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EFFECT OF EXOGENOUS NAA AND 1-MCP ON REDUCING IMMATURE FRUIT DROP AND ENHANCING THE QUALITY OF YIELD OF BELL PEPPER (CAPSICUM ANNUM L)

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INTRODUCTION

Bell pepper (*Capsicum annum* L) is one of the most intensively grown greenhouse vegetables in Sri Lanka. At present, within Sri Lanka, the crop is most extensively cultivated in the Central province, within an area between 5500 – 6500 sq. meters under protected agriculture, where the yields range from 1.5 – 2 kg per plant (Anon, 2012). An important constraint in the cultivation and popularization of this crop is the high percentage of immature fruit drop (AVRDC, 1986). Research conducted in temperate countries (Yuan and Carbaugh, 2007) have shown that exogenous plant growth regulators i.e. naphthalene acetic acid (NAA) and 1-methylcyclopropene (1- MCP) have helped reducing the fruit drop in bell pepper and also in some other fruits crops. Thus, an experiment was conducted to identify the impact of these two plant growth regulators on immature fruit drop in bell pepper under tropical environmental conditions. The study intended to achieve three specific objectives namely, to (i) ascertain the effect of single or repeated applications of exogenous auxin (naphthalenacetic acid) on fruit drop, (ii) determine the effect of single or repeated applications of ethylene inhibitors (1- methylcyclopropene) on fruit drop, and (iii) evaluate the effect of auxins and ethylene inhibitors on yield and fruit quality.

METHODOLOGY

The experiment was conducted at the Experimental Station of the University of Peradeniya, located at Dodangolla, Kundasale, from July to November 2011, using the bell pepper variety "*Olympus*". Five treatments were imposed at 50 and 70 days after transplanting (DAT) as foliar sprays onto uniform seedlings using a low pressure hand sprayer until the plants were thoroughly wet. A surfactant (*Tween 20*) was mixed at the rate of 0.624 mlL^{-1} to both solutions for the uniform distribution of compounds throughout the chemical. The treatments thus imposed were as; T_1 - No chemical control + water spraying, T_2 – NAA (10ppm) at 50 DAT, T_3 – NAA (10ppm) at 50 + 70 DAT, T_4 – 1-MCP (40ppm) at 50 DAT, T_5 – 1-MCP (40ppm) at 50 + 70 DAT. The treatments were arranged in a completely randomized design (CRD) with three replicates. Management practices such as irrigation, fertilizer application, weeding, pest and disease control, plant training, flower and fruit thinning were done when necessary according to recommendations (Weerakkody *et al.*, 2008). The reproductive growth of plants was measured at the onset of flowering while emergence of new fruit and fruit drop were counted twice a week up to the harvesting fruits. The number of fruits per plant, individual fruit weight and total yield per plant were also recorded while quality of fruits were evaluated in terms of juice pH, Brix value, texture, volume, color, aroma, pungency and sweetness. Except aroma, pungency and sweetness (which were measured qualitatively) all the other parameters were measured quantitatively. Parametric data was analyzed using the statistical software package SAS (Statistical Analysis Software) while mean comparisons between treatments was done using LSD (least significant difference) at $p = 0.05$. Non parametric data was analyzed using the Friedman test in MINITAB 14 at $p = 0.05$.

RESULTS AND DISCUSSION

The application of the two chemicals had no significant ($P > 0.05$) effects on the mean fruit drop and cumulative fruit drop. However, overall reduction in fruit drop with dual applications of hormones was apparent (Figure 1). Dual application of 1-MCP showed a greater reduction in fruit drop (35%) than similar applications of NAA. Dual application of 1-MCP showed a positive impact on fruit emergence. However, dry environmental conditions that prevailed could have attributed to reduced fruit set (data not presented) and increased fruit abscission as reported by Huberman *et al.*, (1997).

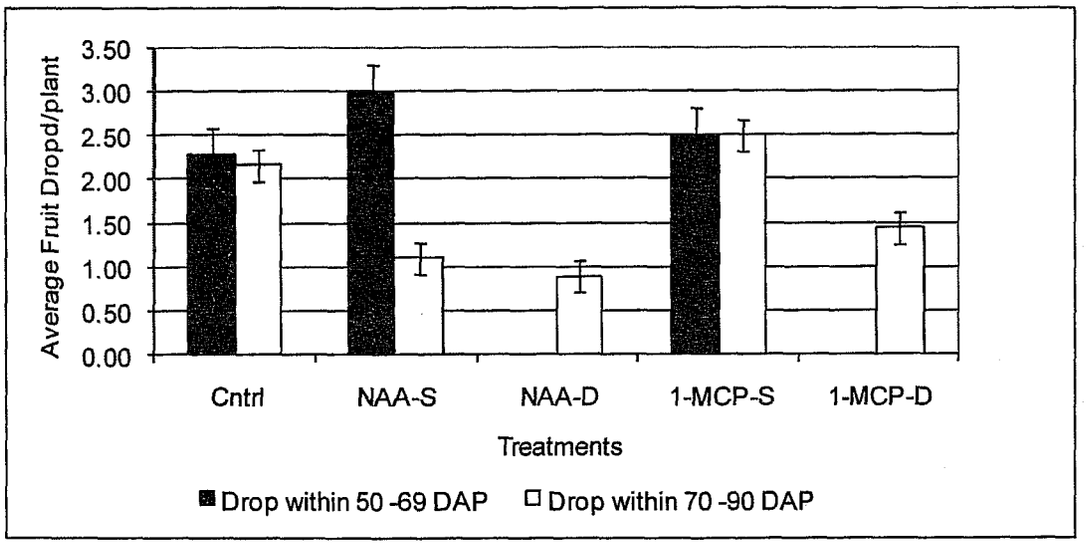

Figure 1: Impact of growth regulators on mean fruit drop in bell pepper at two intervals

Dual application of 1-MCP induced the highest number of fruits per plant while it also reduced the individual weight of fruits (Table 1). It is clear that dual application of 1-MCP resulted in smaller fruits being formed while increasing the number of fruits per plant. Hence, the highest total yield per plant was also recorded in plants sprayed with repeated applications of 1-MCP which agrees to some extent with the finding of Sridhar *et al.*, (2009) who illustrated greater benefits of repeated applications of ethylene inhibitors on increasing fruit yields in bell pepper.

Table 1: Impact of growth regulators on fruit numbers, yields and quality parameters in bell pepper fruits

Parameter	Control	NAA-S	NAA-D	1-MCP-S	1-MCP-D
Fruits per plant	2.83^{a}	2.83^{a}	2.56^{a}	2.56^{a}	3.72^{a}
Weight of fruits (g)	162.04^{a}	164.08^{a}	155.69^{a}	174.69^{a}	153.81^{a}
Yield per plant (g)	462.58^{a}	477.71^{a}	430.98^{a}	456.82^{a}	586.03^{a}
Juice pH	5.33^{a}	5.48^{a}	5.26^{a}	5.36^{a}	5.20^{a}
Brix value	4.8^{b}	4.73^{b}	6.27^{ab}	5.27^{ab}	7.57^{a}
Texture (kg)	2.83^{a}	2.75^{a}	2.58^{a}	3.24^{a}	2.71^{a}
Volume (cm^3)	268.67^{a}	273.67^{a}	279.33^{a}	316.33^{a}	292^{a}
Color (a* value)	0.38^{a}	0.41^{a}	0.37^{a}	0.41^{a}	0.44^{a}

Note: Mean values with the same letter in a raw are not significantly different.

Except for the total soluble solid content, all other quality parameters were not statistically significant ($P > 0.05$) even though variations were observed between plants sprayed with single and repeated application of NAA and 1-MCP (Table 1). The data of the sensory evaluation (data not presented) on aroma, pungency and sweetness did not show any clear variations due to hormonal application.

CONCLUSIONS AND RECOMMENDATIONS

The duel application of 1-MCP increased the quality of fruits in terms of total soluble solids as it increased the brix value, which is indicative of the quality of fresh fruits and vegetables. Even though the other parameters used to evaluate the influence of NAA and 1-MCP on fruit drop and fruit quality of bell pepper were not statistically significant different among treatments apparent changes due to the application of these plant growth hormones were evident. This could be due to the stressful environmental conditions imposed on plants due to high temperature and low humidity levels which could have hindered the natural growth of the bell pepper plants along with the enhanced spread for pests and diseases. Hence, better control of environmental conditions such as temperature, needs to be adopted to further clarify the influence of these two plant growth regulators on reducing fruit drop and enhancing fruit quality in bell pepper as trends of their effectiveness were apparent.

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