Effect of Inorganic Fertilizer and Organic foliar Spray on Growth, Yield attributes and Yield of Linseed

ABSTRACT

Aims: To evaluate the effect of fertilizer and organic foliar spray on growth, yield attributes and yield of linseed.
Study design: The experiment was laid out in randomized block design with four replications.
Place and Duration of Study: A field experiment was carried out at College Farm, N. M. College of Agriculture, Navsari during *rabi* season of 2019-20.
Methodology: The study comprised of nine different treatments *viz.,* T_1(50% RDF),T_2 (50% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS), T_3 (50% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS), T_4(75% RDF), T_5 (75% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS), T_6 (75% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS), T_7(100% RDF),T_8 (100% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS) and T_9(100% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS).
Results: From the results, it was observed that an application of 100% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS (T_9) was resulted in significantly higher values of plant height (63.37 cm at 90 DAS), number of branches plant^{-1} (6.94 at 90 DAS), number of capsules plant^{-1} (51.85), number of seeds capsules^{-1} (8.95) and seed weight plant^{-1} (1.89). Significantly higher seed yield (1157 kg ha^{-1}) and stover yield (2051 kg ha^{-1}) of linseed were observed with the application of 100% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS (T_9).
Conclusion: It can be concluded that, application of 100% RDF (60-30-00 N- P_2O_5-K_2O kg ha^{-1}) + Foliar spray of 1% banana pseudostem sap or vermiwash at 30 and 60 DAS was found to be the most viable option for getting higher growth and yield in linseed.

Keywords: *Linseed, growth, yield, vermiwash and banana pseudostem sap*

1. INTRODUCTION

Linseed (*Linum usitatissimum* L.) is also known as flax, commonly named as Alashi or Alsi. It is a member of genus *Linum* in the family *Linaceae*. Linseed or flax is one of most important *rabi* oilseed crop. Linseed plant has different utilities. It is grown either for the oil extraction from the seed or for fiber directly or after processing. It contains 33 to 45 % oil [1]. The linseed oil is an important ingredient in the manufacture of paint varnish, resins or solvents as an impregnator, as a plasticizer, printing ink linoleum. Linseed is one of the most important crop of the world cultivated over an area of 22.70 lakh ha with a production of 22.39 lakh tonnes and productivity is 986 kg ha^{-1}. Australia and Canada have the highest productivity of about 0.7 t ha^{-1}. India rank fifth in area with 320 thousand hectares with annual production of 174 thousand tonnes and productivity of 543.80 kg ha^{-1} [2].
Adequate nutrient supply is a key input to increase the productivity of any crop. Fertilizer application is an important option to supply plant nutrients and improve crop yield. It is well known that banana is the heavy nutrient feeder crop. After harvest of banana, remaining plant parts (pseudostem-overlapping leaf sheaths of trunk) are treated as waste [3]. While separating fibers from the banana pseudostem, the liquid available is known as sap which contains essential macro and micronutrients, growth promoting substances like cytokinin and GA3 (Gibberelic Acid) and this mixture is inoculated with different microbes like *Rhizobium, Azatobacter*, *etc*. which play an important role in enhancing yield. Vermiwash can also serve as a valuable foliar spray because it is composed of excretory products and mucus secretion from earthworms and micronutrients from the organic molecules in the

soil [4]. In view of above and that very little information is available on these aspects the present investigation is carried out.

2. METHODOLOGY

2.1 Experimental Site and Climatic condition

The field experiment was conducted at College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari during *rabi* season of 2019-20. The experimental field was fairly levelled and uniform. According to agro-climatic condition, Navsari falls under Agro-ecological situation-III of south Gujarat Heavy Rainfall Zone. The climate of this region is typically tropical monsoon type characterized by three well defined seasons *viz.,* warm and humid monsoon with heavy rainfall, moderately cold winter and fairly hot and humid summer. The week-wise meteorological data pertaining to the maximum and the minimum temperatures (ºC), the maximum and the minimum relative humidity (%) and evaporation during the period of experimentation (November-2019 to March-2020) recorded at the meteorological observatory of college farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari are graphically depicted in Fig. 1. The soil of experimental plot was clayey (65.70 %) in texture, low in available nitrogen (180.24 kg ha^{-1}), medium in available phosphorus (35.30 kg ha^{-1}) and high in available potassium (281.50 kg ha^{-1}).

2.2 Experimental Details

The experiment was laid out in Randomized Block Design with four replications comprising of nine treatments. The details of treatments mentioned in Table 1. The soil reaction was slightly alkaline (7.65 pH). The local variety of linseed available at Navsari Agricultural University was used for the experimentation. The RDF *i.e* nitrogen (60 kg ha^{-1}) was applied as Urea, while phosphorous (30 kg ha^{-1}) was applied as SSP.

2.3 Statistical Analysis

The statistical analysis of data recorded for different characters during the course of investigation was carried out through the procedure appropriate to the randomized block design of the experiment as described by [5]. The significance of difference was tested by 'F' test. Five per cent level of significance was used to test the significance of result. The critical differences were calculated when the differences among treatment means were found significant in 'F' test. In the remaining cases, only standard error of means was worked out. The co-efficient of variation (CV %) was also worked out.

Comment [P1]: What is the data recorded, and methods of measurement.

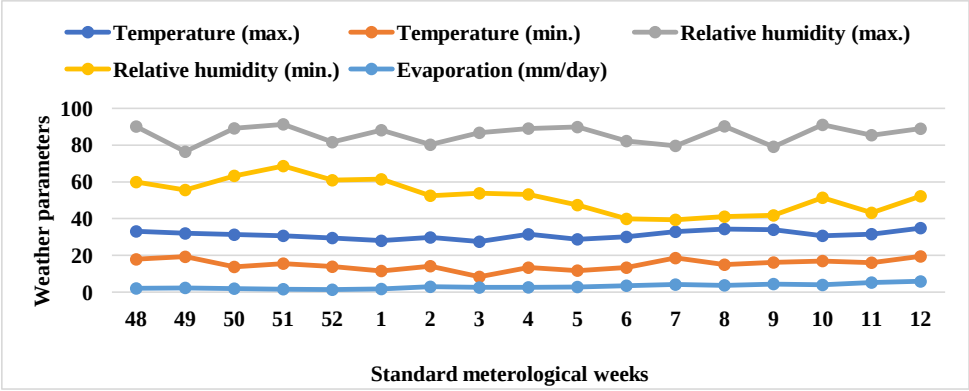

Fig. 1. Mean weekly weather parameters recorded during the crop season (Nov. 2019-March 2020)

Table 1. Treatment details of experiment

Treatment	Details
T_1	50% RDF
T_2	50% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS
T_3	50% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS
T_4	75% RDF
T_5	75% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS
T_6	75% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS
T_7	100% RDF (60-30-00 kg NPK/ha)
T_8	100% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS
T_9	100% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS

3. RESULTS AND DISCUSSION

3.1 Growth Parameters

The data presented in Table 2 revealed significant variation among the treatment on growth parameters. Plant height at 30 DAS was not significantly influenced by different treatments, while significantly higher plant height at 60 DAS and 90 DAS were found under the treatment T_9 (100% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS) but it remained statistically at par with the treatments T_8 and T_7. Increasing the level of fertilizer from 50% RDF to 100% RDF with and without organic liquid spray significantly increased plant height of linseed at 60 and 90 DAS as compared to respective lower levels of fertilizer. Application of 100% RDF without organic liquid spray recorded 25.38 and 13.08 % higher plant height as compared 50% RDF and 75% RDF, respectively at 60 DAS, While In case of plant height at 90 DAS it was 22.54 and 10.39 % higher plant height as compared 50% RDF and 75% RDF, respectively. Similar trend was observed in case of fertilizer levels with foliar spray of 1% vermiwash or foliar spray of 1% banana pseudostem sap at 30 and 60 DAS. Number of branches at 45 DAS was not significantly influenced by different treatments, while significantly maximum number of branches plant^{-1} at 90 DAS observed under treatment T_9 (100% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS) which was statistically at par with treatment T_8, T_7 and T_6.Various nutrient management treatments did not manifest their significant effect on days to 50 % flowering.

Significant increase in plant height and number of branches plant^{-1} with increasing level of fertilizer might be due to direct application of nitrogen and phosphorous through chemical fertilizers which enhanced their availability, increased photosynthetic activity and translocation of the photosynthates from sources to sink and resulted in higher plant height and a greater number of branches per plant. At the same time, organic liquids included in the treatments, namely, vermiwash and banana pseudostem sap contains beneficial microorganisms and plant growth promoting substances in addition to macro and micronutrients which also further improved plant height and number of branches per plant of linseed. These results are in conformity with the finding of Meena et al. [6] in linseed, George et al. [7] in chilli and Bokare [8] in onion.

3.2 Yield attributes and Yield

The data presented in Table 3 revealed significant variation among the treatment on yield attributes and yield. Application of 100% RDF + foliar spray of 1% banana pseudostem sap at 30 and 60 DAS (T_9) recorded significantly higher number of capsules plant^{-1}, but it remained statistically at par with the treatments T_8, T_7, T_6 and T_5. Application of 100% RDF + foliar spray of 1% banana pseudostem sap at 30 and 60 DAS (T_9) recorded significantly higher number of seeds capsules^{-1}, however it

remained statistically at par with the treatments T_8, T_7 and T_5. An examination of data reveals that treatment T_9 recorded the maximum seed weight plant^{-1} which was statistically at par with treatment T_8, T_7 and T_6. Different nutrient management treatments did not exert their significant effect on test weight of linseed. Significantly higher seed yield was found under the treatment T_9 (100% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS). However, it remained statistically at par with treatments T_8, T_7, T_6 and T_5. Significantly higher stover yield was observed under the treatment T_9 (100% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS). It was statistically at par with the treatments T_8, T_7, T_6 and T_5. Various nutrient management treatments did not exhibit their significant variation on harvest index.

Significantly higher seed yield was recorded with the application of organic spray over other treatments may be due to higher seed yield is attributed to the higher number of capsule plant^{-1} and higher number of seeds capsule^{-1} etc. and also due to adequate supply of nutrient element at the right time from organic spray and inorganic fertilizers which helped in optimum dry matter partitioning from the source to sink during reproductive stage of plant that maximize accumulation of photosynthates to capsule consequently increase the seed yield of linseed and another probable reason for enhance the seed yield may be due to cumulative effects of nutrient (macro and micro) on vegetative growth which ultimately lead to more photosynthetic activities. Moreover, application of banana pseudo stem sap or vermiwash and inorganic fertilizers may enhance carbohydrate and nitrogen metabolism of pectin substances in the plants. Similar results were also reported by Meena et al. [6], Khajani et al. [9] and Nitin Sood et al. [10] in linseed crop, Shiv Kumar et al. [11] in groundnut and Salunkhe et al. [12] in onion.

Table 2. Effect of nutrient management practices on plant height, number of branches per plant and days to 50 per cent flowering of linseed

	Treatments	Plant height (cm)			Number of branches per plant		Days to 50 per cent flowering
		30 DAS	60 DAS	90 DAS	45 DAS	90 DAS	
T_1	50% RDF	17.30	31.13	46.72	2.66	4.40	62.75
T_2	50% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS	17.83	33.61	49.43	2.71	5.28	61.75
T_3	50% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS	18.15	33.68	50.16	2.74	5.17	62.00
T_4	75% RDF	18.60	36.26	54.05	2.94	5.53	63.75
T_5	75% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS	19.26	38.34	57.40	3.18	5.92	63.25
T_6	75% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS	19.37	38.99	58.27	3.17	6.37	62.75
T_7	100% RDF	20.06	41.72	60.32	3.20	6.60	63.80
T_8	100% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS	20.43	43.76	61.49	3.22	6.90	64.75
T_9	100% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS	20.59	43.81	63.37	3.35	6.94	64.25
	SEm±	0.81	1.41	2.08	0.17	0.34	2.30
	CD at 5%	NS	4.15	6.08	NS	1.01	NS
	CV%	8.60	7.50	7.48	11.28	11.74	7.31

NS- Non Significant

Table 3. Effect of nutrient management practices on number of capsules per plant, number of seed per capsule, test weight, yield, stover yield and harvest index of linseed

Treatment		Yield attributing characters				Seed yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Harvest index (%)
		No. of capsules plant^{-1}	No. of seed Capsule^{-1}	Seed weight plant^{-1} (g)	Test Weight (g)			
T_1	50% RDF	31.45	6.02	1.17	6.34	690	1305	34.55
T_2	50% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS	35.53	6.73	1.38	6.45	819	1491	35.51
T_3	50% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS	37.05	6.81	1.36	6.53	806	1513	34.68
T_4	75% RDF	41.15	7.35	1.46	6.63	891	1679	34.66
T_5	75% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS	45.88	7.99	1.64	6.76	1006	1819	35.42
T_6	75% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS	47.30	8.26	1.66	6.87	1012	1872	35.14
T_7	100% RDF	49.93	8.63	1.73	6.99	1060	1944	35.35
T_8	100% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS	50.75	8.91	1.85	7.02	1156	2031	36.37
T_9	100% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS	51.85	8.95	1.89	7.18	1157	2051	36.01
SEm±		2.08	0.42	0.08	0.20	55.32	85.67	1.55
CD at 5%		6.09	1.24	0.23	NS	162	250	NS
CV%		9.61	10.99	10.34	6.05	11.58	9.81	8.80

**NS- Non Significant*

4. CONCLUSION

On the basis of experimental results, it can be concluded that application of 100% RDF (60-30-00 N-P_2O_5-K_2O kg ha^{-1}) gave significantly higher yield of linseed. In addition to fertilizer application, foliar spray of 1% vermiwash or 1% banana pseudostem sap at 30 and 60 DAS improve yield of linseed.

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