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Effect of liquid bio formulation on growth, yield and quality of okra (*Abelmoschus esculentus* L.)

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Abstract

The present investigation aimed to find out the “Effect of Liquid Bio Formulation on Growth, Yield and Quality of Okra (*Abelmoschus esculentus* L.)” was carried out at Instructional Farm Agriculture (Horticulture), Faculty of Agriculture and Veterinary Sciences, Mewar University Chittorgarh, Rajasthan. The experiment was laid out in Randomized Block Design. Replicated thrice with 9 treatment combinations, comprising like T₁ Control, T₂ Vermiwash 5%, T₃ Panchgavya 5%, T₄ Jeevamrit 5%, T₅ Cow urine 5%, T₆ Vermiwash 10%, T₇ Panchgavya 10%, T₈ Jeevamrit 10% and T₉ Cow urine 10%. Tested variety during research Akra Anamika.

The application of liquid organic formulation on productivity was found most effective improve success on growth yield and quality of okra. The maximum plant height was found (30.06 and 68.20 cm), maximum number of leaves (14.10 and 26.29) respectively, were recorded at 30 and 60 DAS, Highest average fruit weight (i.e. 12.03 g), maximum number of fruits per plant (14.06). The highest yield per plant (169.14 g), the maximum fruit yield per (6.77 kg) significantly maximum fruit yield (i.e. 125.23 q ha⁻¹), the highest protein content (12.69%), the highest ascorbic acid content (19.08 mg/100 g), the highest chlorophyll content (40.35 mg/100 g), the maximum net return (₹ 174965.18) and maximum B: C ratio (i.e. 2.32), were recorded under T₇ (Panchgavya 10%).

Keywords: Okra, liquid bio formulation, growth, yield and quality

Introduction

Okra (*Abelmoschus esculentus* L. Moench) belongs to the family Malvaceae (2n = 130) and one of the prominent vegetable crops in the world. It is highly nutritious vegetable crop. India is the largest producer of okra in the world. The major okra growing states are Uttar Pradesh, Odisha, Bihar, Andhra Pradesh and West Bengal.

Liquid organic manure is a process of recycling of organic wastes in an environmentally safe method. Liquid organic manure is a mixture of worm casts, which is rich source of micro and macronutrient. The worm casts apart from increasing the density of microbes also provide the required nutrients of plants.

Panchagavya holds a pivotal role in enhancing the quality of fruits and vegetables, commonly utilized as a foliar spray, soil application in conjunction with irrigation, and even as a seed treatment. Particularly in South India, farmers employ Panchagavya as a sustainable agricultural practice, steering away from chemical fertilizers and pesticides that contribute to environmental degradation. As an alternative to conventional chemicals, Panchagavya is sought after for its ability to improve crop establishment and health (Kumar *et al.*, 2020) [6]. Functioning as a potent growth promoter and immunity booster for plants, Panchagavya is rich in beneficial microbial populations, serving as a natural fertilizer with remarkable effects on plant growth. It enhances the biological and metabolic efficiency of crops, containing growth hormones like Auxins and Gibberellins, which positively influence crop development. Furthermore, it acts as a tonic for soil enhancement, promoting both crop growth and yield, thereby instilling vigor in plants while ensuring quality production. Panchagavya's significance extends to its role in conferring resistance against pests and diseases, consequently elevating overall yields.

The use of cow urine has been well known in India since ancient times. It is a rich source of macronutrients and micronutrients with prophylactic and disinfectant properties thus

improving the atmosphere and also improving soil fertility (Pathak and Ram, 2013) ^[9]. Cow urine is a unique product of dairy which have huge property such as manure, antimicrobial agent, disinfectant. It contains 95% water, 2.5% urea and remaining 2.5% contains mineral salts, hormones and enzymes. In organic farming, cow urine is used for preparation of number of growth promoter and bio-pesticides, which are effective in improving soil fertility, and management of large number of pests and diseases in varied group. The biochemical contents of the plants increased with cow urine application (Pradhan *et al.*, 2018) ^[10].

Materials and Methods

The field experiment was conducted at Agriculture Research Farm, Mewar University Gangrar, Chittorgarh, Rajasthan during 2024-25, which is situated at South-East part of Rajasthan at an elevation of 582.17m above mean sea level at 24°35' N latitude and 73 ° 42' E longitude. It falls under the agro-climatic zone IV A i.e. Sub humid Southern Plain and the Aravalli hills of Rajasthan. Spray treatment wise at first flowering okra. Application of liquid bio formulation at flowering and 15 days after flowering.

Results and Discussion

Effect of liquid bio formulation on

Growth attributes

Data examine in Table 1 to 3 indicate that application of liquid bio formulation brought about a significant variation in growth parameters as viz., plant height was found to be maximum (14.10 and 26.29)), The maximum number of leaves (14.10 and 26.29) respectively, were recorded at 30 and 60 DAS and minimum days taken to first flowering (47.65) was recorded under T₇ (Panchgavya 10%).

Panchagavya contains macronutrients such as N, P, K and micronutrients needed for various vitamins, amino acids, growth regulators such as auxins and gibberellins which are required for proper growth and development of plants. Similar results were recorded by Malarvizhi *et al.* (2009) ^[7] in paprika cv. Kt-PI-19 and Swain *et al.* (2015) ^[13] in chilli. This increase in number of leaves per plant might be due to the proper nutrition to okra crop through the foliar application of organic products which contributed to enhance source-sink relationship in the plant. The results were in the similar line with Suchitra *et al.* (2017) ^[12] in okra

Application of 10% panchagavya showed better results on plant growth because panchagavya contains macronutrients such as N, P, K and micronutrients needed for various vitamins, amino acids, growth regulators such as auxins and gibberellins which are required for proper growth and development of plants. Similar results were recorded by Gopakkali and Sharanappa (2014) ^[4] in chilli and Mishra *et al.* (2015) ^[8] in capsicum. The result also showed that the application of organic substances with the combination of inorganic fertilizers was found more beneficial for increasing the height of okra plants. This might be due to the fact that the organic substances would have provided congenial of soil physical condition and the micronutrients in an optimum range to the plant. Application of organic substances helped to promote the metabolic activities through the supply of such important micronutrients in the early growth phase which in turn must have encouraged the overall growth. Similar findings were also reported by Swain *et al.* (2015) ^[13] in Chilli and Amiry *et al.* (2017) ^[1] in

okra.

Yield attributes and yield

A glance of the data represented in Table 4 to 5 that there was significant effect on liquid organic formulation on yield of okra. Maximum fruit weight (i.e. 12.03 g), fruits per plant was found to be maximum (14.06), highest yield per plant (169.14 g). The maximum fruit yield per (6.77 kg), maximum fruit yield (i.e. 125.23 q ha⁻¹) was recorded under T₇ (Panchgavya 10%)

The above result indicated that, the probable reason of increasing fruit yield is due to the better availability of nutrient through both the organic and inorganic sources at right time of plant growth stage. The higher growth of plant which provide the more area for photosynthetic activities, cell division, cell expansion as well as metabolic process results in increased the yield of plant. This may lead to early flowering resulted in producing productive flowers ultimately results in increased yield per hectare (q) and more number of fruit per plant due to the application of liquid organic manures along with recommended dose of fertilizer. This result are also corroborated by the findings of Boraiah (2013) ^[2], Kumar and Devakumar (2016) ^[3] and Rakesh *et al.* (2017) ^[11]. The increased values for yield parameters in the study might be due to higher number of bacteria, fungi and actinomycetes were found in panchagavya and due to which higher mineralization and solubilization of nutrients was occurred that provide nutrients to plants resulted in it could be increased yield attributes and yield. Panchagavya also have higher enzymatic activity (Acid-phosphatase, Alkaline phosphatase and dehydrogenase activity). Panchagavya contain considerable level of growth regulators such as auxins, gibberellins, cytokinin which in turn increased the production of growth regulator in cell system and the action of growth regulators in plant system stimulated the necessary growth and development, leading to better yield. The easy transfers of nutrients and growth stimulants to plants through foliar spray might be the reason for enhancement in yield attributes.

Liquid formulations favoured vigorous growth and synthesized more these hormones in plants, which might have helped to the translocation as well as more quantity of available phosphorus through the xylem vessels and their accumulation in the auxiliary buds that would have favoured the plant to enter reproductive phase

The results obtain were in with the findings of (Swain *et al.* (2015) ^[13] in which they reported that higher yield response of crops due to liquid organic formulations application could be attributed to improved physical and biological properties of the soil resulting in better supply of nutrients to the plants.

Quality parameters

The data (Table 6) highest protein content (12.69%), highest ascorbic acid content (19.08 mg/100 g) and highest chlorophyll content (40.35 mg/100 g) was observed under treatment T₇ (Panchgavya 10%). This is due to easy availability of nitrogen and organic carbon lead to balanced C: N ratio which improved the quality of produce. Panchagavya has macronutrients, micronutrients and amino acids which are required for biological processes of plants. These contents are helpful for improve the quality of fruit. Similar results observed through use of liquid formulations by Jandaik *et al.* (2015) ^[5] in okra and methi.

Total soluble solid (⁰Brix) concluded that Organic liquid formulations play an important role in improving productivity and quality of fruit. Fermented liquid organic manures contain microbial population and promote growth of plant in addition to nutrients which helps to increase chlorophyll content in leaves might have lead to increased photosynthesis activity which in turn have better growth attributes. The results are in conformity with those reported by Rakesh *et al.* (2017)^[11] in okra.

Economics

A perusal of data (Table 7) reveals that the economics on net return of okra changed with the advancement of the yield period on all the observation. The maximum net return (₹ 174965.18) and maximum B: C ratio (i.e. 2.32) was found significant under T₇ (Panchgavya 10% at.

Table 1: Effect of liquid bio formulation on plant height

Treatments	Treatments details	Plant height (cm)	
		At 30 DAS	60 DAS
T ₁	Control	24.64	63.39
T ₂	Vermiwash 5%	26.37	64.59
T ₃	Panchgavya 5%	27.75	65.68
T ₄	Jeevamrit 5%	27.48	65.14
T ₅	Cow urine 5%	25.45	64.63
T ₆	Vermiwash 10%	28.82	66.45
T ₇	Panchgavya 10%	30.06	68.20
T ₈	Jeevamrit 10%	29.15	67.55
T ₉	Cow urine 10%	28.20	66.19
	S.Em±	1.43	3.67
	CD at 5%	4.28	11.00
	CV%	8.98	9.66

Table 2: Effect of liquid bio formulation on number of leaves

Treatments	Treatments details	Number of leaves	
		At 30 DAS	60 DAS
T ₁	Control	10.42	20.60
T ₂	Vermiwash 5%	11.68	21.88
T ₃	Panchgavya 5%	12.73	22.73
T ₄	Jeevamrit 5%	12.24	22.17
T ₅	Cow urine 5%	11.25	21.53
T ₆	Vermiwash 10%	13.44	24.18
T ₇	Panchgavya 10%	14.10	26.29
T ₈	Jeevamrit 10%	13.92	25.47
T ₉	Cow urine 10%	13.17	23.54
	S.Em±	0.75	1.28
	CD at 5%	2.24	3.84
	CV%	10.32	9.57

Table 3: Effect of liquid bio formulation on Days taken to first flowering

Treatments	Treatments details	Days taken to first flowering
T ₁	Control	51.37
T ₂	Vermiwash 5%	50.66
T ₃	Panchgavya 5%	49.70
T ₄	Jeevamrit 5%	50.45
T ₅	Cow urine 5%	50.87
T ₆	Vermiwash 10%	48.98
T ₇	Panchgavya 10%	47.63
T ₈	Jeevamrit 10%	48.31
T ₉	Cow urine 10%	49.26
	S.Em±	2.93
	CD at 5%	NS
	CV%	10.21

Table 4: Effect of liquid bio formulation on average fruits weight, number of fruits per plant and yield per plant

Treatments	Treatments details	Average fruits weight (g)	Number of fruits per plant	Yield per plant (g)
T ₁	Control	9.25	11.50	106.38
T ₂	Vermiwash 5%	10.56	12.68	133.90
T ₃	Panchgavya 5%	11.74	13.05	153.21
T ₄	Jeevamrit 5%	11.25	12.85	144.56
T ₅	Cow urine 5%	10.21	12.36	127.21
T ₆	Vermiwash 10%	11.82	13.46	159.10
T ₇	Panchgavya 10%	12.03	14.06	169.14
T ₈	Jeevamrit 10%	11.94	13.76	164.29
T ₉	Cow urine 10%	11.69	13.18	154.07
	S.Em±	0.61	0.63	4.35
	CD at 5%	1.83	1.89	13.05
	CV%	9.46	8.42	9.09

Table 5: Effect of liquid bio formulation on fruit yield per plot and yield

Treatments	Treatments details	Fruit yield per plot (kg)	Yield (q/ha)
T ₁	Control	4.26	79.05
T ₂	Vermiwash 5%	5.36	100.55
T ₃	Panchgavya 5%	6.13	113.35
T ₄	Jeevamrit 5%	5.78	106.87
T ₅	Cow urine 5%	5.05	93.55
T ₆	Vermiwash 10%	6.36	117.76
T ₇	Panchgavya 10%	6.77	125.01
T ₈	Jeevamrit 10%	6.57	121.90
T ₉	Cow urine 10%	6.16	113.89
	S.Em±	0.29	6.09
	CD at 5%	0.87	18.24
	CV%	8.63	9.76

Table 6: Effect of liquid bio formulation on fruit protein content, ascorbic acid content and chlorophyll content

Treatments	Treatments details	Protein content (%)	Ascorbic acid content (mg/100 g)	Chlorophyll content (mg/100 g)
T ₁	Control	10.19	16.32	35.51
T ₂	Vermiwash 5%	11.24	17.43	36.45
T ₃	Panchgavya 5%	11.74	18.06	37.67
T ₄	Jeevamrit 5%	11.47	17.86	37.24
T ₅	Cow urine 5%	11.27	17.25	36.15
T ₆	Vermiwash 10%	12.07	18.52	38.76
T ₇	Panchgavya 10%	12.69	19.08	40.35
T ₈	Jeevamrit 10%	12.33	18.82	39.56
T ₉	Cow urine 10%	11.89	18.19	38.32
	S.Em±	0.72	0.36	0.65
	CD at 5%	2.15	1.08	1.95
	CV%	10.65	8.09	9.45

Table 7: Effect of liquid bio formulation on Net return and B: C ratio

Treatments	Treatments details	Net return	B:C ratio
T ₁	Control	102520.10	1.86
T ₂	Vermiwash 5%	132780.30	2.03
T ₃	Panchgavya 5%	157868.93	2.29
T ₄	Jeevamrit 5%	146068.15	2.15
T ₅	Cow urine 5%	121870.44	1.87
T ₆	Vermiwash 10%	162091.13	2.21
T ₇	Panchgavya 10%	174965.18	2.32
T ₈	Jeevamrit 10%	168787.15	2.27
T ₉	Cow urine 10%	156153.08	2.17
	S.Em±	9069.66	0.08
	CD at 5%	27192.03	0.25
	CV%	10.69	6.66

Conclusion

On the basis of present investigation entitled “Effect of Liquid Bio Formulation on Growth, Yield and Quality of Okra (*Abelmoschus esculentus* L.)” it can be concluded that treatment T₇ (Panchgavya 10% at first flowering) was found significantly superior in terms of growth, yield and quality parameters of okra crop, improved and increased different crop attributes.

Therefore, treatment T₇ (Panchgavya 10%) recommended for okra crop to obtain superior values of growth, yield, quality parameters and increased net return of the treatments. This treatment also enhanced the physical properties and also microbial population in the soil.

However, these findings are based on one year's field experimentation and hence need further experimentation for confirmation

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