Fungicide Applications Based on Duration of Leaf Wetness Periods to Control Alternaria Leaf Blight of Cantaloup in South Texas

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ABSTRACT

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Initiation of fungicide applications based on duration of leaf wetness periods to control *Alternaria cucumerina* on cantaloup was studied in south Texas. Delaying applications until leaf wetness periods were of 8-hr duration gave equivalent control with at least a one-third reduction in the number of applications as currently used based on crop phenology.

Leaf blight incited by *Alternaria cucumerina* (Ellis & Everh.) Elliot and downy mildew incited by *Pseudoperonospora cubensis* (Berk. & Curt.) Rostow, are serious production-limiting diseases of cantaloup (*Cucumis melo* L.) in south Texas. Alternaria leaf blight occurs perennially due to the presence of primary inoculum from previous cantaloup crops. Downy mildew is more sporadic because primary inoculum is airborne into the area from more southerly latitudes. These two diseases often occur simultaneously on cantaloup in this area. Either pathogen can produce severe foliage loss accompanied by sunscalding of the maturing fruits (1,5). Because these diseases threaten commercial production, growers initiate a spray program with protective fungicides when the plants reach the first-bloom stage. Plants are sprayed at 5- to 7-day intervals until preharvest cutoff.

The first half of the cantaloup-production season in south Texas has few and often no hours of dew, the principal source of leaf wetness. About midseason, there is a rapid transition to moderate and, soon, very long leaf wetness periods due to dew formation. Thus, environmental conditions are usually not favorable for infection by either *A. cucumerina* or *P. cubensis* until well after the first-bloom stage (8). This study was designed to determine if Alternaria leaf blight and downy mildew on cantaloup could be controlled at present levels, but with fewer fungicide applications, by basing the initiation of spray schedules on the duration of leaf wetness periods, rather than on crop phenology. However, during the 1978 and 1979 growing seasons when the study was conducted, only Alternaria leaf blight occurred in epiphytotic proportions; fewer than 2% of the lesions examined during the study could be attributed to downy mildew.

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MATERIALS AND METHODS

On 17 March 1978, a field experiment consisting of 16 plots (12 × 30 m) of Perlita cantaloup was planted near Weslaco, in extreme south Texas. Bed spacing was 2 m and interplot spacing was 3 m. Four treatments, replicated four times in a randomized complete block design, were applied as follows: 1) nonsprayed check, 2) regular spray program initiated at first bloom, 3) spray program initiated when the leaf wetness period reached at least 8 hr, and 4) spray program initiated when the leaf wetness period reached at least 12 hr. The protective fungicide applied was Dithane M-45, manganese ethylene bisdithiocarbamate plus zinc ion, at the rate of 2.25 kg a.i./ha at 7-day intervals following initiation. Duration of leaf wetness periods was monitored in both 1978 and 1979 with a model 880 Thermoelectric Dew Point Hygrometer (E. G. & G. International, Inc.), which continuously sampled from within the cantaloup canopy at a height of 10 cm. For comparison, a modified Davis-Hughes leaf wetness recorder developed by Miller and Amador (6) was included in the 1979 study. Plots were harvested three times, beginning when at least 5% of the melons reached the full-slip stage on 16 June and ending on 26 June. Immediately prior to the first harvest, the following determinations were made to quantitatively evaluate the effects of the treatments on the severity of *A. cucumerina* on the foliage: 1) foliage retention ratings were made by counting and averaging the number of living leaves per 0.25 m^2, 10 counts per plot; 2) percent leaf loss was determined based on counts of both living and dead leaves per 0.25 m^2; and 3) a lesion index was determined based on the average lesion diameter per leaf multiplied by the number of lesions per leaf from a random sample of 20 leaves per plot. At each harvest, both fruit quantity and quality were evaluated as follows: 1) individual weight, as well as number of all harvestable melons; 2) percent soluble solids, as percent sucrose, from a random sample of 20 fruits per plot at each harvest; and 3) percentage of sunscalded fruit from each plot.

The 1979 study was conducted similarly at the same location, except individual plot size was increased to 26.5 × 22 m and only two treatments (regular spray program initiated at first bloom and spray program initiated when the leaf wetness period reached 8 hr) were included. These plots were planted on 7 March and picked from 12 to 25 June.

RESULTS

In the 1978 study, the regular program plots received six fungicide applications, which were begun at first bloom on 27 April. The 8-hr leaf wetness program plots received four applications beginning 17 May, and the 12-hr leaf wetness program plots received two applications beginning 1 June.

Foliage retention was poor, percent leaf loss was high, and lesion indices were large for the nonsprayed check treatment and the 12-hr leaf wetness program (Table 1). They were significantly lower and comparable in both the regular spray program and the 8-hr leaf wetness program treatments.

There were no significant differences in fruit weight and number, but marked differences occurred in percent soluble solids and percent sunscalded fruit among treatments (Table 1). Soluble solids were significantly higher in the regular spray program and the 8-hr leaf wetness program treatments than in the nonsprayed treatment. Even though the percentage of sunscalded fruit was high in all four treatments, it was significantly higher for the nonsprayed check and 12-hr leaf wetness program treatments than

Table 1. Severity of Alternaria leaf blight and resultant fruit quantity and quality of cantaloup as affected by timing of initiation of protective fungicide spray schedules

Treatment	Foliage retention[x]	Percent foliage loss	Lesion index[y]	Average fruit wt (kg)	Number of harvested fruit	Average soluble solids (% sucrose)	Percent sunscalded fruit
1978							
Nonsprayed	6.8 a[z]	75 a	110 a	0.93	314	5.9 a	60 a
Spray schedule initiated at first bloom	18.6 c	31 c	20 b	0.88	342	7.9 b	40 b
Spray schedule initiated after 8-hr leaf wetness period	19.9 c	26 c	54 b	0.97	306	8.0 b	45 b
Spray schedule initiated after 12-hr leaf wetness period	11.3 b	58 b	100 a	0.95	292	7.2 ab	60 a
1979							
Spray schedule initiated at first bloom	18.7	28	64	0.99	733	6.7	40
Spray schedule initiated after 8-hr leaf wetness period	17.6	32	128	0.94	692	6.5	42

[x] Average number of living leaves per 0.25 m^2.
[y] Average lesion diameter in millimeters × number of lesions per leaf.
[z] Numbers in a column for each year followed by the same letter are not significantly different ($P = 0.05$) according to Duncan's multiple range test for 1978 and Student's paired t test for 1979. Absence of letters indicates no significant differences.

for the regular spray program and 8-hr leaf wetness program treatments, which did not differ significantly from each other.

In the 1979 study, which included only the two effective control treatments from 1978 (regular and 8-hr programs), there were no significant differences in fruit quality, quantity, or disease severity between treatments (Table 1). The regular spray program treatment received eight applications, beginning at first bloom (17 April), and the 8-hr leaf wetness program treatment received five applications, beginning 8 May.

In the 1979 study, the dew point recorder and the leaf wetness recorder gave comparable measurements (within 30 min) of the duration of leaf wetness periods. The measured periods did not always coincide; they usually began and ended earlier according to the dew point hygrometer, but duration of wetness was comparable. Because of its easier operation and lower cost, the leaf wetness recorder would be preferable for grower use.

DISCUSSION

In the 1978 study, delaying fungicide applications to control Alternaria leaf blight of cantaloup until leaf wetness periods reached at least 8 hr allowed a reduction of two applications out of six from the regular spray program system initiated at the first-bloom stage, while still maintaining a comparable level of disease control. Delaying applications until leaf wetness periods reached 12 hr gave no better control than the nonsprayed check treatment, which clearly indicated that this practice would not be feasible for use in commercial cantaloup production in south Texas. These two treatments were therefore eliminated in the 1979 study as inefficacious and to reduce interplot interference. Results of the 1978 study were confirmed in 1979. A comparable level of control was maintained with the two effective treatments used from 1978 and the number of fungicide applications was reduced from eight to five when the spray program was not initiated until leaf wetness periods reached at least 8 hr.

In 1978, the calculated percentage of disease control (2) based on percent leaf loss in the best treatments (regular and 8-hr programs) was only 59 and 64%, respectively. These values were probably low because plots on the research farm had been planted in cantaloup, one or two crops per year since 1967, with no chemical controls applied. Thus, an unusually high amount of primary inoculum was probably available on the debris from previous crops (3). Cantaloup growers in this area routinely rotate their plantings each year to avoid this situation with *A. cucumerina*. The relatively high percentages of sunscalded fruit in the best treatments can also be attributed to the severity of these disease conditions. Commercial growers in this area who follow the same spray regime with the same chemical used in this study obtain better levels of control. The purpose of this study, however, was not to determine the maximum level of control obtainable but rather to determine if a level of control equal to that obtained using current practices could be reached by basing initiation of spray programs on an environmental component, duration of leaf wetness periods, instead of crop phenology. The percent leaf loss, ie, percent leaves completely dead, and the percent sunscalded fruit give the best estimate of the economic impact of the disease because the direct result of the former is the latter, loss of marketability. These studies were late-season plantings for this area. With earlier season plantings, the potential would have existed to further reduce the number of fungicide applications. In any case, one should not overlook the beneficial results of decreasing: 1) the total number of fungicide applications and thus production costs, 2) the total amount of pesticide released into the environment, and 3) the total energy input into production of the crop while still maintaining the same level of disease control.

Fungicide application programs to manage foliage diseases of vegetable crops can be better implemented by monitoring meteorological conditions that prevail in a production area than by crop phenology. Data presented in other studies (4,7) indicate that similar potentials to reduce fungicide usage exist.

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