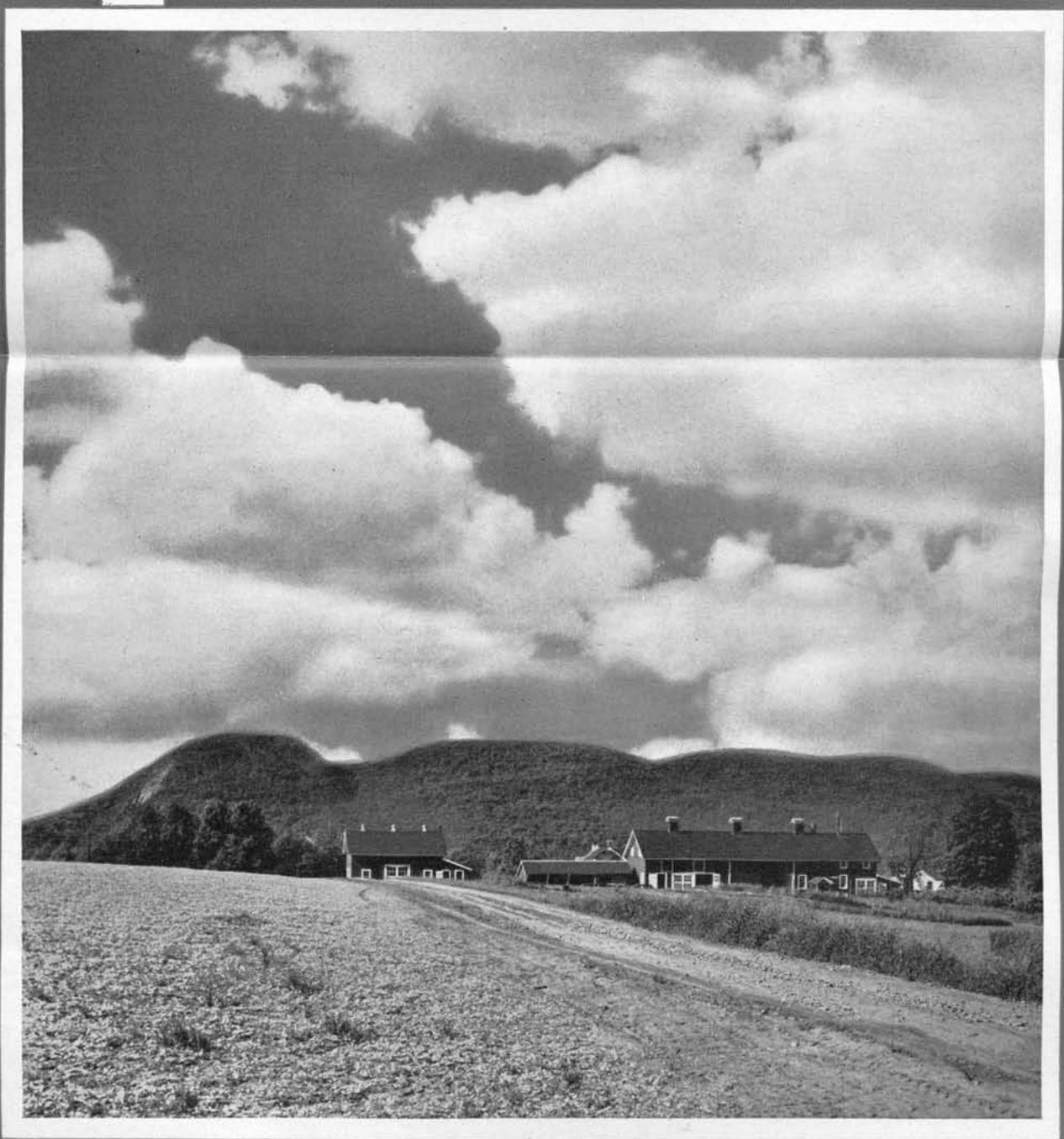


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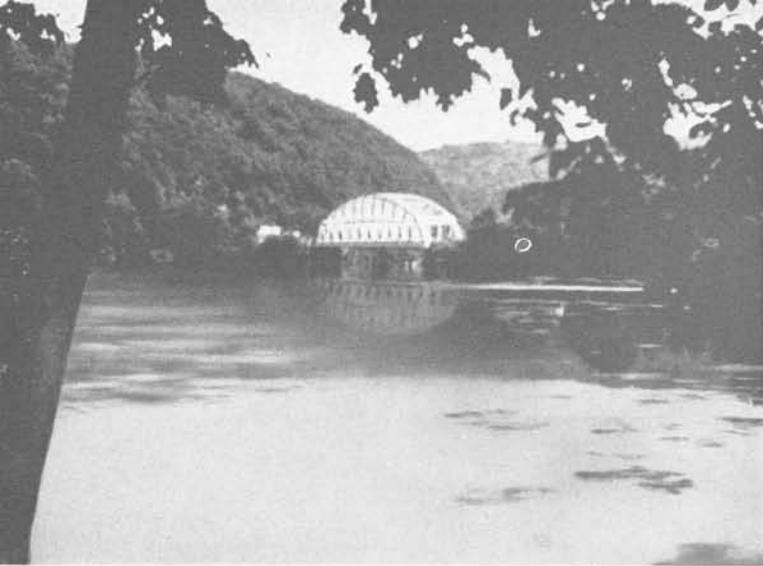
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THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION, NEW HAVEN



THAT BLOOMIN' LAKE

by A. E. Dimond¹

Not all that blooms is beautiful. Take lakes, for instance. In recent years Lake Zoar on the New Haven-Fairfield County border has formed the habit of "blooming" by turning into a green pea soup by midsummer, and residents along the lake complain of the floating green mats which accumulate in coves and of the odor caused when this vegetation dies and decays.

The greenness in the water and the floating green mats consist of very simple kinds of plants called algae. Almost always algae live in water; in the spring they can be seen in many ponds and puddles.

In lakes, algae are always present and they vary in quantity from a few cells in a quart of water to many millions. When they are so abundant as to be a nuisance, the lake in which they occur is said to "bloom."

In recent years Lake Zoar has become less desirable as a vacation spot with the existence of this troublesome bloom. Each year the bloom appears earlier and seems to get worse. What can be done to control the growth of these algae? At the request of the Governor's Office, four State agencies are cooperating in finding the answer to this question. The State Water Commission, the Department of Health, the State Commission of Fisheries and Game and The Connecticut Agricultural Experiment Station have pooled their knowledge in an effort to learn why the algae are so much worse on Lake Zoar than they used to be and what can be done about them.

The Algae's Diet

Algae, like other plants, require nutrients on which to grow. They grow better in water that has the right kinds of fertilizer elements in it than in water low in these salts. Strangely enough, the algae do not care for fertilizers that have lots of organic matter in them; they grow best on simple salts containing nitrate, phosphate, and sulfate.

The problem of algal blooms is closely linked to sewage treatment and sewage disposal. Years ago sewage was untreated and was frequently emptied raw into streams. Today this practice is rare — sewage is first treated in a number of ways to oxidize the organic matter through bacterial action. In the process organic nitrogen is converted to nitrate and organic phosphorus is changed to phosphate—the very foods algae need for rapid growth. Years ago, when raw sewage was dumped into streams and pollution was the rule, algae seldom formed

blooms in streams and lakes. Today with modern sewage treatment, which converts organic matter into inorganic nutrient elements, algae are much more numerous. In former years the health problem was greater because bacteria causing diseases thrive in untreated sewage; today treatment reduces such health hazards. Thus, it happens that the more sewage is treated to reduce the health hazards, the more suitable are the wastes as food for algae.

Solution to the Problem

The obvious way to rid Lake Zoar of algae without damaging it as a producer of game fish is to reduce the levels of fertilizer elements in the waters that feed the lake. The four Connecticut agencies mentioned above have made a survey of the amounts of nitrate and phosphate in the several streams that feed the Housatonic River above Lake Zoar. They have found that the bulk of these come from the Still and Pootatuck Rivers.

Removal of nitrate from waters is almost impossible, and because some algae can fix nitrogen from the air, removal of nitrogen would probably be useless in controlling the bloom. Removal of phosphate has been chosen as the approach most likely to succeed in this case. Algae cannot obtain phosphate except from the water in which they grow and phosphate can be removed to a high degree by known processes.

For years lakes in the vicinity of Madison, Wisconsin, have bloomed in a manner similar to Lake Zoar. Scientists at the University of Wisconsin have developed a process for phosphate removal from sewage effluents, but they have not had an opportunity to test the method in an isolated stream. The opportunity to test this process is ideal in Connecticut. For this reason a supplementary process plant is planned for construction at

the Fairfield State Hospital, which is cooperating in these studies by making available their facilities for the investigation. The sewage treatment plant at this institution does a good job of oxidizing the organic wastes and reducing the bacterial content of the sewage. Under these conditions organic phosphorus compounds are oxidized to phosphates, which are then discharged with the effluent from the treatment plant into the Pootatuck River. The supplementary treatment is designed to remove most of these phosphates. An opportunity is thus provided to measure the effect of phosphate removal on algal blooming in the stream.

Alum Traps Phosphates

The supplementary treatment will consist of a settling tank into which alum is put. After a suitable settling time, the curd of phosphate trapped on alum will be drawn off. The remaining water clear fluid will be run into one of a pair of lagoons on the grounds of the Fairfield State Hospital. Into the other lagoon will be run sewage effluent which has not received supplementary treatment and which contains amounts of phosphate comparable with the amounts in Lake Zoar. By the amounts of blooming in these two ponds, the cooperating scientists can estimate the chances that the bloom on Lake Zoar can be controlled through installation of similar supplementary treatment plants strategically located along the Still and Pootatuck Rivers. The operation at the Fairfield State Hospital is a large scale experiment; it guides the way to a solution although it will not, of itself, be the solution to the problem on Lake Zoar. But with luck that bloom-in' lake will bloom no more in years to come.

¹ Dr. Dimond is head of the Station's Department of Plant Pathology and Botany.

What Goes Into A Good Cigar?

by T. R. Swanback¹



The average cigar user, when he settles down for a good smoke, gives little thought to the painstaking effort that has given him the light-colored, aromatic, well-flavored product he enjoys so much. He would undoubtedly be amazed at the chemical background of his favorite after-dinner smoke. A little too much of this or that element and his cigar would have an unpleasant flavor, or the ash would tend to flake and fall off too soon. What goes into the soil has a profound effect on the cured and fermented tobacco leaf, and the most careful blending of plant nutrients is necessary to obtain the desired high grade product.

Nitrogen at Top

Tobacco specialists agree that nitrogen tops the list of essential elements. Without sufficient nitrogen, the cured leaf would be yellow, non-elastic, brittle and almost worthless as cigar binder or wrapper. With proper nitrogen fertilization, the color will be good, and the texture will have just

the right degree of elasticity. But "proper nitrogen fertilization" means a great deal more than just throwing on a generous amount of some nitrogen-containing fertilizer. Research at the Tobacco Laboratory has shown that many factors must be considered: proper nitrification (the breaking down of the fertilizer material into the nitrate form the plant can use), correct balance of nitrogen applications to suit the soil as well as the crop need, and proper cultural practices. Also, the land must be supplied with other fertilizer materials that contribute to the efficient utilization of the all-important nitrogen.

But the addition of nitrogen is just the beginning of the story. After producing a cigar leaf that fills all the requirements of good texture and satisfactory color, the burn and aroma, too, must meet approval of the expert.

Through extensive experimentation, we have found how much and what form of potash supplied in the

fertilizer will produce proper burn of the tobacco leaf. Proper burn means a cigar that will continue to "glow" once it is lit and one in which the glow will proceed at a suitable rate. Too much potash will produce too rapid a burn which does not permit complete combustion since carbon particles are fused in with the potash compounds, causing a dark to black ash. Too rapid combustion, caused by too much potash, results in certain "sharp" and disagreeable substances being carried with the smoke to the mouth, disturbing the solace and contentment of the smoker, to say the least.

Magnesia compounds in the leaf promote the completeness of combustion, since by nature of their chemical properties, they do not fuse. Too much magnesia, however, causes the ash to become flaky and fall off the cigar, scattering over the smoker's clothes.

Here's where calcium compounds come in. Calcium tends to make the ash firm, so that it adheres to the cigar a reasonable length of time.

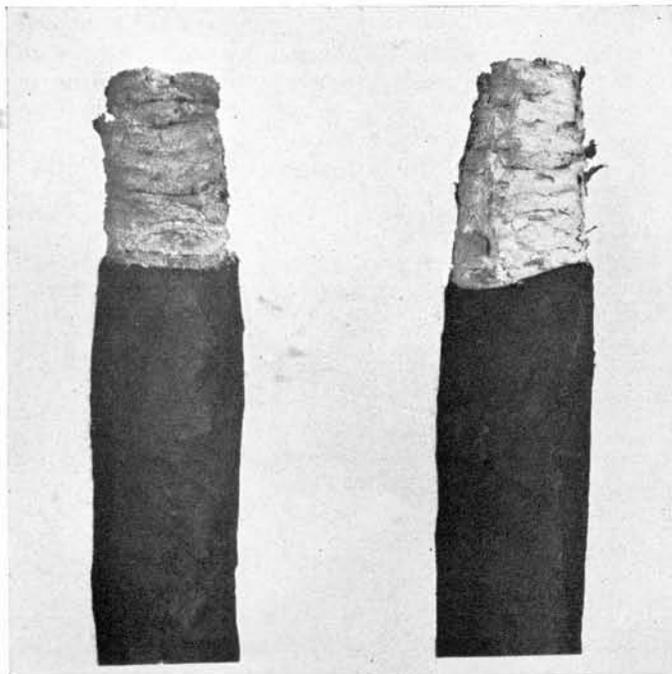
What about flavor and aroma? These, of course, vary with the taste of the individual, but our research along these lines indicates that increasing the content of calcium (and consequently lowering potash content) improves flavor. Aroma seems to be linked with magnesia.

Another major element in tobacco nutrition is phosphorus, essential for all higher green plants, but especially important in tobacco production. Without phosphorus, the leaves become leathery and too dark in color.

Minor Elements Important, Too

Minor or microelements also have their place and many of these have been studied quite extensively at the Tobacco Laboratory. It has been found that several of them play a part in the production of quality cigar tobacco. Most recently, we have found that copper, never before used in the fertilizer formula, has a very important role. Copper compounds added directly to the soil or in the fertilizer serve as soil amendments and improve both yield and quality, in some instances as much as 30 per cent.

Thus, a good cigar is not just a good cigar. It's a combination of many elements—nitrogen, phosphorus, potash, calcium, and even copper—judiciously blended together. In fact, it's really a chemical formula the cigar smoker enjoys!



NOT ENOUGH

TOO MUCH

Lack of magnesia results in a dark and muddy ash, while an excess gives an ash that is flaky.

¹ Mr. Swanback is agronomist at the Station's Tobacco Laboratory at Windsor.



The Station's annual Field Day, held in August, gives farmers and gardeners a chance to see what's going on at the "outdoor laboratory" and to witness agricultural research in action.

The Station's Outdoor

"If you ask nature a question properly, she will give you the answer," wrote Samuel W. Johnson, father of the experiment station idea in America. The Connecticut Station's outdoor laboratory in Mount Carmel, sometimes called the "Experiment Station Farm," is one place where our scientists ask the questions and nature provides the answers. It is actually an extension of the laboratories on Huntington Street in New Haven. It is especially valuable because we can put plants in the soil and grow them in a natural environment.

Our outdoor laboratory has little in common with a commercial farm. We do grow plants in soil, we do use tractors for cultivation and sprayers to apply pesticides. But our principal product is scientific information, and not bushels of apples and potatoes and crates of lettuce and strawberries. We are concerned, not with production of pounds of grain or baskets of perfect peaches, but with scientific knowledge of the fertility of the soil, inheritance of desirable characters, and control of pests, which will result in better production. We are studying the factors that will influence production, and using as few plants as possible to give a reliable answer.

Large Acreages Not Necessary

Why as few plants as possible? The farmer, used to large acreages, usually expresses surprise when he sees the relatively tiny plots at Mt. Carmel. But experience has shown us that we get better answers from small plots than we do from large ones. Nature is full of variations. We have only to look at the human population, where two people who look

alike are the rare exception, to know that this is true. The variability among plants and soils is just as great as that among humans. Take a nice, level acre of land that looks just the same in every section. Appearances are deceiving, because the variation in fertility over the acre may be as great as 50 per cent. If you tried to grow potatoes on it, the yield range could easily vary from 200 to 400 bushels per acre, even on two spots planted from the same seed piece.

This variation for which nature is

known has been the special study of a branch of statistics known as biometry. And biometricians have provided us with ways of dealing with this variation. One answer they give us is to make our experimental plots as small as possible. A second part of the solution is to locate these plots in several places in an experimental field. That's the reason for the checkerboard effect so common at Mt. Carmel where a dozen tall corn plants are seen growing next to 12 very short ones, or a few badly diseased toma-

atoes are growing in happy proximity to a small square of near perfect fruits.

With these two provisions, small plots and scattered ones, the biometrician can, by the ingenious use of mathematics, separate the variation nature puts into an experiment from the differences the researcher introduces with his treatments. Small plots, too, give us an opportunity to study a few plants with great thoroughness. Such careful study would be impossible if thousands of plants were used, and random selection to get representative

sampling would be difficult in large fields.

Types of Research

What kind of work goes on at Mt. Carmel? One example is the study of types of chemicals that may be put on leaves to prevent vegetable diseases. These chemicals must kill the disease spores or the germ tubes growing from them, but must not injure the leaves of crop plants. A complete and accurate study of these chemicals is made in the laboratories at New Haven. There, suitable tests select those that will destroy the disease spores and will not be washed from the plant by rainfall. Greenhouse plants are used to determine the effect of the potential fungicides on the foliage. The final test is made in the spiral plots in the outdoor laboratory.

These "spirals" were developed here for this very purpose. The scientists wanted plants



Spiral plots like this one are used for testing the effectiveness of new materials for plant disease and insect control. The spiral pattern makes spraying easier and permits a large number of experimental plots.

Laboratory — THE MT. CARMEL FARM

growing out of doors and subject to a "natural" infection of disease. They wanted to use a power sprayer which would provide good coverage of the plants. So, instead of planting long rows of beans or celery or tomatoes and moving the sprayer around over the field, they used a spiral row, with room enough in the center for a power sprayer. A counterbalanced boom carries the hose and is swivelled so that the operator can walk around the spiral, spraying the plots as he goes, and finishing the job at the spot where he will begin his next "round." There are only a few plants in each plot, and each "spiral" will allow comparison of eight new materials with a standard, well-known fungicide. This has proved to be an ideal way to apply new materials for study.

New Fungicides Developed in Spirals

When the disease has developed in the unsprayed plots (a very essential feature of such an experiment), the amount of disease on all the sprayed plants can be determined by a trained technician. The answer is the performance of a new material under field conditions. The highly effective fungicides zineb and nabam were developed in these spiral plots.

Most fruit pest work goes on in the experimental orchard and, here again, conditions are anything but like those the commercial grower would like to see on his own farm. An apple tree riddled by curculio or scab is a sight that would cause the good apple grower deep concern but it may be just the kind of apple tree the researcher wants in his search for scientific facts. In the first place, if we don't leave a few trees unsprayed in a given year, we can't tell exactly how many insects are present, nor how bad an infestation may be. More important, those riddled trees may be part of an experiment to determine how much spray the grower should put on to control insect pests. If we use only one concentration of spray material, it may be that we'd hit close to the ideal dosage and obtain perfect fruit. But maybe we used more than was necessary to do the job. The grower needs a margin of safety. Obviously, he wants to use enough material for good control but, just as obviously, he does not want to spend extra dollars for unnecessary excesses. The way we establish the correct amount is by applying the chemical under test in a dosage series. Starting with a concentration so low that we're sure it won't kill all the bugs, we step this up in a series of successively higher dosages until we can determine, by mathematical evaluation, just how much is needed to give a good kill of insects. Thus, the visitor to the Experimental Farm may see in an orchard where curculio work is going on, some trees with no curculio, others with a slight infestation, and still others with the pest present in great numbers.

Freak Corn Plants

One of the strangest sights at the "farm" is the field where geneticist Donald F. Jones maintains his "nursery" of genetic stocks of corn. Here are lazy plants lying prone on the ground, plants with ragged leaves, dwarf plants, plants with tassels but no pollen and

Dr. Philip Garman grades apples for curculio injury—one of the final steps in determining which sprays and how much of them are best for controlling this important apple pest.



Dr. Donald F. Jones, with one of the freak types of corn he maintains for genetic stock. This one is a dwarf corn which at its tallest attains a height of about two feet.

some with no ears. Dr. Jones has been studying these abnormalities and their inheritance for the past 25 years. The knowledge he has gained has enabled him to transfer pollen sterility to female parent plants of the inbred type used to produce hybrid seed. The costly job of detasseling has been eliminated, and the end result is less expensive hybrid seed corn. Thorough knowledge of the inheritance of characters has thus enabled Dr. Jones to make practical use of pollen sterility.

Some of the other "freak" corn

plants have had practical application, too. The dwarf characteristic, for example, is useful for producing shorter corn for easier handling.

The above are just a few of the examples of the ways scientists go about their work at the Station's outdoor laboratory—unconventional ways by the standard of ordinary farm practice. But, remembering that the Experimental Farm's chief product is new knowledge, it's no wonder that the methods for harvesting this particular crop are somewhat different.



From the Director

Harlan Hatcher, President of the University of Michigan, recently viewed with some alarm the modern trend toward research institutes. Speaking to a national group of university administrators, he feared that the universities might be losing one of their treasured functions.



He was, perhaps, unduly pessimistic. Universities will always engage in research. They automatically discover gaps in knowledge and they will always strive to plug them.

Modern society, however, is deeply impressed with the significance of research, and will surely encourage it strongly. Samuel W. Johnson, founder of our Station, recognized an elementary fact 100 years ago when he said that a research institute can "make a regular business of discovery." Research must necessarily assume a secondary position in a university where the "regular business" is to store and dispense information.

At first industry considered that research was subsidiary to their educational function, i.e., sales. But industry soon discovered that research could create new products to sell. Industry then set up its own research institutes, elevating research from a third or fourth order position to a first order rank in the company.

Most of the first dozen agricultural experiment stations were established as independent research institutes. Those established after 1888 were attached to a university or college. They operated under a director who was second in rank only to the president of the University. The trend has been away from this. In general, the director of the station is now no longer the equivalent of a vice-president. His position is much further down on the ladder, cognate with that of an associate or even an assistant dean.

Perhaps, discerning Mr. Hatcher has pointed out a situation ripe for a swing back. Industry has already swung and a few universities have recognized the problem. Wisconsin, for example, now has a quasi independent research institute for enzyme chemistry. It is said to be "making a regular business of discovery," as our Station has always done.

James G. Horsfield

TOOLS OF SCIENCE: Tree Volume Tables

by Henry W. Hicock¹

Foresters use tree volume tables to estimate timber offered for sale, on the stump and to determine yield and growth of forest stands. One method of preparing tree volume tables is outlined below.

Measurements used in preparing the tables are obtained during felling operations as the trees are cut into logs. They are the total tree height and height of stump in feet, and diameter in inches outside and inside bark at stump height, at 4½ feet above ground (breast height) and at the top of each log.

These field data are plotted on a special graph paper as shown diagrammatically in the accompanying figure. The tree shown is a pine 8.4 inches in diameter at breast height and 44 feet in total height. The use of this graphic record of the tree in the preparation of two tables will be demonstrated. One table expresses the volume in cubic feet of stem, including bark, between a stump 0.5 foot high and a top diameter of 2.0 inches outside bark; the other, the volume in board feet of the stem, without bark, between a stump 0.5 foot high and a top diameter of 5.0 inches inside bark.

The stump below line A-B and the top EOF above a 2 inch diameter limit are waste. The section AEFB is usable for pulp and its volume with bark is desired in cubic feet. The line EF represents the top diameter limit for pulp. The section A'C'DB is usable as sawlogs and its volume is needed in board feet. The line C'D represents the top diameter limit for sawlogs.

The scales on the diameter and height axes are so arranged that, if the area of AEFB is measured, the volume of that portion of the tree which AEFB portrays graphically can be obtained in cubic feet. For the tree in question the volume is 9.52 cubic feet.

To determine the board-foot content in the section A'C'DB, the section length (28.5 feet) is divided into logs 8.15 feet long and half logs 4.08 feet long in such a manner that the highest board foot volume will result (in this case three 8.15-foot logs, and one half log). The top diameter of these logs is then scaled from the chart and the volume read from a board-foot log rule. For this tree, the volume of the 3½ logs is 33.7 board feet. The above procedure is followed for all trees used in constructing the tables.

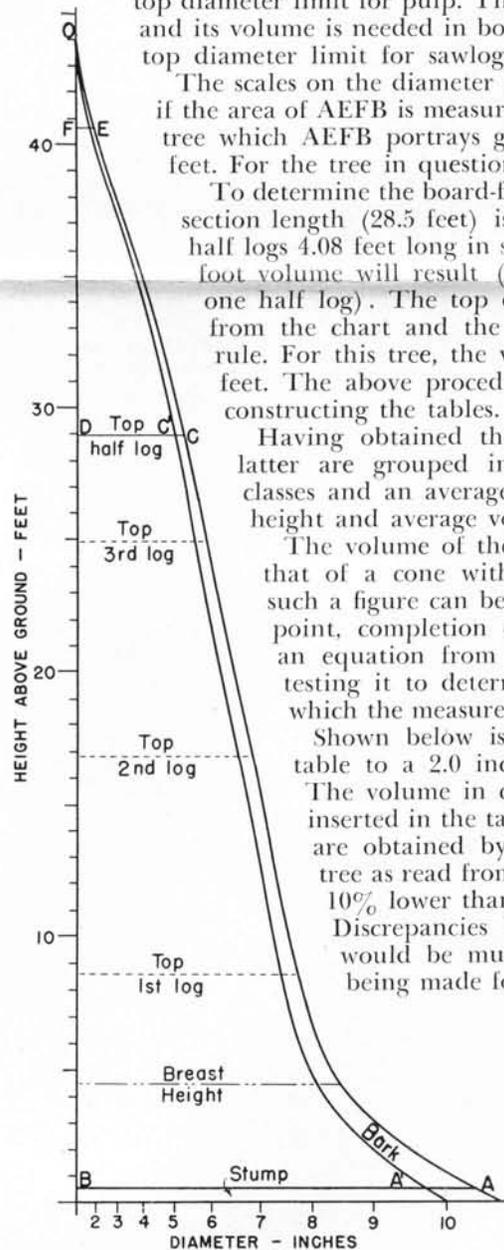
Having obtained the volumes for individual trees, the latter are grouped into diameter-breast-high and height classes and an average breast high diameter, average total height and average volume computed for each class.

The volume of the usable portion of a tree is roughly that of a cone with the top removed. The volume of such a figure can be expressed as an equation. From this point, completion of the tables consists in developing an equation from the averages mentioned above and testing it to determine how well it fits the trees from which the measurements were taken.

Shown below is a portion of a cubic foot volume table to a 2.0 inch top diameter limit, outside bark.

The volume in cubic feet of the sample pine tree is inserted in the table in italics to indicate how volumes are obtained by interpolation. The volume of this tree as read from the table is 8.61 cubic feet or about 10% lower than its actual volume (9.52 cubic feet).

Discrepancies between actual and tabular volume would be much less if the volume estimate were being made for 100 trees instead of only one.



Diameter breast high, inches	Total Height in Feet	
	40	45
Volume (cubic feet)		
8.0	7.05	7.90
<i>8.4</i>	—	<i>8.61</i>
9.0	8.90	10.00

¹ Mr. Hicock is head of the Station's Forestry Department.

Insect Resistance to Insecticides

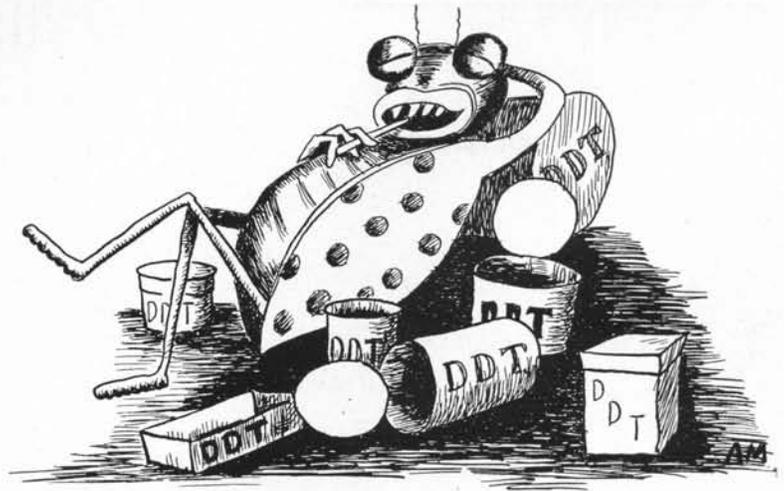
by R. L. Beard¹

"One man's meat is another man's poison" is one way of saying that all individuals do not respond alike to food or medicine. The same is true of insects. In general, flies are easier to kill than beetles, but even within the same species, some individuals are easy to kill and some are difficult. In insect control operations, some of these differences seem to exist because some individuals are lucky and escape death by not being hit by the chemical. But even when an insecticide is applied directly to the insects, individuals differ in their tolerance.

It has happened that insect species susceptible to certain insecticides have become, over a period of time, tolerant, or as we say, resistant to the insecticide. Undoubtedly this phenomenon is often used as an excuse when poor results are obtained from an insecticide application, but there can be no question about there being resistance in some cases. Certain strains of houseflies, for instance, can spend practically their entire lives in contact with heavy concentrations of the same chemical. In Korea, body lice have developed resistance to DDT, and the prospect of having "cootie" infestations reminiscent of World War I points up the seriousness of the situation. In fact, few insect control problems have required for their solution the cooperation of the practical man in the field and the research worker in the laboratory so much as this one. No one yet knows the solution to the problem, but many are working on it.

A Super-Insecticide?

Some entomologists feel that the answer lies in the direction of finding the super-insecticide which will put all entomologists out of work. Other entomologists feel that such an insecticide is a will-o'-the-wisp, the search for which may cause us more trouble in the long run than the benefits justify. They feel that the answer to the resistance problem demands a knowledge of how and under what conditions resistance develops and the wise use of insecticides, possibly in conjunction with control measures other than chemical treatment. Those of us here at the Connecticut Station are of the latter group—not because we are afraid of working ourselves out of a job, but because to us the good evidence is all in this direction. We believe that emphasis must be on control and not on attempted eradication.



Although resistance to insecticides is not a new phenomenon—years ago the codling moth in some areas became resistant to lead arsenate—it has recently become far more important because of the rapidity with which it has developed and because in some cases insects developing resistance to one insecticide have been found to be resistant to other insecticides. Resistance has seemed to develop most often among the insecticides which are lasting in their effectiveness, and under conditions where the chemical is used intensively.

The basic assumption has always been that insects surviving a chemical treatment are the most resistant individuals, and their survival permits the breeding of a resistant strain of insects. This seems reasonable enough, but it seemed desirable to test this assumption. This was done by treating large numbers of insects with chemicals and one week later, testing the survivors for their susceptibility to the same or different insecticides. Surprisingly, the survivors were just as susceptible or even more so, than insects not selected as survivors of a treatment. Some of this could be explained by the fact that the effects of the first treatment had not yet worn

off, and in effect, some of the survivors were still "sick" when given the second treatment. But this was not true in all cases. It appeared that the insects might be resistant one day and susceptible on another day. We people have our ups-and-downs; why shouldn't insects?

Recovery Rate Varies

To test this further, one can't bring dead insects alive again to test them a second time, but one can knock them out with something like a low dose of nicotine and determine their rates of recovery. Insects slow to recover might be considered susceptible and those recovering rapidly might be considered resistant. When such tests are made repeatedly, it is observed that the same individuals are not always the slow ones (nor the fast ones), but that they vary from time to time. This is generally true—and not just a happenstance because of this type of test, we have a clue as to why resistance develops most often to insecticides which are lasting in their effectiveness (like DDT) and under conditions where the chemical is used intensively. This clue is, that under such conditions only those insects survive which are *consistently* resistant from day to day, and hence most likely to breed resistant strains in succeeding generations. If this is true, the answer then lies in avoiding these conditions—either by not using any one chemical intensively, by using chemicals which act quickly and then lose their effectiveness, or by using in combination different chemicals which at any one time kill different individuals in a population.

This last "way out" is being extensively studied by Neely Turner of our staff. "Joint action" of mixtures of insecticides may come to be as important to the agriculturist and public health officer in controlling insect pests as mixtures of antibiotics have become to the physician in curing diseases.

¹ Dr. Beard is an entomologist.



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of Plant Science

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List of New Station Publications

BULLETINS

- 550. The Production of Hybrid Corn Seed Without Detasseling.
- 551. Commercial Fertilizers. Report for 1951.
- 552. Control of Apple Insects. (*Charge of \$1.00 per copy for this bulletin.*)
- 553. The Formation of Asparagine in Etiolated Seedlings of *Lupinus albus* L.
- 554. Chrysanthemum Gall Midge.

CIRCULARS

- 181. Combating Blue Mold of Tobacco.
- 182. Birch Leaf Miner Control.

REPRINT

- Circular 169. How Good Lawns Grow.

HYBRID VIGOR IN FLOWERS

by D. F. Jones¹

Seed catalogs are listing many hybrid vegetables, corn, squash, cucumbers, peppers, eggplant and tomatoes, but not many flowers. Recently hybrid petunias have found their way into a few catalogs and will probably increase in popularity as the advantages of hybrid vigor become more generally known.

This stimulus to increased growth resulting from cross-fertilization is shown by nearly all organisms, both plants and animals. It is at its highest expression in the first generation after crossing, but the beneficial effects may last for several generations. In corn, hybrid vigor disappears rapidly so that only the first cross is used. Cross-fertilized seed is produced each year from selected inbreds and foundation single crosses. In tomatoes, eggplants and peppers, the higher yields, early maturity and sturdy growth persist into the second generation with very little reduction so that second generation hybrid seed is being used in increasing quantities.

With Corn, It's Easy

The production of hybrid seed is relatively simple in naturally cross-fertilized plants such as corn, where the male and female flowers are separated and borne on different parts of the plants. The tassel or pollen-producing flowers are easily removed before any pollen is shed. All of the seeds on these detasseled plants are therefore crossed by pollen from other plants grown in the same field. Squash, cucumbers and melons also have separate male and female parts on the same plant and are easily cross-fertilized.

Plants that are perfect flowered with both anthers and stigmas in the same

flower, such as tomatoes and related plants, are much more difficult to cross. These plants are self-fertilized in nature. To make a hybrid, the anthers must be removed before pollen is shed and pollen must be applied by hand to each individual flower. This is why the hybrid seed is so expensive.

Pollen Sterility

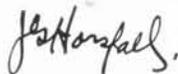
Various types of pollen sterility have been discovered in tomatoes which make it possible to pollinate the flowers without previous emasculation. Some of the plants are sterile and some are fertile. These must be separated before planting in the field. This simplifies seed production. In corn and petunias a new type of sterility has been discovered that makes it possible to have all of the seed parent plants free from pollen so that the production of hybrid seed is still further simplified.

In corn, it is necessary to restore pollen fertility in the farmer's field since corn is grown primarily for the grain. In flowers, such as petunia, it is a distinct advantage to have the plants sterile. Since they do not seed, the plants remain in full bloom over a much longer period. It is not necessary to remove the blossoms as they form, as is the case with most flowers, which will otherwise stop blooming. Hybrid petunias are sturdy, easy to grow and bloom all summer. As soon as this sterile pollen condition can be transferred and incorporated in desirable varieties suitable for cross-fertilization, first generation hybrid seed of these free-flowering and long blooming petunias will be available in quantity.

¹ Dr. Jones is head of the Station's Genetics Department.

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