Effect of Irrigation, Surfactant and Fertilizer Rates on Nitrate and Chlorophyll Content in Tomato Leaves

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INTRODUCTION

- Tomato is one of the most important vegetables grown in the United States.
- Due to continuous rise in the cost of fertilizers and irrigation water crisis, there is a need to continuously find ways for efficient use of fertilizers and irrigation water, without affecting the quality and quantity of the tomatoes
- Soil surfactants can potentially enhance water and nutrient uptake by plants, and thereby optimize overall crop productivity.

OBJECTIVE

•The objective of this study was to evaluate the influence of surfactant, Nitrogen (N) fertilizer and irrigation rates on the nitrate and chlorophyll content of tomato leaves at different growth stages.

MATERIALS & METHODS

Time & Location:

- During summer 2011, Variety Quality 23 tomatoes were grown on sandy loam soil, at California State University farm.

Experimental Design:

- Split-split plot design with eight treatments and three replications

Treatments:

- Irrigation: 3 rates based on % total ET by subsurface drip irrigation technique. (main plot treatment)
- Surfactant: 2 treatments without and with surfactant @ 0.5 gallons/acre 1DAT and 0.25 gallons/acre 15 and 30DAT.(sub-plot treatment)
- Fertilizer: 3 rates of UAN-32 in six splits.(sub-sub plot treatment).

ACKNOWLEDGMENTS

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Plot Layout for Aquatrols 2011 Project at CIT

<<-----Barstow avenue------->>

Block 3			Block 2			Block1		
I2	I3	I1	I1	I3	I2	I3	I2	I1
(49) F2	(43) F1	(37) F2	(31) F1	(25) F1	(19) F2	(13) F1	(7) F2	(1) F1
(50) F3	(44) F2	(38) F1	(32) F2	(26) F2	(20) F3	(14) F3	(8) F1	(2) F2
(51) F1	(45) F3	(39) F3	(33) F3	(27) F3	(21) F1	(15) F2	(9) F3	(3) F3
(52) F2	(46) F1	(40) F2	(34) F2	(28) F2	(22) F3	(16) F3	(10) F2	(4) F1
(53) F1	(47) F2	(41) F3	(35) F3	(29) F3	(23) F1	(17) F2	(11) F1	(5) F2
(54) F3	(48) F3	(42) F1	(36) F1	(30) F1	(24) F2	(18) F1	(12) F3	(6) F3

LEGEND	Irrigation	% ET	Surfactant	gal/acre	Fertilizer	lbs N/acre
	I1	100	S1	0	F1	100
	I2	80	S2	1	F2	150
	I3	60			F3	200

Numbers 1 to 54 in ( ) represent the sub plots, which are 3 beds x 25 feet long = 3 beds x 5'/bed

Data Analyses:

• Leaf tissue analysis was done at 1" diameter of fruit (first ripe stage) and at final harvest stage (red ripe stage).

• SPAD reading was done at 30 days after transplant, on 08/11, and then on 08/19, 08/25, 09/02 and 09/09 using SPAD meter.

• Statistical analysis was done at P value of 0.06 using GLM model of SPSS 20.

RESULTS

• At first ripe stage, fertilizer rates had a significant effect (P=0.02) on leaf tissue NO3-N concentration. 150 and 200 lbs N/acre had highest NO3-N levels.

•150 & 200 lbs N/acre had highest NO3-N levels for all irrigation & surfactant treatments

•At harvest, mean petiole NO3- N level was highest in plants receiving 200 lbs N/acre. interaction was significant at P= 0.10. Plants receiving surfactants, fertilized with 150 & 200 lbs N/acre and irrigated at the80 and 100 % ET had relatively higher nitrate levels than those at 60% ET irrigation rates.

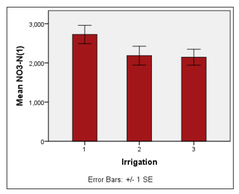

Fig. 1

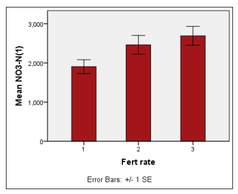

Fig.2

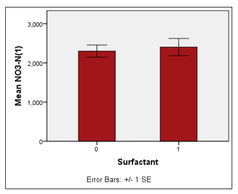

Fig. 3

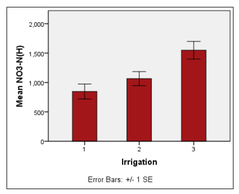

Fig. 4

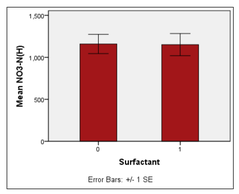

Fig. 5

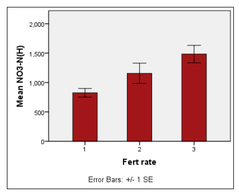

Fig. 6

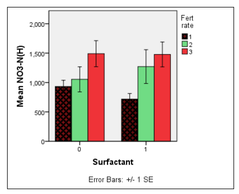

Fig. 7

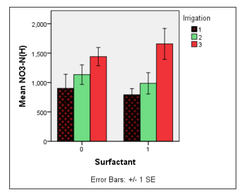

Fig. 8

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RESULTS CONT'D

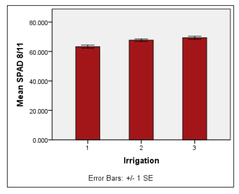
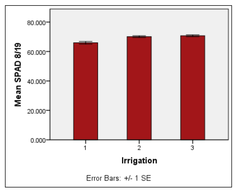


Fig. 9



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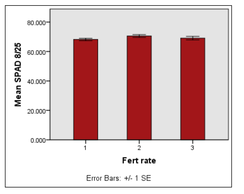

Fig. 11

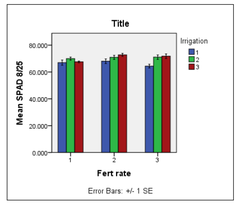

Fig. 12

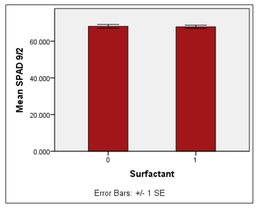

Fig. 13

•On 8/11 (Fig.9), irrigation had significant effect on leaf chlorophyll content at p = 0.06, irrigation rate of 80(I2) and 60(I3) percent of the total Evapotranspiration (ET) by subsurface drip irrigation technique.

•On 8/19 (Fig.10), irrigation had significant effect on leaf chlorophyll content at p = 0.06, irrigation rate of 80(I2) and 60(I3) percent of the total Evapotranspiration (ET) by subsurface drip irrigation technique.

•On 8/25 (Fig.11), fertilizer had significant effect on leaf chlorophyll content at p=0.06, fertilizer rate of UAN 32 200(F3) pounds N/acre.

•On 9/02 (Fig.13), surfactant had no significant effect on leaf chlorophyll content at p=0.06

CONCLUDING REMARKS

Overall, there was a slight decrease in the chlorophyll contents in leaves as the tomatoes progressed from immature green to full red stage (harvest). At first ripe stage, irrigation rates had a significant effect (P = 0.06) on leaf chlorophyll content. At harvest, there was no significant difference in the chlorophyll content due any of the three factors investigated in this study. It is noteworthy that unlike other studies reported in the literature, the chlorophyll contents measured with the SPAD meter in this study did not show any positive correlation with the nitrate concentrations determined in leaf petioles. In future studies, we intend to investigate the correlation between chlorophyll readings and total nitrogen content of the leaves.

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