Control of Cercospora Leaf Spot of Sugar Beets With Protective Fungicides

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Cercospora leaf spot is one of the major problems of beet cultivation in central and southern Europe, and at times, in certain parts of North America. The disease is caused by the fungus *Cercospora beticola* Sacc. and is spread by airborne spores produced on the leaf lesions. The fungus thrives at high temperatures, but does not become epidemic unless temperatures (20°C or more) are combined with high humidity. The spots are isolated at first but in severe attacks, they coalesce and the leaf shrivels. Consequently, badly attacked plants are surrounded by a ring of dead, brown leaves, still attached to the crown but lying on the ground. The destruction of the foliage reduces yield and produces a lower sugar content.

In 1959, and again in 1961, the incidence of leaf spotting on sugar beet leaves reached amounts considerably above normal in southwestern Ontario and led to renewed interest in the use of fungicides to control this disease. Spraying crops periodically with 4-4-50 Bordeaux mixture has been resorted to in some countries to avoid epidemics. However, in Europe, the trend is now toward the use of the dithiocarbamate and organo-tin fungicides for the control of leaf spotting diseases of sugar beets. Consequently, in the tests reported here, examples of the above-mentioned chemicals were used.

The plots were located at the Pesticide Research Institute, London, Ontario. The sugar beet seed was of the monogerm type supplied by the Canada and Dominion Sugar Company Limited, Chatham, Ontario. Each plot consisted of 4-rod rows of sugar beets. These rows were separated from the next plot by alleys 3-feet wide. Four replicate plots were used for the treatments which occurred once, randomized, in each of four blocks of plots.

The chemicals[2] listed in Table 1 were sprayed on the plants in an equivalent of 66 gallons of water per acre but applied as

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[2] Generic, chemical, trade name and source (in parentheses) of the fungicides used in this paper: maneb-manganese ethylene bisdithiocarbamate-Dithane M-22 (80%), zineb-zinc ethylene bisdithiocarbamate - Dithane Z-78 (65%), nabam - disodium ethylene bisdithiocarbamate - Dithane A-40 (100%), 0/4527 - composition not reported, (Rohm and Haas Co.); Bordeaux 12.5% copper - Bordo powder (Niagara Brand Chemicals); dodine - n-dodecylguanidine acetate - Cyprex 65W (American Cyanamid Co.); triphenyltinacetate (Pesticide Research Institute, London, Canada).

500 ml per 4-rod rows. The spreader-sticker Triton X-114 was used with all fungicides except triphenyltinacetate. Triton X-100 was used with the latter. Seven weekly applications were made of all fungicides except triphenyltinacetate which was applied six times. Applications began on July 26 although the first trace of Cercospora spotting was noted on June 21, at which time the beets were in the 5- to 7-leaf stage. A one gallon knapsack sprayer was operated at 40 psi in applying the fungicides.

The area used for sugar beets in this study had been used for the same purpose the previous year. Spotting of leaves began in one corner of the field and the disease spread slowly to the entire plot area by fall. Whenever the Cercospora leaf spots began to appear in 1961 (approximately June 21) they were somewhat more numerous at first on leaves in the originally contaminated corner of the field than elsewhere. Within three weeks after the first spots were noted the beets of the entire area were showing traces of leaf spotting. It is assumed that inoculum from the 1960 plants infested the entire area giving rise to a uniform source of inoculum for the 1961 season.

Table 1.—The effect on disease rating and sucrose content of spraying sugar beet plants with fungicides.

Fungicide	Rate in grams in 500 ml per four rod rows	Kleinwanzlebener[1] *Cercospora* Chart	Avg. % Sucrose
Maneb	1.50	2.5	15.4**
Zineb	1.50	3.0	14.9
Bordeaux	3.75	3.0	14.9
Dodine	1.50	5.0	13.5
Nabam plus zinc sulphate	0.75	3.0	14.7
Triphenyltinacetate	0.50	1.5	16.0
0/4527	1.50	2.5	15.6
Untreated		5.0	14.2
			L.S.D. 1% 0.44

[1] Kleinwanzlebener Chart Reading 1.5 = some plants with spots on outer leaves only—some on both inner and outer leaves; 2.5 = spots on inner leaves—some spots joining together; 3.0 = spots joining to form large areas of dead leaf; 5.0 = outer leaves dead, inner leaves severely damaged, fresh foliage begins to grow.

Table 1 reports the fungicides used, their source and rate of application, estimation of the amount of leaf spotting and the percentage of sucrose present in the roots. The date of applications for all the fungicides except triphenyltinacetate were July 26, August 3, 10, 16, 23, 30 and September 6. In the case of the latter chemical the August 10 application was missed. The estimation of leaf spotting was made on October 6 using a Kleinwanzlebener *Cercospora* chart (2)[2]. By that time, the outer leaves

[2] Numbers in parentheses refer to literature cited.

of the untreated plants had been killed by the *Cercospora* and new inner leaves were being produced. This regrowth tends to mask the observable damage but the effect of the early loss of the outer leaves is noted in reduced sucrose levels.

The data for sugar percentage were obtained for each treatment from eight 5-beet samples collected at random, two from each plot, and analysed in the laboratory of the Canada and Dominion Sugar Company, Chatham. The reduction in average sucrose percentage caused by the disease is evident in Table 1. Whereas the percentage sucrose was 14.2 in unsprayed plots, it was as high as 16.0 in treated ones. Under the conditions of this experiment, all treatments except dodine gave increased levels of sucrose significant at the 1% level when compared with the levels of untreated samples.

The results presented here are merely indications of which fungicides might be used economically to control this disease. In Germany and Italy, (1, 3, 4) sprays of copper, organo-tin or dithiocarbamate fungicides are applied from two to four times at two-week intervals depending on the date of beginning of the natural infection. Economical control under North American conditions will probably be possible only if the number of applications can be kept as low as those in Europe. More testing is required to determine the best fungicide for the control of this disease.

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