Influence of Plant Growth Regulators on Growth and Yield of Chilli (*Capsicum annuum* L.)

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INTRODUCTION

Chilli is one of the most important cash crops grown in Sri Lanka. The extent cultivated with chilli in Sri Lanka is about 15,267 ha in 2016. Though the potential yield of green chilli is approximately $15x10^3$ kg/ha, the national average yield is only about 4740 kg/ha in 2016 (AgStat, 2017). Adoption of poor pest and disease controlling methods, non-adoption of good agronomic practices and poor management of soil abiotic and biotic stresses are the key factors affecting productivity of chilli.

Plant Growth Regulators (PGRs) are organic compounds that modify plant physiological processes and they are called as bio-stimulants or bio-inhibitors. The importance of PGRs was first recognized in 1930s. The PGRs act on plant cells to stimulate or inhibit specific enzymes or enzyme systems and help to regulate plant metabolism and hence are used to modify crop growth rate and growth pattern during various stages of development and they can influence quality and safety as well. They normally are active at very low concentrations in plants (Harms and Oplinger, 1914).

Gibberellic Acid (GA_3) and Naphthalene Acetic Acid (NAA) are two PGRs used in commercial horticulture to improve plant growth and yields. These PGRs enable greater photosynthesis and plant metabolism, allow the production of bigger leaves, and bigger root system, increase cell growth in stems, leaves and roots. GA_3 can increase crop yields and used to help plants suffering from nutrient and growth deficiencies. The objective of this study was to find out the effect of PGRs on growth and yield of chilli.

MATERIALS AND METHODS

The experiment was conducted during *Maha* 2015/16 at the research fields of the Field Crops Research and Development Institute, Maha-Iluppallama ($8^0$06' 42.73" N and $80^0$28' 03.27" E, Elevation 117 m above mean sea level), located in the North Central province (DL1b agro-ecological region) of Sri Lanka. The soil type of the tested location is classified as Reddish Brown Earths (local) or Typic Rhodustalfs (USDA soil Taxonomy) or Rhodic Otherieutic Cutanic Luvisols (FAO classification) (Mapa *et al.,* 2010).

***** Short Communication***

Plots with 4.8 m by 2.7 m were arranged in a randomized Complete Block Design (RCBD) and treatments were replicated three times with the objective of investigating the effect of a selected PGR on growth and yield chilli Hybrid MICHHy 1. GA_3 (T1 – T4 treatments) used for the study was 90% analytical grade and the commercial product (T5 - T8 treatments) comprised of 10% GA3, 6% Ca and 2% B.

Treatments were; T1 - 50 ppm GA_3 at 30 and 45 days from planting, T2 - 50 ppm GA_3 at flower initiation stage, T3 - 100 ppm GA_3 at 30 and 45 days from planting, T4 - 100 ppm GA_3 at flower initiation stage, T5 - 50 ppm commercial product at 30 and 45 days from planting, T6 - 50 ppm commercial product at flower initiation stage, T7 - 100 ppm commercial product at 30 and 45 days from planting, T8 - 100 ppm commercial product at flower initiation stage, T9 - 20 ppm NAA at 30 and 45 days from planting, T10 - 20 ppm NAA at flower initiation stage, T11- 30 ppm NAA at 30 and 45 days from planting, T12 - 30 ppm NAA at flower initiation stage, T13 - Control (water spray at 30 and 45 days from planting) and T 14 - Control (water spray at flower initiation stage).

Land preparation, fertilizer application, organic matter applications were done as recommended by the Department of Agriculture. Thirty days old seedlings, raised on standard field nurseries, were planted in plots at a spacing of 60 x 45 cm. Only one plant was kept in one hill. Treatments were applied as described. Data on plant height, canopy width, number of pods per plant, dry chilli yield, leaf area and shoot and root dry weight at 75 days after planting were recorded. Analysis of variance (ANOVA) was carried out using the Statistical Analysis System (SAS institute Inc.). Mean separation was performed using Duncans' Multiple Range Test.

RESULTS AND DISCUSSION

Shoot dry weight and the leaf area significantly increased with the application of GA_3 and the commercial product than the plants sprayed with NAA and water (Table 1). The results of the present study on plant growth parameters were comparable with several past studies. Emongor (2007) reported that GA_3 induced increase in cowpea vegetative growth, yield components and yield. Application of GA_3 at flowering stage increased the growth of chilli (Natesh *et al.,* 2005).

Although several authors reported that application of NAA increased the growth, dry matter and yield in cowpea, green gram, black gram and chilli (Ullah *et al.,* 2007; Rajesh *et al.,* 2015; Natesh *et al.,* 2005) the effect of NAA on the growth

parameters was not shown in the present study. The applied concentration may not adequate to show an effect.

Table 1. Effect of plant growth regulators and time of application on yield and growth of chilli

Treatment	Yield (t/ha)	Leaf area (g)	Leaves dry weight (g)	Shoot dry weight (g)	Root dry weight
T1	12.08 ^{dc}	2898.5 ^{bcde}	9.6 ^{a}	19.81 ^{cdef}	5.98 ^{a}
T2	16.31 ^{abc}	3858.0 ^{ab}	15.58 ^{a}	28.83 ^{ab}	6.3 ^{a}
T3	10.35 ^{d}	3679.0 ^{abc}	11.01 ^{a}	24.34 ^{bcd}	6.23 ^{a}
T4	15.19 ^{abc}	3123.5 ^{bcd}	12.08 ^{a}	25.27 ^{bc}	6.53 ^{a}
T5	12.34 ^{bdc}	2761.5 ^{bcdef}	10.28 ^{a}	17.75 ^{cdef}	6.52 ^{a}
T6	17.86 ^{a}	3545.0 ^{bc}	14.62 ^{a}	18.2 ^{cdef}	6.81 ^{a}
T7	12.06 ^{dc}	4841.0 ^{a}	15.02 ^{a}	34.42 ^{a}	8.07 ^{a}
T8	15.77 ^{abc}	2405.5 ^{cdef}	14.64 ^{a}	23.37 ^{bcde}	6.86 ^{a}
T9	17.64 ^{a}	1720.5 ^{ef}	8.93 ^{a}	15.72 ^{ef}	4.96 ^{a}
T10	16.01 ^{a}	1525.0 ^{f}	9.17 ^{a}	12.01 ^{f}	4.57 ^{a}
T11	14.91 ^{abc}	2205.5 ^{def}	7.61 ^{a}	16.09 ^{def}	4.48 ^{a}
T12	18.41 ^{a}	2075.5 ^{def}	18.89 ^{a}	15.4 ^{ef}	8.45 ^{a}
T13	16.05 ^{abc}	1696.0 ^{ef}	12.43 ^{a}	11.47 ^{f}	6.21 ^{a}
T14	17.41 ^{a}	1749.5 ^{ef}	12.85 ^{a}	13.22 ^{f}	7.12 ^{a}
CV%	13.03	20.27	53.42	17.99	40.70

Means with same letters in same column are not significantly different at p = 0.05

Note : T1 - 50 ppm GA3 at 30 and 45 days from planting, T2 - 50 ppm GA3 at flower initiation stage, T3 - 100 ppm GA3 at 30 and 45 days from planting, T4 - 100 ppm GA3 at flower initiation stage, T5 - 50 ppm commercial product at 30 and 45 days from planting, T6 - 50 ppm commercial product at flower initiation stage, T7 - 100 ppm commercial product at 30 and 45 days from planting, T8 - 100 ppm commercial product at flower initiation stage, T9 - 20 ppm NAA at 30 and 45 days from planting, T10 - 20 ppm NAA at flower initiation stage, T11- 30 ppm NAA at 30 and 45 days from planting, T12 - 30 ppm NAA at flower initiation stage, T13 - Control (water spray at 30 and 45 days from planting) and T14 - Control (water spray at flower initiation stage)

Yield was significantly lower with the application of GA_3 and the commercial product. That indicates the plant is converting to vegetative phase producing more leaves and branches sacrificing the reproductive phase with the effect of GA_3. Application of GA_3 at 45 days after planting is not suitable since the plant is in the reproductive phase at that time.

Application of GA_3 one time did not affect the yield but significantly increased the growth of the plants than the control treatments. The positive effect on growth from GA_3 and the commercial product was not shown by the yield. The nutrients supplied for the plants may not be adequate for increased vegetative growth and yield increment.

CONCLUSIONS

Growth of chilli significantly increased with the application of GA_3 and GA_3 containing commercial product whereas the yield was significantly reduced with application of these products. Application of GA_3 for chilli is not suitable after flower initiation. Effect of NAA in used concentrations was not shown by the growth and yield of chilli.

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