Effects of Number and Timing of Chlorothalonil Applications on Onion Yield

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ABSTRACT

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Chlorothalonil at 1.75 kg a.i./ha and mancozeb at 2.69 kg a.i./ha were applied to New Mexico Yellow Grano onions to determine the effects of the number and timing of chlorothalonil treatments on bulb yield. Bulb yields decreased linearly ($Y = 31.45 - 0.77X$, $P = 0.05$) as the number of chlorothalonil applications increased. Yields of onions treated with 10 mancozeb applications and those of untreated controls did not differ significantly. No significant difference in yield was observed among treatments with equivalent numbers of chlorothalonil applications, indicating that the total number and not the timing of applications affected bulb yield.

Alternaria porri (Ell.) Cif., causal agent of purple blotch, causes severe foliage damage to onions (*Allium cepa* L.) in southern Texas during years when weather conditions favor disease development (3). Because acceptable resistant cultivars are not available, purple blotch must be controlled with protective fungicides. Fungicides must be applied to the foliage for 2–3 mo to ensure adequate disease protection.

Mancozeb and chlorothalonil are commonly used in southern Texas to control purple blotch. Recently, several reports have indicated that chlorothalonil caused yield reductions on both long- and short-day onion cultivars (1,2,6). Yield reductions as high as 30% were reported in Florida on two short-day onion cultivars sprayed 10 times with chlorothalonil (6) under low levels of purple blotch. The purpose of this investigation was to determine the number of chlorothalonil applications necessary to cause yield reductions and the effects of early- and late-season chlorothalonil applications on bulb yields. A preliminary report has been published (5).

MATERIALS AND METHODS

Chlorothalonil (Bravo 500) and mancozeb (Manzate 200 80WP) were evaluated on New Mexico Yellow Grano onions at 1.75 and 2.69 kg a.i./ha, respectively. Each onion plot, except the controls, received 10 fungicide applications on a 7- to 10-day schedule. These treatments consisted of combinations of 0, 2, 4, 6, 8, or 10 consecutive chlorothalonil applications either preceding or following 10, 8, 6, 4, 2, or 0 consecutive mancozeb applications. Thus, plots receiving two consecutive early-season chlorothalonil applications would then receive eight consecutive mancozeb applications; and conversely, plots receiving two consecutive early-season mancozeb applications would then receive eight consecutive chlorothalonil applications. Fungicides were dispersed in water and applied at the rate of 560 L/ha through five hollow-cone nozzles (25 core and D-2 tip) per bed under 51.8×10^4 Pa at the pump. Initial fungicide applications were made when the bulbs were 2–2.5 cm in diameter.

Treatments were arranged in a randomized complete block design with four replicates. Each plot consisted of one bed 9.1 × 1 m, with two rows of transplanted onions per bed. Plants were spaced 8 cm apart within rows. Adjacent plots were separated by one untreated bed that served to minimize drift of fungicides between plots and as an area for inoculum increase. Seven applications of ethyl parathion (Penncap E) at 3.5 L/ha were made to control thrips (*Thrips tabaci* (Linderman)). Plots were treated with two applications of liquid nitrogen fertilizer: 33.6 kg/ha preplant and 33.6 kg/ha sidedressed. One week before harvest, disease ratings were made for each plot on an index of 1–10, where 1 = no disease symptoms and 10 = complete dieback of leaves. Onions were harvested when about 50% of the tops had fallen over. Bulbs were weighed and graded according to size.

RESULTS AND DISCUSSION

Purple blotch levels were low, with disease ratings ranging from 3 to 4, and not significantly different ($P = 0.05$) among fungicide treatments and the control. Leaf damage levels of less than 25% within 2–3 wk of harvest have been observed to have no significant effect on yield (4); therefore, yield losses reported in this experiment are attributed to fungicide treatments and not to damage caused by purple blotch.

There was an inverse relationship ($Y = 31.45 - 0.77X$, $P = 0.05$) between the number of chlorothalonil applications and yield of New Mexico Yellow Grano bulbs (Fig. 1). Onions treated with 2, 4, 6, 8, and 10 applications of chlorothalonil yielded 30.0, 29.3, 25.1, 26.6, and 23.6 t/ha, respectively. Onions receiving 6, 8, or 10 applications of chlorothalonil yielded significantly less than onions receiving equivalent mancozeb applications and the control.

Onions initially treated with mancozeb had reduced yields if subsequently treated with chlorothalonil (Fig. 2). As the number of chlorothalonil applications increased after the mancozeb treatments, yield losses became greater. For example, onions treated with two mancozeb applications followed by eight chlorothalonil applications yielded 25.9 t/ha, whereas onions treated with eight mancozeb applications followed by two chlorothalonil applications yielded 29.8 t/ha. Conversely, the yields in plots initially treated with chlorothalonil increased ($Y = 25.2 + 0.76X$, $P = 0.05$) as the number of mancozeb applications increased. This confirms the previous findings on Granex 33 and Texas Early Grano 502 that chlorothalonil suppresses onion yield (1,6).

No significant difference in yield was observed among treatments with equal numbers of chlorothalonil applications (Table 1), indicating that the total number and not the timing of applications

Table 1. Effects of timing of chlorothalonil applications on yield of New Mexico Yellow Grano onions

Chlorothalonil applications	Yield (t/ha)[a]		
	Early[b]	Late[c]	*t*-Statistic
2	30.0[d]	29.8	−0.049
4	29.3	31.6	1.152
6	25.1	28.9	1.821
8	26.6	25.9	−0.280

[a] Each numerical entry is an average of four replicates.
[b] Chlorothalonil applications preceding mancozeb applications; 10 fungicide applications made.
[c] Mancozeb applications preceding chlorothalonil applications; 10 fungicide applications made.
[d] Means within the same row are not significantly different ($P = 0.05$) according to Student's *t* test.

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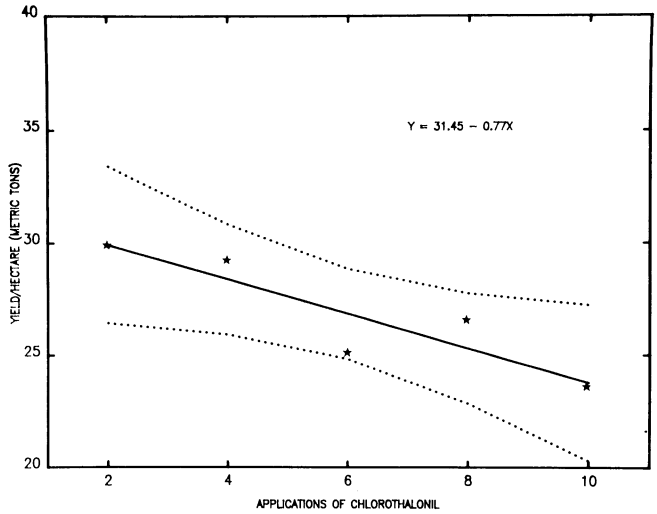

Fig. 1. Effect of increasing chlorothalonil applications on onion bulb yield. Dotted lines represent 95% confidence limit (* = actual yield).

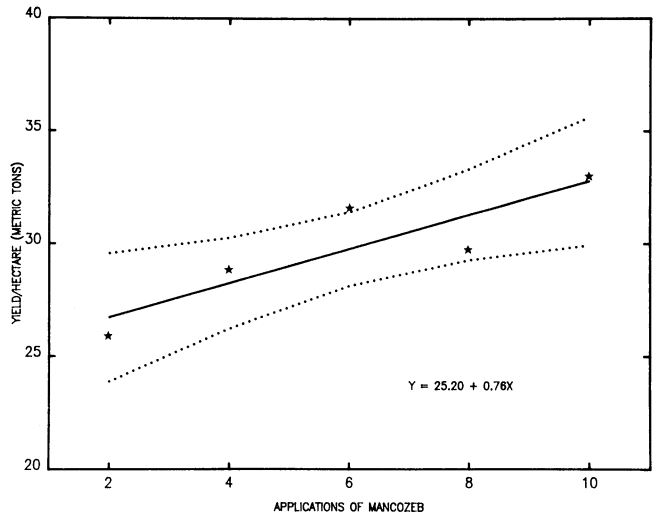

Fig. 2. Effect of increasing mancozeb applications on onion bulb yield. Dotted lines represent 95% confidence limit (* = actual yield).

affects bulb yield. For example, onions treated with either two early or two late chlorothalonil applications had yields of 30.0 and 29.8 t/ha, respectively; however, onions treated with either eight early or eight late applications of chlorothalonil had yields of only 26.6 and 25.9 t/ha, respectively.

Even though six to 10 chlorothalonil applications reduced yield under low purple blotch levels, it is still a valuable fungicide to use in purple blotch management programs. Numerous examples demonstrating its efficacy in controlling onion foliage diseases have been reported (2,3). Judicious use of this fungicide coupled with the use of other fungicides in disease management programs should maintain adequate purple blotch control while minimizing the yield-suppressing effects of chlorothalonil.

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