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Response of integrated nutrient management on productivity, profitability and quality of summer sesamum

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Abstract
A field experiment was carried out during the summer season of 2018-20 at Navsari, Gujarat, to evaluate the effect of integrated nutrient management on growth, yield attributes, yields nutrient uptake and economics on sesamum. Growth and yield attributing characters were significantly higher with application of 125% RDF and remained at pat with 100% RDF. In case of different organic manurial treatments observed plant height and number of capsules per plant were observed significantly higher with bio compost @ 5 t/ha and remained at pat with spraying of 1% banana pseudostem sap at flowering and capsule formation stages. Rate of fertilizers and organic manurial treatments were found no significant differ on oil content. In case of biofertilizer, growth and yield attributes were observed non significant. Seed yield and stover yield were significantly superior with application of 125% RDF and bio compost @ 5 t/ha which remained at par with 100% RDF spraying of 1% banana pseudostem sap at flowering and capsule formation stages. Application of biofertilizers as seed treatment gave significantly highest seed yield and stover yield. Nutrient content (N, P_2O_5, K_2O) were found significantly no differ, but nutrient uptake were recorded statistically highest under 125% RDF, bio compost @ 5 t/ha and A*zotobacter* & PSB (10 ml each / kg seed). Net return and B:C ratio were recorded maximum under the 125% RDF, bio compost @ 5 t/ha and *Azotobacter* & PSB (10 ml each / kg seed).

Keywords: Sesamum, bio compost, azotobacter & PSB and banana pseudostem sap

Introduction
All over the world sesamum is grown on more than 8.0 million ha with production of 5.0 million tonnes and productivity of 565 kg/ha. India is the largest producer of sesame in the world. In country, It is cultivated on 2 million ha with total production of 0.811 million tonnes. The average productivity of the crop is 430 kg/ha (DAC, 2016–17) [2]. It's oil content varies from 46 to 52% and protein content 18–20%. The appropriate combination of mineral fertilizers, organic manure and biofertilizers are helps in fulfill the need of INM. Fertilizers play important role for obtaining higher crop production. *Azotobacter* improves seed germination and has beneficiary response on crop growth. It can helps to increase nutrient availability and to rehabitated soil fertility for better crop response. *Phosphate solubilizing bacteria* (PSB) play a vital role in the nutrition of plants. PSB solubilize the unavailable bound phosphates of the soil and make them available to plants which increase overall plant growth and increase 10 to 15% in yield. Beside this, banana pseudostem contained high quality (strength) fibres in the order of 1%. While, extracting the fibers from pseudostem, it gives out about 50 t/ha of scotching waste (solid) and *i.e*. about 45 per cent of liquid biomass material called as 'SAP' and it's content of macro elements in the range of 0.70-1.5% N, 0.11-0.20% P, 2.25-3.95% K, 0.05-0.11% S and micro nutrients were observed in the range of 50-100, 100-200, 5.0- 2.8 ppm of Fe, Mn and Zn, respectively (Patil, 2008) [6]. Main objectives of this experiment are to find out the effect of integrated nutrient management on yield potential, quality and optimum dose from different treatments for summer sesamum. Hence in present study, integrated nutrient management effect on sesamum evaluated under south Gujarat condition.

Material and Method
The experiment was conducted during the summer seasons of 2018-20 at Instructional Farm, N. M College of Agriculture, N. A. U., Navsari, Gujarat ($20^0$57' N latitude and $72^0$54'E longitude. latitude and, in the tropical region having an altitude of 10 meters above the mean sea levels). The soil of the experimental field was heavy black having pH 7.5, medium in

organic carbon (0.55%), low in available nitrogen (240 kg/ha) and high in phosphorus (57 kg/ha) and potassium (335 kg/ha). The climate of this region is a characterized by fairly hot summer, moderately cold winter and warm humid monsoon with heavy rainfall. The experiment consisting of 3 levels of rate of fertilizers, 3 levels of organic manurial treatment and 2 levels of biofertilizers thereby making 18 treatment combinations were laid out in randomized block design with factorial concept and replicated 3 times. The variety of sesame 'Gujarat sesamum 3' was used as the test crop and sowing on second week of February during all the years. Fertilizes applied respectively, before sowing as per treatment. Through urea and diammonium phosphate respectively. Thinning, hoeing and weeding were done at 20 days after sowing to maintain spacing between two plants within in row, proper aeration and weed-free condition.

Five plants were selected randomly from each plot and tagged permanently. The height of each plant was measured from base of the plant to the tip of main shoot at harvesting. Total capsules of 5 tagged plants were counted at harvesting stage from each net plot and average number of capsules/plant was computed. To find out the most profitable treatment, economics of different treatments were worked out in terms of net returns (Rs./ha) on the basis of the prevailing market rate. Data recorded on various observations were subjected to their statistical analysis. Data on all parameters were identical in three years, hence, pooled data are presented for interpretation of the results.

Result and Discussion

On the basis of pooled of three years (2018-2020), growth parameter *viz*., plant height and number of branches were significantly superior under the application of 125% RDF and remained at par with 100% RDF. Application of biocompost @ 5 t/ha was found significantly higher and which remained at par with spraying of 1% banana pseudostem sap at flowering and capsule formation stages of sesamum. It might be due to right rate of inorganic and organic manures, better growth of sesamum so crop received sufficient quantity of nutrients during their crop growth cycle. Number of branches was not found significant under organic manurial treatment as well as biofertilizer application. Interaction effect was observed non significant effect on plant height and number of branches. Increase in plant height and number of branches under higher dose of recommended fertilizers. The findings are in close agreement with the results obtained by, Thakur *et al*.(2014) and Prasannakumara *et al*. (2015)

Yield parameters such as number of capsules per plant, seed yield and stover yield were observed significantly higher under 125% RDF and biocompost @ 5 t/ha treatments, which remained at par with 100% RDF and spraying of 1% banana pseudostem sap at flowering and capsule formation stages. Application of biofertilizes was found non significant effect on all the yield attributes. Different treatments of fertilizers, organic manures and biofertilizers interaction effects in respect of yield attributes and yields were failed up to significant levels in pooled results. Application of organic and inorganic nutrients improve the more number of capules per plant might be due to increase in photosynthetic activity. The beneficial effect of INM on vegetative growth was reflected in increasing the yield contributing characters. This was largely attributes due to better growth of plant resulted inadequate supply of photosynthates which for development of sink, this increased the economic yield. Oil content in seed did not differed significantly due to different treatments. The results are in conformity with the findings of Thanki *et al.* (2014) [10] and Deshmukh *et al*. (2014) [3].

On the basis of pooled analysis, N, P_2O_5 and K_2O content were not significantly differed in plant by application of various treatments. In case of uptake of nitrogen, 125% RDF recorded significantly higher, but it also remain at par with 100% RDF. In case of uptake of P_2O_5 and K_2O were found significantly the highest with application of 125% RDF. Pooled data of nutrient uptake of N and K_2O were significantly the highest with treatment of biocompost@ 5 t/ha, but in case of P_2O_5 it was statistically at par with spraying of 1% banana pseudostem sap at flowering and capsule formation stages. Significantly the highest N, P_2O_5 and K_2O uptakes by plant, were registered with *Azatobacter* & PSB (10 ml each/ kg seed) compare to control treatment. (without biofertilizer). This might be due to more availability of nutrients by higher amount of inorganic fertilizers as well as organic and biofertilizers which resulted into higher uptake of nutrients by sesamum plant. The interaction effect among different treatments were found non significant. These results are in agreement with the results obtained by Nayak *et al.* (2014) [4] and Parmar *et al.* (2020) [5].

Net return and benefit:cost ratio (BCR) increased steadily with increase in fertilizers dose. The highest net returns and B:C ratio were obtained from 125% RDF., biocompost @ 5 t/ha followed by spraying of 1% banana pseudostem sap along with application of *Azatobacter* and PSB (10 ml each/ kg seed). Similar results were reported by Deshmukh *et al.* (2014) [3].

Table 1: Growth, yield and quality parameters of sesamum as influenced by different treatments (Pooled over 3 years)

Treatment	Plant height at harvest (cm)	Branches per plant	Capsules per plant	Oil content (%)	Seed yield (kg/ha)	Stover yield (kg/ha)	Net Returns (Rs./ha)	B:C ratio
Rate of fertilizers								
125% RDF	91.33	3.53	59.92	52.15	1026	1502	65278	2.75
100% RDF	89.11	3.48	58.48	51.59	996	1443	62734	2.70
75% RDF	84.87	3.31	55.61	51.45	916	1380	55189	2.52
S.Em. ±	1.02	0.05	0.67	0.33	15	20	-	-
CD (p=0.05)	2.86	0.14	1.88	NS	44	57	-	-
Organic manurial treatments							-	-
Without organic manure	84.74	3.35	55.40	51.13	906	1366	55556	2.59
Bio compost @ 5 t/ha	91.57	3.51	59.44	52.07	1038	1500	64681	2.65
Spraying of 1% banana pseudostem sap at flowering and capsule formation stages	89.00	3.46	59.14	51.99	994	1459	63316	2.75
S.Em. ±	1.02	0.05	0.67	0.33	15	20	-	-
CD (p=0.05)	2.86	NS	1.88	NS	44	57	-	-

Biofertilizer							-	-
Without biofertilizer	87.86	3.41	57.38	51.60	937	1409	58656	2.67
Azotobacter & PSB (10 ml each / kg seed)	89.01	3.46	58.62	51.86	1022	1475	66956	2.90
S.Em. ±	0.83	0.04	0.56	0.27	13	16	-	-
CD (p=0.05)	NS	NS	NS	NS	36	47	-	-
C. V.%	8.62	10.80	8.65	4.85	12	10.31	-	-
Interaction							-	-
DXY S.Em. ±	1.79	0.08	1.18	0.59	25.10	35.03	-	-
CD (p=0.05)	NS	NS	NS	NS	NS	NS	-	-
MXY S.Em. ±	1.79	0.08	1.18	0.59	25.10	35.03	-	-
CD (p=0.05)	NS	NS	NS	NS	NS	NS	-	-
BXY S.Em. ±	1.46	0.07	0.56	0.48	20.50	28.60	-	-
CD (p=0.05)	NS	NS	NS	NS	NS	NS	-	-
DXMXBXY S.Em.±	4.40	0.21	2.89	1.44	61.50	85.81	-	-
CD (p=0.05)	NS	NS	NS	NS	NS	NS	-	-

Table 2: Nutrient content and uptake of sesamum as influenced by different treatments (Pooled over 3 years)

Treatments	**Nutrient content (%)**			**Nutrient uptake by plant (kg/ha)**		
	N	**P_2O_5**	**K_2O**	**N**	**P_2O_5**	**K_2O**
Rate of fertilizers						
125% RDF	2.90	0.35	1.04	29.89	3.26	10.62
100% RDF	2.88	0.34	1.04	28.82	3.08	10.35
75% RDF	2.84	0.34	1.02	26.26	2.77	9.38
S.Em. ±	0.02	0.002	0.008	0.50	0.05	0.15
CD (p=0.05)	NS	NS	NS	1.42	0.15	0.44
Organic manurial treatments						
Without organic manure	2.83	0.34	1.02p	25.84	2.75	9.26
Bio compost @ 5 t/ha	2.93	0.35	1.04	30.57	3.21	10.86
Spraying of 1% banana pseudostem sap at flowering and capsule formation stages	2.87	0.35	1.03	28.56	3.15	10.25
S.Em. ±	0.027	0.002	0.008	0.50	3.05	0.15
CD (p=0.05)	NS	NS	NS	1.42	0.15	0.44
Biofertilizer						
Without biofertilizer	2.87	0.34	1.02	27.09	2.89	9.66
Azotobacter & PSB (10 ml each / kg seed)	2.88	0.35	1.04	29.55	3.18	10.59
S.Em. ±	0.02	0.002	0.007	0.41	0.04	0.13
CD (p=0.05)	NS	NS	NS	1.71	0.12	0.37
C. V.%	7.03	6.27	6.24	13.23	12.88	11.70
Interaction						
DXY S.Em. ±	0.04	0.005	0.01	0.88	0.09	0.27
CD (p=0.05)	NS	NS	NS	NS	NS	NS
MXY S.Em. ±	0.04	0.005	0.01	0.88	0.09	0.27
CD (p=0.05)	NS	NS	NS	NS	NS	NS
BXY S.Em. ±	0.03	0.004	0.01	0.72	0.07	0.22
CD (p=0.05)	NS	NS	NS	NS	NS	NS
DXMXBXY S.Em.±	0.11	0.01	0.03	2.16	0.22	0.68
CD (p=0.05)	NS	NS	NS	NS	NS	NS

Conclusion

On the basis of experimental results it can be concluded that better growth of sesamum, economical yields, higher nutrients uptake and more income with application of 100% RDF as inorganic source of nutrients along with 1% banana pseudostem sap at flowering and capsule formation stages along with *Azatobacter* and PSB (10 ml each/ kg seed) as a seed treatment**.**

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