Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 11 [11] October 2022 : 42-47

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD

ORIGINAL ARTICLE **OPEN ACCESS**

Enhancing the Growth and Productivity of Sesame (*Sesamum Indicum* L.) Through different Organic Manures in Sandy Loam Soil

G. Kiruthika[1*], P. Poonkodi[2], A. Angayarkanni[2], A. Sundari[3] and M.V. Sriramachandrasekharan[4]
[1]Research scholar, Department of Soil Science and Agricultural Chemistry
[2]Professor, Department of Soil Science and Agricultural Chemistry
[3]Professor, Department of Agronomy
[4]Professor and Head, Department of Soil Science and Agricultural Chemistry
Faculty of Agriculture Annamalai University, Annamalai Nagar, Tamil Nadu, India.
E-mail : kiruthikagnanavel@gmail.com

ABSTRACT
The present investigation was carried out at farmer's holding at Vallampadugai village, Cuddalore district, Tamil Nadu, India during 2021, to investigate the effect of different organic manures on growth, yield attributes and yield of sesame in a sandy loam soil. The experiment consisted of application of different organic manures (poultry manure, sheep manure and press mud) at various levels 0, 5, 7.5, 10 and 12.5 t ha^{-1}. The experiment was laid out in a factorial randomized block design with three replications. The results revealed that among the different organic manures applied, the application of 12.5 t of poultry manure per hectare was found beneficial in increasing growth attributes viz., plant height, number of branches plant^{-1}, chlorophyll content and leaf area index. The higher values of yield attributes viz., number of capsules plant^{-1} (77.89), number of seeds capsule^{-1} (71.23), 1000 seed weight (3.23 g) and seed yield (818.2 kg ha^{-1}), stover yield (1684.2 kg ha^{-1}) and biological yield (2502.4 kg ha^{-1}) were obtained with application of poultry manure at 12.5 t ha^{-1}.
***Keywords**: Sesame, poultry manure, sheep manure, press mud, growth, yield attributes and yield.*

Received 04.09.2022 Revised 29.09.2022 Accepted 15.10.2022

INTRODUCTION

Sesame (*Sesamum indicum* L.) is an important oilseed crop of India belongs to family *Pedaliaceae* and it is widely cultivated throughout the world and comes at 4th position among all oil seed crops. Sesame is referred as the "Queen of Oil Seeds." It has high-protein and oil. Sesame seed is rich source of protein (25%), energy (631 kcal/100g), fat (60.2%), carbohydrate (11.7%), dietary fibre (11.6%) and it also contains thiamine, riboflavin, niacin, ascorbic acid, vitamin A, minerals (Mg, Ca, Fe, P, Zn), phytic and oxalic acid. Area under sesame in India was 13,71,700 ha with the production of 3.99 lakh metric tonnes (Department of Agriculture, Co-operative and Farmers Welfare, 2019).

Many of the components required for plant growth and development are found in organic manures. Manures function as soil amendment by providing organic matter to the soil, in addition to boosting soil fertility [1]. Organic materials improve soil physical properties such as aggregate stability, water holding capacity, soil aeration, soil structure, drainage, and root penetration, as well as soil chemical properties such as soil nutrient content and soil pH [2,3]. Sesame production and seed quality would most likely be improved by applying organic manures in the form of crop residues and animal manure [4,5,6]. The essential minerals locked up in organic manures slowly mineralize and become available to the crops, resulting in increased production and quality besides improving the fertility of the soil [7]. In sesame, the most favourable organic manure is the poultry manure. It enhances the soil fertility by adding phosphorus, nitrogen and micronutrients, as well as improving moisture and nutrient retention [8]. Sheep manure helps to improve soil structure contributing to crop yield and agricultural product quality and it can greatly reduce environment pollution. Industrial wastes like press mud can also be used in agriculture [9]. It is a good media of both organic and inorganic plant nutrients as it contains organic carbon, N, P, K, Ca and S and abundance of micronutrients. Therefore, a field experiment was conducted to determine the impact of various organic manures on the growth, yield, and yield qualities of sesame.

MATERIAL AND METHODS

A field trial was conducted at farmer's holding at Vallampadugai village, Cuddalore district, Tamil Nadu, India. The soil of experimental site was sandy loam in texture (62.6 % sand, 26.9% silt and 10.0% clay) with bulk density (1.49 Mg m^{-3}), pH (7.47), EC (1.72 dSm^{-1}) in 1:2.5 soil: water ratio, soil organic carbon (3.15 g kg^{-1}). The soil is low in available N (214.6 kg ha^{-1}), medium in available P (13.2 kg ha^{-1}) and medium in potassium (275.4 kg ha^{-1}). The treatments included were three different organic manures at different levels *viz,* poultry manure (0, 5, 7.5, 10 and 12.5 t ha^{-1}), sheep manure (0, 5, 7.5, 10 and 12.5 t ha^{-1}) and press mud (0, 5, 7.5, 10 and 12.5 t ha^{-1}). Recommended dose of fertilizers was added (35:23:23 kg N, P_2O_5 and K_2O ha^{-1}) to all plots. The organic manures *viz.,* poultry manure (3.20 % N, 2.03% P, 1.57% K), sheep manure (2.97 % N, 1.13 % P, 2.01% K) and press mud (1.44 % N, 0.82% P, 1.20% K) were incorporated into the plots according to treatment schedule after land preparation and left for two weeks before sowing. Five plants from each plot were chosen to measure plant height, number of branches $plant^{-1}$, chlorophyll content and leaf area index at harvest stage. Various yield components like number of capsule $plant^{-1}$, number of seed $capsule^{-1}$ and 1000 seed weight were recorded at harvest stage. The seed, stalk and biological yield were recorded separately and expressed in kg ha^{-1}. When the leaves and stems turned from green to yellow with a crimson tint, the crop was ready for harvest. The plants were manually harvested by being cut at the base, near to the ground, with a sickle. To reduce seed loss when the capsule dehisces, plants from each plot were placed in a sack to dry. The sacks were gently battered with sticks to release all of the seeds from the capsules when the harvested plants had dried sufficiently. After that, winnowing was used to separate the seeds from the chaff. The seed yield per hectare was calculated using the entire net plot of plants. The data obtained from the study were statistically analysed as proposed by [10].

RESULTS AND DISCUSSION

Growth parameters

A glance on the data of the growth parameters in sesame was depicted in the table (1) and Fig. (1,1a,2and 2a). Application of different organic sources at different levels favourably increased the growth parameters of sesame *viz.,* plant height, and number of branches $plant^{-1}$, chlorophyll content, leaf area index and days for 50% flowering.

Among the different organic sources applied, poultry manure (S_1) registered the maximum value of growth parameters *viz.,* plant height (110.96 cm), number of branches $plant^{-1}$ (9.18), chlorophyll content (41.09 SPAD value), leaf area index (3.11) and days for 50% flowering (48.56). This might be attributed to high N content of poultry manure, which released through mineralization thereby favoured uptake of primary nutrients [11]. The poultry manure with nitrogenous fertilizer produced the maximum growth characters of sesame with ensuring proper growth and development [12]. These findings are in consistent with other authors [13,14,15]. Thus, balanced nutrition under favourable environment might have helped in production of new tissues which have ultimately increased the plant height, dry matter accumulation, number of branches per plant, chlorophyll content and LAI. These results are in agreement with the findings who observed higher growth parameters as a result of application of fertilizers and manures in combination [16,17,18,19]. The treatments next in order to poultry manure (S_1) were sheep manure (S_2) and press mud (S_3) in registering the growth attributes.

Application of different organic manures at various levels showed a significant variation on growth parameters of sesame increasing levels of organic manure gradually increased the growth parameters. Among the various levels of organic sources tried, L_4 which received 12.5 t ha^{-1} of each organic manure recorded the maximum plant height (118.61 cm), number of branches $plant^{-1}$ (9.62), chlorophyll content (43.59 SPAD value), leaf area index (3.33) and days for 50% flowering (49.56). However, this level (L_4) was found to be on par with L_3 (10 t ha^{-1}) in registering the plant height (116.16 cm), number of branches $plant^{-1}$ (9.42), chlorophyll content (42.59 SPAD value), leaf area index (3.26) and days for 50% of flowering of sesame (48.65). The interaction effect between sources and levels of various organic manures on growth parameters were significant. Application of poultry manure @ 12.5 t ha^{-1} (S_1L_4) recorded maximum plant height (128.23 cm), number of branches $plant^{-1}$ (10.87), chlorophyll content (46.38 SPAD value) and leaf area index (3.61). However, it was found to be on par with application of poultry manure @ 10 t ha^{-1} (S_1L_3) which registered 127.45 cm, 10.74, 45.75 SPAD value and 3.57, respectively. This was followed by treatment (S_2L_4) which received sheep manure @ 12.5 t ha^{-1} and it was on par with (S_2L_3). The lowest growth parameters were observed in (S_1L_0) With regard to days for 50% of flowering of sesame, the interaction effect was not significant.

Yield attributes

Application of the different organic sources, significantly increased the yield attributes over control (Table 2). Application of poultry manure recorded highest yield attributes *viz*., number of capsule $plant^{-1}$ (63.75),

number of seeds capsule^{-1} (60.34) and 1000 seed weight (2.94 g). This treatment was followed by sheep manure (S_2) and pressmud (S_3). This could be due to balanced and adequate amount of nutrients through poultry manure as per requirement of crop which favoured better environment for growth and development [20]. The increased photosynthates and their transportation of available nutrients from poultry manure may favoured the to sink resulted in increased plant growth and yield attributes [12]. The large population of microorganisms were introduced into the soil through organic manure application which promoted N fixation and P solubilization. All these contributed to the enhancing effect on growth and yield attributes derived from the poultry manure application. The effect of poultry manure on these parameters is related to its role in providing more plant nutrients and enhancing the solubility of natural soil nutrients [15]. The adequate supply of macro and micro nutrients earlier in the life of a plant through organic manures, which is considered important in promoting vegetative growth and reproductive growth, thereby increased assimilating surface of plant as well as total photosynthesis, this resulting in improving the yield attributes of sesame [21].

Among the various levels of organic manures studied, the application of 12.5 t ha^{-1} of different organic manures recorded the highest number of capsule plant^{-1} (71.06), number of seeds capsule^{-1} (64.63) and 1000 seed weight (3.06 g) of sesame. However, it was equally efficacious with application of 10 t ha^{-1} (L_3) of different organic manures which registered 69.80, 63.27 and 2.97, respectively. The level L_3 was significantly superior to the other levels of organic manures. A positive interaction effect on yield attributes was noticed due to different sources and levels of organic manures were significant. The treatment (S_1L_4), which received poultry manure @ 12.5 t ha^{-1} recorded the highest number of capsule plant^{-1} (77.89) and number of seeds capsule^{-1} (70.97). However, it was statistically on par with application of poultry manure @ 10 t ha^{-1} (S_1L_3). This was followed by the treatment pairs (S_2L_4) which found to be on par with (S_2L_3) registered the values 70.08 and 63.42, respectively. The treatments S_2L_0 and S_3L_0 were registered the lowest number of capsule plant^{-1} (33.52) and number of seeds capsule^{-1} (42.18). Concern the 1000 seed weight, the interaction effect was non-significant.

Yield

Application of organic manures with varying levels significantly increased the seed, stover and biological yield of sesame (Table 3). Among the various organic manures, the application of poultry manure (S_1) has been recorded the highest seed yield (697.4 kg ha^{-1}), stover yield (1492.3 kg ha^{-1}) and biological yield (2189.7 kg ha^{-1}) of sesame. This might be due to the effect of poultry manure in reducing the soil pH to some extent by producing organic acids which paved way for greater availability of both macro and micronutrients [20]. The source (S_1) was followed by sheep manure (S_2) and press mud (S_3).

Among the levels of organic manures, the highest sesame yield was evidenced at 12.5 t ha^{-1} of different organic manures the highest seed, stover and biological yield ranged from 463.3 to 818.2 kg ha^{-1}, 1069.2 to 1684.2 kg ha^{-1} and 1533.3 to 2502.4 kg ha^{-1} respectively. With respect to the various levels, application of 12.5 t ha^{-1} of different organic manures recorded the maximum seed yield (762.0 kg ha^{-1}), stover yield (1584.2 kg ha^{-1}) and biological yield (2346.2 kg ha^{-1}). However, this level (L_4) was on par with application of 10 t ha^{-1} of different organic manures (L_3) by registering 738.3 kg ha^{-1} and 1542.4 kg ha^{-1}of seed and stover yield respectively. The biological yield of sesame was significantly superior to the rest of the levels of organic manures. Among the interactions, application of different sources and levels of organic manures on yield of sesame were significant. Application of poultry manure @12.5 t ha^{-1} (S_1L_4) recorded the highest seed yield (818.2 kg ha^{-1}), stover yield (1684.2 kg ha^{-1}) and biological yield (2502.4 kg ha^{-1}). This treatment was closely on par with the treatment which received poultry manure @ 10 t ha^{-1} (S_1L_3). The treatment (S_1L_4) was followed by (S_2L_4) which received sheep manure @ 12.5 t ha^{-1} registered seed, stover and biological yield of 754.0, 1586.7 and 2340.7 kg ha^{-1}, respectively. It was statistically on par with S_2L_3.The betterment in yield characters might be due to effect of poultry manure application that produced the highest yield of sesame compared with sheep manure. This could be due to the fact that poultry manure has a low carbon to nitrogen ratio, which allows it to mineralize and release nutrients faster than other manures [20]. Application of various organic manures increase the supply of easily assimilated major and micronutrients to plant, besides mobilizing unavaiable nutrients into available form. This might be due to higher requirement of nutrients by young, fast growing tissue and perfoms a number of functions related to growth, development, photosynthesis and utilization of carbohydrates [22,23]. All these processes are favorably improved with application of organic manures that modifed the yield in sesame

Table 1. Effect of different organic manures on growth parameters in sesame

Sources / Levels	Plant height (cm)						Number of branches plant^{-1}						Chlorophyll content (SPAD value)					
	L_0	L_1	L_2	L_3	L_4	Mean	L_0	L_1	L_2	L_3	L_4	Mean	L_0	L_1	L_2	L_3	L_4	Mean
S_1	73.23	107.33	118.56	127.45	128.23	**110.96**	6.25	8.44	9.58	10.74	10.87	**9.18**	31.70	39.29	42.34	45.75	46.38	**41.09**
S_2	73.35	100.23	110.43	120.07	121.42	**105.10**	6.20	7.48	8.63	9.75	9.82	**8.38**	31.69	38.65	40.75	43.54	44.10	**39.75**
S_3	73.47	83.35	91.71	100.95	106.19	**91.13**	6.22	5.90	6.69	7.76	8.17	**6.95**	31.67	33.02	35.67	38.49	40.28	**35.83**
Mean	**73.35**	**96.97**	**106.90**	**116.16**	**118.61**		**6.22**	**7.27**	**8.30**	**9.42**	**9.62**		**31.69**	**36.99**	**39.59**	**42.59**	**43.59**	
	S		L		S × L		S		L		S × L		S		L		S × L	
S Ed	0.91		1.43		2.34		0.08		0.11		0.19		0.32		0.51		0.85	
CD (P=0.05)	1.87		2.91		4.73		0.18		0.23		0.39		0.70		1.06		1.74	

Table 2. Effect of different organic manures on yield attributes in sesame

Sources / Levels	Number of capsule plant^{-1}						Number of seeds capsule^{-1}						1000 seed weight (g)					
	L_0	L_1	L_2	L_3	L_4	Mean	L_0	L_1	L_2	L_3	L_4	Mean	L_0	L_1	L_2	L_3	L_4	Mean
S_1	33.86	61.19	69.36	76.45	77.89	**63.75**	42.54	54.12	62.84	70.97	71.23	**60.34**	2.56	2.80	2.92	3.18	3.23	**2.94**
S_2	33.52	53.26	62.03	70.61	71.08	**58.10**	42.22	50.01	55.38	63.42	64.54	**55.11**	2.57	2.67	2.85	2.98	3.05	**2.82**
S_3	33.74	46.37	54.61	62.34	64.21	**52.25**	42.18	44.25	49.76	55.43	58.13	**49.95**	2.56	2.61	2.71	2.75	2.89	**2.70**
Mean	**33.71**	**53.61**	**62.00**	**69.80**	**71.06**		**42.31**	**49.46**	**55.99**	**63.27**	**64.63**		**2.56**	**2.69**	**2.83**	**2.97**	**3.06**	
	S		L		S × L		S		L		S × L		S		L		S × L	
S Ed	0.54		0.74		1.29		0.49		0.71		1.19		0.05		0.06		-	
CD (P=0.05)	1.14		1.56		2.64		1.06		1.49		2.51		0.10		0.13		-	

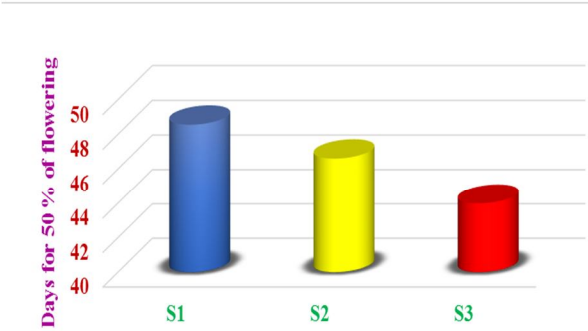

Fig. 1 Effect of different sources of organic manures on days for 50% flowering in sesame

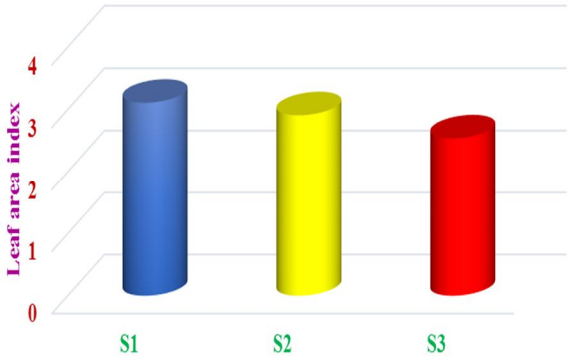

Fig. 2 Effect of different sources of organic manures on leaf area index in sesame

Table 3. Effect of different organic manures on yield in sesame

Sources / Levels	Seed yield (kg ha^{-1})						Stover yield (kg ha^{-1})						Biological yield (kg ha^{-1})					
	L_0	L_1	L_2	L_3	L_4	Mean	L_0	L_1	L_2	L_3	L_4	Mean	L_0	L_1	L_2	L_3	L_4	Mean
S_1	467.3	664.2	736.8	800.4	818.2	**697.4**	1076.3	1467.2	1565.6	1668.3	1684.2	1492.3	1543.6	2131.4	2302.4	2468.7	2502.4	2189.7
S_2	463.3	602.1	670.4	741.2	754.0	**646.2**	1072.4	1373.8	1462.2	1563.5	1586.7	1411.7	1535.7	1975.9	2132.6	2304.7	2340.7	2057.9
S_3	464.1	546.1	605.4	673.3	713.8	**600.5**	1069.2	1193.6	1299.7	1395.4	1481.6	1287.9	1533.3	1739.7	1905.1	2068.7	2195.4	1888.4
Mean	**464.9**	**604.1**	**670.9**	**738.3**	**762.0**		**1072.6**	**1344.9**	**1442.5**	**1542.4**	**1584.2**		**1537.5**	**1949.0**	**2113.4**	**2280.7**	**2346.2**	
	S		L		S × L		S		L		S × L		S		L		S × L	
S Ed	6.61		13.23		19.81		14.65		21.59		36.25		21.98		25.87		46.96	
CD (P=0.05)	13.26		26.47		39.67		29.36		43.26		72.58		44.36		52.02		95.12	

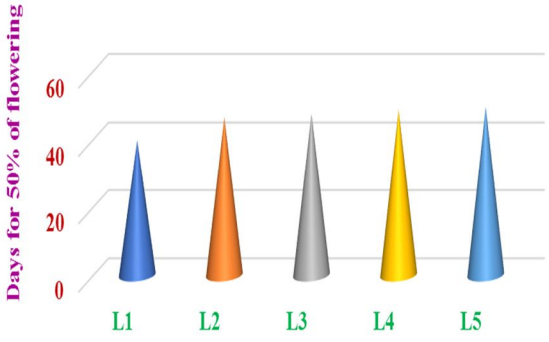

Fig. 1a Effect of different levels of organic manures on days for 50% flowering in sesame

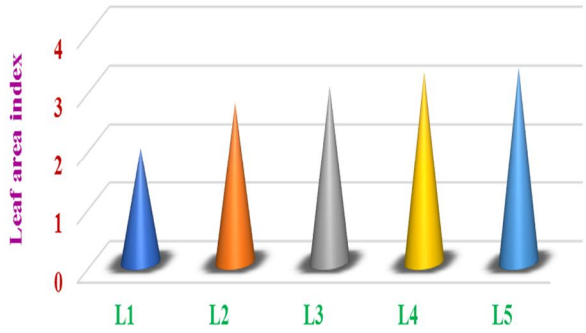

Fig. 2a Effect of different levels of organic manures on leaf area index in sesame

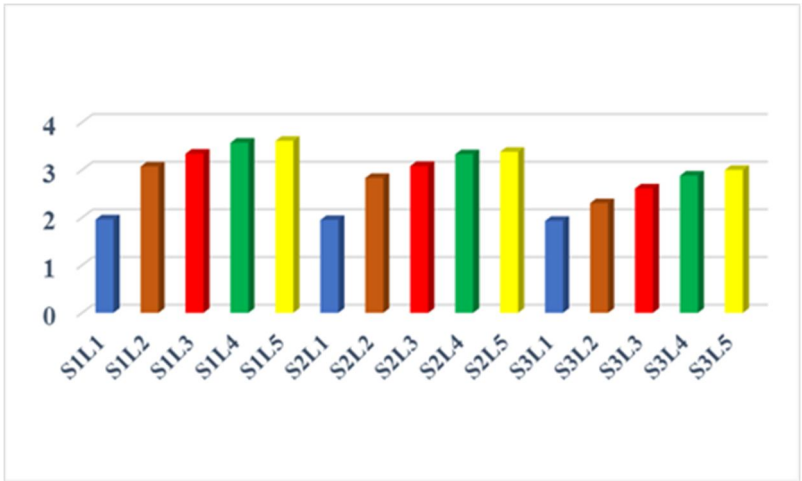

Fig. 2c Interaction effect of different sources and levels of organic manures on leaf area index in sesame

CONCLUSION

The application of poultry manure at 12.5 t ha^{-1} performed better in improving growth parameters such as plant height, number of branches plant^{-1}, chlorophyll content, days for 50% flowering, and leaf area index. This treatment also resulted in the highest yield and yield attributes, such as number of capsules plant^{-1}, number of seeds capsule^{-1},1000 seed weight, Seed yield, stover yield, and biological yield of sesame in sandy loam soil compared to other organic manures like sheep manure and press mud.

REFERENCES

1. Anonymous (2007a). Effect of organic and inorganic nutrient sources on soil mineral nitrogen and maize yields in western Kenya.
2. Crasswell ET, Lefroy RDB. (2001). The role and function of organic matter in tropical soils. *Nutrition Cycling in Agroecosystem*, 61: 7-18. https://doi.org/10.1023/A:1013656024633
3. Murphy BW. (2015). Impact of soil organic matter on soil properties- A review with emphasis on Australian soils, *Soil Research,* 53(6): 605-635. http://doi.org/10.1071/SR14246.
4. Anyanga WO, Obong, YY. (2001). Sesame (*Sesamum indicum* L.). In J. K. Mukiibi (Ed.), Agriculture in Uganda, 11: 97-102.
5. Morri, JB. (2002). Food, industrial, nutraceutical, and pharmaceutical uses of sesame genetic resources. In J. Janick& A. Whipkey (Eds.), Trends in new crops and new uses. ASHS Press, Arlington, VA,153-156.
6. Bedigian D. (2003). Evolution of sesame (Revisited): Domestication, diversity and prospects. *Genetic Resources and Crop Evolution*, 50: 779-787. https://doi.org/10.1023/A:1025029903549
7. Lal R. (2004). Soil carbon sequestration to mitigate climate change. *Geoderma*, 123: 1-22.
8. Farhad W, Saleem MF, Cheema MA, Hammad HM. (2009). Effect of poultry manure levels on the productivity of spring maize (*Zea maize* L.). *The Journal of Animal and Plant Science*,19 (3): 122-125.
9. Poonkodi P, Raghupathy B. (2001). Effective utilization of industrial wastes for higher yield of soybean. *Adv. Plant Sci*., 14(11): 543-546.
10. Gomez AA, Gomez RA. (1976). Statistical procedures for agricultural research with emphasis on rice. IRRI, Los Banos, Philippines, 294.
11. Vimera K, Kanaujia SP, Singh VB, Singh PK. (2012). Effect of integrated nutrient management on growth and yield of king chilli under foothill condition of Nagaland. *J. Indian Soci. Soil Sci.,* 60: 45-49.
12. Vaiyapuri V, Amudha A, Sriramachandrasekharan MV, lmayavaramban V. (2004). Effect of nitrogen levels and organics on growth and yield of sesame. *Adv. Plant Sd.* 17(2): 681-685.
13. Ahou EI-Magd AM, El-Bassiony, Fawzy ZF. (2006). Effect of Organic manure with or Without Chemical Fertilizers on improving the physicaland biological properties of soil. *App. 3d. Res.,* 2(10): 791-798.
14. Haruna IM, Aliyu L, Olufajo OO, Odion EC. (2011). Growth of sesame (*Sesamum indicum* L.) as influenced by poultry manure, nitrogen and phosphorus in Samaru, Nigeria. *American-Eurasian J. Agric. & Environ. Sci*. 10(4): 561-568.
15. Akande MO, Makinde EA, Otuwe,MO. (2011). Dry matter partitioning of sesame and nutrient dynamics with organic and inorganic fertilizers. *Trop. Subtrop. Agrosyst,* 14: 1063-1069.
16. Halepyati AS. (2001). Conjunctive use of organic and inorganic fertilizersin rabi/summer groundnut in UKP area. *Karnataka Journal of Agricultural Science,* 14 (2): 454-55.
17. Purushotham G, Harsha KN, Shashidhara GC, Krishnegowda M, Tanveer A, Manjunath BN. (2004). Integrated nutrient management in sesame. (*Sesamum indicum* L.). *JournalOilseeds Research,* 26: 264-265.
18. Singh GR, Chaure NK, Sharma RN, Thakur BS. (2006). Seed yield, quality and economics of summer sesame (*Sesamumindicum* L.) as influenced by time of nitrogen application. *IndianAgricultural,* 50(1/2): 5-7.
19. Deshumkh SS, Shaikh AA, Desai MM. (2010). Influence of integrated nutrient management on growth and yield contributing characters of summer sesame. *Journal of Maharashtra Agricultural Universities,* 35 (1): 3-6.
20. Haruna IM, Abimiku MS. (2012). Yield of sesame (*Sesamum indicum* L.) as influenced by organic fertilizers in the Southern Guinea Savanna of Nigeria, ISSN 1927 050X E-ISSN 1927-0518. *Sustainable Agricultural Research*, 1(1): 66-69.
21. Ghosh AK, Duary B, Ghosh DC. (2013). Nutrient management in summer sesame (*Sesamum indicum* L.) and its residual effect on black gram (*Vigna mungo* L.). *International Journal of Bio-resource and Stress Management,* 4 (4): 541-546.
22. Naugriya MN, Jhapatsingh P. (2004). Role of nitrogen and sulphur on performance of *Sesamum indicum* under plantation of Dalbergia sissoo in marginal land of Chhattisgarh, *Indian Journal of Agroforestry*, 6(1): 89-91.
23. Duhoon SS, Jyotishi A, Deshmukh MR, Singh NB. (2004. Optimization of sesame (*Sesamum indicum* L.) production through bio/natural inputs. *Proc. 4th Int. Crop Science Congress*, Brisbane, Australia.

CITATION OF THIS ARTICLE

G. Kiruthika, P. Poonkodi, A. Angayarkanni, A. Sundari and M.V. Sriramachandrasekharan. Enhancing the Growth and Productivity of Sesame (*Sesamum Indicum* L.) Through different Organic Manures in Sandy Loam Soil. Bull. Env.Pharmacol. Life Sci., Vol 11 [11] October 2022 : 42-47