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IMPACT OF FOLIAR APPLICATION OF MORINGA LEAF EXTRACT ON YIELD AND QUALITY ATTRIBUTES OF CHILLI (Capsicum annuum L.) CV. MIPC-01

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Abstract *A pot experiment was carried out at the Crop Farm, Eastern University of Sri Lanka, from January to May 2019 to evaluate the impact of Moringaoleifera leaf extract (MLE) on yield and quality attributes of chilli (Capsicum annuum L.) var. MIPC-01. MLE is considered as a natural plant growth enhancer. Because it contains appreciable amounts of plant growth regulators such as cytokinin in the form of zeatin, antioxidants, proteins, β- carotene, vitamin C and phenols, and had a remarkable effect on yield in many plants such as onions, bell pepper, soybean, sorghum, coffee, tea, chilli, melon and maize. The experiment was laid out in a Completely Randomized Design with seven replicates and seven treatments. The treatments were (T0) control (Distilled water), T1, T3 and T5 - 10, 20 and 30% MLE application was in once a week whereas T2, T4 and T6 - 10, 20 and 30% MLE application was once in two weeks interval. Young moringa leaves and the tender parts were shade dried for four days and made into powder. Then the powdered material was used for the preparation of MLE. Stock solution (100% MLE) was prepared and refrigerated and then, the different concentrations were prepared by adding distilled water on volume basis. Foliar application of MLE was commenced at 2 weeks after transplanting (WAT) and continued until pod formation. For once in a week and once in two weeks, the plants were sprayed with MLE eight and four times respectively. At each time, the plant was sprayed with 25 ml of MLE. The results suggest that foliar application of MLE at 10% in one week interval had significant ($p<0.05$) effects on the number of pods/ plant, number of seeds/pod, length of the pod, total yield/plant, leaf chlorophyll content, total soluble solid content over the control. Therefore, it was concluded that MLE is helpful in improving yield and quality attributes of chilli and MLE at 10% at one week interval is recommended for improving the yield and quality of chilli. Application of MLE is the cheapest, environmental friendly and low-cost technology for enhancing yield in chilli.*

Keywords *Moringa Leaf Extract, Foliar application, Chilli, Yield*

INTRODUCTION

Chilli (*Capsicum annum*L.) belongs to the family Solanaceae and it is one of the most important spices cultivated for its fruits. They are widely used as both green and ripe dried form for its pungency. It is mainly used as a vegetable and also a condiment but the topmost use of chilli throughout the world is as a spice due to its pungency and pleasant flavor. Chilli is one of the most essential cash crops grown in Sri Lanka and it has become a vital ingredient in Sri Lankan meals. Plant nutrients can be applied by soil and foliar methods to providethe required macro and micronutrients. The foliar application of nutrients is more useful than soil application as it can be utilized by plants efficiently. Studies have indicated that the usage of moringa leaf extract (MLE) is a profitable technique to increase the yield through eco-friendly way.MLE is a plant bio-stimulant and has high antioxidant activity. It is a rich source of plant secondary metabolites, osmoprotectants, amino acid, K, Ca, Fe, ascorbate and growth-regulating hormones

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such as zeatin (a cytokinin) (Hussain et al., 2013). Therefore, it has the potential to use as a foliar spray. According to the research findings MLE causes more and larger fruits, and increased yield by 20 and 35% due to the effect of cytokinin in onions, bell pepper, soya, maize, sorghum and melon. Moringais one of the best alternatives to inorganic fertilizers and has an effect on the yield and quality of crops and thus its application can be promoted among farmers. Keeping view of the above, this investigation was carried out to determine the impact of foliar application of different concentrations and application frequencies of Moringa (*Moringaoleifera*) Leaf Extract (MLE) as a foliar application with recommended fertilizer on yield and quality attributes of chilli (Capsicum annuum L.) cv. MIPC-01.

MATERIALS AND METHODS

A pot experiment was carried out in the Crop Farm of Eastern University, Sri Lanka (latitude of 70 43'N and the longitude of 810 42'E) during the period from January to May 2019 to study the impact of foliar application of MLE on yield and quality attributes of chilli. This experiment was laid out in a Completely Randomized Design (CRD) with seven treatments and seven replicates. The treatments were; T0 - control (Distilled water),T1 - 10% MLE at once a week interval, T2 - 10% MLE at once in two weeks interval, T3 - 20% MLE at once a week interval, T4 - 20% MLE at once in two weeks interval, T5-30% MLE at once a week interval and T6 - 30% MLE at once in two weeks interval. The potting media was prepared using topsoil: sand: compost at 1:1:1. The dimension of a polythene bag was 30 cm x 50 cm. The bags were filled with the potting mixture leaving half- inch at the top to hold the water. Thirty days-old seedlings were transplanted from nursery to each poly bags. Fertilizer application and agronomic practices were carried out according to the recommendationby the Department of Agriculture. Foliar application of MLE was started at 2 weeks after transplanting and continued until to pod formation and at each time, plant was sprayed with 25 ml of MLE. The data were statistically analysed using statistical software SAS 9.4 and the mean comparison within treatments was performed by Duncan Multiple Range Test (DMRT) at 5 % significant level.

RESULTS AND DISCUSSION

NUMBER OF PODS/PLANT

At harvest, foliar application of 10% MLE at one week interval significantly ($p<0.05$) influenced the increased mean number of pods/plant when compared to the control (T0) (Table 1). The highest number of pods/plant was observed in T1 (26.0) followed by T4 (20.0) and the lowest number of pods/plant was recorded in T0 (3.0). Therefore, MLE at 10% concentration at one week interval was the most effective treatment. This might be due to the presence of cytokinin in MLE which is helpful in increasing number of pods/plant.These results are corroborated with research findings of Ogbuehi and Agbim (2018) who reported that the application of 10% MLE increased the number of pods of soybean.

NUMBER OF SEEDS/POD

At harvest, number of seeds/podwas significantly ($p<0.05$ affected by the foliar application of MLE 10% at weekly intervals (Table 1). Maximum number of seeds/pod was recorded in T1 (89.0) and theminimum number of seeds/pod was observed in control treatment (68.50). The treatment T2 was on par with T3, T4 and T5. Therefore, it is clear that the application of MLE improved the number of seeds/pod. This is in agreement with the findings of Afzal and Iqbal (2015) who reported that 2% MLE increased the number of grains per spike in wheat.

LENGTH OF PODS

At harvest, the length of pods exhibited a significant difference ($p<0.05$) among the treatments

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(Table 1). At harvest, the maximum length of pods was observed in T1 (8.35cm) followed by T2 (6.80cm) and T6 (6.65 cm) while the minimum length was observed in T0 (5.0cm). The response was similar at T3, T4, T5 and T6. Application of MLE at the rate of 10% at weekly interval increased the average length of pods compared to control. This might be due to the presence of cytokinin and gibberellic acid in the leaves. This is in agreement with the findings of Makkar*et al.* (2007) who reported that cytokinin and gibberellic acid present in the leaves led to the production of larger fruits.

TOTAL YIELD PER PLANT

There was a remarkable variation ($p<0.05$) on total yield/plant by the foliar application of MLE 10% at weekly intervals (Table 1) and the highest yield was recorded in T1 (113.45g/plant) followed by T6 (68.60g/plant) and T4 (62.27g/plant) (Table 1). The minimum yield was noticed from T0 (9.49g/plant). Thissignificant increment in yield might be due to the presence of zeatin which improves crop yield and quality. This finding is in consistent with the Mvumi*et al*. (2013) in maize, onions and tomato. Foliar application of MLE caused a remarkable increase in plant yield between 20 and 35% was reported by Foidl*et al*. (2001). Leaves are rich source of nutrients such as ascorbate, carotenoids, phenols, K, Zn and Ca which enhances the translocation of carbohydrate from the source (leaves) to sink (storage organ).

LEAF CHLOROPHYLL CONTENT

At harvest, the maximum chlorophyll content was observed in T1 (70.60) and the minimum chlorophyll content was recorded in T0 (46.45) (Table 1). Hence, there is a significant increment of chlorophyll content by the application of MLE at the rate of 10% concentration in one week interval. This might be due to the presence of cytokinin in the MLE. The cytokinin delays leaf senescence, cell division and cell enlargement and improves the leaf area with increased photosynthetic pigments. This is in line with the findings of Ali *et al*. (2011). Further, MLE is a rich source of Magnesium which is accountable for the synthesis of chlorophyll and increment of leaf chlorophyll content. This is in agreement with the findings of Ogbuehi and Agbim (2018) who reported that MLE application heightened the chlorophyll content of soybean leaves.

TOTAL SOLUBLE SOLIDS (TSS) CONTENT OF PODS

Maximum TSS content was recorded in T1 (22.5 Brix) andT5 (20 Brix) the minimum value for the total soluble solid content was recorded in T0 (13.0 Brix). No significant differences were observed among the treatments T2, T3 and T4. This might be due to the presence of high amount of the carbohydrate content and protein content in moringa leaves which are responsible for the increment of TSS.Similar results have been reported by research findings that is the increased TSS content in Hollywood plum by 6% (Thanaa*et al*. 2017).

Table: 1 Effect of different concentrations of MLE on yield and quality attributes ofChilli at harvest

Treatment	No. of pods /plant	No. of seeds /pod	Length of pods(cm)	Total yield/plant (g/plant)	Leaf chlorophyll content	Total soluble solid content of pods (TSS) (brix)
T0	$3.0^{c} \pm 0.29$	$68.50^{c} \pm 0.46$	$5.0^{c} \pm 1.00$	$9.49^{c} \pm 0.21$	$46.45^{d} \pm 0.8$	$13.0^{c} \pm 0.70$
T1	$26.0^{a} \pm 0.88$	$89.0^{a} \pm 0.61$	$8.35^{a} \pm 1.12$	$113.45^{a} \pm 0.14$	$70.60^{a} \pm 0.7$	$22.5^{a} \pm 1.06$
T2	$12.0^{bc} \pm 0.58$	$80.0^{b} \pm 0.61$	$6.80^{b} \pm 0.25$	$41.64^{bc} \pm 0.81$	$64.75^{abc} \pm 0.12$	$17.0^{bc} \pm 0.70$
T3	$11.5^{bc} \pm 1.61$	$78.0^{b} \pm 1.23$	$5.60^{bc} \pm 2.01$	$39.07^{bc} \pm 1.72$	$56.3^{c} \pm 0.78$	$15.50^{bc} \pm 1.76$
T4	$20.0^{ab} \pm 1.17$	$80.0^{b} \pm 0.30$	$5.70^{bc} \pm 0.5$	$62.27^{b} \pm 1.42$	$67.8^{ab} \pm 0.59$	$15.50^{bc} \pm 0.35$

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T5	$10.5^{bc} \pm 1.32$	$79.0^{b} \pm 1.24$	$6.0^{bc} \pm 0.5$	$37.01^{bc} \pm 1.11$	$62.4^{abc} \pm 2.19$	$20.0^{a} \pm 0.70$
T6	$17.5^{ab} \pm 0.14$	$81.0^{ab} \pm 0.30$	$6.65^{b} \pm 0.37$	$68.60^{b} \pm 0.13$	$60.5^{bc} \pm 0.25$	$18.50^{ab} \pm 1.06$
P value	**0.0289**	**0.018**	**0.008**	**0.002**	**0.005**	**0.025**

p< 0.05- NS; Not Significant

Mean values in a column having the dissimilar letter/letters indicate significant differences at 5% level of significance according to Duncan Multiple Range Rest (DMRT).

CONCLUSION

This study highlights that the foliar application of MLE at 10% concentration at one-week interval positively affected the yield and quality attributes of chilli over the control. Therefore, foliar application of naturally available MLE at the rate of 10% concentration at one-week interval (from 2 WAT to pod formation stage) with recommended fertilizer could be recommended for the cultivation of chilli to increase the crop productivity. MLE is a natural growth enhancer which is cheap, environmental friendly and low-cost technology for enhancing yield in chili.

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