EFFECT OF A MYCORRHIZAE FORMULATION ON ONION YIELD AND QUALITY

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Introduction

Onion growers routinely fumigate onion fields in the fall prior to planting. Fumigation is highly detrimental to mycorrhizal fungi colonizing onion roots. Onions growing in fumigated fields may suffer from P deficiency due to inadequate mycorrhizal colonization. Application of mycorrhizae to the soil could overcome the loss due to fumigation. This trial tested onion yield and grade response to an application of mycorrhizae to previously fumigated soil.

Materials and Methods

The onions were grown at the Malheur Experiment Station, Ontario, Oregon on an Owyhee silt loam previously planted to wheat. In the fall of 2002, the wheat stubble was shredded, and the field was disked, irrigated, ripped, moldboard-plowed, roller-harrowed, fumigated with Telone C-17 at 20 gal/acre, and bedded. Soil analysis indicated the need for 100 lb P_2O_5/acre, 150 lb K /acre, 6 lb Mn/acre, 2 lb Cu/acre, and 1 lb B/acre, which was broadcast in the fall. A soil sample taken on May 9 showed a pH of 7.7, 1.4 percent organic matter, 20 ppm nitrate-N, 29 ppm P, and 216 ppm K.

Onion (cv. 'Vaquero', Sunseeds, Morgan Hill, CA) was planted in two double rows, spaced 22 inches apart (center of double row to center of double row) on 44-inch beds on March 17, 2003. The single onion rows in the double row were spaced 3 inches apart. Onion was planted at 150,000 seeds/acre. Drip tape (T-tape, T-systems International, San Diego, CA) was laid at 6-inch depth between the two double onion rows on March 28. The distance between the tape and the double row was 11 inches. The drip tape had emitters spaced 12 inches apart and a flow rate of 0.22 gal/min100 ft.

Immediately after planting the onion rows received 3.7 oz of Lorsban 15G per 1,000 ft of row (0.82 lb ai/acre), and the soil surface was rolled. Onion emergence started on April 7. The trial was irrigated on April 14 with a minisprinkler system (R10 Turbo Rotator, Nelson Irrigation Corp., Walla Walla, WA) for even stand establishment. Risers were spaced 25 ft apart along the flexible polyethylene hose laterals that were spaced 30 ft apart.

The experimental design was a randomized complete block with five replicates. There were two treatments: an untreated check and a liquid mycorrhizae formulation (LP9).

The LP9 was manufactured by Western Labs Inc. (Parma, ID). The LP9 was applied in a furrow on both sides of each onion double row on May 24. The trench was filled and the field was drip-irrigated manually for 4 hours. Both treatments received standard fertilizer applications based on soil and tissue analyses.

Onion tissue was sampled for nutrient content on June 4 and 19. The roots from four onion plants in each check plot were washed with deionized water and analyzed for nutrient content by Western Labs, Parma, Idaho. The onions in all treatments were fertilized according to the nutrient analyses. Fertilizer was applied through the drip tape: ammonium sulfate at 25 lb N/acre on May 30, urea ammonium nitrate solution at 25 lb N/acre on June 5, 16, and 25, and zinc chelate at 0.25 lb Zn/acre and copper chelate at 0.2 lb Cu/acre on June 25.

The field was irrigated automatically twice per day based on soil water potential readings. Soil water potential was measured with four granular matrix sensors (GMS, Watermark Soil Moisture Sensors Model 200SS, Irrometer Co., Riverside, CA) installed at 8-inch depth in the center of the double row in each of four adjacent plots. Sensors were calibrated to SWP (Shock et al. 1998). The GMS were connected to a datalogger with three multiplexers (AM 410 multiplexer, Campbell Scientific, Logan, UT). The datalogger read the sensors and recorded the soil water potential every hour. The irrigations were controlled by the datalogger using a relay driver (A21 REL, Campbell Scientific, Logan, UT) connected to a solenoid valve. Irrigation decisions were made every 12 hours by the datalogger: if the average soil water potential at 8-inch depth was -20 kPa or less the field was irrigated for 4 hours. The pressure in the drip lines was maintained at 10 psi by a pressure regulator. Irrigations were terminated on September 2.

Roundup at 24 oz/acre was sprayed on March 28. The field had Prowl (1lb ai/acre) broadcast on April 21 for postemergence weed control. Approximately 0.4 inch of water was applied through the minisprinkler system on April 21 to incorporate the Prowl. The field had Buctril at 0.12 lb ai/acre and Poast at 0.4 lb ai/acre applied on April 28. Thrips were controlled with one aerial application of Warrior on June 5 and two aerial applications of Warrior (0.03 lb ai/acre) plus Lannate (0.4 lb ai/acre) on July 16 and August 4.

On September 11 the onions were lifted to field cure. On September 17, onions in the central 40 ft of the middle two double rows in each subplot were topped and bagged. The bags were placed into storage on September 29. The storage shed was managed to maintain an air temperature of approximately 34°F. On December 11 the onions were graded. Bulbs were separated according to quality: bulbs without blemishes (No. 1s), double 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 (<2¼ inches), medium (2¼-3 inches), jumbo (3-4 inches), colossal (4-4¼ inches), and supercolossal (>4¼ inches). Bulb counts per 50 lb of

supercolossal onions were determined for each plot of every variety by weighing and counting all supercolossal bulbs during grading.

Results

There was no significant difference in onion yield or grade between the mycorrhizae treatment and the check (Table 1).

Discussion

Mycorrhizae can be beneficial for plant phosphate uptake. Plant phosphate uptake is particularly slow in early spring when the soil is cold, and in soils with low phosphate. The late application timing and good soil phosphate status worked against benefits from the mycorrhizae treatment being shown in this trial.

References

Shock, C.C., J.M. Barnum, and M. Seddigh. 1998. Calibration of Watermark Soil Moisture Sensors for irrigation management. Pages 139-146 *in* Proceedings of the International Irrigation Show, Irrigation Association, San Diego, CA.

Table 1. Onion yield and grade response to a mycorrhizae formulation, Malheur Experiment Station, Oregon State University, Ontario, OR, 2003.

Treatment	Total yield	Marketable yield by grade					Nonmarketable yield		
		Total	>4¼ in	4-4¼ in	3-4 in	2¼-3 in	Rot	No. 2s	Small
	cwt/acre						%	cwt/acre	
Check	837.6	815.2	9.7	152.3	632.6	20.6	2.1	2.3	5.4
LP9	826.7	801.9	8.0	153.3	619.8	20.9	2.3	3.4	5.3
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS