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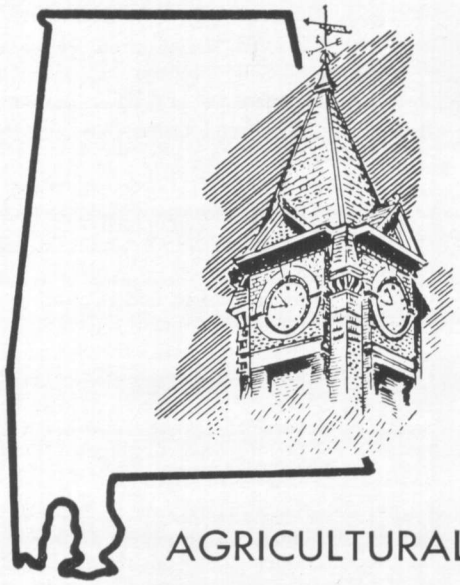

HIGHLIGHTS of AGRICULTURAL RESEARCH

AGRICULTURAL EXPERIMENT STATION, AUBURN UNIVERSITY

HIGHLIGHTS *of* Agricultural Research

A Quarterly Report of Research Serving All of Alabama

VOLUME 12, NO. 3 FALL, 1965

In this issue . . .

On the cover. Artificial or "direct" seeding of forest trees instead of planting seedlings has become a popular practice in the South. A study started in 1959 at the Lower Coastal Plain Substation was designed to determine the effectiveness of different techniques in direct seeding of loblolly and slash pine on old fields. Shown here is one of the experimental areas of slash on the Substation. Details of the study are reported in the story on page 3.

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Auburn, Alabama

New and Timely PUBLICATIONS

Listed here are timely and new publications reporting research by the Agricultural Experiment Station.

Bul. 329. Oats for Forage and Grain.

Bul. 335. Crimson Clover in Alabama.

Bul. 350. Seasonal Variation in Prices of Selected Farm Commodities.

Bul. 354. Procurement of Corn in Alabama.

Bul. 356. Rural Land Ownership and Use in Alabama.

Bul. 358. Costs of Packing Fresh Peaches in Chilton County, Ala.

Cir. 147. Diseases of Small Grains in Alabama.

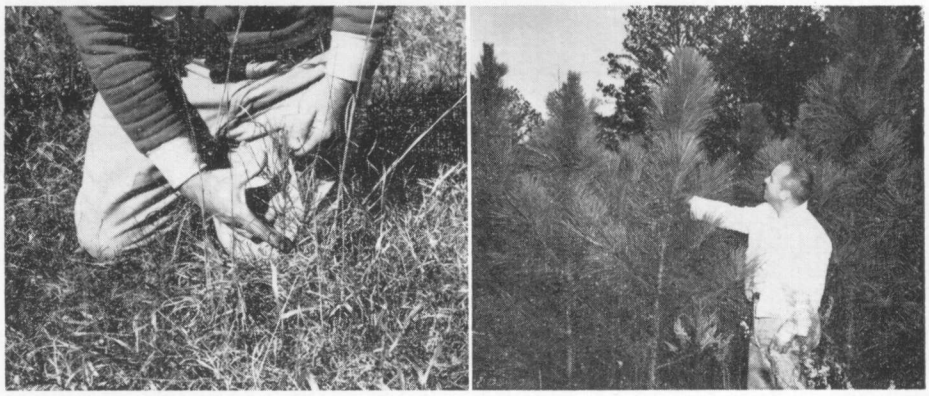
Cir. 148. Farm Handling and Marketing of Pecans in Alabama.

Cir. 150. Directed Growth of Ornamental Plants with Chemicals.

Leaf. 66. Forage Production of Winter Annuals Sod-Seeded on Dallisgrass-White Clover.

Leaf. 71. Yuchi—New Arrowleaf Clover.

Free copies may be obtained from your County Extension Chairman or by writing the Auburn University Agricultural Experiment Station, Auburn, Alabama.



Loblolly pine seedling at left 2 years after seeding and at right is slash pine establishment by direct seeding.

ARTIFICIAL SEEDING of PINE on OLD FIELDS

L. E. DeBRUNNER and E. J. HODGKINS, *Department of Forestry*
W. J. WATSON, *Lower Coastal Plain Substation*

Artificial or "direct" seeding of forest trees has become popular in the South, but results are too often discouraging.

In 1959 a study was started at the Lower Coastal Plain Substation, Camden, to determine the effectiveness of different techniques in direct seeding of loblolly and slash pine on old fields. Three different old fields were selected for the study. The sand hill area was a deep sand on a moderate south slope, the horse pasture area was a fine sandy loam on a slight west slope, and the red field area was a shallow sandy loam on a slight west slope. The vegetation on all areas was dense, including broomsedge, other grasses, and weeds typical of early succession in old fields. The sand hill area had, in addition, patches of sumac and plum, while the horse pasture area, abandoned 8 years prior to the beginning of this study, had large patches of residual crimson clover and some smaller patches of johnsongrass.

Two site preparation methods were used: (1) triple disking with a light farm disk in September, and (2) broadcast burning in November.

Seeding was done in November 1959 and February 1960 using slash and loblolly pine seed, unstratified, and stratified for 30 days. All combinations of time of seeding, species, and stratification treatment were used. The entire study was repeated during the 1960-61 planting season. All seed were treated with bird and rodent repellants as is standard in direct seeding operations. The seed were dropped on the soil and pressed in with the foot.

An acceptable establishment rate was considered to be 11% for loblolly pine, 14% for slash, or 12.5% for the two species combined. This was based on an assumption of a normal seeding rate of 1 lb. per acre with a minimum establishment of at least 2,000 seedlings.

Table 1. Per Cent Survival After 2 Years for Direct Seeded Loblolly and Slash Pines for Two Site Preparation Treatments and 2 Years of Seeding

Site preparation	Survival		
	Horse pasture	Sand hill	Red field
	Pct.	*Pct.*	*Pct.*
1959-60 planting			
September disking	4.6	1.4	11.6
November burning	2.1	0.6	7.5
1960-61 planting			
September disking	3.2	5.3	20.1
November burning	1.7	2.8	20.4

Using this standard, the only acceptable results were from the 1960-61 seedings at the red field, Table 1. At this location vegetation was predominantly broomsedge and the soil was not droughty. At the horse pasture apparently no site preparation method was sufficiently complete to reduce competition, while the deep sandy soil of the sand hill created severe moisture shortages.

The generally lower survivals from the 1959-60 seedings as compared with the 1960-61 seedings probably are attributable to low rainfall in February, March, and April of 1960 (14.9 in. in 1960 and 31.88 in. in 1961).

September disking gave superior results over November burning as a site preparation method for every situation except the 1960-61 seedings at the red field. This particular situation represented the most favorable combination of weather, vegetative competition, and soil for direct seeding in this study.

Stratification did not affect success for either loblolly or slash pine when seeding was done in November, Table 2. Stratification of seed was critical for both species when seeding was performed in February, even though standard laboratory germination tests did not indicate that the slash pine needed stratification. There was no advantage to the more commonly used late winter seeding over fall seeding.

Site preparation intensity must increase as the competitiveness of the original vegetation increases. If initial vegetative cover is dense and predominantly composed of anything other than broomsedge, preparation of the site must approach that used for row crop cultivation. In addition, thorough site preparation can improve survival under droughty conditions. However, for inherently droughty soils, it is safer to rely on planting seedlings than direct seeding.

For direct seeding cutover forest land, late winter application of stratified seed is commonly recommended for both loblolly and slash pines. The data from this study tend to justify extending this recommendation to old fields. Data also indicate that fall seeding of unstratified seed was as effective.

Table 2. Per Cent Survival of Direct Seeded Pines After 2 Years for Two Periods of Planting and Two Seed Treatments

Species	Month of planting	Seed treatment	Survival		
			Horse pasture	Sand hill	Red field
			Pct.	*Pct.*	*Pct.*
Loblolly	November	Unstratified	3.8	2.4	20.3
Loblolly	November	Stratified	2.9	4.4	21.7
Loblolly	February	Unstratified	0.2	0.2	2.6
Loblolly	February	Stratified	2.5	2.0	13.4
Slash	November	Unstratified	2.9	4.2	15.8
Slash	November	Stratified	3.6	2.2	18.0
Slash	February	Unstratified	1.8	1.5	10.2
Slash	February	Stratified	3.9	5.3	19.7

(L) Note weeds in untreated plot. (R) Plot treated April 28, 1965, with 10 lb. per acre of Casoron wettable powder.

Chemicals for Weed Control in Field-Grown Nursery Crops

H. J. AMLING, J. L. TURNER, and W. A. DOZIER, JR.
Department of Horticulture

FOUR HERBICIDES show great promise for reducing weed control costs in field-grown nursery crops. They have proved best in experiments by Auburn University Agricultural Experiment Station to determine the potentials of a number of chemicals as possible herbicides. The experiments are being conducted at Auburn and in cooperative tests with nurserymen in northern Alabama.

The four herbicides—Simazine, Dacthal, Casoron, and Treflan (listed in table)—must be applied before annual weed seeds germinate or immediately after annual weeds have been removed by cultivation. In applying these herbicides, the manufacturer's recommendations on label must be followed precisely and must not exceed the specified rates.

Simazine has long residual life. Therefore, only one application is made during any season. It is applied as a mixture of 2½-3¾ lb. of 80% wettable powder in at least 25 gal. water per acre, or as 4% granules at 50-75 lb. per acre, with higher rates used on silt loam or clay loam soils. Simazine must not be used in seedbeds, cutting beds, or on nursery crops listed in table that have been transplanted less than a year. Because of phytotoxicity, care must be taken in applying Simazine to broadleaf evergreens and deciduous woody nursery stock not listed in table but on manufacturers' labels.

Dacthal has a short life, 4-6 weeks, and is one of the safest to use. It may be applied to newly established transplants and liners. Dacthal, 75% wettable powder, is applied at rate of 12-14 lb. in 50 gal. water per acre.

Casoron has long residual life. It must not be used in seedbed, cutting beds, or on transplants. It can be applied 4 weeks after transplanting. The 50% wettable powder is applied at rate of 10-12 lb. per acre, or 4% granules at rate of 125-150 lb. per acre. For best results, the treated area is irrigated immediately with ½-1 in. of water.

Treflan must be incorporated in the soil during or immediately after application to prevent loss of activity. Woody nursery stock liners can be planted in treated soil immediately after incorporation. It can be applied at pre- or post-planting of gladioli corm or cormels. Treflan, 4 lb. per gal. emulsifiable concentrate, is applied at rate of 1-2 pt. per acre.

The above herbicides will not control perennial weeds. Herbicides that control such weeds will also injure field-grown nursery crops. Such herbicides must be applied as directed sprays on a spot-control basis. The diethylamine salt of 2,4-D in water at the manufacturer's recommended rate will control most broadleaf perennial weeds in field-grown nursery crops. Dalapon in water plus a wetting agent at rates recommended by manufacturer will control most perennial grasses.

Control of weeds in field-grown nursery crops will be expanded to include more chemicals and crops as research currently in progress provides additional information.

SUGGESTED HERBICIDES FOR FIELD-GROWN ORNAMENTALS

Nursery crops	*Weeds controlled*	*Herbicides*
Narrow leafed woody nursery stock, boxwood, dogwood, apple, grape	Most annual weeds	Simazine
Woody nursery stock including azalea	Crabgrass and some broadleafs	Dacthal
Narrow leafed woody nursery stock, boxwood, apple, peach, plum, cherry, forsythia, holly (Ilex spp., except crenata), privet (Ligustrum spp.), roses, and pyracantha	Most annual weeds	Casoron
Woody nursery stock, new liners, established plants, gladiolus (trial basis only)	Most annual grasses and weak annual broadleafs	Treflan

ABC's for Home Use of Native Alabama Foliages

HENRY P. ORR, *Dept. of Horticulture*

ALABAMA IS WEALTHY in native plants that can be used to increase the beauty of its countryside.

This beautification can begin at home by transplanting native shrubs, trees, and vines into the home landscape, or by cutting foliages and flowers for home arrangements. Cultivating many of these plants can result in conservation of the natural beauty of the State and Nation. Conserving and replanting these native plants can do much to beautify local and national roadsides.

Another possible use for native plants is to cultivate selected species for producing foliage and branches for massed marketing. Alabama is known for its southern magnolia, smilax, and leucothoe foliage plants. However, visiting floral artists have pointed out the need for other native materials that are not available commercially.

Plant materials that have been appealing to many artists include: various pines (especially longleaf and spruce, *Pinus glabra*), American beautyberry, fetterbush lyonia, oakleaf hydrangea, various sumacs, southern waxmyrtle, redbay persea, brook eounymus, eastern baccharis, farkleberry, partridge berry, mountain laurel kalmia, various hollies (including American selections, Alabama dahoon, and such selected seedlings as the Foster hybrids), Florida anisetree, American bittersweet, devilwood osmanthus, and various yuccas.

For design use, the listed plant materials are valuable as fresh cut branches or foliages. Many are further enticing in flower or fruit. All can be processed with glycerin or permanent-type antifreeze for longer-lived "native permanents."

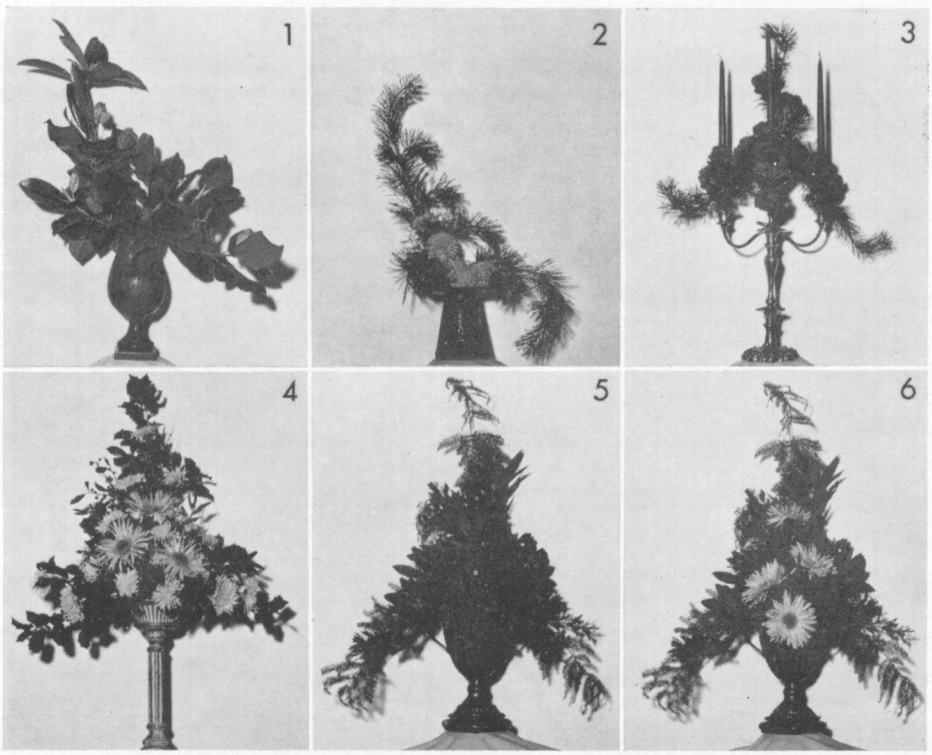
Most native materials last longer if cut as a flush of growth matures and just before a new flush begins. Sharp shears should be used to make slanting cuts at the base of the material. Greater amounts of water will be absorbed if the base of the stem is split.

Preferably, branches should be cut from well watered plants and either plunged deep into warm water or placed in moist plastic bags. The soaking or bagged branches should be placed in a 40° F. cooler overnight or in a nondrafty cool location, such as a cellar. After this period of water and cooling conditioning, cut materials can be shipped to distant markets by sealing in plastic bags and placing the bags in protective cardboard boxes. Prior to use in arrangements, the stems should be recut and placed in water. Most of these cut foliages will last longer than fresh cut flowers that are used with them in water-filled containers, or if placed in water-filled floral plastics.

Tones and shades of oranges, reds, and browns are appealing to most people, especially in fall and winter arrangements. Many of the native plant materials will turn to these colors if cut in the prime of growth and treated with glycerin or permanent-type antifreeze. Usually glycerin is used in a mixture of one-third glycerin and two-thirds water. Antifreeze is mixed in equal parts with water. Processing is generally more rapid using antifreeze, but results may be less uniform and some brittleness may be noted. The glycerin mixture is more expensive and the process is slower, but results are usually more uniform.

For home use, a favorite arrangement can be made of native materials in a glazed container, and one of the described mixtures substituted for water in the container. If the arrangement is placed in a warm, aerated, illuminated location, a gradual color change in the materials can be observed as the mixture moves into cells of the plants.

Darker shades will result if the mixture is allowed to remain in the vase or container until the color change is uniform. It may be necessary to add more solution to obtain the darker colors. Lighter shades will result if the mixture is removed and water is substituted after several days of processing. This must be experimented with in home locations, since maturity of plant materials, temperature, light, and aeration affect the rate of absorption.



Varied uses of native foliage are illustrated here: (1) Southern magnolia can be used for line or mass effect, and developing fruits add interest. (2) Spruce, or swamp, pine combined with three yellow chrysanthemums gives an exotic Oriental flavor in a Japanese usabata. (3) Elegance of silver candelabrum is accented by spruce pine and red carnations. (4) Formal arrangement of American holly foliage with daisies and chrysanthemums complement classic lines of gold and white metal compote. (5) A group of swamp natives can be decorative in a pewter-washed copper urn. Common bald cypress provides the lacy fringe, redbay the blue-green complement to the container color, and possumhaw viburnum the focal point. (6) Adding four daisies to the number 5 grouping makes it appropriate for special occasions.

FARMERS ARE CONSERVATIVE BORROWERS

JOHN E. DUNKELBERGER
Dept. of Agricultural Economics

BORROWING MONEY is a serious question with many farmers! The economic depression of the 1920's and 30's caused most of them to become conservative in their attitudes toward borrowing money. They had seen friends and neighbors lose their farms because of over indebtedness, and didn't want the same fate to happen to them. For many farmers, borrowing became an evil to avoid, except as a last resort.

Since then many changes have occurred in the American economy. A new generation of farmers is now in business in Alabama. These farmers are finding that many public and private agencies actually promote borrowing money and ready use of credit for expanding one's farm or business, buying household appliances, or even financing vacations. People in large cities and the suburbs have been found to be quite liberal in their attitudes toward borrowing. To what extent is this also true of Alabama farmers?

Majority are Conservative

Results of an attitude study of 126 farmers in Clarke, Fayette, Monroe, Montgomery, and Tallapoosa counties indicate how farmers currently regard borrowing money. Only 9% were completely opposed to borrowing regardless of purposes. The largest proportion (51%) favored borrowing only for farm and business purposes. These two attitudes can be classified as conservative by current national standards.

A somewhat more liberal attitude toward borrowing prevailed among the remaining farmers. They favored borrowing money for house improvements and appliances. Three per cent of these same people also favored borrowing for such luxury items as pleasure trips and vacations.

Conservative versus Liberal Borrowers

Results indicate a considerable difference of opinion among Alabama farmers about borrowing. This suggests questions about the personal and business characteristics of farmers with different attitudes, see table.

Farmers with liberal attitudes were more likely to be under 40 years of age. A higher percentage of them completed less than 8 grades of schooling and rented their present places. They were more likely to be actively involved in organization life of the community and to hold an optimistic outlook for the future. This optimism was reflected in plans to increase size of their farm operations.

A liberal rather than a conservative attitude toward borrowing money was also more typical of men with different types of farming operations. About two-thirds of the farmers with liberal attitudes were on farms of less than 100 acres, while less than one-half of those of the conservative viewpoint were on small farms. Similarly, almost 40% having a liberal attitude had a total gross farm income of less than $500, whereas those of a conservative attitude were more likely to have a total gross farm income range of $500 to $2,500. Moreover, a liberal attitude was also most pronounced among farmers with both small total capital investments under $1,000 and large capital investments of $10,000 or more. Farmers with capital investment ranging between these levels tended to have a conservative attitude.

Other considerations relative to difference in attitude toward borrowing money involve amount and source of total family income. A liberal attitude toward borrowing was somewhat more likely among farmers whose families have low incomes (less than $1,500). In contrast, a conservative attitude was more pronounced among farmers with family incomes between $1,500 and $4,000. Farmers having a liberal attitude were almost twice as likely to have nonfarm work providing additional income than were the conservatives. Also, almost one-half of the farmers with a liberal attitude had wives who were employed off the farm for all or part of the year.

Meaning of All This

Attitudes of Alabama farmers toward borrowing money and the use of credit indicate a strong conservative tendency. While urban people tend to take credit buying for granted, a large segment of the farmers in Alabama view it with skepticism and almost none favor the frivolous use of credit. Farmers with a liberal attitude toward borrowing tend to be young men attempting to get started in farming. They realize that they may have to borrow to obtain a place of their own or to expand their operation. At the same time, they have little capital investment to lose in case they default their loans. They also gain additional confidence in their ability to repay from the regular nonfarm income they receive from either their own or their wife's off-farm employment. On the other hand, farmers with a conservative attitude tend to be older, better established, and dependent solely upon farming for their livelihood. They are not interested in risking the loss of money.

SELECTED CHARACTERISTICS OF ALABAMA FARMERS WITH CONSERVATIVE AND LIBERAL ATTITUDES TOWARD BORROWING MONEY

Characteristics	Attitude	
	Conservative	Liberal
	*Pct.**	*Pct.**
Personal:		
Under 40 years	7.2	23.4
Less than 8 grades	46.4	55.3
Renters	11.0	37.0
Active participators	27.5	44.9
Optimistic outlook	34.7	43.1
Increase farm operation	12.3	34.7
Farm:		
Less than 100 acres of land operated	45.8	64.7
Less than $500 gross farm income	25.0	39.1
Median gross farm income ($500-$2,499)	51.4	34.8
Under $1,000 total capital investment	10.9	25.6
Total capital investment ($10,000 or more)	29.7	39.5
Total family income:		
Less than $1,500	44.9	53.4
Median ($1,500-$3,999)	39.2	24.4
Both farm and nonfarm sources	36.0	63.3
Homemaker gainfully employed	27.9	45.5

* Meaningful comparison is between conservative and liberal attitudes for each specific characteristic; percentages do not add to 100%.

VETCHES *and* NEMATODES

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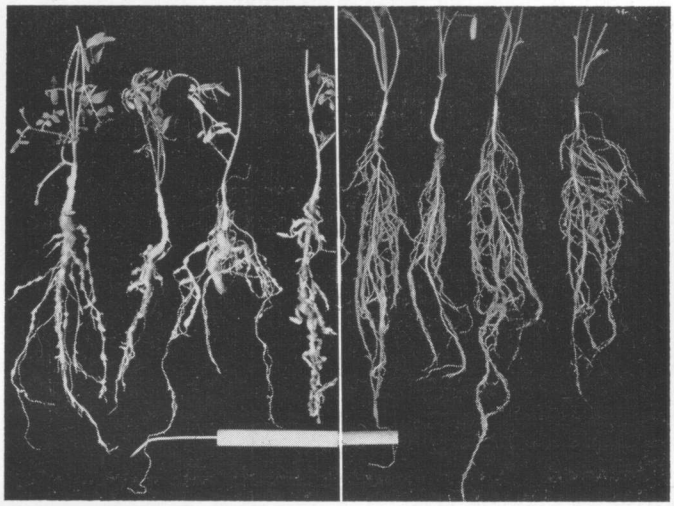
E. D. DONNELLY and R. L. SHEPHARD,
Department of Agronomy and Soils



Hairy and three other vetches were susceptible to all five root-knot nematode species. Left—Note severe galling on hairy. Right—Warrior was resistant to the nematodes most commonly found in Alabama.

WARRIOR VETCH, developed by Auburn University Agricultural Experiment Station, is resistant to three of the five important root-knot nematode species. By contrast hairy vetch, for many years the most commonly grown in the State, is highly susceptible to all five of the root-knot nematodes.

Differ in Resistance

Experiments were conducted at Auburn to determine relative resistance of vetch to the five root-knot nematode species.

Warrior vetch was highly resistant to three – southern, cotton, and Javanese species. (See table.) Roots of Warrior subjected to these nematodes were practically free of damage, whereas roots of the other vetches were severely galled. (See photos.) Poor growth is associated with severe root-knot galling. Growth of Warrior was superior to that of the other vetches when grown in nematode-infested soil. In addition Warrior acts as a trap crop – it traps larvae that enter the roots which prevents reproduction. The high level of resistance in Warrior is of value in soils where these nematodes are a serious problem.

Warrior is an important new vetch variety for Alabama because the southern and cotton root-knot nematodes are the most widespread species in the State. It has performed well, whereas other varieties have done poorly in soil heavily infested with cotton root-knot nematode in tests at the Station's Plant Breeding Unit, Tallassee. Root-knot resistance increases Warrior's value as a seed, green manure, and grazing crop.

Warrior was susceptible to peanut and northern root-knot nematodes, just as all other vetches tested. Therefore, Warrior should not be grown on soils heavily infested with the latter two nematodes.

Little or no resistance to the five root-knot species was found in hairy, Auburn woollypod, bigflower, or narrowleaf.

Rotations Are Important

Surveys indicate that peanut and northern root-knot nematodes are most abundant in southeastern Alabama where peanuts are frequently damaged by these nematodes. For this reason, vetches should not be planted after peanuts where these nematodes are present. Corn is resistant to the northern species and cotton is resistant to both northern and peanut root-knot nematodes. Thus, the two crops reduce the numbers of these two species in the soil, making it possible to grow vetch on land devoted to cotton and corn.

Importance of growing vetch in a rotation following a non-host crop was demonstrated at the Station's Wiregrass Substation, Headland, on soil infested with the northern root-knot nematode. Vetch was planted in two fields. Corn had been grown on one the previous season and peanuts on the other. Peanuts, a good host for the northern species, had built up a high population of this root-knot nematode in the soil, whereas corn, a poor host, kept the population low. Vetch planted in the field previously in peanuts was severely attacked by the nematode resulting in total loss. Yet vetch was not affected when planted following a corn crop.

* Cooperative with Department of Botany and Plant Pathology.

RELATIVE RESISTANCE OF FIVE VETCHES INOCULATED WITH FIVE ROOT-KNOT NEMATODE SPECIES*

Vetch species	Root-knot species				
	Javanese	Southern	Cotton	Peanut	Northern
Warrior	0.0	0.0	0.0	2.9	2.6
Hairy	3.7	3.8	4.0	3.6	3.0
Auburn woollypod	3.8	3.9	4.0	4.0	3.6
Bigflower	3.0	3.7	3.3	3.1	2.3
Native	3.1	3.7	3.9	3.1	2.3

* Based on 0 = no galls, 1 = slight galling, 2 = light galling, 3 = moderate galling, 4 = heavy galling.

Putting Results to Work

Warrior vetch could be used for seed production, green manure, or grazing on land infested with Javanese, southern, and cotton root-knot nematodes. In addition to withstanding attacks of these three nematodes, Warrior would serve as a trap crop. Thus the nematode population would be reduced and growing conditions made more favorable for succeeding crops – even those susceptible to three of the root-knot nematode species.

None of the vetch varieties should be planted after peanuts on land infested with the northern and peanut root-knot nematodes. In such cases, vetch should be planted only after resistant crops like cotton and corn. All adapted vetches could be expected to grow well in southeastern Alabama on peanut and northern nematode-infested land following a resistant crop. Both cotton and corn reduce the northern root-knot nematode population to a safe level, but only cotton reduces the peanut nematode substantially.

Warrior would be preferable to hairy vetch following cotton in rotations in all areas of the State where reduction of the cotton nematode is of primary concern.

Bermudagrass lawn here was treated to control weeds February 8, 1965. Plot on right untreated and plot on left treated. Photo was made March 15, 1965.

Controlling Broadleaf Winter Weeds in Lawns

D. G. STURKIE,
Dept. of Agronomy and Soils

You don't have to look at unsightly winter weeds in your lawn.

The common winter weeds that occur in summer lawns in Alabama have been effectively controlled in experiments at Auburn.

In Alabama summer lawn grasses are usually dormant in winter and lawns are frequently infested with weeds that grow during the winter and produce seed in the spring. Such weeds shade grass, reduce vigor, and are unsightly. After dying areas of bare vegetation result.

Winter weeds occur most often on bermuda, but may occur in zoysia, St. Augustine, or centipede lawns. When conditions are favorable for seed germination, plants may come up in the fall, winter, or early spring. A good dense sod of summer grass will aid in preventing an infestation of winter weeds, but under the best conditions weeds may occur. It is necessary to use some method of control to rid the lawn of these pests.

Plants may be removed by hand but this is tedious and often expensive. Use of an herbicide for control is usually cheaper and easier. Experiments with herbicides for control of winter weeds were conducted at Auburn annually since 1962. Tests have shown that several herbicides gave good control of weeds with little or no damage to lawn grasses. Weeds present on areas under treatment are given in the table.

There are two general types of herbicides. One is called a contact herbicide and will kill all annual broadleaf plants and grasses such as annual bluegrass, ryegrass, and little barley. The kill is rapid and in 2 or 3 days one can tell if any plants were missed in spraying. The best contact sprays tested were diquat and paraquat. Endothal is satisfactory, but is slower than diquat and paraquat. They may be used underneath trees and shrubs without damage if not sprayed on the foliage. These chemicals will kill the leaves on contact.

Tops of perennials, such as white clover, will be killed by contact spray but may recover. Do not use these chemicals to control perennials.

A second type herbicide is translocated herbicides. These are absorbed and translocated throughout the plant. Such chemicals kill slowly and it may take 2 to 5 weeks before the effect is evident. The best translocated herbicides tested were 2,4-D, 2,4,5-T, dicamba, silvex, and mixture of 2,4-D with the others. Simazine also gave excellent control of broadleaf plants and grasses. It is injurious to bermuda if used at too high a rate. Therefore, care must be used to keep the rate low. All weeds listed in the table were killed by 2,4,5-T, dicamba, silvex, and mixture of 2,4-D with the others. Although 2,4-D will kill most of the weeds, there are some it will not always kill, such as henbit, chickweed, speedwell, vetch, and knotweed.

The translocated herbicides should be applied very carefully. Apply only on a still day to avoid spray drift. Do not spray on or underneath flowers, trees, or shrubs. Apply on a warm, clear day when there is little chance of rain.

Be sure to calculate amount of herbicide to use according to recommended rates. Rates per acre of active material that gave good control in these tests were paraquat at 1 lb.; 2,4-D(amine), 2,4,5-T, dicamba (banvel D), diquat, silvex, and simazine at 2 lb. per acre; and endothal at 5 lb. per acre. Check the container for instructions and amounts to use. Materials may vary widely in amount of active ingredient they contain. Always use a wetting agent. Any good household detergent used to wash dishes or clothes will suffice for a wetting agent. In applying the spray, it is desirable to mark off the lawn with strings to get the spray uniformly distributed. Poor control or damage to lawn grass may follow an uneven application.

Winter weeds are controlled best by spraying when lawn grasses are fully dormant. This is usually in January and February. Be sure to spray before grass begins growth in the spring or you may injure grass. Chemicals recommended have been applied to bermuda, zoysia, and centipede while dormant without damage. No tests have been conducted on St. Augustine.

When only a few plants are present, it is easier to spot treat than to spray the entire area. To spot treat you may use a sponge moistened with the spray solution. Rub the sponge on the plants. You may also use an oil can or squeeze bottle to apply a small amount of spray.

Weeds Present in Herbicide Studies at Auburn

Common name	Scientific name
Black medic	(Medicago lupulina L)
Chickweed (smooth)	(Stellaria media (L) Cyrill)
Chickweed (hairy)	(Cerastium vulgatum L)
Cranesbill (carolina)	(Geranium carolinianum L)
Cudweed	(Gnaphalium sp)
Chaerophyllum	(Chaerophyllum sp)
Clover (large hop)	(Trifolium procumbens L)
Clover (small hop)	(Trifolium dubium Sibth)
Clover (spotted bur)	(Medicago arabica Huds)
Clover (white)	(Trifolium repens L)
Sticky cerastium	(Cerastium viscosum L)
Dandelion (common)	(Taraxacum officinale Weber)
Dandelion (false)	(Pyrrhopappus carolinianus (walt.) DC)
Henbit	(Lamium amplexicaule L)
Johnny jumpup	(Viola kitaibeliana (R & S)
Knotweed (prostrate)	(Polygonum aviculare L)
Pepper grass	(Lepidium virginicum L)
Primrose (cut-leaf)	(Oenothera laciniata Hill)
Primrose (white evening)	(Oenothera speciosa Nutt)
Speedwell	(Veronica arvensis L)
Vetch (native)	(Vicia angustifolia Reichard)
Venus looking glass (small)	(Specularia biflora R & P)
Wartcress (swine)	(Coronopus didymus (L) sm)

RANCID MILK—Complex Problem Facing Dairymen*

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Department of Dairy Science

RANCIDITY IS A SERIOUS dairy problem. Just ask any dairyman who has had milk rejected because of it.

Rancidity results from hydrolysis (chemical decomposition) of milk fat by an enzyme called lipase. Off-flavor results from short chain fatty acids that are liberated by hydrolysis.

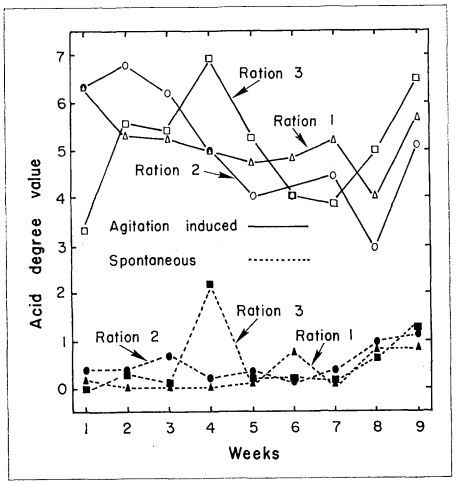
Cold milk, when aged, shows varying degrees of milk fat hydrolysis, designated as spontaneous hydrolytic rancidity or lipolysis. This development can be increased by altering the milk component on which the enzyme acts (called substrate), by shaking, agitation by air, temperature treatments, and homogenization. Induced lipolysis is the term for this type of rancidity.

In parlor and pipeline milking operations, induced lipolysis sometimes occurs to such an extent that milk is rejected because of off-flavor. Generally the cause can be found in air agitation of the milk with foaming as it flows through risers or other points from cow to bulk tank.

Where air leakage is not immediately evident, rancidity is often blamed on such factors as rations fed cows. Pasture, alfalfa leaf meal, and other ration ingredients have been credited with eliminating rancidity on many dairy farms.

To determine effect of ration ingredients on development of rancidity in milk, two trials were run at Auburn. In trial 1, three groups of three cows each were fed these rations: Ration 1 – continuous grazing on Coastal bermudagrass, fescue, and millet pasture, with a 16% concentrate fed at rate of 1 lb. per 3 lb. of milk; ration 2 – alfalfa hay and silage, plus 1 lb. of concentrate to 3 lb. of milk; and ration 3 – Coastal hay only, plus 1 lb. concentrate per day.

Milk samples were taken weekly from the weigh jar at morning and evening milkings during the 9-week test. Half of each sample was immediately cooled in ice water and held 48 hours for use in determining spontaneous lipolysis. Remainder of the sample was agitated in a blendor to simulate air agitation, then cooled and held 24 hours for measuring agitation – induced lipolysis. The extent of fat hydrolysis in the samples after incubation was determined as acid degree value, see graph. Rancidity resulting from both spontaneous and agitation-induced lipolysis was not affected by ration.



Rancidity of fat from milk of cows fed test rations is shown by the curves. To be measurable, differences must be at least —0.687 for spontaneous and —1.704 for agitation-induced lipolysis.

In a second trial, short-term effects of variation in total digestible nutrients (TDN) and inclusion of green feed were studied. For this test, six grade Holsteins, 30-60 days in milk and producing 50-60 lb. daily, were assigned randomly to six rations.

Rations were calculated to supply 80, 100, and 120% of the recommended TDN allowance of each cow, based on body weight and milk production at beginning of the experiment. Rations consisted of grain concentrate, alfalfa hay, and corn silage, with and without green-chopped alfalfa at each nutritional level. Each cow was fed a different ration during each of the six 10-day periods. Milk samples were taken from morning and evening milkings on alternate days and rancidity development determined as in the first trial.

Results from trial 2 are given in the table. Neither variation in TDN level nor inclusion of green-chopped alfalfa in the ration had an effect on spontaneous or agitation-induced lipolysis. In fact, variation among the individual cows was much greater than differences among rations for both types of lipolysis in both trials. This animal variation in susceptibility to agitation-induced lipolysis could account for rancidity variations encountered.

Control of rancidity on the farm, as indicated by these tests, depends on elimination of air leaks and control of excessive foaming and agitation in the pipeline system. The amount of care required will depend on the susceptibility of the milk to induced lipolysis as influenced by cows in the herd.

RANCIDITY OF FAT FROM MILK OF INDIVIDUAL COWS RESULTING FROM SPONTANEOUS AND AGITATION-INDUCED LIPOLYSIS, AS AFFECTED BY TOTAL DIGESTIBLE NUTRIENT LEVEL[1] AND GREEN FEED

Cow no.	Forage[3]	Rancidity, in acid degree values[2]							
		Spontaneous				Agitation-induced			
		Calculated TDN levels			Cow mean	Calculated TDN levels			Cow mean
		80%	100%	120%		80%	100%	120%	
1	1	0.30	0.56	0.62	0.56	10.42	11.11	9.20	10.41
	2	0.65	0.47	0.76		10.20	11.50	10.04	
2	1	0.35	0.28	0.81	0.39	8.85	8.50	9.91	7.76
	2	0.29	0.18	0.41		8.09	6.44	4.80	
3	1	0.59	0.21	0.47	0.39	9.33	12.15	8.74	9.14
	2	0.58	0.45	0.29		8.60	7.36	8.65	
4	1	0.64	0.84	0.39	0.49	9.24	6.62	7.49	7.82
	2	0.69	0.11	0.26		8.84	8.12	6.60	
5	1	0.23	0.53	0.19	0.29	7.56	8.92	5.01	8.58
	2	0.16	0.26	0.39		10.98	9.95	9.15	
6	1	0.76	0.43	0.39	0.44	12.47	12.63	11.96	11.02
	2	0.15	0.89	0.64		8.97	6.79	13.30	
Mean	1	0.45	0.47	0.48	0.47	9.64	9.99	8.72	9.45
	2	0.42	0.33	0.46	0.40	9.28	8.36	8.75	8.80
TDN mean		0.44	0.40	0.47		9.46	9.18	8.74	

[1] Per cent of recommended TDN allowance based on body weight and milk production.
[2] To be measurable, differences must be 0.148 for spontaneous and 1.387 for agitation-induced lipolysis.
[3] Forage 1 without and forage 2 with green-chopped alfalfa.

* Supported in part by a grant from the American Dairy Association.

New Promising Controls of Three Common Nematodes of Chickens

S. A. EDGAR, *Poultry Science Department*

NEW EFFECTIVE REMEDIES are in prospect for control of the three roundworms that most often infect floor-reared chickens. The three continue to plague the poultry industry despite availability of a few drugs that have proved effective against at least two of the species.

They are the large roundworm (*Ascaridia galli*), cecal worm (*Heterakis gallinae*), and a tiny thread worm (*Capillaria obsignata*). Life cycles of all three are similar, with the worms infecting and growing to maturity in the small intestine or cecal pouches. Eggs are passed in droppings of infected chickens and become infective within 7 to 14 days under favorable conditions. Severe infection by the large roundworm can stunt growth of chickens, impair egg production of laying hens, and may cause death. The importance of the cecal worm is the part it plays in transmission of blackhead (histomoniasis) caused by a protozoan. Although blackhead is common and an important disease of turkeys, it is of less importance in chickens. The cecal worm should be controlled to prevent blackhead. The importance of the thread worm has not been clearly determined. Yet it often has been the only disease agent associated with poor producing hens.

Properly spaced treatments with piperazine or continuous feeding of hygromycin have resulted in good control of the large round and cecal worms. Hygromycin in 9 to 12 months renders a premise virtually free of infective worm eggs. Neither drug has proved very effective in eliminating the thread worm. Although the most widely used drug for cecal worm treatment has been phenothiazine, treatment often results in not more than 50-60% elimination.

Studies at Auburn University Agricultural Experiment Station on the large round and cecal worms as disease carriers have confirmed the work of others, but mild infections for 28 to 55 days consisting of 29 to 131 tiny thread worms per bird did not affect growth.

Under floor conditions, chickens often become infected with all three worms. Therefore, tests were conducted at Auburn to determine the effect of multiple experimental infections on growing chickens. Results of two such tests are summarized in Table 1. In the first test chickens infected at 1 week of age with an average of 31 worms of the species 28 days later averaged 105 grams less in weight than the noninfected birds. In a second test of 21 days duration, chickens infected at 45 days of age, averaging 66 worms per bird, gained 192 grams less than controls. Growth was not affected until about 2 weeks after infection, at which time the larvae migrate in the intestinal wall.

Numerous floor trials at this Station revealed that one treatment each of three to four successive broods of broilers with piperazine at 5 weeks of age or continuous medication of three or four broods with 10-12 grams of hygromycin per ton of feed resulted in near elimination of infective worm eggs of the large round and cecal worms from litter.

Recently tests at Auburn resulted in a high degree of elimination of the thread worm. Sample results are summarized in Table 2. Mintic caused 94 to 100% elimination of the thread worm, 50-69% of the large roundworm, and no elimination of the cecal worm, Tests 1-3. Lower levels of the drug were less effective. Piperazine phosphate resulted in excellent elimination of the large roundworm, and good to fair elimination of the cecal and thread worms.

In a 2-day treatment, CoRal caused 59-86% elimination of the three species, and 7-day treatment with Bayer 9002 resulted in 72-100% elimination.

Although the most effective levels for treating with the last two compounds have not been determined, prospects are good that new effective remedies against all three of the most common roundworms in chickens will soon be available.

TABLE 1. EFFECT OF THREE SPECIES OF ROUNDWORMS ON GROWING CHICKENS, MIXED INFECTIONS

Treatment	Average gain, days after innoculation				Worms per bird, average		
	7	14	21	28	Large roundworm	Cecal worm	Tiny thread worm
	Gm.	*Gm.*	*Gm.*	*Gm.*	*No.*	*No.*	*No.*
Test 1[1]							
Noninfected	90	202	360	536	0	0	0
Infected	78	153	274	431	7	7	17
Test 2[2]							
Noninfected	168	290	420	----	0	0	0
Infected	145	167	228	----	18	4	44

[1] White Plymouth Rock crosses, 7-day-old.
[2] White Leghorn males per treatment, 45-day-old.

TABLE 2. EFFICIENCY OF SEVERAL NEW COMPOUNDS IN CAUSING ELIMINATION OF THREE SPECIES OF ROUNDWORMS IN CHICKENS

Experiment	Birds	Medication[1]	Duration of treatment	Worm elimination		
				Large roundworm	Cecal worm	Tiny thread worm
	No.		*Days*	*Pct.*	*Pct.*	*Pct.*
1	8	None	0	0	0	0
	8	1% Mintic	1	50	0	94
	8	3.2% piperazine phosphate	1	100	88	46
2	5	None	0	0	0	0
	5	1% Mintic	1	69	0	100
	5	3.2% piperazine phosphate	1	97	92	83
3	5	None	0	--[2]	--	0
	5	Mintic	1	--	--	100
	5	3.2% piperazine phosphate	1	--	--	76
4	10	None	0	0	0	0
	10	0.0035% CoRal	2	66	86	59
	10	0.0125% B9002	3	66	100	95
	10	0.0125% B9002	7	72	100	98

[1] Mintic was given in drinking water and other medications in feed.
[2] No test.

* Financial support and supplies of CoRal and Bayer 9002 by Chemagro Corp., and provision of Mintic by Ayerst Laboratories are gratefully acknowledged.

MANAGEMENT PRACTICES versus CROWN and STOLON ROT in COASTAL

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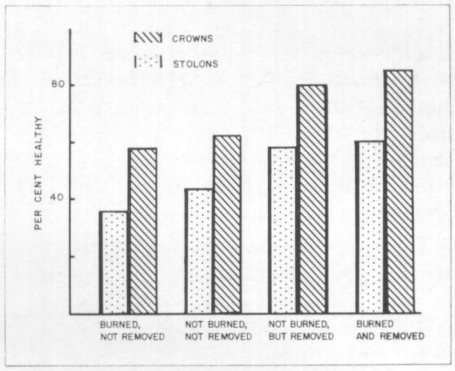
HAROLD YATES and J. E. BARRETT,
Gulf Coast Substation



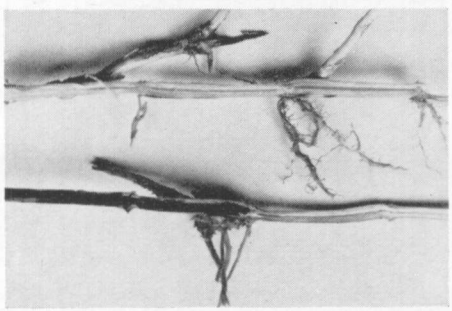
Shown is incidence of disease-free crowns and stolons in Coastal bermuda under some management practices.

COASTAL BERMUDAGRASS is often plagued with diseases and insects.

Some, such as foliar diseases or spittlebug attacks, may develop dramatically throughout an entire field or pasture. Such severe outbreaks are usually sporadic in occurrence. However, there are other diseases that are more subtle, but may be more important in contributing to the gradual decline of a Coastal bermuda planting. Diseases of this type are the crown, root, and stolon rots that are brought on by soil-inhabiting fungi. The occurrence and importance of these inconspicuous diseases have been the subject of recent investigations.

Diseases Occurred in Unused Grass

Observations for the past four growing seasons on field and greenhouse-grown Coastal bermuda suggested that crown and stolon rots occurred when grass was not utilized. That is, the grass was not mowed or grazed at appropriate times and a dense cover soon developed.



Coastal bermuda stolons above are split lengthwise for disease diagnosis. At top are healthy and bottom infected with stolon rot fungus.

The importance of dense cover for population buildup of some insects and foliage-attacking fungi has been recognized and late winter or early spring burning of grass is frequently recommended for control. The effect of cover on crown and stolon rot incidence, however, was not known and field tests to evaluate this were conducted in 1963 and 1964.

Field Tests Conducted

Plots were established in two adjacent fields of Coastal bermudagrass at the Gulf Coast Substation near Fairhope. Some plots were burned off each year in early spring before grass began to turn green; others were left unburned. From half of the burned plots, grass was removed periodically by mowing or grazing throughout the growing season; the other half was left untouched and grass accumulated to a dense cover. The unburned plots were handled similarly.

Crown and stolon rot incidence was determined from samplings during the 2-year period. This involved digging numerous plants with associated stolons from each plot. Stems were removed and crowns with stolons were thoroughly washed. Fifty to 100 crowns and stolons were randomly selected from the sample for each plot and evaluated for presence of disease. Each was carefully examined externally, then split with a razor blade and re-examined, see photo. Tissues were scored as diseased if any dead or rotted matter, regardless of extent, was apparent to the naked eye.

Results

At the end of the second year, estimated stand loss in grass allowed to accumulate a dense cover was 45% in the unburned plots, and 25% in the previously burned plots from which grass had not been removed.

A summary of disease data from all plots is presented in the chart. The largest percentage of healthy or disease-free crowns and stolons was found in burned plots from which grass had been periodically removed by mowing or grazing. By contrast, the highest disease incidence (fewest healthy crowns and stolons) occurred in plots where grass had accumulated for a season. Annual one-time removal of cover by burning did not appear to have any noticeable effect where pastures were not mowed or grazed. This, however, does not preclude the value of burning for controlling other types of diseases in which the casual agent survives in leaf and stem tissues.

The reasons for increased incidence of crown and stolon rots under a cover are probably many and complex. Environmental conditions apparently are more conducive to fungal activities and less favorable for growth of Coastal bermudagrass. Similarly, growth and development of certain insects may be favored and this in turn could be directly related to disease incidence. Previous research has shown that two crown and stolon-attacking fungi in Coastal bermuda enter the plants principally through wounds. Most extensive rotting with which these fungi were associated occurred around wounds apparently inflicted by insects.

temperature controls germination of hard-seeded vetch

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Department of Agronomy and Soils

EXPERIMENTAL VETCH varieties now being tested at Auburn have a built-in thermostat to control seed germination! This control allows seed to germinate only at low fall temperatures when moisture conditions are most favorable for seedlings.

One mechanism involved in germination control is hard seedcoat. A hard-seeded variety could be used in several ways: As a reseeding winter annual grazing crop, to provide cover on roadsides, and as wildlife feed.

Grandiflora (*Vicia grandiflora*) and native vetch (*V. angustifolia*) commonly reseed under natural conditions in Alabama. Both are useful for wildlife feed and soil conservation. Unfortunately both shatter badly, thus preventing commercial seed production.

Seek Nonshattering Vetch

The vetch breeding program at Auburn University Agricultural Experiment Station is aimed at developing a nonshattering reseeding variety with good seed production and forage quality. This work has been reported previously in HIGHLIGHTS OF AGRICULTURAL RESEARCH (*Developing New Vetches*, Vol. 8, No. 3, and *Prospects Good for Reseeding Vetch*, Vol. 10, No. 3).

In field trials during the past 3 years, some of the new vetches have reseeded well on bermudagrass and bahiagrass sods. Practically no seed germinated until mid-October, although moisture conditions were favorable in July and September. Recent laboratory studies have helped explain this result.

Temperature Cycle Has Effect

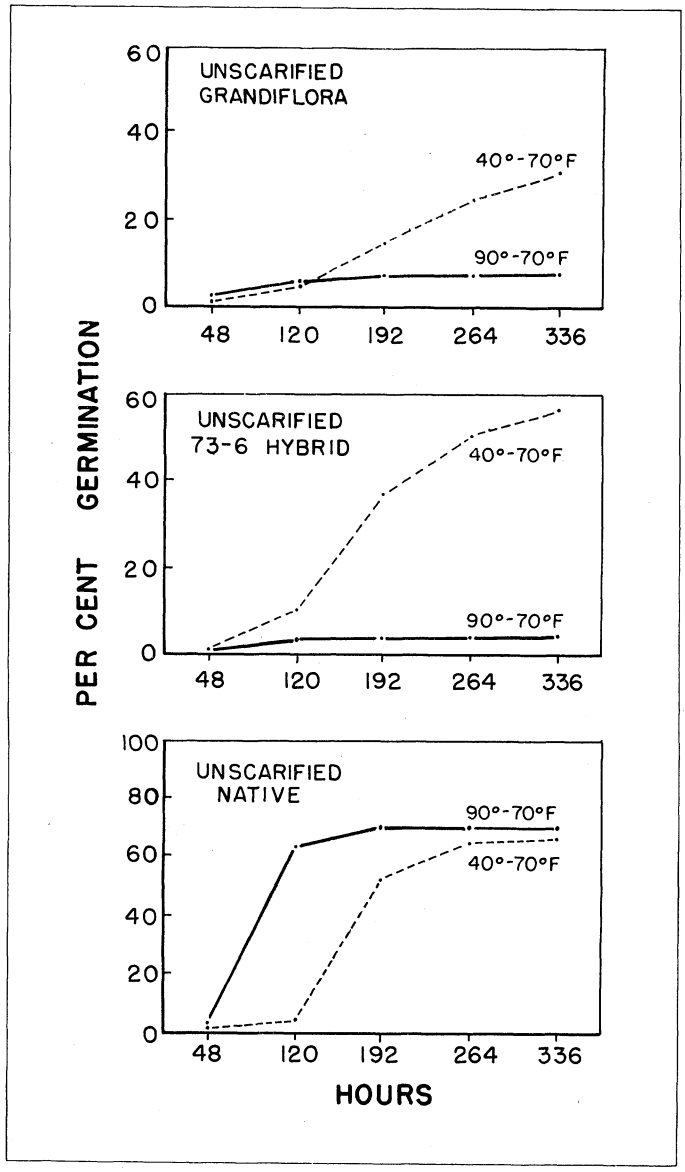
Germination tests on scarified and unscarified seed were done in a germinator. Two temperature cycles were used: (1) a starting temperature of 70° for 16 hours, followed by 90° for 8 hours; and (2) a starting temperature of 40° for 16 hours, followed by 70° for 8 hours. The high temperature cycle is similar to night and day temperatures of early fall and the low cycle corresponds to late autumn night and day temperatures.

Native vetch responded to temperature in a manner different from grandiflora and experimental Ala. 73-6, as shown by the graphs. Unscarified seed of native vetch germinated slower in the lower temperature cycle. At the end of 336 hours (14 days), only 60 to 70% of the unscarified seed had germinated. The other 30 to 40% with delayed germination may be the reason for reseeding of this species under natural conditions.

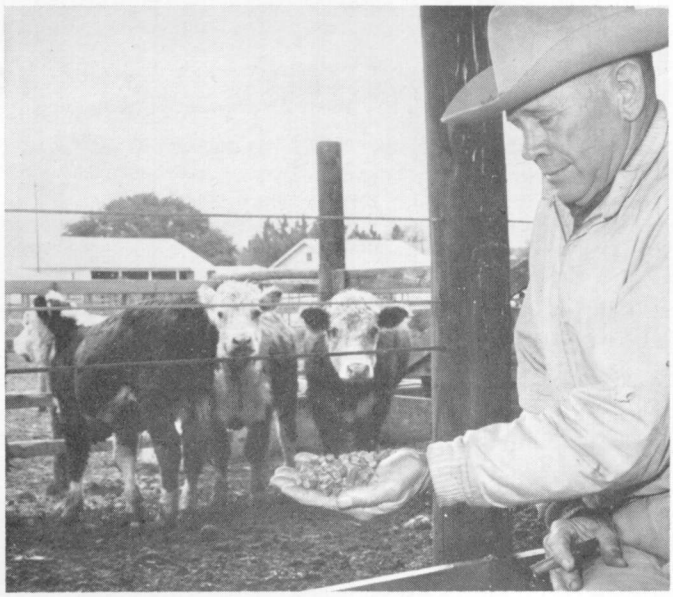
Ala. 73-6 and grandiflora responded alike to low temperature, as shown by the graphs. Unscarified seed of these vetches germinated rapidly in the low temperature cycle, but slowly in the higher cycle. Seedcoat permeability was increased by cold temperatures, thus permitting intake of water for germination.

Experimental hard-seeded vetch varieties reacted to temperature in the same manner as Ala. 73-6 under field conditions. The seed lay dormant during the summer and germinated when cooler autumn temperatures arrived. This is an important trait for establishment and survival of vetch in Alabama, since moisture is normally adequate from time of first frost until seed are matured.

A large number of vetch hybrids being tested have this mechanism for delaying germination. This makes the new varieties better able to cope with their environments.



Different responses to temperature of native, grandiflora, and experimental Ala. 73-6 vetches is illustrated by the graphs.



PELLETS—key to fattening on forage?

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J. G. STARLING, *Wiregrass Substation*
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FATTENING CATTLE on a forage ration has been a longtime dream of Southern cattlemen. So far it has not come to pass, but feeding tests with pelleted hay show hope for the future.

It is clearly established that Coastal bermudagrass produces high yields when poorly fertilized. The only problem is in efficient utilization of the forage.

When used for grazing, Coastal bermuda will carry more animals per acre than any other permanent pasture sward commonly grown in Alabama. Although Coastal grazing is adequate for beef herds, yearling steers will not fatten on it. Furthermore, Coastal is a summer grass and yearling steers are largely fed during fall and winter. However, if pelleted Coastal hay could be substituted for grain containing feeds in rations for growing and finishing steers, it might have much merit. Advantages would result because (1) Coastal pellets can be produced locally at relatively low costs, and (2) grain is frequently scarce in Alabama and relatively expensive.

Research at Auburn and several of the Substations has evaluated feeding value of numerous pelleted forages, including Coastal bermudagrass, johnsongrass, lespedeza sericea, alfalfa, peanut vines, and silages. Although it has not been a wonder feed, pelleted forage has shown promise in all tests.

Some forages are much easier to pellet than others. Generally, legumes are relatively easy. Johnsongrass is easy to pellet and the pellets do not break when handled as readily as do Coastal pellets. Coastal is difficult to pellet and power requirements for grinding and pelleting are high. Nevertheless, pelleted Coastal hay has looked promising when substituted for grain in rations for finishing cattle for slaughter.

In a 3-year study at the Wiregrass Substation, yearling steers were full fed pelleted Coastal for 100 days and then changed to a finishing feed. The Coastal pellet used in this study contained 83% Coastal hay, 10% cane molasses, and 7% protein-mineral supplement. Other cattle were fed the finishing feed for the entire period. The finishing feed was made of 53% ground ear corn, 10% cane molasses, 30% Coastal hay, and 7% protein-mineral supplement. All test cattle got vitamin A and stilbesterol.

In all 3 years, feeding pelleted Coastal for 100 days lowered feed cost for the total finishing period. The pellet fed animals were not as well finished when sold as the concentrate fed controls, but they killed Good carcasses. Although cattle fed the concentrate mixture for the entire period gained faster and used less feed per unit of gain, the pellet fed cattle did well during the 100 days on the forage pellets, see table.

No particular effort was made to get immature, high quality Coastal hay for the test. Numerous tests at Auburn and at other state experiment stations have shown improvement in nutritive value of Coastal hay when cut immature. Thus, it should be possible to get better results with pellets made from high quality Coastal than were recorded for hay of only fair quality in this test.

CATTLE PERFORMANCE ON PELLETED COASTAL BERMUDAGRASS

Feeding period	Gain data			
	Pelleted Coastal		Finishing feed	
	ADG	Feed/ cwt.	ADG	Feed/ cwt.
	Lb.	*Lb.*	*Lb.*	*Lb.*
First 100 days on feed	2.08	915	2.80	841
Entire period, (173 days)	2.21	1,079	2.69	961

At the Black Belt Substation, nitrated johnsongrass cut in immature stage and pelleted has been successfully fed to yearling cattle. However, feed intake has been lower than expected and more research is needed to determine value of pelleting this forage. Based on data already collected, pelleted johnsongrass is equal or superior to pelleted Coastal bermuda.

One advantage of pelleting is that supplementary feeds can be added during processing. Coastal bermudagrass may be low in protein, and it is nearly always deficient in minerals. Therefore, when this forage is pelleted it should have enough protein and minerals added to correct deficiencies.

Serious consideration should be given to adding a limited amount of corn or molasses to Coastal hay before pelleting. Either addition will improve feeding value and greatly aid in making a satisfactory pellet. Adding supplementary feeds to correct a nutrient deficiency of Coastal almost always improves feed efficiency and lowers cost of gain.

In considering Coastal bermudagrass pellets, major emphasis should be given to producing a high yield of immature forage. Feeding the Coastal as pellets simply offers the opportunity of improving efficiency and, therefore, the profitableness of using this productive grass for fattening cattle.

MILK PRICE CHANGES HAVE VARYING EFFECT ON CONSUMPTION

LOWELL E. WILSON, *Dept. of Agricultural Economics*

How much do retail price changes affect milk consumption? Very little, unless the changes are sizeable. But the effects may be greater than has generally been believed.

Information on price-consumption relationships for milk products is vitally needed by private firms, farmers' cooperatives, and government agencies involved in dairy policy. Considerable effort has been spent in seeking such information, but findings have not provided definite patterns.

Effect of price change on milk consumption is often measured by "price elasticity of demand." This concept is defined as the percentage change in consumption for a given percentage change in price. Since demand varies inversely with price changes, the demand elasticity figure is a negative value. If the demand for a product has an elasticity value of less than 1, demand for the product is said to be inelastic. In such a case, a 1% change in price is accompanied by less than 1% change in quantity demanded. But if the quantity changes more than 1%, demand is elastic.

Total revenue (price times quantity) is increased following a price rise if the product has an inelastic demand. On the other hand, an elastic demand causes revenue to decrease with a price increase.

Varying estimates of short-term elasticities of demand – immediate response of consumers to price change – for fluid milk have been reported. These estimates have been grouped into two categories: (1) consumption response to small changes in price, and (2) response to large changes.

Responses Measured

Small Price Changes. Most studies have concluded that demand for milk is hardly affected by price. Results of an early study in Chicago during 1920-22 indicated that consumers tended to vary purchases of milk inversely 0.1% for each 1% change in retail price, see table. Similar habits were found in several metropolitan areas.

In general, pre-1940 studies indicated that the demand for milk was highly inelastic with respect to price. However, some estimates made after World War II showed more effects from price. A 1948 study in the Portland, Maine, market showed that consumers reduced consumption 0.45% for 1% change in price. A Connecticut study made in 1949 found elasticity to average −0.48.

Reasons suggested for the lack of consumer response to small changes in milk prices include: (1) consumer indifference to price of milk, (2) slow adjustment of food habits, (3) belief that price changes are temporary, and (4) price changes (generally increases) are in line with the general price level.

Large Price Changes. Some studies have indicated that consumers are more responsive to large changes than to small fluctuations in retail milk prices. Since changes have usually been small, most price elasticities have been determined from these small fluctuations. Data have been inadequate for determining elasticities from large price changes. Often the large price changes resulted from "price wars," affecting only part of a market.

One of the largest and most abrupt price changes in the New York area – an increase of 3¢ per qt. – occurred in August 1957 when three markets were included in the New York Federal Milk Order. Following this large price increase, analysis of milk consumption showed elasticities up to −0.6 to −0.8.[1]

The larger New York consumption response may be associated with: (1) publicity accompanying the price change, (2) an exceptionally large price increase, and (3) more acceptable fluid milk substitutes becoming available.

Large price decreases were studied in Washington, D.C., in 1940, when a controlled price situation was established among low-income families. Dropping milk prices from an average of more than 12¢ down to 5¢ per qt. caused elastic responses, −1.5 for Negro and −1.2 for white households.[2]

[1] New York (Cornell) Agr. Expt. Sta. Bul. 951, 1959.

[2] USDA Cir. 645, 1942.

Based on findings of the Michigan State University Consumer Panel, it was concluded that price changes did not induce consumption changes to any important degree.[3] During the study period, prices paid by consumers increased about 17%, and milk purchases declined slightly.

An analysis of the demand for fluid milk in 1,365 households in 12 southeastern cities in 1955-56 revealed that price changes greatly affected demand for fluid milk. The demand elasticities reported were in the range of −2.0 to −3.0.[4] However, the statistical evidence was not conclusive.

Limited Response to Price

Most studies dealing with consumer response to milk price changes show a highly inelastic demand. Nevertheless, there are indications that, in some instances, consumers react to price changes by adjusting their purchases.

It is difficult, if not impossible, to isolate the effect of price changes alone on consumption. This helps explain diverse findings. Usually where price changes were small, studies have shown a highly inelastic demand.

Growing price competition in many markets, such as from grocery stores selling lower priced milk, is likely to increase consumer response to prices. Availability of lower cost fluid milk substitutes, such as dry whole milk and concentrated milk, is also likely to affect marketing practices.

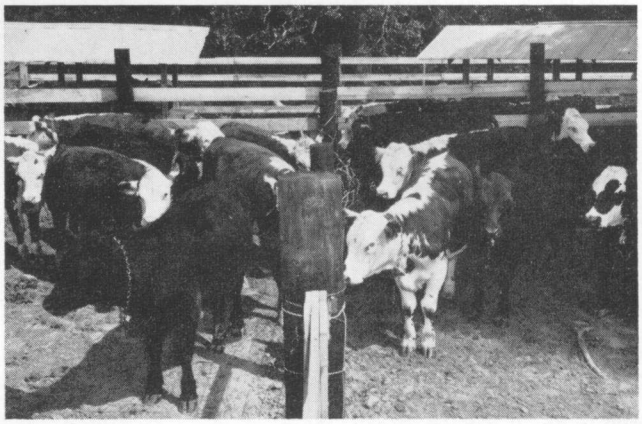
[3] Mich. State. Univ. Dept. Agr. Econ. 788, 1960.

[4] Ga. Agr. Expt. Sta. Tech. Bul. N.S. 12, 1957.

Short-Term Elasticities of Demand for Fluid Milk with Respect to Price, for Specific Periods, Markets[1]

Market	Period studied	Demand elasticity
Chicago	1920-22	−0.10
New York, metro. area	1919-24	− .10
Baltimore	1922-31	− .28
Boston	1922-31	− .06
Connecticut	1922-31	− .14
Several selected mkts.	1934-35	− .28
New York, metro. area	1933-37	0 to − .20
New York, low-income area	1938-40	− .33
Portland, Me.	1948	− .45
Eastern Conn. community	1948-49	− .48
Memphis, Tenn.	1952-53	− .40

[1] Rojko, Anthony S., *The Demand and Price Structure for Dairy Products*, USDA, AMS, Tech. Bul. 1168, 1957, p. 109.



Steer calves from the more liberally-fed dams were heavier at weaning and maintained this weight advantage throughout a growing-finishing system.

RESTRICTED vs. FULL FEED for Overwintering Beef Cows

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MATURE COWS in strong flesh condition are able to tolerate periods of restricted winter feeding, but calves from such cows are about 30 lb. lighter at weaning.

This was found to be true in tests conducted at the Lower Coastal Plain Substation. In the fall of 1957, 17 grade Hereford females were assigned to each of two feeding treatments to determine what effect restricted feeding during the winter would have on cow and calf performance.

The restricted group received fair quality grass hay free choice, salt, and water. The animals were confined to a small sod lot from November 1 to April 1. The hay was common bermudagrass and/or surplus forage removed from improved pastures. The control or optimum-fed cows were fed good quality Coastal bermuda hay, plus 2 lb. of 41% cottonseed meal per animal daily. In addition they had access to an improved dallisgrass-white clover pasture with a limited amount of fescue.

On April 1 both groups were turned together on lush spring pasture and remained together until November 1 when they reentered the winter test. All cows were bred to performance tested Angus bulls so that most calves would be dropped in fall and early winter, October-January. Heifer calves were kept as replacements in the group in which they were born and steer calves were carried through post-weaning, growing-finishing program.

The two groups of heifers were kept separate after weaning because optimum-fed heifers received a limited amount of a high-roughage growing mixture while on permanent summer grazing. The restricted-fed heifers received only grazing. At 15 months of age all heifers were placed in their respective cow groups and exposed to the bull.

Both groups of cows lost weight during the winter periods of the 7-year study but optimum-fed cows lost the least (65 vs. 119 lb.) None of the weight losses was excessive.

The optimum-fed cows were fed an average of 17.8 lb. of hay plus 2 lb. of CSM daily from November 1 to April 1. The restricted-fed cows received an average of 24.7 lb. of hay but no CSM during this same period. Total hay fed per cow during the winter feeding period was 2,670 lb. and 3,705 lb. for the optimum- and restricted-fed cows, respectively. In addition to hay, the optimum cows each received 300 lb. CSM. Based on "good" quality hay @ $30, "fair" quality @ $20, and CSM @ $70 per ton, the per cow wintering cost was $50.55 and $37.05 for the optimum and restricted groups, respectively.

MILK PRODUCTION[1]

Dates milked	Nov. 1	April 1	56 days later
Optimum	5.83	4.59	4.45
Restricted	5.41	3.01	4.51

[1] Values given are 4% fat corrected milk (FCM) adjusted to 12 hours (3-year mean).

The 250-day weaning weights of calves, adjusted for sex and age of dam differences, were 450 vs. 420 lb. for optimum and restricted, respectively (7-year average). Not only were calves from the better-fed dams heavier at weaning but steer calves maintained this weight advantage throughout a growing-finishing program. The 55 optimum-fed steer calves averaged 44 lb. heavier at weaning than the 37 restricted-fed ones; at beginning of feedlot this difference was 39 lb.; and at the end of the feedlot fattening period the difference was 43 lb.

The most noticeable effect of the restricted-feeding regimen was upon replacement females. The heifers reared under the restricted feeding program were smaller at 15 months of age and apparently did not reach puberty as early as did the better fed heifers. Twenty-nine of 43 optimum-fed heifers calved as 2-year-olds, whereas only 17 of 34 restricted-fed heifers calved. There were 6 heifers on each feeding treatment that calved at 2 years of age and then failed to calve at 3 years. Even though the restricted-fed heifers were up to 100 lb. smaller at 2 years of age, average difference in the body weights at 5 years of age was less than 40 lb.

Milk production of the cows is given in the table. These data show that cows nursing fall-dropped calves decline materially in milk production during periods of restricted feeding. However, they still possess the ability to respond to lush grazing with a resulting increase in milk flow. After about 60 days on spring grazing their milk production was equal to that of the more liberally fed cows.

Mature cows in strong flesh condition were able to tolerate periods of restricted feeding. However, calves weaned from such cows were about 30 lb. lighter at weaning (250 days). Winter feed cost was $13.50 per cow more for the optimum group. Nutrients in addition to dam's milk must be provided the calf if normal weaning weight is attained under such a program. About 50% of the replacement females reared under a restricted-feeding regimen calved at 2 years of age, whereas more than two-thirds of better-fed heifers calved at that age. Steer calves from the more liberally-fed dams were heavier at weaning and maintained this weight advantage through a growing-finishing system.

These data indicate that a herd of mature beef cows in good flesh could be wintered on fair to good quality grass hay alone provided they were fed an ample quantity (20-25 lb. daily). Replacement females must not be subjected to such a restricted feeding plan until they are at least 4 years of age.

BIOLOGICAL CONTROL of INSECTS

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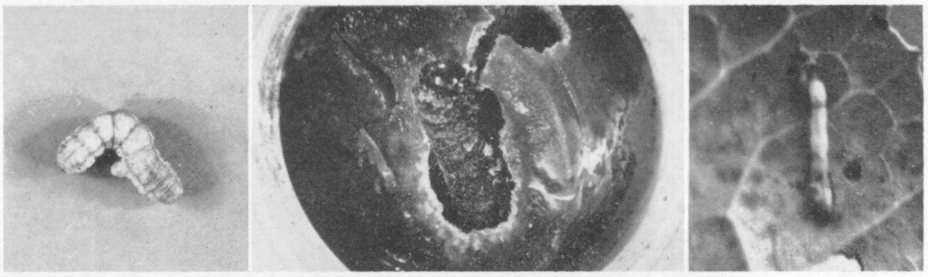

Three examples of biological control are shown above. Left is insect parasite emerging from tobacco budworm larva; center, fungus disease of corn earworm; and right, virus disease of cabbage looper.

In the continuous search for more effective methods of controlling destructive insects, entomologists have recognized the value of biological control.

This approach involves the use of predaceous and parasitic insects and pathogenic microorganisms, specifically protozoa, bacteria, nematodes, fungi, and viruses. Many of these organisms can be applied in the field like conventional insecticides and are capable of producing deadly diseases in some insects. Research is currently underway at Auburn University Agricultural Experiment Station to determine the effectiveness of various predators, parasites, and pathogens as biological control agents.

Predators and parasites commonly attack many of our agricultural pests. These biological control agents are continuously operating to help maintain potentially destructive pests at sub-economic levels.

Predators and parasites that are getting a close look by Auburn are those attacking the *Heliothis* (bollworm and tobacco budworm) complex. Several different predators attack all stages of the insects' life cycle. Parasites currently being studied attack the egg and larval stages. Three species of parasites have been recovered from *Heliothis* larvae collected on crimson clover during the early spring months. One of these parasites, *Cardiochiles nigriceps* Vier, attacks tobacco budworms and has been responsible for significant reductions in field populations.

Trichogramma minutum Riley is an egg parasite that attacks a wide variety of insect eggs. This tiny parasite is often responsible for significant reductions in *Heliothis* populations by destroying their eggs. Data presented in Table 1 illustrate the effectiveness of this parasite.

Some fungi, bacteria, and viruses cause diseases in insects and are potentially important as biological agents.

At Auburn, 12 species of fungi and bacteria have been isolated thus far from diseased, field-collected bollworms and budworms. These microorganisms are now being tested to determine which are responsible for insect mortality and offer most promise as control agents. In such tests, healthy, laboratory-reared bollworm and budworm larvae are inoculated with a suspect pathogen, held in controlled environments, and observed for disease development.

Table 1. Reduction of Heliothis Egg Populations by an Egg Parasite, Trichogramma minutum, Alabama, 1964

Date collected	Host	Eggs	Parasitized	Eggs parasitized
		No.	*No.*	*Pct.*
5/11-25	corn blade	216	192	88.9
5/29-6/16	corn silks	248	133	53.6
5/14-6/16	tomatoes	241	178	73.9
6/1	cotton	5	2	40.0
7/3-17	corn silks	124	23	18.5
	Total	834	528	62.1

One fungus, *Aspergillus flavus* Link, causes 100% larval mortality within one week after inoculation. Research is now underway to determine the most desirable conditions for infection and disease development in order that this fungus may be evaluated in field trials.

Although fungi and bacteria may prove effective, it appears that viruses offer the greatest promise as biological control agents. Many insect viruses remain infectious under a wide range of environmental conditions, are easily applied in the field, and appear to be completely harmless to man and other animals.

A virus disease affecting the cabbage looper, *Trichoplusia ni* (Hubner), has been observed to occur naturally among loopers on several crops in Alabama. The disease has been successfully established in laboratory and field populations by applying sprays of the virus in the same manner as conventional insecticides. In field experiments during 1964, looper control obtained with weekly applications of the virus compared favorably with recommended insecticides, Table 2.

A similar virus has been effective for control of the bollworm and budworm in laboratory and field investigations.

Table 2. Control of the Cabbage Looper on Cabbage, Cullman, 1964

Treatment	Rate/a.	Damaged heads
	Lb.	*Pct.*
Parathion	0.5	10
VIRUS	10 larvae	33
Naled	2.0	33
Malathion	1.5	43
Diazinon	0.5	53
Untreated	0	64

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