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Onion Production at the Alcorn State University Experiment Station

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Abstract

Onion is one of the alternative crops recommended for production in the State of Mississippi. However, additional information on the agronomic practices for its profitable productions are needed by farmers wishing to enhance their income opportunities through vegetable and other alternative crops productions. A field experiment was therefore used to determine the effect of foliar applications of "Response 9-9-7" on the yield potential and quality of 'Hybrid Vidalia Granex' onion. Applications made every 7, 14, 21 or 28 days were based on 1:500, 1:250, 1:167 and 1:125 dilutions, respectively. The dilutions represent the ratios of "Response 9-9-7" to water. Transplanting onion on a Memphis silt loam soil was at a within-row distance of 4 inches and at a 1 to 1 ½ inches of soil depth with 3 replications of each "Response 9-9-7" dilution (treatment). Treatment arrangement was a Randomized Complete Block Experiment Design. Yield potential was based on the total weight of marketable onions, whereas the quality was based on the leaf mineral compositions. Data were analyzed by the analysis of variance, and means separated by the Least significant difference (LSD) test procedure. The overall marketable onions were highest (6.79 tons per acre) due to 1:500 dilution, applied every 7 days. The micronutrient levels were significant ($P<0.05$) for zinc and copper. The highest level of 62.00 ppm for zinc and highest level of 20.13 ppm for copper were due to 'Response 9-9-7' applied every 28 days.

Keywords: Response 9-9-7, Spray frequency, Onion production, Yield potential, Leaf nutrient

1.0 Introduction

Onion (*Allium cepa*) which belongs to the plant family liliaceae is the most widely cultivated of the *Genus Allium* (Brewster, 1994). Common onions are normally available in three colors: yellow, red and white with over 300 species grown in nearly all parts of the United States. Fairly cool temperatures are important

during early development but high temperatures help during bulbing and curing (Poincelot, 1980). As a cool season crop, it withstands moderate freezing temperatures in Mississippi where it is grown by direct seeding in field plots or by transplanting young plants raised in the greenhouse (Nagel, 2007).

While the large mature onion bulbs are most often eaten, they can also be eaten at immature stages. Young plants therefore, may be harvested before bulbing occurs and used whole as scallion. Additionally, onions are eaten raw in salads, served broiled, baked, creamed, stemmed, fried and pickled in soups and stews and in combination with other vegetables and meals (Splittstoesser, 1984). Doctors were known to prescribe onions to facilitate bowel movements and to relieve headaches, coughs, snakebite, and hair loss. They were also prescribed by doctors in the early 16th century to help with infertility in women and some house pets (Salgado, 2011). Wide- ranging claims have been made for the effectiveness of onions against conditions ranging from common cold to heart disease, diabetes, osteoporosis and other diseases (World's Healthiest Food, 2006).

Preliminary studies have shown that increased consumption of onions reduces the risk of head and neck cancers. In the United States, products that contain onion extracts are used in the treatment of topical scars (Zurada, 2006), and may be beneficial for women who are at increased risk for osteoporosis as they go through menopause, by destroying osteoclasts so they do not break down bones. Planting 2, 3, 4, or 5 rows of onions on modified beds with drip irrigation resulted in consistent increase in onion yield for both transplanted and direct seeded onions (David *et al.*, 1985). This study

was undertaken to determine the effect of seaweed base fertilizer applications on field-grown onions in Southwest Mississippi.

2.0 Materials and Methods

A field experiment was used to determine the effect of "Response 9-9-7" on the yield and quality of "Hybrid Vidalia Granex" onion. "Response 9-9-7", a seaweed base fertilizer with a natural organic plant nutrient source is a product from the Coast Biologicals, Limited, New Zealand. It contains most macro- and micro- nutrients required for plant growth and development (Table 1). Yield for the purpose of this study is a measure of the weights of marketable large size onion bulbs (6.0 oz and over), medium – size bulbs (4.0 to 5.9 oz.), and small – size onions (Less than 4.0 oz) harvested. Quality represents the macro- and micro- nutrient compositions of harvested mature onion leaves.

Field preparations included disking, row preparation, fertilizer and herbicide applications. A tractor was used for disking (2 times) before row preparations. Each row was 10 feet long, and 3.5 feet wide, replicated 3 times. Based on soil test result (Table 2), fertilization rates were 214 lbs for NH_4 NO_3, 152 lbs for P_2 0_5, and 125 lbs for $K_2$0 per acre. Applica-tions were incorporated into the soil to allow for greater absorption by plants. Dacthal-75 herbicide was also incorporated into the weed free rows at the rate of 8lb/acre to control major weed infestations.

Transplanting at 1 to 1 ½ inches soil depth was at a within-row spacing of 4 inches. "Miracle Grow" soluble fertilizer (10:30:10) prepared by dissolving 1 tablespoon in 1 gallon of water was applied immediately after transplanting at the rate of 1 cup of solution to each transplant. Side-dressing with NH_4NO_3 at the rate of 39 gm/row was 3 inches away from one side of each row and about 2 inches into the soil. Additional plot management were through hoeing and hand-pulling. However, hoeing during bulb formation was away from the rows to allow for better bulb exposure and enlargement.

"Response 9-9-7" dilutions which were prepared by mixing its 1 part each with 500, 250, 167 or 125 parts of water represented the spray frequencies of 7, 14, 21 and 28 days (Treatments), respectively. The experiment design was a Randomized Complete Block (RCB). The study which was initiated on February 15, 2008 was terminated on July 21st of the same year. Data collections were on yield (weight of marketable onions) and quality (macro-and micro-nutrient leaf contents). Data were analyzed by the analysis of variance and means separated at 5% and 1% levels of probability by the Least significant difference test (Steele and Torrie, 1980).

3.0 Results

The effect of "Response 9-9-7" on the onion bulb yield potential is reported in Table 3). Large onions were highest, 3.86 tons per acre due to a 1:250 dilution applied every 14 days. This value was not different from 3.83 and 3.27 tons per acre reported for 7 and 28 days of spray frequencies, respectively. The lowest yield of 2.49 tons per acre was due to application made every 21 days. The medium-sized onion bulbs were significantly ($P<0.05$) highest, 3.14 tons per acre due to a 1:167 dilution, applied every 21 days, but was not significantly ($P<0.05$) different from 2.64 tons per acre reported for a 1:125 dilution, applied every 28 days. The lowest value of 2.08 tons per acre was due to 1:250 dilution applied every 14 days. Yields of small onion bulbs were not significantly ($P<0.05$) different. The overall bulb yield (total) was highest (6.79 tons per acre) due to 1:500 dilution or 7 days spray frequency but was not different from 6.41 and 6.31 tons reported for 1:125 and 1:250 dilutions, respectively.

Macronutrient contents of onion leaves were not influenced by foliar application of "Response 9-9-7" (Table 4). However, the levels were generally comparable to those reported for vegetable crops (Neilson, *et al.*; 1989). Micronutrient contents of onion leaves were significant ($P<0.05$) for zinc and copper (Table 5). The highest level for zinc which was 62.00 ppm was due to "Response 9-9-7" applied every 28 days. The lowest level of 27.33 ppm was due to 1:250 "Response 9-9-7" dilution applied every 14 days. The highest level of copper content (20.13 ppm) was due to 1:125 dilution applied every 28 days, whereas the lowest level (11.33 ppm) was due to 1:250, applied every 14 days.

3.1 Soil Chemical Composition

Table 1: Nutrient Composition for Response 9-9-7

Response 9-9-7 Nutrient Compositions (%)								
N	**P_2O_5**	**K_2O**	**Mg**	**Cu**	**Zn**	**Mn**	**B**	**Mo**
9.0	9.0	7.0	0.015	0.007	0.005	0.012	0.003	0.001

Y= Values were determined by manufacturers. Same is the dilutions and spray frequencies used in this study.

Table 2: Soil Test Results[Y]

Extractable Nutrient Levels[x]					**Cation Exchange**	**Organic Matter**	**Soil Acidity**
P	K (Lb/A)	Ca	Mg	S	Capacity (Meq/L)	(%)	pH
70.0	142.0	3800.0	1074.0	113.0	14.1	0.79	7.3
M	L	H	H	L	----	----	----

X: L = Low, M = Medium, H = High
Y: Soil samples were taken one month before field preparation and planting.

3.2 Yield

Table 3: Onion Yield Potential (Tons/Acre)

Response	Weight f Onion			
Spray Frequency Days	Largex	Medium	Small	Total
	(Tons per Acre)			
7	3.83	2.59	0.36	6.79
14	3.86	2.08	0.36	6.31
21	2.49	3.14	0.39	6.02
28	3.27	2.64	0.50	6.41
LSD, 5%	0.80	0.52	0.09	0.48
LSD, 1%	1.16	075	NS	NS

Y = Values are averages of 3 replications
X = Large = 6 oz and over; Medium = 4 t0 5.9oz; Small = Less than 4 oz

Table 5: Onion Leaf Micronutrient Compositions[Y]

Response	Nutrient Level			
Spray Frequency (Days)	Fe	Mn	Zn	Cu
	(Partition per million)			
7	200.67	22.33	28.00	16.67
14	225.33	25.33	27.33	11.33
21	188.00	31.00	46.00	11.67
28	189.33	24.00	62.00	20.33
LSD, 5%	---	NS	NS	16.78	4.88
LSD, 1%	---	NS	NS	2442	7.11

Y = Values are averages of 3 replications. Leaf samples from mature onions.

Table 4: Onion Leaf Maconutrient Compositions[Y]

Response	Nutrient Levels					
Spray Frequency (Days)	N	P	K	Ca	Mg	S
	(Percent)					
7	2.48	0.089	2.18	3.52	0.55	0.25
14	2.88	0.095	2.65	3.23	0.53	0.27
21	2.81	0.094	2.76	3.25	0.52	0.24
28	2.79	0.092	2.13	3.28	0.53	0.26
LSD, 5%	––	NS	NS	NS	NS	NS	NS

Y = Values are averages of 3 replications. Leaf samples were taken from mature onions.

4.0 Discussions

The overall reductions in marketable onion yield could be due to inadequate weed management, soil acidity, and initial low plant densities. Since onion cannot compete with other plants, inefficient control of spiny amaranth (*Amaranthus spinosus*) and purple nutsedge (*Cyperus rotundus*) by hoeing and hand pulling could have contributed to yield reductions, even with the initial application of Dacthal-75 herbicide. The soil pH level (7.3) which is higher than the recommended pH range (6.0 to 6.5) for Missis-sippi growers could have contributed to the non-significant variations in leaf macro-nutrients, but not for micronutrients. Based on yield data, weekly foliage applications of treatments seems better utilized by onion plants for growth and development than applications made every 2, 3 or 4 weeks. Because onion has narrow leaves, adding

'Spreader-stickers' to treatments could enhance their intake by plants to support greater plant growth and yield potentials. With the significant increase in within-row plant spacing in this study, the number of plants per unit area was decreased significantly ($p<0.05$) and so was the corresponding yield Potential.

5.0 Conclusions

In Southwest Mississippi, "Hybrid Vidalia Granex" onion transplanted into field plots in the spring will produce marketable bulbs within 154 days from the transplanting date. Spraying foliage of transplanted onions every 28 days with one part of "Response 9-9-7" to 125 parts of water (1:125) could be more economical than spraying with 1:500, 1:250, and 1:167 dilutions applied every 7, 14, and 21 days, respectively. Leaf macronutrients may not be influenced by foliage application of "Response 9-9-7" at levels used in this study and soil pH of 7.3, but will influence levels of zinc and copper. "Hybrid Vidalia Granex" onion grown in Southwest Mississippi will produce more than 50% large – size bulbs (6.0 oz and over) compared to both medium-size bulbs (4.0 to 5.9 oz) and small-size bulbs (less than 4.0 oz).

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