

Proc. Fla. State Hort. Soc. 129

Paper No. V- 20

Business phone: 352-273-4814

Program section: Vegetable

Email: guodong@ufl.edu

Refereed Manuscript: Yes

Optimizing Nitrogen Rates for Watermelon [(*Citrullus lanatus* (Thunb.) Matsum. & Nakai)] Production with Fertigation in North Florida: A One-Year Case Study

Tanumoy Bera, Yuqi Cui, Moshe Doron, and Guodong Liu,

University of Florida/IFAS, Horticultural Sciences Department, PO Box 110690,
Gainesville, FL 32611-0690

Abstract: New innovative methods of improving fertilizer use efficiency for commercial watermelon production in Florida are critically required to comply with the Basin Management Action Plans (BMAPs) being developed around the state. A field trial was conducted to evaluate the effects of different nitrogen (N) fertilization rates without or with Agrhizome (with SumaGrow Inside) on watermelon yield, quality and soil fertility after harvest. Treatments included were: 0, 75, 112 and 150 lbs/ac of N with or without SumaGrow (SG). Watermelons were harvested 4 times along with measuring the Brix values. After harvest soil samples were analyzed to evaluate soil fertility. Application of 150 lbs/ac N with and without SG produced statistically similar but highest watermelon yield of 29.5 and 28.3 tones/ac, respectively. Among the N treatments SG had no significant effect on the total watermelon yields. Marketable watermelon yields were also greatest with 150 lbs/ac N without and with SG. There was no significant different among the treatments in respect to Brix values at 2nd and 3rd harvest. At 4th harvest, 75 lbs N /ac produced watermelon with greatest Brix vale (11.3). After harvest, soil phosphorus content was not influenced by N fertilizer rates while soil potassium content was highest without N fertilization.

Key words: Watermelon, N rates, SumaGrow, yield, quality, soil fertility

Introduction

In the USA, Florida is the leading watermelon producer in production, acreage, total value of produce and export earnings. In 2015, Florida produced 5.8 million cwt watermelons from 21,500 acres of land worth \$88.2 million (USDA, [2016](#)). Watermelons are being grown throughout the state among which Suwannee and Santa Fe River drainage basins are one of the major areas. Watermelons farms in these regions are situated in sensitive areas requiring farmers to comply with the Basin Management Action Plans (BMAPs) being developed around the state. Thus new and innovative methods of fertilization are important for the commercial watermelon production. Shukla et al., ([2014](#)) noted that growers applied 265 lbs N/ac fertilizer which is much higher than recommended rates to maximize watermelon production. Consequently, excess N fertilization causes eutrophication and ecosystem deterioration through leaching and runoff.

Soil microorganisms play a significant role in efficient uptake and utilization of nutrients by crop plants. Numerous studies have shown that soils with an effective population of soil microbes can help reducing the need of fertilizers for crops. Application of concentrated, beneficial microorganisms to crops represents a potential alternative for farmers to achieve profitable crop yields with less fertilizer inputs (Adesemoye and Kloepper, [2009](#)). Agrhizome with SumaGrow (SG), an OMRI listed product is a concentrated liquid biofertilizer consisting of living, beneficial bacteria and fungi in a humate carrier. Thus application of SG could be beneficial for watermelon production by reducing chemical fertilizer requirements while maintaining higher production. Therefore

the objectives of this trial were 1) Determine if yields (tones/acre) of watermelons are the same or better using a 25% or 50% reduction in industry standard nitrogen fertilization rates with SG; 2) Determine if the quality of the watermelons using the reduced fertilization rates and SG are the same or better when compared to industry standard fertilization rates; and 3) Determine if soil fertility is improved at harvest time after using SG.

Materials and methods

The trial was conducted during March and July, 2015 at Suwannee Valley Agricultural Extension Center, Live Oak with eight treatments. The treatments were formulated as no fertilizer without SG or with SG; 75 lbs N/ac without SG or with SG; 112 lbs N/ac without SG or with SG; UF IFAS standard fertilizer rate of 150 lbs N/ac without SG or with SG. Treatments were imposed in a randomized block design with 4 replications. Soil was fumigated with Telone C-35 to eradicate nematode infestation. The plots were 33 ft long and placed 7.5 ft apart. In each plot, 20% of N and K fertilizer through ammonium nitrate and potassium chloride were hand broadcasted and mixed with soil as preplant application in 30-inch swath. Drip tape was laid at the center of the swath and black polythene much was placed to cover the swath. Rest 80 % was applied through 10 fertigation events during April and June. One month old watermelons seedlings (Variety: Sugar heart) were planted with 3 ft plant to plant distance. Pollinizer cultivar was 'Ace'. Watermelons were harvested four times, weighed and graded as marketable and non-marketable. During growing season, leaves tissues were sampled three times to assess the N concentration. After each harvest, Brix values of melons were measured with a digital refractometer from randomly chosen three watermelons from each plot. Soil samples

were analyzed to determine soil available P and exchangeable K after completion of trial by Mehlich-3 extractant (Mylavarapu et al., 2014). During the growing season, soil water content was maintained between 0.09-0.12 % on volume basis and standard pest and weed control measures were followed. Aanalysis of variance (ANOVA) was conducted using SAS 9.2 for interpreting data.

Results and Discussion

The total watermelon yield among eight treatments ranged from 9.5 to 29.5 tones/ac (Table 1). Application of 150 lbs/ac N with or without SG produced statistically similar, but highest watermelon yields among the treatments. The N rate of 150 lbs/ac without and with SG produced 28.3 and 29.5 tones/ac watermelons, respectively. The N rates of 75, 112 and 150 lbs/ac produced statistically similar total yield, which was 66%, 91% and 140% greater than that of watermelon yields obtained without N fertilizer (Table 2).

Similar to total yield, greatest marketable yield was produced with 150 lbs/ac N without and with SG. Across SG treatments, application of 0 lbs/ac N produced lowest marketable yield (11.3 tones/ac) whereas 150 lbs N/ac produced highest marketable yield of 26.6 tones/ac (Table 1). Neither the total yield nor the marketable yield was influenced by the application of SG. On an average marketable yield was 6-15.5 % lower than total yield. In 1992 and 1996, Hochmuth et al. and Hochmuth and Hochmuth found highest total watermelon yield of 19.3 and 22 tones/ac with 120 lbs N/ac in the same region which is lower than the maximum yield obtained in our study. The late harvesting accounted for 76-97 % of the total harvest in our trial (Table 1) in contrast to Hochmuth and Hochmuth, 1996 who obtained 72% of the total as early harvest. So the difference in

the response of watermelon to N fertilizer widely varied depending on soil, climate, varieties and growing season.

Due to fewer number of harvest, at 1st harvesting Brix value was not measured. Brix value of watermelon did not show any significant difference during 2nd and third harvest. At 4th harvest 75 lbs/ac N with SG had highest Brix value while lowest value was recorded in watermelon with no N or SG among the treatments (Table 3). Thus at 4th harvest, Brix value was significantly influenced by N fertilizer rates but SG failed to have any impact. Leaf tissue N concentration from plants among the treatments at early, midseason and maturity were above sufficient ($> 3.5\%$), sufficient ($\approx 3.5\%$) and below sufficient ($< 3.5\%$) level, respectively. After harvesting of watermelon, soil sampling and analysis was done to evaluate available P and exchangeable K (Table 3). Available P content in the soil after harvest was not influenced by the application of N fertilizer with or without SG. This may be due to availability of very high amount of P in soil of the region. Potassium content after harvest was higher with 0 lbs/ac N fertilizer with or without SG compared to other treatments due to lower yield without any N fertilization which in turn resulted in lower K uptake by the watermelon with same rate of K application throughout the growing season.

Overall, the impact of SG application was not encouraging in increasing the watermelon yield while N fertilization improved the total and marketable yield significantly.

Repeated trial with different N rates is needed to choose best N rates for economic and sustainable watermelon production in the region.

Acknowledgements

This study is supported by Southwest Florida Water Management District. Mr. R. C. Hochmuth, Mr. B. Broughton and Mr. M. Boyette at SVAEC, University of Florida provided field assistance.

Reference

- Adesemoye, A.O. and J.W. Kloepper. 2009. Plant–microbes interactions in enhanced fertilizer-use efficiency. *Appl. Microbiol. Biotechnol.* 85:1–12.
- Hochmuth, G. and R. Hochmuth. 1996. Responses of watermelon yield and whole leaf and petiole sap N seasonal profiles to N fertilization. *Fla. Agr. Expt. Sta. Research Report: Suwannee Valley REC 96-2.*
- Hochmuth, G., E. Hanlon, and B. Hochmuth. 1992. Field-testing N recommendations for icebox and standard watermelons in north central Florida. *Fla. Agr. Expt. Sta. Research Report: Suwannee Valley REC 92-97.*
- Mylavarapu, R., T. Obreza, K. Morgan, G. Hochmuth, V. Nair, and A. Wright. 2014. Extraction of Soil Nutrients Using Mehlich-3 Reagent for Acid-Mineral Soils of Florida. <<http://edis.ifas.ufl.edu/ss620>>
- Shukla, S., G.S. Hendricks, T.A. Obreza, and W.G. Harris. 2014. BMP-Recommended Water and Phosphorus Inputs for Tomato and Watermelon Can Reduce Environmental Losses of Phosphorus and Save Water. < <http://edis.ifas.ufl.edu/faq/index.html>>
- United States Department of Agriculture (USDA). 2016. National Agricultural Statistics Service, Vegetables 2015 Summary. < <http://usda.mannlib.cornell.edu/usda/current/VegeSumm/VegeSumm-02-04-2016.pdf>>

Table1: Watermelon yield in 2015 as impacted by N fertilizer rates and SummaGrow (SG) application

N rates(lbs /ac)	SG	Total yield (tones/ac)	Marketable yield (tones /ac)	Reduction in marketable yield as % of total yield	% total yield harvested at 3 rd and 4 th harvest
0	-	14.5 ^{bc}	13.6 ^{ab}	6.2	81
	+	9.5 ^c	8.9 ^b	6.3	97
75	-	22.9 ^{abc}	20.9 ^{ab}	8.7	77
	+	17.1 ^{abc}	14.5 ^{ab}	15.2	85
112	-	24.4 ^{ab}	22.2 ^{ab}	9.0	82
	+	22.6 ^{abc}	19.1 ^{ab}	15.5	76
150	-	28.3 ^a	26.2 ^a	7.4	79
	+	29.5 ^a	27.1 ^a	8.1	76

Means followed by different letters are significantly different by each other according to Duncan's new multiple range test at $P \leq 0.05$.

Table 2: Mean effect of N fertilizer rates and SummaGrow (SG) application on Watermelon yield in 2015

Treatments		Total yield (tones /ac)	% increase over 0 lbs N/ac	Marketable yield (tones /ac)	% increase over 0 lbs N/ac
N fertilizer rates (lbs/ac)	0	12.0 ^b		11.3 ^b	
	75	20.0 ^{ab}	66	17.7 ^{ab}	57
	112	23.6 ^a	91	20.8 ^{ab}	84
	150	28.9 ^a	140	26.6 ^a	135
SG	-	22.6 ^a		20.8 ^a	
	+	19.7 ^a		17.5 ^a	

Means followed by different letters in each treatments are significantly different by each other according to Duncan's new multiple range test at $P \leq 0.05$.

Table 3: Brix value at 4th harvest, available P and K in soil after harvest of watermelon in 2015 as impacted by N fertilizer rates and SummaGrow (SG) application

N rates(lbs/ac)	SG	Brix at 4 th harvest	Available P (lbs/ac)	Available K (lbs/ac)
0	-	10.0 ^c	463 ^a	41.3 ^a
	+	10.6 ^{bc}	467 ^a	53.8 ^a
75	-	10.9 ^{ab}	431 ^a	24.0 ^b
	+	11.7 ^a	443 ^a	20.3 ^b
112	-	10.8 ^b	424 ^a	20.8 ^b
	+	10.4 ^{bc}	442 ^a	25.0 ^b
150	-	10.9 ^{ab}	463 ^a	20.8 ^b
	+	11.2 ^{ab}	454 ^a	18.8 ^b

Means followed by different letters are significantly different by each other according to Duncan's new multiple range test at $P \leq 0.05$.