EVALUATION OF THE EFFECT OF FOLIAR APPLIED PLANT GROWTH REGULATORS ON BELL PEPPER YIELDS

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Bill Weir, Ph.D. – University of California
Bob Giampaoli – Live Oak Farms
Mike Marchini – Live Oak Farms
Nathan Sano – Director - California Pepper Commission
Bob Heisey - California Pepper Commission

INTRODUCTION/OBJECTIVES:

To evaluate the effects of three different plant growth regulators on pepper yields and quality.

METHODS AND MATERIALS:

On May 1, 2014, Mike Marchini assisted in selecting a site in a large pepper field for a PGR study. Transplants were established and growing vigorously.

A plot was measured and staked consisting of a five foot bed by 10 feet long for each treatment and replicated four times.

On May 2, 2014, 4.5 mg/plot of Indolebutanoic acid (IBA) were applied by back pack spray to treatment #2, and 4.5 mg/plot were applied to treatment #5. Then, on May 5th, another 4.5 mg/plot of IBA were applied to treatment #5. IBA is a hormone that is effective in root initiation. Plant heights were measured on June 11 and on June 23, 2014.

On June 11, 2014, and June 20, 2014, two applications of Gibberelic acid (GA3) were made to treatment #3 at a rate of 3.0 mg/plot. The purpose of gibberellins is for fruit enlargement.

On July 20, 2014, 1.0 quart of Ethephon was applied to treatment #5 to evaluate its fruit ripening properties.

On August 2, 2014, all plots were harvested and weights recorded. Data were subjected to an ANOVA statistical program to test for significant differences among treatment means.

TREATMENTS:

1. Untreated check
2. Indolebutanoic acid, one application
3. Gibberelic acid, two applications
4. Ethephon
5. Indolebutanoic acid, two applications

Site Location:	Live Oak Farms, Le Grand, CA
Host Crop Variety:	Classic Bell Pepper
Plot Description and Size:	One five foot bed by 10 feet long for each treatment, replicated four times.
Experimental Design:	Randomized complete block

Application Conditions:
FIRST APPLICATION: (IBA)

Date:	May 2, 2014
Time:	8:00 a.m.
Wind:	Calm
Sky:	Clear
Temperature:	68 F

SECOND APPLICATION: (IBA)

Date:	May 5, 2014
Time:	8:00 a.m.
Wind:	Light NW
Sky:	Clear
Temperature:	69 F

FIRST APPLICATION: (GA3)

Date:	June 10, 2014
Time:	7:00 p.m..
Wind:	Calm
Sky:	Clear
Temperature:	80 F

SECOND APPLICATION: (GA3)

Date:	June 20, 2014
Time:	9:00 p.m..
Wind:	Calm
Sky:	Clear
Temperature:	86 F

FIRST APPLICATION (Ethaphon)

Date:	July 20, 2014
Time:	30:00 p.m.
Wind:	Calm
Sky:	Clear
Temperature:	92 F

RANDOMIZATION:

REPS	TREATMENTS				
IV	3	1	2	5	4
III	5	4	1	3	2
II	2	3	4	5	1
I	1	2	3	4	5

ASSESSMENTS:

Pepper yields and quality

RESULTS:

Table 1 shows the relative plant heights on two dates after applications. The Ethephon treated plants were not included in these measurements since the applications were not made until July 20th. The height measurements show that IBA applied once on June 11th and applied twice on June 11TH and June 23rd, resulted in the tallest plants.

The ANOVA in table 2 shows that there were no significant differences among treatment means at the 95% confidence level. Multiple range tests give means for each of the treatments and shows that treatment #2 yielded 1246 – 40 lb boxes per acre, while the untreated control and the Gibberlic acid treatments yielded only 823 and 828 boxes, respectively.

The Ethephon applied two weeks prior to harvest resulted in an average of 20% chocolate and red compared to 1 – 3% in the untreated control.

Although there are large numerical differences between these means, they were not significantly different due to variation of the same treatment weights in various replications. More replications or a better harvesting crew might be beneficial.

Table 1 – Relative heights in inches, of pepper plants on two dates, treated with various PGR's

TREATMENTS:	June 11, 2014				June 23, 2014			
REPS	I	II	III	IV	I	II	III	IV
1. Untreated check	12	9	10.5	9.5	13	14	13	13
2. Indolebutanoic acid, 1X	11	13.5	10	11	15	17	15	14
3. Gibberelic acid	13	12	11	10	13	17	15	16
4. Ethephon	----Not yet applied---							
5. Indolebutanoic acid, 2X	10.5	11.5	13	10.5	14	16	18	17

Table 2 - Multifactor ANOVA – YIELDS

Dependent variable: YIELDS
Factors:
TREATMENTS
REPS

Number of complete cases: 20

This procedure performs a multifactor analysis of variance for YIELDS. It constructs various tests and graphs to determine which factors have a statistically significant effect on YIELDS. It also tests for significant interactions amongst the factors. The F-tests in the ANOVA table will allow you to identify the significant factors. For each significant factor, the Multiple Range Tests will tell you which means are significantly different from which others. The Means Plot and Interaction Plot will help you interpret the significant effects. The Residual Plots will help you judge whether the assumptions underlying the analysis of variance are violated by the data.

Analysis of Variance for YIELDS - Type III Sums of Squares

Source	*Sum of Squares*	*Df*	*Mean Square*	*F-Ratio*	*P-Value*
MAIN EFFECTS					
A:TREATMENTS	529767.	4	132442.	1.05	0.4202
B:REPS	712296.	3	237432.	1.89	0.1850
RESIDUAL	1.50711E6	12	125592.		
TOTAL (CORRECTED)	2.74917E6	19			

All F-ratios are based on the residual mean square error.

The ANOVA table decomposes the variability of YIELDS into contributions due to various factors. Since Type III sums of squares (the default) have been chosen, the contribution of each factor is measured having removed the effects of all other factors. The P-values test the statistical significance of each of the factors. Since no P-values are less than 0.05, none of the factors have a statistically significant effect on YIELDS at the 95.0% confidence level.

Table of Least Squares Means for YIELDS with 95.0% Confidence Intervals

			Stnd.	*Lower*	*Upper*
Level	*Count*	*Mean*	*Error*	*Limit*	*Limit*
GRAND MEAN	20	985.01			
TREATMENTS					
1	4	828.65	177.195	442.574	1214.73
2	4	1246.13	177.195	860.049	1632.2
3	4	823.925	177.195	437.849	1210.0
4	4	1091.53	177.195	705.449	1477.6
5	4	934.825	177.195	548.749	1320.9
REPS					
1	5	821.46	158.488	476.143	1166.78
2	5	1027.16	158.488	681.843	1372.48
3	5	1276.54	158.488	931.223	1621.86
4	5	814.88	158.488	469.563	1160.2

This table shows the mean YIELDS for each level of the factors. It also shows the standard error of each mean, which is a measure of its sampling variability. The rightmost two columns show 95.0% confidence intervals for each of the means.

Multiple Range Tests for YIELDS by TREATMENTS

Method: 95.0 percent LSD

TREATMENTS	*Count*	*LS Mean*	*LS Sigma*	*Homogeneous Groups*
3	4	823.925	177.195	X
1	4	828.65	177.195	X
5	4	934.825	177.195	X
4	4	1091.53	177.195	X
2	4	1246.13	177.195	X

Contrast	*Sig.*	*Difference*	*+/- Limits*
1 - 2		-417.475	545.994
1 - 3		4.725	545.994
1 - 4		-262.875	545.994
1 - 5		-106.175	545.994
2 - 3		422.2	545.994
2 - 4		154.6	545.994
2 - 5		311.3	545.994
3 - 4		-267.6	545.994
3 - 5		-110.9	545.994
4 - 5		156.7	545.994

* denotes a statistically significant difference.

This table applies a multiple comparison procedure to determine which means are significantly different from which others. . There are no statistically significant differences between any pair of means at the 95.0% confidence level. At the top of the page, one homogenous group is identified by a column of X's. Within each column, the levels containing X's form a group of means within which there are no statistically significant differences. The method currently being used to discriminate among the means is Fisher's least significant difference (LSD) procedure. With this method, there is a 5.0% risk of calling each pair of means significantly different when the actual difference equals 0.

May 2, 2014 – First IBA application

May 5, 2014 – Date of second IBA application

June 10, 2014 – Date of first GA3 application

June 1, 2014 –Measuring IBA plant heights

June 11, 2014 – Measuring IBA plant heights

June 23, 2014 – IBA treated, 21 days after treatment. Untreated Check after 21 days

June 23, 2014 - Date of second GA3 treatment

July 20, 2014 – Time of Ethaphon application

Second harvest of pepper plots