California Pepper Commission – ANNUAL Report for 2011

Title: The Effect of Nitrogen Fertilization on Yield and Quality of Bell Peppers

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Summary: A field study was conducted at the UC West Side Research and Extension Center in Fresno County to investigate 5 rates of nitrogen fertilizer (60-315 lbs N/A) on the yield and postharvest quality of drip irrigated bell peppers. The cultivar 'Double Up' was transplanted and grown without plastic mulch or poles on 40-inch beds with a manifold system that allowed different nitrogen rates to be applied simultaneously through subsurface drip irrigation to different parts of the test plot. Prior to planting the soil tested very low for soil residual nitrogen. Whole leaf samples were collected four times during the growing season beginning at first flower and analyzed for nitrogen content. The field was picked twice for yield, quality attributes, and postharvest evaluations. The peppers showed a significant yield response to the varying levels of nitrogen fertilizer. Total marketable yield ranged from 7.3 to 20.4 tons per acre. The two lower Nitrogen treatments (60 and 135 lbs/A) were definitely insufficient for maximum yield and size, but there were only subtle differences between the three higher rates (195, 255, 315 lbs N/A). The two highest rates produced more extra-large fruit compared to the lower rates. Postharvest evaluations of mature green fruit at the first harvest revealed that there was no difference in form, firmness, or dry weight, but fruit weight and pericarp thickness were significantly less in the two lowest nitrogen rates. At the second harvest mature green fruit were more firm, weighed more, and had higher dry weights at the higher nitrogen levels. Green color hue was darker in lower N fruit of the first pick, but there were no hue differences in the second pick. Bruising and cracking differences were noted between the nitrogen treatments, but did not follow a consistent trend. **In summary, postharvest evaluations of mature green marketable fruit were inconsistent and indicated that nitrogen content was not necessarily a driving factor.** As expected red fruit had higher fresh and dry weights than green fruit, but only fresh weights were affected positively by increasing nitrogen. Red color was similar among all treatments except the low N treatment in which the fruits were orange-red.

Background: In the Central Valley peppers are grown for fresh and processing markets, and in some cases the same crop is used for both purposes. Some fields are grown on poles and plastic mulched beds for extended fresh market production, while others are grown without plastic mulch or support for a once (or twice) over harvest. Many bell pepper growers use drip irrigation and apply liquid nitrogen fertilizers through the drip system. Planting configurations differ by grower. Although growers learn how to grow peppers under drip irrigation on their soils, nitrogen best management practices have not been updated for many years. Yield of peppers also varies significantly depending upon pepper variety, planting method, time of planting and other cultural practices including irrigation and fertilization. There has not been a recent study that investigates the relationship between nitrogen fertilizer and pepper quality at

harvest, when grown under drip irrigation. Good quality mature-green peppers for fresh market should be of a color typical of the variety, without defects (cracks, sunburn, shrivel), firm to hand pressure and retain firmness during typical commercial handling, and have no decay. Pepper firmness varies by variety, wall thickness, and weight loss during commercial handling. It is expected that peppers with a higher dry matter content will also perform better during commercial handling than those with less.

Goals and Objectives

The goal of this project is to evaluate the effect of nitrogen applied to a drip irrigated crop of bell peppers throughout the season on pepper yield, horticultural attributes (maturity, fruit size, and marketable fruit), and pepper quality parameters at harvest including fruit weight, color, form, firmness, bruise susceptibility, cracking, pericarp wall thickness, and dry weight.

Methods and Procedures for 2011 (Figure 1)

FIELD Trial: Preseason soil samples were collected from several fields to locate a suitable site low in residual soil nitrogen to conduct the fertilizer rate test. A subsurface drip irrigation system was established in a field at the UC WSREC in panoche clay loam soil. A series of manifolds was built which allowed for 5 separate yet simultaneous applications of nitrogen (N) fertilizer rates to different sections of the field. A preplant application of 150 units of 11-52-0 was uniformly applied to the field prior to transplanting. The goal was to apply five rates (75, 150, 225, 300, and 375 lbs/acre) of N in the form of CAN 17, however the growing season was shorter than anticipated and the total N applied was 60, 135, 195, 255, and 315 lbs N/A. Each rate was split into 10 applications that were made on: June 9, 16, 23, 28, July 8, 15, 22, 29, Aug 4 and 11.

Bell peppers (cultivar Double Up) were transplanted on May 11 with a commercial transplanter set at a 10" within row spacing in a single row on a 40-inch bed. The estimated plant population was 15,750 plants per acre. Plot size was four 40-inch beds x 60' length and each treatment was replicated 4 times in the field in a Randomized Complete Block Design. Only the middle 2 beds were used for data collection and the outer 2 beds served as a buffer zone between N treatments. Weed control consisted of Dual Magnum applied at transplanting and several hand cultivations for the rest of the season. Radiant for thrips and Assail for whitefly management were applied. Whole leaf plant tissue samples (80-60 leaves per plot) were collected on June 23, July 14, August 4, and August 25 and sent to the DANR Laboratory for % Total N analysis. The peppers were hand harvested on August 2 and August 19 and sorted by size, color and defects. *A once-over, destructive harvest was conducted on August 26, but data collection was unreliable and yield results are not shown.* Composite postharvest soil samples were collected from two depths (0-6 and 6-12 inches) from the low, middle and high nitrogen treatments on September 8.

POSTHARVEST Evaluations: Fruit were harvested twice as mature-green fruits (August 2 and August 19) and once as ripening fruit (August 19). The mature-green harvested on Aug 2 corresponded to an early harvest and there were no red fruit on the plants. On August 19 there were good quantities of mature-green and ripening fruit on the plants. A minimum of 30 fruit per field replicate were harvested, placed in plastic bags that were overlapped and placed in plastic crates and transported in an air-conditioned van to the laboratory at UC Davis. Fruit were held at 45°F (7.5°C), covered with plastic sheets to prevent weight loss, while completing evaluations

(completed within 2 days of harvest). Fruit with defects were eliminated and 12 fruit per field rep were used for quality evaluations (weight, firmness, % weight loss, color, pericarp or wall thickness and % dry weight) and another set of 12 fruit per rep were used to determine bruise and crack susceptibility.

For Aug 2 harvest, there was some stickiness due to white fly incursion in the plot. Therefore all peppers were washed with running potable water and stems were trimmed to <0.5cm from the fruit surface. For bruise susceptibility and cracking susceptibility, peppers were submerged in water at 7.5C (45°F) overnight for maximum turgidity and peppers were tested at 7.5°C (45°F).

Postharvest Evaluation Measurements: *Evaluations were performed in the order listed below.*

Harvest #1 Mature-green: Evaluations 1, 2, 3, 4, 5, 7, 8, and 9.
Harvest #2 Mature-green: Evaluations 1, 2, 3, 5, 6, 8, and 9.
Harvest #2 Red fruit: Evaluations 1, 2, and 9.

1. **Fruit weight**
2. **Color (external)** was assessed nondestructively at the midpoint of the fruit using a reflectance colorimeter. The L*a*b* values generated are reported as L* (lightness or darkness), chroma (color intensity) and hue (green color). Hue color value is reported.
3. **Firmness** (3 assessments done in the order listed)
    a. **Firmness score**, a subjective score from 5 to 1, where 5=very firm, 4=firm, 3=moderately firm, 2=moderately soft, and 1=soft.
    b. **Compression test** to measure whole fruit firmness; objective measurements made by pushing a flat plate on the wall of the pepper using a computerized texture analyzer; values will be correlated with the subjective scoring of firmness.
4. **Form or shape.** 5=excellent shape, 4= good, 3=fair, acceptable, 2=poor, 1=very poor, unusable
5. **% weight loss.** Peppers on trays at 45°F for 5 days. Reweigh to calculate % weight loss.
6. **Bruise Susceptibility.** Peppers were at 45°F. A 2cm stainless steel sphere (67g) was dropped through a PVC tube from 1, 2 or 3 feet height. Fruit were marked at each drop. Fruit were scored on a 1 to 5 scale, where 1=no damage, 2=slight, 3=moderate, 4=moderately severe and 5=severe damage. A bruise index was calculated by summation of multiplying the score of the 3 different drops by the height dropped; a minimum score of 6 or a maximum score of 30 could be obtained. After dropping, the peppers were stored 10 days at 45°F and then scored again for damage appearance (1 to 5 scale). See **Figure 1** for scoring scale. *Bruise susceptibility test performed on harvest #2 mature-green fruit only.*
7. **Cracking susceptibility.** Turgid peppers can sometimes crack or split easily when boxes are handled roughly and/or dropped. Measurement was made at 45°F (7.5°C). Individual fruit were dropped through tubes (galvanized stove pipes) onto the blossom end from heights of 1, 2 or 3 feet. Peppers that had visible cracking (either at blossom end, side or stem-end) were scored 1 and peppers with no visible cracking were scored 0. A cracking index was calculated as the sum of the score x drop height; a minimum score of 0 or maximum score of 6 could be obtained. *Crack susceptibility test performed on harvest #1 mature-green fruit only.*
8. **Pericarp wall thickness.** A ring segment cut at the midpoint of the pepper and wall thickness measured with a digital vernier caliper; 2 measurements per ring were averaged.
9. **Dry weight.** 150 g cut rings were accurately weighed to nearest 0.01g and dried in a plastic tray in the freeze dryer. Calculate % dry weight.

Results and Discussion: FIELD Trial

Soil residual nitrogen (preplant and postharvest):

Preplant and postharvest soil sample results for nitrate nitrogen, phosphate, and potassium are shown in Tables 1 and 2. Figures 2a, 2b, and 2c depict the postharvest results in a bar graph, which is visually easier to interpret. Preplant samples revealed very low nitrate nitrogen levels of 4.3 and 5.3 ppm in the top 6 inches and 6-12 inches, respectively. So it was anticipated that the pepper crop should respond to applied nitrogen treatments.

> *According to research conducted by UC Vegetable Crops Specialist Tim Hartz[1]:*
> *"In California vegetable rotations soil residual nitrate-nitrogen (NO3-N) can range from virtually none to enough to completely supply the next crop. In general NO3-N concentration less than 10 PPM suggests limited residual soil N, and normal fertilization practices are appropriate. Concentrations greater than 20 PPM indicate that adequate soil N is present to support crop growth for at least several weeks, and additional N fertilization can be delayed or, in some cases eliminated."*

Postharvest soil samples revealed an upward trend of soil residual nitrogen as applied nitrogen increased. Very little nitrogen remained in the plots where very little nitrogen was applied (5.2 ppm in top 6" and 1.7 ppm at 6-12 inch depth); an indication that the crop used virtually all that was applied, and indeed nitrogen was limiting in the 6-12 inches where root activity is pronounced. Substantially more soil residual nitrogen was left in the field in the plots where high nitrogen rates were applied (30.0 ppm upper and 15.2 ppm lower depth). This serves as an indication that when too much nitrogen is applied, it is not used by the crop and remains in the soil after harvest for subsequent crops or as an environmental risk. The middle rate was in the middle.

Field Trial Table 1: 2011 Preplant Soil Analysis - ppm

Soil Depth	NO3-N	Olsen-P	K
0-6"	4.30	12.1	315
6-12"	5.25	7.15	242

Field Trial Table 2: 2011 Postharvest Soil Analysis - ppm

	Soil Depth	NO3-N	Olsen-P	K
60 lbs N	0-6"	5.22	25.3	365
	6-12"	1.66	12.4	290
195 (225)* lbs N	0-6"	15.23	21.1	317
	6-12"	15.03	14.9	246
315 (350)* lbs N	0-6"	30.03	16.3	322
	6-12"	15.20	12.1	246

***** *<u>Postharvest soil sample comment:</u> A fertilizer application was made after the second pepper pick on August 19th anticipating an August 26th destructive harvest and a possibility that the cropping period would continue. Hence the applied nitrogen was higher than what was applied for the first two harvests. The actual rate is shown in parenthesis. The last crop irrigation was August 25th. Soil samples were collected on September 8, 14 days after the last irrigation.*

Figure 2a.

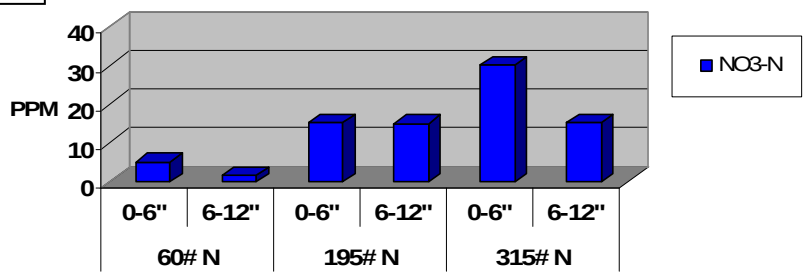


Figure 2b.

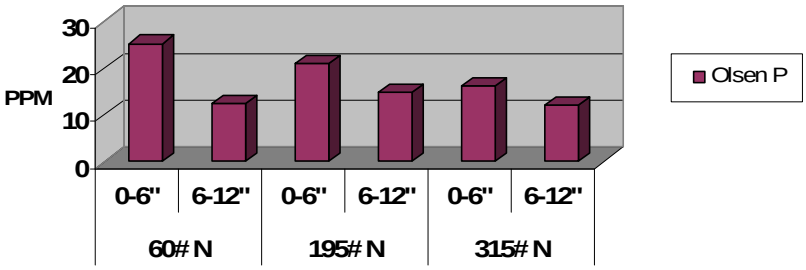
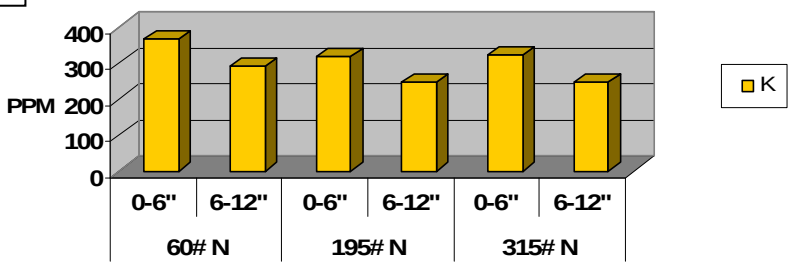


Figure 2c.



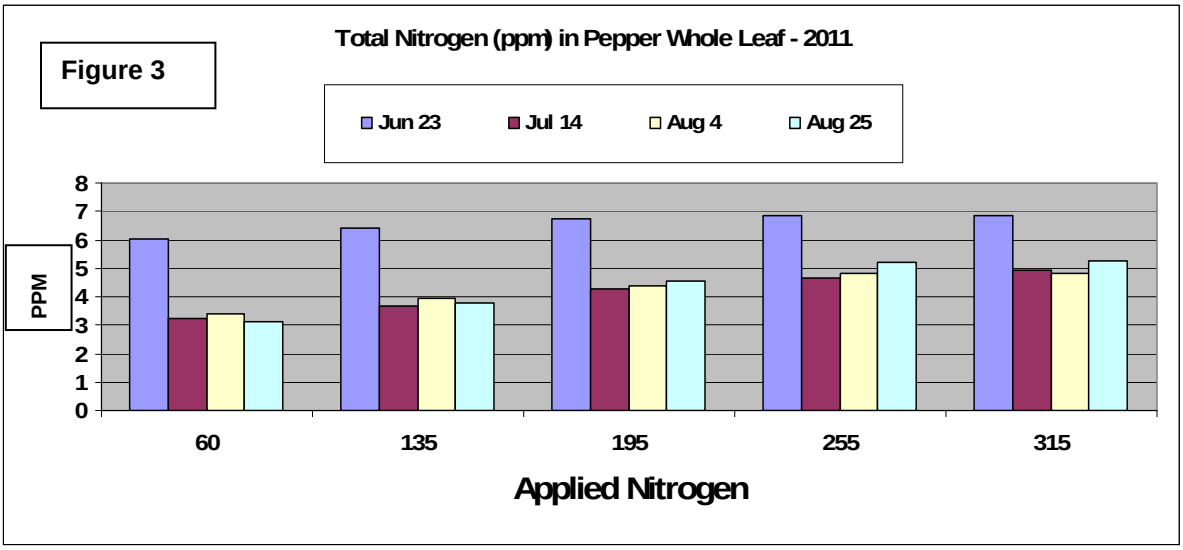
Pepper whole leaf tissue samples: All samples were collected 5-6 days after a fertilizer application and were initiated at first flower (June 23). Results clearly indicate that plots receiving higher amount of nitrogen fertilizer contained higher percentage of total N in their leaves (Table 3 and Figure 3). This trend was consistent in all four sample dates (June 23, July 14, Aug 4, and Aug 25). The highest concentration of nitrogen was found in the first sample date, when all samples contained over 6% total N. On July 14 and Aug 4 the amount of nitrogen ranged from 3.2 to 4.95 percent; on Aug 25 the range expanded from 3.1 to 5.3%.

***** *Whole leaf samples comment: A fertilizer application was made after the second pepper pick on August 19th anticipating an August 26th destructive harvest and a possibility that the cropping period would continue. Hence the applied nitrogen was higher on August 25th than what was applied for the first two pepper harvests. The actual rate is shown in parenthesis in Table 3.*

Field Trial Table 3: The Effect of N-Rates on Pepper Leaf Tissue Samples

	% Total Nitrogen in Whole Leaf Samples* - 2011			
N lbs/A	**June 23**	**July 14**	**Aug 4**	**Aug 25**
60	6.04 c	3.22 d	3.38 d	3.11 d (60)**
135	6.42 b	3.69 c	3.95 c	3.79 c (155)
195	6.74 ab	4.30 b	4.39 b	4.54 b (225)
255	6.84 a	4.66 a	4.81 a	5.19 a (295)
315	(6.83 a	4.95 a	4.80 a	5.27 a (350)
LSD (0.05)***	**0.34**	**0.30**	**0.25**	**0.25**
CV%	3.38	4.61	3.80	3.71

* 80 leaves collected on June 23, 60 leaves collected per plot on other dates x 4 replications
** applied more Nitrogen after second pick ***averages followed by the same letter are not significantly different from each other



Pepper Yield: Pick #1 - Market yield ranged from 5.1 to 12.4 tons/acre (**Table 4 and Figure 4**). Peppers had a positive yield response to applied nitrogen with the two lowest rates yielding less than the three highest rates. There was no difference between the three highest rates in market or total yield. The 2 lowest N rates (60 & 135 lbs) produced more medium size and cull fruit and less extra-large fruit than the three higher nitrogen rates (195, 255 & 315 lbs). The two highest N rates yielded more extra-large fruit. No red fruit was harvested at this pick.

Pick #2 - No extra-large fruit were picked from any plot. The three highest N rates yielded more large fruit and higher market yield than the two lowest N rates. There was no difference between treatments in the amount of red fruit picked.

Both Picks - Marketable yield was predominately green fruit. The two lowest N rates (60 &135 lbs/acre) were insufficient amounts for maximum pepper yield. Although yields were significantly higher than the low N treatments, there was virtually no difference between the 3 high rates except in extra-large fruit production. In this situation the 2 highest rates of applied nitrogen (255 & 315 lbs/acre) produced more extra-large fruit than the 195 lbs/acre rate.

Field Trial Table 4: Effect of N-Rates on Pepper Yield, Fruit Size, Maturity, Culls ***

Pick #1 - August 2, 2011 Pepper YIELD (Tons/Acre)

N lbs/A*	Small	Med	Large	X-L	Culls	Total Pick 1	Market Yield**
60 (50)*	0.61	2.55	2.57	0.00 c	1.40 a	7.12 c	5.12 c
135 (95)	0.37	4.45	3.00	1.04 c	1.45 a	10.30 b	8.48 b
195 (135)	0.61	3.56	5.45	3.44 b	0.17 b	13.23 a	12.45 a
255 (175)	0.27	1.46	5.04	5.94 a	0.15 b	12.86 ab	12.44 a
315 (215)	0.16	1.34	4.85	7.37 a	0.08 b	13.80 a	11.69 a
LSD (0.05)	**NS**	**1.4**	**NS**	**2.2**	**0.6**	**2.9**	**4.8**
CV%	143.6	35.1	39.6	41.0	56.6	16.6	30.8

* number in parenthesis is actual amount of N applied by this harvest date

Pick #2 - August 19, 2011 Pepper YIELD (Tons/Acre)

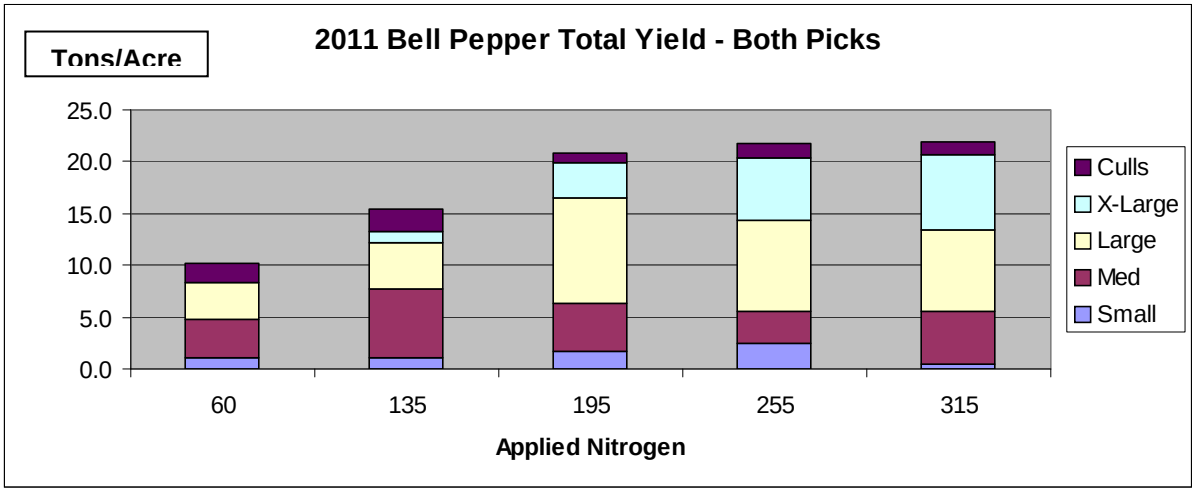
N lbs/A	Small	Med	Large	X-L	Culls	Total Pick 2	Market Yield**	Tons REDS
60	0.42	1.22	0.93 c	0.00	0.56	3.13 b	2.15 c	0.44
135	0.68	2.28	1.45 bc	0.00	0.68	5.10 b	3.74 bc	0.44
195	1.05	1.11	4.73 a	0.00	0.79	7.67 a	5.84 a	0.10
255	2.15	1.74	3.73 a	0.00	1.27	8.88 a	5.47 ab	0.93
315	0.24	3.75	3.03 ab	0.00	1.11	8.13 a	6.79 a	0.15
LSD (0.05)	**0.7**	**2.0**	**1.9**	**NS**	**NS**	**2.0**	**1.9**	**NS**
CV%	49.9	64.5	44.0		44.9	19.9	25.4	92.8

Both Picks - TOTAL Pepper Yield (Tons/Acre)

N lbs/A	Small	Med	Large	X-Large	Culls	TOTAL Yield	Market Yield**	MKT Reds	Market Greens
60	1.03	3.77	3.50 c	0.00 c	1.95 a	10.25 c	7.26 c	0.44	6.83 c
135	1.05	6.73	4.45 bc	1.04 c	2.12 a	15.39 b	12.22 b	0.44	11.78 b
195	1.66	4.67	10.18 a	3.44 b	0.96 b	20.91 a	18.28 a	0.10	18.19 a
255	2.42	3.20	8.77 a	5.94 a	1.41 ab	21.74 a	17.91 a	0.93	16.98 a
315	0.40	5.10	7.89 ab	7.37 a	1.18 b	21.93 a	20.35 a	0.15	20.20 a
LSD (0.05)	**1.1**	**NS**	**3.9**	**2.2**	**0.7**	**4.2**	**3.7**	**NS**	**4.0**
CV%	54.3	36.2	36.9	41.0	31.8	15.0	15.7	92.8	17.6

** Market Yield = Med, Large, X-Large Sizes

*** Averages followed by the same letter are not significantly different (statistically) from each other



Results and Discussion: POSTHARVEST Evaluations

HARVEST 1 MATURE GREEN FRUIT

The nitrogen applied by the time of the first harvest on August 2 was 50, 95, 135, 175, and 215 for the 60, 135, 195, 255, 315 lb N/acre treatments, respectively. There were significant differences in pepper fruit weight at harvest, with the lower N treatments resulting in fruit of less weight (**Table 1**). Fruit weights from the 3 highest N levels were the same (**Table 1**).

Average % dry weight was 5.96% (Table 1) and did not differ among the 5 N treatments. Pericarp wall thickness averaged 6.04mm and was significantly less in fruit from the lower N treatments. Weight loss in peppers stored at 7.5°C (45°F) on open trays averaged 1.12% over a 5 day period (**Table 1**). Fruit from the lowest N treatment had the highest % weight loss while fruits from the 135 lb N treatment had the lowest weight loss, but this follows no trend.

Pepper firmness scores and objective determination of pepper firmness showed there were no differences among the treatments (**Table 2**). Hue (green) color values decreased slightly with increased N level, but these differences were very small. The crack susceptibility indices of peppers from Harvest 1 were the same except for 195 lb N which had a slightly lower crack index (**Table 2**), but again this follows no trend.

Postharvest Table 1. Fruit weight, pericarp thickness and % dry weight of Harvest 1 mature-green peppers in relation to N fertilization. Data are averages of 12 fruit x 4 field reps per treatment except dry weight data which is from duplicate analyses from composite samples per field rep.

N treatment, lbs/A	N applied by this harvest, lbs/A	Fruit wt. grams	% weight loss (5 days at 45°F)	% dry weight	Pericarp thickness, mm
60	50	151.4 c	1.23	5.91	5.24 c
135	95	187.1 b	0.94	5.89	5.87 c
195	135	212.0 a	1.16	5.93	6.22 ab
255	175	216.7 a	1.18	6.12	6.46 a
315	215	219.8 a	1.11	5.94	6.42 a
Average		**197.4**	**1.12**	**5.96**	**6.04**
LSD.05		**20.4**	**0.18**	**ns**	**0.43**

Postharvest Table 2. Firmness score, firmness measurement, and color of peppers Harvest 1 mature-green stage. Data are averages of 12 fruit x 4 field reps per treatment.

N treatment, lbs/A	N applied by this harvest, lbs	Color, Hue value	Fruit form 5=excellent 1=poor	Firmness score 5=hard, 1=soft	Firmness measurement Newtons	Crack Susceptibility Index
60	50	123.1	3.6	4.3	26.6	1.9 ab
135	95	122.4	3.7	4.3	27.8	2.0 bc
195	135	121.5	3.7	4.6	29.0	1.6 a
255	175	121.3	3.6	4.6	29.4	2.0 bc
315	215	120.8	3.4	4.6	29.1	1.9 ab
Average		**121.8**	**3.6**	**4.5**	**28.4**	**1.9**
LSD.05		**1.3**	**ns**	**ns**	**ns**	**0.3**

HARVEST #2 MATURE GREEN FRUIT

In the 2nd harvest, fruit weight was again significantly affected by the lowest N treatment and was not different among the other 4 field N treatments **(Table 3).** Average fruit weight was about 30 g less than in harvest 1. Firmness at harvest varied inconsistently among the field treatments and was very similar to firmness of harvest 1 peppers. Green color of harvest 2 fruits was similar to that of harvest 1 fruits and did not vary among field treatments. The % dry weight was highest in peppers from 225 and 300 lb N. The bruise index in 2011 was determined slightly differently in that a wider range of scores were given to the damage caused to the fruit. There appears to be a trend that the fruit from the lower N treatments were slightly less susceptible to bruise damage than the fruits from plants receiving the highest N inputs, but this was not strong enough to be statistically significant.

Postharvest Table 3. Fruit weight, firmness, color, % dry weight and bruise susceptibility of Harvest #2 mature-green peppers in relation to N fertilization. Data are averages of 12 fruit x 4 field reps except dry weight data which is from duplicate analyses from composite samples per field rep.

N treatment, lbs/A	Fruit wt. grams	Firmness, Newtons	Color Hue value	% dry weight	Bruise index
60	123.1 b	28.4 ab	121.6	6.27 bc	14.8
135	163.3 a	32.5 a	122.2	6.11 c	15.0
195	177.5 a	31.6 a	122.1	6.52 ab	15.7
255	169.1 a	26.0 b	121.7	6.64 a	17.4
315	178.4 a	31.6 a	122.7	6.16 c	17.5
Average	**162.3**	**30.0**	**122.1**	**6.34**	**16.1**
LSD.05	**21.3**	**5.3**	**ns**	**0.32**	**2.9**

HARVEST #2 RED FRUIT

In the red fruit, the lowest N treatment resulted in significantly smaller fruit (**Table 4**), consistent with the green fruit harvest. Red color was similar among all treatments except the low N treatment in which the fruits were not as red (they were more orange-red based on the hue values). As expected the % dry weight of the red peppers was higher than that of mature-green peppers but was not significantly different among the N treatments.

Postharvest Table 4. Firmness score, firmness measurement, and color of peppers Harvest #2 Red stage. Data are averages of 12 fruit x 4 field reps per treatment.

N treatment, lbs/A	Fruit weight, grams	Color, Hue value	% dry weight
60	144.4 c	41.9 b	7.92
135	200.3 b	34.2 a	8.12
195	226.1 a	33.0 a	7.84
255	215.6 ab	31.8 a	8.31
315	229.8 a	33.9 a	8.02
Average	**203.2**	**35.0**	**8.12**
LSD.05	**21.6**	**3.4**	**ns**

Postharvest Figure 1. Scale for scoring bruise susceptibility in 2011.

1 = no damage

2 = slight damage

3 = moderate damage

4 = moderately severe

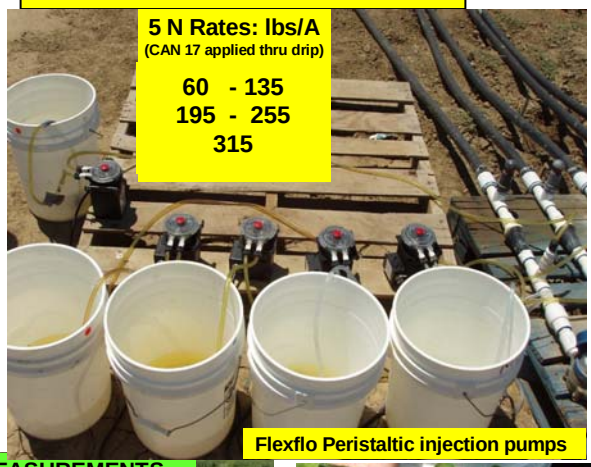
5 = severe damage

Concluding remarks: This field study showed that in nitrogen depleted soil relatively high rates of nitrogen (about 250 lbs per acre) are needed to produce good yields of bell peppers with large and extra large fruit sizes grown with subsurface drip irrigation in the Central Valley's growing conditions. Postharvest evaluations of mature green marketable fruit were inconsistent and indicated that nitrogen content was not necessarily a driving factor. In general there was no difference in form (shape). Green color hues and firmness ratings waffled. Fruit weight, dry weight, and pericarp thickness responded positively to nitrogen. Bruising and cracking differences were noted between the nitrogen treatments, but did not follow a consistent trend. As expected red fruit had higher fresh and dry weights than green fruit, but only fresh weights were affected positively by increasing nitrogen. Red color was similar among all treatments except the low N treatment in which the fruits were orange-red.

Reference: Hartz, T.K. 2007. Soil Testing for Nutrient Availability: Procedures and Interpretation for California Vegetable Crop Production, UC VRIC website, 7pp. http://vric.ucdavis.edu/pdf/Fertilization/fertilization_Soiltestingfornutrientavailability2007.pdf

FIGURE 1.

N-Rate Study - 2011



5 N Rates: lbs/A
(CAN 17 applied thru drip)

60 - 135
195 - 255
315

Flexflo Peristaltic injection pumps

MEASUREMENTS

15' row x 1 40-inch bed

Destructive Harvest
YIELD
Size Grades
Maturity
Quality (culls, sunburn, BER)

MEASUREMENTS

Harvest #1 Mature Green Peppers sampled and analyzed in Postharvest Lab

Postharvest Evaluations

Firmness measurements

Firmness using texture analyzer (control speed of compression)
For peppers use 25mm flat disc as shown in photo and compress peppers 5mm

Report data as
Force to compress; 1 Newton = 9.81 kg-force = 4.5 lb-force

Postharvest Evaluations

Cracking Susceptibility

Peppers scored for visible cracking at the blossom end.

Score 1= none, 2= slight, 3= moderate, 4= moderately severe and 5= severe.

Peppers dropped onto blossom end from heights of 1, 2 or 3 feet

Rings from equator for:
Pericarp thickness
% dry weight

Dried ground sample can be used for sugars or other components