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Effect of biofertilizer on growth, yield and economics of sesame (*Sesamum indicum* L.)

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Abstract
A field experiment was conducted during kharif season of 2019 at the Experimental farm, College of Agricultural Biotechnology, Latur to Study the effect of biofertilizer on growth, yield and economics of sesame (*Sesamum indicum*). The experiment was laid out in randomized block design with three replications and treatments were consisting of eight with chemical fertilizers and liquid biofertilizer. The treatments were, T1-RDF 50:25:00 Kg NPK ha^{-1}, T2-50% RDF + Azotobacter T3-75% RDF + Azotobacter, T4-^{1}00% RDF + Azotobacter, T5-50% RDF + Azotobacter + PSB, T6-75% RDF + Azotobacter + PSB, T7-^{1}00% RDF + Azotobacter + PSB, T8-Control. The results of the field study indicated that the yield attributes and yield of sesame were significantly influenced by different treatments The significantly higher number seed capsule^{-1} (63.30), seed yield plant^{-1} (6.13 g), seed yield ha^{-1} (780 kg ha^{-1}) and straw yield (3060 kg ha^{-1}) was obtained with the application of 100% RDF+Azotobacter+PSB (T7),The higher values of yield attributes and yield of sesame was observed with the application of 100%RDF+Azotobacter+PSB (T7) where as it was at par with the 100% RDF+Azotobacter (T4) and 75%RDF+Azotobacter+PSB (T6).

Keywords: Biofertilizer, growth, economics, sesame, *Sesamum indicum* L.

Introduction
The sesame seed has been considered as 'Queen of Oilseed' for its high oilseed content and quality and traditionally categorized as a health food in China, Japan and Asian countries. It is considered to have both nutritional and medicinal value. Moreover, seed is a rich source of edible oil (48-55%) and protein (20-28%) with anti-oxidants lignans such as sesamolin and sesamin which prevents rancidity and gives sesame oil a shelf life. Sesame oil is called 'poor man's ghee'. The lignin content has useful physiological effect in human and animal health. (Ashakumary, 1999). The seeds are very rich in iron, magnesium, manganese, copper and calcium and contain vitamin E, A, B and B1. The seed contain phytosterols associate with reducing the level of blood cholesterol and also phytoestrogens with anti-oxidants an anti-cancer property.
Sesame response to bio fertilizers and inorganic fertilizers has not been adequately studied. It is clear that the inorganic and bio fertilizers are essentially required by sesame crop for improving yield and quality of oil taking in to consideration the factor discussed above present investigation was undertaken at Experimental Farm College of Agriculture, Latur during kharif season of with the following objectives: To study the effect of bio fertilizer on growth and yield of sesame & to study the economics of sesame.

Material and Methods
The experiment was conducted during *kharif* season of 2019-20 at Experimental farm of College of Agricultural Biotechnology, Latur. The soil in the experimental site was uniform and leveled. The soil was medium black in color with good drainage. The soil sample was collected before sowing from all the plots. A composite sample of about ½ kg was taken from 0-30 cm depth and analyzed for the determination of physical and chemical properties of the soil. The experimental field was laid out as per the plan after preparatory tillage before sowing. The plan of layout consisted of 24 number of plots spread over three replications. The treatment was allotted to different plot randomly in each replication. Each experimental unit was 5.4 m x 4.5 m in size (Gross). The net plot size was 4.5m x 3.9 m. The distance between two replications was 1.5 meter and distance between two plots was 1.0 meter. The present experiment was laid out in Randomized Block Design with three replications. The allotment of treatments to various plots in each replication was done by randomization.

Result and Discussion

Number of seeds capsule^{-1}, seed yield plant^{-1}, weight of capsule plant^{-1} and test weight (g) of sesame as influenced by different treatments Data on yield contributing character *viz*. number of seeds capsule^{-1}, seed yield plant^{-1} (g), capsule yield plant^{-1}(g), and test weight (g) are presented in Table 17. From Table 17 it showed that the mean number of seeds capsule^{-1}, seed yield plant1 (g) capsule yield plant^{-1} (g), test weight (g) were 55.06, 5.29 (g), 15.65 (g) and 2.94 (g) respectively.

Table 1: Number of seeds capsule^{-1}, seed yield plant^{-1}, weight of capsule plant^{-1} and test weight of sesame as influenced by different treatments

Treatments	No. of seeds capsule^{-1}	Seed yield plant^{-1}(g)	Weight of Capsules plant^{-1} (g)	Test weight (g)
T1- RDF (50:25:00) Kg NPK ha^{-1}	55.60	5.42	15.97	2.87
T2- 50% RDF + Azotobacter	50.00	4.85	13.80	2.67
T3 - 75% RDF + Azotobacter	53.20	5.31	15.80	2.82
T4 – 100% RDF + Azotobacter	59.35	5.80	17.20	2.95
T5 – 50% RDF + Azotobacter + PSB	52.65	5.02	15.20	2.76
T6- 75% RDF + Azotobacter + PSB	58.21	5.65	16.30	2.90
T7-100% RDF +Azotobacter + PSB	63.30	6.13	17.90	3.05
T8-Control	48.20	4.10	13.00	2.60
SE+	3.67	0.31	0.90	0.21
CD at 5%	7.61	0.64	1.86	NS
C.V.	8.16	7.13	7.04	8.92
General Mean	55.06	5.29	15.65	-

Number of seeds capsule^{-1}

Data pertaining to number of seed capsule as affected by different treatments are presented in Table 17. The maximum number of seeds per capsule (64) was produced by the application of 100%RDF+Azotobacter +PSB (T7) which was at par with T4 and T6 and found significantly superior over rest of the treatments.

The significantly lowest number of seeds capsule^{-1} (48.20.) was recorded with treatment Control T8.

Seed yield plant^{-1} (g)

Data on seed yield per plant as affected by different treatments are presented in Table 1. The higher seed yield plant (6.13 g plant) was obtained due to the application of 100% RDF+ Azotobacter + PSB (T7). Which was at par with T4 and T6 found significantly superior over rest of the treatments. The significantly lowest seed yield per plant (4.10 g). Was produced with the treatments of Control (T8).

Capsule yield plant^{-1} (g)

Data on capsule yield per plant as affected by various treatments are presented in Table 1. The significantly highest capsule yield (17.90) was produced by the application of 100% RDF+ Azotobacter +PSB (T7) which was at par with T4 and T6 and found significantly superior over rest of the treatments. The significantly lowest capsule yield per plant (13 g plant^{-1}) was obtained with the treatment T8 Control.

Test weight (g)

Data on test weight (g) as influenced by various treatments is presented in Table 1. The mean test weight (g) was not influenced significantly due to different treatments. The mean test weight was 2. (g) Numerically highest test weight (3.05 g) was observed with the application of 100% RDF + Azotobacter + PSB (T7) and lowest test weight observed was 2.60 g due to treatments Control (T8).

Straw and Biological yield (kg ha^{-1}), Harvest index (%)

Data on seed, straw and biological yield and harvest index as influenced by various treatments are presented in Table 18 and depicted in Fig. 9. It is evident from the data that the mean seed, straw and biological yield, harvest index were 634 kg ha^{-1}, 2792 kg ha^{-1}, 3426 kg ha^{-1} and 18.39 per cent respectively.

Table 2: Seed yield, straw yield, biological yield (kg ha^{-1}) and harvest index (%) of sesame as influenced by different treatments

Treatments	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index (%)
T1-RDF 50:25:00 Kg NPKha^{-1}	583	2702	3285	17.69
T2- 50% RDF + Azotobacter	495	25/2	3067	16.15
T3 - 75% RDF + Azotobacter	553	2655	3208	17.25
T4 – 100% RDF + Azotobacter	717	2940	3657	19.61
T5 -50% RDF + Azotobacter + PSB	525	2603	3128	16.80
T6- 75% RDF + Azotobacter + PSB	665	2802	3467	19.19
T 7- 100% RDF + Azotobacter + PSB	780	3060	3840	20.55
T8-Control	443	2405	2848	15.43
SE+	37	120	199	-
CD at 5%	77	353	412	-
C.V.	7.62	7.66	8.22	-
General Mean	595	2717	3313	-

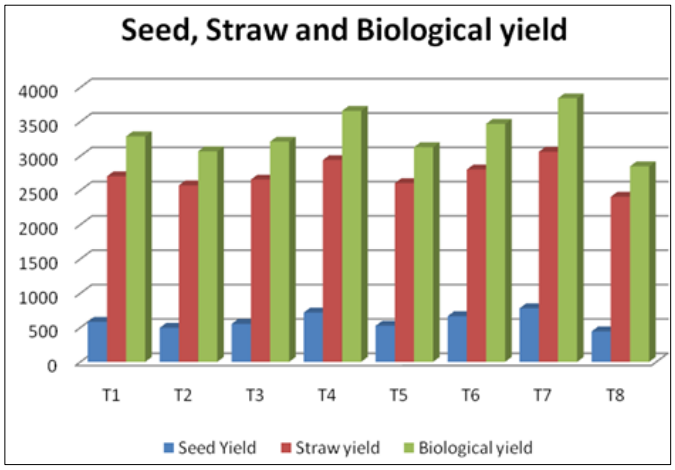

Fig 1: Seed, straw and biological yield (kg ha^{-1}) as influenced by different treatments

Seed yield (kg ha^{-1})

Data on mean seed yield (kg ha^{-1}) as influenced by different treatments is presented in Table 2. Mean seed yield of sesame was 595 (kg ha^{-1}). The seed yield of sesame was differed significantly due to different treatments. The maximum seed of 780 kg ha^{-1} was produced by the application of 100%RDF + Azotobacter + PSB (T7) which was at par with T4 and T6 and found significantly superior over rest of the treatments.

The significantly lowest seed yield (443 kg ha^{-1}) was obtained due to Control (T8).

Straw yield (kg ha^{-1})

The data presented in Table.18 indicated that, the mean straw yield (kg ha^{-1}) of sesame was 2717 kg ha^{-1}. The straw yield per hectare was significantly influenced by various treatments.

The maximum straw yield (3060 kg ha) was produced by the application of 100% RDF + Azotobacter + PSB (T7) which was at par with T4 and T6 and found significantly superior over rest of the treatments.

The minimum straw yield (2405 kg ha^{-1}) was obtained due to treatment Control (T8).

Biological yield (kg ha^{-1})

Data on biological yield as affected by different treatments are presented in Table 18. The average biological yield was 3313 kg ha^{-1}

The biological yield was different significantly due to different treatments. The application of 100%RDF + Azotobacter + PSB (T7) was produced significantly higher biological yield (3840 kg ha). This treatment was found significantly superior over all of the given treatments and at par with T4 and T6.

The lowest biological yield (2848 kg ha) was observed with treatments Control (T8). This treatment was found significantly inferior over rest of the treatments.

Harvest index (%)

Data on harvest index is presented in Table 18 revealed that; the mean harvest index of sesame crop (18.39%) was observed which was influenced due to different treatments.

The maximum harvest index (20.55%) was recorded with the application of 100%RD F+ Azotobacter + PSB (T7) whereas minimum harvest index (15.43%) was recorded with treatment T8 Control.

Conclusion

From the result summarized in this chapter the following valid conclusion are drawn.

1) The application of 100% RDF + Azotobacter + PSB (T7) resulted in improvement of growth attributes as well as yield attributes, seed yield (kg ha1), NMR, GMR and B: C ratio and found most effective and ideal for increasing productivity of sesame.
2) The quality parameter was also found significantly superior for higher oil content (49.90%) with application of 100%RDF + Azotobacter + PSB (T7).

Above conclusion are based on single season research and it needs further confirmation by repeating the trial for at least one more season.

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