Holden Research and Consulting

17twinNtomato01 Utilizing Twin N in Tomato for Nitrogen reduction

Protocol ID: 17twinNtomato01 Location: Camarillo, CA Trial Year: 2017
Trial ID: By: David Holden
Project ID: Study Director: Doug Whitener
Sponsor Contact:

Trial Establishment Guidelines

Project ID: Developer: Holden/Whitener
Revision Number: Revision Status:
Revision Date: Feb-24-2017 Issue Date: Feb-24-2017
Site Type:
Treated Plot Width: Country:
Treated Plot Length: Climate Zone:
Treated Plot Area: Experimental Unit:
Replications: Tillage Type:
Study Design:
Untreated Arrangement:

Keywords:

Trial ID	Responsible	Number of Trials	Site Requirements
		1	

Total Trials: 1

Conduct Under GLP: No Study Rules:
Conduct Under GEP: No Officially Recognized Organization:

No.	Guideline	Description

Objectives:

Crop Description

Crop 1: LYPXP Lycopersicon es., transplanted Transplanted tomato
Variety: tbd Description:
BBCH Scale: BVSO
Planting Rate, Unit: Row Spacing, Unit:

Target Pest Description

Pest 1 Type: Code:
Common Name:
Description:
Artificial Population: Establishment Date:
Establishment Rate, Unit:
Concentration, Unit:
Establishment Method/Description:

Soil Description

Additional Measured Elements

Element	Quantity	Unit

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Application

Application Method:	
Application Timing:	
Application Placement:	
Appl. Equipment:	
Equipment Type:	
Operation Pressure, Unit:	
Nozzle Type:	
Nozzle Size:	
Nozzle Spacing, Unit:	
Nozzles/Row:	
Band Width, Unit:	
% Coverage:	
Row Sides Applied:	
Boom Height, Unit:	
Ground Speed, Unit:	
Incorporation Equip.:	
Hours to Incorp.:	
Incorp. Depth, Unit	
Carrier:	
Water Hardness (ppm CaCO3):	
Spray Volume, Unit:	
Mix Size, Unit:	
Spray pH:	
Propellant:	
Tank Mix (Y/N):	

Equipment Comment:

Application Directions:
Pre-plant fertilizer. 75 lbs/ac N, remainder to go on in the tape

All applied in tape or under the tape for soil uptake.

Crop Stage At Each Application

	A
Crop 1 Code, BBCH Scale:	LYPXP BVSO
Stage Scale Used:	
Stage Majority, Percent:	
Stage Minimum, Percent:	
Stage Maximum, Percent:	
Diameter, Unit:	
Height, Unit:	
Height Minimum, Maximum:	
Plant Foliage Height, Unit:	
Crop coverage (%):	

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Pest Stage At Each Application

Pest 1 Code, Disc., Scale:	
Stage Majority, Percent:	
Stage Minimum, Percent:	
Stage Maximum, Percent:	
Diameter, Unit:	
Height, Unit:	
Height Minimum, Maximum:	
Density, Unit:	
Coverage, Unit:	

Geographic Area/Environmental Considerations:
Ventura county

Cropping Considerations:
Tomato

Data to Collect:
1. Pre-plant soil, and harvest.

2. Tissue analysis at late season

3. SPAD/Vigor Analysis in season

4. Final yield analysis based on production per sampled plants.

Statistical Analysis:
Appropriate for test

Summarize and Submit Study By (Date): Oct-31-2017

General Comments

General Comments:

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Trt No.	Treatment Name	Other Rate	Other Rate Unit	Appl Code	Appl Description	Comment 1
1	Grower Standard Nitrogen	150	lbs/ac		A=Second irrigation	Tape applied
2	G.S. Reduced Nitrogen Twin N	100 1	lbs/ac tbd	 AB	B= 30 days later in drip	

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Project ID: Study Director: Doug Whitener
Sponsor Contact:

General Trial Information

Study Director: Doug Whitener
Investigator: David Holden

Trial Reliability: GOOD
Initiation Date: May-5-2017 **Planned Completion Date:** Aug-30-2017
Completion Date: Aug-30-2017

Trial Location

City: Somis **Country:** USA United States
State/Prov.: California

Conducted Under GLP: No
Conducted Under GEP: No

Conclusions:

Methods and Materials:

This trial was set up as a Block Designed study of four replicates to evaluate the effects of the grower standard program compared to a reduced nitrogen input grower standard program with multiple applications of Twin N for the production of cannery type tomatoes (cv Dri-319). The application rates and timing can be found in the attached Application Rate, Description tables, and notes section found in this report. In season nutrients were applied and can also be found in the Notes section of this report with the description of the total rates of nitrogen applied to both treatments.

Data collection consisted of in season growth and vigor data collection along with end of season harvest data. Harvest data is based on the sampling of two plants per replicate. Production was quantified according to the size and quality of the tomatoes produced.

Results and Discussion:

All data for this trial will be found in this report, along with the A&L Western Laboratories soils and leaf analysis reports.

In season height, vigor, and SPAD analysis of the developing tomato plants can be found in the data columns 1-6 with no significant differences noted between the two treatments. Vigor was based on a visual rating of the plants over time and rated on a 0-5 scale, 3 representing normal for the plants at that time, with a higher rating indicating healthier plants. SPAD (http://www.johnmorris.com.au/files/product/attachments/18012 /160254_manual_instr.pdf) readings of relative petiole chlorophyll content were also taken in season.

Final average yields were taken by harvesting all tomatoes from two plant sub samples per replicate, grading as to marketable or not and by color (red and green). This data can be found in columns 7-18 and totaled for the period in columns 19-21 for all production. Unmarketable tomato yields will be found in columns 16-18, with no significant differences found between treatments based on weight and count. The average marketable yields were extrapolated to tons per acre and can be found in column 23. No significant differences in yield were noted between the treatments with the highest yields coming out of treatment 2, the Twin N treatments with 33% less nitrogen applied . The extrapolated yields are based on an average for California cannery tomato production of approximately 49 tons per acre for the 2014 season

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(https://www.nass.usda.gov/Statistics_by_State/California/Publications/Vegetables/2016/201601ptom.pdf). Data from columns 13 and 19 were used to come up with a ratio of utilization by weight of the marketable fruit to total fruit by weight percent utilization found in column 22. Based on this no significant differences in the utilization ratio was found.

Pre plant soil analysis is reported in A&L report 17-096-020 for the site on which the trial occurred. Of note in this report, there very little residual nitrogen in the soil, with high and ample amounts of phosphorus and potassium. The end of season soil report 17-250-131 (sample ID's TNTM1 and 2 for treatments 1 and 2) showed end of season comparative nutrient values with the exception that the Twin N (ID TNTM2) treatments showed significantly lower remaining soil nitrate nitrogen when compared to the grower standard, along with a lower soluble salts reading (less remaining nitrogen). Finally a close to harvest leaf sample was taken and is reported in report 17-228-063. This report shows adequate nutrient levels for all necessary elements, with slightly elevated nitrogen relative to the grower standard for the Twin N treatment, even though less nitrogen overall was applied.

At no time during the course of this trial were any adverse or phytotoxic effects observed to this crop.

All data rated as significant was done so utilizing the Least Significant Difference analysis at a 90% confidence level.

Conclusion:

It should be noted that there were no significantly different data found in any of the analysis performed, but that numerically better yields were realized on 33% less nitrogen inputs for this season. This is but one years tomato crop cycle data, but the data does seem to indicate improved nitrogen use when utilized in conjunction with Twin N.

Contacts

Study Director: Doug Whitener

Investigator: David Holden
Organization: Holden Research and Consulting

Cooperator/Landowner

Organization: Holden Research

Crop Description

Crop 1: LYPXP Lycopersicon es., transplanted Transplanted tomato
Variety: Dri319 **BBCH Scale:** BVSO
Planting Date: May-5-2017

Site and Design

Treated Plot Width: 3.33 FT
Treated Plot Length: 25 FT
Treated Plot Area: 83.25 FT2 **Treatments:** 2
Replications: 4 **Study Design:** RACOBL Randomized Complete Block (RCB)

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Application Description

	A	B
Application Date:	May-16-2017	Jun-20-2017
Application Method:	IRRDRE	IRRDRE
Application Placement:	SOIL	SOIL
Applied By:	Holden	Holden
Air Temperature, Unit:	62 F	74 F
% Relative Humidity:	70	40
Wind Velocity, Unit:	2 mph	2 mph
Wind Direction:	w	w
Dew Presence (Y/N):	N no	N no
% Cloud Cover:	0	0
Next Moisture Occurred On:	May-16-2017	Jun-14-2017

Crop Stage At Each Application

	A	B
Crop 1 Code, BBCH Scale:	LYPXP BVSO	LYPXP BVSO

Application Equipment

	A	B
Appl. Equipment:	Backpac 2	Hypro Pump
Operation Pressure, Unit:	30 T-Jet	40 psi
Nozzle Type:	Hollow Co	
Nozzle Size:	8004	
Incorp. Depth, Unit	0	
Carrier:	WATER	WATER
Spray Volume, Unit:	25 GAL/AC	0 0
Mix Size, Unit:	1 Gallons	2 Gallons

Trt No	Treatment Application Comment
1	No adverse effects from any of the treatments

Date	By	Notes
Jun-2-2017	Holden	First nitrogen applied. 6 gal/ac UAN 32 (21 lbs n) for high rate, 4 gal/ac (14 lbs/ac n) for low rate.
Jun-14-2017	Holden	Second nitrogen applied. 12gal/ac UAN 32 43 lbs n) for high rate, 8 gal/ac (28 lbs/ac n) for low rate.
Jun-28-2017	Holden	Third nitrogen applied. 12gal/ac UAN 32 43 lbs n) for high rate, 8 gal/ac (28 lbs/ac n) for low rate.
Jul-12-2017	Holden	4th. nitrogen applied. 12gal/ac UAN 32 43 lbs n) for high rate, 8 gal/ac (28 lbs/ac n) for low rate.

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Sponsor Contact:

Trt No.	Treatment Name	Other Rate	Other Rate Unit	Appl Code	Appl Description	Comment 1
1	Grower Standard Nitrogen	150	lbs/ac		A=Second irrigation	Tape applied
2	G.S. Reduced Nitrogen Twin N	100 1	lbs/ac tbd	 AB	B= 30 days later in drip	

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Sponsor Contact:

Product quantities required for listed treatments and applications of trials included in this table:

Amount*	Unit	Treatment Name	Form Conc	Form Type	Lot Code

* 'Per area' calculations based on spray volume= 100 GAL/AC, mix size= 1 gallons (mix size basis).
* Adjusted for multiple applications in treatment list.

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Sponsor Contact:

Pest Type							
Pest Code							
Pest Scientific Name							
Pest Name							
Crop Code			LYPXP	LYPXP	LYPXP	LYPXP	LYPXP
BBCH Scale			BVSO	BVSO	BVSO	BVSO	BVSO
Crop Scientific Name			Lycopersicon e>	Lycopersicon e>	Lycopersicon e>	Lycopersicon e>	Lycopersicon e>
Crop Name			Transplanted t>	Transplanted t>	Transplanted t>	Transplanted t>	Transplanted t>
Crop Variety							
Description			Spad	Vigor	height	Spad	Vigor
Part Rated							
Rating Date			Jun-6-2017	Jun-6-2017	Jun-6-2017	Jul-6-2017	Jul-6-2017
Rating Type			CONDUC	VIGOR	HEIGHT	CONDUC	VIGOR
Rating Unit			SPAD	0-5	IN	SPAD	0-5
Sample Size, Unit							
Collection Basis, Unit							
Number of Subsamples			1	4	4	1	4
Assessed By							
SE Name							
Rating Timing							
Days After First/Last Applic.			21 21	21 21	21 21	51 16	51 16
Trt-Eval Interval			28 DA-A	28 DA-A	28 DA-A	28 DA-A	28 DA-A
Plant-Eval Interval			32 DP-1	32 DP-1	32 DP-1	62 DP-1	62 DP-1
Days After Emergence							
ARM Action Codes							
Sort Order for View							
Number of Decimals							
Trt No.	Treatment Name	Other Rate	Other Rate Unit / Appl Code	1	2	3	4	5
1	Grower Standard Nitrogen	150	lbs/ac	33.80	2.5	12.5	48.60	5.0
				32.10	2.8	11.5	49.70	5.0
				34.60	3.8	13.8	48.30	5.0
				28.30	3.3	12.8	50.30	5.0
			Mean =	32.20	3.1	12.6	49.23	5.0
2	G.S. Reduced Nitrogen Twin N	100 1	lbs/ac tbd AB	31.80	4.0	13.8	49.70	5.0
				35.40	3.0	12.5	46.70	5.0
				32.60	3.5	13.8	54.80	5.0
				29.70	3.5	12.5	52.10	5.0
			Mean =	32.38	3.5	13.1	50.83	5.0

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Sponsor Contact:

Pest Type							
Pest Code							
Pest Scientific Name							
Pest Name							
Crop Code			LYPXP	LYPXP	LYPXP	LYPXP	LYPXP
BBCH Scale			BVSO	BVSO	BVSO	BVSO	BVSO
Crop Scientific Name			Lycopersicon e>	Lycopersicon e>	Lycopersicon e>	Lycopersicon e>	Lycopersicon e>
Crop Name			Transplanted t>	Transplanted t>	Transplanted t>	Transplanted t>	Transplanted t>
Crop Variety							
Description			Spad	red	red	red	green
Part Rated				FRUMAR C	FRUMAR C	FRUMAR C	FRUMAR C
Rating Date			Jul-26-2017	Aug-30-2017	Aug-30-2017	Aug-30-2017	Aug-30-2017
Rating Type			CONDUC	WEIFRE	YIELD	WEIFRE	WEIFRE
Rating Unit			SPAD	LB	NUMBER	LB	LB
Sample Size, Unit				2 PLANT	2 PLANT	1 FRUIT	2 PLANT
Collection Basis, Unit							
Number of Subsamples			1	2	2	2	2
Assessed By							
SE Name							
Rating Timing							
Days After First/Last Applic.			71 36	98 56	98 56	98 56	98 56
Trt-Eval Interval			28 DA-A	21 DA-G	21 DA-G	21 DA-G	21 DA-G
Plant-Eval Interval			82 DP-1	124 DP-1	124 DP-1	124 DP-1	124 DP-1
Days After Emergence							
ARM Action Codes						T1	
Sort Order for View							
Number of Decimals				1	1	2	1
Trt No.	Treatment Name	Other Rate	Other Rate Unit / Appl Code	6	7	8	9	10
1	Grower Standard Nitrogen	150	lbs/ac	61.70	18.4	100.0	0.18	11.4
				64.20	19.3	109.5	0.18	2.3
				63.10	10.1	53.5	0.19	8.2
				58.40	16.9	91.5	0.18	7.4
			Mean =	61.85	16.2	88.6	0.18	7.3
2	G.S. Reduced Nitrogen	100	lbs/ac	61.20	25.0	124.0	0.20	11.6
	Twin N	1	tbd AB	63.00	18.7	95.5	0.20	7.8
				59.30	10.4	52.0	0.20	4.8
				58.70	18.9	103.0	0.18	3.2
			Mean =	60.55	18.3	93.6	0.20	6.8

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Sponsor Contact:

Pest Type									
Pest Code									
Pest Scientific Name									
Pest Name									
Crop Code				LYPXP		LYPXP		LYPXP	
BBCH Scale				BVSO		BVSO		BVSO	
Crop Scientific Name				Lycopersicon e>		Lycopersicon e>		Lycopersicon e>	
Crop Name				Transplanted t>		Transplanted t>		Transplanted t>	
Crop Variety									
Description				green		green		all marketable	
Part Rated				FRUMAR C		FRUMAR C		FRUMAR C	
Rating Date				Aug-30-2017		Aug-30-2017		Aug-30-2017	
Rating Type				YIELD		WEIFRE		WEIFRE	
Rating Unit				NUMBER		LB		LB	
Sample Size, Unit				2 PLANT		1 FRUIT		2 PLANT	
Collection Basis, Unit									
Number of Subsamples				2		2		2	
Assessed By									
SE Name									
Rating Timing									
Days After First/Last Applic.				98 56		98 56		98 56	
Trt-Eval Interval				21 DA-G		21 DA-G		21 DA-G	
Plant-Eval Interval				124 DP-1		124 DP-1		124 DP-1	
Days After Emergence									
ARM Action Codes						T2		T3	
Sort Order for View									
Number of Decimals				1		2		1	
Trt No.	Treatment Name	Other Rate	Other Rate Unit	Appl Code	11	12	13	14	15
1	Grower Standard Nitrogen	150	lbs/ac		75.0	0.15	29.8	175.0	0.17
					14.0	0.16	21.5	123.5	0.17
					77.5	0.09	18.3	131.0	0.14
					56.0	0.13	24.4	147.5	0.16
				Mean =	55.6	0.13	23.5	144.3	0.16
2	G.S. Reduced Nitrogen	100	lbs/ac		76.0	0.15	36.6	200.0	0.18
	Twin N	1	tbd	AB	59.5	0.13	26.4	155.0	0.17
					26.0	0.19	15.1	78.0	0.19
					27.0	0.12	22.1	130.0	0.17
				Mean =	47.1	0.15	25.1	140.8	0.18

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Pest Type									
Pest Code									
Pest Scientific Name									
Pest Name									
Crop Code				LYPXP		LYPXP		LYPXP	
BBCH Scale				BVSO		BVSO		BVSO	
Crop Scientific Name				Lycopersicon e>		Lycopersicon e>		Lycopersicon e>	
Crop Name				Transplanted t>		Transplanted t>		Transplanted t>	
Crop Variety									
Description				unmarketable		unmarketable		total producti>	
Part Rated				FRUUNM C		FRUUNM C		FRUTOT C	
Rating Date				Aug-30-2017		Aug-30-2017		Aug-30-2017	
Rating Type				WEIFRE		YIELD		WEIFRE	
Rating Unit				LB		NUMBER		LB	
Sample Size, Unit				2 PLANT		2 PLANT		2 PLANT	
Collection Basis, Unit									
Number of Subsamples				2		2		2	
Assessed By									
SE Name									
Rating Timing									
Days After First/Last Applic.				98 56		98 56		98 56	
Trt-Eval Interval				21 DA-G		21 DA-G		21 DA-G	
Plant-Eval Interval				124 DP-1		124 DP-1		124 DP-1	
Days After Emergence									
ARM Action Codes									
Sort Order for View									
Number of Decimals				1		1		1	
Trt No.	Treatment Name	Other Rate	Other Rate Unit	Appl Code	16	17	18	19	20
1	Grower Standard Nitrogen	150	lbs/ac		0.6	6.0	0.05	30.4	181.0
					1.8	19.0	0.09	23.3	142.5
					0.1	1.5	0.04	18.4	132.5
					0.1	1.0	0.06	24.5	148.5
				Mean =	0.7	6.9	0.06	24.2	151.1
2	G.S. Reduced Nitrogen	100	lbs/ac		2.1	10.0	0.22	38.7	210.0
	Twin N	1	tbd	AB	0.1	0.5	0.06	26.5	155.5
					0.3	2.0	0.27	15.4	80.0
					0.2	3.0	0.04	22.3	133.0
				Mean =	0.7	3.9	0.15	25.7	144.6

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Pest Type									
Pest Code									
Pest Scientific Name									
Pest Name									
Crop Code						LYPXP		LYPXP	LYPXP
BBCH Scale						BVSO		BVSO	BVSO
Crop Scientific Name						Lycopersicon e>		Lycopersicon e>	Lycopersicon e>
Crop Name						Transplanted t>		Transplanted t>	Transplanted t>
Crop Variety									
Description						total producti>		Utilization	marketable
Part Rated						FRUTOT C		FRUTOT C	FRUTOT C
Rating Date						Aug-30-2017		Aug-30-2017	Aug-30-2017
Rating Type						WEIFRE		RATIO	WEIFRE
Rating Unit						LB		%	T-US
Sample Size, Unit						1 FRUIT			1 A
Collection Basis, Unit									
Number of Subsamples						2		2	2
Assessed By									
SE Name									
Rating Timing									
Days After First/Last Applic.						98 56		98 56	98 56
Trt-Eval Interval						21 DA-G		21 DA-G	21 DA-G
Plant-Eval Interval						124 DP-1		124 DP-1	124 DP-1
Days After Emergence									
ARM Action Codes						T9		T10	T11
Sort Order for View									
Number of Decimals						2		1	1
Trt No.	Treatment Name	Other Rate	Other Rate Unit	Appl Code		21		22	23
1	Grower Standard Nitrogen	150	lbs/ac			0.16		95.5	60.8
						0.16		91.5	43.9
						0.14		99.4	37.4
						0.16		99.4	49.7
					Mean =	0.16		96.4	47.9
2	G.S. Reduced Nitrogen	100	lbs/ac			0.18		94.4	74.6
	Twin N	1	tbd	AB		0.17		99.8	53.9
						0.19		97.7	30.9
						0.17		98.9	45.1
					Mean =	0.18		97.7	51.1

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Pest Type								
Pest Code								
Pest Scientific Name								
Pest Name								
Crop Code				LYPXP	LYPXP	LYPXP	LYPXP	LYPXP
BBCH Scale				BVSO	BVSO	BVSO	BVSO	BVSO
Crop Scientific Name				Lycopersicon e>	Lycopersicon e>	Lycopersicon e>	Lycopersicon e>	Lycopersicon e>
Crop Name				Transplanted t>	Transplanted t>	Transplanted t>	Transplanted t>	Transplanted t>
Crop Variety								
Description				Spad	Vigor	height	Spad	Vigor
Part Rated								
Rating Date				Jun-6-2017	Jun-6-2017	Jun-6-2017	Jul-6-2017	Jul-6-2017
Rating Type				CONDUC	VIGOR	HEIGHT	CONDUC	VIGOR
Rating Unit				SPAD	0-5	IN	SPAD	0-5
Sample Size, Unit								
Collection Basis, Unit								
Number of Subsamples				1	4	4	1	4
Assessed By								
SE Name								
Rating Timing								
Days After First/Last Applic.				21 21	21 21	21 21	51 16	51 16
Trt-Eval Interval				28 DA-A	28 DA-A	28 DA-A	28 DA-A	28 DA-A
Plant-Eval Interval				32 DP-1	32 DP-1	32 DP-1	62 DP-1	62 DP-1
Days After Emergence								
ARM Action Codes								
Sort Order for View								
Number of Decimals								
Trt No.	Treatment Name	Other Rate	Other Rate Unit	Appl Code	1	2	3	4	5
1	Grower Standard Nitrogen	150	lbs/ac		32.20 a	3.1 a	12.6 a	49.23 a	5.0 a
2	G.S. Reduced Nitrogen Twin N	100 1	lbs/ac tbd	AB	32.38 a	3.5 a	13.1 a	50.83 a	5.0 a
LSD P=.05					4.182	1.19	1.17	6.193	0.00
Standard Deviation					1.859	0.53	0.52	2.753	0.00
CV					5.76	16.09	4.04	5.5	0.0
Grand Mean					32.288	3.28	12.88	50.025	5.00
Bartlett's X2					0.082	0.255	0.168	3.78	0.0
P(Bartlett's X2)					0.775	0.613	0.682	0.052	.

Means followed by same letter do not significantly differ (P=.05, Duncan's New MRT)

Holden Research and Consulting

17twinNtomato01 Utilizing Twin N in Tomato for Nitrogen reduction

Trial ID: 17twinNtomato01 Location: Camarillo, CA Trial Year: 2017
Protocol ID: 17twinNtomato01 Investigator: David Holden
Project ID: Study Director: Doug Whitener
Sponsor Contact:

Pest Type							
Pest Code							
Pest Scientific Name							
Pest Name							
Crop Code			LYPXP	LYPXP	LYPXP	LYPXP	LYPXP
BBCH Scale			BVSO	BVSO	BVSO	BVSO	BVSO
Crop Scientific Name			Lycopersicon e>	Lycopersicon e>	Lycopersicon e>	Lycopersicon e>	Lycopersicon e>
Crop Name			Transplanted t>	Transplanted t>	Transplanted t>	Transplanted t>	Transplanted t>
Crop Variety							
Description			Spad	red	red	red	green
Part Rated				FRUMAR C	FRUMAR C	FRUMAR C	FRUMAR C
Rating Date			Jul-26-2017	Aug-30-2017	Aug-30-2017	Aug-30-2017	Aug-30-2017
Rating Type			CONDUC	WEIFRE	YIELD	WEIFRE	WEIFRE
Rating Unit			SPAD	LB	NUMBER	LB	LB
Sample Size, Unit				2 PLANT	2 PLANT	1 FRUIT	2 PLANT
Collection Basis, Unit							
Number of Subsamples			1	2	2	2	2
Assessed By							
SE Name							
Rating Timing							
Days After First/Last Applic.			71 36	98 56	98 56	98 56	98 56
Trt-Eval Interval			28 DA-A	21 DA-G	21 DA-G	21 DA-G	21 DA-G
Plant-Eval Interval			82 DP-1	124 DP-1	124 DP-1	124 DP-1	124 DP-1
Days After Emergence							
ARM Action Codes						T1	
Sort Order for View							
Number of Decimals				1	1	2	1
Trt No.	Treatment Name	Other Rate	Other Rate Unit	Appl Code	6	7	8	9	10
1	Grower Standard Nitrogen	150	lbs/ac		61.85 a	16.2 a	88.6 a	0.18 a	7.3 a
2	G.S. Reduced Nitrogen Twin N	100 1	lbs/ac tbd	 AB	60.55 a	18.3 a	93.6 a	0.20 a	6.8 a
LSD P=.05					2.825	5.07	26.09	0.017	7.07
Standard Deviation					1.256	2.25	11.59	0.008	3.14
CV					2.05	13.08	12.72	3.98	44.46
Grand Mean					61.200	17.22	91.13	0.190	7.06
Bartlett's X2					0.178	0.369	0.12	0.002	0.002
P(Bartlett's X2)					0.673	0.544	0.729	0.961	0.967

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Project ID: Study Director: Doug Whitener
Sponsor Contact:

Pest Type							
Pest Code							
Pest Scientific Name							
Pest Name							
Crop Code			LYPXP	LYPXP	LYPXP	LYPXP	LYPXP
BBCH Scale			BVSO	BVSO	BVSO	BVSO	BVSO
Crop Scientific Name			Lycopersicon e>	Lycopersicon e>	Lycopersicon e>	Lycopersicon e>	Lycopersicon e>
Crop Name			Transplanted t>	Transplanted t>	Transplanted t>	Transplanted t>	Transplanted t>
Crop Variety							
Description			green	green	all marketable	all marketable	all marketable
Part Rated			FRUMAR C	FRUMAR C	FRUMAR C	FRUMAR C	FRUMAR C
Rating Date			Aug-30-2017	Aug-30-2017	Aug-30-2017	Aug-30-2017	Aug-30-2017
Rating Type			YIELD	WEIFRE	WEIFRE	YIELD	WEIFRE
Rating Unit			NUMBER	LB	LB	NUMBER	LB
Sample Size, Unit			2 PLANT	1 FRUIT	2 PLANT	2 PLANT	1 FRUIT
Collection Basis, Unit							
Number of Subsamples			2	2	2	2	2
Assessed By							
SE Name							
Rating Timing							
Days After First/Last Applic.			98 56	98 56	98 56	98 56	98 56
Trt-Eval Interval			21 DA-G	21 DA-G	21 DA-G	21 DA-G	21 DA-G
Plant-Eval Interval			124 DP-1	124 DP-1	124 DP-1	124 DP-1	124 DP-1
Days After Emergence							
ARM Action Codes				T2	T3	T4	T5
Sort Order for View							
Number of Decimals			1	2	1	1	2
Trt No.	Treatment Name	Other Rate	Other Rate Unit	Appl Code	11	12	13	14	15
1	Grower Standard Nitrogen	150	lbs/ac		55.6 a	0.13 a	23.5 a	144.3 a	0.16 a
2	G.S. Reduced Nitrogen Twin N	100 1	lbs/ac tbd	 AB	47.1 a	0.15 a	25.1 a	140.8 a	0.18 a
LSD P=.05					66.72	0.090	7.98	62.86	0.038
Standard Deviation					29.65	0.040	3.54	27.94	0.017
CV					57.72	28.25	14.6	19.61	9.79
Grand Mean					51.38	0.141	24.28	142.50	0.171
Bartlett's X2					0.08	0.0	0.968	1.617	0.149
P(Bartlett's X2)					0.777	0.985	0.325	0.203	0.699

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17twinNtomato01 Utilizing Twin N in Tomato for Nitrogen reduction

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Protocol ID: 17twinNtomato01 Investigator: David Holden
Project ID: Study Director: Doug Whitener
Sponsor Contact:

Pest Type										
Pest Code										
Pest Scientific Name										
Pest Name										
Crop Code					LYPXP		LYPXP		LYPXP	
BBCH Scale					BVSO		BVSO		BVSO	
Crop Scientific Name					Lycopersicon e>		Lycopersicon e>		Lycopersicon e>	
Crop Name					Transplanted t>		Transplanted t>		Transplanted t>	
Crop Variety										
Description					unmarketable		unmarketable		total producti>	
Part Rated					FRUUNM C		FRUUNM C		FRUTOT C	
Rating Date					Aug-30-2017		Aug-30-2017		Aug-30-2017	
Rating Type					WEIFRE		YIELD		WEIFRE	
Rating Unit					LB		NUMBER		LB	
Sample Size, Unit					2 PLANT		2 PLANT		2 PLANT	
Collection Basis, Unit										
Number of Subsamples					2		2		2	
Assessed By										
SE Name										
Rating Timing										
Days After First/Last Applic.					98 56		98 56		98 56	
Trt-Eval Interval					21 DA-G		21 DA-G		21 DA-G	
Plant-Eval Interval					124 DP-1		124 DP-1		124 DP-1	
Days After Emergence										
ARM Action Codes							T6		T7	
Sort Order for View										
Number of Decimals					1		1		1	
Trt No.	Treatment Name	Other Rate	Other Rate	Unit	Appl Code	16	17	18	19	20
1	Grower Standard Nitrogen	150		lbs/ac		0.7 a	6.9 a	0.06 a	24.2 a	151.1 a
2	G.S. Reduced Nitrogen Twin N	100 1		lbs/ac tbd	 AB	0.7 a	3.9 a	0.15 a	25.7 a	144.6 a
LSD P=.05						2.16	16.60	0.214	8.36	56.90
Standard Deviation						0.96	7.38	0.095	3.72	25.29
CV						143.93	137.24	91.21	14.89	17.1
Grand Mean						0.67	5.38	0.104	24.95	147.88
Bartlett's X2						0.104	1.224	5.347	1.219	2.165
P(Bartlett's X2)						0.747	0.269	0.021*	0.27	0.141

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17twinNtomato01 Utilizing Twin N in Tomato for Nitrogen reduction

Trial ID: 17twinNtomato01 Location: Camarillo, CA Trial Year: 2017
Protocol ID: 17twinNtomato01 Investigator: David Holden
Project ID: Study Director: Doug Whitener
Sponsor Contact:

Pest Type						
Pest Code						
Pest Scientific Name						
Pest Name						
Crop Code				LYPXP	LYPXP	LYPXP
BBCH Scale				BVSO	BVSO	BVSO
Crop Scientific Name				Lycopersicon e>	Lycopersicon e>	Lycopersicon e>
Crop Name				Transplanted t>	Transplanted t>	Transplanted t>
Crop Variety						
Description				total producti>	Utilization	marketable
Part Rated				FRUTOT C	FRUTOT C	FRUTOT C
Rating Date				Aug-30-2017	Aug-30-2017	Aug-30-2017
Rating Type				WEIFRE	RATIO	WEIFRE
Rating Unit				LB	%	T-US
Sample Size, Unit				1 FRUIT		1 A
Collection Basis, Unit						
Number of Subsamples				2	2	2
Assessed By						
SE Name						
Rating Timing						
Days After First/Last Applic.				98 56	98 56	98 56
Trt-Eval Interval				21 DA-G	21 DA-G	21 DA-G
Plant-Eval Interval				124 DP-1	124 DP-1	124 DP-1
Days After Emergence						
ARM Action Codes				T9	T10	T11
Sort Order for View						
Number of Decimals				2	1	1
Trt No. Treatment Name	Other Rate	Other Rate Unit	Appl Code	21	22	23
1 Grower Standard Nitrogen	150	lbs/ac		0.16 a	96.4 a	47.9 a
2 G.S. Reduced Nitrogen	100	lbs/ac		0.18 a	97.7 a	51.1 a
Twin N	1	tbd	AB			
LSD P=.05				0.035	7.50	16.27
Standard Deviation				0.016	3.33	7.23
CV				9.21	3.43	14.6
Grand Mean				0.169	97.07	49.53
Bartlett's X2				0.009	0.593	0.968
P(Bartlett's X2)				0.924	0.441	0.325