Wild hosts. There are many weeds in South Florida which harbor viruses of various kinds. These grow in profusion along canal and ditch banks and provide a constant source of inoculum for several of the cultivated crops. That these weeds play an important part in the present serious condition can not be doubted, however, the identity of the respective viruses on these wild host plants is not well known and until a thorough study of them is made a sound program of control can not be recommended. During the past year, the Everglades Experiment Station at Belle Glade has instituted studies on the problem and out of this should come a better understanding of the disease complex and a logical approach to the commercial control of all mosaic troubles in South Florida.

CONTROL OF CELERY DISEASES

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One of the tests given to inmates of insane asylums to determine their eligibility for release is to give them a mop and let them into a room containing a wash basin running over the brim. If the patient begins to mop the floor before he turns off the faucet he stays. For at least sixty years farmers and experiment station workers have been mopping celery diseases frantically while the basic sources continue to flow unheeded.

We spend approximately a quarter of a million dollars in Florida annually for chemicals, and a lot more for labor and equipment in attempts to control our number one celery disease, Cercospora blight. A substantial portion of state appropriations are spent finding out which chemical to use, how many pounds to add to 100 gallons, how many gallons to spray on an acre, what supplements to mix with it, how often to apply it, proper pressure, orifice size, nozzles per row and a dozen other technical angles.

At first we were exploring the use of copper compounds. Bulletin 366 published in 1942 summarizes results of eleven years work by Townsend of the Belle Glade station on the use of copper-containing materials. Now the trend is toward organic materials, particularly the carbamates. At Sanford we like a mixture of iron and zinc dimethyl carbamates, now being marketed in 70 percent active powders as Fermate, Zerlate and Karbam. We find that one pound each of the iron and zinc salts in 100 gallons of water, applied weekly at the rate of 125 gallons per acre, controls blight. The sprayer should operate at 300 pounds pressure and have at least three nozzles per row.

Although we like this mixture best there are other materials that will control blight. The sodium ethylene carbamate marketed as Dithane D14, the zinc ethylene carbamate sold as Dithane Z 78 or Parzate, and the quinone marketed as Phygon have all been reported as effective. Many of the old copper compounds still do a good job when properly applied.

The working out of a satisfactory spray program is important but even the best spray program is only an emergency measure to save the celery crop until a more basic solution can be found. Growers want an immediate solution of their problem and fungicide sprays are rapid. Also it is easy to set up a spray experiment, for a dozen chemical manufacturers are willing and eager to furnish samples for test. But pathologists would be doing a serious disservice if they allowed pressure from either short sighted growers or aggressive mer-

chants to deter them from searching for a more permanent and economically sound means of eliminating loss.

A few years ago Townsend of Belle Glade and Emerson of Cornell began work on a program of breeding blight resistant celery. The parents from which they obtained resistance had hollow petioles, a sprawling habit, pink coloring, and a strong flavor. It took several years of crossing to bring blight resistance into a strain that approached commercial celery in quality. The program has been delayed by lack of facilities for producing seed and by restrictions against out of state travel but it is making definite progress. There will be tests at Sanford and Belle Glade this year of some sixty selections. A little more work will be needed to get strains ready for release, but it is possible to have on the market within three years strains of both green and golden celery which will not need fungicidal sprays. If this project can be completed it will be of more importance to Florida celery growers than all the spray tests of the past sixty years.

Another celery disease on which a lot of emergency experiments have been performed is damping-off. We plant our celery seed on saturated soil in beds surrounded by water, covered by cloths which restrict air movement, during seasons when the temperature is often above ninety and when rains occur almost every day. It would be difficult to produce conditions more favorable for development of fungus diseases. Growers often sow three times the number of beds they expect to need in hopes that enough plants will survive. With this disease as with blight the most obvious and immediate solution is to apply chemicals. Formaldehyde or chlorpicrin applied to the soil before planting reduce but do not eliminate damping-off. The cost has been so high that most growers do not practice the treatment. Seed treatments also help in some cases but they are not adequate for the severe conditions under which our celery plants are grown. Sprays or drenches are therefore necessary as supplements to the soil and seed treatments. We have found one of the carbamates marketed as Tersan to be the most effective in our tests at Sanford. It has the disadvantage of being injurious if used in excess. A weekly treatment using 1 pound to the 100 gallons and no more than 20 gallons to a 1200 square foot bed has given good control. It should not be applied less than 2 weeks after seeding. A quinone, sold as Spergon, has been used extensively for this purpose. At 4 pounds per 100 gallons it is less injurious than Tersan, but in our tests not as effective a fungicide. The iron carbamate, Fermate, used as a dust for blue mold control in the tobacco area has also given protection from damping-off.

With damping-off as with blight we have concentrated on emergency treatments of the mopping up category by necessity. But with this disease also there are more basic solutions in sight. Tisdale at Gainesville and Brooks at Plant City investigated the effect of soil organic matter on damping-off. Their results plus those of workers in other states suggest that a fundamental solution of the damping-off problem might be found by establishing conditions in the soil under which organisms which antagonize the pathogen will thrive. We have no end in sight on this approach, but there are enough encouraging leads to make further investigations well worth while. It is quite within the realm of possibility to use the common soil organism, Trichoderma, to antagonize the plant pathogenic Rhizoctonia just as medical men have used the mold, Penicillium, to antagonize human pathogens.

A third disease of celery, Septoria blight, is less common in Florida than it is elsewhere. It may be distinguished from Cercospora blight by the presence of minute black fruiting bodies appearing as dots on the surface of the lesions. Spray programs for this have also been devised but a more basic solution is readily available. The organism apparently does not survive in Florida soils so that the only means of in-

troducing it is with infected seed. Fruiting bodies of the fungus, Septoria, appearing as black bumps on the surface of the seed make detection of infected seed lots easy. The fungus does not sporulate at high temperatures so that our only concern need be with the late crop sown in November and December. Seeds planted in this period should be examined and if Septoria pycnidia are present should be dipped in water at 118°F. for 30 minutes. Seed which is two or more years old contains no viable Septoria spores. We are fortunate to have so simple a means available for the solution of a problem which is much more complicated in other celery growing areas.

Mosaic is a fourth disease which in some areas has become serious. The most common type produces mottled leaves and stunted plants and most serious of all elongate brown lesions on the petioles. There is no chemical spray or dust which controls mosaic virus because the infective agent is within the plant. The disease lives through the summer on weeds and is spread from plant to plant by aphids. At present control must be through the use of herbicides to keep all areas near the seedbeds free of weeds and of insecticides to control aphids. There is some reason to think that some of the blight resistant celery strains may also be resistant to mosaic but further work is necessary to prove it.

Nematode injury is frequently classed as a disease. The root knot nematode which produces swellings on the roots and the meadow nematode which chews off the fine roots are both pests of celery. Within the past few years cheap fumigants have been introduced which make it possible for growers to reduce the nematode population of their seedbeds and even their entire fields at a cost of less than fifty dollars per acre. Ethylene dibromide injected into the soil, at 15 gallons of 20 percent solution by volume per acre, has been the most satisfactory material in our trials. Dichlor propene injected at 20 gallons of 50 percent mixture is also satisfactory as a nematocide, but it is corrosive and remains in the soil longer than ethylene dibromide. Florida can expect some new approaches to the nematode problem when Christie, nematologist of the federal department of agriculture, begins his work here.

Another disease of celery which appears in some seasons is pink rot. It is caused by the soil inhabiting fungus, *Sclerotinia sclerotiorum,* which attacks mature plants at the base and destroys them. Its outbreaks have been sporadic, often following injury by cold, blight, or spray material. Dr. Brooks studied the disease at some length and published his results in press bulletin 567. He recommends the use of 800 to 2000 pounds of calcium cyanamid stirred into the soil five weeks before setting plants. Flooding the soil for four weeks is another possible control.

There are a number of other celery diseases which sometimes cause loss. Bacterial blight produces leaf spots which can be distinguished from Cercospora by the absence of mold and from Septoria by the absence of pycnidia. It is controlled by soil rotation and by the same sprays which are used against Cercorpora. Yellows is a fungus disease caused by Fusarium growing in the water vessels of the plant. It stunts and yellows the plant. Resistant varieties of celery must be used where this is present. Phoma rot causes a rotting at the base similar to pink rot except that pycnidia are present in the rotted areas. It is a cool weather fungus for which no control is known.

In addition to the infectious diseases mentioned there are a number of physiological disturbances often found in celery fields. Black heart is the most serious of these because its appearance is unpredictable and no control is known. Crack stem caused by boron deficiency is rarely a problem today because of the easy control method of applying 10 pounds of borax per acre. Pencil stripe, which appeared a year ago, appears to be related to borax supply also. There are a number of other nutrient deficiency

symptoms which are outside the scope of this paper.

In presenting a general paper of this sort it is easy to multiply specific recommendations for control of the various diseases and to lose sight of the general principles of disease control which underly the recommendations. In approaching a disease problem the cheapest, most efficient solution is to find a crop variety which is immune or resistant. Our breeding program on celery is therefore the most valuable of all our celery disease projects. If no plants resistant to a disease are available the use of some organism which will permanently parasitize the pathogen is another basic and satisfactory approach. Attempts to control damping-off by antagonists are examples. A somewhat less satisfactory approach is to exclude the pathogen by artificial means. Seed treatment for Septoria and weed and aphid control for mosaic are examples.

In dealing with a disease which lives in the soil, and where resistant strains are unknown, a fourth approach, eradication, is possible. Flooding or treating with cyanamid for pink rot control, and fumigating for damping-off and nematode control come to mind.

When time is short and ideas are few we will continue to grab for the mop instead of the faucet. But protective sprays are expensive and they should always be looked upon as either a last resort or a source of emergency relief.

VALUE OF RAPID SOIL TESTS IN DETERMINING FERTILIZER NEEDS

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During the last 10 years agronomists and soil chemists have contributed much to the development of rapid chemical tests as a means of determining the fertilizer needs of the soil. These many contributions have shown that no method has yet been devised that is infallible. This has led some workers to question the chemical accuracy and the reliability of the results of such soil tests, despite the fact that many commercial organizations and several state experiment stations are making thousands of rapid soil tests each year. The chief advantages of these rapid tests over the older and more conventional chemical methods are their simplicity and the rapidity with which the individual tests can be carried out. These features make them well suited for routine soil testing.

There is a tendency on the part of some workers to expect too much of the rapid soil tests and to criticize them when they fail to come up to expectations. It is not reasonable to think that soil tests, in all cases, should correlate directly with the crop responses obtained from the use of fertilizers. There are various reasons for this lack of correlation but the principal one is the failure for the most part to adapt a set of methods suitable for the soils and crops under investigation. It should be obvious that the results of chemical soil tests provide only a part of the information necessary for an intelligent fertilizer recommendation. When properly correlated with crop responses to fertilizers on different soils, chemical soil tests can furnish valuable and otherwise unobtainable information that can serve a very useful purpose in fertilizer recommendations. This is true only when the tests can be relied upon to give consistently accurate and reliable analytical results.

Let us now consider some of the pecu-