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Effect of foliar application of micronutrients, novel organic liquid fertilizer and sea weed extract on yield of okra [*Abelmoschus esculentus* L. (Moench)]

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Abstract

The experiment entitled "Effect of foliar application of micronutrients, Novel organic liquid fertilizer and Sea weed extract on okra [*Abelmoschus esculentus* L. (Moench)]" was carried out during *kharif* season of 2016-17 and 2017-18 at the Vegetable Research Scheme, Regional Horticultural Research Station, Navsari Agricultural University, Navsari, Gujarat. The experiment was conducted on fixed plot site with a set of nine treatments *viz.*, the treatments comprising of two level of micronutrient mixture (Grade - I) (T₁: Micronutrient mixture (Grade I) 1% and T₂: micronutrient mixture (Grade I) 2%); three level of Novel organic liquid fertilizer (T₃: Novel organic liquid fertilizer 0.5%, T₄: Novel organic liquid fertilizer 1% and T₅: Novel organic liquid fertilizer 1.5%); three level of Sea weed extract (T₆: Sea weed extract 2%, T₇: Sea weed extract 4% and T₈: Sea weed extract 6%) and control (T₉). The experiment was evaluated in Randomized Block Design (RBD).

Foliar treatment had a significant impact on almost all parameters included in the study. Among the different foliar treatments, Novel organic liquid fertilizer 1.5% had significantly the higher values of growth parameters *viz.*, pod length (8.64 cm), pod diameter (1.43 cm), number of pods per plant (24.35), pod weight (11.45 g) and marketable pod yield (kg/plant and t/ha) *i.e.* 0.280 and 15.537 respectively.

Keywords: Okra, yield, micronutrients, novel organic liquid fertilizer and sea weed extract

Introduction

India has extremely varied and diverse physiography and agro-climatic condition, so there is wide variation in the types of vegetables that are grown in different seasons and parts of the country. In India, area become limiting factor for providing food to the large population of our country. Therefore, research toward regulation of plant growth as an important factor in improving the yield and quality of vegetable crops.

Okra is one of the most important and popular vegetable among different vegetables cultivated in India. In India, okra is cultivated in area of 5.07 lakh ha are and 60.03 lakh MT production with 12.0 MT/ha productivity. Andhra Pradesh having first rank while, Gujarat state rank fourth position in okra production. Gujarat occupy the 65660 ha area for okra and it produces 7.23 lakh MT with 11 MT/ha productivity (Anon., 2016) [6].

Okra [*Abelmoschus esculentus* (L.) Moench] is a member of the family Malvaceae and native to South Africa and Asia. Earlier, its botanical name was [*Hibiscus esculentus* (L.) Moench] under the section *Abelmoschus* of *Hibiscus*, established by Linnaeus in 1737. Okra is known by many local names in different parts of the world. For example, it is called *lady's finger* in England, *gumbo* in the United States of America and *bhindi* in India. Okra pods are considered nutritious. It provides some human supplementary vitamins such as vitamin C, A, B- complex and minerals like calcium, potassium, iron and others (Adebooye and Opunta, 1996) [1].

Micronutrients disorder appears to be the most widespread and frequent problem in crop production worldwide, resulting in severe losses in yield and nutritional values. Micronutrients like, copper (Cu), zinc (Zn) and iron (Fe) are important for proper functioning of biological systems of plant but their deficiency and toxicity lead various disorders.

Sea weeds have been used as manure, cattle feed, food for human consumption and as a source of phycocolloids such as agar, alginic acid and carrageenan. Besides their application as farm yard manure (FYM), liquid extracts obtained from seaweeds have recently gained importance as foliar sprays for several crops because the extract contains growth promoting hormones

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(IAA and IBA), cytokinins, trace elements (Fe, Cu, Zn, Co, Mo, Mn, Ni), vitamins and amino acids (Sivasankari, 2006 and Verkleij, 1992) [9, 10].

While, separating fibers from the banana pseudostem, the liquid available is known as banana pseudostem sap which contains sufficient amount of essential macro and micro plant nutrients. The application of sap saving of about 20 to 40 per cent RDF could be achieved without affecting the yields of banana, sugarcane and other crops.

Materials and Methods

The present investigation entitled “Effect of Foliar Application of Micronutrients, Novel Organic Liquid Fertilizer and Sea Weed Extract on Okra [*Abelmoschus esculentus* L. (Moench)]” was carried out at Vegetable Research Scheme, Regional Horticultural Research Station (R.H.R.S.), ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari during *kharif* 2016-17 and 2017-18. The experiment was taken on the okra crop. Okra variety “GAO- 5” was selected for experiment. The treatments were given by foliar application. The experiment was laid out in a Randomized Block Design (RBD) with four replications.

Results

All the important attributes related to growth were significantly affected by various foliar applications. The Table 1 clearly indicated that among the various foliar spray, significantly the higher pod length (8.64 cm), pod diameter (1.43 cm), number of pods per plant (24.35), pod weight (11.45 g), and maximum marketable pod yield (kg/plant and t/ha) i.e. 0.280 kg and 15.537 tonne respectively were noticed under foliar spray of Novel organic liquid fertilizer 1.5 % (T₅).

Discussion

The important attributes related to yield are *viz.* pod length, pod diameter, number of pods per plant and weight of pod (Table 1). All these were significantly affected by treatment of novel organic liquid fertilizer @ 1.5 %, except pod length in which treatment differences was found non-significant in both the year of study but pooled analysis was found

significant. It is noteworthy that the okra crop responded well to application of Novel organic liquid fertilizers, seaweed extract and micronutrient mixture.

During the course of investigation, there was significant increase in pod characters by application of Novel organic liquid fertilizers 1.5 %. It might be due to higher carbohydrate accumulation in plant at early stages of growth as a resulted better nutrient supply, which causes an increased in pod size. Another favorable factor contributing for better pod characters might be the involvement of novel organic liquid fertilizer which contained fair amount of macro and micronutrients as well as growth promoting substances which induced better plant growth.

Almost both the yield attributes *viz.* pod yield per plant (kg) and total pod yield (t) per hectare were significantly influenced with application of Novel organic liquid fertilizers. Okra plant sprayed with 1.5 % Novel organic liquid fertilizers favorably influenced the growth parameters registering the higher values for all the yield attributes *viz.* pod yield per plant and total pod yield and proved superior over other treatments.

The higher values of yield per plant and total yield might be due to the higher production of dry matter, height of plant, branches and pods produced per plant. All these factors are very closely related to crop yield. The other reasons may be the effect of novel organic liquid fertilizer which contain macro and micronutrients. The nutrients N and K at higher rate exerted a significant positive influence on yield. The other bio-parameters which could have helped in the increase of yield were synthesis of carbohydrates and their translocation to the potential storage organs through better growth and more number of pods per plant. All these reasons individually or synergistically resulted in increased vegetative growth reflecting in terms of foliage production, plant height which in turn has increased the yield. Usefulness of the nutrients to determine the influence on pod characters of okra and its yield is adequately stressed and the present study also corroborated with the findings of Anon. (2011) [2] and Anon. (2014) [5] in banana; Anon. (2012) [3] in mango; Anon. (2013) [4] in papaya; Deore *et al.* (2010) [7] in chilli and Salunkhe *et al.* (2013) [8] in onion.

Table 1: Effect of different level of micronutrient mixture, Novel organic liquid fertilizer and Sea weed extract on yield and yield attributes of okra

Treatments	Pod length (cm)	Pod diameter (cm)	Number of pods per plant	Weight of pod (g)	Marketable pod yield (kg/plant)	Marketable pod yield (t/ha)
T ₁ : Micronutrient mixture (Grade I) 1 %	8.11	1.20	22.48	10.00	0.228	12.647
T ₂ : Micronutrient mixture (Grade I) 2 %	8.18	1.21	22.72	10.22	0.233	12.952
T ₃ : Novel Organic Liquid Fertilizer 0.5 %	8.29	1.25	23.47	10.53	0.249	13.842
T ₄ : Novel Organic Liquid Fertilizer 1%	8.57	1.39	23.70	11.31	0.269	14.925
T ₅ : Novel Organic Liquid Fertilizer 1.5 %	8.64	1.43	24.35	11.45	0.280	15.537
T ₆ : Sea weed extract 2 %	8.48	1.33	23.56	10.95	0.260	14.425
T ₇ : Sea weed extract 4 %	7.78	1.17	22.06	9.09	0.205	11.397
T ₈ : Sea weed extract 6 %	7.64	1.16	21.15	8.98	0.193	10.703
T ₉ : Control	7.48	1.15	19.78	8.62	0.175	9.703
S.Em. ±	0.26	0.03	0.50	0.22	0.010	0.547
C.D. at 5 %	0.72	0.09	1.40	0.63	0.028	1.551
C.V. %	9.58	7.73	6.60	6.67	12.93	12.93

Conclusions

On the basis of present investigation on the Effect of foliar application of micronutrients, Novel organic liquid fertilizer and sea weed extract on of okra [*Abelmoschus esculentus* L. (Moench)], it could be concluded that foliar spray with Novel organic liquid fertilizer@ 1.5 % (T₅) found to be beneficial to

pod length (8.64 cm), pod diameter (1.43 cm), number of pods per plant (24.35), pod weight (11.45 g) and marketable pod yield (kg/plant and t/ha) i.e. 0.280 and 15.537 respectively.

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