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Effects of foliar applications of different growth promoting substances on growth and yield of Bitter gourd (*Momordica charantia* L.)

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Abstract: An experiment was conducted to investigate the influence of different growth promoting substances on growth and yield of bitter gourd. Experiment was laid out in a randomized complete block design (RCBD) with four replications. Different foliar sprays viz. T1- Effective Microorganism (EM), T2- Cow urine, T3- Commercial growth promoting substance (Boom flower) and T4- Water (control) were tested. Highest values for average vine length (175.4 cm) and vine weight (40.9 g) were recorded in T3 and lowest male: female flower ratio (7:1) was obtained in T1. Maximum fruit length (29.9 cm) and fruit weight (158.1 g) were recorded in T1. The results revealed that application of EM is one of the ways to increase the yield of bitter gourd.

Keywords: Bitter gourd, foliar application, phyllosphere, yield

Introduction

Bitter gourd (*Momordica charantia* L.) is an important functional food crop grown in low and mid country during both *Maha* and *Yala* seasons in Sri Lanka. Bitter gourd is eaten as a vegetable and it has been successfully grown in elevation from mean sea level to about 1200 m in Sri Lanka. It has the highest nutritive values especially ascorbic acid and iron (Behera, 2004). It also has a compound known as charatin which is used in the treatment of diabetes to lower blood sugar levels (Shetty *et al*., 2005). In cucurbits male flowers are found to bloom at the lower nodes and female flowers appear a week later and never bloom first before the male flowers (Sumpoudlek and Abella, 1974). As a crop bitter gourd has a number of problems viz. low seed germination, small and "D" shaped fruit, low yield, non-synchronous flowering and diseases (Sikder, 2004).Use of plant growth regulators (PGRs) may be a useful alternative to increase the crop production. Globally PGRs have been used widely in crop production as it has significant positive effect on crop production. PGRs are being used to enhance the yield (Nickell, 1982).

EM is a certain harmonious grouping of three basic components such as photosynthetic bacteria, lactic acid bacteria, and yeasts. EM helps to increase the overall vigor and species diversity of the beneficial micro flora in the soil or whatever environment where EM is applied. Use of EM has spread to millions of households and thousands of farms around the world. Cow urine is a biological excretory product which being an antioxidant and a bio enhancer, increases the production of antibiotics and promotes healing processes. It gives hormones, enzymes, mineral salts, amino acids and also enriched in cytokines. Boom flower is a commercial product. It has been used as plant growth regulator and booster. It induces profuse flowering and helps in the retention of flower and fruits. No systematic study has been carried out to test the effect of these growth regulators on growth and yield of bitter gourd. Hence the present study was undertaken to find out the effect of foliar application of different growth promoting substances on growth and yield of bitter gourd.

Materials and Methods

The experiment was carried out at crop farm, Eastern University, Sri Lanka. The field is located in the latitude of 7° 43' N and the longitude of 81° 42' E. It belongs to the agro- ecological region of low country dry zone in Sri Lanka. The mean annual rainfall ranges from 1400 mm to 1680 mm and temperature varies from 30° to 32° C. The soil type is sandy regosol. The bitter gourd (*Momordica charantia* L.) variety Thirunelveli white was planted. The experiment was laid out in a randomized complete block design (RCBD) and treatments were replicated four times. Plants were raised in a pandal system, having 2.5m × 1.5m dimensions. Foliar sprays used viz. EM (T1), cow urine (T2), boom flower (T3) and water as control (T4). All the foliar solutions were diluted 10 times. Diluted EM, cow urine, boom flower and water (control) were applied at 30 and 60 days after planting (DAP). Fertilizers such as Urea, Triple Superphosphate and Muriate of Potash were applied at the rate of 225, 200 and 180 kg/ha respectively. All other management practices were done as recommended by the department of agriculture. Five vines were selected randomly from each plant at 45 DAP for the measurements of vine length and fresh weight of vine. The fruits were picked at 5 days interval. The parameters such as average length of vine, dry weight of vine, male: female flower ratio, length and fresh weight of fruits were measured. Data were analyzed by using SAS version 9.1 and treatment comparisons were performed by using Turkey's test at 5% significant level.

Results and Discussion

Length and weight of vine

Application of different foliar sprays had a significant ($p<0.05$) influence on average vine length and weight (Tab.1). Boom flower application produced highest vine length and weight of 175.4 cm and 40.9 g respectively compared to control (127.5 cm and 17.4 g respectively). Plant height increment was due to cell division, cell expansion and cell elongation. EM could significantly enhance the growth, yield and quality of crops (Higa and Wididana, 1991). EM treatment of Le Conte pear tree had significantly increased the vegetative growth, the number of current shoot/main branch, shoot length and diameter and leaf area (Abd-E1-Messeih *et al.*, 2005). Commercial Boom flower consists of 2.2 % (w/v) of nitrogen. Boom flower has been used in crop production as energizer and yield booster. Application of boom flower quickly enters into the plant and changes the bio chemical pathways of plant to uptake more nutrient from the soil. It could be attributed to higher values of vine length and weight.

Tab.1: Effect of different growth promoting substances on average vine length and weight of bitter gourd

Treatments	Length of vine (cm)	Weight of vine (g)
T1	144.1 ^{c}	30.5 ^{b}
T2	152.6 ^{b}	34.7 ^{b}
T3	175.4 ^{a}	40.9^{a}
T4	127.5 ^{c}	17.4 ^{c}
F- test	*	*

*= Significant at 5% level of probability. Mean values in a column having the dissimilar letters indicate significant differences at 5% level.

Length and weight of fruits

Application of EM, Cow urine and Boom flower had effect on length and weight of fruit compared to control treatment (Tab.2). Significant ($p<0.05$) increase in fruit length and weight was observed in EM application compared to other treatments. Application of EM had produced highest fruit length (29.9 cm) and fruit weight (158 g) than other treatments. Shortest length (12.4 cm) and lowest weight of fruit (65.7 g) were obtained in control (Tab.2).

Tab.2: Effect of different growth promoting substances on average fruit length and weight of bitter gourd

Treatments	Length of fruit (cm)	Weight of fruit (g)
T1	29.9 ^{a}	158.1 ^{a}
T2	17.1 ^{b}	97.3 ^{b}
T3	14.5 ^{c}	86.4 ^{c}
T4	12.4 ^{d}	65.7 ^{d}
F- test	*	*

*= Significant at 5% level of probability. Mean values in a column having the dissimilar letters indicate significant differences at 5% level.

Auxins and a number of plant growth regulators are known to cause physiological modifications in plants mainly on flowering behavior, sex ratio, increased fruit set, enlargement and development of fruits, and source-sink relation. Growth regulators bring certain changes in metabolism during fruit and seed development. This might have caused greater accumulation of food reserves resulting in higher yield (Gedam *et al*., 1998; Rafeekher *et al*., 2002). Foliar application of N-fixing microorganisms to the phyllosphere of crop plants markedly increased their yield (Sen Gupta *et al*., 1982a; Sen Gupta *et al*., 1982b).

Male: female flower ratio

Influence of different growth promoting substances on male: female flower ratio is given in fig.1. The ratio was lower when the plants were treated with EM spray (7:1) and followed by plants treated with boom flower (8:1). The highest ratio (20:1) was recorded in control treatment.

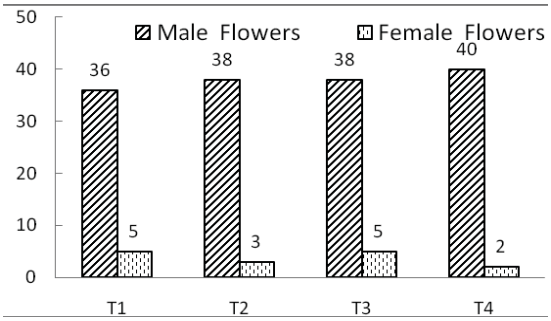

Fig. 1: Effect of different foliar applications on male: female flower ratio of bitter gourd

Application of growth promoting substances had influenced on the ratio of male and female flowers. Application of EM improves crop growth and yield by increasing photosynthesis, producing bioactive substances such as hormones and enzymes, controlling soil diseases and accelerating decomposition of lignin materials in the soil (Higa, 2000). Iwahori *et al*. (1970) reported that several growth regulators such as ethrel ethylene had enhanced female sex expression in cucurbits. Surendranath and Rao (1981) stated that the ratio of male and female flowers is determined by a balance of auxin and gibberellin; the balance in favour of auxin resulting in the formation of female and the latter of male flowers. It is suggested that certain microorganisms in EM culture including photosynthetic bacteria and N-fixing bacteria can enhance the plants' photosynthetic rate and efficiency, and N-fixing capacity as well (Pati and Chandra, 1981).

Conclusion

From the results, it is suggested that boom flower spray had significant effect on length and weight of the vine. Though, application of EM markedly increased the fruit weight and number of female flower compared to other growth promoting substances. These benefits may be achieved via changes in metabolisms during fruit setting and development. However, further studies are needed in order to confirm the effect of application of EM solution on bitter gourd.

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