Plant Archives Vol. 18, Special Issue (ICAAAS-2018), 2018 pp. 308-310 *ISSN 0972-5210*

EFFECT OF SPACING AND ORGANIC MANURES ON THE FRESH HERBAGE YIELD, DRY MATTER PRODUCTION AND LEAF NUTRIENT CONTENT OF VALLARAI (*CENTELLA ASIATICA*)

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Abstract

An experiment was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University. A field trial was conducted in a split plot design keeping plant spacing (30 x 15cm, 45 x 15 cm and 45 x 30 cm) as main plot treatment and basal application of FYM @ 25 t ha^{-1}, vermicompost @ 5 t ha^{-1} and foliar application of humic acid @ 0.2 per cent at monthly intervals as sub-plot treatment in three replications. The results of the present study revealed that the spacing of 45 x 30 cm and foliar spray of humic acid @ 0.2 per cent at monthly intervals was found to be superior in improving the herbage yield and dry matter production. With regard to leaf nutrient content the closer spacing of 30 x 15cm and foliar spray of humic acid @ 0.2 per cent at monthly intervals was found to be superior.

Key words *:* Spacing, Farmyard manure, Vermicompost, Humic acid and Vallarai (*Centella asiatica*)

Introduction

India has been considered as the treasure house of the world's richest source of valuable medicinal plants. In the present context of back to nature in health care, it is relevant that these variable medicinal plants are not only preserved but also multiplied and their cultivation popularized to meet the ever increasing demand of the domestic industries and to exploit export market. Shift from wild collection to cultivation of medicinal plants will also ensure purity, authenticity and sustainability in the supply of raw herbal materials required for the herbal industry. Currently global market for herbal products which includes medicine, health supplements and herbal cosmetics is estimated to be around US$ 62 million and India's share is only two percent. Hence attention of researchers need to be focused on systematic research on commercial cultivation of medicinal plants as an alternative revenue generation for the Indian farmers for augmenting the supply of herbal raw material to the drug industry as well as for export.

Vallarai (Indian penny wort) scientifically called *Centella asiatica* belongs to the family Umbelliferae. It is a perennial, prostrate, aromatic herb flourishing in water logged and damp areas of tropical regions. The fresh leaves contain a glucoside, asiaticoside and asiatic acid, whereas the roots and leaves contain vallarine, pectic acid and resin. The plant also contains ascorbic acid to a level of about 13.8mg per 100 g. The drug helps to maintain youthful vigour and strength and is reported to improve the receptive and retentive capacity of the mind. It is a nervine and cardiotonic, astringent and diuretic and used to cure diarrhoea, anaemia, diabetes, cough etc. It is also employed in the treatment of ulceration of the womb, elephantiasis, ascarias and in granular cervicitis. The whole plant also serves as a popular kitchen herb in Tamil Nadu and certain other parts of India and is used for the preparation of chutneys, pickles, refreshing drinks, etc. More importantly it is used as a nerve tonic for improving memory and in treating insanity. As the whole plant is used as such in drug preparation, there is a need for producing the crop chemical free, which necessitates the use of organic farming technology. Continuous use of inorganic fertilizers has resulted in ecological imbalance with consequent illeffects to the soil (Subramanian *et.al*., 2001). Under such condition, it has become imperative to use all the organic nutrient sources in a judicious way to sustain soil fertility and crop productivity on a long term basis. Due to the lack of information on the agronomic practices, the crop is not grown on a commercial scale. Out of the several agronomic practices, plant spacing is one of the most important factor which influences the growth of the plant. In this context the present investigation was undertaken inorder to study the effect of spacing and organic manures on the fresh herbage yield, dry matter production and nutrient uptake of *Centella asiatica*.

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Materials and methods

An experiment was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University. A field trial was conducted in a split plot design keeping plant spacing (30 x 15cm, 45 x 15 cm and 45 x 30 cm) as main plot treatment and basal application of FYM @ 25 t ha^{-1}, vermicompost @ 5 t ha^{-1} and foliar application of humic acid @ 0.2 per cent at monthly intervals as sub-plot treatment in three replications. Observation on fresh herbage yield , dry matter production and leaf nutrient content were recorded at 120 days after planting and the data were analysed statistically (Panse and Sukhatme, 1985).

Results and Discussion

It can be inferred from the data presented in Table.1 that the spacing and organic nutrients significantly influenced the fresh herbage yield and dry matter production. The interaction effects for fresh herbage yield was non significant but the significant effect was produced by the dry matter production.

Among the various spacings the maximum the highest fresh herbage yield and dry matter production (1.01 kg $plot^{-1}$ and 0.32 kg $plot^{-1}$) respectively were recorded in M_3, followed by M_2 which registered the values of 0.77 kg $plot^{-1}$ and 0.25 kg $plot^{-1}$ respectively. The lowest values of 0.55 kg $plot^{-1}$ and 0.66 kg $plot^{-1}$ respectively were registered in M_1. With regard to the organic nutrients, it was observed that the maximum fresh herbage yield and dry matter production (0.90 kg $plot^{-1}$and 0.29 kg $plot^{-1}$ respectively) were registered in S_3. The next best treatment was S_2 which registered the values of 0.77 kg $plot^{-1}$ and 0.25 kg $plot^{-1}$ respectively. While the least values of 0.66 kg $plot^{-1}$ and 0.23 kg $plot^{-1}$ respectively were registered in S_1. The interaction effect of spacing and organic manures on the dry matter production $plot^{-1}$ were significant. The treatment combination of M_3S_3 registered the maximum dry matter production (0.3540 kg $plot^{-1}$) followed by M_3S_2 (0.3160 kg $plot^{-1}$). The least dry matter production was recorded in M_1S_1 (0.1780 kg $plot^{-1}$). The treatments M_2S_3, M_3S_1 and M_1S_3, M_2S_1 were found to be on par with each other.

The ultimate goal to be achieved in any management system is maximization of the yield. In the present study, it was observed that various levels of spacing and organic nutrients exhibited significant variation on the herbage yield and dry matter production. The plants planted at wider spacing recorded higher herbage yield and dry matter production when compared to closer spacings. This may be due to the fact that at wider spacing, plants must have faced less competition for moisture and sunlight which was reflected in the increased plant spread (East-West and North-South), higher number of laterals with maximum leaf area, which in turn lead to increased herbage yield and dry matter production as suggested by Mastiholi *et al*. (2007) in coleus. Similar results were obtained by Santhi and Vijayakumar (1997) in palmarosa and Kubsad *et al*. (2009) in ashwagandha.

In the present study, it was found that the herbage yield and dry matter production was significantly influenced by the foliar application of humic acid @ 0.2 per cent level at monthly intervals. The low molecular weight humic substances have been reported to be directly absorbed by plants when it is applied on foliage and better nutrient absorption by the plants due to the humic acid application might have augmented the green herbage yield and dry matter production as described by Moriyama (1982). Similar findings have been reported by Dhanasekaran (2006) in tomato and Meena *et al*. (2007) in fenugreek.

The results pertaining to the effect of various spacing and organic manures on the total nitrogen, phosphorus and potassium content presented in table.2 shows significant variations. However, nitrogen and phosphorus interaction effects were non significant but the total potassium content exhibit highly significant.

Among the spacing levels, the highest total nitrogen, phosphorus and potassium content (1.286 per cent, 0.734 per cent and 2.120 per cent respectively) were recorded in M_1, followed by M_2 which registered the values of 1.156 per cent, 0.655 per cent and 1.799 per cent respectively. The least NPK content 1.004 per cent, 0.572 per cent and 1.510 per cent were observed in M_3. With regard to the various organic manures, S_3 registered the maximum NPK content of 1.154 per cent, 0.659 per cent and 1.829 per cent respectively followed by S_2 which registered the values of 1.149 per cent, 0.654 per cent and 1.820 per cent respectively. Treatment S_1 recorded the least NPK content of 1.143 per cent, 0.648 per cent and 1.780 per cent. The interaction effect of spacing and organic nutrients on total potassium content was found to be significant. The treatment combination of M_1S_3 registered the maximum total potassium content (2.160 %) followed by M_1S_2 (2.151 %). The least total potassium content (1.503 %) was recorded in M_3S_1.

The uptake of nutrients is primarily a function of total biomass production and nutrient content at cellular level. Increase in uptake of nutrients coincides with the rapid growth phase with a very low rate of uptake during initial vegetative phase. In the present study, nitrogen, phosphorus and potassium uptake was more under closer spacing which may be attributed to the higher plant population per unit area. Similar results have been reported by Gandhikumar and Vijayakumar (1997) in davana. Further, Joy *et al*. (2004) also reported that closer spacing recorded higher uptake of major nutrients which may be due to higher plant density along with optimum growth, leading to higher uptake of nutrients. This is in accordance with the findings of Venkatesan (2009) in medicinal solanum.

It can be observed from the present study that the leaf nutrient content of nitrogen, phosphorus and potassium was significantly influenced by the application of humic acid @ 0.2 per cent at monthly intervals. Improvement in cell wall permeability due to humic acid application would have facilitated more absorption of NPK from soil as suggested by Bhuvaneswari and Dhanasekaran (2007) in radish. Similar

results were reported by Dhanasekaran (2006) in tomato and Muruganantham (2009) in guduchi.

Conclusion

Based on the findings of the present study, it can be concluded that the optimum spacing of 45 x 30 cm and foliar application of humic acid @ 0.2 per cent at monthly intervals can be considered as the best practice for obtaining higher fresh herbage yield, dry matter production and leaf nutrient content in vallarai(*Centella asiatica*).

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Table 1: Effect of various spacing and organic manures on fresh herbage yield and dry matter production in vallarai (*Centella asiatica*)

Treatments	Fresh herbage yield (kg plot^{-1})				Dry matter production (kg plot^{-1})			
	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean
M_1	0.45	0.54	0.66	0.55	0.17	0.19	0.22	0.19
M_2	0.65	0.77	0.90	0.77	0.22	0.25	0.28	0.25
M_3	0.89	1.01	1.14	1.01	0.28	0.32	0.35	0.32
Mean	0.66	0.77	0.90	0.77	0.23	0.25	0.29	0.25

	M	S	M X S	M	S	M X S
SED	0.027	0.22	NS	0.0026	0.0033	0.24
CD (p = 0.05)	0.08	0.05		0.007	0.007	0.018

Table 2: Effect of various spacing and organic manures on leaf nutrient content in vallarai (*Centella asiatica*)

Treatments	Total nitrogen content (percent)				Total phosphorus content (percent)				Total potassium content (percent)			
	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean
M_1	1.282	1.287	1.290	1.286	0.730	0.734	0.740	0.734	2.051	2.151	2.160	2.120
M_2	1.152	1.156	1.162	1.156	0.648	0.656	0.663	0.655	1.788	1.799	1.811	1.799
M_3	0.997	1.005	1.012	1.004	0.568	0.573	0.576	0.572	1.503	1.511	1.518	1.510
Mean	1.143	1.149	1.154	1.15	0.648	0.654	0.659	0.050	1.780	1.820	1.829	1.810

	M	S	M X S	M	S	M X S	M	S	M X S
SED	0.0009	0.0014	NS	0.00191	0.00163	NS	0.0027	0.0013	NS
CD (p = 0.05)	0.002	0.003		0.00531	0.00354		0.0075	0.0029	