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The Effect of Abcissic Acid (VBC-30025) on the Acceleration of Ripening of Bell Pepper[1]

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Introduction

The sale of colored bell peppers has greatly increased in recent years, both in Florida fields and hydroponic greenhouses. Colored bell peppers are very perishable once they begin to mature and turn color. Agents that accelerate the ripening of bell pepper may be useful in improving the quality of the harvested product by taking less time from first color to harvest or by improving the red color of the fruit. This trial was conducted to evaluate various materials, rates, and timings of the application for their effect on acceleration of ripening of bell pepper.

Materials and Methods

This pepper trial was conducted at the University of Florida, North Florida Research and Education Center – Suwannee Valley, near Live Oak FL from 2 April to 23 June, 2004. The greenhouse structure was a stand-alone 30 x 60 ft greenhouse with 7 ft high screened sidewalls and the top was covered with two layers of polyethylene. The area between the two layers was constantly inflated with air. The greenhouse was heated with propane forced-air heaters and cooled with natural ventilation via an open ridge vent at the peak of the greenhouse and the automated to open side-walls.

This trial was designed as a randomized complete block with four replications. Plots were established using six bell pepper plants per plot. 'Brigadier' pepper transplants grown in one-inch Speedling trays were used to establish the trial. The transplants were placed in 3-ft long lay-flat bags filled with perlite. Three plants per bag were planted on 2 April 2004. The plants were grown using standard greenhouse soilless culture (Photo 1) with perlite bags (Florida Greenhouse Vegetable Production Handbook,

Photo 1. Peppers grown in layflat bags of perlite.

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http://edis.ifas.ufl.edu/TOPIC_BOOK_Florida_Greenhouse_Vegetable_Production_Handbook). The plants were not pruned but were supported by a string attached to an overhead cable (Photo 2).

Treatments (Table 1) were applied according to the estimated harvest date for mature (full red color) fruit. The first application date was 26 May 2004 (54 days after transplanting, DAT), approximately 10-14 days before first mature (full red color) fruit. The second application date was 3 June 2004 (61 DAT), when most of the early fruit had 20-30% red color.

Photo 2. String used to support pepper plants to overhead cable.

The target maturity for fruit harvest was full red color development. The harvest dates were 10, 16, and 23 June. Only red fruit (Photo 3) were harvested on June 10 and 16, but on the final harvest (23 June), all large fruit were harvested, red and green.

Harvested fruit were graded by size to US Fancy, US No. 1, or cull and then weighed. After harvests on June 10 and 16, additional postharvest evaluations were made on color. External color was determined with a Minolta Chroma Meter CR—200 (Photo 4). Surface reflectance was measured using CIE color standard values (L*, a*, b*) using a Minolta Chroma Meter CR 2000 Series (Minolta Co., Ltd., Osaka, Japan) on opposite sides of the equator (Exp. 1 only). Illuminant angle was D65 with an 8-mm aperture. The a* and b* values were converted to hue angle and chroma value, where Lightness is 0 = black, 100 = white; hue angle is 0^{o} = red, 45^{o} = orange; chroma value = hue intensity where the higher the value, the more intense the color.

Data were analyzed by analysis of variance and means separation was by Duncan's Multiple Range Test.

Photo 3. Fruit harvest from 10 June 2004.

Results and Discussion

Total US Fancy red fruit yield (Table 2) for the three harvests ranged from 7.5 – 9.6 lbs per plot (6 plants) with no significant difference between treatments. Total US No. 1 red fruit yield for the three harvests ranged from 0.7 – 2.4 lbs/plot with no significant

difference between treatments. No significant differences were found between treatments for Total Cull red fruit or for US Fancy red fruit on the second harvest (16 June).

Photo 4. Using a Minolta Chroma Meter (CR-200) to measure color parameters.

Significant differences were found from the first harvest (10 June) yield data (Photo 5). Highest yield of US Fancy red fruit was found in the two Ethephon treatments. There was no significant difference between the Untreated Check and any of the VBC-30025 treatments for US Fancy red fruit yield on 10 June. The same trend was found for US No. 1 red fruit on 10 June where the Ethephon treatments had significantly higher yields than all other treatments.

Color measurements taken on full-red harvested fruit from 10 and 16 June harvests are reported in Table 3. Color data confirm that excellent color was present on peppers from all treatments and for both harvests. Lightness was almost medium (34-37), hue angle was red (29-31^{o}) and chroma was fairly intense (37-42). Chroma values were slightly higher for peppers from the first harvest. Even though these color values had some significant differences, they were only slight and were not detectable to the naked eye.

Photo 5. Fruits harvested from one plot (replicate 4) of each treatment on 10 June.

Table 1. Treatments applied to bell pepper to evaluate acceleration of ripening of fruit.

Treatments	Concentrations	Application Timing	Application (DAT)[z]
VBC-30025	150 ppm	10-14 days prior to anticipated harvest at red color	54
VBC-30025	150 ppm	20-30% red color	61
VBC-30025	300 ppm	10-14 days prior to anticipated harvest at red color	54
VBC-30025	300 ppm	20-30% red color	61
VBC-30025	150 ppm + 150 ppm	10-14 days prior to anticipated harvest at red color followed by 20-30% color	54 + 61
Ethephon	200 ppm	10-14 days prior to anticipated harvest at red color	54
Ethephon	200 ppm	20-30% red color	61
Untreated Check	water only	10-14 days prior to anticipated harvest at red color followed by 20-30% color	54 + 61

[z] DAT = Number of days after transplanting.

Table 2. Effect of VBC-30025 and Ethephon treatments at various concentrations and timings on the yield and grade of bell pepper.

Treatment	Trtmt. Conc. (ppm)	Application Date[z]	Yield (lbs/6-plants)						
			Early[y] Red Fruit			2nd Harvest[y] Red Fruit	Season Red Fruit		
			Fancy	US #1	Cull	Fancy	Fancy	US #1	Cull
VBC-30025	150	26 May	0.7 bc[w]	0.1 b	0	4.6	8.9	1.5	0.0
VBC-30025	150	3 June	0.8 bc	0.0 b	0	3.4	7.5	2.4	0.3
VBC-30025	300	26 May	0.9 bc	0.0 b	0	5.2	8.8	1.1	0.3
VBC-30025	300	3 June	1.4 b	0.3 b	0	3.4	8.5	1.8	0.2
VBC-30025 + VBC-30025	150 + 150	26 May + 3 June	0.6 c	0.1 b	0	4.8	9.6	0.7	0.2
Ethephon	200	26 May	3.6 a	1.2 a	0	4.0	7.9	2.3	0.3
Ethephon	200	3 June	3.3 a	1.1 a	0	4.4	9.3	2.0	0.7
Untreated Check	0	26 May + 3 June	1.0 bc	0.2 b	0	3.8	8.2	1.2	0.7
Significance[x]			**	**	NS	NS	NS	NS	NS

[z] Application dates were 26 May (54 days after transplanting and approximately 10-14 days prior to anticipated harvest at full red color fruit) and 3 June (61 days after transplanting, when approximately 20-30% of early fruit had red color).

[y] Early fruit yield was from first harvest (10 June), 2nd harvest was from 16 June only.

[x] Treatment effects were significant at 1% (**) probability levels or not significant (NS).

[w] Means are separated by Duncan's multiple range test. Means in a column with the same letter are not significantly different.

Table 3. Effect of VBC-30025 and Ethephon treatments at various concentrations and timings on external color parameters of bell pepper fruit harvest at full-red stage.

Harvest Date	Treatment	Treatment Concentration (ppm)	Treatment Application Date	External Color		
				Lightness	Hue Angle	Chroma Value
June 10	VBC-30025	150	26 May	35.1 b[z]	28.8 b	41.0 a
	VBC-30025	150	3 June	34.9 b	30.7 ab	40.3 ab
	VBC-30025	300	26 May	35.8 ab	30.7 ab	42.5 a
	VBC-30025	300	3 June	35.9 ab	30.6 ab	40.6 ab
	VBC-30025 + VBC-30025	150 + 150	26 May + 3 June	36.7 a	30.9 ab	42.3 a
	Ethephon	200	26 May	34.5 b	29.1 b	38.7 b
	Ethephon	200	3 June	36.7 a	31.5 a	42.0 a
	Untreated Check	0	26 May + 3 June	35.8 ab	29.7 ab	41.9 a
	Significance[y]			**	**	**
June 16	VBC-30025	150	26 May	35.4 a	29.0	39.8 a
	VBC-30025	150	3 June	34.9 abc	30.0	39.0 ab
	VBC-30025	300	26 May	34.8 abc	30.0	39.5 a
	VBC-30025	300	3 June	34.4 bc	29.0	37.6 bc
	VBC-30025 + VBC-30025	150 + 150	26 May + 3 June	35.3 a	30.0	39.6 a
	Ethephon	200	26 May	34.1 c	30.0	35.9 c
	Ethephon	200	3 June	35.0 abc	31.0	37.3 bc
	Untreated Check	0	26 May + 3 June	35.2 ab	30.0	39.7 a
	Significance[y]			*	NS	**

[z] Means are separated by Duncan's multiple range test. Means in a column for each date with the same letter are not significantly different.

[y] Treatment effects were significant at 1% (**) probability levels or not significant (NS).