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Effect of Organic Manures on Growth and Yield of Linseed (Linum usitatissimum L.)

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Abstract

A field experiment entitles "Effect of Organic Manures on Growth and Yield of Linseed (Linum usitatissimum L.) was carried out during rabi season of 2021-22 at the Agronomy Farm Mewar University, Gangrar, to find out the best treatment for the growth and yield of linseed. The experiment was laid out in Randomized Block Design, comprising nine treatments with three replications. The result showed significant superiority in giving the maximum plant height (84.65 cm at 90 days), plant diameter (5.40 cm^2 at 90 days), Secondary branches (24.92), Number of leaves (387.08), capsule/plant (58.50 at harvesting), and seed yield q/ha (20.12). The results showed that T_8 (50% Vermicompost + 50 % Neem Cake) was the best in terms of linseed growth and yield.

Keywords: *Growth, Linseed, Organic Manures, and Yield parameters.*

1. INTRODUCTION

Linseed also known as Alsi or Flaxseed *(Linum usitatissimum L.)* belongs to the genus Linum and belongs to the family Linaceae, with the chromosomes, 2n=30, and is native to the Eastern Mediterranean region to India. *Linum usitatissimum* is the sole commercially important species in the genus Linum, which has approximately 230 species (Rowland *et al*., 1995; Tadesse *et al*., 2010). It is an important global crop valued for its dietary fiber and oil, as well as for its usage as food, growth regulator, and animal feed additive. India is the world's largest linseed cultivator in terms of acreage, but it ranks third in terms of production, it is grown practically everywhere in the world, and is one of the oldest agricultural crops. Canada, the United States, Argentina, India, Poland, Romania, the Soviet Union, Uruguay, Ethiopia and China are the world's top flaxseed producers. After Canada, India is the worlds, second-largest linseed producer accounting for 21.21% of the total planted area (Tandon *et al*., 2021). Due to its amazingly high amount of ALA (alpha-linolenic acid), high quality protein, and dietary fiber (35%), linseed has appeared as a healthy meal. It also ranks first among all oilseed crops because of its several uses, (Carter 1993; Rubilar *et al*., 2010; Rabetafika *et al*., 2011). It has the maximum amount of omega-3 fatty acids, which helps to reduce the risk of heart disease, arthritis, inflammatory bowel disease, and

other health issues. Linseed is also rich in a class of phytoestrogen which is known as lignans, and due to which gives protection and against a certain form of cancer due to estrogenic and anti-estrogenic activity in the body. The linseed oil cake contains about 10% of oil 9% fiber, 32% proteins, 6% minerals, and 11% moisture thus, it is used as a feed for poultries, animals and milch cattle, therefore, priced 50% further as compared to rapeseed and mustard cake. The cake of linseed is also used as organic manure, where nitrogen contains about 5%, phosphorous with 1.5% and potash 1.8%.

In India the most important linseed producing states are Madhya Pradesh, Uttar Pradesh, Bihar, Chhattisgarh, Jharkhand, Maharashtra, Orissa, West Bengal, Assam, Andhra Pradesh, Karnataka, Nagaland, Rajasthan, Himachal Pradesh and Telangana, and. It produces 9-12 percent of imported vegetable oils, 12- 15% of total global oilseed area, 7-8 percent of oilseed output, 6-7 percent of vegetable oil production, and edible oil production is of 9-10 percent. The overall oilseed production in the country is estimated approximately 31.42 million tonnes in 2018-2019 (Sahu *et al.* 2020).

The use of organic manures holds an important place with the farmers since earliest. Organic manures play an important part in crop production. The concept of bio-safety is being instigated at diverse levels for a healthier, effective and holistic approach towards the global food security exhibiting possible to be careful of many problems in an efficient manner (Prasad and Gill, 2009). Organic farming has emerged as an efficient option in terms of the growing demand for healthy food supply, by considering all of the negative impacts of prolonged chemical use, as well as environmental contamination and long-term sustainability (Reddy, 2010). Organic agriculture is more productive and sustainable (Mader *et al*., 2002).

A balanced supply of nutrients provides many benefits, including plant growth, increased yields, long-term soil fertility, and the micronutrients needed to fight disease and insects without harming the environment. Use of organic fertilizers such as wood ash, vermicompost, neem cakes, and FYM. Organic fertilizers not only provide macro- and micronutrients to plants, but also contribute to improving soil health at physical, chemical, and biological levels (Reddy and Reddy, 2003). Vermicomposting is a mesophilic composting technique that uses microbes and earthworms that thrive at temperatures between 10 and 32 degrees Celsius. Vermicompost is a plant-friendly, non-toxic material (Louraduraj, 2006). On the other hand, farm yard manures (FYM) are readily available and contains all the nutrients farmers need to grow a wide variety of crops. It is one of the first fertilizers required for healthy plant growth by increasing water retention and soil fertility. Wood ash is the light gray, powdery residue that results from burning firewood, campfires, and other similar sources. It is the most abundant calcium-rich element. Ash appears in the form of phosphorus, potassium and magnesium. Ash is becoming increasingly important in agriculture, as it contains several micronutrients (Fe, Zn, Mn, and Cu) required for plant growth. In India, neem has been used as a natural fertilizer since very early times. It has become known for its dual effectiveness as a soil conditioner and pest repellent. Both neem cake and neem leaves are used to prepare the soil and restore soil quality. Neem cake is used for a variety of things, but most commonly an organic fertilizer that nourishes the soil. It is also a rich source of NPK.

2.MATERIALS AND METHODS

2.1 Description of the study area: A field experiment was conducted during *rabi* season 20212022 at Mewar University research farm. Geographically, Chittorgarh is located at 24.88°N and 74.63°E. It has an average

elevation of 1292 feet (394 meters). Chittorgarh is in the southern part of the state of Rajasthan, in the north-western part of India. It is located on the banks of river Gambhiri River and Berach. Chittorgarh is located between 23° 32' and 25° 13' north latitudes and between 74° 12' and 75° 49' east longitudes in the south-eastern part of Rajasthan state. Chittorgarh has a dry climate. This regions climate is arid or semi-arid, with harsh temperatures in both summer and winter. In the summer, the temperature can reach 48°C, while in the winter, it can drop to -1.0°C. Summer lasts from April through June and is extremely hot. Summer temperatures range from 43.8°C to 23.8°C on average. From October until February, the winter season begins. Chittorgarh has a pleasant winter climate. The temperature ranges from 28.37°C to 11.6°C on average. Depending on the area's dryness, the average number of rainy days ranges from 6 to 42. The typical annual rainfall is 200-400 mm, with extreme dry zones receiving as little as 150 mm. Rainfall in the south-eastern section of Rajasthan can reach 1000 mm. Some areas of western Rajasthan receive relatively little rain, with an average of only 100 mm per year. Throughout the year, the Aravalli range receives a lot of rain and has cold temperatures.

2.2. Experimental Details

The experiment was set up using a Randomized Block Design, with nine treatments and three replications.

I. Season: *Rabi*, 2021-2022

II. Crop: Linseed

III. Variety: Pratap Alsi-1

IV. Seed rate: 25-30 kg/ha

V. Experimental Design: RBD (Randomized Block Design)

VI. Number of treatments: 9

VII. Number of Replication: 3

VIII. Number of plots: 9 X 3= 27

IX. Size of each plot: 3.5 X 2.4 m

X. Total length of experimental Plot: 7 m

XI. Total width of experimental Plot: 12 m

Treatment Details

Table 1: Treatment Details

T_1	100% FYM
T_2	100% Vermicompost
T_3	50% Vermicompost + 50% FYM
T_4	75% Vermicompost + 25 % FYM
T_5	25% Neem Cake + 75 % FYM
T_6	50% FYM + 25% Neem Cake + 25% Wood ash

T_7	50% Neem Cake + 50% FYM
T_8	50% Vermicompost + 50 % Neem Cake
T_9	Control

3. RESULT AND DISCUSSION GROWTH PARAMETERS

3.1. Days to Germination (Earliest)

Data showed the days to germination of several organic manures showed that there were large differences between the various linseed treatments. The maximum number of days taken to germinate (11.75) was recorded in treatment T_9 (Control) and minimum number of days taken to germinate (10.42) was recorded in T_6 (50% FYM + 25% Neem Cake + 25% Wood Ash).

3.2. Number of leaves/plants

At 90 DAS, the maximum number of leaves per plant (387.08) was recorded in T_8 (50% Vermicompost + 50% Neem Cake) and the minimum number of leaves per plant (204.92) was found to be in T_3 (50% Vermicompost + 50% FYM). The application of Vermicompost had a great impact on number of leaves with the combination of Neem cake. Development of plant growth caused by the application of organic manures with increased in number of leaves was reported earlier (Katiyar *et al*.,2012; Baharvand *et al*.,2014; Prajapati and Swaroop, 2016)

3.3. Number of secondary branches/plants

At 90 DAS, the maximum number of secondary branches per plant (24.92) was recorded in T_8 (50% Vermicompost + 50% Neem Cake) and T_6 (50% FYM + 25% Neem Cake + 25% Wood Ash) was found to be in par (23.00), the minimum number of secondary branches per plant (15.42) was found to be in T_9 (Control).

3.4. Plant Height (cm)

Plant height (cm) is an index of plant growth and is known to be influenced by environmental and crop management practices. The data recorded for plant height (cm) from the different treatments of organic manures in linseed at different successive growth stages, at 90 DAS, the maximum height per plant (84.65) was recorded in T_8 (50% Vermicompost + 50% Neem Cake) and the minimum height per plant (63.63) was found to be in T_9 (Control). The result obtained was found to be significant.

3.5. Plant Diameter (cm)

The maximum number of diameters per plant (5.40 cm) was recorded in T_8 (50% Vermicompost + 50% Neem Cake) and (4.20) was found to be in par T_6 (50% FYM + 25% Neem Cake + 25% Wood Ash), the minimum number of plant diameter (3.07cm) was found to be in T_5 (25% Neem Cake + 75% FYM).

3.6. Days to First Flowering (Earliest)

The maximum number of days taken to first flowering (71.00) was recorded in T_9 (Control) and the minimum number of days taken for first flowering (68.67) was found to be T_1 (100% FYM). Application of FYM recorded

significantly a less number of days to flower, it might be due to the fact that FYM stimulate the growth activity of microorganism in the soil (Balyan *et al*., 2006).

Fig.1. Flowering Stage

3.7. Days to capsule

The maximum number of days taken to capsule (83.33) was recorded in T_5 (25% Neem cake + 75 % FYM) and the minimum number of days to capsule (74.00) was found to be in T_1 (100% FYM).

Fig.2.Overview of the field at capsule formation stage

3.8. Number of Capsule/Plants at Harvesting

The maximum number of capsules per plant (58.50) was recorded in T_8 (50% Vermicompost + 50% Neem cake) and the minimum number of capsules per plant (49.83) was found to be in T_2 (100% Vermicompost). The combination of vermicompost and neem cake treatment had an interactive effect on flowering and fruit production, with a significant increase compared to applying either treatment alone. This may be due to the increased N availability of the plant due to the combination of organic fertilizers. This observation is consistent with (Branley & Warren 1960), who observed a significant increase in the number of flowers with increasing N content. Also, (Penalosa *et al.*, 1988).

Fig.3. Capsule at Maturing Stage

3.9. CAPSULE YIELD

3.9.1. Linseed Yield/plot (kg)

Application of organic manures alone or in combination of VC, FYM, neem cake or wood ash significantly enhanced the grain yield. The highest yield (1.69kg) was recorded in T_8 (50% Vermicompost + 50% Neem cake), whereas lowest yield per plot recorded in control plot (0.84kg) was found for the treatment T_9 (Control).

3.9.2. Linseed Yield (q/ha)

The maximum seed yield (20.12 q/ha) was recorded in treatment T_8 (50% Vermicompost + 50% Neem Cake) and minimum seed yield (9.96 q/ha) was found for the treatment T_9 (Control). Due to the increased yield per plot which increased total yield quintal per ha. The application of organic fertilizers such as vermicompost showed increased growth in terms of plant height and
yield, which may be a better alternative to inorganic fertilizers. (Indirabai *et al*., 2009 and Tamilselvi *et al.*, 2009). The use of neem cakes an organic fertilizer, has become essential. Adding neem (*Azadirachta indica*) cake to the soil not only improves soil organic matter, but also reduces nitrogen loss by inhibiting nitrification. It is an excellent soil conditioner that increases crop yields over the long term and does not adversely affect the environment (Lokanadhan *et al.,* 2012). Neem cake is cost effective as compared to other fertilizers. This enhances their efficiency and released their nutrients slowly which give rise to higher yield.

3.9.3. Test Weight (g)

The data relating to test weight (g/1000 seed) was recorded and is given in Table 2. Test weight (1000 grains weight) was significantly influenced by different treatments. The highest test weight (7.33 g) was recorded in the treatment with T_1 (100% FYM) and T_6 (50% FYM + 25% Neem cake + 25% Wood Ash) while the lowest test weight (6.00 g) was recorded in T_5 (25% Neem cake + 75% FYM) which was significantly lower than the other treatments.

Table 2: Effects of Organic Manures on Growth and Yield of Linseed (*Linum usitatissimum L.)*

Treatments	Days to Germination (Earliest)	No. of leaves/ Plant	No. of Sec. branches / Plant at 90DAS	Plant Height at 90DAS (cm)	Plant Diameter (cm)	Days to first Flowering	Days to Capsule	No. of Capsules at Harvesting	Yield kg/ha	Yield q/ha	Test weight (g)
T_1	10.75	210.08	22.25	67.58	3.33	68.67	74.00	51.17	1.34	15.95	7.33
	11.25				3.11	69.33	76.67	49.83	0.92	10.9	7.00

T_2		211.25	20.67	70.00						1	
T_3	10.92	204.92	19.50	73.92	3.08	70.33	78.33	53.67	1.30	15.52	6.33
T_4	11.08	302.83	21.33	73.79	3.41	70.67	79.67	54.92	1.14	13.57	6.67
T_5	10.92	223.08	15.58	74.17	3.07	69.33	83.33	51.08	1.00	11.94	6.00
T_6	10.42	273.58	23.00	77.92	4.20	69.00	78.67	55.25	1.65	19.68	7.33
T_7	10.83	230.33	19.92	74.08	3.33	70.00	75.00	50.00	1.25	14.92	6.33
T_8	10.58	387.08	24.92	84.65	5.40	70.33	78.00	58.50	1.69	20.12	6.67
T_9	11.75	275.17	15.42	63.63	3.08	71.00	78.33	51.33	0.84	9.96	6.67

*T_1 – 100% FYM, T_2 - 100% Vermicompost, T_3 - 50% Vermicompost + 50% FYM, T_4- 75% Vermicompost + 25% FYM, T_5- 25% Neem Cake + 75% FYM, T_6- 50% FYM + 25% Neem Cake + 25% Wood Ash, T_7- 50% Neem Cake + 50% FYM, T_8- 50% Vermicompost + 50% Neem Cake and T_9- Control.

CONCLUSION

Based on results from linseed (*Linum usitatissimum* L.) experiments carried out over a year during the *rabi* season (December 2021–April 2022), it can be concluded that the usage of a combination of Vermicompost and neem cake greatly boosts linseed growth and production. Among the thereby combinations, however, T_8 (50 percent vermicompost + 50 percent neem cake) application resulted in maximum number of leaves (387.08 plant^{-1}), number of secondary branches (24.92 plant^{-1}), plant height (84.65cm), plant diameter (5.40 cm), number of capsules/plant (58.50 plant^{-1}), seed yield (1.69kg/plot) and seed yield q/ha (20.12q/ha).

PLATES

Taking observations at 30DAS, 60DAS and 90DAS respectively.

Harvesting

Threshing of Linseed

Sun-drying

Winnowing

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