International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(2): 1117-1120

Received: 21-01-2018
Accepted: 22-02-2018

SN Rathava
P.G. Student
Department of Vegetable Science, College of Horticulture, S. D. Agricultural University, Jagudan, Mehsana, Gujarat, India

P Verma
Associate Professor, Department of Vegetable Science, College of Horticulture, S. D. Agricultural University, Jagudan, Mehsana, Gujarat, India

Yogesh Pawar
Scientist, Department of Vegetable Science, College of Horticulture, S. D. Agricultural University, Jagudan, Mehsana, Gujarat, India

TB Limbachiya
P.G. Student, Department of Vegetable Science, College of Horticulture, S. D. Agricultural University, Jagudan, Mehsana, Gujarat, India

Correspondence
Yogesh Pawar
Scientist, Department of Vegetable Science, College of Horticulture, S. D. Agricultural University, Jagudan, Mehsana, Gujarat, India

Influence of fertilizer levels and biofertilizers on yield and economics of okra (*Abelmoschus esculentus* L. Moench) CV. GAO-5

SN Rathava, P Verma, Yogesh Pawar and TB Limbachiya

Abstract
The present experiment was conductedat Horticulture Instructional Farm, C. P. College of Agriculture, S. D. Agricultural University, Sardarkrushinagar, Gujarat during the *Kharif* season of 2015 in a factorial randomized block design with three replications. Twenty treatments were tested comprising of different fertilizer levels (Control, 25% RDF, 50% RDF, 75% RDF and 100% RDF) and biofertilizers (*Azotobactor*, PSB and *Azotobactor* + PSB). The results of the present investigation revealed that application of 100 per cent RDF significantly increased number of pod per plant (9.12), yield per plant (137.91g), yield per plot (2.80kg)and yield per hectare (115.06q) and days taken to last picking (103.54). Application of *Azotobactor* @ 20 ml/kg seed increased number of pod per plant (8.40), yield per plot (2.75kg) and yield per hectare (113.26q) whereas, combined application of *Azotobactor* + PSB @ 20 ml/kg seed should be significantly increased yield per plant (133.68g) and days taken to last picking (101.60). The application of 100 per cent RDF and combined application of *Azotobactor* @ 20 ml/kg seed should be significantly increased the gross return, net return and benefit cost ratio in okra cv. GAO-5 during *Kharif* season.

Keywords: biofertilizers, economics, fertilizer levels and yield

Introduction
Okra (*Abelmoschus esculentus* L. Moench) popularly known as bhindi or lady's finger, is one of the chief vegetables grown extensively throughout the India in summer and rainy seasons. Okra pods contain fairly high nutritive and medicinal value (Nadkarni, 1927).
Okra produces fruit for a long time and needs balanced and sufficient supply of nutrients for higher yield with better quality. Indiscriminate use of inorganic fertilizers has resulted in decreased nutrient uptake, poor quality of vegetables and deterioration of soil health (Ganeshe *et al.*, 2000 and Agrawal, 2003) [5, 2]. All these underline the need to utilize organic manures/biofertilizers for sustainable okra production. Organic manures constitute a dependable source of macro and micro nutrients and are helpful in improving physical, chemical and biological health of soil, reduced nutrient losses, increases nutrient availability, also increase water holding capacity and uptake leading to sustainable production devoid of harmful residues, besides improving quality of vegetables (Acharya *et al.*, 2000 and Singh *et al.*, 2000) [1, 15]. However, their integration has proved superior than individual components with respect to yield, quality and nutrient uptake as well (Magray, 2002) [8].
Biofertilizers play an important role in increasing availability of nitrogen and phosphorus. They increase the biological fixation of atmospheric nitrogen and enhance phosphorus availability to the crop. They are helpful in reduction of the application dose of macronutrients especially nitrogen and phosphrous.
It has been observed that sole application of organic manures or inorganic fertilizers are not able to sustain the soil fertility and crop productivity, therefore present investigation was planned on influence of fertilizer levels and biofertilizers on yield and economics of okra.

Material and Methods
The experiment was carried out at Horticulture Instructional Farm, C. P. College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat during the *Kharif* season of 2015. Experimental soil was loamy sand soil in nature (pH 7.8), EC- 0.18 dSm^{-1} and low organic carbon (0.17%).

It was low in soluble nitrogen (124.02 kg ha^{-1}), available phosphorous (25.31 kg ha^{-1}) and high in potassium (284.18 kg ha^{-1}). The experiment was in laid out in a Factorial Randomized Block Design replicated thrice with twenty treatments *viz.* T_1 – Control, T_2 – *Azotobacter* alone, T_3 – PSB alone, T_4 – *Azotobacter* + PSB, T_5 – 25% RDF only, T_6 – 25% RDF + *Azotobacter*, T_7 – 25% RDF + PSB, T_8 – 25% RDF + (*Azotobacter* + PSB), T_9 – 50% RDF, T_{10} – 50% RDF + *Azotobacter*,T_{11} – 50% RDF + PSB, T_{12} – 50% RDF + (*Azotobacter* + PSB), T_{13} – 75% RDF, T_{14} – 75% RDF + *Azotobacter*, T_{15} – 75% RDF + PSB, T_{16} – 75% RDF + (*Azotobacter* + PSB), T_{17} – 100% RDF, T_{18} – 100% RDF + *Azotobacter*, T_{19} – 100% RDF + PSB, T_{20} – 100% RDF + (*Azotobacter* + PSB). The field was thoroughly prepared and the applied RDF (100:50:50 kg/ha) at the time of sowing. Two seeds per hill were sown with a spacing of 45 X 30 cm. Nitrogen in the form of urea was applied in two split doses *i.e.* 1st dose at the time of sowing and 2nd dose at 30 days after sowing (DAS). Before sowing seed were treated with *Azotobacter* and PSB inoculants. The biofertilizer solutions were prepared in warm water with addition of jaggery and made sticky paste. The seeds were treated for half an hour and then dried in shade for 30 minutes and then sown in the experimental plot immediately. The observations regarding yield attributing characters were recorded from ten representative plants from each plot. The data were analyzed using analysis of variance (ANOVA) under Factorial Randomized Block Design following the procedure as stated by Panse and Sukhatme (1967).

Results and Discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads:

Number of pod per plant

The number of pod per plant was significantly increased as the dose of NPK was raised from 0 to 100 per cent RDF. The highest number of pod per plant (9.12) was observed with f_4 treatment and lowest (6.79) were observed with f_1 treatment. The highest number of pod per plant seemed to be the result of increased number of branches per plant which gave rise to more number of nodes wearing profused flowering under the influence of optimum level of chemical fertilizers. These results are in close conformity with the findings of Selvi and Perumal (2000) [13] and Swain *et al.* (2003) [16] in okra.

The seed treatment with all the biofertilizers significantly influenced the number of fruits per plant as compared to soil treatment. The b_1 (seed treatment with *Azotobactor*) treatment yielded the highest (8.40) number of pod per plant. While as b_3 (seed treatment with *Azotobactor* + PSB) treatment was statistically at par with b_1 treatment. The increase in number of pod per plant might be attributed to improved vegetative growth which resulted in better availability of nutrients at vital growth period, greater synthesis of carbohydrates and their proper translocation, improved water status of plant and increased nitrate reductase activity. The results are in concurrence with the findings of Nurruzzaman *et al.* (2003). The interaction between fertilizer levels and biofertilizers showed non-significant effect on stem thickness in okra.

Yield per plant (g)

Data in table 1 disclosed that effect of different fertilizer levels for yield per plant was significant. Highest yield per plant was observed with 100 per cent RDF (137.91 g) level which was statistically similar with 75% RDF level (131.87 g). Though, the lowest yield per plant was obtained from control (86.33 g) treatment. Study of data in table 4.14 suggested that yield per plant was significantly altered by various biofertilizers. Maximum yield per plant of 133.68 g was found from the combination of *Azotobactor* + PSB which was at par with *Azotobactor* (126.55 g), whereas, least yield per plant was noted from PSB (89.25 g).

Increment in yield due to increased level of RDF when applied with biofertilizers might be due to the higher rate of photosynthesis and sugar formation due to enhanced chlorophyll synthesis and enzyme activity which lead to translocation of more photosynthates to developing fruits which ultimately leads to higher production of dry matter and consequently more yield. Present Findings are unison to Kanzariya *et al.* (2010) [7], Wagh *et al.* (2014) [17] and Nwaoguala *et al.* (2015) [11] in okra. Increase of yield also due to the effect of interaction of RDF levels and biofertilizers was statistically not significant.

Yield per plot

Data showed that effect of different fertilizer levels for yield per plot was significantly increased with the application of 100% RDF (2.80 kg) it was not significantly followed by 75% RDF (2.75 kg). The lowest plant height was observed from control (2.28 kg). Significant impact of biofertilizers was also noticed for yield per plot (table 4.15). Maximum yield per plot was acquired with application of *Azotobactor* @ 2.0 ml/kg seed (2.75 kg) which was at par with control treatment (2.55 kg) and Azotobactor + PSB @ 2 ml/kg seed (2.54 kg). whereas least yield per plot was noted from PSB @ 2 ml/kg seed (2.42 kg).

Increased yield per plot might be due to the fact that application of NPK synergized with biofertilizers. Though in the present experiment their interaction was not significant but close view of data in table 1 throw the light that, combined application of recommended dose of fertilizer with biofertilizer has beneficial effects which might be a reason for higher yield. Bharadiya *et al.* (2007) [3], Wagh *et al.* (2014) [17] and Nwaoguala *et al.* (2015) [11] in okra are in agreement with the present ascertainment. Analysis of table 1 established the non-significant influence of combination of fertilizer levels and biofertilizers for yield per plot.

Yield per hectare

Effect of different fertilizer levels for yield per hectare was found statistically effective and it was significantly increased with the application of 100% RDF (115.06 q) level which was statistically at par with 75% RDF level (113.07 q). Lowest yield per hectare was observed in control (93.80 q).

Data in table 1 showed significant impact of various biofertilizers for yield per hectare. Maximum yield per hectare was obtained from the *Azotobactor* (113.26 q) which was statistically at par with control (104.93 q) and *Azotobactor* + PSB (104.71 q) whereas least yield per hectare was noted from PSB (99.44 q).

The yield per hectare is derived from per plot observation and as the yield per plot was altered by fertilizer levels and biofertilizers per hectare yield was altered. Our finding are in concurrence with Choudhary *et al.* (2015) [4] in okra.

Days taken to last picking

Significantly maximum days taken to last picking (103.54) were observed in the treatment which received 100% RDF which was at par with 75% RDF treatment (102.63). The

minimum days for last picking of 94.79 were recorded by control treatment.

Further look at the table 1 unveil that biofertilizers play a significant role in fluctuating the days from sowing to last picking. Significantly maximum days taken to last picking were found from the combination of *Azotobactor* + PSB (101.60 DAS) which was at par with *Azotobactor* (99.98 DAS) alone and control (99.32 DAS). Though the least days were recorded by PSB (96.27 DAS).

Superiority of reduced dose of fertilizers along with *Azotobactor* + PSB might be due on account of combined effect of chemical fertilizers which favorably influenced flowering and fruit and ultimately resulted in increased productive span. Findings of Kanzariya *et al.* (2010) [7] and Gayathri and Reddy (2013) [6] have supported the present results.

Data in table 1 also revealed that interaction effect of fertilizer levels and biofertilizers for days taken to last picking were not significant.

Economics of okra

The economics indicating cost of cultivation, gross return, net return and benefit cost ratio under different fertilizer levels and biofertilizers are furnished in Table 2.

The results in table 2, revealed that among the fertilizer levels, application of 75% RDF recorded maximum gross return of ₹226140ha^{-1}, net return of ₹171384 ha^{-1} and benefit cost ratio *i.e*. 4.12. Whereas, absolute control recorded minimum gross return of ₹187600ha^{-1}, net return of ₹137150 ha^{-1} and benefit cost ratio *i.e.* 3.71.

Data presented in table 2 revealed that among different biofertilizers treatment, application of *Azotobactor* @ 20 ml/kg seed was recorded maximum gross return of ₹ 226520ha^{-1}, net return of ₹176046 ha^{-1} and benefit cost ratio *i.e*. 4.48. Whereas, minimum gross return of ₹198880 ha^{-1}, net return of ₹148406 ha^{-1} and benefit cost ratio *i.e.* 3.94 was observed with application of PSB. Both these treatments gave highest B: C ratio. Similar, findings have been reported by Selvi and Perumal (2000) [13] and Sharma *et al.* (2010) [14] in okra.

Table 1: Effect of different fertilizer levels and biofertilizers on yield of okra

Treatments	Number of pod per plant	Yield per plant (g)	Yield per plot (kg)	Yield per hectare (q)	Days taken to last picking
Fertilizer levels					
f_0	7.20	86.33	2.28	93.80	94.79
f_1	6.79	108.42	2.52	103.84	97.38
f_2	7.70	99.71	2.48	102.13	98.13
f_3	8.04	131.87	2.75	113.07	102.63
f_4	9.12	137.91	2.80	115.06	103.54
S.Em. (±)	0.19	3.83	0.09	3.75	1.23
C.D. (p=0.05)	0.55	10.97	0.26	10.73	3.53
Biofertilizers					
b_0	7.23	101.90	2.55	104.93	99.32
b_1	8.40	126.55	2.75	113.26	99.98
b_2	7.23	89.25	2.42	99.44	96.27
b_3	8.21	133.68	2.54	104.71	101.60
S.Em. (±)	0.17	3.43	0.08	3.35	1.10
C.D. (p=0.05)	0.49	9.81	0.23	9.73	3.15
Interactions					
f_0b_0	6.73	75.40	2.31	95.00	94.54
f_0b_1	7.86	99.63	2.62	107.77	95.34
f_0b_2	6.51	74.32	2.41	98.98	93.05
f_0b_3	7.71	95.95	1.79	73.47	96.24
f_1b_0	6.60	101.91	2.65	109.23	96.76
f_1b_1	7.27	108.38	2.61	107.33	100.08
f_1b_2	6.15	89.85	2.22	91.21	95.48
f_1b_3	7.12	133.54	2.61	107.57	97.19
f_2b_0	7.57	96.02	2.52	103.68	102.51
f_2b_1	8.69	123.38	2.74	112.74	101.19
f_2b_2	7.35	56.80	2.03	83.41	87.55
f_2b_3	7.20	122.63	2.64	108.70	101.26
f_3b_0	6.79	112.38	2.54	104.38	101.64
f_3b_1	8.13	141.44	2.83	116.33	98.65
f_3b_2	7.68	109.22	2.75	113.06	103.10
f_3b_3	9.54	164.43	2.88	118.51	107.12
f_4b_0	8.48	123.81	2.73	112.35	101.14
f_4b_1	10.05	159.92	2.97	122.11	104.67
f_4b_2	8.48	116.07	2.69	110.51	102.17
f_4b_3	9.46	151.85	2.80	115.28	106.20
S.Em. (±)	0.38	7.66	0.18	7.50	2.46
C.D. (p=0.05)	NS	NS	NS	NS	NS

Table 2: Effect of different fertilizer levels and biofertilizers on economics of okra

Treatments	Total cost of cultivation (₹)/ha)	Gross returns (₹)/ha)	Net returns (₹)/ha)	Benefit: Cost ratio
I. Fertilizer levels				
Control (f_0)	50450	187600	137150	3.71
25% RDF (f_1)	51885	207680	155795	4.00
50% RDF(f_2)	53320	204260	150939	3.83
75% RDF(f_3)	54756	226140	171384	4.12
100% RDF(f_4)	56191	230120	173928	4.09
II. Biofertilizers				
Control (b_0)	50450	209860	159410	4.15
Azotobactor (b_1)	50474	226520	176046	4.48
PSB (b_2)	50474	198880	148406	3.94
Azotobactor + PSB (b_3)	50474	209420	158946	4.14

*****Recommended dose of fertilizer for okra (100:50:50 kg/ha)

***** Selling price of okra ₹ **20/kg**

Conclusion

In view of the results obtained from present investigation, it could be concluded that to achieve highest fruit yield and maximum net return 100 and 75 per cent of recommended dose of fertilizer (100:50:50) with along biofertilizer strain *i.e. Azotobactor* + PSB in okra cv. Gujarat Anand Okra-5.

References

1. Acharya, CL, Mandal, KG. Integrated plant nutrient supply in vegetable crops. 2000, 79-104.
2. Agrawal AK. Role of organic enrichers in management of salinity. Agro bios. 2003; 2:21-23.
3. Bharadiya PS, Kalalbandi BM, Shinde VN. Effect of inorganic and organic fertilizers on growth and yield of okra. The Asian Journal of Horticulture. 2007; 2(2):199-201
4. Choudhary K, More SJ, Bhanderi DR. Impact of bio-fertilizers and chemical fertilizers on growth and yield of okra (*Abelmoschus esculentus* L. Moench). The Ecosan, 2015; 9(1&2):67-70.
5. Ganeshe RK, Pandey RP, Rawat AK. Influence of biofertilizers and nitrogen on growth, yield, shelf-life and economics of Okra. Jawaharlal Nehru Krishi Vihswa Vidyalaya Research Journal. 2000; 32:33-37.
6. Gayathri K, Reddy SS. Effect of integrated nutrient management growth and yield of okra (*Abelmoschus esculentus* (L.) Moench) cv.Arka Anamika. Vagetable Science. 2013; 40(2):246-248.
7. Kanzariya HR, Kapadiya PK, Tank AK, Jat G, Kacha HL. Effect of chemical fertilizers and biofertilizer on growth, yield and quality of okra (*Abelmoschus esculentus* (L.) Moench) cv. Gujarat Okra-2. Haryana J. hortic. Sci. 2010; 39(1&2):165-168.
8. Magray RG, Madrap IA. Performance of okra in relation to yellow vein mosaic virus in different seasons. International Journal of Plant Sciences. 2002; 5(1):33-35.
9. Mani S, Ramanthan KM. Effect of nitrogen and potassium on the yield of behind fruit. South Indian Hort. 1990; 28(4):136-138.
10. Nandkarni KM. Indian Meteria Medica. Nandkarni and Co Bombay, 1927, 51.
11. Nwaoguala CNC, Law-Ogbomo KE, Osaigbovo AU. Influence by artificial defoliation and NPK fertilizer application on growth and yield of okra (*Abelmoschus esculentus* (L.) Moench). African Journal of Food agriculture Nutrition and Development, 2015; 15(2):9795-9806.
12. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers, Indian Council of Agriculture Research Publication, New Delhi, 1978, 369.
13. Selvi D, Perumal R. Effect of integrated nutrient management on yield and economics of okra in an ineptisol. Veg. Sci. 2000; 27(2):207-208.
14. Sharma TR, Pandey AK, Updhyaya SD, Agrawal SB. Effect of vermicompost on yield and quality of *Kharif* season okra [*Abelmoschus esculantus* (L.) Moench]. Veg. Sci., 2010; 37(1-2):181-183.
15. Singh GB, Biswas PP. Balanced and integrated nutrient management for sustainable crop production. Indian Journal of Fertilizers. 2000; 45(5):55-60.
16. Swain AK, Pattanayak SK, Jena MK, Nayak RK. Effect of integrated use of bioinoculants and fertilizers nitrogen on growth, yield and nitrogen economy of okra. J. Indian Soc. Soil Sci. 2003; 51(2):145-150.
17. Wagh, SS, Lahariya, GS, Iratkar, AG, Gajare, AS. Effect of INM on nutrient uptake, yield and quality of okra (*Abelmoschus esculentus* (L) Moench). An Asian Journal of Soil Science. 2014; 9(1):21-24.
18. Yalwalkar KS. Vegetable Crops of India.Agriculture Horticulture Publishing House, Nagpur, India, 1980, 71.