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Effect of Nitrobenzene on Postharvest Quality of Bell Pepper (*Capsicum annuum* L.) Under Green House Condition

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Abstract

Bell pepper (Capsicum annuum L.) is grown extensively throughout the world. Poor fruit-set as well as loss of reproductive structures due to moisture stress is one of the major barriers to tropical adaptation of bell pepper. Hence, the objective of the present study was to examine the effect of nitrobenzene (flowering stimulant and yield booster) on postharvest quality of bell pepper yield. The study was conducted at a farmer poly tunnel located in Pilimathalawa (WU1), Sri Lanka. The experiment was laid out in a Completely Randomize Design (CRD) with four treatments randomized in three replicates. The treatments were T_1 – Control (with out Nitrobenzene), T_2 – Nitrobenzene 15%, T_3 – Nitrobenzene 20%, T_4 – Nitrobenzene 25%. Plants were established in drip-fertigated bags in the Poly tunnel and standard crop management practices were applied through out the study. Nitrobenzene was sprayed to the seedlings 40, 55, 80 and 105 days after planting. Albert solution, 6: 30: 30 fertilizer mixture 20: 20 fertilizer mixture and $Ca(NO_3)_2$ were used as recommended fertilizers. Measurements were taken on shelf-life in room temperature, shelf-life in refrigerator, weight loss in room temperature and weight loss in refrigerator. The data obtained were tabulated and analyzed subjected to the Analysis of Variance (ANOVA) procedure of Statistical Analysis System (SAS). Duncan's New Multiple Range Test (DNMRT) was performed to compare the differences among treatment means at p=0.05. The highest shelf-life and lowest weight loss were observed in T4, i.e. 25% Nitrobenzene applied treatment. On the other hand the lowest shelf-life as well as highest weight loss were recorded from T3 (20% nitrobenzene), T2 (15% nitrobenzene) and T1 (control of the experiment). Among different treatments tested, 25% nitrobenzene applied plants showed superior results in contrast to other nitrobenzene levels with yield quality as well as postharvest performances under greenhouse condition.

Key words: *Bell pepper, Nitrobenzene, Poly tunnel, Fruit setting, postharvest quality*

Introduction

Bell pepper (*Capsicum annuum* L.) is one of the most important vegetable crops grown extensively throughout the world especially in temperate countries. The crop is very sensitive to environmental factors [2]. The optimum temperature requirement for Bell pepper growth ranged from 16-25^{0}C [3]. When large fruited bell peppers are exposed to environmental stresses during the flowering and fruiting period, abscission of flowers and flower buds may occur [6]. This loss of reproductive structures can result in serious yield decrease, and constitutes a major risk factor in pepper production. Nitrobenzene is a new generation plant energizer and yield booster of low cost PGRs compared to others. Nitrobenzene is quickly absorbed into the plants. It influences the bio chemical pathway of the plants to uptake more nutrients from the soil. It also increases the nutrient use efficiency thus improves the vegetative growth. Induces profuse flowering and helps in the retention of the flowers and fruits [8]. Pointed fruit which develop to a similar size as normal blocky fruit, are probably a result of an imbalance of pepper plant growth regulators (hormones) in the developing fruit [11]. Plant growth regulators are used to modify a crop by changing the rate or pattern, or both, of its response to the internal and external factors that govern development from germination through vegetative growth, reproductive development, maturity, and senescence or aging, as well as postharvest preservation. The regulation of plant growth (other than herbicidal action, which kills the plant) can be useful in numerous ways [7]. Among others, it can regulate the Chemical composition of the plant, enhance plant resistance to pests and environmental factors

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and prevent postharvest spoilage [9]; [10]; [1]; [4]; [12]. Plant growth regulators are organic compounds, other than nutrients, that modify plant physiological processes. It is called bio stimulants or bio inhibitors, act inside plant cells to stimulate or inhibit specific enzymes or enzyme systems and help regulate plant metabolism. They normally are active at very low concentrations in plants [5]. As a further improvement step for greenhouse fruit set of bell pepper, Nitrobenzene can be adopted. Four sprays of nitrobenzene during 40, 55, 80 &105 days after sowing (DAS) improve the yield up to 40 %. Unfortunately, very limited research has been carried out regarding the use of growth regulators on bell pepper varieties in Sri Lanka. Therefore, this research was designed to study the effect of different concentrations of nitrobenzene on postharvest quality of Bell pepper. Furthermore it was expected to assess the most effective nitrobenzene concentration to reduce cost of production in order to improve the profit in commercial growers.

Materials and Methods

Experimental design and treatments

The experiment was laid out in a Completely Randomize Design (CRD) with four treatments randomized in three replicates. The treatments were four different concentrations of Nitrobenzene (%) applied to the seedlings to cover whole aerial parts of the plant as an aqueous spray by using a hand sprayer as given below table i.

Table i. Different concentrations of Nitrobenzene (%) applied to the plants

Treatments	Nitrobenzene levels (%)
T1	Control (without Nitrobenzene)
T2	Nitrobenzene 15%
T3	Nitrobenzene 20%
T4	Nitrobenzene 20%

Planting materials and handling

The study was conducted at a farmer Poly tunnel located in Pilimathalawa (WU1- Wet Zone area in Up country), Sri Lanka. Plants were established in drip-fertigated bags in the Poly tunnel and standard crop management practices were done through out the study. Nitrobenzene was sprayed at the 40, 55, 80 and 105 days after transplanting of seedlings in pots. Albert solution, 6: 30: 30 fertilizer mixture and $Ca(NO_3)_2$ were used as recommended fertilizers.

Measurements

Data were collected at 50, 65, 90 and 115 days after transplanting. Measurements were taken on growth, yield and yield determining parameters with postharvest quality. Bell peppers are harvested at an immature stage when they are in full size and green. Ten fruits were selected randomly from each treatment and kept in normal environmental conditions and at the same time remaining five fruit samples were kept in refrigerator to determine the shelf life (days). At the same time weight loss was recorded at five days intervals by using a digital balance.

Statistical analysis

The data obtained were tabulated and analyzed subjected to the Analysis of variance (ANOVA) procedure of Statistical Analysis System (SAS). Duncan's New Multiple Range Test (DNMRT) was performed to compare the differences among treatment means at p=0.05.Correlation analysis was used to determine the strength of the relationships between measured parameters of Bell pepper.

Results and Discussion

Evaluation of postharvest parameters

The highest shelf life in room temperature and refrigerator was recorded from T4, i.e. 25% Nitrobenzene applied treatment and lowest fruit weight was recorded from T1, i.e. control treatment. According to these results, nitrobenzene can extended the shelf life in room temperature conditions.

The highest weight loss in room temperature was recorded from T1, i.e. control treatment and it has significantly difference among other treatments tested. On the other hand, there was no significant difference ($p>0.05$) among treatments T2, T3, T4, i.e. 15%, 20% and 25% Nitrobenzene. But, according to the mean values of weight loss in room temperature conditions showed 25% nitrobenzene decreased the weight loss of bell pepper and extended the postharvest qualities. There was no significant difference ($p>0.05$) among treatments on weight loss in refrigerator. But, average results show T4, i.e. 25% nitrobenzene applied treatment was decreased the weight loss in refrigerator and extended the postharvest qualities.

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Table ii. Effects of different concentrations of Nitrobenzene on postharvest parameters

Treatment	shelf life in room temperature (days)	shelf life in refrigerator (days)	weight loss in room temperature (g)	weight loss in refrigerator (g)
Control (without Nitrobenzene) (T1)	7.0c	18.2c	72.0a	20.2a
15% Nitrobenzene (T2)	7.6bc	20.0b	68.2b	18.2a
20% Nitrobenzene (T3)	7.8b	20.6ab	67.6b	17.2a
25% Nitrobenzene (T4)	8.6a	21.4a	66.2b	17.2a

Note*:* Means followed by the same letter/s along the column are not significantly different at p=0.05

Correlation analysis

When linear correlation analysis was performed for the overall data set, there was a significant (p=0.05) positive correlation among shelf life of bell pepper fruits.

Table iii. Linear correlation coefficients between Plant Height (PH), Plant Girth (PG), Leaf Area Index (LAI), Number of Flowers per Plant (NFLO), Number of Fruits per Plant (NFUPP), Total yield per Plant (TYLD) and Shelf Life (SL) of Bell pepper.

	PH	PG	LAI	NFLO	NFUPP	TYLD	SL
PH	-						
PG	0.71624**	-					
LAI	-0.08192 ns	0.21027 ns	-				
NFLO	0.61762*	0.87982**	0.35235 ns	-			
NFUPP	0.91320***	0.65674*	0.02409 ns	0.70117*	-		
YYLD	0.75055**	0.87640**	0.28498 ns	0.86007**	0.81251**	-	
SL	0.59750*	0.57419*	0.29882 ns	0.60661*	0.68439*	0.61555*	-

Note: ns- non significant at p=0.05;* significant at p<0.05;** significant at; p<0.01;*** significant at p<0.0001

Conclusion

Results clearly revealed that the application of nitrobenzene had a significant (p<0.05) effect on postharvest parameters of Bell pepper. Among different treatments tested, 25% Nitrobenzene showed an optimum result to ensure the postharvest performance of Bell pepper yield. A long shelf life was observed in T4 i.e. 25% Nitrobenzene applied treatment. Furthermore high Nitrobenzene levels showed a significant positive impact on postharvest quality of Bell pepper with extending the shelf life. Furthermore 25% nitrobenzene applied treatment reduced the weight loss in refrigerator as well as in room temperature with extending the postharvest qualities. In the light of this situation application of 25% Nitrobenzene can be considered as the most effective treatment to enhance postharvest quality of Bell pepper under greenhouse condition.

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