

Biofertilizers versus inorganic fertilizers: Their effects on Okra

ABSTRACT

The study on **Effects** of different inorganic fertilizers and bio-fertilizers in growth, yield and quality on **Okra (*Abelmoschus esculentus L. Moench*)**, was carried out during March – June 2023 at Department of Horticulture, Naini Agricultural Institute, SHUATS, Prayagraj. **Again: Longitude, Latitude, Altitude above sea level of the site**

The abstract shall address the following issues:

1. What is the purpose of the experiment: To benchmark biofertilizers v.s. inorganic fertilizers.
2. What are the main findings?
3. What is the take-home lesson?

This abstract belongs to Material and Methodology

The experiment was carried out to screen out the best combination of Biofertilizer and inorganic manures for growth, yield and quality of okra and to work out the economics.

The experiment was carried under Randomized Block Design (RBD) with three replications. There were 15 treatments T₁ 100:80:80 (RDF) (Control), T₂ (75% N + 100% PK + Azotobacter), T₃ (75% N + 100% Pk + Azospirillum), T₄ (75% P + 100% NK + PSB), T₅ (75% N + 100% PK + Azotobacter + Azospirillum), T₆ (75% NP + 100% K + Azotobacter + PSB), T₇ (75% NP + 100% K + Azospirillum + PSB), T₈ (75% NP + 100% K + Azotobacter + Azospirillum + PSB), T₉ (50% N + 100% PK + Azotobacter), T₁₀ (50% N + 100% PK + Azospirillum), T₁₁ (50% P + 100% NK + PSB), T₁₂ (50% N + 100% PK + Azotobacter + Azospirillum), T₁₃ (50% NP + 100% K + Azotobacter + PSB), T₁₄ (50% NP + 100% K + Azospirillum + PSB), T₁₅ (50% NP + 100% K + Azospirillum + Azotobacter + PS). The result shows that T₈ 75%N + 100%PK + Azotobacter + Azospirillum + PSB was found superior in terms of plant height (9.30cm in 20 days, 30.23cm in 40 days, 43.58cm in 60 days), plant spread (19.94cm² in 20 days, 34.64 cm² in 40 days, 60.74 cm² in 60 days), days to first flowering (33.98 days), days to 50% flowering (42.43days), days to fruit setting (46.95 days), days to first fruit picking (48.68 days), fruit weight (9.83g), length of fruit at marketable stage (13.10cm), girth of fruit (2.02cm), no. of fruit per plant (23.98/plant), no. of seeds per fruit

(48.39), fruit yield per plant(g) 235.65g, fruit yield per plot (kg) 7.78kg, fruit yield (t/ha) 19.44 t/ha, TSS (14.61°Brix), ascorbic acid (21.31 mg/100g). Net economic returns of treatment was highest in T₈ (75%N + 100%PK + Azotobacter + Azospirillum + PSB) Rs.472592.83 with highest cost benefit ratio of (4.27).

Too much information for an abstract

Key words: Inorganic fertilizers, Bio- fertilizers, Okra, Growth, Yield, Quality.

1. Introduction

Inorganic fertilizers are banned from organic farming in several countries by law viz. standards of certification. Since ecological farming requires a systemic approach (ALTIERI, Miguel A.; HECHT, Susanna B. (1990) Agroecology and small farm development. Boca Raton, FL: CRC Press) we present here a kind of “acid test” to check out the real effects on a sample cultivar which is Okra. In this paper we will check the effects of (a) inorganic fertilizers versus (b) Biofertilizers on (c) Okra (*Abelmoschus Esculentus* L. Moench).

- (a) Inorganic fertilizers are industrially manufactured chemicals containing plant nutrients. Nutrient content is higher fertilizers than organic manures and nutrients are released almost immediately. (T.Yellamanda Reddy and G.H Sanjara Reddy., 2016). Nitrogen impart green colour to plant, encourages vegetative growth. It is present in most of substances of cells. Nitrogen is essential constituent of protean. It is constituent of protoplasm of chlorophyll and coenzyme. It plays an important role in synthesis of Auxin. While Phosphorus can increase the disease resistance, enhance new cell formation and necessary for root development and required for formation and maturity of grain. It is essential constituent for nucleic acid & phytin. The most essential function are energy storage and transfer of energy (ADT and ATP), act as energy currency. Potassium on the other hand helps in stomata regulation, provide disease and drought tolerance in plant. It is responsible for quality products. It is essential for formation and translocation of sugars, helps in chlorophyll formation. It is useful in stress condition because it secretes 60 enzymes. (Nem Raj Sunda., 2019) Biofertilizers have also become an important component for the crops, it holds a great promise to improve crop yields through better nutrient supplies. Azotobacter and Azospirillum are the two most important non-symbiotic N-fixing bacteria and considered to be very important for fixation of N in non-leguminous crops. Under appropriate conditions, Azotobacter and Azospirillum an enhance (write: improve) plant development and promote the yield of several agricultural/horticultural important crops in different soils and climatic regions (Jagnow, 1987; Becking, 1992; Okon and Labandera-Gonzalez, 1994).

- (b) Biofertilizers have also become an important component for the crops, it holds a great promise to improve crop yields through better nutrient supplies. Azotobacter and Azospirillum are the two most important non-symbiotic N-fixing bacteria and considered to be very important for fixation of N in non-leguminous crops. Under appropriate conditions, Azotobacter and Azospirillum enhance plant development and promote the yield of several agricultural/horticultural important crops in different soils and climatic regions (Jagnow, 1987; Becking, 1992; Okon and Labandera-Gonzalez, 1994). These beneficial effects of Azotobacter and Azospirillum on plants are attributed mainly to an improvement in root development, an increase in the rate of water and mineral uptake by roots, displacement of fungi and plant pathogenic bacteria and, to a lesser extent, biological N₂fixation. (Okon and Itzigsohn, 1995). Besides N₂fixation, Azotobacter synthesizes and secretes considerable amounts of biologically active substances like B vitamins, nicotinic acid, pantothenic acid, biotin, heteroxins, gibberellins etc. which enhance root growth of plants (Mishutin, 1970; Rao, 1986). Another important characteristic of Azotobacter association with crop improvement is excretion of ammonia in the rhizosphere in the presence of root exudates, which helps in modification of nutrient uptake by the plants (Narula and Gupta, 1986). The ability of Azospirillum to produce plant growth regulatory substances along with N₂fixation stimulate growth and thereby productivity. The changes that occur in the plant roots help in transport of minerals and water (Sarig et al., 1988). All these factors combined produce positive effects on crop yield especially for cereals and vegetables.
- (c) Concerning Okra: Bhindi or Okra botanically known as *Solanum melongena* belongs to the family Malvaceae having chromosome number of Okra $2n=130$. Its origin is tropical Africa. Okra seed germinates in 25-35°C but fast germination observed at 35°C seeds of okra does not germinate below 20°C temperature. Temperature above 42°C cause flower drop. (P.Muthukumar and R. Selvakumar., 2013)

Its tender green fruits are used as a vegetable and are generally marketed in fresh form, but sometimes in canned or dehydrated form. Major states of cultivation in India are Uttar Pradesh, Bihar, Orissa, West Bengal, Andhra Pradesh, Karnataka and Assam (Anon., 2011). West Bengal and Karnataka are major producers of okra. Okra is a good source of vitamin A and C. Vitamin A is high as 88 I. U. and vitamin C 13 mg per 100 gm of edible portion. It is rich source of Calcium, Potassium and other mineral matters. Calcium and Potassium content ranges from 66 mg to 103 mg per 100 gm of edible portion. It contains 89.6% water and the food value per 100 gm of edible portion is carbohydrates 6.4 gm, protein 1.9 gm, fiber 1.2 gm, magnesium 53 mg, phosphorus 56 mg, sulphur 30 mg, and oxalic acid 8 mg. Rahman and (Akter., 2012). Okra is cultivated for its fibrous fruits or pods containing round, white seeds. The fruits are harvested when immature and eaten as a vegetable.

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2. Materials and Methods

The experiment, “The Effect of different Inorganic Fertilizers and Bio-Fertilizers on Growth Yield and quality of Okra” (*Abelmoschus esculentus*) is conducted at Vegetable Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, and PRAYAGRAJ (UP) (give the longitude and latitude of each one of the experimental sites) during March – June 2022.

All the facilities necessary for cultivation, including labour were made available in the department. The experiment was conducted in Randomized Block Design (give some information on that design) with 15 treatments in three replications write: experimental re-runs. It's clearer. Explain what is T and explain the variables.

viz. T₁ 100:80:80 (RDF) (Control), T₂ (75% N + 100% PK + Azotobacter), T₃ (75% N + 100% Pk + Azospirillum), T₄ (75% P + 100% NK + PSB), T₅ (75% N + 100% PK + Azotobacter + Azospirillum), T₆ (75% NP + 100% K + Azotobacter + PSB), T₇ (75% NP + 100% K + Azospirillum + PSB), T₈ (75% NP + 100% K + Azotobacter + Azospirillum + PSB), T₉ (50% N + 100% PK + Azotobacter), T₁₀ (50% N + 100% PK + Azospirillum), T₁₁ (50% P + 100% NK + PSB), T₁₂ (50% N + 100% PK + Azotobacter + Azospirillum), T₁₃ (50% NP + 100% K + Azotobacter + PSB), T₁₄ (50% NP + 100% K + Azospirillum + PSB), T₁₅ (50% NP + 100% K + Azospirillum + Azotobacter + PS). The data was recorded for the following parameters viz plant height (cm), plant spread (cm²), days to first flowering, days to 50% flowering, days to first fruit setting, days to first fruit picking, weight of the fruit (g), length of the fruit at marketable stage (cm), girth of the fruit (cm), no. of seeds per fruit, No. of fruit per plant (g), average yield (kg), total yield (t/ha), TSS (°Brix), ascorbic acid (mg/100g), cost of cultivation (Rs.), gross return (Rs.), Benefit cost ratio. okay

3. Result and Discussion PLEASE SEPARATE RESULTS FROM DISCUSSION OTHERWISE YOU'LL PROVIDE A LOGICAL MAZE

The Study on Effect of different inorganic fertilizers and Bio-Fertilizers on growth, yield and quality of okra (*Abelmoschus esculentus*) var. TMOH 346 in Prayagraj (redundance) was carried out at Research Field of Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) in the year 2021–2022. The experiment was conducted in a Randomized Block Design (R.B.D.) with three replications. mean data of all the traits were subjected to

statistical analysis and salient features of experimental finding are mentioned below:

3.1 Growth Parameter

The differences in plant growth among the plants might be due to influence of various levels of inorganic fertilizers and biofertilizers, soil and environmental conditions. Nitrogen can impart green colour to the plant, encourage vegetative growth. It is present in most of substances of cells it is essential constitute of protein. It plays an important role in synthesis of auxin. Phosphorus enhances new cell formation and necessary for root development (Nem Raj Sunda, 2011).

Table 1: Effect of different inorganic fertilizers and bio fertilizers on growth parameter of okra (TMOH 346)

Treatment	Plant height (cm)			Plant spread (cm ²)		
	20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS
T ₁	6.63	23.22	30.58	13.07	19.79	40.41
T ₂	7.12	27.05	36.33	14.90	27.16	48.86
T ₃	7.34	27.17	37.08	15.10	26.81	49.30
T ₄	7.37	26.70	34.67	14.02	22.44	44.75
T ₅	7.73	27.80	37.16	15.75	28.47	50.31
T ₆	9.23	29.27	41.34	17.41	31.54	55.97
T ₇	9.17	29.10	40.32	16.64	29.48	55.77
T ₈	9.30	30.23	43.58	19.94	34.64	60.74
T ₉	7.93	25.80	36.09	14.75	26.51	46.92
T ₁₀	7.71	25.51	35.23	14.57	25.59	46.17
T ₁₁	7.58	27.10	35.18	14.23	24.48	45.56
T ₁₂	7.43	27.65	37.62	15.34	28.13	49.67
T ₁₃	9.06	29.03	38.41	16.03	29.16	53.67
T ₁₄	7.84	27.85	38.10	16.19	28.88	52.61
T ₁₅	9.27	29.29	41.81	17.67	32.87	57.08
F-Test	S	S	S	S	S	S
SE(d) ±	0.54	0.61	0.65	0.25	0.63	0.5
CD _{0.05}	1.10	1.24	1.34	0.52	1.3	1.03
C.V.	8.22	2.71	1.81	1.98	2.82	1.22

In table no. 1 Statistical analysis shows that all the traits were found significant From the experiment it was observed that T₈ (75%N + 100%PK + Azotobacter + Azospirillum + PSB) shows the maximum plant height 9.30cm in 20 Days,

30.23cm in 40 Days and 43.58cm in 60 days, followed by T₁₅ (50% + 100% PK + Azotobacter + Azospirillum + PSB) 9.27cm in 20 days, 29.29cm in 40 Days and 41.81cm in 60 days. The minimum plant height 6.63cm in 20 days 23.22cm in 40 days and 30.58cm in 60 days was found in T₁ RDN (100:80:80) N:P: K. The maximum plant spread 19.94cm² in 20 days, 34.64cm² in 40 days and 60.74cm² in 60 days was observed in T₈ (75%N + 100%PK + Azotobacter + Azospirillum + PSB) followed by T₁₅ (50% + 100% PK + Azotobacter + Azospirillum + PSB) 17.67cm² in 20 days, 32.87cm² in 40 days and 57.08cm² in 60 days. The minimum plant spread 13.07cm² in 20 days 19.79cm² in 40 days and 40.41cm² in 60 days was found in T₁ RDN (100:80:80) N:P: K.

Table 2: Effect of different inorganic fertilizers and bio fertilizers on earliness and yield parameter of okra (TMOH 346)

Treatment	Days to first flowering	50% flowering	Days to first fruit setting	Days to first fruit picking	No. of fruit per plant	Fruit length (cm)	Fruit weight (g)	Fruit girth (cm)	No. of seeds per plant	Fruit yield (g)	Fruit yield (kg)	Fruit yield (t/ha)
T ₁	51.26	64.51	69.76	72.66	15.71	7.40	6.06	1.20	26.64	95.19	3.14	7.85
T ₂	42.83	53.54	58.20	61.09	19.86	9.68	7.54	1.49	33.83	149.72	4.94	12.35
T ₃	42.03	52.68	56.82	59.83	20.48	9.92	7.58	1.54	34.43	155.15	5.12	12.80
T ₄	46.77	57.82	62.34	65.15	19.21	8.13	7.09	1.23	29.97	136.16	4.49	11.23
T ₅	38.58	48.69	53.24	56.35	20.76	11.19	7.71	1.71	37.22	159.96	5.28	13.20
T ₆	34.84	44.17	49.56	51.61	22.69	11.58	8.16	1.87	40.30	185.11	6.11	15.27
T ₇	37.20	46.86	51.11	54.01	21.64	11.48	8.06	1.85	39.82	174.31	5.75	14.38
T ₈	33.98	42.43	46.95	48.68	23.98	13.10	9.83	2.02	48.39	235.65	7.78	19.44
T ₉	43.73	54.39	58.83	61.54	20.20	9.55	7.45	1.44	32.97	150.56	4.97	12.42
T ₁₀	44.74	55.62	59.84	63.28	19.69	9.16	7.37	1.39	31.90	145.08	4.79	11.97
T ₁₁	45.52	56.43	60.98	63.57	19.63	8.92	7.24	1.33	31.12	142.04	4.69	11.72
T ₁₂	40.94	51.38	55.90	59.04	20.26	10.98	7.66	1.64	35.75	155.11	5.12	12.80
T ₁₃	38.12	48.00	52.40	55.15	21.37	11.45	7.89	1.81	39.06	168.54	5.56	13.90
T ₁₄	38.44	48.35	52.60	55.46	20.58	11.31	7.82	1.77	38.47	161.01	5.31	13.28
T ₁₅	34.21	44.23	49.05	51.38	22.82	11.80	8.23	1.90	42.31	187.86	6.20	15.50
F-Test	S	S	S	S	S	S	S	S	S	S	S	S
SE(d) ±	0.57	0.57	0.62	0.59	0.14	0.20	0.06	0.03	0.71	1.90	0.06	0.15
CD _{0.05}	1.18	1.18	1.28	1.21	0.29	0.42	0.14	0.07	1.45	3.90	0.12	0.32
C.V.	1.72	1.37	1.37	1.24	0.84	2.46	1.10	2.64	2.40	5.26	1.45	1.45

Explanation missing

Table 3: Effect of different inorganic fertilizers and bio fertilizers on quality parameter economic parameters of okra (TMOH 346)

Treatment	Ascorbic acid (mg/100g)	TSS (°Brix)	Total cost of cultivation (Rs. ha-1)	Net return (Rs. ha-1)	B:C
T ₁	16.09	11.30			
T ₂	17.07	12.81	112190.60	123415.05	1.10
T ₃	17.40	13.08	110241.60	260310.12	2.36
T ₄	15.87	12.23	110136.60	273853.13	2.49
T ₅	17.59	13.25	110286.60	226710.14	2.06
T ₆	19.29	13.80	110361.60	285545.67	2.59
T ₇	19.17	13.74	110511.60	347626.33	3.15
T ₈	21.31	14.61	110406.60	321017.25	2.91
T ₉	16.89	12.68	110631.60	472592.83	4.27
T ₁₀	16.77	12.55	108067.60	264564.44	2.45
T ₁₁	16.66	12.41	107962.60	251101.16	2.33
T ₁₂	17.50	13.17	108112.60	243440.77	2.25
T ₁₃	18.52	13.51	108187.60	275707.65	2.55
T ₁₄	17.89	13.40	108337.60	308795.93	2.85
T ₁₅	19.86	13.91	108232.60	290257.83	2.68
F-Test	S	S	108457.60	356504.81	3.29
SE(d) ±	0.32	0.08			
CD _{0.05}	0.66	0.18			
C.V.	2.22	0.83			

The tables must be placed here.

DISCUSSION!!!! (to write “may” does not refer to a fact. Facts are reserved for “RESULTS”)

3.2 Earliness parameter

Khan et al., (2013) reported the difference in days to flowering might be due to the genetic variation among the treatments. The early flowering may be attributed to the genetic makeup of the cultivar. Regarding the nitrogen fertilizer treatments, the higher doses of N delayed blooming. This may be due to the fact that excessive supply of N promotes luxuriant and succulent vegetative growth dominating the reproductive phase. As P enhances development of reproductive parts stimulates blooming and fruit setting, therefore minimum days to flowering were recorded in plot fertilized with lowest dose of N (100 kg ha⁻¹) combined with phosphorus and potassium. The results are in line with that of who reported that number of days to flowering was reduced by P and increased by N in okra. The differences in days to first fruit setting among the plants might be due to expression to the growing soil and environmental conditions. This may be due to the continued release of nutrients during the growing period of crop (**Gurjar et al., 2022**). The faster and more vegetative growth results in early flowering as well as early picking of fruits. Days to first pickings and productive span were significantly affected with the application of different fertilizer treatments. This increase might have been on account of combined effect of chemical fertilizers and biofertilizers, which favourably influenced flowering and fruit and ultimately resulted in increased productive span. These findings are in agreement with the results of (**Kanzariya et al., 2010**). The least number of days to flowering 33.98 days was observed in T₈ (75%N + 100%PK + Azotobacter + Azospirillum + PSB) followed by T₁₅ (50% + 100% PK + Azotobacter + Azospirillum + PSB) 34.21 days. The maximum number of days was found in T₁ RDN (100:80:80) N:P:K 51.26days (table no. 2). The least number of days to 50% flowering 42.43 days was observed in T₈ (75%N + 100%PK + Azotobacter + Azospirillum + PSB) followed by T₁₅ (50% + 100% PK + Azotobacter + Azospirillum + PSB) 44.23 days. The maximum number of days was found in T₁ RDN (100:80:80) N:P:K 64.51days (table no. 2). The least number of days to first fruit setting 46.95 days was observed in T₈ (75%N + 100%PK + Azotobacter + Azospirillum + PSB) followed by T₁₅ (50% + 100% PK + Azotobacter + Azospirillum + PSB) 49.05 days. The maximum number of days was found in T₁ RDN (100:80:80) N:P:K 69.76 days (table no. 2). The least number of days to first fruit picking 48.68 days was observed in T₈ (75%N + 100%PK + Azotobacter + Azospirillum + PSB) followed by T₁₅ (50% + 100% PK + Azotobacter + Azospirillum + PSB) 51.38 days and the maximum number of days was found in T₁ RDN (100:80:80) N:P:K 72.66 days (table no. 2).

3.3 Yield parameter (Section “Discussion”).

Increase in yield attributes fruit weight (units to be given not in abbreviations g), length of fruit at marketable stage (cm), girth of fruit(cm), number of fruits per plant, fruit yield per plant (g), fruit yield per plot (kg),

fruit yield (t/ha) (t is time according to ISI standards, write metric tons, if that are not British tons) might occur due to increased photosynthetic area and translocation of photosynthates in plants which subsequently accelerated the formation of more number of large sized fruits with more number of seeds/ fruits resulting in increase in fruit weight. The increase in fresh fruits weight of okra due to bio-fertilizer application could be attributed to easy solubilization effect of released plant nutrient leading to improve nutrient status and water holding capacity of the soil. The results obtained were in agreement with the findings of (Premsekhar and Rajashree 2009). The maximum number of fruits per plant 23.98 was observed in T₈ (75%N + 100%PK + Azotobacter + Azospirillum + PSB) followed by T₁₅ (50% + 100% PK + Azotobacter + Azospirillum + PSB) 22.82 and the minimum was found in T₁ RDN (100:80:80) N:P:K 15.71 (table no. 2). The maximum length of the fruit 13.10 cm was observed in T₈ (75%N + 100%PK + Azotobacter + Azospirillum + PSB) followed by T₁₅ (50% + 100% PK + Azotobacter + Azospirillum + PSB) 11.80cm and the minimum length of the fruit was found in T₁ RDN (100:80:80) N:P:K 7.40cm (table no. 2). The maximum weight of the fruit 9.83g was observed in T₈ (75%N + 100%PK + Azotobacter + Azospirillum + PSB) followed by T₁₅ (50% + 100% PK + Azotobacter + Azospirillum + PSB) 8.23g and the minimum weight of the fruit was found in T₁ RDN (100:80:80) N:P:K 6.06g (table no. 2). The maximum girth of the fruit 2.02cm was observed in T₈ (75%N + 100%PK + Azotobacter + Azospirillum + PSB) followed by T₁₅ (50% + 100% PK + Azotobacter + Azospirillum + PSB) 1.90cm and the minimum girth of the fruit was found in T₁ RDN (100:80:80) N:P:K 1.20cm (table no. 2). The maximum number of seeds per fruit 48.39 was observed in T₈ (75%N + 100%PK + Azotobacter + Azospirillum + PSB) followed by T₁₅ (50% + 100% PK + Azotobacter + Azospirillum + PSB) 42.31 and the minimum number of seeds per plant was found in T₁ RDN (100:80:80) N:P:K 26.64 (table no. 2). The maximum number of seeds per fruit 48.39 was observed in T₈ (75%N + 100%PK + Azotobacter + Azospirillum + PSB) followed by T₁₅ (50% + 100% PK + Azotobacter + Azospirillum + PSB) 42.31 and the minimum number of seeds per plant was found in T₁ RDN (100:80:80) N:P:K 26.64(table no. 2).). The maximum fruit yield per plant (g) was observed in T₈ (75%N + 100%PK + Azotobacter + Azospirillum + PSB) 235.65g followed by T₁₅ (50% + 100% PK + Azotobacter + Azospirillum + PSB) 187.86g and the minimum fruit yield per plant (g) was found in T₁ RDN (100:80:80) N:P:K 95.19g(table no. 2) . The maximum fruit yield per plot (kg) was observed in T₈ (75%N + 100%PK + Azotobacter + Azospirillum + PSB) (7.78kg) followed by T₁₅ (50% + 100% PK + Azotobacter + Azospirillum + PSB) (6.20kg) and the minimum fruit yield per plot (kg) was found in T₁ RDN (100:80:80) N:P:K 95. (3.14kg) (table no. 2). The total yield per hectare varies from 19.44 to 7.85 t/ha. The maximum yield tonnes per hectare of okra was recorded in T₈ (75%N + 100%PK + Azotobacter + Azospirillum + PSB) (19.44t/ha) whereas minimum average yield per hectare was recorded in T₁ RDN (100:80:80) N:P:K (7.85 t/ha) (table no. 2).

3.4 Quality parameter

The maximum vitamin C (mg/100g) 21.31 was observed in T₈ (75%N + 100%PK + Azotobacter + Azospirillum + PSB) followed by T₁₅ (50% + 100% PK + Azotobacter + Azospirillum + PSB) 19.86 and the minimum vitamin C was recorded in T₁ RDN (100:80:80) N:P:K 16.09 (table no. 3). The maximum TSS (°Brix) was recorded in T₈ (75%N + 100%PK + Azotobacter + Azospirillum + PSB) (14°Brix) followed by T₁₅ (50% + 100% PK + Azotobacter + Azospirillum + PSB) (13.91°Brix) and the minimum TSS (°Brix) was recorded in T₁ RDN (100:80:80) N:P:K (11.30°Brix) (table no. 3). Significantly, the maximum net returns per

hectare was obtained by T₈ (75%N + 100%PK + Azotobacter + Azospirillum + PSB) Rs.47,2592.83 with cost benefit ratio of 4.27 and minimum net returns per hectare was obtained in T₁ RDN (100:80:80) N:P:K Rs.123415.05 with 1.10 cost benefit ratio (table no. 3).

Conclusion is missing and has to address the following questions:

1. Which fertilizers have better effects on the plant?

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