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Effect of different soil amendments against wilt disease of linseed caused by *Fusarium oxysporum* f. sp. *lini*

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Abstract

The experiment was conducted during *rabi* 2018-19 and 2019-2020 in wire house of Department of Plant Pathology T.D.P.G. College, Jaunpur. The experiment which was conducted in 2018-19 and 2019-20, under pot culture method for PDC and yield contributing character were recorded. The six soil amendments with Neem cake, Mustard cake, Linseed cake, Sesamum cake, Castor cake and Vermi compost were applied. Among the six soil amendments Neem was found most effective soil amendment for controlling the wilt disease in linseed as well as most effective for the growth and yield character in linseed crop, the vermi compost was least effective soil amendment for controlling the wilt disease and showed 6.50 and 10.89 PDC respectively in the year of 2018-19 and 2019-20.

Keywords: Linseed, wilt, soil amendment, management

Introduction

Linseed, (*Linum usitatissimum* L.) is one of the oldest oilseed crop known as poor man's crop in India. It has got special importance amongst oilseed crop in *rabi* and has also been called as 'Alsi', also known with the local name as 'Tisi', 'Mosina' and 'Arise' in India. The oldest regions of linseed cultivation are reported to be in Asia and on the Mediterranean coast. Linseed is extensively grown in countries of the temperate zone as well as in those of the tropical zone. Linseed occupies a greater importance among oilseed owing to its various uses and special qualities. It is grown mainly for seed used for extracting oil in rainfed conditions. The oil content of the seed varies from 33-47%. Linseed oil is an excellent dyeing oil is used in manufacturing paints and varnishes, oilcloth, waterproof fabrics and linolenum and as edible oil in some areas. Linseed cake is very good manure and animal feed. Dual purpose linseed straw produces fibre of good quality. Linseed is also used in the manufacturing of the paper and plastics. Owing to development of improved linseed varieties and refinement of packages of practices for different situations of linseed cultivation, there has been a steady but slow increase in the yield of linseed over a long period. The national yield average for the quinquennium 1981-86 was 272 kg./ha., which increased to 293 kg./ha. by the next quinquennium of 1985-90. The present national average yield in year 2000 is 385 kg./ha. Rainfed linseed is grown in 0.82 mha. In 281 districts of which 0.80 mha. is under rainfed based on 1966-94 data in 16 states- Andhra Pradesh, Bihar, Jharkhand, Chattisgarh, Orissa, Madhya Pradesh, Maharashtra, Gujrat, Punjab, Hissar, Uttaranchal, Uttar Pradesh, Rajasthan, Karnataka, Tamil Nadu and West Bengal covering arid semi-arid and dry sub-humid regions. About 85% of the area (0.66 mha.) is grown in 42 districts. In India, linseed is grown on an area of 2,96,000 ha with ha production of 1,49,000 tonnes and productivity of 503Kg/ha. Whereas in Maharashtra it is grown on 27,000 ha, with production of 293 kg/ha. (DAC&FW, 2018) ^[1]. The production of linseed in Uttar Pradesh during 2017-18 was 602 kg./ha. (DAC&FW, 2018) ^[2] There are many fungal diseases which affect the production of linseed worldwide *viz.*, Fusarium wilt (*Fusarium oxysporum* f. p. *lini*), Rust (*Melampsora/ini*), Powdery mildew (*Oidium lini* Skorik), Alternaria blight (*Alternaria linicola*), Foot rot (*Rhizoctonia solani*, *Pythium* spp), Damping off of seedling (*Pythium* sp.) etc. The early work on flax wilt was started in the United States in 1889 by Luggar, a biologist in the Minnesota, Agricultural Experiment Station.

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Material and Methods

Soil will be collected and sterilized in autoclave, filled in earthen pots separately. Neem cake (2.77gm./kg soil), Mustard cake (2.53 gm./kg of soil), Linseed oil cake (2.28 gm./kg. soil), Sesamum cake (2.77gm./kg soil), Castor cake (2.77gm./kg soil), and Vermi compost (2.77gm./kg soil), will be mixed individually in the sterilized soil filled pots, two weeks prior to sowing. Soil will be inoculated with *Fusarium oxysporum* f.sp. *lini*. @ 10% will be released in the pots 15 DAS. Control pots were filled with soil without adding amendments. The seeds of susceptible linseed variety of Chambal will be sown in each pot (15 seed per pot) where finally 10 plants will be maintained. The experiments was conducted in CRD with three replication.

Observation to be recorded

1. Plant Disease Control

$$\text{Percent of disease control} = \frac{C - T}{C} \times 100$$

Where,

C = Percent disease incidence of controls pots

T = Percent disease incidence in treated pots

- b. Plant population
- c. Plant height
- d. Fresh and dry weight (g)
- e. Number and weight of capsule per plant
- f. Number and weight of seeds per plant
- g. Test weight
- h. Grain yield (q/h)

1. Plant Population

Plant Population is maintained of 10 plants in each of the pots, to evaluate the effect of soil amendments which of the amendments are useful for prevailing the disease.

2. Plant Height

Height of each of the ten plants are taken from each of the pots of different amendments. Plant height shows the amount of nutrition taken from the amendments as the linseed have most important for economic as well as biological yield prospective.

3. Fresh and Dry Weight

When the crop gets matures with full development of capsule and seed the crop is harvested and the weight of each bundle of pots with having specific code are to be taken for the weighing process weight of each bundle of specific pot are recorded in the chart, and after that each bundle are separately dehydrated in hot air oven for 10 minutes under 60⁰ C of temperature and weight are recorded in the chart. This is done to enumerate the weight difference between dry weight and fresh weight.

4. Number and weight of capsule per plant

1. **Number of Capsule:** The total number of capsule in treatment is calculated by counting the number of capsule in all the 10 plant maintained in the pot.
2. **Weight of Capsule:** The weight of capsule is taken of each treatment taken at the time of harvesting in order to check the effect of amendments.

5. Number and Weight of Seed Per Plant

The capsule are taken for extraction of seed from the capsule, firstly the number of of seed are recorded in each capsule then total number of seed in bundle recorded then after weight of seed from each plant from the bundle are recorded.

6. Test weight

Seed samples were taken from each pot. Healthy seeds are taken for measuring the weights of seeds were recorded in gram by using an electronic digital balance.

7. Grain yield

Yield are taken in gram are taken from each bundle of the pots of different soil ammendments.

Statistical analysis

The statistical analysis of field experiment was done by the method randomized block design (RBD) prescribed by Wilk (1955) [9]. The significance of treatment difference was tested by variance ratio test at 5 per cent level of probability.

Result and Discussion

The experiment which was conducted in 2018-19 and 2019-20, under pot culture method for PDC and yield contributing character are represented in (Table 1, 2 and 3) with histogram (Fig. 1 and 2) respectively. The result presented in year 2018-19, Table 1, reveled that the maximum PDC (10.66%) was recorded in Neem cake followed by Mustard cake (8.66%), Linseed cake (7.66%), Sesamum cake (7.50%), Castor cake (7.00%) which were statically at par with each others. The minimum PDC was recorded in Vermi compost (6.50%) in year 2018-19.

Similarly, result are showed in 2019-20, in Table 1, the maximum PDC% (20.00) was recorded in Neem cake followed by Mustard cake (16.66), Linseed Cake (13.33), Sesamum cake (7.50%), Castor cake (7.00%) respectively these were statically at par with each of them. The minimum PDC was recorded in Vermi compost (6.50%). Similar result have also been reported by Jeyarajan *et al.*, (1987) [3] and Singh (2021) [8]

The data of yield contributing character year of 2018-19, represented in Table 2, histogram Fig.1, are as follows, the plant population in pot and population in each treatment was kept uniform with 10 plant in each pot.

The effect of treatment on the height of plant the average maximum plant height was recorded in Neem Cake (53.33) followed by Mustard Cake (51.00), Linseed Cake (46.90%), Sesamum cake (46.50%) and the lowest (45.12) plant height was recorded in Vermi compost. The soil amendments with Linseed cake, Sesamum cake, Castor cake and Vermi compost were statically at par with each other.

The average fresh weight of plants in each treatment the average of maximum fresh weight was recorded maximum in Neem Cake (81.33), The next order of superiority Mustard Cake (76.00), Linseed Cake (71.33), Sesamum cake (71.20%), Castor cake (71.00%) and minimum (70.00) Vermi compost. These treatment were statically at par with each other.

From the same sample of fresh plant was taken to dry under hot air oven the average maximum dry weight was recorded in Neem Cake (49.66) The next order of superiority Mustard Cake, Linseed Cake (30.66), Sesamum cake (30.50%), Castor

cake (30.25%) and minimum (70.00) Vermi compost. These treatment were statically at par with each other.

The number of capsule in plant shows the productivity of crop, the average maximum number of capsule in one plant of each treatment was found maximum in Neem cake (10.66) the next effective amendment were Mustard Cake (8.66), Linseed Cake (7.66), Sesamum cake (7.50%), Castor cake (7.20%) and minimum (7.00) Vermi compost. These were statically at par with each other.

The capsule after counting taken for weight the average maximum weight was found in Neem Cake (0.53) the next effective amendment were Linseed Cake (0.41), Sesamum cake (0.40), Castor cake (0.38), Mustard Cake (0.37), and minimum (0.35) Vermi compost. These were statically at par with each other.

The average number of seed in one plant was found maximum in Neem Cake (81.33) the next effective amendment were Mustard Cake (71.33), Linseed Cake (63.66), Sesamum cake (63.50), Castor cake (63.00), and minimum (5.75) Vermi compost. These were statically at par with each other.

The average weight of seed in one plant was recorded maximum in Neem Cake (0.98) the next effective amendment were Mustard Cake (0.91), Linseed Cake (0.75), Sesamum cake (0.70), Castor cake (0.69), and minimum (0.68) Vermi compost. These were statically at par with each other.

The average test weight was found maximum in Neem Cake (6.76) the next effective amendment were Linseed Cake (5.96), Sesamum cake (5.85), Mustard Cake (5.83), Castor cake (5.50), and minimum (5.00) Vermi compost. These were statically at par with each other.

The average grain yield was found maximum in Neem Cake (9.83) the next effective amendment were Mustard Cake (9.13), Linseed Cake (7.56), Sesamum cake (7.30), Castor cake (7.25), and minimum (7.00) Vermi compost. These were statically at par with each other. Similar result have also been reported by Jeyarajan *et al.*, (1987) ^[3] and Singh (2021) ^[8]

The data of yield contributing character are presented in year of 2019-20 in Table.3 and Fig.2 are as follows, the plant population in pot and population in each treatment was kept uniform with 10 plant in each pot.

The effect of treatment on the height of plant the average maximum plant height was recorded in Neem Cake (61.66) the next effective amendment were Mustard Cake (63.00), Linseed Cake (62.33), Sesamum cake (62.00), Castor cake (61.94) and the lowest (60.00) plant height was recorded in Vermi compost. These were statically at par from each other.

The average fresh weight of plants in each treatment the average of maximum fresh weight was recorded maximum in Linseed Cake (73.00), the next effective amendment were Mustard Cake (72.66), Sesamum cake (72.60), Castor cake (72.50), Neem Cake (72.00) and minimum (71.60) Vermi compost. These were statically at par from each other.

From the same sample of fresh plant was taken to dry under hot air oven the average maximum dry weight was recorded in Neem Cake (50.66) the next effective amendment were Mustard Cake (40.00), Linseed Cake (33.00), Sesamum cake (32.58), Castor cake (32.42) and minimum (32.00) Vermi compost. These were statically at par from each other.

The number of capsule in plant shows the productivity of crop, the average maximum number of capsule in one plant of each treatment was found maximum in Linseed Cake (12.66), the next effective amendment were Sesamum cake (12.00), Castor cake (11.70), Neem cake (11.33), Vermi compost (11.20), and minimum Mustard Cake (10.66). These were statically at par from each other.

The capsule after counting taken for weight the average maximum weight was found in Neem Cake (1.00) the next effective amendment were Mustard Cake (0.75), Linseed Cake (0.72), Sesamum cake (0.71), Castor cake (0.70), and minimum (0.69) Vermi compost. These were statically at par from each other.

The average number of seed in one plant was found maximum in Neem Cake (81.33) the next effective amendment were Mustard Cake (71.33), Linseed Cake (63.66), Sesamum cake (63.50), Castor cake (63.00), and minimum (5.75) Vermi compost. These were statically at par from each other.

The average weight of seed in one plant was recorded maximum in Neem Cake (0.98) the next effective amendment were Mustard Cake (0.91), Linseed Cake (0.75), Sesamum cake (0.70), Castor cake (0.69), and minimum (0.68) Vermi compost. These were statically at par from each other.

The average test weight was found maximum in Neem Cake (6.76) the next effective amendment were Linseed Cake (5.96), Sesamum cake (5.85), Mustard Cake (5.83), Castor cake (5.50), and minimum (5.00) Vermi compost. These were statically at par from each other.

The average grain yield was found maximum in Neem Cake (9.83) the next effective amendment were Mustard Cake (9.13), Linseed Cake (7.56), Sesamum cake (7.30), Castor cake (7.25), and minimum (7.00) Vermi compost. These were statically at par from each other. Similar result have also been reported by Jeyarajan *et al.*, (1987) ^[3] and Singh (2021) ^[8]

Table 1: Percent Disease Control (2018-19 and 2019-20)

S. No.	Treatments	PDC (%)	
		2018-19	2019-20
1.	Neem cake	10.66	20.00
2.	Mustard Cake	8.66	16.66
3.	Linseed oil Cake	7.66	13.33
4.	Sesamum Cake	7.50	13.00
5.	Castor Cake	7.00	12.5
6.	Vermi Compost	6.50	10.89
7.	Control	5.33	6.66
	C.D	2.43	3.41

Table 2: Yield Contributing character in pot (2018-19)

S. No.	Treatments	Plant Population	Plant height (cm.)	Fresh and dry weight		Number and weight of capsule per plant		Number and weight of seeds per plant		Test weight (gm.)	Grain yield (gm./cm ²)
				Fresh weight (gm.)	Dry weight (gm.)	Number of capsule per plant	Weight of capsule per plant (gm.)	Number of seeds per plant	Weight of seeds per plant (gm.)		
T1	Neem cake	10	55.33	81.33	49.66	10.66	0.53	81.33	0.98	6.76	9.83
T2	Mustard Cake	10	51.00	76.00	30.66	8.66	0.37	71.33	0.91	5.83	9.13
T3	Linseed oil Cake	10	47.00	71.33	30.66	7.66	0.41	63.66	0.75	5.96	7.56
T4	Sesamum Cake	10	46.90	71.20	30.50	7.50	0.40	63.50	0.70	5.85	7.30
T5	Castor Cake	10	46.50	71.00	30.25	7.20	0.38	63.00	0.69	5.50	7.25
T6	Vermi Compost	10	45.12	70.00	30.00	7.00	0.35	58.75	0.68	5.00	7.00
T7	Control	10	35.35	51.33	21.66	5.33	0.20	31.66	0.65	4.43	6.56
	C.D.		2.10	4.10	3.16	1.71	0.11	3.68	0.23	0.52	2.39

Table 3: Yield contributing character in pot (2019-20)

S. No.	Treatments	Plant Population	Plant height (cm.)	Fresh and dry weight		Number and weight of capsule per plant		Number and weight of seeds per plant		Test weight (gm.)	Grain yield (gm./cm ²)
				Fresh weight (gm.)	Dry weight (gm.)	Number of capsule per plant	Weight of capsule per plant (gm.)	Number of seeds per plant	Weight of seeds per plant (gm.)		
T1	Neem cake	10	61.66	72.00	50.66	11.33	1.00	80.66	1.06	7.76	13.66
T2	Mustard Cake	10	63.00	72.66	40.00	10.66	0.75	83.00	0.97	7.30	10.66
T3	Linseed oil Cake	10	62.33	73.00	33.00	12.66	0.72	76.33	0.83	6.70	9.50
T4	Sesamum Cake	10	62.00	72.60	32.58	12.00	0.71	76.20	0.82	6.56	9.49
T5	Castor Cake	10	61.94	72.50	32.42	11.70	0.70	76.00	0.81	6.20	9.20
T6	Vermi Compost	10	60.00	72.00	32.00	11.20	0.69	75.30	0.80	6.00	9.00
T7	Control	10	54.33	63.00	20.00	9.33	0.62	51.00	0.60	5.06	7.66
	C.D.		4.51	4.03	3.80	2.17	0.19	2.60	0.11	0.41	1.88

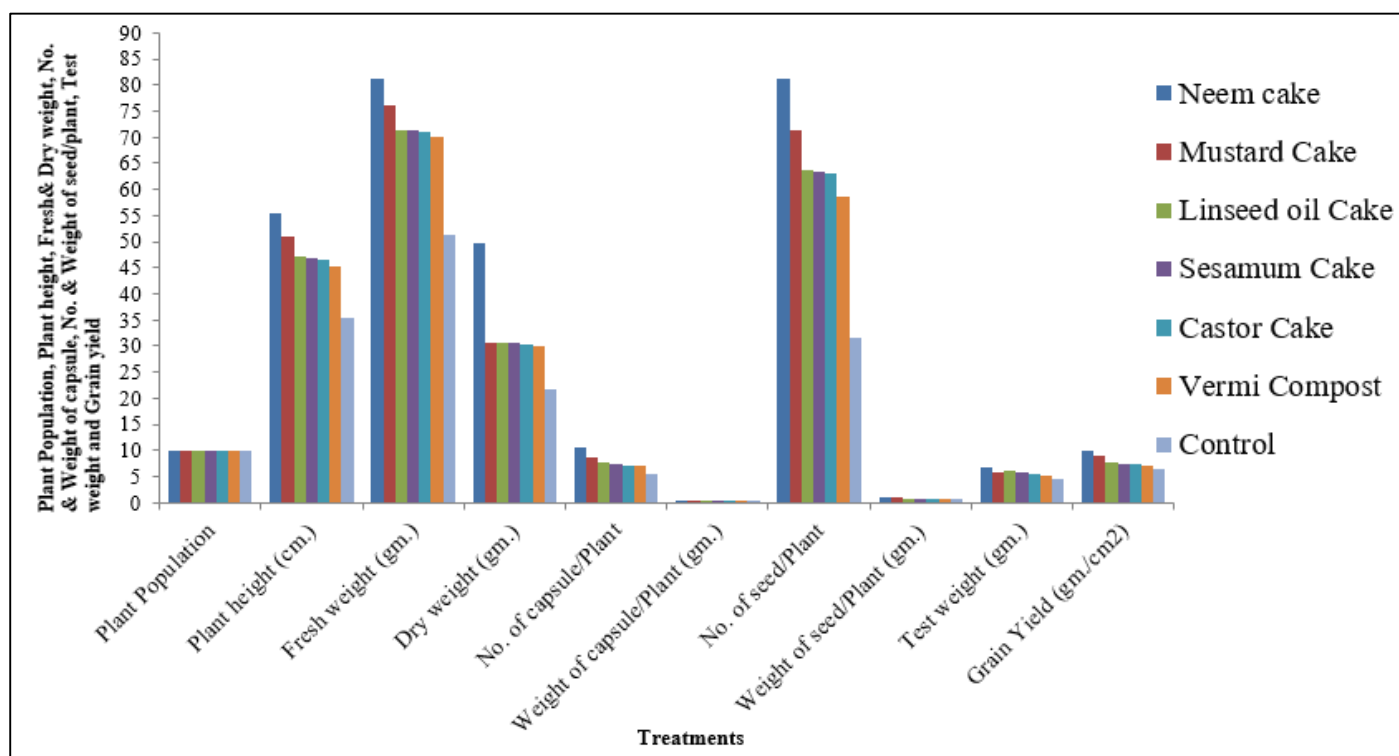


Fig 1: Yield Contributing Character in pot. (2018-19)

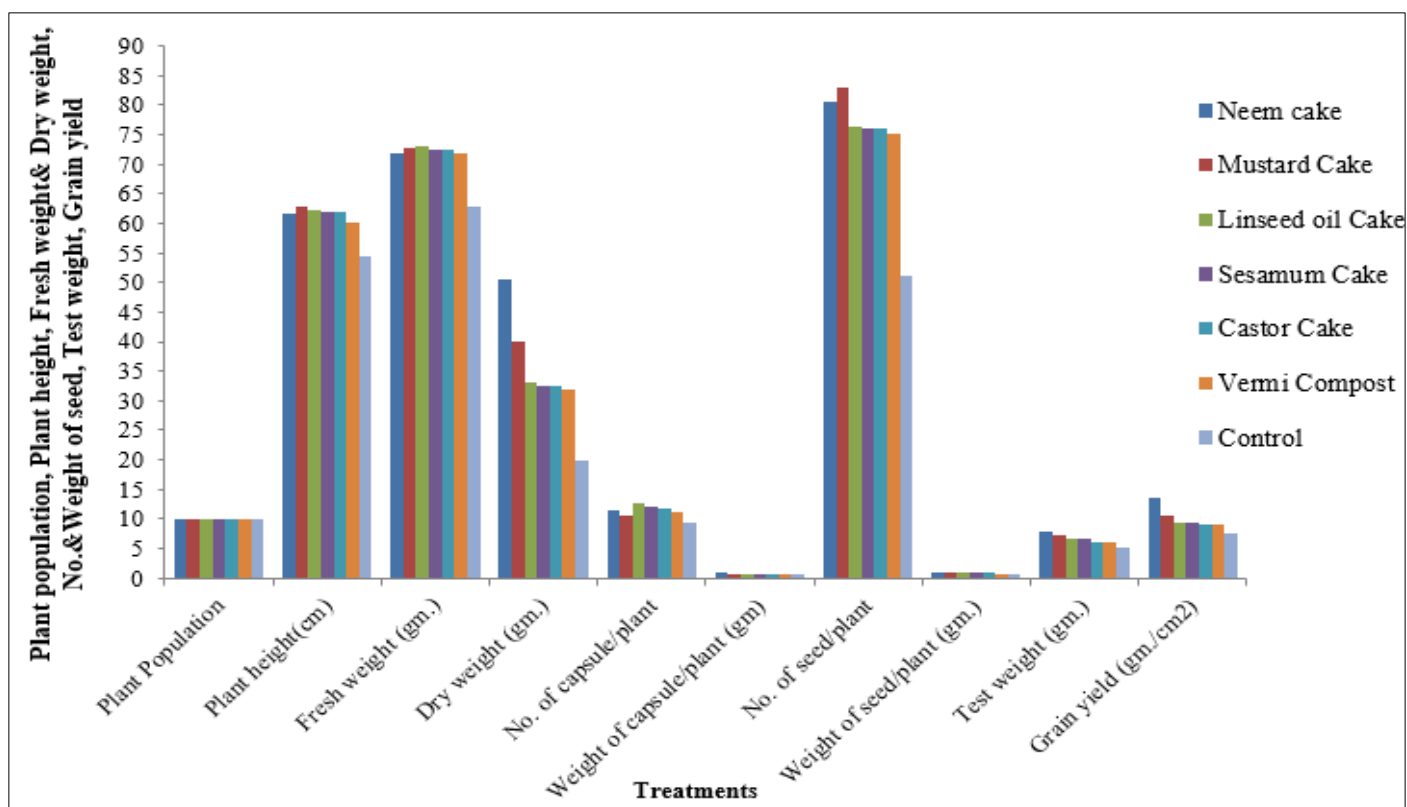


Fig 2: Yield Contributing Character in Pot Culture. (2019-20)



Fig 1: Management under pot culture method (2018-19)



Fig 2: Management under pot culture method (2019-20)

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