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Response of Sesame Growth and Yield to *Jivamrut*

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A field experiment was conducted at Agronomy Instructional Farm, C. P. College of Agriculture, to study the "Response of sesame growth and yield to *jivamrut*" during *kharif* season of 2020 with Seven treatment combinations comprising, three levels of *jivamrut,* two time of application of *jivamrut* and one control (No *jivamrut*) were evaluated in randomized block design (in a factorial arrangement) with single control and replicated four times. The results of present investigation revealed that significantly the highest plant height and branches per plant were found with application of *jivamrut*. Levels of *jivamrut* and time of application of *jivamrut* were found non-significant with respect to plant height. Time of application of *jivamrut* was found significant with respect to branches per plant but levels of *jivamrut* was found non-significant. The yield attributes of sesame *viz*., number of capsules per plant, test weight, seed yield and stalk yield were found significant due to application of *jivamrut*, levels of *jivamrut* and time of application of *jivamrut*. Application of *jivamrut* was found significant but levels and time of application of *jivamrut* were found non-significant with respect to number of seeds per capsule. Application *jivamrut* provided significantly higher seed (556 kg/ha) and stalk (1425 kg/ha) yields of sesame, in case of levels of

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jivamrut (L_3) 1000 lit/ha recorded significantly higher seed (607 kg/ha) and stalk (1513 kg/ha) yields of sesame and application of *jivamrut* at 20 days interval recorded significantly higher seed (647 kg/ha) and stalk (1708 kg/ha) yields as well as higher net return and benefit: cost ratio also found with this (L_3) and 20 days interval. Interaction was found non-significant for yield attributes and yield.

Keywords: jivamrut; sesame; growth and yield; economics.

1. INTRODUCTION

Sesame (*Sesamum indicum* L.) known as "Queen of Oilseed Crop" is a premier and the oldest oilseed crop grown in India. Sesame or gingelly is commonly known as til (Hindi, Punjabi, Assamese, Bengali, Marathi), tal (Gujarati), nuvvulu, manchi nuvvulu (Telugu), ellu (Tamil, Malayalam, Kannada), tila/pitratarpana (Sanskrit) and rasi (Odia) in different parts of India.

Over the years along with its increasing demand, production of sesame seed is also increasing. The edible oilseeds which come in the assorted range of white, black & brown are one of the most favored crops to farmers for its resistance to stand with unfavorable weather conditions and grow with minimum attention. Sesame is grown in almost all the states in large or small areas. In India, though Sesame is cultivated in one or more seasons (kharif and rabi) nearly 75% of annual acreage and production comes from kharif crop (June-November). In Kharif- 2019 all India sesame acreage was 13,71,700 hectares. Gujarat (1,16,200 ha; 8%), Uttar Pradesh (4,17,435 ha; 30%), Rajasthan (2,70,191 ha; 20%) and Madhya Pradesh (3,14,300 ha; 23%) jointly accounted for 85 % of the national acreage. At the national level, there was an increase in acreage by 4 % with respect to kharif- 2018. The decrease observed in Madhya Pradesh was quite large (29 %). However, increases in Gujarat (49%) and Uttar Pradesh (26%) were substantial (IOPEPC 2019).

Area under sesame in Gujarat is 1,65,000 ha and the production 107,000 tonnes with the productivity of 649 kg per hectare [1].

Now-a-days there is a huge demand for organic sesame in the global market. India has greater scope to produce sesame as it is traditionally grown without much chemical fertilizer and plant protection. In this context, there is a need to create awareness among the farmers to produce organic sesame and also facilitates them. Further adoption of organic farming is reduces the ill effects of chemical farming.

Jivamrut is ecofriendly organic liquid can be prepared from water, cow dung, cow urine along with other ingredients like pulse flour, jaggery these were mixed in the ratio of (200:10:10:2:2) to this handful of soil from the bund of the farm is added and allowed to ferment, which provides a congenial environment for beneficial soil organisms upon its application. This can help in making essential nutrients available for plant growth *viz*., nitrogen, phosphorous and potassium to plants [2]. So, Attention is given on application of *jivamrut* to find out effect, optimum level and suitable time of *jivamrut* on growth and yield of sesame.

2. MATERIALS AND METHODS

A field experiment was conducted on Plot No. B-3 at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, site is located at 72˚ 19' East longitude and 24˚ 19' North latitude at 154.52 meter above the mean sea level at North Gujarat Agro-climatic Zone, India. Climate of this region is sub-tropical monsoon type and falls under semi-arid region. The soil of experimental field was loamy sand in texture low organic carbon and available nitrogen; and medium in available phosphorus and potassium.

Seven treatment combinations comprising, three levels of *jivamrut* (L_1: *jivamrut* @ 500 lit/ha, L_2: *jivamrut* @ 750 lit/ha and L_3: *jivamrut* @ 1000 lit/ha) two time of application of *jivamrut* (T_1: 20 days interval and T_2: 40 days interval) and one control (No *jivamrut*) were evaluated in Randomized block design (factorial concept) with single control and replicated four times. Sesame variety GT 3 was used for present experiment and sown at 45 cm inter row spacing. Common application of 1 t/ha castor cake and 5 t/ha FYM were applied at the sowing time of sesame. FYM contains 0.50% N, 0.25% P_2O_5, 0.50% K_2O. Castor cake contain 4.3% N, 1.8% P_2O_5, 1.3% K2O.

For preparation *jivamrut* 200 litres of water was put in a plastic barrel,10 kg of fresh desi cow dung was added followed by 10 litres of aged

cow's urine, to this 2 kg of jaggery, 2 kg of pulse flour (gram) and a handful of live soil from under canopy of the banyan tree (about 100 g) were added. The solution was regularly stirred clockwise in the morning and evening continuously for 7 days and let it ferment in the shade [2]. Different doses of *jivamrut* were applied in experimental plots as per treatment.

The biometric observations were recorded from five randomly selected plants (tagged earlier in each net plot). The details of various growth, yield attributes and yield studied during the course of investigation in order to evaluate the effectiveness of each individual treatment, the relative economics of each treatment was worked out in terms of net realization and BCR). Statistical analysis of the data of various characters studied in present investigation was carried out with the help of ANOVA and mean separation method as per appropriate procedure suggested by Panse and Sukhatme [3] for the design of experiment.

3. RESULTS AND DISCUSSION

3.1 Effect on Growth Attributes

The data on plant height of sesame recorded at harvest as influenced by levels and time of *jivamrut* application and their interaction are provided in Table 1.

Plant height and number of branches per plant of sesame due to application of *jivamrut* was found significant. Treatment A_2 (*jivamrut*) recorded significantly higher plant height (117.0 cm) and number of branches per plant (3.57 cm) as compare to A_1 (No *jivamrut*). *Jivamrut* was attributed to micronutrients, growth hormones and higher microbial population in phyllosphere which might have resulted in higher uptake of as soil nutrients which by the end significantly increased the plant growth and overall development [2].

Plant height and number of branches of sesame measured at harvest was not differed significantly due to different levels of *jivamrut*. However, numerically higher values was recorded with 1000 lit/ha (L_3) of *jivamrut*.

Plant height of sesame measured at harvest was not differed significantly due to different time of application of *jivamrut*. However, treatment T_1 (*jivamrut* at 20 days interval) recorded significantly higher number of branches per plant (3.83) compared to T_2 (*jivamrut* at 40 days interval). Interaction effect of levels and time of application of *jivamrut* on plant height and number of branches per plant of sesame was found statistically non-significant.

3.2 Effect on Yield Attributes and Yield

The results depicted in Table 1 to number of capsules per plant, number of seeds per capsule, test weight, seed yield and stalk yield indicated that differences in sesame due to application of *jivamrut* was found significant. Treatment A_2 (*jivamrut*) recorded significantly higher number of capsules per plant (33.17), number of seeds per capsule (56.2), test weight (3.06 g), seed yield (556 kg/ha) and stalk yield (1425 kg/ha) as compare to A_1 (No *jivamrut*). The increase in seed yield might be due to better availability of nutrients and plant growth hormones during the critical period of crop growth. Higher seed yield under these treatments contributed to improvement in growth attribute and yield attributes having significant positive correlation with seed yield. Similar results were also observed by Shwetha et al. [4], Siddappa [5], Basavaraj Kumbar [6], Reshma Sutar [7], Puneet Kaur [8], Karan Bhadu [9] and Sumanth Prabhu [10].

Number of capsules per plant, test weight, seed yield and stalk yield of sesame differed significantly due to different levels of *jivamrut.* Treatment L_3 (1000 lit/ha of *jivamrut*) recorded significantly higher comparable to L_2 (750 lit/ha of *jivamrut*). Palekar [2], Vasant kumar (2006) and Devakumar [11] reported the beneficial effects of *jivamrut* which was attributed to huge quantity of microbial load and growth hormones which in turn might have enhanced the soil biomass, thereby sustaining the availability and uptake of applied as well as native soil nutrients which ultimately have resulted in better growth and yield of crops. These findings are in conformity with the results of Siddappa [5], Basavaraj Kumbar [6], Reshma Sutar [7], Puneet Kaur [8] and Karan Bhadu [9].

In case of treatment T_1 (*jivamrut* at 20 days interval) significantly higher number of capsules per plant, test weight, seed yield and stalk yield were recorded compared to T_2 (*jivamrut* at 40 days interval. This may be attributed to the application of liquid manures (*jivamrut*), which act as stimuli in the plant system, enhancing the production of growth regulators and hormones in cells. This, in turn, could boost soil biomass,

sustaining the availability and uptake of both applied and native soil nutrients, ultimately resulting in improved crop growth and yield. These finding are in conformity with the results of Puneet Kaur [8]. Harvesting index was non-significant due to any treatment of *jivamrut.*

Table 1. Effect of *jivamrut* on growth attributes, yield attributes and yield

Treatments	Plant height (cm)	No. of branches/ plant	No. of capsules/ plant	No. of seeds/ capsule	Test weight (g)	Seed yield (kg/ha)	Stalk yield (kg/ha)	Harvest index (%)
***Jivamrut* (A)**								
A_1: No *jivamrut*	98.9	2.55	25.60	48.5	2.44	374	997	27.32
A_2: Application of *jivamrut*	117.0	3.57	33.17	56.2	3.06	556	1425	28.29
S.Em.±	5.9	0.20	1.86	2.5	0.13	31	81	1.44
C.D. at 5%	17.5	0.59	5.55	7.3	0.37	93	241	NS
Levels of *jivamrut* (L)								
L_1: 500 lit/ha	114.2	3.43	30.62	55.1	2.87	514	1299	28.62
L_2: 750 lit/ha	117.3	3.55	33.13	55.9	3.11	547	1465	27.40
L_3: 1000 lit/ha	119.6	3.73	35.75	57.9	3.18	607	1513	28.87
S.Em.±	4.0	0.13	1.27	1.7	0.09	21	55	0.98
C.D. at 5%	NS	NS	3.77	NS	0.25	63	164	NS
Time of application of *jivamrut* (T)								
T_1: 20 days interval	120.9	3.83	36.67	58.2	3.32	647	1708	27.61
T_2: 40 days interval	113.0	3.30	29.67	54.2	2.79	465	1143	28.98
S.Em.±	3.3	0.11	1.04	1.4	0.07	17	45	0.80
C.D. at 5%	NS	0.33	3.08	NS	0.21	52	134	NS
Interaction (L × T)								
S.Em.±	5.7	0.19	1.80	2.4	0.12	30	78	1.39
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS
C.V. %	9.88	11.22	11.19	8.57	8.14	11.37	11.44	9.87

Table 2. Economics as influenced by different treatments

Treatments	Gross returns (₹/ha)	Total cost of cultivation (₹/ha)	Net returns (₹/ha)	Benefit:cost ratio (BCR)
***Jivamrut* (A)**				
A_1: No *jivamrut*	37898	30982	6916	1.22
A_2: Application of *jivamrut*	56329	36940	19389	1.51
Levels of *jivamrut* (L)				
L_1: 500 lit/ha	52099	34954	17145	1.48
L_2: 750 lit/ha	55382	36940	18442	1.49
L_3: 1000 lit/ha	61506	38926	22580	1.57
Time of application of *jivamrut* (T)				
T_1: 20 days interval	65587	38926	26661	1.69
T_2: 40 days interval	47072	34954	12117	1.34

Note: Rate of various inputs: 1. FYM @ ₹ 1.50 per kg. 2. Castor cake @ ₹ 6/kg. 3. Jivamrut @ ₹ 2/liter. 4. Skill labour (spraying) @ ₹ 324 per day. 5. Labour @ ₹ 260 per day
Selling price: (i) Seed ₹ 100/kg
(ii) Stalk ₹ 0.50/kg

Interaction effect of levels and time of application of *jivamrut* on number of capsules per plant of sesame was found statistically non-significant [12].

3.3 Effect on Economics

Application of *jivamrut* secured higher net returns (₹ 19,389/ha) with benefit: cost ratio (BCR) of 1.51 than no *jivamrut* indicated in Table 2.

Among the levels of application of *jivamrut*, maximum net returns of ₹ 22,580/ha and benefit : cost ratio (BCR) of 1.57 were obtained from 1000 lit/ha *jivamrut* (L_3) followed by 750 lit/ha *jivamrut* (L_2) having the net returns of ₹ 18,442/ha with benefit: cost ratio (BCR) of 1.49.

In case of the time of *jivamrut* application maximum net returns of ₹ 26,661/ha and benefit: cost ratio (BCR) of 1.69 were obtained from application of *jivamrut* at 20 days interval (T_1).

4. CONCLUSION

In light of results obtained from present investigation, it is concluded that sesame growth under converted organic plot should be given 1000 or 750 lit/ha *jivamrut* each at 20 days interval for obtaining higher growth and sesame yield.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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