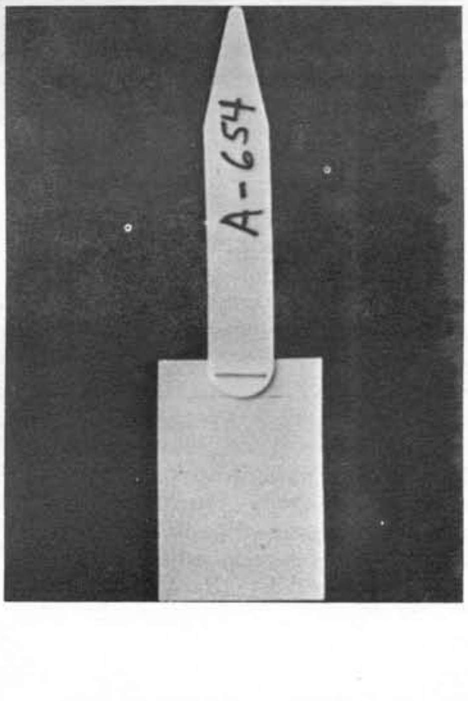
FALL 1970

Frontiers of Plant Science



Parent hands test sample to volunteer of the American Friends Service Committee during demonstration of new dipstick test for detection of lead poisoning. Insert shows actual dipstick.

(*Story on page 2*)

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION NEW HAVEN

A New Test for Detecting Lead Poisoning in Children

Lester Hankin and Kenneth R. Hanson

Department of Biochemistry

ALTHOUGH MOST readers of this publication think of this Station as oriented towards plant science, our studies have always included other aspects of man's biological environment. Described here is a new test we have developed, in cooperation with Drs. Kornfeld and Ullmann of the State Department of Health, concerned directly with people, especially children. The test is being used to identify children who have ingested lead, a cumulative poison.

Lead poisoning among children is a very serious environmental and public health problem. It is especially serious in the older parts of our cities. These "high risk" areas have many old homes in which the interiors, over the years, have been painted with lead-based paint. Flaking and peeling of the underlayers of paint is not uncommon. Children eat the fallen chips of paint, and thus fall victims of lead poisoning. Excessive habitual eating of non-edible material is called pica and is found most commonly in the one to six year old age group. If lead ingestion is not detected in time, serious neurological disorders, mental retardation and, not infrequently, death can follow. Fortunately, laboratory tests can often detect poisoning before clinical symptoms are evident, and therapy can then be initiated before the child becomes critically ill. It is estimated that only one-tenth of the children in the most susceptible age group have been tested, even once, for possible lead poisoning.

As long as children are exposed to the hazards of lead ingestion, it is of the utmost importance that they be tested regularly for signs of poisoning. To be practical, a large-scale testing program must not put an impossible demand upon scarce medical resources, and the test itself must be such that responsibility for sample collection can be placed in the home. It is our belief that the dipstick test we have developed will make large scale screening for lead poisoning possible.

The laboratory development was carried out at this Station and the field testing was done by the State Department of Health. The scientific results of the investigation are reported in the December, 1970 issue of *Clinical Pediatrics* (Vol. 9, no. 12).

Two types of laboratory tests have been used widely for the detection of lead poisoning. One is the direct determination of lead in blood and the other is the assay of delta-aminolevulinic acid (ALA) in urine. Lead interferes with the synthesis of haemoglobin in the blood. An enzyme called delta-aminolevulinic dehydrase is essential for making haemoglobin. Lead blocks this enzyme, and the ALA, instead of being used in blood synthesis, begins to pile-up and is excreted in abnormal amounts in the urine. Excessive ALA in urine is therefore often an indication of lead poisoning.

Both methods have proven valuable as part of intensive, but small-scale detection programs. With both methods there are practical limitations on the numbers that can be tested. In assaying for lead in blood the limit is set by the availability of medical personnel and by the emotional problems of drawing samples of blood from small children.

Connecticut now has a program for testing urine for its ALA content, but a major gap exists between the number of children who *should be* tested and those that *are* tested. Obtaining urine samples at collection points or by house-to-house visits is far from ideal. A more serious problem has been the transport of sample bottles of liquid urine to the laboratory. In addition, the older laboratory procedure, involving column chromatography is relatively lengthy. It seemed to us, when we first set out to apply experience gained in other areas of research to

(Continued on page 5)

Why Research On Lead?

In this issue of Frontiers we print an article on finding lead in the bodies of children.

Do you wonder why The Connecticut Agricultural Experiment Station would do research on how to find lead in children's bodies? The answer is simple, I think. We can put our chemical expertise to work on an important problem in contemporary society.

We began as chemists nearly a century ago. What could chemistry do for society? We were the first to ask the question, and we continue to ask it. Our first answer was that a chemist could tell Connecticut farmers the difference between Quinnipiac River mud and Peruvian guano, which were both sold at that time as fertilizers. River mud soon disappeared from the market. We went on to use chemistry to tell the difference between pure food and adulterated food. We administered perhaps the first pure food law in the country and thus was born consumer protection.

Later our chemists went pioneering into the field of human nutrition. We proudly display gold medals for discovering the significance of amino acids in the diet and the first vitamin.

Children eat lead paint. This is nutrition, abnormal nutrition, but nutrition withal. Thus, it came within our purview.

How can a chemist tell if a child has eaten lead? Other chemists have shown that if a child has eaten lead, he secretes an odd amino acid into his urine. The chemists call this amino acid by the euphonious name of delta-aminolevulinic acid. It is an extraordinary chemical because it is made by both plants and man. From it plants make chlorophyl, the green in their leaves. From it man makes haemoglobin, the red in his blood.

If a child eats lead, his body is unable to transform the delta-aminolevulinic acid into haemoglobin. Thus, the amino acid builds up, and the child excretes it with his urine—the more the amino acid, the more lead he has eaten.

As plant scientists we were fascinated to learn that this substance occurs in the urine of children who eat lead paint. We discussed the matter with the Department of Health in Hartford and with their help developed a rapid assay method. The paper presented here tells the story. Now the fight against lead has a new weapon. We still don't know why a child eats lead, but at least now it's easier to tell if he has. Thus, do we put agricultural science to work for society.

James G. Horsfall

Corn Blight

Peter R. Day
Department of Genetics

THIS SUMMER corn blight hit the headlines and began a scare that corn and, therefore, beef and pork might be in short supply this winter. In spite of the losses estimated now at 15 percent, there will be no severe shortage because this year's harvest, estimated at 4.4 billion bushels, will be the third largest in our history.

Even though the blight hit mildly in Connecticut where we grow corn for our milk cows, the Station became immediately concerned because it might be more severe in a wetter summer.

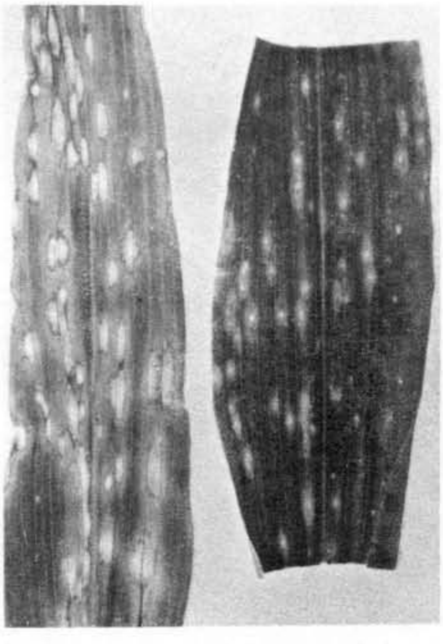
What caused the epidemic and what steps are being taken to guard against similar damage in the future?

The epidemic was due to southern leaf blight, caused by a fungus called *Helminthosporium maydis.* Blighted corn looks scorched as though killed by an early frost. The lesions (see photo) produce spores which are spread by wind and rain, and cause fresh infections. Two other fungi also cause blights: northern leaf blight caused by *Helminthosporium turcicum,* a minor problem readily controlled with resistant hybrids, and yellow leaf blight caused by a different fungus, *Phyllosticta zeae,* which first began to be reported on corn in the north in 1968. The three diseases are very difficult to tell apart in the field. All three were found in Connecticut fields this summer by our extension colleagues at Storrs.

Epidemics of plant disease run riot when weather conditions and the genetic make-up of the crop favor them. The first analyses of weather data for the corn belt show that weather this summer was not unusual in providing highly favorable conditions for spread and development of leaf blight. However, we do know that the genetic make-up of the corn itself was a major factor. This stems from current practice in hybrid seed production.

Virtually all of the corn grown this year was hybrid. At one time hybrid seed corn was produced by hand detasselling—removing the male elements, i.e., the pollen, so that the seed parent was not self-pollinated. On the peak day in the season the job occupied 125,000 people. It was the most expensive part of raising seed corn. A search for a genetic substitute for detasselling began. The late Donald F. Jones of this station and his former colleague Paul Mangelsdorf were the first to show how to use a corn strain with naturally sterile pollen. This is called cytoplasmic male sterility. A cytoplasmic character is transmitted by the mother plant to all its progeny. Three sources of cytoplasmic male sterility were available: T, S, and B. Jones and Mangelsdorf worked with the S and T forms. The cytoplasmic male sterility character was introduced by crossing an inbred to the sterile source, crossing the hybrid back to the inbred and repeating the backcross in each successive generation. A hybrid, made up with "sterile cytoplasm", was fertile because of the action of the restorer genes from the male parent.

Beginning in the early 50's the system has become widely adopted so that in the last few years including 1970 about 80% of commercial hybrids were made up with the aid of T cytoplasmic male sterility. The wide use of T rather than S cytoplasm came about because it worked better.



Leaves of corn inbred with T cytoplasm (left) and normal cytoplasm (right) with blight lesions.

(*Photo courtesy of Dr. A. Hooker*)

The first indications of a snag came from research published in 1961 at the Central Experiment Station in the Philippines. It was found that T cytoplasmic male sterile corn inbreds and hybrids were much more susceptible to the southern blight disease than their normal counterparts. In fact this paper and another confirming it published in 1965, are the first descriptions of the cytoplasmic inheritance of disease susceptibility in a crop plant.

A check in 1963 showed no difference in disease reaction between the male sterile and normal corn lines used in the Philippines which had been inoculated with strains of *Helminthosporium maydis* from Illinois. The same was true of similar tests made later in Pennsylvania. But in 1969 corn with T cytoplasm with heavy infection was found in southern Iowa, Indiana, and Illinois. By 1970 the disease, noted first on winter crops in Florida, spread to Alabama and Mississippi and later east from Texas to the Atlantic Coast and north to Minnesota, Wisconsin, Michigan, and southern Ontario. A new race of the fungus had developed specifically adapted to corn carrying the T cytoplasm. In 1969 it was reported that high susceptibility to yellow leaf spot is also associated with T male sterile cytoplasm. Although plant breeders had produced a wide spectrum of different corn hybrids with great genetic diversity they had overlooked the fact that these hybrids were nearly uniform with respect to their cytoplasms. The weather conditions favored the build up and spread of a new form of the pathogen all too well adapted to its host.

The short term cure is simple—not to use hybrids made up with T cytoplasm. Normal cytoplasm is highly resistant to the T race. In practice the 3 million bushels of seed produced by hand detasselling this year will only satisfy 20% of the

(Continued on page 8)

Crop Improvement of Cucumbers by Control of Sex

William L. George
Department of Genetics

KNOWLEDGE OF how the sex of plants is expressed and how it works will pay off in terms of crop improvement. Sexual reproduction generates new genetic combinations in much the same way as a dealer in a card game deals new hands. Through hybridization the breeder obtains new combinations in his search for new varieties and hybrids of crop plants and ornamentals.

Sex in plants is under genetic control and is expressed at the time flowers are formed. There are three kinds of flowers, male, female, and perfect. Perfect flowers have both male and female organs. Fruits can develop from female and perfect flowers but not from male flowers. The sex of many plants follows a fixed pattern during development so that only one kind of flower is produced. For example, the tomato produces perfect flowers only and is hermaphroditic. The same is true in those species which consist of separate male and female plants. Examples are asparagus and American holly. However, the sex of some plants such as the cucumber changes during development so that two or more kinds of flowers are produced.

The major variations in sex expression in cucumbers are summarized in Table 1. Commercial varieties of cucumbers (for example, Marketer, Straight Eight, Ashley, Tablegreen) go through stages of first male, then mixed male and female, and finally into a completely female phase (monoecious sex expression). In the apple or lemon varieties of cucumbers the plants produce male flowers first followed by perfect flowers (andromonoecious sex expression). Whether plants ultimately produce female or perfect flowers is determined by a pair of genes, *G* for female and *g* for perfect flowers. There are also marked differences among the market varieties in the number and time of appearance of female flowers. It seems there are many genes with minor effects which control the rate of change from male to female flowers. In addition, a major gene called *Acr* accelerates the rate of change from male to female flowers. In some cases, then, *Acr* incorporated in monoecious (*G*) lines results in the development of plants which are persistently female. When *Acr* is introduced into andromonoecious (*g*) lines we obtain plants persistently perfect.

Some of these genetic variations in sex expression have been used to produce hybrids in cucumbers. Male flowers can be made to form on the genetic female plants (*G, Acr*) by spraying them with a chemical growth regulator called gibberellic acid. These "females" can then be self-pollinated to produce true-breeding female lines which are used to breed hybrids by natural crossing with monoecious lines. Seeds harvested from such crosses are hybrid. These hybrids, called gynoecious or "all female" in the seed catalogues, can produce high yields particularly early in the season, because of the increased numbers and early appearance of female flowers.

However, good pollination is often a problem with such "all female" hybrids. Here, the number of male flowers, introduced by mixing seed from monoecious *acr* lines with the hybrid seed, is critical. To develop into fruits the female flowers must be pollinated by bees carrying pollen from the male flowers. It is difficult to strike the correct balance in the proper proportions of male and female flowers. If the male flowers are few in a planting, a large number of poorly pollinated, misshaped fruits result. This is particularly true very early and very late in the growing season.

One way to avoid this problem and still have the potential of high yield would be to alter the sex habit of the cucumber plant further by developing commercially acceptable varieties or hybrids with perfect flowers at every leaf axil. In theory each perfect flower would have the potential of producing a fruit. Since the flowers are perfect, the pollen source is "built in". However, the idea is more easily stated than accomplished. The gene for perfect flowers (*g*) has many fruit abnormalities associated with it. Fruits from perfect flowers are small in size and round, whereas the market demands a long cucumber.

We are trying to improve these fruits by transferring gene *g* into varieties which have long fruits. In this way we expect to "stretch out" the fruit. We transfer gene *g* by the backcross method, that is, by continuous selection and crossing of the

Figure 1. Cucumber variety trial. Insert shows actual fruit produced.

Table 1. Variations in sex expression in cucumbers.

Sex Form	*Botanical Name*	*Major Genes*
Male, then female	Monoecious	*G, acr*
All female	Gynoecious	*G, Acr*
Male, then perfect	Andromonoecious	*g, acr*
All perfect	Hermaphroditic	*g, Acr*

perfect flowered types to the long fruited parents. After three backcrosses the results look promising and fruit length has already doubled (Figure 2). Further backcrossing should lengthen the fruit even more.

A second aspect of our research with cucumbers deals with changes in plant growth habit. Cucumber plants are vines that occupy much space. A gene which terminates the growth of the plant after it has produced a certain number of leaves enables us to reduce plant size. Depending on the environment, these smaller or determinate plants can be as short as 8-10 inches. Recently, we found a gene which modifies determinate growth so that we can develop plants of both small and intermediate size (Figure 3). We should thus be able to develop compact cucumber varieties both for mechanical harvest and the home garden. Our ultimate aim is to have hermaphroditic (perfect flowered) forms combined with different growth habits. We believe that the information from cucumbers will be useful in improving other crop plants, particularly melons, squashes, pumpkins, and ornamental gourds.

As a final thought, to quote William Cowper, "Variety's the very spice of life." In plant breeding, variation provided by sexual reproduction is the very essence of crop improvement.

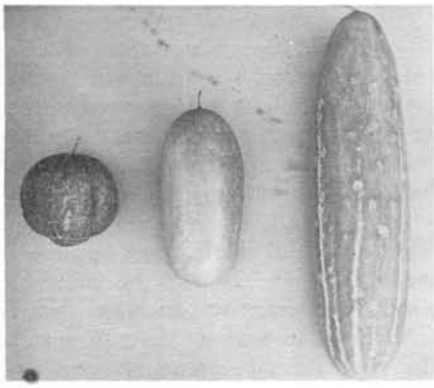


Figure 2. Increase in length of fruit from perfect flower: (left to right) Fruit of perfect flowered parent, fruit from a plant of the third backcross generation with perfect flowers, and long fruited parent.

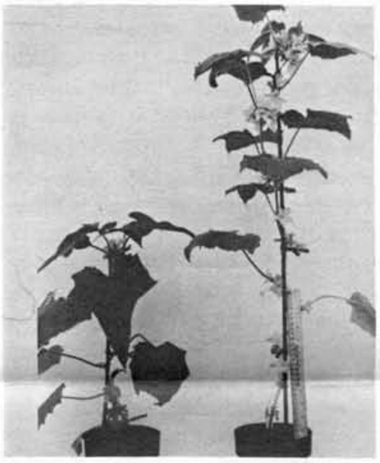


Figure 3. Determinate plants carrying a gene modifier for short growth habit on the left and intermediate growth habit on the right. Growth of the stem has stopped. The plants will not get any larger.

New Staff Appointments

Dr. Raymond P. Poincelot, Jr. in the Department of Biochemistry will investigate the nature of the membranes of leaves concerned with photosynthesis. In the Department of Soil and Water Dr. Wendell A. Norvell will study the exchange of algae-nourishing phosphorus between the water and sediments of Connecticut lakes. Dr. David Sands will study bacterial diseases of plants. He is in the Department of Plant Pathology and Botany. Investigating insect parasites of the gypsy moth is Dr. Ronald M. Weseloh; Department of Entomology. The new business manager is Francis E. Sultzman, Jr.

Lead Test

(Continued from page 2)

this problem, that mass screening could be realized if we could change the existing ALA procedure. We have done this with the aid of a material known as ion exchange paper.

The dipstick that we developed consists of a piece of ion-exchange paper that is stapled to a plastic handle. The test kit contains a dipstick wrapped in aluminum foil, instructions for its use, and a return envelope for mailing. To be used, the foil is removed from around the dipstick. The mother has the child urinate into a bottle or paper cup, then immerses the paper part of the dipstick into the urine, and quickly withdraws it. After drying in air, the dipstick is rewrapped in the foil and mailed to the laboratory for analysis. The laboratory portion of the test is considerably simpler than the older method of analysis so that the same number of personnel can carry out many more determinations per day.

The dipstick was field-tested in the innercity of Hartford with help from Volunteers of the American Friends Service Committee. Results were compared with those obtained by the present technique for estimating ALA in urine. Excellent agreement was found. The Laboratory Division of the Connecticut State Department of Health is now in the process of converting its ALA testing program to the dipstick method.

By far the greatest importance of the dipstick test is that the means are now available for the screening of large numbers of children for lead poisoning. This will close the gap between those who *should be* tested and those who *are* now tested. Since both the collection and analysis of samples is easier, the frequent testing of "high risk" children, even on a monthly basis, is now possible. The hazards of lead poisoning are not eliminated by this new test. It does, however, offer another weapon against lead poisoning by increasing the chances that a child who has ingested lead will be found before he becomes critically ill.

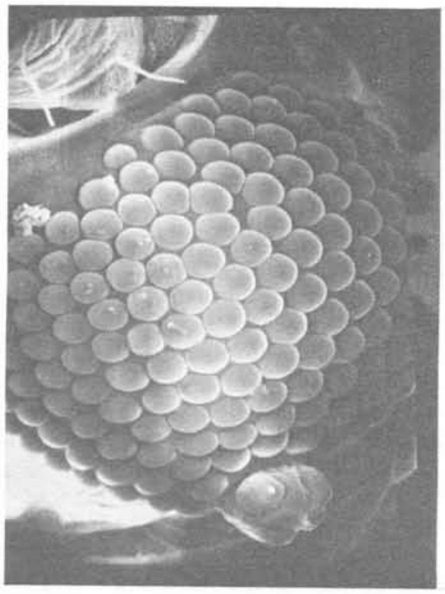
The new test procedure is fully described in Station Bulletin 716. Address requests to Publications, Box 1106, New Haven 06504

RESPONSE OF APHIDS TO COLOR AND LIGHT

From Theory to Practical Application

James B. Kring

Department of Entomology



Scanning electron micrograph of black bean aphid eye, magnified 500 times.

(*Photo by R. Gaskill, Univ. of Conn.*)

During the past several years, I have developed a biological control method to protect plants from aphids. Aluminum foil placed on the soil around plants repels aphids and thus delays the spread of aphid-borne plant diseases. The research described here evolved from basic studies of aphid behavior.

Despite the fact that aphids are born on green plants and mature on them, flying aphids will alight on yellow objects in preference to green ones. Since starved and diseased plants are more frequently yellow than healthy ones, more aphids alight on them. Prof. L. Broadbent of England pointed out that traps painted yellow caught more aphids than traps painted other colors. Prof. V. Moericke of West Germany studied this response to yellow, and developed a trap for aphids. This is simply a metal pan, painted yellow, and partially filled with water containing detergent to lower the surface tension. Aphids attracted to the yellow pans, and alighting on the surface of the water, are trapped when they fall through the surface.

Since yellow flowers do not attract aphids, experiments were designed to see if various colored flowers would repel them. Garden nasturtium, petunia, and marigold were all tried. Yellow pan traps placed among the plants caught aphids until the plants began to bloom, and then the numbers captured decreased.

I also attempted to trap aphids with cake pans painted other colors, including green. Yellow was always the most attractive. Aphids dropped, or flew directly, into the trap. In 1960, I tested the accuracy of aphids in finding the trap, by completely surrounding a yellow trap with water-filled, unpainted aluminum cake pans. Unexpectedly, none of the pans captured aphids. However, another yellow pan trap, not surrounded by aluminum had trapped aphids. These and subsequent experiments showed that the unpainted aluminum pans repelled aphids from the trap. It was easy from this to imagine that a plant surrounded by aluminum would be protected from aphids. I proposed that the aluminum reflects the skylight and thus repels aphids.

These discoveries were reported to my fellow entomologists at a national meeting in 1962. Dr. Floyd F. Smith of the U.S.D.A., asked if I objected if his group started investigations in this research area. I was pleased to encourage him, for such cooperation soon determines the merit of an idea.

Laboratory studies with a flight chamber were initiated to determine how light reflected from an aluminum surface interferes in aphid behavior. Here, the flight behavior of an aphid, as observed in the field, was reproduced. In the flight chamber, when they were ready to alight, aphids would choose colors containing the most yellow. They did not respond to blue, orange, or red. When flying aphids were illuminated with light from below, they turned in flight. Aphids ready to alight on a yellow surface could be made to avoid it by suddenly illuminating the surface with short-wave light. In the field a similar turning and avoidance reaction is observed with aluminum foil.

Meanwhile, Dr. Floyd Smith informed me of his successful field experiments. He covered most of the area around the plants with sheets of aluminum thereby reducing the numbers of alighting aphids and the spread of aphid-borne virus. In my own field experiments, I used aluminum foil, manufactured for building insulation. The results were as dramatic as my cake pan experiment. The sheets of aluminum not only protected traps and plants from aphids, but they also reduced disease and the numbers of leafhoppers on asters and dwarf dahlias. Many other surfaces were field-tested. Those materials that were orange, red, or blue, or that reflected short-wave light, were the most effective. Aluminum reflects the most skylight and repels the most aphids.

In field testing this method of insect control, the cooperation of industry and other researchers was essential. Aluminum foil on preshrunk paper was supplied to me by the Anaconda Aluminum Company. In Florida, Drs. Moore and Wolfenbarger developed and tested machine and hand methods of application of foil to the soil to protect squash and tomatoes. In New York, G. V. Johnson and A. Bing successfully reduced the spread of virus in gladiolus plantings. Other applications elsewhere have resulted in success and failure.

Despite the dramatic reductions in the numbers of aphids alighting in water traps surrounded by foil,

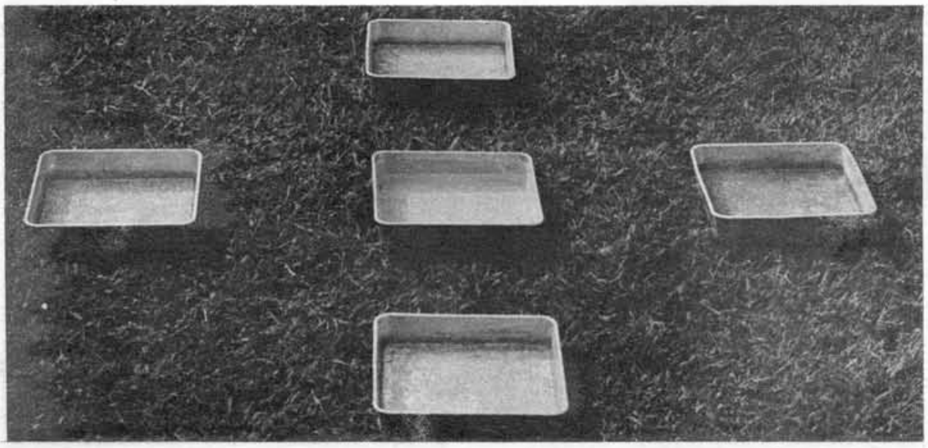
Aphids caught on yellow painted sticky stakes indicates how high they fly above squash plants protected by aluminum foil.

spread of virus disease to plants is only delayed. Some experimenters have demonstrated that aphids, probably using other guidance systems, still find their way to certain plants. To study this problem, it was necessary to devise a new trap. This is a square, sticky, yellow wooden stake. With this trap, the direction the aphid came from, and how high it was flying can be determined, permitting us to test methods of driving the aphids higher above the plant. For example, we can now determine if a curved aluminum surface is more effective than a flat surface.

To use aluminum foil on paper on the soil only once is wasteful, and bits of torn aluminum blowing around the environment are unsightly. Accordingly, I have used aluminum foil attached to a wooden frame for two years and found it still effective. Oxidized or used aluminum surfaces can actually reflect more short-wave light than new ones. Furthermore, the use of such surfaces soften the glare that makes working in an aluminum covered field uncomfortable.

Where serious virus disease conditions exist, and it is not possible to grow a crop of squash, even with the use of insecticides, aluminum foil-protected plants produce a crop.

These studies are but another example of how basic knowledge of insect behavior can lead to cultural insect control.



Aluminum pans (9 x 9 x 2 inches) used to test aphid behavior. Four unpainted pans are sufficient to repel aphids from center yellow trap pan.

Results of Research

Scientific research benefits no one unless it is published, so that the findings can be put to work. Since you last received *Frontiers*, members of the Station Staff submitted 64 scientific papers to be published in scientific journals. In addition the Station itself has published the following Bulletins, and Circulars. These are available by request from Publications, The Connecticut Agricultural Experiment Station, Box 1106, New Haven 06504.

Entomology

- B 711 *Induction and termination of embroyonic diapause in the salt marsh mosquito, Aedes sollicitans (Diptera: Cylicidae).* J. F. Anderson.
- C 224 (Revised) *Insects in Houses.* Neely Turner.
- C 233 *Chinch Bug Control.* J. C. Schread.
- C 234 *The Annual Bluegrass Weevil.* J. C. Schread.
- C 235 *Iris Borer and its Control.* J. C. Schread.
- C 236 *Wasps in Connecticut.* S. W. Hitchcock.

Ecology

- C 237 *Plant Nutrients and Animal Waste Disposal.* C. R. Frink.

Reports on Inspection

- B 712 *The 74th Report on Food Products, 1969.* J. G. Hanna.
- B 713 *Pesticides Report of Inspections, 1969.* J. G. Hanna.
- B 714 *Commercial Feeding Stuffs Report for 1968 and 1969.* J. G. Hanna.
- B 715 *Commercial Fertilizers Report for 1969.* J. G. Hanna.

Biochemistry

- B 716 *A Dipstick Test For The Mass Screening Of Children For Lead Poisoning Based On Urinary delta-Aminolevulinic Acid.* L. Hankin, K. R. Hanson, J. M. Kornfeld and W. W. Ullmann. (available after January 1, 1971)

Environmental Policy

James G. Horsfall
Director

The report of the Governor's Committee on Environmental Policy has now been published and presented to the Governor. It was a great challenge.

The study shattered any complacency that I might have had left. No question. Society faces some harsh and uncomfortable decisions if we are to continue to live a comfortable life.

We thought we had repealed some laws of Nature, but we had not. We thought that man had been esconced in a soft warm spot in the heart of Nature, but he had not.

We thought we could continue indefinitely to throw noise and noxious gases into the air, refuse into the water, garbage into the soil. We thought that Nature would enfold them, purify them, and return them to us. She always had. Not so any longer. Nature has done all she can for us. It is our next move.

We must reduce the pressure on Nature. We must move as rapidly as we can to adjust our output of filth and corruption to fit the purifying capacity of Nature. There are really only four fundamental options that are open to society: (1) adjust the size of the population down, (2) pass laws to force the reduction in filth output, (3) educate people to the harsh facts of the case, and (4) develop new technology to help Nature recycle the wastes or reduce the waste output of present technology.

The towering American ethic must be rephrased from, "If you are *not* growing, you are dying," to "If you *are* growing, you could be dying." Nature is telling us harshly that geometric growth of population is simply not tolerable in a finite environment.

We at the Experiment Station accept the challenge of option 4 to develop new technology. Our business is plants and soils. These are the great purifiers provided by Nature. Our research is aimed to improve their performance. Before plants arrived on this earth, there was no oxygen in the air, and without oxygen there could be no animals. Plants recycle the carbon dioxide exhaled by autos and animals and restore the oxygen for reuse. Our research shows that an acre of plants can absorb the carbon dioxide from the cars of 50 commuters and the polluting ozone from 8 cars.

We are investigating many things, (a) the geometry of the arrangement of plants along highways to reduce noise pollution, (b) the possible role of forests and meadows to purify the water in sewage, (c) the algal pollution in lakes, (d) the effect of phosphates and nitrates in sewage or in detergents on algae in lakes, (e) the prevention of ozone damage to plants, (f) the use of soil in purifying biogradable wastes from cities. These are some of our moves to help Nature help us.

Corn Blight

(Continued from page 3)

national requirement. Much of this will go to southern states where the risks are greater. Most farmers will have to grow some T cytoplasm corn next year because only this is available in bulk. Some hybrids are already put out as blends with up to 50% seed with normal cytoplasm for pollination. Most seed producers have voluntarily agreed to label all hybrid seed for sale next year stating its percentage of T cytoplasm.

Fungicides such as the dithiocarbamates, are with one exception labelled for use only on grain corn and in any case may not provide an economical control if they need to be applied several times per season. Clean plowdown to reduce pathogen survival over winter has also been advocated and may be helpful.

For the future, hybrids based on S and other resistant but male sterile cytoplasms are being prepared and tested. With some luck and normal weather next year's crops should be no worse than this.

Frontiers of Plant Science published in May and November, is a report on research of The Connecticut Agricultural Experiment Station. Available to Connecticut citizens upon request.
Vol. 23 No. 1 November 1970
Bruce B. Miner, *Editor*

THE CONNECTICUT
AGRICULTURAL EXPERIMENT STATION
NEW HAVEN, CONNECTICUT 06504

James G. Horsfall
Director

POSTAGE PAID
United States Department of Agriculture