Original Research Article

Impact of Organic Foliar Formulations on Growth and Yield of Okra (*Abelmoschus esculentus*)

ABSTRACT

Aims: To evaluate the effect of foliar application of different organic formulations on growth and yield of okra.

Study design: Randomized Block Design

Place and Duration of Study: Agronomy organic farm, College of Agriculture, Pune, during summer season of 2019-20.

Methodology: The experiment was laid out in Randomized Block Design with eight treatments and three replications. The gross and net plot sizes were 3.30 m x 3.00 m and 2.70 m x 2.40 m, respectively. The treatments consisted seven organic formulations with one control i.e. no foliar spray *viz.* control (no foliar spray), T_1: control (no foliar spray), $T_{2:}$ foliar application of cow urine at 5%, $T_{3:\ foliar}$ application of jeevamrut at 5%, $T_{4:}$ foliar application of EM solution at 1%, $T_{5:}$ foliar application of humic acid at 2%, $T_{6:}$ foliar application of fulvic acid at 2%, $T_{7:}$ foliar application of vermiwash at 5% and $T_{8:}$ foliar application of seaweed extract at 0.25%.

Results: The results revealed that all the growth contributing characters *viz*., plant height, number of branches plant^{-1}, plant spread, number of nodes plant^{-1}, internodal length and leaf area plant^{-1} were found significantly higher with the foliar application of seaweed extract at 0.25%. This was followed by foliar application of vermiwash at 5%. However, substantial reduction in growth characters was observed with control (no foliar spray).

Conclusion: The expression of growth characters in okra like Plant height, number of branches per plant, Plant spread, Number of nodes, internodal length and Leaf area were recorded higher with the foliar application of sea weed extract at 0.25% and were found statistically difference among all growth characters except the Internodal length which was found to be non-significant.

Key word: Foliar spray, sea weed extract, Plant height, okra, Malvaceae family

1. INTRODUCTION

Okra (*Abelmoschus esculentus* L.) is an annual, erect, broadleaved, hairy plant belonging to the Malvaceae family. It is originated in Ethiopia (Sathish and Eshwar, 2013) and was then propagated in North Africa, in the Mediterranean, in Arabia and India by the 12^{th} century B.C. (Nzikou *et al*., 2006). Among the various vegetable crops, okra is one of the fruit vegetables. Okra is widely cultivated vegetable and can be found in almost every market all over India (Acharya *et al*., 2021).

The exploitative agriculture for a long time in our country has brought down the fertility status of the soil to a level that even provision of high rate of fertilizers is unable to sustain the productivity of soil. So as to attain the productivity of soil and promote the health of the soil, use of organic sources is imperative (Bhattacharyya and Mathur, 2017).

Recent developments in intensive agriculture, though contributed immensely towards surplus food, caused degradation of fertile land and left residues in food products. Thus, there is need of increasing awareness throughout the world about the organic, sustainable agricultural practices.

2. MATERIAL AND METHODS

Field experiment was conducted to study the effect of foliar sprays of organic formulations on growth of okra at the Agronomy organic farm, College of Agriculture, Pune, during summer season of 2019-20. The experiment was laid out in Randomized Block Design with 08 treatments which include T_1: control (no foliar spray), T_2: foliar application of cow urine at 5%, T_3: foliar application of jeevamrut at 5%, T_4: foliar application of EM solution at 1%, T_5: foliar application of humic acid at 2%, T_6: foliar application of fulvic acid at 2%, T_7: foliar application of vermiwash at 5% and T_8: foliar application of seaweed extract at 0.25% imposed to okra variety Phule Vimukta. The foliar sprays were taken at 30 and 45 days after sowing. The gross and net plot sizes were 3.30 m x 3.00 m and 2.70 m x 2.40 m, respectively. The okra seed was dibbled at a spacing of 30 ×15 cm^2.

A full dose of Nitrogen, Phosphorus and Potassium was applied through vermicompost as a basal application at the time of sowing. *Azotobacter,* PSB and *Trichoderma* seed treatment was given to all the treatments.

Plant protection measures were undertaken as per the necessity to protect the crop from pests and disease incidence by using organic measures. The spraying of NSKE at 10 ml /lit, Metarrhyzium at 5 g/lit and Dashparni Ark at 25 ml/lit was used for control of sucking pests.

3. RESULTS AND DISCUSSION

Plant height, Number of branches, Plant spread, Number of nodes, Internodal length and Leaf area

Effect of foliar application of organic formulations were significantly influenced plant height, number of branches, plant spread and number of nodes per plant at 42, 56, 70 and 84 days after sowing whereas leaf area was influenced significantly at all the growth stages and number of nodes per plant was found to be influenced non-significantly at all the growth stages.

Plant height

The significantly taller plants were recorded with the foliar spray of sea weed extract at 0.25% (T_8). However, it was on par with foliar application of vermiwash at 5% (T_7) and with foliar application of cow urine at 5% (T_2), foliar application of jeevamrut at 5% (T_3), foliar application of humic acid at 2% (T_5) and foliar application of vermiwash at 5% (T_7).

The taller plants observed with the application of seaweed extract might be due to the plant growth regulators that are present in the seaweed and seaweed extracts, including cytokinins, auxins and GA's (Sadeghipour *et al.*, 2022). It is hypothesized that seaweed synthesizes relatively high concentration of plant growth regulator's because this confers an adaptive advantage that allows it to survive the extreme temperature range (Crouch *et al.* 1990). Gollan and Wright (2006) concluded that the increase in shoot characteristics due to the auxins content in the seaweed extracts which have an effective role in cell division and enlargement which leads to increase the shoot growth (Kim *et al.*, 2023).

Number of branches

The maximum number of branches plant^{-1} was obtained with the foliar application of sea weed extract at 0.25% which was significantly superior over all other treatments. It was on par with foliar application of jeevamrut at 5% (T_3) and foliar application of vermiwash at 5% (T_7) and it was on par with foliar application of cow urine at 5% (T_2). The higher number of branches recorded with the application of sea weed extract was 1.67.

This increase in number of branches plant^{-1} was owing to more availability of essential nutrients in a balanced form to plants which supported the plant growth and development. Similar results were recorded by Rathore *et al.* (2009) and Sharma *et al.* (2022).

Plant spread

The differences in plant spread due to different organic formulations were influenced significantly. The foliar application of seaweed extract at 0.25% recorded significantly higher plant spread as compared to rest of the treatments. However, it was on par with the foliar application of vermiwash at 5% (T_7).

The increase in plant spread may be due to availability of optimum amount of nutrients from the sea weed extract.

Number of nodes

The foliar application of seaweed extract at 0.25% produced significantly more number of nodes plant^{-1} than all other treatments. The next best treatment was found to be vermiwashat 5%, whereas the lower number of nodes were recorded from control treatment in which no foliar spray was undertaken. The results were found to be on par with the foliar

application of cow urine at 5%, foliar application of jeevamrut at5%, foliar application of humic acid at 2% and foliar application of vermiwash at5%.

Internodal length

The data revealed that effect of different foliar application treatments on intermodal length in okra was found to be non-significant. However, numerically intermodal length was recorded higher with foliar application of seaweed extract at 0.25% (T_8). Whereas, no foliar spray (T_1) recorded significantly the lowest intermodal length in okra.

Leaf area

Treatment	Plant height	Number of branches	Plant spread	Number of nodes	Internodal length	Leaf area
T_1: Control (No folia spray)	90.26	1.20	38.95	22.53	4.01	17.00
T_2: Foliar application of cow urine at 5%	107.71	1.47	41.54	26.27	4.10	24.60
T_3: Foliar application of Jeevamrut at 5%	109.14	1.53	41.98	26.49	4.12	27.23
T_4: Foliar application of EM-Solution at1%	93.07	1.33	39.18	22.78	4.03	17.17
T_5: Foliar application of Humic acid at 2%	102.33	1.40	40.35	25.08	4.08	23.47
T_6: Foliar application of Fulvic acid at 2%	97.74	1.40	40.16	24.07	4.06	19.40
T_7: Foliar application of Vermiwash at 5%	115.82	1.53	43.99	28.78	4.13	27.78
T_8: Foliar application of Sea weed extract at 0.25%	119.79	1.67	46.48	28.86	4.15	27.83
S.E.m±	5.79	0.09	1.42	1.40	0.27	1.94
C.D. at 5 %	17.57	0.26	4.32	4.24	NS	5.95
General mean	104.48	1.44	41.58	25.61	4.08	23.06

Table 1- Treatment variability in Plant height, Number of branches, Plant spread, Number of nodes, Internodal length and Leaf area

The difference in leaf area plant^{-1} due to different organic formulations was statistically significant at all the crop growth stages. The foliar application of sea weed extract at 0.25% resulted in significantly higher leaf area plant^{-1} as compared to rest of the treatments at all the crop growth stages. However, it was on par with the foliar application of cow urine at5%, Jeevamrut at 5%, Humic acid at 2% and Vermiwash at 5%. This increase in growth and biomass accumulation in the said nutrient combination could be due to various

metabolic processes which could have led to the enhanced leaf area plant^{-1}. The minimum leaf area plant^{-1} was reported under control i.e. no foliar spray (T_1).

Kavitha *et al*. (2008) reported that seaweed extract foliar spray significantly influenced the growth attributes at all the stages of observation and also observed that the maximum LAI (6.38) of rice was recorded with spraying of seaweed extract at 0.3% twice at 50% flowering and milk stages than other treatments and was followed by spraying of sea weed extract at 0.3% at milk stage (Selvakumar *et al.*, 2022).

4. CONCLUSION

The expression of growth characters in okra like plant height, number of branches per plant, plant spread, number of nodes, internodal length and leaf area were recorded higher with the foliar application of sea weed extract at 0.25% and were found statistically significant among all growth characters except the internodal length which was found to be non-significant.

Recent developments in intensive agriculture, though contributed immensely towards surplus food, caused degradation of fertile land and left residues in food products. Thus, there is need of increasing awareness throughout the world about the organic, sustainable agricultural practices.

Disclaimer (Artificial intelligence)
Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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