Cumulative Effect of Fertilizer and Organic Spray (Banana Pseudostem Sap or Vermiwash) on Yield, Quality, Uptake and Economics of Linseed (Linum usitatissimum L.)

ABSTRACT

In the current study was oriented to examine the yield, quality, uptake and economics of linseed were evaluated with different nutrient management practices during rabi season of 2019-20. The experiment was laid out in Randomized Block Design with four replication conducted at College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari. The experimental field was fairly levelled and uniform. The treatments comprising of T1(50% RDF),T2 (50% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS), T3 (50% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS), T4(75% RDF), T5 (75% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS), T6 (75% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS), T7(100% RDF),T8 (100% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS) and T9(100% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS). The result indicated that significantly higher seed yield, oil yield and nutrient uptake by seed and stover found with treatment T9. Whereas economics of the experiment show that the maximum gross return (₹94611 ha-1), net return (₹63679 ha-1) and benefit cost ratio (BCR) (3.06) were obtained under the treatment T9. On the basis of experimental results, it can be concluded that to obtain better yield, quality, uptake and economics of rabi linseed crop, the crop should be fertilized with 100% RDF (60-30-00 N-P2O5-K2O kg ha-1) and carry out foliar spray of 1% vermiwash or 1% banana pseudostem sap at 30 and 60 DAS.

Keywords: Linseed; yield; quality; economics; vermiwash; banana pseudostem sap.

1. INTRODUCTION

India is one of the leading oilseeds growing country in the World and fourth largest vegetable oil economy next to USA, China, and Brazil. The diverse agro-ecological conditions in the country are favorable for growing nine annual oilseed crops, which include groundnut, rapeseed, mustard, soybean, sunflower, sesame, safflower, niger, castor and linseed. Linseed is one of the oldest oilseed crops grown in almost all the countries of the world. Linseed (Linum usitatissimum L.), one of the oldest oilseed crop cultivated either as oilseed crop or fibre crop, is perhaps one of the most antique plant. Flax is self-pollinated crop which is widely adapted to temperate climate of the world. Linseed is an annual herbaceous plant and grows to a height of 30 to 120 cm. Fiber types are tall growing and less branched than the seed types. The stem is glabrous greyish green with leaves narrow and alternate. Fruit is a capsule, globular in shape mostly indehiscent. Seeds are compressed shinning yellow or light brown. Linseed or flax is one of most important rabi oilseed crop. It contains 35 to 45 % oil.

Fertilizer application is an important option to supply plant nutrients and improve crop yield. Nitrogen is a structural component of chlorophyll and protein therefore, adequate supply of nitrogen is beneficial for both carbohydrate and protein metabolism as it promotes cell division and cell enlargement, resulting in more leaf area and thus ensuring better growth and development of plant and improve yield. Phosphorus is an important plant nutrient which helps in root development and requires for grain formation to maturity of grain and ultimately improve crop yield of linseed (Parmar et al.) [1].

It is well known that banana is the heavy nutrient feeder crop. Banana pseudostem sap (BPS) has been extracted from the outer sheath of pseudostem of banana. It looks like colorless clean water immediately after extraction. These are vital for plant growth and development (Islam et al.) [2]. 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 is a liquid extract produced from vermicompost in a medium where earthworms are richly populated. Vermiwash having micronutrients, beneficial soil microbes and also contain 'plant growth hormones & enzymes'. In view of above and that very little information is available on these aspects; the present investigation was carried out.

2. MATERIALS AND METHODS

Navsari Agricultural University campus is geographically located at 20o57' N latitude and 72o 54' E longitude with an altitude of 10 m above the mean sea level. According to agro climatic condition, Navsari falls under Agro-ecological Situation-III of South Gujarat Heavy Rainfall Zone which is characterized by fairly warm summer, mild winter and warm humid monsoon with heavy rainfall. 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. The soil of the experimental site was characterised by dark greyish brown type having medium to poor drainage with flat topography and good water holding capacity. 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).

The experiment was laid out in Randomized Block Design having nine treatments comprising of T1(50% RDF),T2 (50% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS), T3 (50% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS), T4(75% RDF), T5 (75% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS), T6 (75% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS), T7(100% RDF),T8 (100% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS) and T9(100% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS)with four replications. The present experiment was carried out with local variety of linseed. The spacing was kept between row 30 cm and between plant 10 cm. Oil content of seed was determined by Soxhlet apparatus as per the method suggested by Tiwari et al.[3].

Statistical procedures appropriate to the randomized block design as described by Panse and Sukhatme [4] and the differences were tested by F- test. Summary table for treatment mean has been prepared and furnished with standard error of mean (S.Em.) and co-efficient of variation (%). Critical Difference (C.D.) at 5 % level of probability has also been calculated where the treatment effects were found significant.

3. RESULTS AND DISCUSSION

3.1 Effect on yield

Data presented in Table 1 revealed that significantly higher seed yield and stover yield was found under the treatment T9(100% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS). However, it remained statistically at par with treatments T8, T7, T6 and T5. Significantly higher seed yield was recorded with the application of organic spray over other treatments. It might 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 ultimately helps to improve seed yield as well as stover yield of linseed crop. Similar results were also reported by Meena et al. [5], Khajani et al. [6] and Tanvi patle et al. [7] in linseed crop.

3.2 Effect on quality

The quality of produce as affected by different treatments was judged by oil content and oil yield in seed. Data of these estimates obtained and presented in Table 1 Different nutrient management practices failed to exert its significant influence on oil content. While T9 (100% RDF + foliar spray of 1%banana pseudostem sap at 30 and 60DAS) recorded the maximum oil yield (449 kg ha-1). It was remained statistically at par with treatment T8 (100% RDF + foliar spray of 1%vermiwashat 30 and 60DAS) (440 kg ha-1), T7 (100% RDF) (402 kg ha-1) and T6 (75% RDF + foliar spray of 1% banana pseudostem sap at 30 and 60 DAS) (380 kg ha-1). The oil yield is correlated with seed yield and oil content in seed. So, this was due to higher seed yield under corresponding treatment. These results are in accordance with the findings of Esmail et al. [8] and Nitin Sood et al. [9] in linseed.

3.3 Effect on NPK content and uptake by crop

The results pertaining to nitrogen, phosphorus and potassium content in seed and stover of linseed as affected by various treatments are furnished in Table 2 and 3. The result revealed that nitrogen, phosphorus and potassium content in seed and stover of linseed were not influenced significantly by various treatments. The treatment T9(100% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS) recorded significantly higher nitrogen, phosphorus and potassium uptake by the seed of linseed, but it was found statistically at par with (T8) and (T7). Application of 100% RDF without organic liquid spray recorded 44%, 39.78% and 42.91% higher nitrogen, phosphorus and potassium uptake by seed as compared 50% RDF and 19.45%, 19.66% and 21.64% higher nitrogen, phosphorus and potassium uptake by seed as compared 75% RDF. 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. The results of data presented in Table 3 show that different treatments significantly affected nitrogen,

phosphorus and potassium uptake by linseed stover. The treatments showed that application of 100% RDF + foliar spray of 1%banana pseudostem sap at 30 and 60DAS (T9) recorded the maximum uptake of nitrogen (15.93 kg ha-1), phosphorus (9.38 kg ha-1) and potassium (17.15 kg ha-1) by stover of linseed, but it was found statistically at par with (T8) and (T7). It might be due to the reason that uptake is product of nutrient content and seed or stover yield, so in accordance with this fact having higher nitrogen, phosphorous, potassium content and seed yield contribute to higher uptake of nitrogen, phosphorous and potassium and also due to application of inorganic fertilizer with organic liquid spray (banana pseudostem sap or vermiwash) increase the availability of nitrogen, phosphorous and potassium to plant which directly affected nutrient uptake by plant. Similar results were also obtained by Zafar et al. [10] and Nitin Sood et al. [9] in linseed.

3.4 Effect on economics

The regional adaptability of any agronomic practices in any crop is completely based on the highest economic return of a treatment. Therefore, it is necessary to work out economics of different treatments for valid comparison of agronomic practices and sound recommendation. The data presented in Table 4 in respect to cost of cultivation, gross return, net return and benefit cost ratio was not statistically analysed. The results are drawn based on average values. The maximum net return (₹63679 ha-1) was recorded under the treatment T9 (100% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS) followed by the treatment T8 (100% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS) (₹63579 ha-1) and T7 (100% RDF) (₹57304 ha-1). While in case of BCR, maximum BCR of 3.06 was found under the treatment T9 (100% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS) and T8 (100% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS), it might be due to higher seed and stover yield and comparatively lower cost of cultivation.

4. CONCLUSION

On the basis of experimental results, it can be concluded that to obtain higher and profitable yield as well as better quality, uptake of nutrient and economics of rabi linseed, the crop should be fertilized with 100% RDF (60-30-00 N-P2O5-K2O kg ha-1) and carry out foliar spray of 1% vermiwash or 1% banana pseudostem sap at 30 and 60 DAS.

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Table 1. Impact of nutrient management practices on yield and quality of linseed

Treatment		Yield		Quality	
		Seed yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Oil Content (%)	Oil Yield (kg ha^{-1})
T_1	50% RDF	690	1305	35.54	247
T_2	50% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS	819	1491	36.12	297
T_3	50% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS	806	1513	36.63	296
T_4	75% RDF	891	1679	36.81	328
T_5	75% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS	1006	1819	37.73	379
T_6	75% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS	1012	1872	37.57	380
T_7	100% RDF	1060	1944	37.93	402
T_8	100% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS	1156	2031	38.07	440
T_9	100% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS	1157	2051	38.85	449
	SEm±	55.32	85.67	1.15	23.80
	CD at 5%	162	250	NS	69
	CV%	11.58	9.81	6.20	13.31

Table 2. Impact of nutrient management practices on content and uptake of nutrient by seed of linseed

Treatment		Nutrient content (%)			Nutrient uptake (kg ha^{-1})		
		N	P	K	N	P	K
T_1	- 50% RDF	2.08	0.58	1.37	14.42	3.98	9.39
T_2	- 50% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS	2.21	0.60	1.38	18.01	4.96	11.16
T_3	- 50% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS	2.28	0.63	1.43	18.39	4.70	11.33
T_4	- 75% RDF	2.34	0.60	1.46	20.95	5.31	12.89
T_5	- 75% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS	2.36	0.63	1.58	23.82	6.36	15.87
T_6	- 75% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS	2.33	0.65	1.57	23.95	6.60	15.92
T_7	- 100% RDF	2.45	0.62	1.55	26.01	6.61	16.45
T_8	- 100% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS	2.47	0.65	1.62	28.60	7.49	18.73
T_9	- 100% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS	2.49	0.66	1.65	28.67	7.64	19.04
	SEm±	0.10	0.02	0.06	1.49	0.42	0.83
	CD at 5%	NS	NS	NS	4.36	1.24	2.44
	CV%	9.10	9.02	9.11	13.30	14.25	11.54

Table 3. Impact of nutrient management practices on content and uptake of nutrient by stover of linseed

Treatment		Nutrient content (%)			Nutrient uptake (kg ha^{-1})		
		N	P	K	N	P	K
T_1	- 50% RDF	0.71	0.39	0.76	9.17	5.10	9.97
T_2	- 50% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS	0.73	0.43	0.78	10.82	6.44	11.64

T_3	- 50% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS	0.73	0.42	0.77	11.02	6.35	11.66
T_4	- 75% RDF	0.72	0.45	0.78	12.10	7.49	13.11
T_5	- 75% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS	0.74	0.42	0.79	13.44	7.60	14.31
T_6	- 75% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS	0.73	0.44	0.82	13.61	8.56	15.27
T_7	- 100% RDF	0.74	0.45	0.80	14.48	8.99	11.49
T_8	- 100% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS	0.75	0.44	0.81	14.95	8.85	16.25
T_9	- 100% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS	0.77	0.46	0.83	15.93	9.38	17.15
	SEm±	0.02	0.01	0.03	0.73	0.51	0.92
	CD at 5%	NS	NS	NS	2.13	1.50	2.68
	CV%	6.39	9.21	10.03	11.41	13.50	13.27

Table 4. Impact of different treatments on economics of linseed

	Treatment	Gross return (₹ ha^{-1})	Cost of cultivation (₹ ha^{-1})	Net return (₹ ha^{-1})	B:C ratio
T_1	- 50% RDF	56505	28363	28142	1.99
T_2	- 50% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS	67011	29855	37156	2.24
T_3	- 50% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS	65993	29855	36138	2.21
T_4	- 75% RDF	72959	28904	44055	2.52
T_5	- 75% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS	82299	30396	51903	2.71
T_6	- 75% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS	82832	30396	52436	2.73
T_7	- 100% RDF	86744	29440	57304	2.95
T_8	- 100% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS	94511	30932	63579	3.06
T_9	- 100% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS	94611	30932	63679	3.06

**Selling price: Linseed seed – 80 ₹ kg^{-1}*

**Cost of Input: Linseed 120 ₹ kg^{-1}, Urea-5.93 ₹ $kg^{-1}$and SSP-7.44 ₹ kg^{-1}*