchable size, usually ¾ to 1 lb.

While production costs are similar for the two types of operation, the net returns are quite different. In 1970 fishout producers averaged $27.19 net return to land, labor, and management per acre while producers who drained their ponds and harvested the fish after the initial fishout period received $157.74. The difference was primarily due to the fact that when a pond is drained and fish are harvested, a monetary return is gained for every fish produced. Fishout production results in higher returns per pound of fish harvested, but fewer pounds are harvested from each pond. As the pond is fished out the recreational aspects of fishing decline. Some producers attempt to alleviate this by continuous stocking of catchable size fish. The catchable size fish are purchased from live haulers or produced in other ponds on the same farm. The margin between purchase and sales price of such fish is small, however, making this type of operation feasible only in areas of high population density.

Profit and Loss

Approximately 70% of the recreational catfish producers sustained a loss from their operations in 1970, see table. The profitable operators generally used more feed and stocked fingerlings at a higher rate resulting in higher costs. The major difference was the $624 greater return due to sales of a greater quantity of fish. Profitable producers sold over 1,000 lb. of fish per acre while the unprofitable producers sold less than 200 lb.

Many producers, both recreational and commercial, have commented about the recreational aspects of feeding their fish.

Average Costs and Returns Per Acre of Catfish Produced by Profitable and Unprofitable Operations, Alabama, 1970

Item	Profitable	Unprofitable
	Dol.	*Dol.*
Variable cost	352.20	295.10
Fixed cost	52.20	65.31
Total cost	404.40	360.41
Total returns	725.25	101.25
Net returns	320.85	−259.16

When floating feed is used the catfish rise to the surface and can be viewed at all stages of growth. Additional value is gained from catching fish for home consumption. All producers reported relatively high levels of home consumption. Including fish for friends and cookouts, home consumption averaged more than 100 lb. per acre. The value of these fish reduced the loss sustained by some operations.

Unharvested fish did not represent a total loss. Most remained in the pond for use the following season. A minimum of feed is necessary to maintain such fish over winter, but the larger fish coul[d] limit survival of fingerlings restocked i[n] the same pond through competition for food.

Satisfaction

Many producers were satisfied with their operation even though the business sustained a loss. The catfish pond was a pleasant hobby, and the recreational benefits exceeded the loss sustained. In some cases any catfish sales were considered as profit since the pond was considered strictly a hobby. Some operators with losses were quite unhappy. The catfish operation was started with expectations of profits. Due to poor location or other factors the profits did not materialize. These producers were left with an investment and expenses but with no feasible means of recovering their losses.

Before entering the recreational catfish business an individual must clearly define his goals. Is the operation designed as a business or as a hobby? If it is a business the operator must consider factors such as location, advertising, and alternative markets. If a hobby, then the operator can buy some healthy fingerlings, ensure good pond aeration, use floating feed, and watch them grow. C[at]fish production can be both fun and pro[f]itable. It can also be neither.

Calculating Machine Performance Rates

E. S. RENOLL, *Department of Agricultural Engineering*

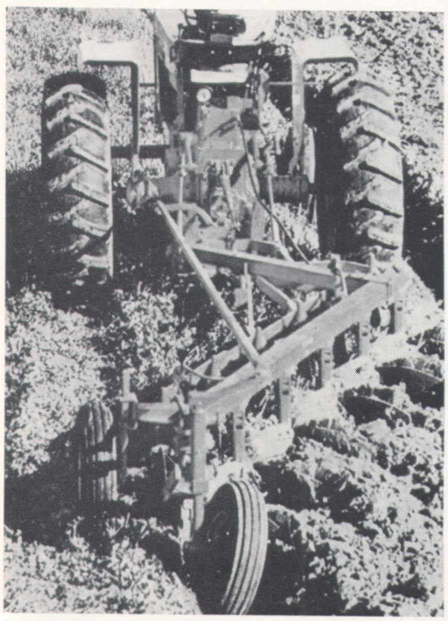
PERFORMANCE RATES of individual machines are important when planning for efficient utilization. This performance rate or capacity influences total investment in machinery, operating cost, and timeliness of field operations. It is usually expressed in acres per hour but can be expressed in bushels or tons per hour.

Machine capacity in a specific field is influenced by machine ground speed, working width, and lost production time. Lost production time includes row-end turning, filling hoppers or tanks, machine adjustment, and mechanical failure.

Since all machines have some lost time, none do productive work 100% of the time, and thus all are operating at less than 100% maximum capacity. Field efficiency is used to express the time actually spent doing productive work. For example, if a 4-row planter is in the field 8 hours but has 2 hours of lost time, the machine is only performing its function 75% or .75 of the time. The field efficiency for the planter thus is .75. Since the machine is performing its function only 75% of the total field time its machine capacity per field hour is also reduced in proportion. For this reason most formulas used in predicting field machine capacity include an estimate for field efficiency.

Calculating Machine Capacity

Certain basic information relating to machine operation must be known before capacity calculations can be made. This includes machine working width, ground speed, and field efficiency.



Machine working width, ground speed, and field efficiency must be known before machine capacity can be determined.

Two methods are commonly used to calculate machine capacity. The first method produces relatively accurate values while the second is used for obtaining a rough approximation.

Method 1. This method gives reliable results and uses the following formula.

$$C = \frac{5280 \times S \times W \times E}{43{,}560} = \frac{S \times W \times E}{8.25}$$

Where: C = Capacity in acres per hour
S = Ground speed in mph
W = Width of machine in feet
E = Field efficiency expressed in decimal
5,280 = Feet in a mile
43,560 = Square feet per acre

Example: 4-row planter, 36-inch rows
Speed 4 mph
Field efficiency .75
Machine width – 12 ft. $\left\{\frac{4 \times 36}{12}\right\}$

$$C = \frac{S \times W \times E}{8.25}$$

$$C = \frac{4 \text{ mph} \times 12 \text{ ft.} \times .75}{8.25}$$

$$= 4.35 \text{ acres/hour}$$

Machine	Field efficiency
Moldboard plow	0.80
Disk-harrow	0.80
Spring-tooth or spike-tooth harrow	0.80
Field cultivator	0.80
Row-crop cultivator	0.80
Rotary hoe	0.80
Row-crop planter (4-row, seed, pesticide and fertilizer)	0.60
Row-crop planter (4-row, seed and fertilizer)	0.65
Grain drill	0.70
Mower	0.75
Conditioner	0.75
Rake	0.80
Windrower	0.75
Baler	0.65
Rotary cutter	0.75
Forage harvester	0.65
Combine, small grain	0.65
Combine, corn	0.60
Cottonpicker	0.60
Fertilizer distributor	0.70
Anhydrous ammonia applicator	0.60
Sprayer	0.60

COMMON FIELD EFFICIENCY VALUES

One problem with this method is the difficulty of obtaining accurate estimates or values for field efficiency. Ideally each farm manager should obtain them for his own conditions and operations. However, this may require more record keeping than some farmers are willing to handle. The table gives some suggested average field efficiency values which were obtained from field research. These are recommended for use when actual field values are not available.

Values obtained by using Method 1 have been found to agree reasonably well with capacities obtained by timing machines in the field. These calculated values can be used in budgeting machinery use and in helping plan new machinery purchases.

Method 2. This is a short-cut method and is used only for obtaining a quick approximation in a simple and easy way and uses the following formula.

$$C = \frac{S \times W}{10}$$

Where: C = Capacity in acres per hour
W = Machine width in feet
S = Ground speed of machine in mph

This formula assumes a field efficiency of 82.5% or .825.

Example: 4-row planter, 36-inch rows
Speed – 4 mph
Machine width – 12 ft.

$$C = \frac{S \times W}{10}$$

$$C = \frac{4 \text{ mph} \times 12 \text{ ft.}}{10}$$

$$= 4.8 \text{ acres/hour}$$

Method 2 tends to over estimate the capacity of many machines. This is evident in the two examples shown where Method 1 resulted in a capacity of 4.35 acres per hour and method 2 in 4.8.

Machine capacity estimates are useful in planning for the judicious use and purchase of individual farm machines.

STACKING vs. BALE SYSTEMS OF HANDLING HAY

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TESTS INVOLVING a comparison of stack with bale systems of handling and feeding hay have been conducted for two feeding seasons, 1970-71 and 1971-72, at the Black Belt Substation, Marion Junction.

Based on results of the 1970-71 test, seven systems were tested or synthesized in the 1971-72 tests, involving four for steer feeding and three for cow and calf wintering operations. There were bale and stack system comparisons for each. Johnsongrass hay was used. Although the Black Belt Substation only harvested an average of about 475 tons of hay during the tests, costs were synthesized for 250 through 2,000 tons for analysis purposes in order that farmers might be better able to assess the best system for their particular size of operation. This report will emphasize the 1971-72 results as the 1970-71 results have been reported earlier.[1]

Seven systems were tested or synthesized for the 1971-72 season. The same hay conditioner and rake were used in all systems with adequate power available. Otherwise, different equipment for each system was as follows:

System 1 (bales) – New Holland Hayliner 277 Baler with New Holland Stakliner 1010 for transporting and feeding.

System 2 (bales) – New Holland Hayliner 277 Baler with New Holland Stakliner 1010 for transporting; pickup truck with two men for feeding.

System 3 (stacks) – Hesston Model 30 StakHand with Hesston Stakfeeder 60 for transporting and feeding.

System 4 (stacks) – Hesston Model 30 StakHand with Hesston Stakfeeder 30 for transporting and feeding.

System 5 (bales) – New Holland Hayliner 277 Baler with self propelled New Holland 1047 Stackcruiser for transporting; pickup truck with two men for feeding.

System 6 (stacks) – Hesston Model 30 StakHand with Hesston Stakmover 30 for transporting; self fed from stacks in the open.

System 7 (stacks) – Hesston Model 30 StakHand with Hesston Stakmover 30 for transporting; self fed from stacks enclosed in collapsible panels.

For the different systems, economic analysis indicated, as was the case in the 1970-71 tests, that the *harvesting and feeding costs per ton* were generally lower for the stack systems than for the bale systems, except at low average volumes of hay harvested per year for Systems 1 and 2 for steer feeding, Table 1. However, when *total costs per hundredweight gain and per cow and calf wintered* were computed, costs were lower for the bale systems in 1971-72, as was the case in 1970-71, and for the same reasons – trampling and wastage, resulting in more hay required per hundredweight gain and per cow and calf wintered with the stack systems than for the bale systems, Table 2.

It appears from the tests over the 2 years, that if trampling and wastage could be reduced sufficiently under the stack systems tested, these systems *could* be the least costly methods of hay-making and feeding. Otherwise, losses from trampling and spoilage can easily outweigh the cost economies of the stack systems on the heavy Black Belt soils which were involved in these tests, causing costs per hundredweight gain and per cow and calf wintered to be lower for the bale system.

Collapsible panels around stacks in one cow and calf wintering operation, System 7 did reduce wastage considerably, compared with the comparable system without panels, System 6, and appear promising as one solution to the trampling and wastage problem.

TABLE 1. HAY HARVESTING AND FEEDING COST PER TON HARVESTED, FOR DIFFERENT HARVESTING AND FEEDING SYSTEMS, BLACK BELT SUBSTATION, ALABAMA, 1971-72[1]

	Cost per ton when average tons harvested per year are			
	250	500	1,000	2,000
Steer feeding systems				
System 1 (bales)	$16.10	$11.09	$ 8.59	$ 7.35
System 2 (bales)	17.86	13.13	10.77	9.59
System 3 (stacks)	19.68	12.35	8.69	6.85
System 4 (stacks)	17.77	11.29	8.07	6.45
Cow and calf wintering systems				
System 5 (bales)	$20.91	$14.68	$11.56	$10.01
System 6 (stacks)	15.31	9.77	7.02	5.63
System 7 (stacks)	15.96	10.42	7.67	6.28

[1] Includes costs of harvesting and feeding *only*. Excludes cost of growing hay and cost of supplemental feed.

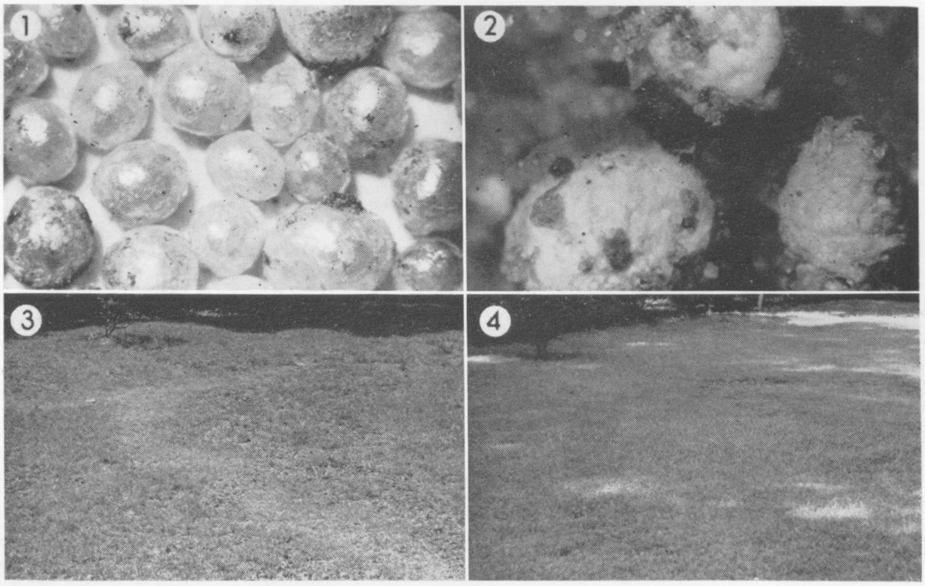
TABLE 2. COST PER CWT. GAIN AND PER COW AND CALF WINTERED, FOR DIFFERENT SYSTEMS OF HAY HARVESTING AND FEEDING, BLACK BELT SUBSTATION, ALABAMA, 1971-72[1]

	Cost per unit when average tons harvested per year are			
	250	500	1,000	2,000
Steer feeding systems				
System 1 (bales)	$28.61	$25.42	$23.83	$23.05
System 2 (bales)	29.73	26.72	25.22	24.47
System 3 (stacks)	36.15	30.12	27.11	25.59
System 4 (stacks)	34.58	29.24	26.60	25.26
Cow and calf wintering systems				
System 5 (bales)	$34.76	$28.90	$25.97	$24.51
System 6 (stacks)	47.30	38.32	33.86	31.60
System 7 (stacks)	40.41	33.21	29.65	27.85

[1] Includes cost of production, harvesting, and feeding hay as well as cost of other feed supplements fed.

[1] Progress Report Series No. 97 and Highlights of Agricultural Research, Vol. 18, No. 4.

Encysted ground pearls (1) damage plant roots, while egg masses (2) indicate that another generation is about to appear. Damaged lawn (3) was treated in summer 1969 and showed much recovery (4) by 1970.



Methods Sought for Controlling Pesky Ground Pearls in Lawns

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RAYMOND L. SELF, Ornamental Horticulture Field Station

GROUND PEARLS are scale insects that infest the roots of lawn grasses. They are called ground pearls because of the pearl-like appearance of cysts that enclose immature stages of the insect (picture 1). These cysts can be found in the soil throughout the year. The insects feed with slender sucking mouth parts that extend through the wall of the cyst and are inserted into the plant root. The species in Alabama is *Margarodes meridionalis*.

Heaviest Alabama infestations of ground pearls occur in Mobile, although the insect is widely distributed over the southern half of the State. All common lawn grasses (centipede, bermuda, zoysia, St. Augustine) have been found infested.

Lawn damage is noticed when areas of grass become unthrifty or die. However, there is no known relationship between number of ground pearls per unit of soil and extent of damage to grass. Moreover, direct damage to grass by ground pearls is frequently masked by the effect of other pests and by such factors as irrigation and fertilization.

Research on ground pearls has been disappointing throughout the United States, generally leading to inconclusive results. A major difficulty in studying this insect is that the number of pearls varies considerably from place to place even within a small infested area. This variability is a serious handicap to satisfactory sampling.

Life History Learned

Ground pearl research at Auburn University Agricultural Experiment Station has provided information on life history of the pest. Females reach maturity and emerge from the cysts during late May. The wingless female moves in the soil for a while, then settles down, covers itself with waxy secretions, and deposits about 100 eggs. The presence of these egg masses (picture 2) in the soil indicates that a new generation is about to begin. Egg laying continues into July and egg hatching into August. After hatching, the young start feeding on grass roots and protect themselves by forming a cyst.

Chemical Control Tried

Chemical control tests were conducted at the Ornamental Horticulture Field Station, Mobile, and at other State locations.

In one test, insecticides were applied to a centipede lawn at Fairhope in July 1969, aimed at controlling the hatching young. The following spring the lawn was properly fertilized and received abundant water.

Post-treatment sampling in May 1970 showed that Thimet + Zinophos, Dasanit, and Dyfonate (12 lb. active ingredient per acre) reduced populations more than other materials tested. Maximum reduction in number of pearls was 80%. Additional observations indicated that proper fertilization and irrigation were helpful in improving appearance of the grass.

Results of the treatment are evident in pictures 3 and 4. Picture 3 was made in July 1969 prior to treatment. Picture 4, made in July 1970, shows substantial recovery of the grass. The following season, however, the lawn was grossly neglected and the grass appeared as damaged in 1971 as it had in 1969 before treatment. The number of pearls had increased considerably, also.

Results Suggest Action Needed

Although the beneficial effects in this test were short lived, the pictorial sequence suggests that ground pearl control can be obtained. Results further suggest that insecticidal applications and good care of the lawn are important in reducing damage.

At present there is no single insecticidal treatment that will guarantee long-term ground pearl control. Since relative susceptibility of the pest's developmental stages to insecticides is unknown, timing of application for maximum effectiveness has not been established. Promising approaches to effective control include insecticidal treatments in May against the emerging female, systemic insecticides applied in early spring against the developing insects, or multiple applications during the season. However, these various approaches need further evaluation and comparison.

Southern Yellow Pine Plywood Sheathing - - - AN EVALUATION

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Department of Forestry

Of all new houses built in the U.S.A., more than 90% have woodframe walls with plywood sheathing, more than 75% have plywood roof sheathing, and more than 55% have plywood subfloors or underlayment.

Ten years ago, plywood sheathing was produced exclusively in the West Coast area, primarily from Douglas fir. The South presently produces approximately 33% of the Nation's needs in plywood sheathing. It has been estimated that by 1980 the South could, under the most favorable conditions, account for 59% of the Nation's softwood plywood production.

This article summarizes experimental results of an evaluation of three constructions of ½-in. thick southern pine plywood for the benefit of both producers and consumers of this product. The evaluation considered only flexural and panel shear properties and dimensional stability in relation to panel cost, though other properties are also recognized as being important.

Background

In the past, most ½-in. southern yellow pine sheathing has been manufactured with 5-plies, with each veneer sheet 1/10-in. thick. A small percentage was and still is manufactured as 3-ply, with all plies 1/6-in. in thickness. Currently, however, more than 80% of the total production output is 4-ply, with all plies 1/8-in. in thickness. This 4-ply plywood basically has the same characteristics as 3-ply, since the grains of the two middle plies are oriented parallel to one another but perpendicular to the faces.

Since the 5-ply panel has 4 glue lines, the 4-ply has 3 glue lines, and the 3-ply only 2 glue lines, cost of production varies. Also other manufacturing costs, such as for veneer peeling, veneer sorting, assembling, and curing increase with decreasing veneer thickness. It has been estimated by several manufacturers of southern pine plywood that overall manufacturing costs of 3-ply panels are approximately 15% lower than those of 5-ply and 8% lower than 4-ply construction.

Test Procedures

Nine panels 4 x 8 ft., ½-in.-thick, of southern yellow pine plywood were constructed in a plywood mill. All veneer was peeled from a single tree of loblolly pine (*Pinus taeda*, L.). All veneer used for the construction of all panels (faces, cores, and cross bands) was selected so as to be of equal quality, free from all visible defects. A commercial extended phenolic resin was used with 90 lb. spread per MDGL (1,000 sq. ft. of double glue line) for bonding all panels. Panels were prepressed at room temperature with 160 psi. for 3 min. and then hot pressed with 200 psi. at 285°F for 6½ min. Cured panels were cooled under pressure and then stored in a conditioned room at 50% RH and 73°F until testing.

Ten plywood specimens were cut from each panel (3 panels x 3 constructions x 10 = 90 specimens altogether) and tested to failure in static bending with face grain orientation parallel to span, according to ASTM Standards D805-63.

Ten 15 x 15-in. panel specimens, with face grain orientation parallel to two opposite edges, were cut from panels of each plywood construction. These panels were used for determining dimensional stability as well as for panel shear tests.

Summary and Conclusions

Results of these tests indicate that among the three constructions (3-ply, 4-ply, and 5-ply) of ½-in. southern yellow pine plywood considered, 3-ply panels are the most efficient for subflooring. That is, the 3-ply plywood would perform best at the lowest cost. Among the three constructions, the 3-ply can support higher flexural loads and deflect less as subflooring than the 4-ply and 5-ply when panels are used with face grain orientation parallel to span (perpendicular to the joists). Specifically, at 16-in. spans, flexural strength and stiffness of 3-ply panels are approximately 8% higher than those of 4-ply panels, while the manufacturing cost of 3-ply plywood is approximately 5-8% less.

Similarly, results indicate that the 5-ply construction is inefficient for subflooring when compared to the manufacturing cost and the flexural properties of either 3-ply or 4-ply constructions. Flexural strength and stiffness (with face grain orientation parallel to span) of 5-ply panels over 16-in. spans are 10 and 21% lower, respectively, than corresponding properties of 3-ply plywood, while manufacturing cost of the 5-ply is approximately 10-15% higher.

Uses

Although the 3-ply construction exhibits significantly larger dimensional changes than the other two panels, it appears that this would create few if any problems in use as subflooring since moisture changes in modern housing are not large enough to produce appreciable internal stresses.

For utilization as roof sheathing, where moisture changes are not as well controlled as in subflooring, dimensional changes of the 3-ply construction might cause some trouble. Therefore, the 4-ply construction becomes more desirable and is highly competitive. Internal stresses in the 3-ply panels used as roof sheathing, however, could easily be restrained by additional nailing, but only at increased installation cost.

Ration Fed to Cows Affects Horn Flies

JOHN R. BOURNE and KIRBY L. HAYS, *Department of Zoology-Entomology*

THE WORLD to a horn fly is a cow. The cow provides a warm, moist place for the adult fly to live, and food is there for the taking. All the fly has to do is probe the cow's skin with its proboscis and begin sucking blood.

Since a cow provides all of life's needs, an adult horn fly seldom leaves its home. One exception is that the female leaves to lay eggs – in fresh manure while it still contains body heat.

The female flies to a fresh manure pile, crawls under it or into a crack and lays her brownish eggs, placing them in the manure itself. She then returns to the cow. The eggs hatch and the horn fly larvae live in and feed on the manure before migrating to the soil to pupate.

Since manure is the primary habitat of the immature stages of the pesky horn fly, constituents of manure must be of considerable importance to the fly. When this idea was investigated in Auburn research, nutrition of the host cow (in this case, roughage eaten) was found to affect growth and development of the horn flies.

Johnsongrass vs. Peanut Vine Hay

A grade Hereford steer and an Angus-Hereford steer were the test animals. In the first test the Hereford steer was fed johnsongrass hay and the Angus-Hereford got peanut vine hay. Feeds were reversed in the second test, with the Hereford getting peanut vine and the Angus-Hereford fed johnsongrass hay. Each steer was allowed all the hay he would eat and drinking water was available at all times. A colony of horn flies was maintained in the laboratory to provide eggs for use in the test.

Effects of diet were determined by growing horn flies in manure collected directly from the test steers. Dry wood shavings were mixed with the feces to absorb excess water and the eggs were placed in the mixture.

After the eggs hatched, the trays of manure were examined daily to observe growth of the larvae. When all larvae had pupated they were recovered, 50 were weighed, and all were held for emergence of the adult. Emerged adults were anesthetized with carbon dioxide and weighed. The percentage of adults emerging from pupae was calculated.

Flies Showed Differences

Size difference showed up among the horn flies, favoring the peanut vine hay manure. Horn flies raised in this manure were always heavier in the pupal stage than those from the manure of johnsongrass-fed steer. This was true regardless of which steer consumed the hay, as shown by data in the table. The fly's pupal period was slightly longer when fed on feces from johnsongrass hay feeding than if grown in manure from peanut vine hay.

Pupae from johnsongrass hay feces were characteristically light brown, while those from peanut vine hay feces were always reddish brown.

A greater percentage of adults emerged from pupae raised in manure from steers fed peanut hay than that from johnsongrass hay feeding, regardless of which steer consumed the hay. Female horn flies were always heavier and larger than the males, despite differences in manure in which they were raised. However, manure from the peanut vine hay produced largest flies of both sexes – regardless of which steer ate the hay.

Although chemical analyses were not made on the manure, a comparison of nutritive value of the roughages might help explain size and weight differences of the horn flies. In general, johnsongrass hay is about 50% digestible and peanut vine hay about 58%. In addition, johnsongrass hay contains only 3.4% protein in comparison with about 10% for peanut vine hay. Nitrogen-free extracts from the two are about the same. Thus, the higher protein content of the peanut vine hay appears to be responsible for the larger size of horn flies in this test.

SOME EFFECTS OF DIET AND HOST ANIMAL ON THE HORN FLY, *Haemotobia irritans* (L.)

Measurement	Test 1—17 samples		Test 2—6 samples	
	Johnsongrass, Hereford	Peanut vine, Hereford-Angus	Johnsongrass, Hereford-Angus	Peanut vine, Hereford
Pre-adult period, days	6.9	6.8	7.3	6.5
Pupa av. weight, mg.	3.4	4.1	4.0	4.7
Pct. of pupa producing adults	80.2	80.8	90.0	95.5
Adult male av. weight, mg.	4.1	4.7	4.7	4.7
Adult female av. weight, mg.	6.3	7.4	7.8	8.4

Water Status in Virus-Infected Corn Plants

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Dept. of Botany and Microbiology

MAIZE DWARF MOSAIC is a common and often damaging disease of corn and sorghum in Alabama and several other states. The disease is caused by the maize dwarf mosaic virus (MDMV).

Typically, leaves of MDMV-infected plants show a mosaic pattern of normal green-colored tissue alternated with abnormal light-colored tissue. Red to purple discoloration of foliage also has been associated with MDMV infection, particularly in sorghum. These symptoms or responses of plants to infection by MDMV are obvious. To better understand development of viral diseases, researchers at Auburn University and other institutions have been determining what plant processes are affected such that these symptoms are eventually expressed. It has been found that MDMV infection affects a number of physiological processes including photosynthesis, respiration, nitrogen metabolism, and element accumulation in corn.

One aspect that had not been studied was the water status of the infected plant. It was suspected that MDMV infection had some influence because infected corn and sorghum in the field and greenhouse appeared to wilt less than healthy plants. Experiments were conducted to determine if transpiration or loss of water vapor by MDMV-infected corn differed from that of healthy plants.

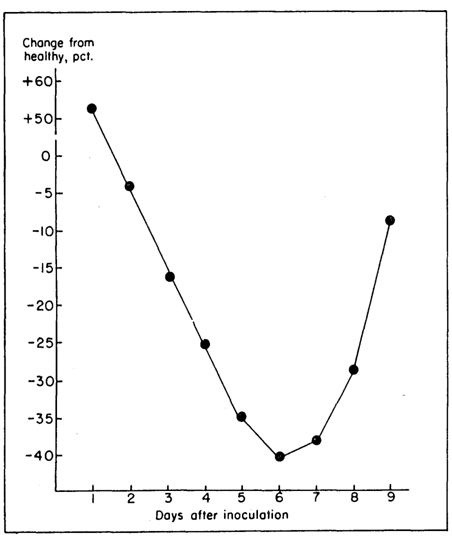

Fig. 1. Average change in transpiration of MDMV-infected plants from healthy plants.

The water status of MDMV-infected and healthy corn seedlings was compared in several tests in controlled environment chambers. Infected seedlings were obtained by artificially inoculating them with the virus. Healthy seedlings were treated in identical manner except they were not inoculated with the virus. Transpiration and water deficiency of healthy and infected seedlings were measured on plants growing in soil under conditions of adequate water availability and also under stress conditions where plants were not watered for periods of time. Similar determinations were made on plants in liquid culture. The frequency and degree of opening of stomata in leaves of healthy and infected seedlings were also determined.

Regardless of conditions under which plants were grown, the rate of transpiration was lower in MDMV-infected plants than in healthy ones. Data obtained from an experiment in which plants were grown under stress (water withheld from beginning of experiment) are illustrated in Figure 1. The initial increase in transpiration rate of MDMV-inoculated plants probably was due to damage during the inoculation process. Mosaic symptoms appeared in inoculated plants at 5 days after inoculation. By 6 days after inoculation, transpiration of infected plants was reduced by 40% as compared to healthy plants. All healthy plants were wilted after 9 days without water; MDMV-infected plants remained turgid. Increased water economy by infected plants was also indicated by the fact that water deficiency was less in leaves of MDMV-infected plants than in healthy plants, Figure 2.

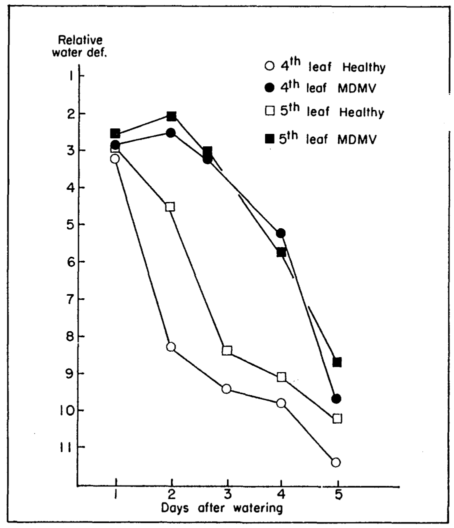

Fig. 2. Water deficiency in healthy and MDMV-infected leaves under increasing water stress.

Reduced transpiration of MDMV-infected plants did not appear to be the result of reduced water uptake by roots. Nor was it due to fewer stomata since leaves of infected and healthy plants were found to contain approximately the same numbers of stomata. However, leaves of infected plants did show a greater resistance to air flow through them than did those of healthy plants. This indicated there was a reduction i stomatal apertures in MDMV-infectea leaves. This was confirmed by direct observation of stomata in epidermal strips from leaves. Strips from healthy leaves had more stomata completely open than did strips from MDMV-infected; more stomata in the latter were closed or only partially open, see table.

These results show that MDMV infection influenced water status of corn seedlings apparently through an effect on stomatal transpiration. Increased water economy by MDMV-infected plants is not taken as a "beneficial effect" of virus infection because of the overriding detrimental effects of the virus on other processes. Stomatal closure may be a contributing factor in reduced photosynthesis associated with MDMV infection.

FREQUENCY OF STOMATA AT VARIOUS APERTURES IN EPIDERMAL STRIPS OF HEALTHY AND MDMV-INFECTED LEAVES

Strip	Stomata condition		
	Closed	Partially open	Completely open
	Pct.	*Pct.*	*Pct.*
Healthy	6	30	64
MDMV-infected	24	38	38

FEDERAL MILK MARKETING ORDERS

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Approximately 60% of milk marketed in the United States is sold under Federal milk marketing orders. In 1971, 141,300 dairymen delivered 67.9 billion pounds of milk to handlers regulated by Federal orders. Regulated markets are located throughout the United States. These market areas included most of the major population centers. Alabama is one of the few states where Federal milk orders are not in effect. However, some producers in the State ship milk to handlers who are regulated by Federal milk orders in adjoining states.

Price instability for milk in the 1930's, which threatened the adequacy of high quality milk supply, gave rise to the Federal order program. In planning production to meet the year-round consumer demand for fresh milk products, dairymen needed reasonable and stable prices. The Agricultural Marketing Agreement Act of 1937, the enabling legislation, states that prices established under orders must – "reflect the market supply and demand for milk, ensure a sufficient quantity of pure, wholesome milk, and be in the public interest."

Provisions

Milk handlers in regulated markets are required to pay the same minimum price within each market for milk, follow certain marketing practices, and make reports to the market administrator. Wholesale and retail prices for milk products are not determined under the order but are established by competition in the market place. However, in a few areas where both state and Federal orders are in effect wholesale and retail prices may be fixed by the state agency.

Minimum prices which milk handlers pay producers are established in each order. Classified pricing of producer milk is used throughout all Federal orders. Milk used in fluid products, such as fluid whole milk, skimmilk, chocolate milk and buttermilk, is placed in Class I, the highest priced use. Milk in excess of Class I which is used in manufactured products is Class II (or additional lower priced classes). Prices are established for milk of 3.5% butterfat content and adjustments are made in price as butterfat content may vary from 3.5%. In some markets with large supply areas location price differentials are applied to producer milk. Class prices are determined monthly by formulas. The Class II or manufacturing price is based on a nationwide market for these products and varies little among markets. Class I price in most markets is set at a specified differential above the Class II price. The size of the differential is determined by historical data and comparisons with other markets. Month to month changes in Class I prices result primarily from changes in the Class II price.

In addition to pricing provisions, each order provides for pooling returns among producers (either marketwide or individual handler), definitions, and a system of market administration. Since markets have individual problems, orders may be adjusted to fit the particular needs. However, with increasing size of milk markets in recent years, order provisions are being coordinated.

Need For An Order

Purpose of the Agricultural Marketing Act is to establish and maintain orderly marketing. Certain marketing problems are indicative of disorderly marketing and suggest the need for a Federal order. Examples include the absence of an effective system of classified pricing, undermining of prices of producer associations by handlers, unequal bargaining strength between producer groups, price discrimination by handlers in purchase of producer milk and lack of market information. Price competition between milk moved across state lines and in state milk supplies has been a factor warranting Federal regulation.

Establishment of Order

The order program is administered by the U.S. Department of Agriculture. Usually a proposal for an order is made to the USDA by a producer cooperative association who represents dairymen supplying milk in the marketing area. A summary of the steps is: (1) *Pre-hearing* discussions are held by the USDA to learn of the need for an order. A proposed milk order is drafted and presented to the Dairy Division for study. Meetings are held with dairy groups to discuss Federal order marketing. (2) A *public hearing* is held to receive evidence about economic and marketing conditions relating to milk in the proposed area. Producers, handlers, and consumers may present testimony at the hearings. (3) If the evidence justified a market order, a *recommended decision* is prepared by the Dairy Division. After review and possible changes resulting from requests by interested persons, a *final decision* is made. The final decision includes a statement of findings, conclusions, and the complete order. (4) *Producers vote* to approve or reject the order. The order can go into effect only upon approval in a referendum by vote of two-thirds of the producers voting. Producers may vote individually or in a bloc vote through cooperative associations. If an individual handler pool is proposed, three fourths of the producers voting must favor its approval. (5) If a favorable vote is received, a *final order* is issued by the Secretary of Agriculture and remains in effect until suspended or terminated. An order must be terminated at the request of a majority of producers who supply more than half the milk for the market.

WHEY SHOWS POTENTIAL FOR USE AS LIVESTOCK FEED INGREDIENT

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NUTRITIOUS WHEY – 11 billion lb. of it – is dumped annually because no satisfactory method has been found to make use of it.

High water content (94%) is a major deterrent to use of whey. Much is being processed by new techniques that make it feasible to extract the protein and lactose from whey. These whey products are being used in the manufacture of many human foods.

The abundance of whey being produced in small plants scattered around the nation poses the real environmental problem. Since it is not economically feasible to haul this fluid whey to other plants for processing, it is being dumped and creating a pollution problem.

One approach to the problem being taken in Auburn research is concerned with a process to incorporate fluid whey into animal feed. Effort has been made to keep the processing as simple as possible to minimize processing cost and use of equipment.

The process involves a fermentation of whey to produce organic acids, followed by neutralization of the acids with anhydrous ammonia to produce ammonium salts of the organic acids. These ammonium salts can be utilized by cattle as a protein substitute.

Laboratory findings show the simplicity of the fermentation and ammonification. Whey is placed in a vat and neutralized by infusion of ammonia. The neutralized whey is fermented by acid producing bacteria, thereby converting more lactose into acids. When the pH of the solution is lowered to about 4.5 by accumulation of acids, the fermenting organisms are inhibited. By neutralizing these acids with ammonia, the organisms once again grow and produce more acid. Alternate fermenting and neutralizing with ammonia converts most of the whey lactose to acid, and this acid is converted to useful ammonium salts. Products containing about 60-75% crude protein equivalent (dry matter basis) resulted from this process with cottage cheese whey, as shown below:

Trial number	*Initial protein, pct.*	*Final protein, pct.*	*Fermentation time, hours*
1	13.25	63.67	168
2	14.63	75.08	168
3	18.40	72.14	168
4	20.41	60.26	168

The fermented and nitrogen enriched whey was blended with other ingredients, ensiled, and fed to lambs. Nitrogen in the products was utilized by the lambs, but not as well as nitrogen from cottonseed meal, as shown by data in the table. In further tests, fermented whey-corn mixtures were fed wet and dried to lambs. Both types of products were utilized efficiently.

Effort has also been made to develop ensiling procedures for the enriched whey product to eliminate a drying process. The fermented and ammoniated product is extremely difficult to dry and once dried it quickly hydrates on exposure to air. The dried but hydrated product becomes extremely tough and gummy, making it unsuitable as an ingredient for mixed feeds. When the whey product is blended with corn and ensiled, it may be fed as silage or dried and used as a blending ingredient in dry mixed feeds.

The Auburn research has resulted in a process for converting fluid whey into a valuable animal feed. If this process can be used by livestock feeders to produce a valuable feed, it may be that much of the whey presently dumped into streams and sewage treatment facilities can be returned to the farm. Further research underway is seeking improved methods of feeding the new animal feed derived from whey.

PERFORMANCE OF LAMBS FED FEEDS CONTAINING FERMENTED AND AMMONIATED CHEESE WHEY

Ration	Dry matter intake/ head/day	Average daily gain	Nitrogen intake/ head/day	Nitrogen retained/ head/day
	Lb.	*Lb.*	*Grams*	*Grams*
Basal (no protein)	1.06	−0.33	0	0
Basal + whey (fermented and ammoniated)	1.65	.31	30.36	14.44
Basal + cottonseed meal	2.00	.40	39.48	21.78

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