AN EVALUATION OF TOMATO PRODUCTION PROBLEMS IN THE ST. LUCIE-MARTIN COUNTY AREA

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Introduction—

The Ft. Pierce vegetable section which includes parts of Indian River, St. Lucie and Martin counties has undergone a rapid expansion in tomato production in recent years. The center of the area lies west of Ft. Pierce with substantial acreages planted in St. Lucie County. The balance of the tomato acreage is rather scattered as one proceeds northward into Indian River County and southward into Martin County.

While some tomatoes are produced on lands which are definitely marginal, there is a considerable acreage grown on land which is well adapted to the production of satisfactory yields of good quality tomatoes. Much of this more productive soil lies fallow or in cattle-pastures, since growers have experienced excessive crop losses on land which has been previously cropped to tomatoes. Most producers prefer to move to virgin soil each season in order to escape certain problems which seem to be intensified on old tomato land. Much of the better soil accessible to roads has thus been used and growers find it necessary to establish farms at increasing distances from paved roads and markets in order to plant on virgin soils. The expense of road building, dyking, ditching, clearing, bridge building and pump and well installations must be charged off to a single tomato crop. The practice of moving to new soil each season is thus an expensive one, and it is quite obvious that this new land of good quality is becoming increasingly difficult to obtain. Consequently, the future outlook appears to be a forced return to much of the old tomato land, or a sharp reduction in the tomato acreage.

Vegetable crop studies were initiated in the Ft. Pierce area in August, 1946 with the following objectives: to determine the factors responsible for excessive crop losses on soils previously cropped to tomatoes; to find improved tomato varieties with the necessary disease resistant characteristics; to determine the best fertility and soil management practices and to investigate methods of disease and insect control.

Fall Survey—Methods and Discussion.—

A rather extensive survey study of commercial tomato plantings on virgin soils and on soils previously planted to tomatoes was made during the fall tomato season of 1946. Special attention was given to soil analyses; fertilizer formulations and placement; disease and insect diagnoses and incidence; cultural practices, including weed and grass problems; and water control. The primary purpose of this preliminary survey was to study and evaluate the problems confronting the tomato producers. The study was successful in revealing some of the causes for crop losses on second year tomato land and in determining some of the limiting factors on virgin soil. Only the more important problems are discussed in this paper.

A group of commercial tomato plantings was selected for observation and study throughout the season. These farms were selected in such a way as to represent several of the more important soil types upon which tomatoes are grown in this area. The

cropping history was obtained on these farms, and special attention was given to the method of cultivation, fertilization, planting and spraying or dusting. Soil samples were collected and analyzed for pH, calcium, magnesium, and organic matter. Where a variation of soil type existed, or where evidence of poor growth was noted within a field, soil samples were obtained to represent the most vigorous growth as compared with those areas of poor growth or definite foliage deficiency symptoms. Disease and insect incidence was noted and plant material was sent to several State plant pathologists for disease identification. Miscellaneous observations as to grass and weed problems, erosion and water control were made. Various growers and suppliers were questioned in order to obtain their reaction to returning to farms which had previously cropped tomatoes.

The fall season, 1946, proved to be an opportune one for a study of this nature and some interesting and important information was obtained, serving as a foundation for future research studies. Several of the more important production problems are discussed.

Soil Management.—

Some commercial plantings of tomatoes were located on Leon, Immokalee and Sunniland soils where the natural cover had been pine and scrub palmetto with a sparse growth of grass. The pH values of these soils fall within an approximate range of 4.40 to 5.00 with calcium contents of 40 to 200 pounds per acre, and magnesium contents of 3 to 20 pounds per acre. Magnesium and other unidentified deficiency symptoms were prevalent in these plantings. Except for spot treatments of hydrated lime on areas from which dense growths of palmettos were cleared, very few growers applied any liming material on these acid soils. The plant growth and yield were generally poorer on these soils than on the soils with a more favorable pH range.

A majority of the commercial plantings were located on soils of the Charlotte, Sunniland, Arzell and Pompano series with pH values of 5.20 to 6.70, magnesium levels of 15 to 40 pounds and calcium levels of 150 to 400 pounds per acre. The natural cover in this case had been mostly grass prairie interspersed with cabbage palm hammocks and some palmetto. Tomatoes on these soils were generally good, though there was some indication of response to applications of soluble magnesium and secondary elements.

Certain smaller areas in the tomato growing section included in the survey contained a considerable amount of alkaline clay near the surface mixed with the top soil. Here the pH values ranged from 5.80 to 7.00 with magnesium levels of 30 to 90 pounds and calcium levels of 500 to 1100 pounds per acre.

Serious loss of basic elements by leaching under cultivation is an important problem in the area. Leaching on these soils is demonstrated by the fact that samples taken from a field in early August before drainage was initiated showed an average pH value of 6.07. Two months later after drainage, planting and cultivation, and a period of heavy rainfall, the pH of the surface soil had dropped to an average of 5.49. There is evidence that excessive leaching may be a factor contributing to the poor crops generally obtained on soils previously cropped to tomatoes.

Erosion of plant beds during heavy rainfall presents an important problem which is intensified in areas under continuous cropping. The grass flats on virgin soil are usually mowed and raked, but are not plowed or disced before the beds are thrown up. The grass sod is thus utilized in the plant bed to prevent excessive erosion. Two shallow sod furrows are thrown together to form the base of the bed and a deeper sand furrow is thrown upon this sod. Seed are immediately drilled with a mechanical seeder in order to take advantage of the moisture in the fresh bed for seed germina-

tion. The initial fertilizer application consisting of 300 to 700 pounds per acre of a 4-7-5, 4-8-6 or 4-8-8 commercial fertilizer is placed (1) below the seed before the sand furrow is thrown up; (2) above the drill immediately following seeding, or ((3) part applied below the drill and part above the drill. The additional three to four side dressed applications of a 4-8-6 or 4-8-8 fertilizer are applied at the rates of 400 to 600 pounds per acre as the plant beds are built up by means of plowing furrows to each side. The last application of fertilizer is applied at or shortly after blooming begins when the tomatoes are "laid by." Some growers apply approximately 200 pounds per acre of nitrate of potash shortly after picking begins, especially if excessive rainfall has occurred.

On previously cropped soils the general practices are similar, except that it is necessary to plow or disc the soil before preparing the beds in order to control weeds and grasses. These plowed soils are especially susceptible to serious erosion when bedded since the coarse sand of low organic matter content has nothing to bind it. Weeds and grasses present a much more serious problem on these old farms, necessitating hand hoeing in many cases. During a period of frequent rainfall which is typical in the case of the fall crop, weed control is extremely difficult.

Disease and Insect Problems.—

The survey revealed a number of diseases attacking tomatoes which were responsible for substantial losses in many cases. The general disease problem was definitely more severe on second year tomato land, but several diseases appeared on tomato crops planted in virgin soil. Important insect problems appeared during the course of these investigations. DDT was used quite generally throughout the area and gave very good control of several of the common insect pests. No reports of reduced yields which could be attributed to this commercial use of DDT were forthcoming. Several growers reported that DDT had given the highest percentage of worm free fruit they had ever produced. The more important diseases and insects appearing during this study are discussed briefly.

Fusarium wilt, *Fusarium bulbigenum* var. *lycopersci* (Brushi) Wr. and Reinking was one of the most serious diseases appearing on the fall crop in the St. Lucie-Martin County area. This disease was extremely severe on second year tomato land, causing heavy losses in most cases. It is estimated that fusarium wilt alone caused an average of thirty percent loss on this second crop soil. Several plantings were visited where fusarium wilt had attacked 100 percent of the crop. While tomatoes planted on virgin land were not affected seriously by fusarium wilt, nearly all of these plantings contained a light to moderate infection with some crop loss. Much of this virgin land was sufficiently infected with wilt to offer a serious threat to a second crop of tomatoes. It can be definitely stated that fusarium wilt is one of the chief limiting factors in successful production of tomatoes on second year tomato land. Since this is a soil borne disease which attacks through the root system and survives for long periods in the soil, the logical attack of this problem appears to be tomato breeding for a satisfactory tomato which is resistant or immune to fusarium wilt.

Stemphylium leafspot, *Stemphylium solani* Weber, may be placed as second in importance during the fall of 1946. While it has been difficult to separate this disease from soil deficiency symptoms and other foliage diseases, it appears that stemphylium leafspot was one of the chief diseases on tomatoes. None of the commercial fungicidal treatments seemed to be effective in controlling this disease, and every planting visited was affected almost 100 percent at some stage of growth. The disease became severe when the vines were maturing a maximum of fruit and caused a rapid decline of the foliage thus affecting the yield and quality of the fruit. In the variety

trials the only tomato which was not affected with this disease was Wst 1-20, a USDA line carrying resistance to fusarium wilt and to stemphylium leafspot.

Late blight, *Phytophthora infestans* (Mont.) DBy. was first discovered in the variety trials in October and was later found near Stuart and in several of the commercial plantings in the Ft. Pierce area. Late blight was widespread and serious throughout the winter and spring. Only those producers who were able to maintain a careful spray or dust schedule were successful in controlling this disease.

Other diseases appearing during the survey, and causing moderate losses in some plantings were Bacterial spot, *Phytomonas vesicatoria* (Doidge) Bergey et. al; Bacterial wilt, *Phytomonas solanacearum* Erw. Smith; Blossom end rot; Early blight, *Alternaria solani* Ell. and Mart.; Leafmold, *Cladosporium fulvum* Cke.; Soil rot, *Rhizoctonia solani* Kuhn; and a virus disease similar to the sugar beet curly top virus which attacks tomatoes in the far west.

Mole crickets, *Scapteriscus acletus* R. and H. and *S. vicinus* Scud. occur generally throughout the area. On virgin land they are not usually abundant enough to cause serious damage to crops, but after one year's cropping mole crickets often increase in population to such an extent as to threaten any succeeding crop of tomatoes if the seed is drilled in the field. Summer flooding with ditch bank baiting and transplanting to the field from seed beds should reduce damage by mole crickets.

Serpentine leaf miner, *Agromyza pusilla* Meigen built up on the fall tomato crop and a mass emergence of adults at the time the spring crops germinated resulted in very severe damage by the leaf miners to the young tomato seedlings. Prolonged warm weather may have been responsible for the heavy build-up of this insect in the fall and winter.

Other insects appearing in the area included aphids; thrips; tomato horn worms, *Protoparce* sp., southern armyworm, *Xylomyges eridania* Cramer; tomato fruit worm, *Heliothis obsoleta* Fab.

Crop Rotation and Diversification

For the past few years the Ft. Pierce vegetable crop area has been devoted almost entirely to tomatoes. In order to stabilize this area as a truck crop section it would appear that there is a definite need for diversification. In order to formulate a crop rotation plan for weed and grass control, and to reduce damage by insects and diseases, it will be necessary to include vegetable or field crops which do not harbor the same diseases and insects as do tomatoes. From the preliminary work conducted in this section it appears that a number of vegetable crops are well adapted and may be used in rotation with tomatoes. A good summer crop which will withstand considerable water is needed for the area. Sesbania is used for this purpose in certain cases and does quite well when high water levels are maintained. Otherwise there is some question as to the advisability of using sesbania due to the possible increase in nematodes following this crop.