

POTENTIAL PHYTOTOXICITY OF RIMON ON LEAFY GREENS

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Introduction

Rimon (novaluron, Chemtura Corp.) is an insect growth regulator with activity against a variety of caterpillar pests and whiteflies. It has shown excellent activity against the diamondback moth and should prove useful in resistance management, once it is labeled on cole crops and greens. Recent research has indicated a potential problem with use of novaluron on some greens, as phytotoxicity has been detected in mustard greens. This problem was increased if novaluron was applied in a tank mix with certain surfactants. These tests were conducted to evaluate the potential phytotoxicity of Rimon on a variety of leafy greens.

Materials and Methods

Two small plot studies were conducted at the University of Georgia's Horticulture Farm in Tifton, Georgia, to evaluate potential phytotoxicity of Rimon (novaluron; Chemtura Corp.) on various vegetable crops grown for greens. Crops were transplanted or direct seeded based on common production practices. Direct seeded crops evaluated were mustard greens and collard greens. Spinach and collards were also direct seeded, but stand establishment was insufficient for evaluation. Transplanted crops evaluated were collard greens, lettuce, Chinese cabbage, and kale. Varieties of each crop grown were: collards, Heavi-Crop; Chinese cabbage, Blues; Kale, Siberian; Lettuce, Grand Rapids; Turnip, Seven Top; Mustard, Southern Giant Curled.

Direct seeded crops. Mustard and turnips were planted on 3 May, 2005. Both crops were planted on a single 6 foot bed with a single row of each (A row of spinach and collards was also planted but failed to establish). Two rows of drip tape were placed on the bed to maintain moisture for germination and to water the crops once established. Dacthal at a rate of 6 lb per acre was applied on 6 May for weed control. Rimon treatments are shown in Table 1 and included Rimon at three rates (9, 12 and 24 oz/ac) applied a single time and the two lower rates applied twice, and Rimon at the anticipated highest labeled rate (12 oz per acre) in combination with two spray adjuvants applied once and twice. The spray adjuvants evaluated were Dyne-Amic (methylated seed oil plus silicone surfactant; at 0.5% v/v) and Flood (silicone surfactant; at 0.05% v/v). A non-treated check was included for comparison. Each treatment was replicated three times in a RCB design. Experimental plots were one bed by 17 feet. The first application was applied on 27 May and the second, for treatments with two applications, was applied on 2 June. All treatments were applied as broadcast applications with a CO₂ pressurized (60

PSI) backpack sprayer with four hollow-cone nozzles per bed calibrated to deliver 30 GPA.

Transplanted crops. Collards, Kale, Chinese cabbage and Lettuce transplants were grown in greenhouses at the University of Georgia Campus in Tifton. They were seeded on 26 April and were transplanted on 3 June. All four crops were transplanted onto a single 6 foot bed with one row of each crop. Two rows of drip tape were placed on the bed for irrigation. Herbicide was not used on the transplanted crops, but fungicides were needed with an application of Cabrio (12 oz/ac) on 10 June and an application of Maneb (1 lb/ac) plus Alliete (2 lb/ac) on 16 June. Treatments evaluated on the transplanted crops are shown in Table 2 and included Rimon at three rates (6, 9 and 12 oz per acre) with each rate applied alone and in combination with Dyne-Amic (at 0.5% v/v) and Flood (at 0.05% v/v). All treatments were applied on 21 and 29 June. A non-treated control was included for comparison. All treatments were replicated three times in a RCB design. Experimental plots were one row by 17 feet. All treatments were applied as broadcast applications with a CO₂ pressurized (60 PSI) backpack sprayer with four hollow-cone nozzles per bed calibrated to deliver 30 GPA.

Both tests were visually examined and rated for phytotoxicity on the following scale:

- 0 = no phytotoxicity
- 1 = Possible but not obvious, and light or spotty distribution
- 2 = Obvious phytotoxicity with light or spotty distribution
- 3 = Obvious phytotoxicity with moderate distribution
- 4 = Obvious phytotoxicity and heavy throughout the plot

The phytotoxicity observed (in previous tests and this test) consisted of yellow to white spots in the foliage. A variety of conditions can cause some spotting, thus, the 'possible but not obvious' rating was included and did occur in non-treated plots. A rating of 2 would indicate phytotoxicity that could be detected if you knew what to look for and looked specifically for the damage. A level of 2 probably would not be detected in commercial production. A rating of 3 contained enough spotting that it would likely be detected and could serve as a justification for rejection of produce, particularly in periods of over-supply. A level of 4 was very obvious spotting.

Efficacy ratings were conducted on the transplanted crops only. The direct seeded crops had minimal damage and all rates tested had been previously evaluated in efficacy studies. The transplanted crops included a lower rate (6 oz/ac) than had been previously tested; therefore, visual efficacy ratings were conducted. Each plot was rated based on the damage across all four crops on the following scale:

- 1 = excellent control
- 2 = good control
- 3 = poor control
- 4 = no control

Results and Discussion

Direct seeded crops. Phytotoxicity ratings for the direct seeded crops are presented in Table 1. Crops were observed prior to 1 June, but as in previous trials, the phytotoxicity did not become apparent until 5 to 6 days after treatment. On 1 June (6 days after the first application) phytotoxicity on mustard greens was apparent in all Rimon treatments. It was most apparent in the treatment combinations with spray adjuvants. In general, the mustard greens ‘grew out’ of this damage. Ratings taken at 5 days after the second application generally showed significant damage only in treatments with multiple applications or in combination with spray adjuvants. By 8 days after the second application, only the combinations with Dyne-Amic, or Flood applied twice, showed significant phytotoxicity. Phytotoxicity ratings on turnip greens remained low for all treatments on all sample dates. The combination with Dyne-Amic appears to have had a slight, but not statistical, effect on these ratings.

Transplanted Crops. As with the direct seeded crops, plots were examined prior to the first rating shown in Table 2, but phytotoxicity did not appear until well after the first application. Phytotoxicity ratings in Table 2 are only for lettuce as no phytotoxicity was observed on the other three crops. Trends for phytotoxicity in lettuce were similar to the trends for mustard greens. Slight phytotoxicity occurred with all Rimon treatments, particularly after the second application. Rimon alone (at rates tested) did not appear to present a significant problem as ratings generally remained below 2. Addition of spray adjuvants did increase the ratings, with Dyne-Amic generally showing slightly higher ratings than Flood. Efficacy ratings for all Rimon treatments were generally good, however, additional studies specifically for efficacy are needed to verify the efficacy of the lowest rate.

In both tests, as in previous tests, the phytotoxicity that did occur was not a typical ‘burn’. The phytotoxicity appeared as yellow to white spots within the leaf and was not visible until 5 to 7 days after treatment. Spots typically started as yellowish spots that turned white over time. Obvious differences occurred among crops, with only mustard greens and lettuce showing significant phytotoxicity. Although not directly evaluated, plant age may also show significant impact on the potential for phytotoxicity. It appeared that damage was more apparent with younger plants. While not reported here, portions of the mustard greens were treated later in the season (non-replicated) and no phytotoxicity was noted. Observations also indicated that new growth was devoid of phytotoxicity even in the heaviest rated plots (indicating a contact phytotoxicity with no translocation). Addition of the spray adjuvants tested did increase phytotoxicity on susceptible crops with Dyne-Amic generally showing more phytotoxicity than the straight silicone surfactant (Flood).

It appears phytotoxicity with Rimon may pose a problem on extremely succulent vegetables, particularly when mixed with select surfactants. Which surfactants do or do not enhance this phytotoxicity will require additional research. The level of phytotoxicity encountered with Rimon used alone on ‘susceptible’ crops was generally very minor and probably would not be noticed in commercial production. However, when produce is in oversupply, this slight phytotoxicity could be used for rejection of fields or loads.

Table 1. Rimon phytotoxicity ratings on direct-seeded crops, Horticulture Farm, University of Georgia, Tifton, Georgia, 2005.

Treatment	No. of Applications	Ratings on Mustard Greens			Ratings on Turnip Greens		
		6/01	6/07	6/10	6/01	6/07*	6/10*
Check		0.0 c	0.00 d	0.33 d	0.00 d	0.67 a	0.00 a
Rimon 9 oz	1	2.33 b	0.67 cd	0.33 d	0.33 cd	1.00 a	0.33 a
Rimon 9 oz	2	2.67 ab	2.33 ab	1.33 cd	0.67 bcd	0.67 a	0.67 a
Rimon 12 oz	1	2.67 ab	2.00 abc	1.67 bcd	1.00 bc	0.33 a	0.67 a
Rimon 12 oz	2	2.33 b	2.67 a	1.67 bcd	0.67 bcd	0.00 a	0.33 a
Rimon 24 oz	1	2.33 b	1.67 abc	1.33 cd	0.67 bcd	0.00 a	0.33 a
Rimon 12 oz + Flood	1	3.00 ab	1.00 bcd	1.33 cd	1.33 ab	0.00 a	1.00 a
Rimon 12 oz + Flood	2	3.00 ab	3.00 a	3.00 ab	1.33 ab	1.67 a	1.33 a
Rimon 12 oz + DyneAmic	1	4.00 a	3.00 a	2.67 abc	2.00 a	1.00 a	1.00 a
Rimon 12 oz + DyneAmic	2	3.67 ab	3.00 a	3.33 a	2.00 a	2.67 a	2.00 a

Numbers within columns followed by the same letter are not significantly different (LSD, P=0.05).

* Differences were detected at the P = 0.1 level.

Table 2. Rimon phytotoxicity ratings and efficacy ratings on transplanted crops (phytotoxicity ratings are for Lettuce, the other crops did not show any phytotoxicity; efficacy ratings are based on appearance of all four crops), Horticulture Farm, University of Georgia, Tifton, Georgia, 2005.

Treatment	Phytotoxicity Ratings on Lettuce			Efficacy Rating	
	6/28	7/05	7/07	7/05	7/07
Check	0.00 e	1.00 c	0.67 d	4.00 a	4.00 a
Rimon 6 oz	0.33 de	1.67 bc	2.00 bcd	2.33 b	2.33 b
Rimon 9 oz	0.67 de	1.67 bc	1.67 bcd	2.17 bc	2.00 b
Rimon 12 oz	0.33 de	1.00 c	1.33 cd	2.17 bc	2.33 b
Rimon 6 oz + Flood	0.67 de	1.67 bc	1.67 bcd	2.00 bcd	2.00 b
Rimon 9 oz + Flood	1.00 cde	2.00 bc	2.67 abc	2.17 bc	2.33 b
Rimon 12 oz + Flood	2.00 bc	2.00 bc	2.67 abc	1.67 d	2.00 b
Rimon 6 oz + DyneAmic	2.33 ab	3.67 a	3.67 a	1.83 cd	2.00 b
Rimon 9 oz + DyneAmic	1.33 bcd	3.00 ab	3.00 ab	1.83 cd	2.00 b
Rimon 12 oz + DyneAmic	3.33 a	3.67 a	3.67 a	2.00 bcd	2.33 b

Numbers within columns followed by the same letter are not significantly different (LSD, P=0.05).