# Kentucky FARM AND HOME Science

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# *Kentucky* FARM AND HOME *Science*

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Address correspondence about articles in this publication to either the authors or the Department of Public Information and Educational Aids, Experiment Station Building, University of Kentucky, Lexington.

## *In this Issue*



**The Cover** A method for measuring the effectiveness of a systemic insecticide is shown on the cover. Strawberry plants were treated in the field; then leaf disks were cut and mites introduced on them. Examining a disk to determine mite mortality is Dr. J. G. Rodriguez, Department of Entomology and Botany.

### Better use and management recommendations for Kentucky's farm lands to result from

# Soil Characterization Program

By HARRY HUDSON BAILEY

Two programs underway by state and federal agricultural agencies hold promise of expanding our knowledge of Kentucky's soil resources. Results of the work will help research and extension specialists in making better soil use and management recommendations.

The Kentucky Agricultural Experiment Station two years ago began a soil sampling program over a wide area of the state; at the same time the U. S. Department of Agriculture Soil Conservation Service started progressive soil surveys in seven Kentucky counties. The map below shows where samples have been taken, the counties in which surveys have been begun, and counties which have previously been surveyed.

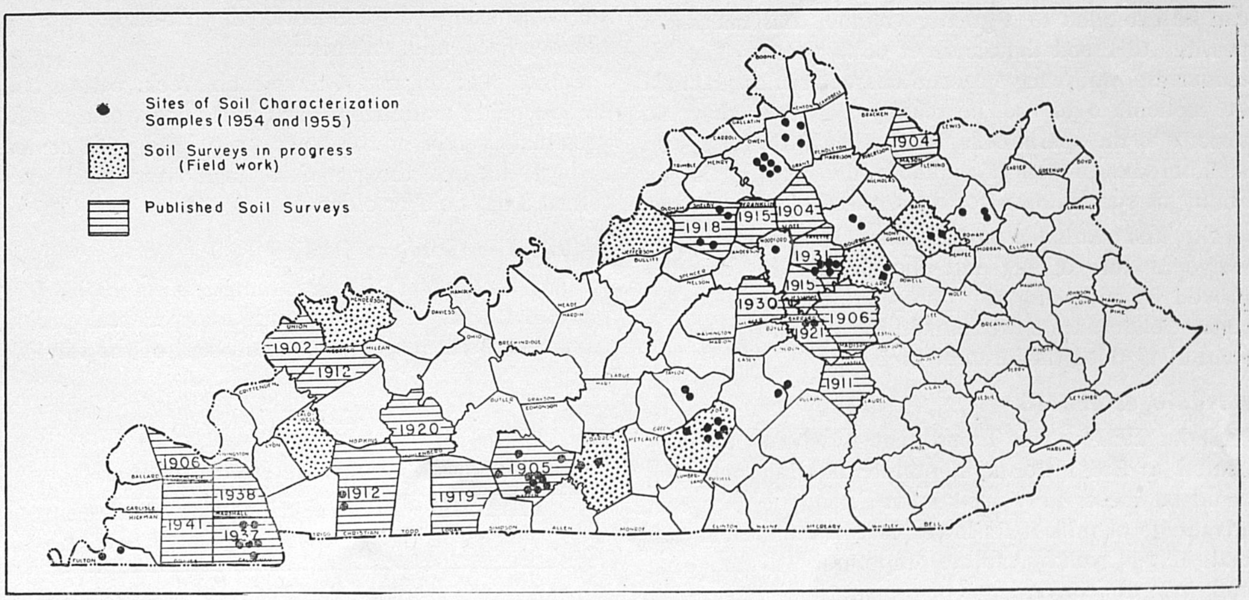
Purpose of the sampling work is to obtain basic information as to texture (percentage of sand, silt and clay), mineral and trace element* composition, soil-water relationships, reaction (pH), and other data. The 28 important soils sampled were selected from each of the principal physiographic divisions of the state (Eastern Coalfields, Bluegrass, etc.). Each was sampled at two locations, 1 to 20 miles apart.

At each site a pit was dug and a sample taken from each of the various horizontal layers (horizons) from the surface downward until unweathered soil material was reached. The number of horizon samples taken from a single pit varied from a minimum of 4 in eastern Kentucky to 15 in some deep soils in the western part of the state.

Considerable laboratory work remains to be done, especially with the samples collected in 1955. As soon as they become available, results are passed on to

*(Continued on page 11)*

* An article on research being done with trace elements by the Kentucky Agricultural Experiment Station appears on page 6 of this issue of *Farm and Home Science.*




**This map shows the progress of the statewide soil characterization program. Indicated are the sites from which samples have been taken, as well as the seven counties now being surveyed by the Soil Conservation Service. The dates on other counties indicate when mapping and survey work was done.**

# Heated Milk as an Extender for Dairy Bull Semen

By JAMES R. PERKINS and DWIGHT M. SEATH

A field trial conducted by the Dairy Section of the Kentucky Agricultural Experiment Station in cooperation with the Kentucky Artificial Breeding Association shows that heated milk can be used as an extender for bull semen.

There was no significant difference between heated milk and yolk-citrate extenders, although heated milk was superior to yolk when used with 2-day-old semen. There was a difference among bulls. The nonreturn rate of some bulls was increased when the extender was changed from yolk-citrate to milk. The tendency was for bulls with a low nonreturn rate when their semen was extended in yolk-citrate to show an increase in nonreturn rate when milk was used as the extender.

### Characteristics of an Extender

One of the chief reasons why artificial insemination has been successful is the fact that semen from a bull can be extended to a greater volume, thus making it possible to breed thousands of cows yearly. The extender used must have certain characteristics. It must be economical to use, be readily available, show no toxicity to the sperm cells, furnish nutrition for sperm metabolism, and must maintain life and fertilizing ability of spermatozoa for a desirable length of time.

The first extender to be adopted for wide usage was a mixture of egg and phosphate. This was improved by replacing the phosphate with sodium citrate. Yolk-citrate has remained the standard extender from 1946 until the present time.

### Advantages of Milk

About 1951 it was found that if whole milk was heated to 203°F for a 10-minute holding period it could be successfully used as an extender. The great advantage of milk is its lower cost as compared with that of egg yolk. Another important advantage of milk is in the convenience of preparation. The results reported from the use of milk extender have varied considerably among experiment stations; consequently,

Fig. 1.—Representatives of the Kentucky Artificial Breeding Association, such as this inseminator, cooperated in the field research on the new semen extender.

it was felt that more research was needed before Kentucky would reject or adopt this new extender.

In the field trial at the Kentucky station the 60-to 90-day nonreturns were compared where semen was extended with yolk-citrate and with heated homogenized milk. Semen was collected from 31 bulls over a 4-month period, and alternate collections were shipped, using the conventional yolk-citrate and a homogenized milk extender.

Semen was shipped 4 days each week, with a collection being made from each bull once weekly. Approximately half of the cows were bred with semen 2 days old, and the remaining half were bred with semen 3 days old or older.

### 19,939 First Services Studied

The average 60-to 90-day nonreturns for 19,939 first services during the four-month experimental period were 70.3 percent. Approximately half of the services

TABLE 1

**Percent 60-90 day nonreturns for 2-and 3-day-old semen diluted with milk and with yolk-citrate**

| | 2-day-old semen | | 3-day-old semen | | Total | |
|---|---|---|---|---|---|---|
| Diluter | 1st services | 60-90 day non-returns | 1st services | 60-90 day non-returns | 1st services | 60-90 day non-returns |
| | | (%) | | (%) | | (%) |
| Yolk | 4,799 | 73.7 | 5,128 | 68.9 | 9,927 | 71.2 |
| Milk | 4,797 | 75.3 | 5,215 | 64.1 | 10,012 | 69.4 |
| Total | 9,596 | 74.5 | 10,343 | 66.6 | 19,939 | 70.3 |

were with egg yolk-citrate extended semen which resulted in a 71.2 percent nonreturn rate, while the remaining half of the services with milk-extended semen gave a nonreturn rate of 69.4 percent. This difference of 1.8 percent in favor of milk was found to be not significant statistically, which means that one would expect this great a variation to be due to chance.

Milk was found to be far superior to yolk-citrate as an extender when 2-day-old semen was used. There was a greater decline in nonreturns with milk between 2- and 3-day-old semen than with yolk, so that yolk was superior as an extender when semen of 3 days old or older was to be used.

### Difference Among Bulls

The results indicated further that there was a difference among bulls; that is, about half of the bulls showed an increase in percentage of nonreturns with milk extender as compared with yolk-citrate extender, while the remaining half showed a decrease when their semen was extended in milk.

The indication was that those bulls showing a high nonreturn rate in respect to yolk extender were lower when their semen was extended with milk, and the rates of those bulls having low nonreturns were improved when heated milk was used as the semen extender.

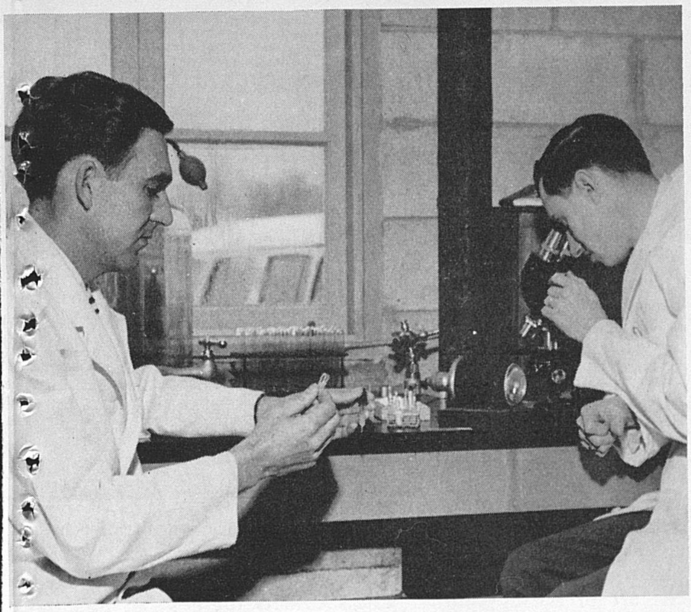


Fig. 2.—Research is continually going on to improve the efficiency of the artificial breeding program in Kentucky.

# Meats Specialists Study Wild Onion Problem in Beef

By JAMES D. KEMP

A sizzling juicy steak smothered in onions, prepared by a good cook, has long been regarded as an appetite stimulator, but wild onion flavor in beef when it isn't desired is another matter.

Yearly, both in the spring and fall during the wild onion seasons, numerous inquiries are received concerning what can be done to remove wild onion flavor from beef. This objectionable flavor is a direct result of the animal's having eaten wild onion or garlic shortly before slaughter; unfortunately, there is no successful way to remove the flavor. A usual answer—and not a very helpful one—is, "Cook the beef with onions."

### Twelve Steers Used

To study this problem, the Animal Husbandry Section tested the effects of wild onion on beef flavor. Twelve grade Hereford steers were placed on a mixed grass pasture heavily infested with onion. After 3 weeks one was removed and slaughtered; its meat had a strong onion flavor and odor. After 4 weeks all the cattle were removed, two slaughtered, and the others placed in drylot and fed alfalfa hay and grain. Six were slaughtered in pairs on the second, fourth and sixth day after having been placed on dry feed.

### Rib Roasts Tested

Rib roasts from the six animals were cooked to 160°F and tested by a taste panel. Beef from the steers slaughtered the day of removal showed marked onion flavor and odor; after 2 days, slight flavor and odor, and after 4 days, no detectable flavor and odor.

The remaining three steers were fed wild onion tops for 4 days. One steer was slaughtered soon after the last feeding. The other two were killed on the second and fourth day, respectively, after the last feeding of onion tops. Taste test results were similar to those of the previous test, with heavy initial contamination, very slight after 2 days, and little if any after 4 days.

From the data obtained, it is concluded that cattle should be removed from pastures containing wild onion at least 4 days before slaughter to make sure the beef will have neither onion avor nor odor.

# Minor Element Research

**Needed in only very small amounts, the minor elements play an important role in plant growth and production; most Kentucky soils thought to be well supplied**

By H. F. MASSEY

Farmers have long been aware of the essential roles played by nitrogen, phosphorus and potassium in plant growth and production. Yet from time to time plants that grew in soils having ample supplies of the "big three" elements failed to flourish and crop yields were disappointingly low. Research has shown that a scarcity of some other element or elements may be responsible for the poor growth of those plants. Thus, the term "minor element" has come into use.

## What Are Minor Elements?

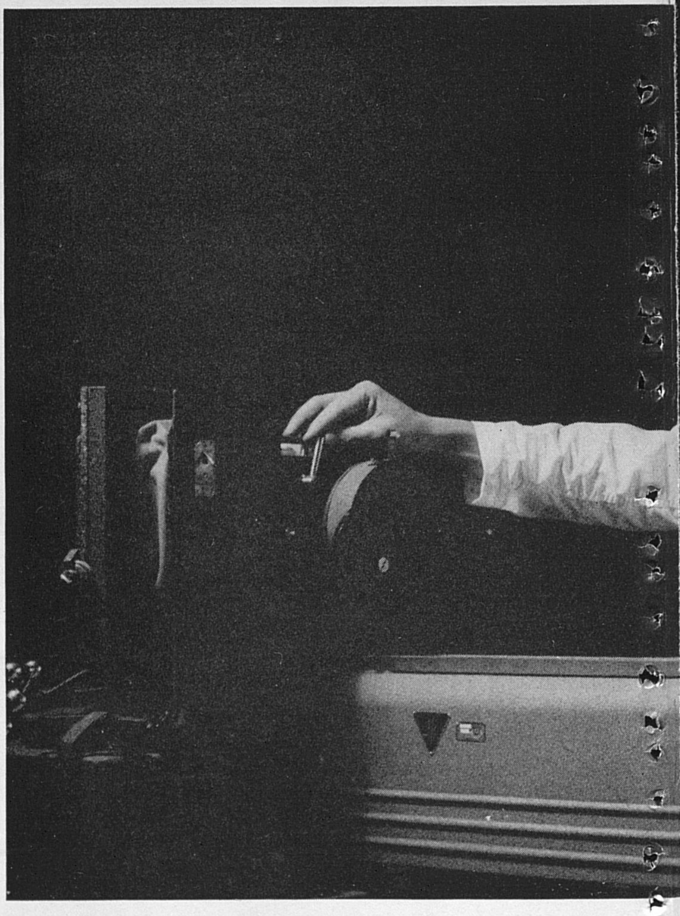
In dealing with plants, this term is given to an element essential for plant growth but needed in only very small quantities. Known to be essential for plant growth, in addition to the "big three," are copper, molybdenum, zinc, boron, manganese, iron, sulfur, calcium and magnesium. Substantial quantities of the last three elements are required and they probably should not be considered minor elements. Other elements may also be required in minute quantities, but as of now the foregoing list includes all minor elements known definitely to be essential for plant growth.

Some elements not believed to be required for plant growth are required for animal growth and are therefore important in plant nutrition because plants must normally supply these elements to animals. Two elements in that category are cobalt and iodine.

The following table gives the approximate average concentration in alfalfa hay of some of the elements just mentioned:

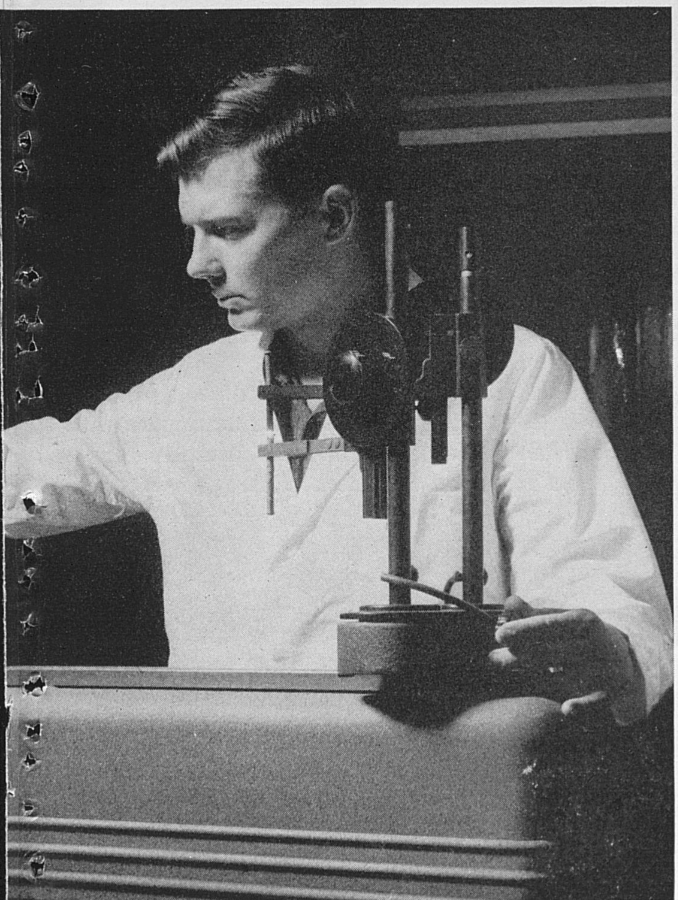
| *Element* | *Percent* |
|---|---|
| Magnesium | 0.3 |
| Sulfur | 0.3 |
| Iron | 0.03 |
| Iodine | 0.02 |
| Manganese | 0.008 |
| Zinc | 0.003 |
| Boron | 0.0025 |
| Copper | 0.0008 |
| Molybdenum | 0.00008 |
| Cobalt | 0.00001 |

Generally speaking, it is not believed that widespread deficiencies of any of the minor elements exist in Kentucky soils. There has not been enough research work with these elements, however, to make possible an authoritative statement. It is known that boron fertilization is often required for crops having a high requirement for that element, such as alfalfa.



**The spectrograph is widely used for the determination of minor elements. As shown in this picture, the operator (Dr. Massey) places a small amount of the sample to be analyzed in the electric arc of the apparatus. The elements present can then be determined by the color of the light given off, and the amount of each element is determined by the amount of light of a par-**

Cases of manganese deficiency on highly limed soils have been reported. During recent years a number of samples of corn which seemed to be suffering from a deficiency of zinc have been brought to the Experiment Station. Zinc deficiency has been produced on the Experiment Station Farm by overliming, which is known to reduce the availability of soil zinc to plants. Thus, it seems likely that some Kentucky soils may be too low in zinc for the proper growth of corn. It is not known how extensive these soils may be, or how much the deficiency affects corn yields in Kentucky, or what is the best way to correct the deficiency. Kentucky's neighbor to the south, Tennessee, has reported considerable zinc deficiency in corn.



ticular color. For example, the instrument can detect as little as one-ten billionth of an ounce of cobalt. With new equipment recently acquired, the Kentucky Agricultural Experiment Station has one of the most modern spectrographic laboratories of any experiment station in the United States.

**Work Being Done in Kentucky**

The preceding discussion suggests the work which needs to be done in Kentucky. The first problem is to determine the status of minor elements in the soils of the state and the minor element needs of those crops commonly grown on Kentucky soils. As a beginning in this work, samples of 35 Kentucky soils have been brought to the Experiment Station for study. Samples of the topsoil large enough for greenhouse experiments were collected, as well as smaller samples of the deeper horizons sufficient for laboratory studies.

These soil samples and plants grown on the soils in the greenhouse are being analyzed for minor elements. As is true of the major nutrient elements (nitrogen, phosphorus, potassium, calcium), not all of a minor element in the soil is available to plants. The major part of any nutrient element is usually held in an "unavailable" or "fixed" form in the soil and is only slowly released for plant growth. Ordinary chemical analysis reveals the total amount of an element in the soil but gives no indication as to what part of the total is actually available to the plant. A good idea as to the availability of the elements in the soil can be obtained from elaborate field and greenhouse experiments, but a quicker laboratory method is needed. Research aimed at finding such methods is underway.

**First the Needs—Then Recommendations**

When the studies mentioned above are completed agronomists should know which soils in Kentucky are likely to be deficient in any of the minor elements. In addition, they will know which crops have the greatest need for particular minor elements and, consequently, are likely to show deficiency symptoms. Then it will be possible to devise the best methods of applying the minor elements and to make recommendations to Kentucky farmers for their use.

* * * * *

**WANTED—Zinc-deficient Corn**

Zinc deficiency first appears in corn 8-10 inches high as a yellow streaking. In severe cases the leaf tips, margins, and sheaths become purple; a broad yellow strip develops down each side of the leaf, the pith may have dark splotches at the lower nodes, and the plant is stunted. Dr. Massey would like to know the extent of zinc deficiency in Kentucky. If you have corn which seems to show zinc deficiency please notify him, giving all particulars.

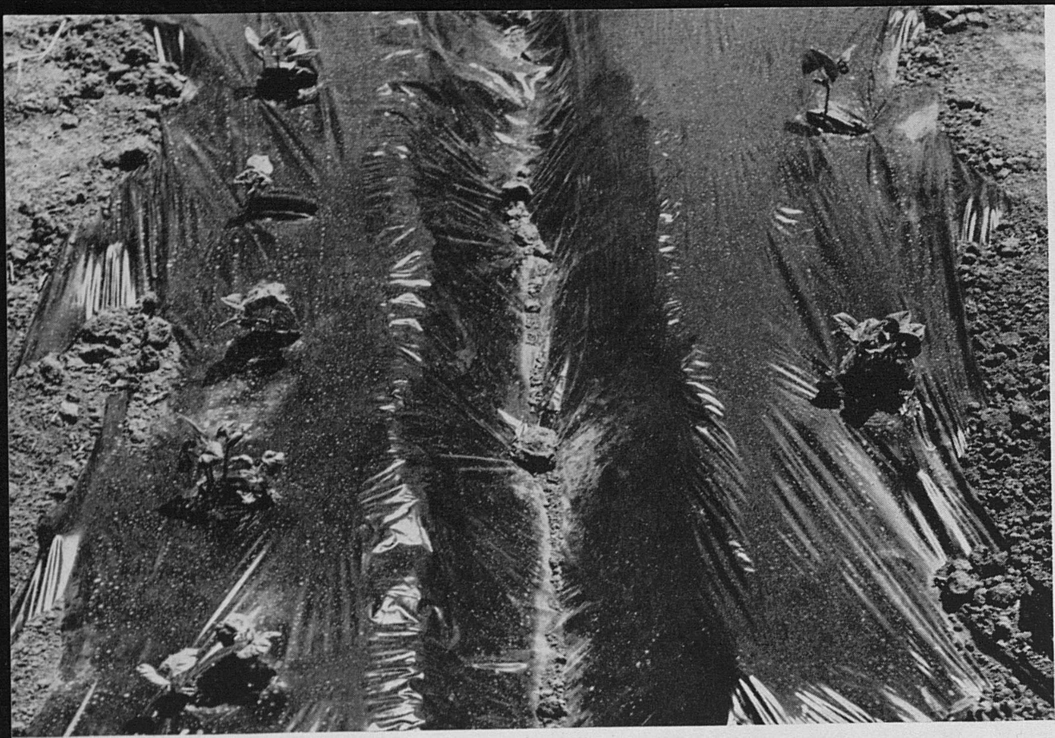


Fig. 1.—Snap bean seedlings emerging through slits in the black plastic mulch. The seed was planted with a corn jobber. Note the condensed moisture droplets on the undersurface of the plastic.

**Kentucky experimental work shows the way to earlier and larger yields of better quality products through use of**

# Plastic Mulch for Vegetables

By E. M. EMMERT

Either dry weather or heavy rains call for mulching around vegetable plants. In the first instance, the purpose is to conserve moisture; in the second, to prevent packing of the soil and ground-spotting of the fruits. In addition, mulching helps to control weeds.

Paper has been found effective as a mulching material, but it is too costly and fragile. Also, it often deteriorates and becomes useless before the season is over. Though aluminum foil does not deteriorate so fast as paper, it too is fragile and costly. Laminated aluminum foil on plastic is a mulching material well suited to hot summer weather because it reflects heat and cools the soil temperature. It is long-lasting but considerably more expensive than black polyethylene plastic, which has been tried successfully at the Kentucky Agricultural Experiment Station. (Recently announced is the development of a plastic impregnated with aluminum particles, which also holds promise as a mulching material.)

The 0.0015-gage black polyethylene plastic is the cheapest and most efficient mulch yet tried on vegetables at the Kentucky Station. Kentucky Wonder beans yielded nearly 200 bushels per acre more with the use of the black plastic and were marketed earlier than beans grown on the check plots. Tomatoes also

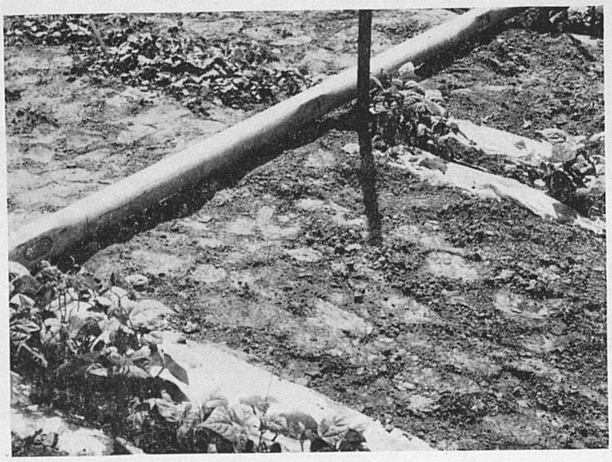


Fig. 2.—Use of "gated" irrigation pipe permits regulation of the amount of water supplied the snap beans protected by the plastic mulch.

## The Balance Sheet: Black Plastic as a Mulching Material

ADVANTAGES

1. Controls weeds effectively in the row, with no danger to crops such as may result from use of herbicides.
2. Increases soil temperature 5-10 degrees, forcing seeds to germinate faster and plants to grow faster because of increased nitrification and heat.
3. Reduces crusting and packing of the soil, resulting in less seed rot and a much better stand under adverse weather conditions.
4. Greatly lessens water loss. Permits furrow irrigation on porous soils. Only about one-third as much water needed as for rotary sprinkler irrigation.
5. Reduces disease because of less spattering of soil-laden water on the plants. Plastic-covered rows prevent ground-spotting of fruits or pods.

DISADVANTAGES

1. More expensive than herbicides if one considers the cost of the plastic and the labor for laying.
2. Soil may become too warm during summer with subsequent injury to seeds.
3. Necessary to make slits before planting or seeding; a hand corn planter (jobber) has been used effectively.
4. Necessary to take up before plowing next year. Plastic can be re-used.

produced larger and earlier yields, and ground spotting was reduced. It seems logical to expect the production of good, non-spotted fruits in wet seasons without staking and without the cracking and sunburning which occurs when tomatoes are staked.

The black polyethylene plastic is tough and stays in position satisfactorily if soil is placed along the edges and, in the case of wide sheets, at intervals in the center. With the use of a corn jobber, large seed can be planted readily. The edges of the punctured opening spring back as soon as the jobber is withdrawn, leaving only a narrow slit. Shoots from the planted seed can emerge through the slit, but those from weeds present in the soil do not. Consequently, no weeding is necessary in the row. Techniques have yet to be devised for the planting of small seed under plastic. If desired, plants can be easily set through holes made in the plastic, and the plastic will spring back, encircling the stems and smothering out weeds. It is possible that a machine could be developed which would drill in fertilizer, lay the plastic and job in the seed or place plants, all in one operation.

### Weeds Easily Controlled

Weeds growing along the edges of the plastic are controlled satisfactorily with the use of a rototiller, though other types of cultivators could be used.

When irrigation is practised, the furrows are covered with plastic and T-shaped slits are made in the plastic, with the stem of the "T" towards the direction from which the water is flowing. The steeper the slope the closer should be the slits, varying from about 3 feet on a 1-percent slope to 1½ on a 10-percent slope.

Soluble fertilizer can be easily washed through the slits by irrigation water. Complete fertilizer, put in ahead of the laying of the plastic, is utilized better under the plastic than in uncovered soil. There is more soil moisture to make it available to the plants

*(Continued on page 11)*

Fig. 3.—Plastic mulch between rows of snap beans. The slits in the center permit water to enter the soil. The steeper the slope, the closer should be the slits. If desired, soluble fertilizer can be added to the irrigation water.

# Establishment of Legumes in Seven-year-old Fescue Sod

**Experiment shows effects of tillage and defoliation treatments on the introduced legumes**

By T. H. TAYLOR, W. C. TEMPLETON, JR., W. N. McMAKIN, and S. H. WEST[1]

Production of most grass pastures in Kentucky would be increased in both quality and quantity if adapted legumes were more abundant in the sward. Trial seedings made over a period of years have shown reasonably good success in establishing legumes in grass sods provided fertility was adequate, the grass was grazed or clipped short at the time of seeding, and the seedings were made at optimum times.

An experiment was started in the spring of 1955 to study the effects of various tillage and defoliation treatments on the establishment and production of alfalfa, sweet clover, red clover, Ladino white clover, annual lespedeza and birdsfoot trefoil seeded in a 7-year-old, tall fescue sod in Christian County. The soil has been tentatively classified as Pembroke silt loam. The legume seedings were made March 11 on (a) undisturbed, (b) lightly disked, (c) heavily disked, and (d) plowed land. Adequate lime and fertilizer were applied prior to seeding.

The occurrence of a hard freeze after many of the legume seedlings had emerged gave an opportunity to observe the effects of low temperature on the various legumes when seeded under different conditions. It was apparent that vegetative cover either on or above the soil surface decreased injury from cold. Most seedlings of alfalfa, sweet clover, red clover, Ladino white clover and birdsfoot trefoil survived temperatures as low as 12°F on the no-tillage and disked-lightly blocks. Killing of seedling plants increased markedly with the absence of vegetative cover on the disked-heavily and plowed blocks. Annual lespedeza seedlings failed to survive the cold weather under any condition.

### Moisture Conditions Excellent

Precipitation was normal or above from March through June (1955), with an accumulated excess of 3.48 inches. Moisture conditions were excellent during this period for the establishment of grasses and legumes. However, a drouth began in July and continued until the latter part of September, with a deficit of 4.57 inches of precipitation for the period.

[1] Former staff member.

Fig. 1.—This scene in Christian County, photographed in October 1955, shows the transformation in one season of an old fescue sod into a flourishing legume-grass mixture. On the left is Madrid sweet clover; on the right, Ladino white clover. Both were seeded (15 and 3 pounds per acre respectively) with a grain drill in March 1955 after the fescue sod had been lightly disked. To insure ample carbohydrate storage in the roots for vigorous growth the next year, the sweet clover was not cut after May.


**Fig. 2.— Prior to the Christian County trial, similar work was done on the Experiment Station Farm at Lexington. This photograph was taken on June 29, 1955, of a Kenland red clover seeding in an undisturbed fescue sod. (A part of the fescue top growth has been removed.) The seeding (12 pounds per acre) was made on Sept. 24, 1954, with a commercial machine adapted for seeding in sod.**

Legume stands were closely related to tillage treatments given the old sod. Disked-lightly and disked-heavily tillage treatments seem to have encouraged the establishment of white clover from seed present in the surface soil whereas plowing did not have such an effect. Establishment of legumes on the non-tilled and disked-lightly blocks was greatly improved by frequent removal of the top growth of fescue above the legume seedlings. From an over-all view, the best stands of legumes were obtained on the disked-lightly and disked-heavily plots, the next best on the non-tilled, and poorest on the plowed plots. The principal reason for the poor stands on the plowed plots was cold injury early in the season. Weediness of the sward and intensity of tillage were also closely related. The non-tilled plots were the least weedy (2%) and the plowed plots were the most (26%). Under the conditions of the experiment, the production of dry herbage was increased by more than two-fold the seeding year by the addition of legume seed. The averages of the disked-lightly and disked-heavily plots were: those seeded to alfalfa, 3,944 pounds; to Ladino white clover, 3,802 pounds, and to annual lespedeza, 5,401 pounds. Similar plots not seeded to legumes produced only 1,650 pounds of dry matter.

Other seedings made at the same time in an adjacent area were subjected to controlled rotational grazing and uncontrolled grazing during the growing season. The effect of these grazing managements will be studied during 1956. Additional seedings were made in the fall of 1955, and others will be made each spring and fall for a few years.

## Soil Characterization Program

*(Continued from page 3)*

Extension and Soil Conservation Service personnel. Workers in other southeastern states having the same kind of soil also exchange information with Kentucky research agronomists as a means of giving wider distribution to their findings.

The progressive soil survey work being done by the Soil Conservation Service in seven counties involves the mapping of all land areas in those counties. The field work is still in progress; when it is completed a published report and soil map will be prepared for publication. In other counties the SCS soil surveys cover only the farms of individuals for whom cooperative farm plans are being prepared. These surveys are known as "conservation surveys."

The seven counties being mapped are Adair, Barren, Bath, Caldwell, Clark, Henderson and Jefferson. Previously mapped counties, for which published soil surveys are available, are Calloway, Garrard, Graves, Logan, Marshall, Mercer, Muhlenberg and Shelby. Copies of the reports may be obtained from the respective county agents. (The following counties have also been mapped and reports published which *are no longer in print:* Christian, Fayette, Franklin, Jessamine, McCracken, Madison, Mason, Rockcastle, Scott, Union, Warren, and Webster. Those wishing soil survey information on any of these counties may consult their county agent or the Department of Agronomy, University of Kentucky.)

## Plastic Mulch for Vegetables

*(Continued from page 9)*

and less leaching. Roots grow to the surface under the plastic so that the fertilizer does not need to be applied deep to be utilized.

Black polyethylene plastic costs ½ cent a square foot; thus an acre can be covered for about $200. On a yearly basis, the cost would be about $50 because the material lasts for 4 years. On wide-row crops only about one-third or one-fourth of the area needs to be covered, which reduces the annual cost to $12-16.

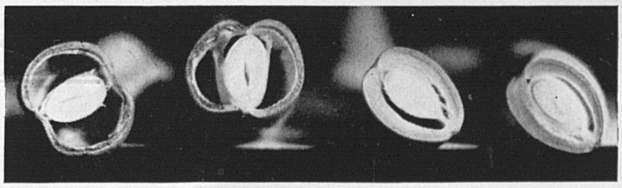


**Fig. 4.— Cross section of snap beans grown (left) without mulch and unirrigated and (right) with mulch and irrigated.**

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# STATION FARM ENLARGED AT LEXINGTON

A 202-acre farm was purchased in March, this year, by the University of Kentucky for addition to the research facilities of the Agricultural Experiment Station. This farm is situated 3 miles south of the present Experiment Station farm at Lexington, on U.S. Route 27.

Both in soil type and topography the new farm is well suited to the research purposes for which it is intended. About half of the area is adapted to detailed plot work; the remainder for more extensive experiments and for support of Station herds.

Purchase of this farm brings to 2,953 the farm acreage owned or under long-time lease for experimental or demonstration purposes by the Experiment Station at eight locations. Of this total, 728 acres are at Lexington. In addition, the Station operates the Robinson forest of 14,297 acres for forestry research and demonstration, and maintains small test or demonstration fields in cooperation with farmers at 75 locations.

Recent diversion of experimental acreage on the Experiment Station farm at Lexington to other campus uses, as well as need for expansion of work, made the new purchase advisable. Actual experimental work on the new farm will not begin until 1957.