THE EFFECTIVENESS OF ROOT FEED II AND STO-5 FOR ONION PRODUCTION WHEN INJECTED INTO A DRIP-IRRIGATION SYSTEM

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Introduction

Drip irrigation provides the opportunity to apply plant nutrients directly into the onion root zone where root growth stimulators can be applied for maximum effect. Increased root growth can stimulate leaf growth and provide a mechanism for resistance to insects and diseases, as well as increase onion grade and yield. Onion thrips and western flower thrips are the main insect pests on onions grown in the Treasure Valley of Idaho and eastern Oregon. In this region about 3,000 – 4,000 acres of onions are grown under drip irrigation. Because of the increased yield and quality of onions grown under drip irrigation this management system is increasing on lands that were formerly marginal for onion production. Root Feed II and STO-5 (Stoller USA, Houston, TX) are plant nutrient additives designed to promote root and plant growth. This trial tested the two additives for their effect on onion yield and grade when applied through drip irrigation.

Materials and Methods

The trial was conducted at the Malheur Experiment Station on a Nyssa silt loam soil previously planted to wheat. The soil had a pH of 8.1, 1.5 percent organic matter, 23 ppm phosphorus (P), 137 ppm potassium (K), 2,690 ppm calcium (Ca), 330 ppm magnesium (Mg), 156 ppm sodium (Na), 1.7 ppm zinc (Zn), 12.8 ppm iron (Fe), 5.8 ppm manganese (Mn), 1 ppm copper (Cu), 10 ppm sulfate (SO_4), and 0.5 ppm boron (B). The onion cultivar 'Redwing' (Bejo Seeds, Oceano, CA) was planted on March 24, 2005 with a planting configuration of 6 double rows on an 88-inch bed. The double rows were spaced 4 inches apart. The seeding rate was 150,000 seeds/acre. Lorsban 15G® was applied broadcast over the bed at a rate of 22.2 oz/1,000 ft of bed for maggot control. Three lines of drip tape were placed on the bed, one tape between two onion rows. Each drip tape was positioned halfway between 2 double rows, at a 2-inch depth in the soil. The drip tape (T-tape, T-Systems International, Inc., San Diego, CA) had a flow rate of 0.22 gal/min/100 ft of tape. Irrigation water was applied when the soil water potential reached -20 kPa. The soil water potential was determined by granular matrix sensors (GMS, Watermark Soil Moisture Sensors, Irrometer Co., Riverside, CA) installed at 8-inch depth.

The experimental design was a randomized complete block design with four replications. There were four treatments including a fertilizer only untreated check (no insecticides), a standard fertilizer/insecticide program, the standard program plus Root Feed II, and the standard program plus both Root Feed II and STO-5. Root Feed II contains 9 percent nitrogen (N), 7 percent Ca, 1.5 percent Mg, and 0.1 percent B by weight and weighs 10.9 lb/gal. STO-5 contains an experimental additive. The Root Feed II and Root Feed II plus STO-5 treatments also included a standard insecticide treatment for thrips control. The application dates and treatment rates are shown in Table 1. The plot size was two 88-inch beds (14.7 ft) by 34 ft in length. Root Feed II and STO-5 were injected into the main irrigation line by a positive displacement injector (Dosmatic Model A30, Dosmatic USA, Inc., Carollton, TX). Root Feed II and STO-5 were applied during the entire 7-hour irrigation period. The Root Feed II and STO-5 treated plots received water from separate delivery hoses so that all treatments would be watered at the same time but the products could be injected into the system as necessary. Soil moisture was monitored to ensure that adequate moisture reached the root zone of all onion rows.

Nitrogen at 50 lb/acre as N-phuric was injected through the drip tape to all plots on June 29 and again on July 5. On July 12, root tissue was sampled from the grower standard fertilizer/insecticide treatment plots and analyzed for nutrients. The root analysis showed that all nutrients were within the sufficiency range for onions.

Thrips counts were made weekly on 15 plants in each plot. Onions were harvested on September 23 and graded on September 30. A visual evaluation for iris yellow spot virus (IYSV) was taken on August 23.

During grading, bulbs were separated according to quality: bulbs without blemishes (No. 1s), split bulbs (No. 2s), neck rot (bulbs infected with the fungus *Botrytis allii* in the neck or side), plate rot (bulbs infected with the fungus *Fusarium oxysporum*), and black mold (bulbs infected with the fungus *Aspergillus niger*). The No. 1 bulbs were graded according to diameter: small (<2.25 inches), medium (2.25-3 inches), jumbo (3-4 inches), colossal (4-4.25 inches), and supercolossal (>4.25 inches).

Treatment differences were compared using protected ANOVA and least significant difference test at the 5 percent probability level, LSD (0.05).

Results and Discussion

The 2005 season had severe thrips pressure and substantial onion yield reductions from thrips and IYSV. There were significant differences in thrips counts between treatments in 6 of the 12 weeks, with most of the significant differences occurring during the latter part of the growing season (Table 2). Thrips counts in the untreated check were significantly different from the other treatments. The season-long average also had significant differences. Adding root stimulators left thrips control unchanged.

The foliar insecticide treatments all significantly increased total yield while decreasing yield of medium bulbs (Table 3). The Root Feed II plus STO-5 treatment increased the yield of 4-inch and larger bulbs (colossal and supercolossal) over the standard grower program. The Root Feed II alone treatment had substantially higher yield of 4-inch and larger bulbs than the standard grower program, but the difference was not statistically significant.

Iris yellow spot virus is thrips transmitted and appeared in the trial during August (Table 4). The Root Feed II, Root Feed II + STO-5 and grower standard all had significantly lower IYSV severity compared to the untreated check, but were not significantly different from each other in severity.

Conclusions

The 2005 season had severe thrips pressure and substantial yield reductions from thrips and IYSV. Root Feed II + STO-5 increased the yield of larger sized bulbs in 2005 compared to the standard fertilizer and insecticide program. The yield response was with a red onion variety and could have been more pronounced on a yellow variety where larger sized bulbs are more of a premium. The Root Feed II treatment provided 44 lb of N/acre more than the 100 lb N/acre provided to all treatments receiving the standard N-phuric fertilizer. There is the possibility that the additional nutrients provided by the Root Feed II could have enhanced onion growth, despite the adequate level of nutrients in onion tissue on July 12.

Root Feed II + STO-5 did not appear to enhance thrips control over a standard grower insect program in this trial.

Table 1. Application dates for drip-applied Root Feed and STO-5 and foliar-applied insecticides for thrips control on drip-irrigated onions, Malheur Experiment Station, Oregon State University, Ontario, OR, 2005.

	Drip application		Foliar application	
Date	Product	Rate/acre	Product	Rate/acre
5/26	Root Feed	5.0 gal		
	STO-5	1.0 pt		
6/2	Root Feed	5.0 gal		
	STO-5	1.0 pt		
6/6			Warrior	3.84 oz
6/11	Root Feed	5.0 gal		
	STO-5	1.0 pt		
6/15	Root Feed	5.0 gal	Warrior	3.84 oz
	STO-5	1.0 pt	MSR	2.0 pt
			Lannate	3.0 pt
6/21	Root Feed	5.0 gal		
	STO-5	1.0 pt		
6/22			Warrior	3.84 oz
			MSR	2.0 pt
6/27	Root Feed	5.0 gal		
	STO-5	1.0 pt		
6/29			Warrior	3.84 oz
			Lannate	3.0 pt
7/4	Root Feed	5.0 gal		
	STO-5	1.0 pt		
7/8			Warrior	3.84 oz
			MSR	2.0 pt
7/11	Root Feed	5.0 gal		
	STO-5	1.0 pt		
7/21	Root Feed	5.0 gal		
	STO-5	1.0 pt		
7/22			Warrior	3.84 oz
			Lannate	3.0 pt
8/1			Warrior	3.84 oz
			Lannate	3.0 pt

Table 2. Weekly thrips counts for drip-irrigated onions treated with Root Feed and STO-5 and foliar insecticides at the Malheur Experiment Station, Oregon State University, Ontario, OR, 2005.

	25-May	1-Jun	8-Jun	13-Jun	21-Jun	28-Jun	6-Jul	14-Jul	20-Jul	26-Jul	3-Aug	10-Aug	Average
	thrips/plant												
Standard	2.0	4.9	3.9	19.5	39.3	15.2	34.2	123.1	70.0	75.6	16.9	12.5	34.7
Root Feed	2.1	4.8	6.2	29.0	52.3	16.8	29.5	107.9	56.7	72.2	13.2	14.5	33.8
Root Feed + STO-5	1.6	5.8	4.4	17.8	44.5	17.4	29.9	106.7	62.8	61.0	12.9	15.8	31.7
Untreated check	2.5	5.3	10.0	20.3	44.7	37.0	61.0	265.1	276.2	409.1	73.6	13.7	101.5
LSD(0.05)*	ns†	ns	5.8	ns	ns	13.2	45.2	ns	60.4	143.3	23.7	ns	19.7

*Least Significant Difference at alpha = 0.05.
†Not significantly different.

Table 3. Total yield of Root Feed- and STO-5-treated onions grown under drip irrigation at the Malheur Experiment Station, Oregon State University, Ontario, OR, 2005.

	Onion yield			
Treatment	Medium	Jumbo	Colossal + supercolossal	Total yield
	cwt/acre			
Root Feed	31.3	698.7	24.3	754.3
Root Feed + STO-5	31.5	653.7	30.1	715.3
Standard	43.3	697.8	9.9	751.1
Untreated check	133.1	338.7	0.0	471.9
LSD (0.05)*	35.6	152.6	15.3	103.1

*Least Significant Difference at alpha = 0.05

Table 4. Iris yellow spot virus (IYSV) evaluation in Root Feed- and STO-5-treated onions grown under drip irrigation at the Malheur Experiment Station, Oregon State University, Ontario, OR, 2005.

Treatment	IYSV severity*
Root Feed	3.0
Root Feed + STO-5	3.3
Standard	3.1
Untreated check	4.8
LSD (0.05)†	0.7

*Rating, 1 = no virus, 5 = severe virus symptoms.
†Least Significant Difference at alpha = 0.05.