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READ—

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Mechanizing Tobacco Production

Kentucky Research Results In Brief

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KENTUCKY AGRICULTURAL EXPERIMENT STATION

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In This Issue

The Cover

On a quarter-acre plot under canvas at the Kentucky Agricultural Experiment Station's Coldstream Farm, entomologists are testing about 150 varieties of tobacco and wild plants related to tobacco for insect resistance. The principal insects being used are aphids, hornworms and budworms. During the growing season the only insecticides used are those to control predators of the insects attacking tobacco. Purpose of the canvas is to induce a heavier build-up of aphids than in the open and also to extend the growing season of the tobacco. Nearby are similar plots growing in the open to provide comparison of insect infestation on sun- and shade-grown tobacco.

Some Clover Clones Resistant To Mosaic Disease

These plants can also be used to study activity and properties of the infecting virus

By STEPHEN DIACHUN and LAWRENCE HENSON

In the 1957 Fall issue of *Kentucky Farm and Home Science*, a common virus disease of red clover was described, and the cause was identified as the bean yellow mosaic virus. Probably this is the most common virus in red clover in Kentucky and, also, in some other clover-growing areas of the United States. The virus is usually spread by so-called pea aphids, insects common on red clover and other forage legumes. There is no known practical way to prevent or control this important disease.

In the previous article we reported that clones of red clover are being tested at the Kentucky Agricultural Experiment Station for their reaction to the virus. In the current article we report the finding of several clones of red clover that are resistant to some strains of the virus and, thus, may be useful as breeding stock for development of superior mosaic-resistant varieties of red clover. Some of these clones are also useful as tools in studying the activity and properties of the virus itself.

In these tests, clones of red clover were established and maintained quite simply by cutting vigorous young shoots from selected plants, keeping the cuttings in glasses of water until roots developed, and potting the rooted cuttings in steamed soil. Plants were inoculated by rubbing carborundum-dusted leaves with a glass spatula dipped in a virus preparation made by crushing young leaves of infected plants. Of course, uninoculated cuttings of the clones were also maintained.

During a study of virus diseases of forage legumes, several hundred red clover plants have been tested by such inoculation. Most of them reacted by showing signs of mosaic or mottle, as described in the previous article and shown in Fig. 1 of this article.

However, a few produced small dead spots on rubbed leaves, such as shown in Fig. 2. In the language of plant pathologists these are "necrotic-spotting" plants. These necrotic-spotting plants can be valuable

(Continued on Page 6)

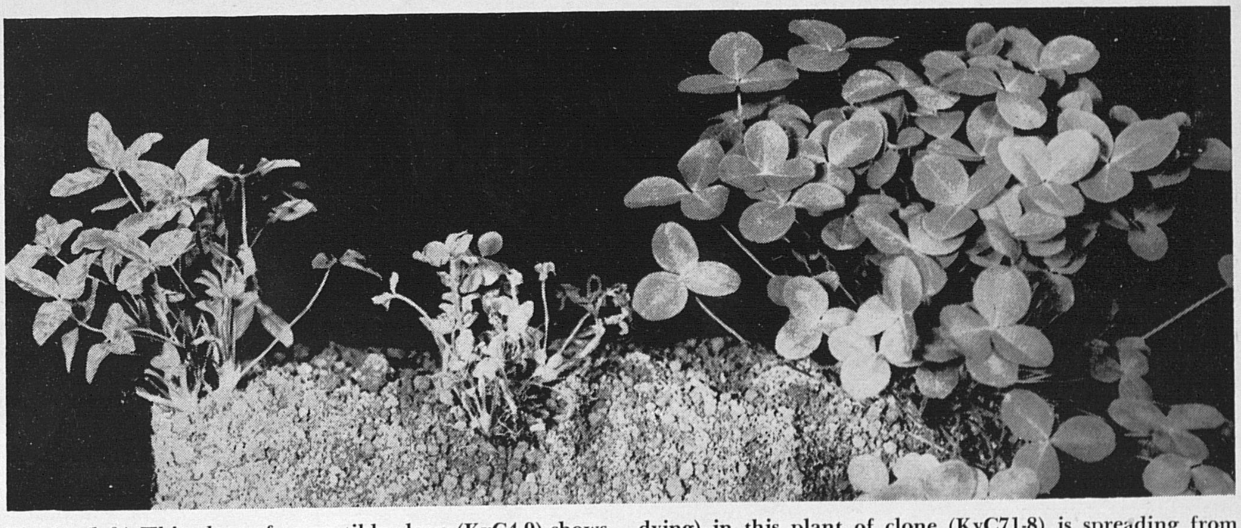

Fig. 1.—(left) This plant of susceptible clone (KyC4-9) shows signs of mosaic. (right) This resistant plant is of a clone (KyC40-2) that does not become readily invaded by the mosaic virus. (center) The systemic necrosis (or complete dying) in this plant of clone (KyC71-8) is spreading from dead spots on the leaves. See Fig. 2 for a close-up view of dead spots on a clover leaf that remained localized and did not spread.

This three-row tobacco primer is operated by four men. The leaves are primed by hand, placed in a vertical conveyor which moves the leaves past a device which places a loop or chain stitch around each group of three leaves. The continuous string of leaves then travels into a burlap bag for transporting to the barn. The machine is being developed by the Gay-Bell Corp. of Paris, Ky. Although it has been in use for several years on farms owned by the developers, it has not been placed on the market. (Mention of commercial names in this article should not be construed to be an endorsement of the products.)

Mechanizing Tobacco Production

Engineers show possibilities of using machines to cut labor and costs long associated with growing and harvesting burley

By EDWARD M. SMITH

Tobacco mechanization implies the integrated use of a system of machines and methods to produce tobacco, from seeds to marketable product. The development of functional requirements and specifications for this system is the objective of the tobacco mechanization research program of the Agricultural Engineering Department.

The average total hand labor requirement for the production of burley tobacco in Kentucky is 409 man-hours per acre. The total hand labor requirement for each of the various production operations in tobacco production is indicative of the basic need for focusing some attention on mechanization. Some production operations, however, need to be performed within a limited optimum time period if the quality of the crop is to be preserved. For example, harvesting must be done at just the right stage of leaf maturity to get the highest quality. When timeliness is considered along with total labor requirements, the two most critical production areas are: (1) establishing the crop in the field, which includes plant bed work and transplanting; and (2) harvesting, which includes topping and suckering, and cutting and housing.

Direct field planting of tobacco seeds represents a possible method of establishing plants in the field with a substantial saving in labor and costs. Such a method would eliminate the time-consuming tasks of plant bed preparation and care, pulling plants, and transplanting.

One obstacle to direct field planting of tobacco is the very small physical size of the seeds. Burley seeds were sent to a commercial company in California having equipment to place a spherical coat of clay of any specified diameter around each seed. The increased physical size and the uniform shape of each seed afforded by this clay coat facilitated mechanical handling and more accurate placement of the seeds.

An exploratory test was designed to study some of the factors concerned with functional requirements of planting machinery for mechanized field planting of coated tobacco seeds. Coated burley (Ky. 58) seeds were planted directly in the field on four different dates and at three different rates to determine their performance as measured by emergence. Because weeds emerge in a few days while tobacco seeds require from about 6 days to 3 weeks, a black polyethylene plastic mulch was placed over the row just prior

This machine for planting coated tobacco seed and laying a plastic mulch in a single operation was developed by the UK Department of Agricultural Engineering. It is a modified one-row corn planter with plastic-laying equipment added.

to planting the seeds. Holes, 18 inches on center along the row, were cut in the plastic mulch through which the seeds were planted. The plastic mulch was selected for its ability to conserve moisture and increase soil temperatures as well as control weeds.

Results indicate that coated tobacco seeds can be planted directly in the field with confidence that the plants will emerge and grow to maturity. This test, also, revealed several problems that need to be solved in order to establish the functional requirements of machinery for direct field planting. Among the problems are (1) seedbed preparation and profile to create the proper physical environment for the emergence of the coated seeds, (2) methods and time of laying the plastic mulch, (3) methods and time of planting the seeds, and (4) methods of thinning the plants to one plant per hill.

A second main area of tobacco production is harvesting and housing burley tobacco. One test was conducted last year to evaluate five different harvesting methods. Two mechanical harvesters were included. One was a priming machine developed by the Gay-Bell Corporation of Paris. The other was a stalk-cutting machine designed by Mr. William C. Irvine of Danville.

The results indicate that burley tobacco can be harvested mechanically without sacrificing yield or quality. Use of the priming machine resulted in significantly higher yields, and both the priming and stalk cutting machines resulted in higher gross return per 100 pounds of cured leaf than from hand-cut tobacco.

The success of mechanical methods of harvesting burley tobacco will be dependent, to a certain extent,

(Continued on Page 6)

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Only one man is needed to operate this housing machine, designed for hanging primed leaves in the tobacco barn. Essentially, it is a movable platform suspended from rails in the barn and powered by an electric hoist. The operator loads the primed leaves on the platform, then hoists the load and himself to the top rail; there he places enough of the load to fill the rail and as he descends he loads the succeeding rails. The device is being developed by the Gay-Bell Corp., of Paris, Ky.

Resistant Clover Clones

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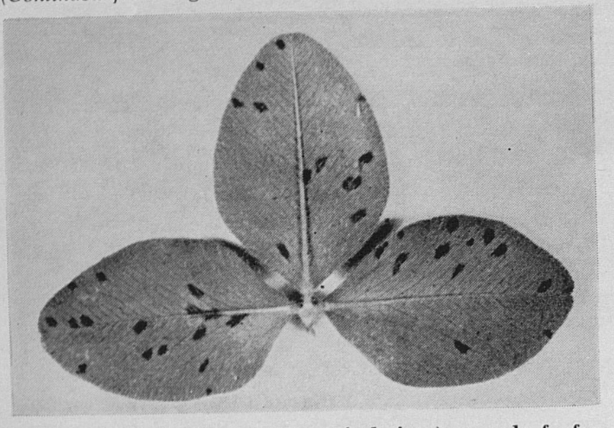

Fig. 2.—These dead spots (necrotic lesions) on a leaf of a plant of clone KyC71-8 remained localized and did not spread. The leaf had been rubbed with bean yellow mosaic virus.

because in some of them the virus becomes localized or immobilized in the small necrotic spots and fails to spread into the growing parts of the plant. In such cases the result is a paradoxical situation in which practical resistance is based on a reaction that is really one of extreme susceptibility or sensitivity, as a necrotic-spotting reaction is.

This type of necrotic-spotting resistance has been exploited successfully by plant pathologists in developing virus-resistant varieties of plants. For example, the burley tobacco mosaic-resistant varieties Ky35, Ky57, and Ky58 developed by plant pathologists at the Kentucky Agricultural Experiment Station carry the necrotic-spotting type of resistance to the mosaic virus.

From among the hundreds of red clover plants tested, several that developed necrotic spots were selected and increased as clones. Six of these clones were selected for further comparison. Clones KyC6 and KyC-71 originated as plants selected among survivors of some seedlings of Kenland red clover that had been inoculated with a fungus that causes southern anthracnose. Clone KyC71-8 is from a plant selected from a group grown from seed produced on a plant of clone KyC71 growing outdoors, i.e. open pollinated. Clone KyC40 is from a plant selected in 1953, growing without symptoms in the midst of infected plants in a field of 3-year-old Kenland. Clones KyC40-1 and KyC-40-2 are from plants from seed produced on a plant of KyC40 growing outdoors in a cage with several other necrotic-spotting clones.

These clones were selected because of their necrotic spotting reaction and also because of their freedom from leaf marking that is common on red clover. The absence of leaf marking serves as an aid in identifying the clones.

Results of tests under greenhouse and field conditions show that in clones KyC6 and KyC71-8 the virus commonly invades the plants systemically and usually kills them, but in clones KyC40, KyC40-1 and KyC40-2 the virus tends to remain confined in the local lesions (Fig. 2). These three clones are vigorous, of good appearance, without leaf markings, and resistant to at least some isolates of bean yellow mosaic virus. They seem to have considerable promise as breeding stock for development of a variety of red clover resistant to this common virus disease of red clover in Kentucky.

Besides helping develop resistant varieties, there is a second and perhaps equally practical use for necrotic-spotting plants, namely, for comparing the relative effectiveness of two or more preparations of the virus. After a necrotic-spotting leaf is rubbed with virus, the virus enters the cells, multiplies, and kills a group of cells, causing a visible dead spot. Obviously this furnishes a means for counting the relative number of active virus particles in the preparation with which the leaf was rubbed, and for comparing one preparation with another. By the use of necrotic-spotting clones we have learned how to prepare and use inoculum more effectively than we could do before. This knowledge is useful in the search for resistant plants, when many plants must be subjected to the disease by inoculation. It is also useful and important in studying the inheritance of resistance.

Tobacco Production

(Continued from Page 5)

upon the development of mechanical methods of housing the tobacco. Increased harvesting efficiency would only magnify the housing problem which is a critical problem from the standpoint of efficient utilization of labor.

The functional requirements for housing stalk cut tobacco in conventional housing facilities were established by a careful study of publications and observations of housing techniques employed by farmers. These requirements were utilized in the development of the principal components of a machine for housing stalk-cut tobacco. A prototype was constructed and its operation was observed. A full-scale machine was constructed and its operation was observed. A full-scale machine will have to be constructed and tested thoroughly before recommendations can be made on the general use of the housing machine.

Kentucky Research Results in Brief

By FRANK B. BORRIES, JR.

SEVERE WINTER SHOWS OATS NEED WINTER-HARDINESS

A severe winter at Lexington—January in particular—proved the various varieties of winter oats used by Kentucky farmers need more of the desirable winter-hardiness factor.

So says Verne Finkner, Kentucky Agricultural Experiment Station small grains breeder, after a survey of yields on the Lexington station farm.

Finkner found the standard varieties winter-killed badly and that survival in some cases was as low as 11 percent. Some of these varieties up to now had been thought sufficiently winter-hardy.

But the test had some encouraging aspects, he added. Several experimental lines, kept right along for just such a rigid—and frigid—test, had good survival.

Wintok, a standard variety, winter-killed badly at Lexington; it had only 25 percent survival and yielded only 15 bushels an acre. But Ky 56-518, an experimental line, had 76 percent survival and yielded 51 bushels an acre. Ky 56-527, another line nursed along just for such a test, had 66 percent survival and yielded 46 bushels per acre.

The four recommended varieties did poorly, Finkner said, since they are not particularly winter-hardy. Atlantic had 11 percent survival and yielded only 13 bushels an acre; Dubois, 30 percent survival and 26 bushels an acre; Forkedeer, 12 percent survival and 17 bushels an acre; and Bronco, 38 percent survival and 28 bushels an acre.

Other experimental lines showed variable results. Four of the list had 30 percent survival; six averaged 40 percent survival; and six were less than 20 percent survival. Yields in each case were comparable to the low survival rate.

BEEF-BULL PERFORMANCE TEST BRINGS DIVIDENDS TO STATE

The Kentucky Agricultural Experiment Station's beef-bull performance test, now in its fifth year, continues to bring dividends to cattlemen, says W. P. Garrigus, animal husbandry section head.

"A nationally known Kentucky breeder learned through one test that one of his top young herd bulls was not producing calves that gained as rapidly as desirable. He already has made a substantial change in his breeding program. Another large cattle operation, using about 800 commercial cows, tested five or six bulls annually and then selected top performers out

(Continued on Page 8)

University of Kentucky
Beef Bull Performance Test

This is to certify that the registered ________ bull named ________ Registration Number ________
Sire ________ Dam ________
Born ________ Owner ________
completed the University of Kentucky Beef Bull Performance Test on ________ 19___ with the following record:

Initial Weight, pounds . . . ___ Average Daily Gain on Test . ___ Final Weight, pounds . . . ___
Initial Type . . . . ___ Pounds per Day of Age . . . ___ Final Type . . . . ___
Initial Finish . . . . ___ Feed Required per 100 pounds of gain . . . . ___ Final Finish . . . . ___
Initial Age, days . . . . . . ___ Final Age, days . . . . . . ___

Dean and Director, College of Agriculture and Home Economics — Head, Animal Husbandry Section — Test Supervisor

The owner of a bull completing the Kentucky Beef Bull Performance Test will be given a certificate which will state the following information about the animal: Weight, type, finish, and age at the beginning and at the end of the test; the average daily gain during the test; pounds of gain per day of age, and feed required per 100 pounds of gain. The certificate will be signed by the Dean and Director, the head of the Animal Husbandry Section, and the test supervisor.

Research Results in Brief

(Continued from Page 7)

of this group for replacements in their breeding program; their feeder calves weaned last fall at an average weight of more than 600 pounds," Garrigus pointed out.

The program is relatively simple. Breeders assign sires to the testing station for a certain period. During this time the bulls are given a standard ration. Weight gains are checked carefully during the period, which lasts about 154 days. At the end the breeder is notified of the total gain and the average daily gain, plus number of pounds of feed required for each 100 pounds of gain ("feed efficiency").

This daily gain factor and feed efficiency are important to herd operators. Bulls which gain rapidly and convert feed efficiently can transmit those factors to calves. A herdsman using such test-proven bulls is quite certain of producing fast-gaining, feed-efficient calves.

Garrigus said that 122 beef bred bulls have been put through the test since 1954. To qualify, a bull must be registered; must be negative to tuberculosis and brucellosis; and be Kentucky-owned. He must be between 7 and 9 months of age at the test's start. All bulls accepted for the test are first scored for type and conformation.

Top gainer in the tests so far was a Hereford bull which averaged a daily gain of 3.75 pounds and required 703 pounds of feed per 100 pounds of gain. The poorest performer was one which gained only 1.66 pounds a day and required 885 pounds of feed per hundredweight of gain. The extreme range in feed conversion has been from 1,202 pounds (per hundredweight gain) to 563 pounds.

* * *

The following are extracts from reports on research projects conducted by the Kentucky Agricultural Experiment Station in 1958-59:

ORCHARD WEEDS—Western Kentucky Experiment Substation researchers at Princeton found three chemicals worked well in first year tests in checking weedy growth in peach orchards. The materials: Crag Herbicide, Simazin and amino triazole. A fourth material caused some damage to trees.

* * *

CALVES TESTED—Calves on full feed in the beef herd performance test have averaged 2.36 pounds daily gains for all calves tested; feed efficiency (pounds of feed needed per pound of gain) averaged 8.20 pounds for all tests so far.

* * *

TRANQUILIZERS NO HELP—Tranquilizers added to feed of steers on test at the University last fall did not produce any appreciable gains.

* * *

GRASS-LEGUME MIXTURE—A grass-legume mixture produced the same yield of forage as a pasture amply fertilized with ammonium nitrate.

* * *

EARLY-SHEARED EWES—Early shearing of ewes —about mid-April, perhaps—may help bring these ewes into a breeding condition earlier.

* * *

HORMONE DUSTS HELP—Hormone dusts used in greenhouses to help tomato production have some advantages over sprays. They are more easily made up, induced higher yields last year than sprays, and are easier to apply inside greenhouses. Field dusts were not so effective as sprays, however.

* * *

CORN PLANTING DATE—Corn should be planted by May 23 to get top yields in eastern Kentucky, planting tests showed last year. If a higher stalk population per acre is combined with this planting date, yields will still be better.

* * *

ANTIBIOTIC IN FEED—Terramycin added to poultry feed at the rate of 200 grams per ton of feed apparently helped egg production.

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University of Kentucky
Lexington, Ky.

Frank J. Welch
Director

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