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Effect of Humic Acid on Growth of Okra (*Abelmoschus esculentus* L.) cv. Arka Anamika

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A B S T R A C T

Humic acid is an organic substance which is beneficial to both soil and plants which possess phytohormone like activity. The present study was conducted to test the effect of different levels of humic acid by soil application and foliar spray either alone or in combination on growth and yield of okra cv. Arka Anamika. The experiment was carried out at Department of Horticulture, Gandhi KrishiVigyana Kendra, University of Agricultural Sciences, Bangalore during *rabi* season of 2019-20 and this experiment was laid out in Randomised Complete Block Design (RCBD) with 9 treatments and 3 replication at spacing of 60 cm X 30 cm between the rows and plants. Two levels of humic acid (10 ml, 15 ml) applied as a soil drench at the time of sowing, foliar spray at 30 days after sowing and in combination of both was imposed. The results of the investigation revealed that, the treatment combination with soil application of HA 15 ml/l + foliar application of HA 15 ml/l (T_9) recorded significantly higher plant height, more number of leaves and branches, highest leaf area and highest chlorophyll content in the leaves.

Introduction

Okra (*Abelmoschus esculentus* L.) is essentially native to Africa but few wild types are found in India. It is generally known as lady's finger or Bhendi and is one of the most delicious vegetables relished world over. It belongs to genus *Abelmoschus* of family Malvaceae. It is a major vegetable crop cultivated in various states of India. It has good demand all round the year for its tender fruits and considered as an economically important vegetable cultivated in tropical and subtropical regions of the world especially India, U.S.A., Nigeria, Sudan, Iraq, Pakistan, Turkey, Australia, U.K and other

neighbouring countries. Okra can be grown on a wide range of soils, but well-drained fertile soils with enough organic matter result in high yield and a pH of 6.0-6.8 is ideally suited. Okra cultivation has made popularity among Indian farmers because of its ease of cultivation, higher yield and wider adaptability (Mandal *et al*., 2012). India stands number one in area and production of okra in the world. The total area and production under okra are reported to be 1148.0 thousand hectare and 7896.3 thousand tons, respectively in world. Okra is cultivated in an area of 5.01 lakh hectares, with a total production of 52.72 lakh tonnes in India (*Anon*., 2018).

Fruits of okra contain good amount of vitamins (A, B and C) and proteins, carbohydrates, fats, minerals and iron calcium and iodine which is obligatory for the resistance against throat disease like simple goiter and it has been used as an ingredient for many herbal formulations, which are used for the cure of various ailments particularly the regulation of blood pressure, fat, diabetes, chronic dysentery, inflammation, genito-urinary disorders and ulcer (Singh e*t al.*, 2014).

Humic acid is a heterogeneous mixture of many compounds with generally similar chemical properties. It performs various functions in the soil and on plant growth one of the functions of humic acid is the positive effect on the promotion of root development (Rengrudkij and Partida, 2003). Humic acid improved the water holding capacity of the soil and also stabilizes soil structure through the formation of micro aggregates (Sumukh Dias, 2001). Humic acid have hormone like activity of cell division and elongation affects on the plant growth and development (Schneider and Wightman, 1974). It increase the uptake of both micro and macro nutrients. Besides the hormonal activity and it improves the nutritional status, it shows anti-stress affect in plant body when soil pH and temperature are unfavourable for plant growth. The present study was carried to study the effect of humic acid on growth of okra (*Abelmoschus esculentus* L.) cv. Arka Anamika.

Materials and Methods

Field experiment was conducted during the year 2019 in *rabi* season carried out at Department of Horticulture, College of Agriculture, GKVK Campus, University of Agricultural Sciences, Bangalore. Geographically, the place is located in the Eastern dry zone (Zone-5) of Karnataka state at 13° 05'' North latitude and 77° 34'' East longitude. Okra cv. Arka Anamika was used for this study. Spacing of 60X 30 cm was followed. FYM@ 25 t/haand Recommended dose of fertilizers: 125:75:63 kg N: P_2O_5: K_2O per ha was applied. The experiment was carried out following randomized complete block design (RCBD) with nine treatments and three replications. The treatment details are:

T1 - Control (FYM+ RDF)
T2 - Soil application of HA (10 ml/l)
T3 - Soil application of HA (15 ml/l)
T4 - Foliar application of HA (10 ml/l)
T5 - Foliar application of HA (15 ml/l)
T6 - Soil application of HA (10 ml/l) + Foliar application of HA (10 ml/l)
T7 - Soil application of HA (10 ml/l) + Foliar application of HA (15 ml/l)
T8 - Soil application of HA (15 ml/l) + Foliar application of HA (10 ml/l)
T9 - Soil application of HA (15 ml/l) + Foliar application of HA (15 ml/l)

Note:

RDF - Recommended dose of fertilizer.
FYM - Farm yard manure.
HA - Humic acid

FYM and RDF are common for all the treatments. 10% humic acid has been used as standard stock for calculation of treatments. Soil application of humic acid is applied as soil drench at the time of sowing and foliar spray of humic acid at 30 days after sowing. Growth parameters like plant height and number of leaves wase recorded at 15, 30, 45 and 60 days after sowing and other growth parameters such as number of branches, leaf area and chlorophyll content were recorded at 60 days after sowing as per the standard procedures.

Results and Discussion

Results obtained during the investigation are presented here with the supported discussions. The data pertaining to plant height (cm), number of leaves per plant, number of branches per plant, leaf area (cm^2), chlorophyll content (SPAD value), were presented in table 1. There was a significant difference among the different levels of humic acid in all the parameters.

The maximum plant height (166.80 cm) was recorded under (T_9) soil application of HA 15ml/l + foliar application of HA 15ml/l whereas, it was minimum (130.26 cm) under control (T_1). The increase in the plant height might be due to the application of humic acid increases the uptake of calcium which plays a major role in the mitotic cell division of apical meristems and influences the plant height was noticed by Haider *et al.,* (2017). The similar result are observed by Kirn *et al*., 2010 in okra, Kumar *et* al., 2015 in okra and Gad *et al*., 2015 in okra.

Maximum number of leaves per plant (28.33) was observed in (T_9) soil application of HA 15ml/l + foliar application of HA 15ml/l which is significant over other treatments and found on par with T_8(25.33) soil application of HA 15ml/l + foliar application of HA 10 ml/l and least in (T_1) FYM+ RDF (21.13). Increase in the number of leaves per plant might be due to the maximum availability and uptake of nutrients improved the plant growth and increases the plant height which is the key factor for number of leaves. The similar study was conducted by Haider *et al.,* (2017) in okra and Shafeek *et al.,* (2016) in cucumber.

The number of branches per plant differed significantly among the different levels of humic acid at all the stages of crop growth. At 60 days after sowing the maximum number of branches were noticed in T_9 (4.60) followed by T_8 (4.33) and minimum number of branches per plant (3.60) were recorded in T_1 (FYM+ RDF). The increase in number of branches per plant which might be due tothe hormone like activity of humic substances which has similar effects as that of auxins this might have promoted for the increase in number of branches (Pizzeghello *et al*., 2001).

The leaf area was recorded at 60 days after sowing. The results showed significant differences among the different levels of humic acid. The highest leaf area (441.08 cm^2) was recorded with T_9 followed by T_8 (424.66 cm^2). While the lowest leaf area (382.45 cm^2) was noticed in T_1. The increase in leaf area might be due to increase in soil porosity, roots development and increase in nutrient uptake, such as nitrogen which is one of basic elements for better vegetative growth of the okra plant (Haider *et al.,* 2017). Similar result was found by Haghighi *et al*., 2011.

Chlorophyll content of leaf was recorded at 60 days after sowing. The results showed significant difference among the different levels of humic acid. The highest chlorophyll content (58.54 SPAD) was recorded with T_9 followed by T_8(53.69 SPAD) and the lowest chlorophyll content of leaf (47.32 SPAD) was noticed from control treatment T_1. The

increased total leaf chlorophyll contents might be due to the acceleration of N and NO_3 uptake, enhancing N metabolism and production of protein by HA that ultimately increase chlorophyll contents (Haghighi *et al*., 2012).

The results obtained in the present study reveals that humic acid application augment the growth in okra cv. Arka Anamika without any adverse effect on soil health of crop. Humic acid could be a good source of plant nutrients which helped to improve the soil fertility and crop productivity. Thus, overall study indicates are ample scope for utilization of humic acid as input material for crop production. It can be concluded that soil drench of humic acid 15 ml/L at the time of sowing and foliar spray of humic acid 15 ml/ L @ 30 days after sowing improve soil fertility, water and nutrient availability, encourage the absorbance and translocation of nutrients in plants, stimulate plant growth by hormonal activity in plants and ultimately ameliorate growth of okra with sustaining natural resource and being environment friendly.

Table.1 Effect of Humic acid on growth of okra (*Abelmoschus esculentus* L.) cv. Arka Anamika''

Treatments	Plant height (cm) (60 DAS)	Number of leaves per plant (60 DAS)	Number of branches per plant (60 DAS)	Leaf area(cm^2) (60 DAS)	Chlorophyll (SPAD value) (60 DAS)
T_1	130.26	21.13	3.60	382.45	47.32
T_2	136.33	21.80	3.86	409.36	48.23
T_3	145.00	24.00	3.93	423.76	47.76
T_4	148.53	23.13	3.86	382.72	49.84
T_5	153.00	25.00	3.93	397.36	50.52
T_6	157.20	24.93	3.93	407.19	53.62
T_7	155.86	24.90	4.13	406.88	53.28
T_8	161.66	25.33	4.33	424.66	53.69
T_9	166.80	28.33	4.60	441.08	58.54
S.Em±	1.18	0.74	0.14	5.98	0.86
CD @5%	3.54	2.23	0.44	17.93	2.60

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