Harvesting Techniques and Application of Bio-stimulants on Growth and Leaf Yield of Curry Leaf (Murraya koenigii Spreng.)

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Abstract A field experiment on effect of harvesting techniques and application of bio-stimulants on growth and yield of curry leaf was conducted at Department of Spices and Plantation Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Periyakulam during 2015. The experiment was laid out in split-split design consisting of three factors, viz., factor – I pruning levels (L1 – 15 cm and L2 – 30 cm), factor – II harvest intervals (H1 – 2 months harvest interval and H2 – 3 months harvest interval) and factor –III foliar applications (N1 – 0.25 per cent ZnSO4, N2 – 0.25 per cent FeSO4, N3 – 2 per cent seaweed extract and N4 – 0.3 per cent humic acid) constituting sixteen treatment combinations. The results have shown that among the harvesting techniques and bio-stimulants the highest growth characters viz., plant height (127.84 and 124.78 cm at first and second harvest), number of secondary branches (7.01 and 13.67 at first and second harvest), leaflet length (7.21 and 7.26 cm at first and second harvest) and leaflet width (3.94 and 3.98 cm at first and second harvest). It was also observed that yield characters viz., leaf yield per plant (643.50 and 714.21 g at first and second harvest) and leaf yield per hectare (4468.46 and 4959.47 kg at first and second harvest).

Keywords Harvest height; Harvest intervals; Foliar application of humic acid and curry leaf

1 Introduction

It is commonly known as curry-leaf tree and is a native of India, Srilanka and other South Asian countries. Leaves of M. koenigii are rich in minerals, vitamin A and vitamin B, and are a rich source of carbohydrates, proteins, amino acids and alkaloids of the 14 global species belonging to the genus Murraya, only two are available in India, namely, M. koenigii (Spreng.) and M. paniculata (L.) Jack (M. exotica (L.) of the two, the former is more popular due to its large spectrum of medicinal properties and also because of the use of its leaves for centuries as a natural flavoring agent in various curries and food items. The plant has been used in traditional Indian systems of medicine for a variety of ailments. The leaves, bark and root of the plant are used in indigenous medicine as a tonic, stomachic, stimulant and carminative. An infusion of the roasted leaves is used to stop vomiting. The green tender leaves are eaten raw for the cure of dysentery. A decoction of the leaves is sometimes given with bitters as a febrifuge and the leaves have been claimed to be used with mint in the form of chutney to check vomiting. It has also been used as an antiperiodic and many a time the powdered dry leaf, mixed with honey and juice of betel nut, is recommended in the Ayurvedic system of medicine.

In moringa, Crosby and Cracker (2007) studied the effect of four pruning methods on leaf yield. The four methods were (i) defoliation (DFF), (ii) laterals pruned to 10 cm (LP10), (ii) two stem harvested every 30 days (2S30) and (iv) six lateral per stem (6 LPS). The results of the study showed that the treatment LP10 (lateral pruned to 10 cm) gave the highest nodes per tree with lateral branches (8.3), laterals per node (2.0), lateral per trees (10.2), total stem length (162 mm) fresh weight (34 g), leaf dry weight (25.2 g), stem dry weight (7.9 g) and total dry weight (33.0 g). In Java citronella, Singh and Ganguly (1973) reported that, under Assam conditions, maximum of four harvests were possible during September, December, March and June. Further they also observed that June and September harvest gave higher herb and oil yields than other harvests. The first harvest
should be taken 90 days after planting to boost tillering. Humic substances originate from chemical and biological degradation of plant and animal residues and from synthetic activities of microorganisms (Schnitzer, 1991). Coal is also found to produce humus matter on degradation. Peat and lignite are reported to have higher content of humic acid. The Neyveli lignite has the humic acid content of 50 to 60 per cent. Humic substances make up a large portion of the dark matter in humus and consist of heterogeneous mixtures of transformed biomolecules exhibiting a supramolecular structure, which can be separated in their small molecular components by sequential chemical fractionation (Fiorentino et al., 2006). According to El-Nemr et al. (2012) application of humic acid @ 3 g per litre as foliar spray recorded the increased plant height, number of leaves and stems per plant, fresh weights of leaves per plant as well as yield in cucumber.

2 Material and Methods
The present experiment consisted of sixteen treatment combinations of two level of harvest height (L₁ - 15 cm and L₂ - 30 cm), two harvest intervals (H₁ - 2 months and H₂ - 3 months) and four levels of bio-stimulants (N₁ – 0.25 per cent ZnSO₄, N₂ – 0.25 per cent FeSO₄, N₃ – 2 per cent seaweed extract and N₄ – 0.3 per cent humic acid) were randomly allocated in split-split plot design replicated three times. Biometrical observations vis., plant height (cm), number of secondary branches, leaflet length (cm), leaflet width (cm), leaf yield per plant (g) and estimated leaf yield per hectare (kg) were taken from each treatment and replication. The data were subjected to statistical analysis as suggested by Panse and Sukhatme (1985).

3 Results
The results of the study on effect of harvesting techniques (harvest height and harvest intervals) and bio-stimulants on growth and leaf yield of curry leaf have shown that the interaction between pruning levels x harvest intervals x application of foliar nutrients had significant effect on biometrical observation and results are presented in the Table 1, Table 2, Table 3, Table 4, Table 5, Table 6, Table 7, Table 8, Table 9, Table 10 and Figure 1.

Table 1 Effect of pruning techniques and foliar nutrients on plant height (cm) in curry leaf at first harvest

| Treatments | L₁ | H₁ | H₂ | Mean | L₂ | H₁ | H₂ | Mean | P X N | H₁ | H₂ | Mean |
|------------|----|----|----|------|----|----|----|------|------|----|----|------|
| N₁         | 52.40 | 98.54 | 75.47 | 54.12 | 79.85 | 76.99 | 53.26 | 99.20 | 76.23 |
| N₂         | 55.13 | 108.94 | 82.04 | 56.44 | 116.08 | 86.26 | 55.79 | 112.51 | 84.15 |
| N₃         | 67.33 | 116.98 | 92.16 | 68.37 | 117.67 | 93.02 | 67.85 | 117.33 | 92.59 |
| N₄         | 72.44 | 118.90 | 95.67 | 76.87 | 127.84 | 103.26 | 75.56 | 123.37 | 99.46 |
| Mean       | 61.83 | 110.84 | 86.33 | 64.40 | 115.36 | 89.88 | 63.11 | 113.10 | 88.11 |

| SE (d)     | 0.196 | 0.444 | 0.050 | 0.486 | 0.206 | 0.448 | 0.453 |
| CD (0.05)  | 0.846 | 1.230 | 0.104 | 1.470 | 0.846 | 1.230 | 1.240 |

Table 2 Effect of pruning techniques and foliar nutrients on plant height (cm) in curry leaf at second harvest

| Treatments | L₁ | H₁ | H₂ | Mean | L₂ | H₁ | H₂ | Mean | P X N | H₁ | H₂ | Mean |
|------------|----|----|----|------|----|----|----|------|------|----|----|------|
| N₁         | 50.35 | 94.69 | 72.52 | 52.00 | 95.96 | 73.98 | 51.18 | 95.33 | 73.25 |
| N₂         | 52.97 | 104.69 | 78.83 | 54.24 | 111.55 | 82.90 | 53.61 | 108.12 | 80.86 |
| N₃         | 62.19 | 114.32 | 88.26 | 63.94 | 114.75 | 89.35 | 63.07 | 114.54 | 88.80 |
| N₄         | 68.87 | 116.35 | 92.61 | 73.51 | 124.78 | 99.15 | 71.19 | 120.57 | 95.88 |
| Mean       | 58.60 | 107.51 | 83.05 | 60.92 | 111.76 | 86.34 | 59.76 | 109.64 | 84.70 |

| SE (d)     | 0.184 | 0.443 | 0.053 | 0.480 | 0.195 | 0.447 | 0.452 |
| CD (0.05)  | 0.793 | 1.230 | 0.110 | 0.195 | 0.793 | 1.230 | 1.240 |
Table 3 Effect of pruning techniques and foliar nutrients on number of secondary branches in curry leaf at first harvest

| Treatments | L₁  | L₂  | P X N |
|------------|-----|-----|-------|
|            | H₁  | H₂  | Mean  | H₁  | H₂  | Mean  | H₁  | H₂  | Mean  |
| N₁         | 6.14| 6.53| 6.34  | 6.14| 6.57| 6.36  | 6.14| 6.55| 6.35  |
| N₂         | 6.25| 6.61| 6.43  | 6.29| 6.67| 6.48  | 6.27| 6.64| 6.46  |
| N₃         | 6.34| 6.73| 6.54  | 6.39| 6.75| 6.57  | 6.37| 6.74| 6.55  |
| N₄         | 6.42| 6.87| 6.65  | 6.45| 7.01| 6.73  | 6.44| 6.94| 6.69  |
| Mean       | 6.29| 6.69| 6.49  | 6.32| 6.75| 6.53  | 6.30| 6.72| 6.51  |

Table 4 Effect of pruning techniques and foliar nutrients on number of secondary branches in curry leaf at second harvest

| Treatments | L₁  | L₂  | P X N |
|------------|-----|-----|-------|
|            | H₁  | H₂  | Mean  | H₁  | H₂  | Mean  | H₁  | H₂  | Mean  |
| N₁         | 10.25|12.10|11.18 |10.46|12.30|11.38 |10.36|12.30|11.28 |
| N₂         | 10.46|12.45|11.46 |10.87|12.51|11.69 |10.67|12.48|11.57 |
| N₃         | 10.87|12.57|11.72 |11.28|12.89|12.09 |11.08|12.73|11.90 |
| N₄         | 11.69|13.59|12.64 |11.89|13.67|12.78 |11.79|13.63|12.71 |
| Mean       | 10.82|12.68|11.75 |11.13|12.84|11.98 |10.97|12.76|11.87 |

Table 5 Effect of pruning techniques and foliar nutrition on leaf length (cm) in curry leaf at first harvest

| Treatments | L₁  | L₂  | P X N |
|------------|-----|-----|-------|
|            | H₁  | H₂  | Mean  | H₁  | H₂  | Mean  | H₁  | H₂  | Mean  |
| N₁         | 5.93| 6.40| 6.17  | 6.02| 6.42| 6.22  | 5.98| 6.41| 6.19  |
| N₂         | 6.14| 6.60| 6.37  | 6.21| 6.60| 6.41  | 6.18| 6.60| 6.39  |
| N₃         | 6.23| 6.68| 6.46  | 6.30| 6.82| 6.56  | 6.27| 6.75| 6.51  |
| N₄         | 6.30| 6.94| 6.62  | 6.34| 7.21| 6.78  | 6.32| 7.08| 6.70  |
| Mean       | 6.15| 6.66| 6.40  | 6.22| 6.76| 6.49  | 6.18| 6.71| 6.70  |

Table 6 Effect of pruning techniques and foliar nutrition on leaf length (cm) in curry leaf at second harvest

| Treatments | L₁  | L₂  | P X N |
|------------|-----|-----|-------|
|            | H₁  | H₂  | Mean  | H₁  | H₂  | Mean  | H₁  | H₂  | Mean  |
| N₁         | 5.68| 6.37| 6.03  | 6.07| 6.47| 6.27  | 5.88| 6.42| 6.15  |
| N₂         | 6.08| 6.52| 6.30  | 6.20| 6.67| 6.44  | 6.14| 6.60| 6.37  |
| N₃         | 6.27| 6.75| 6.51  | 6.29| 6.86| 6.58  | 6.28| 6.81| 6.54  |
| N₄         | 6.37| 7.01| 6.69  | 6.37| 7.26| 6.82  | 6.37| 7.14| 6.75  |
| Mean       | 6.10| 6.66| 6.38  | 6.23| 6.82| 6.52  | 6.17| 6.74| 6.74  |

3.1 Effect of harvesting techniques and bio-stimulants on plant height (cm)
The data on plant height of curry leaf is presented in the Table 1 and Table 2. From the table it is observed that the harvest height (L), harvest interval (H) and bio-stimulants (N) had significant influence on plant height at first
and second harvests of the present study.

Table 7 Effect of pruning techniques and foliar nutrition on leaf width (cm) in curry leaf at first harvest

| Treatments | L_1 | H_1 | H_2 | Mean | L_2 | H_1 | H_2 | Mean | H X N | H_1 | H_2 | Mean |
|------------|-----|-----|-----|------|-----|-----|-----|------|------|-----|-----|------|
| N_1        | 3.11| 3.48| 3.30| 3.11| 3.51| 3.31| 3.11| 3.50| 3.30 |
| N_2        | 3.21| 3.57| 3.39| 3.27| 3.57| 3.42| 3.24| 3.57| 3.41 |
| N_3        | 3.30| 3.66| 3.48| 3.34| 3.76| 3.55| 3.32| 3.71| 3.52 |
| N_4        | 3.39| 3.85| 3.62| 3.42| 3.94| 3.68| 3.41| 3.90| 3.65 |
| Mean       | 3.25| 3.64| 3.45| 3.29| 3.70| 3.49| 3.27| 3.67|      |

SE (d) 0.0004 0.0011 0.0027 0.0011 0.0034 0.0035 0.0076 0.0103

Table 8 Effect of pruning techniques and foliar nutrition on leaf width (cm) in curry leaf at second harvest

| Treatments | L_1 | H_1 | H_2 | Mean | L_2 | H_1 | H_2 | Mean | H X N | H_1 | H_2 | Mean |
|------------|-----|-----|-----|------|-----|-----|-----|------|------|-----|-----|------|
| N_1        | 2.96| 3.52| 3.24| 3.05| 3.53| 3.29| 3.01| 3.53| 3.27 |
| N_2        | 3.15| 3.61| 3.38| 3.15| 3.61| 3.38| 3.15| 3.61| 3.38 |
| N_3        | 3.24| 3.70| 3.47| 3.24| 3.79| 3.52| 3.24| 3.75| 3.49 |
| N_4        | 3.33| 3.89| 3.61| 3.42| 3.98| 3.70| 3.38| 3.94| 3.66 |
| Mean       | 3.17| 3.68| 3.43| 3.22| 3.73| 3.47| 3.19| 3.70|      |

SE (d) 0.0019 0.0016 0.0029 0.0025 0.0041 0.0040 0.0054 0.0115

Table 9 Effect of pruning techniques and foliar nutrition on green leaf yield in curry leaf at first harvest

| Treatments | L_1 | H_1 | H_2 | Mean | L_2 | H_1 | H_2 | Mean | H X N | H_1 | H_2 | Mean |
|------------|-----|-----|-----|------|-----|-----|-----|------|------|-----|-----|------|
| N_1        | 393.39| 551.03| 472.21| 402.93| 583.11| 493.02| 398.16| 567.07| 482.62 |
| N_2        | 407.29| 586.97| 497.13| 407.88| 606.87| 507.38| 407.59| 596.92| 502.25 |
| N_3        | 422.96| 613.80| 518.38| 423.72| 614.79| 519.26| 423.34| 614.30| 518.82 |
| N_4        | 451.44| 640.53| 545.99| 458.37| 643.50| 550.94| 454.91| 642.02| 548.46 |
| Mean       | 418.77| 598.08| 508.43| 423.23| 612.07| 517.65| 421.00| 605.08|      |

SE (d) 0.04 0.16 0.25 0.31 1.70 1.73

CD (0.05) 0.18 4.64 0.53 4.64 0.66 4.68 4.72

Table 10 Effect of pruning techniques and foliar nutrition on green leaf yield in curry leaf at second harvest

| Treatments | L_1 | H_1 | H_2 | Mean | L_2 | H_1 | H_2 | Mean | H X N | H_1 | H_2 | Mean |
|------------|-----|-----|-----|------|-----|-----|-----|------|------|-----|-----|------|
| N_1        | 452.58| 573.30| 512.94| 463.98| 610.69| 537.34| 458.28| 592.00| 525.14 |
| N_2        | 469.76| 638.60| 554.18| 469.68| 663.54| 566.61| 469.72| 651.07| 560.40 |
| N_3        | 486.78| 669.50| 578.14| 487.92| 671.46| 579.69| 487.35| 670.48| 578.92 |
| N_4        | 519.84| 687.50| 603.68| 527.82| 714.21| 621.02| 523.83| 700.87| 612.35 |
| Mean       | 482.24| 642.23| 562.24| 487.35| 664.98| 576.16| 484.80| 653.60|      |

SE (d) 0.38 1.54 0.30 1.59 0.53 1.58 1.63

CD (0.05) 1.61 4.29 0.62 4.55 1.68 4.35 4.40

Higher values of plant height of 89.88 cm and 86.34 cm at first harvest and second harvest were recorded by the treatment L_2 i.e. harvest at 30 cm height. Among the two intervals of harvest three months harvest intervals

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recorded plant height values of 113.10 cm and 109.64 cm at first harvest and second harvest.

Among the different types of bio-stimulants, the application of humic acid @ 0.3 per cent (N₄) recorded higher plant height of 99.46 cm and 95.88 cm at first harvest and second harvest. Interaction between harvest height (L) and harvest interval (H) showed highly significant effect of plant height. The treatment L₂H₁ (harvest at 30 cm height + three months harvest intervals) recorded higher plant height values (115.36 cm and 111.76 cm at first harvest and second harvest. The highest plant height of 103.26 cm and 99.15 cm at first harvest and second harvest were recorded by the treatment L₁N₄ (30 cm harvest height + 0.3 per cent of humic acid). Similarly, the interaction between harvest interval (H) and foliar nutrition (N) showed significant influence on plant height. Among the treatments, the treatment H₂N₄ (30 cm harvest height + 0.3 per cent of humic acid) recorded highest plant height (123.37 cm and 120.57 cm at first harvest and second harvest). In this study, significant to highly significant influence on plant height was showed by the interaction of harvest height (L), harvest interval (H) and foliar nutrition (N). The highest plant height values of 127.84 cm and 124.78 cm at first harvest and second harvest.

This could be ascribed that, pruning might shift the allocation of metabolites in favour of vegetative growth. This is in line with the findings of Singh et al. (2012) who have also observed a similar trend of growth in guava. Harvesting the plant once in three months intervals (H₂) recorded significantly higher plant height at all the three harvests. This might be due to the fact that plant would have sufficient time for adequate growth and increased photosynthetic activity. Humic acid is a commercial product that contains many elements which improves the soil fertility and increase the availability of nutrients and consequently increased the plant growth. Similar reports were also made by Eslah and El-hefny (2010) in cowpea.

3.2 Effect of harvesting techniques and bio-stimulants on number of secondary branches

The data pertaining to number of secondary branches per plant of curry leaf are presented in the Table 3 and Table 4. From the table it was observed that individual effect viz., harvest height, harvest interval, bio-stimulants and their combination effects showed highly significant influence on this trait.

Among the two different harvest heights, the treatment L₂ (30 cm harvest height) registered higher number of secondary branches per plant (6.53 and 11.98 at first and second harvest). Significant difference was exhibited by different harvest intervals on number of secondary branches per plant. The treatment H₂ (three months harvest intervals) registered more number of secondary branches per plant (6.72 and 12.76 at first harvest and second harvest respectively) than the treatment H₁ (two months harvest intervals). Among the different treatments, the treatment N₄ (0.3 per cent of humic acid) produced more number of secondary branches per plant (6.69 and 12.71 at first and second harvest). Interaction between harvest heights and harvest intervals showed highly significant influence on number of secondary branches per plant.

Among the different treatments, the treatment L₂H₂ (30 cm harvest height + three months harvest intervals) registered the highest number of secondary branches per plant (6.75 and 12.84 at first harvest and second harvest.
The highest number of secondary branches per plant (6.73 and 12.78) at first harvest and second harvest respectively were recorded by the treatment L2N4 (30 cm harvest height + 0.3 per cent of humic acid) and it was followed by the treatment L1N4 (15 cm harvest height + 0.3 per cent of humic acid). The results showed that, the treatment H2N4 (three months harvest intervals and 0.3 per cent of humic acid) recorded higher number of secondary branches (6.94 and 13.63 at first harvest and second harvest respectively) as compared to other treatment. Among the different treatment combinations studied, the treatment L2H2N4 (30 cm harvest height + three months harvest intervals + 0.3 per cent of humic acid) registered the highest number of secondary branches per plant (7.01 and 13.67 at first and second harvest). It is evident that taller plants have more number of adventitious buds to produce more branches when compared to low stump height (15 cm harvest height - L4). Higher harvest interval (three months interval) also support higher number of secondary branches per plant due to sufficient time for more growth and longer periods of photosynthesis. These would have also resulted in accumulation of more carbohydrates in the stem. Foliar application of humic acid @ 0.3 per cent (N4) also exhibited significant influence on improvement of number of secondary branches per plant which might be due to the application of humic acid that would have increased the soil fertility due to increase availability of nutrients/elements as reported by David et al. (1994).

3.3 Effect of harvesting techniques and bio-stimulants on leaflet length and leaflet width

In this study the data pertaining to the effect of harvest height, harvest interval, bio-stimulants and their combination effects presented in Table 5; Table 6; Table 7 and Table 8, it showed highly significant influence on leaflet length of curry leaf.

In respect of different harvest heights, the treatment L2 (30 cm harvest height) recorded the higher leaflet length (6.49 and 6.52 cm at first harvest and second harvest) and leaflet width (3.49 cm and 3.47 cm at first harvest and second harvest) respectively compared to the treatment L1 (15 cm harvest height). Among the different harvest intervals, the treatment H2 (three months harvest intervals) recorded the higher leaflet length (6.71 and 6.74 cm at first harvest and second harvest) and leaf width (3.67 cm and 3.70 cm at first harvest and second harvest). Application of bio-stimulants also showed highly significant difference on leaflet length of curry leaf. The highest leaflet length (6.70 and 6.75 cm at first harvest and second harvest) and leaf width (3.65 cm and 3.66 cm at first harvest and second harvest) was recorded by the treatment N4 (0.3 per cent of humic acid).

The interaction effect between the harvest heights and harvest intervals showed highly significant influence on leaflet length. The treatment L2H2 (30 cm harvest height + three months harvest intervals) recorded the highest leaflet length at first harvest (6.76 cm) and second harvest (6.81 cm) and leaflet width at first harvest (3.69 cm) and second harvest (3.73 cm). The results showed that, the treatment L2N4 (30 cm harvest height + 0.3 per cent of humic acid) exhibited the highest leaflet length values at first harvest (6.78 cm) and second harvest (6.82 cm) and leaflet width at first harvest (3.68 cm) and second harvest (3.70 cm). The highest leaflet length at first harvest (7.08 cm) and second harvest (7.14 cm) and leaflet width at first harvest (3.89 cm) and second harvest (3.93 cm) was recorded by the treatment H2N4 (three months harvest intervals + 0.3 per cent of humic acid) and it was followed by the treatment H2N3 (three months harvest intervals + 2 per cent of seaweed extract). The combined effect of harvest heights, harvest intervals and foliar nutrients also showed significant influence on leaflet length. Among the different combinations experimented, the treatment combination, L2H2N4 (30 cm harvest height + three months harvest intervals + 0.3 per cent of humic acid) registered the highest leaflet length at first harvest (7.21 cm) and second harvest (7.26 cm) and leaflet width at first harvest (3.94 cm) and second harvest (3.98 cm).

This might be due to higher harvest height, more number of secondary branches, and higher stem girth registered by the same treatment. Increased number of leaflets per leaf due to foliar application of humic acid was also reported by Abdel- Razzaq and El-Adani et al. (1998) in tomato.

3.4 Effect of harvesting techniques and bio-stimulants on leaf yield and estimated leaf yield

Among the two harvest heights, the treatment L2 (30 cm harvest height) recorded the higher green leaf yield
(517.65 g and 576.16 g per plant at first harvest and second harvest and estimated green leaf yield of 3594.54 and 4000.87 kg per hectare at first harvest and second harvest respectively). When treatments of harvest intervals are compared the treatment \( H_3 \) (three months harvest intervals) recorded higher green leaf yield (605.08 g and 653.60 g per plant at first harvest and second harvest and estimated leaf yield of 4201.65 and 4538.61 kg per hectare at first harvest and second harvest respectively). The higher green leaf yield (548.46 g and 612.35 g per plant at first harvest and second harvest and estimated green leaf yield of 3808.51 and 4252.14 kg per hectare at first harvest and second harvest respectively) were recorded by the treatment \( N_4 \) (0.3 per cent of humic acid).

The interaction effect of harvest height and harvest interval was compared and the higher green leaf yield values of 612.07 g and 664.97 g per plant at first harvest and second harvest and estimated green leaf yield value of 4250.20 and 4617.58 kg per hectare at first harvest and second harvest respectively was recorded by the treatment \( L_2H_3 \) (30 cm harvest height and three months harvest intervals). The higher green leaf yield values of 550.94 g per plant at first harvest and 621.02 g per plant at second harvest and estimated leaf yield of 3825.69 at first harvest and 4312.33 at second harvest were registered by the treatment \( L_2N_4 \) (30 cm harvest height with 0.3 per cent of humic acid). The treatment \( H_2N_4 \) (three month harvest interval + 0.3 per cent of humic acid) registered the highest green leaf yield of 642.02 g and 700.87 g per plant at first harvest and second harvest and estimated green leaf yield of 4458.15 and 4866.81 kg per hectare at first harvest and second harvest respectively.

Among the different treatment, the highest green leaf yield were registered by the treatment combination of \( L_2H_2N_4 \) (30 cm harvest height + three months harvest intervals + 0.3 per cent of humic acid) green leaf yield of 643.50 g and 714.21 g per plant at first harvest and second harvest and estimated green leaf yield of 4468.46 kg per hectare (first harvest) and 4959.47 kg per hectare (second harvest).

This might be due to increased plant height, number of branches, leaflets size and number of leaves per plant registered by the same treatment. Regarding foliar nutrition application of humic acid @ 0.3 per cent (\( N_4 \)) recorded significantly higher green leaf yield per plant and estimated green leaf yield per hectare. Enhancement of significant fresh leaf yield of curry leaf due to humic acid application was also confirmed by Adani et al. (1998) in tomato.

### 4 Conclusions

The influence of three factors and their interactions i.e. harvesting of curry leaf plants at 30 cm height at three months interval of harvests coupled with application of humic acid @ 0.3 per cent had exerted better growth and leaf yield. Hence it could be concluded that depending upon the growth of the plant either winter with less growth and more growth during the summer demand for leaf in the market, either one of the treatment combination.

### References

Adani P., Genevini P., Zaccheo P., and Zochi G., 1998, The effect of commercial humic on tomato plant growth and mineral nutrition, J. of Plant Nutrition, 21: 562-575

https://doi.org/10.1080/01904169809365424

Crosby G.W., and Cracker L., 2007, L.E.ISHS Act Horticulture 75th international symposium on medicinal and nutritional plants, Pruning strategies to maximize leaf production of pollard *Moringa oleifera* (lam), tree seedlings, Development potential for Moringa products, October 29th - November 2nd 2001, Daressalam, Tanzania

David P.P., Nelson P.V., and Sanders D.G., 1994, A humic acid improves growth of tomato seedling in solution culture, J. of Plant Nutrition, 7: 173-184

https://doi.org/10.1080/01904169409364717

El-Nemr M.A., El-Desuki M., El-Bassiony A.M., and Fawzy Z.F., 2012, Response of Growth and Yield of Cucumber Plants (*Cucumis sativus* L.) to Different Foliar Applications of Humic Acid and Bio-stimulators, Australian J. of Basic and Applied Sci., 6(3): 630-637

Fiorentino G., Spaccini R., and Piccolo A., 2006, Separation of molecular constituents from a humic acid by solid-phase extraction following a transterification reaction, Talanta 68: 1135-1142

https://doi.org/10.1016/j.talanta.2005.07.037

Panse V.G., and Sikkhatme P.V., 1985, Statistical Methods for Agricultural Workers, Rev Edn. ICAR, New Delhi

Schnitzer M., 1991, Soil organic matter, The Next 75 years, Soil Sci., 151(1): 45-48

https://doi.org/10.1097/00010694.199110000-00008
Singh B.P., Gorak Singh, and Singh A.K., 2012. Changes in postharvest quality of guava affected by pre harvest application of crop regulators, Singapore J. Pri. India, 24: 1-9

Singh H.S., and Ganguly D., 1973. Studies on the cultivation of Java citronella (Cymbopogon winterianus Jowitt) in Assam, Part I. Growth of the plants and yield of the leaves in relation to various factors, Indian Perfumer 16: 29-37