

are so susceptible to damping-off fungi that to date we have never succeeded in saving more than 15 or 20% of the seed planted. An artificial soil² tried late the past spring gives promise of overcoming this handicap. It is composed of equal parts of sand and ground cork, and unlike peat may be sterilized with steam under pressure without becoming toxic to plants. Nutrient solutions must, of course, be used with the mixture.

The plants grow slowly. After 8 or 10 weeks, when they are from an inch to an inch and a half in height and have 8 or 10 true leaves, they are transferred from the flats to pots. The first shoot grows erect, finally reaching a height of four or five inches, is very slender and has small leaves. Some time during the summer one or more runners branch out from near the base and in some cases reach a length of 18 inches or more before growth is arrested in the fall. The leaves on the runners more nearly approximate normal size.

The plants require a resting period after the summer's growth. One lot of seedlings planted in January and kept in Washington for experimental purposes stopped growing early in October. Near the end of November all but 5 of the pots were set outside the greenhouse. After 6 weeks, during which time there had been only a few days of freezing weather, one plant was returned to the greenhouse. It remained dormant for about three weeks, finally put out a half inch of weak growth and then became dormant again. This process was repeated two or three times, but at the end of May it appeared to have resumed normal growth. Meanwhile a second pot was brought in after eight weeks' exposure. It started vigorous growth immediately and was still growing rapidly the last of May. The plants which were kept in the greenhouse all winter did not turn the normal red winter color. They were just beginning to grow when last seen late in May.

Seedlings would probably bear fruit the third summer if given optimum conditions for growth. So far none of our crosses have bloomed, as it has been necessary to move the older plants several times. At present we have more than 1500 seedlings started.

CURRENT INSECT PROBLEMS AND NEW INSECTICIDES

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What I have to say this afternoon would probably not come under the category of a speech but just as a few remarks covering some of the highlights of the insect pest situation for the season. In discussing this subject over the radio the other day, I was advised by one of the growers here this afternoon that I failed to mention any of the cranberry pests. I was pleasantly surprised to find that someone outside of members of my own family did actually listen in to these noon-day farm programs over radio station WHA. I knew you cranberry growers were having your troubles growing your crop all right but did not want to add to your problem by suggesting that there might be a lot of wormy cranberries. I was afraid that if I started giving statistics from losses of fruit worm and fire worm that the consumers might lose their appetite for cranberry sauce.

The insect obtaining the most publicity over the state and doubt-

² McArdle, R. E. Relation of mycorrhizae to coniferous seedlings. Journal Agricultural Research 44:287-317. 1932.

lessly the one responsible for the most damage to our crops here in Wisconsin this summer, was the grasshopper. While grasshopper injury occurs annually in several counties in the northern part of the state, we never have had the losses and widespread distribution that we experienced last summer. More than thirty-three counties have required some aid from the state during the past two months. The situation became so acute that the Legislature appropriated \$10,000 to buy poison for the control of grasshoppers and army worms. This sum of money naturally did not go very far having to be spread over so much territory and several thousand dollars additional funds had to be allotted by the Governor from other projects of the Department. Distributing this money in counties where it did not amount to a drop in the bucket was about as pleasant a task as attempting to divide up several lolly-pops between a schoolroom of children. Those who got no lolly-pops did not like you and those who got one thought they should have a different colored one like someone else got. In grasshopper control each county agent felt that his county was an exception and that most of the appropriation should be spent in his county. The money, we believe, was allotted fairly since it was divided on the basis of a grasshopper population determined by an accurate survey. One county, Langlade for instance, spent nearly twelve thousand dollars of its own funds and received less than two thousand dollars from the state funds. The poison was mixed and distributed under the direction of the Department of Agriculture and Markets and in every case where the material was used as directed, satisfactory results were secured and no injuries resulted. Every bag of poison carried a warning that the sack should be burned after being emptied and despite all our warnings through the press and during the distribution, some of the farmers became careless, thinking that the poison would not injure the livestock and allowed them to have access to it, resulting in their death. A few reports of this kind soon emphasized the danger of this practice and prevented further losses.

Army worm outbreaks occurred in the vicinity of Appleton, Green Bay, Camp Douglas and Sheboygan and these also were brought under control by poisoning with this same white arsenic, bran and molasses, provided by the special state appropriation. As far as other major pests are concerned, we can only say that it being a hot, dry season following a mild winter, conditions seemed ideal for all of our more serious pests. The potato beetle was worse than it has been for years, the cucumber beetle, corn ear worm, cut worms, codling moths, canker worms as well as scale insects and plant lice, all seemed to take advantage last year of the growers who were compelled to retrench financially and could do little in the way of control. More than one hundred carloads of poison bran grasshopper bait was needed to check the grasshoppers. Despite the speeding up of legislation, purchase, and delivery of the poison, it was nearly the first of July before the most of the material was distributed. A little attention earlier could have reduced these losses to a minimum by killing the grasshoppers in their egg beds at much less expense of time and materials, but like most insect problems, it is difficult to convince the public until the damage is done.

I have brought along with me today some specimens of three plants used for making two new insecticides now becoming popular on the market to replace arsenical sprays wherever possible. With so much agitation on the subject of spray residues, the public is being frightened into believing that they are almost taking their lives in their own hands by eating sprayed fruit. As a matter of fact, there are other avenues of poison that are more dangerous than this one, yet the propaganda directed against fruit has been very disastrous and probably will necessitate the finding of something else as a substitute for

arsenical sprays if the government chemists continue their propaganda. You are all familiar with nicotine sulphur or Black leaf-40, manufactured from the tobacco plant. The cost of this material is very high as compared with arsenical sprays and the like because to make a 0.05 per cent solution the standard mixture requires as much as twenty-five pounds of certain varieties of tobacco leaves. Pyrethrum, as you know, has been used as an insecticide for many years and I have here in my hand a bottle containing the dried heads of a species of chrysanthemum from which the highly volatile oil is extracted. Like nicotine sulphate, it is too expensive on a large scale. This particular species *Chrysanthemum (cinerariae folium)* like most of this material used for pyrethrum manufacture, was imported from Japan. As much as one million five hundred thousands pounds of this material has been imported into this country in a single year. It kills insects by paralyzing the nervous system, but loses its strength upon exposure to the air. It is considered harmless to warm-blooded animals and to human beings.

Recently you have been reading quite a little about Rotenone. It is a volatile substance extracted from the roots of certain tropical plants, primarily Derris and Cube. Rotenone is toxic to both chewing and sucking insects, especially aphids and is considered non-toxic to plants as well as man and animals. Derris from which this insecticide is extracted is a climbing shrub growing throughout the tropics mainly in the Malay Peninsula and East Indies. It is called by the natives "tuba root." This bundle of roots which I am about to pass out to you, are Derris roots imported from the Island of Java. The root is very poisonous to fish when a small piece is thrown into the water. It is said to paralyze fish almost instantly. (You will note I did not say how big the piece had to be.)

You have, no doubt, read recently in your newspaper of a plant which grows here in Wisconsin reported to contain this same Rotenone in its roots. This plant, which has had considerable notoriety throughout the newspapers, is the plant I hold in my hand and is known by several common names including "Devil's Shoestring" and Wild Pea. It is known botanically as (*Cracca Virginiana*). It grows very extensively in light sandy soils in this state. Government chemists claim that it has more Rotenone in its roots than some of the Derris roots have, so it may prove a very valuable weed. If it makes Rotenone spraying material at a reasonable cost, it will revolutionize the spraying industry and we believe will solve the spray residue problem. The main objection against Rotenone, when used as a stomach poison, is that it readily decomposes when exposed to the sunlight and loses its toxic qualities in a few days. This would necessitate frequent repetition of spraying and would make it too costly for orchard application at its present price. These contact sprays can not be analyzed by chemical tests but, like pyrethrum, must be tested on the insects or tried out on the dog, so to speak. It must be compared against known materials in what is known as a death chamber, which in reality is a large fumigating box about eight feet each way in which one hundred or so flies are used to test out a given amount of the material over a definite period with the tests being repeated several days in succession.