Indian Journal of Agronomy **48** (3) : 220–223 (September 2003)

Effect of organic and inorganic fertilizers on growth and yield of linseed (*Linum usitatissimum*) under mid-hill conditions of Himachal Pradesh

D. BADIYALA AND S. KUMAR

Department of Agronomy, Choudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur 176 062

Received: December 2002

ABSTRACT

The effect of farmyard manure (FYM) and chemical fertilizers on growth and yield of linseed (*Linum usitatissimum* L.) under mid-hill conditions of Himachal Pradesh was studied during the winter (*rabi*) seasons of 1995–96, 1996–97 and 1997–98. Better growth, yield attributes as well as yield were recorded with application of FYM @ 5 tonnes/ha over no FYM. Recommended doses of chemical fertilizers ($N_{50}P_{40}K_{20}$) produced taller plants with more number of primary branches, capsules/plant, seeds/capsule and 1,000-seed weight compared to 50% and 75% of the recommended dose of NPK. Highest gross and net returns (Rs/ha) were also obtained with application of the recommended dose of fertilizer, $N_{50}P_{40}K_{20}$.

Key words : Linseed, Seed yield, Net returns, FYM, Nutrients levels

Linseed is an important oilseed crop cultivated both for seed and fibre. In Himachal Pradesh, productivity of linseed is very low (350 kg/ha) due to its nutrient inputs use in a limited quantity because of higher fertilizers costs. There is an ample scope for increasing its production in the state, in general and in Kangra district, in particular by applying optimum levels of farmyard manure along with chemical fertilizers. Hence the present study was undertaken to find out the nutrient input levels for the optimum production of linseed.

MATERIALS AND METHODS

A field experiment was conducted during the winter (*rabi*) seasons of 1995–96, 1996–97 and 1997–98 at Experimental Farm of CSK HPKV, Palampur. The soil was silty clay loam of acidic reaction (pH 5.7) and contained 326, 13, 235 kg/ha of available nitrogen, phosphorus and potassium respectively. Six treatments consisting of 2 FYM levels (FYM @ 5 tonnes/ha and no FYM) and 3 levels of chemical fertilizers, viz. 50 % of the recommended dose of N, P_2O_5, K_2O ($N_{25}P_{20}K_{10}$), 75% of the recommended dose of N, P_2O_5, K_2O ($N_{37.5}P_{30}K_{15}$) and recommended dose of N, P_2O_5, K_2O ($N_{50}P_{40}K_{20}$). The experiment was laid in randomized block design with 4 replications. The linseed variety 'Janaki' was sown on 14 October 1995, 18 October 1996 and 9 October 1997. Well decomposed FYM @ 5 tonnes/ha as per treatment was applied 1 week before the sowing of crop, whereas one-half dose of N along with full dose of P and K were applied as basal dose. The remaining N was top-dressed in 2 equal splits, i.e. with first and second irrigation given at 30 and 60 days after sowing.

RESULTS AND DISCUSSION

Growth and yield attributes

Application of FYM @ 5 tonnes/ha produced taller plants and more number of primary branches than no farmyard manure plots.

Recommended doses of N, P_2O_5, K_2O ($N_{50}P_{40}K_{20}$) also proved significantly superior in terms of plant height and number of primary branches (Table 1) to other 2 lower fertility levels. Badiyala *et al.* (1998) also reported similar findings.

Application of FYM @ 5 tonnes/ha resulted in significantly more capsules/plant, seeds/capsule and 1,000-seed weight over no application of FYM during all the years except during 1996–97 when seeds/capsule were not influenced significantly by application of farmyard manure.

Increasing levels of chemical fertilizers, i.e. from 50% of the recommended levels to the full recommended level of N P_2 O_5 K_2O progressively increased the capsules/plant, seeds/capsule and 1,000-seed weight. However, during 1996–97, the differences in seeds/capsule were not significant with $N_{37.5}$ $P_{20}K_{15}$ and $N_{50}P_{40}K_{20}$. The 1,000-seed weight also showed non-significant differences among all the fertility levels.

Yield

Owing to better nutrient availability in FYM-applied plots the growth and yield attributes showed better perfor-

mance and thereby the seed yield of linseed was also significantly more than in the no-FYM plots during all the 3 years. Mean of the 3 years data also showed the similar trend.

Among the chemical fertilizer levels, the full recommended dose of N, P_2O_5, K_2O ($N_{50}P_{40}K_{20}$) was superior to both the 50% and 75% of recommended level. Linear increase in seed yield with increase in N levels from 0 to 90 kg N/ha was also reported by Singh and Verma (1999) owing to significantly better growth and yield attributes during the experimentation. Similarly, Pandy and Chatterjee (1995), Sharma and Hungsingi (1996 a, b), Sarode *et al.* (1997) and Dubey (2001) also reported the positive effect of fertilizers on grain yield of linseed.

Interaction effect between FYM and chemical fertilizers for seed yield was also found significant on pooled analysis basis. Significantly higher seed yield of linseed was recorded when full recommended levels of N, P_2O_5, K_2O was applied along with 5 tonnes/ha of FYM, while significantly lowest yield was recorded with 50% of recommended dose of N, P_2O_5, K_2O given without any FYM (i.e. in FYM plots). Thus addition of FYM which improved the micro- and macro-nutrient balance and soil rhizosphere environment resulted in improving the yield

Table 3. Interaction between FYM and chemical fertilizer on seed yield of linseed (pooled).

FYM	Recommended dose of fertilier (%N, P_2O_5, K_2O)		
	50%	75%	100%
No FYM	659	920	1117
FYM 5 tonnes/ha	1,029	1,382	1,509
CD(P=0.05)			
FYM	74		
Fertilizer	90		
FYM × fertilizer	131.2		

Table 1. Effect of FYM fertilizer application on growth and yield of linseed

Treatment	Plant height (cm)			Primary branches/ plant			Capsules/ plant			Seeds/ capsule			1,000-seed weight		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
No FYM	67.7	58.3	57.9	5.7	5.0	4.1	22.5	27.0	30.5	7.5	7.93	7.71	7.65	7.80	7.60
FYM@5 tonnes/ha	72.7	61.1	63.6	6.8	6.4	6.3	28.3	43.3	46.4	7.6	8.49	8.62	8.07	8.67	8.46
CD (P=0.05)	1.7	0.7	1.0	0.4	0.4	0.3	2.8	2.6	2.4	0.06	NS	0.24	0.10	0.16	0.28
Fertilizer (kg/ha)															
$N_{25}P_{20}K_{10}$ (50% of the recom.)	63.4	56.2	5.6	4.9	4.5	4.1	21.7	27.8	31.5	6.7	7.50	7.33	7.76	7.88	7.56
$N_{37.5}P_{30}K_{15}$ (75% of the recom.)	71.5	59.1	61.0	6.2	5.3	5.0	24.9	34.7	39.2	7.6	8.25	8.23	8.07	8.18	8.02
$N_{50}P_{40}K_{20}$ (recommended)	75.8	63.8	64.8	7.7	7.17	6.5	29.7	43.5	44.5	8.3	8.87	8.94	8.50	8.65	8.61
CD (P=0.05)	2.5	0.9	1.2	0.7	0.7	0.4	3.5	3.1	2.9	0.07	0.72	0.29	0.60	1.65	0.34

I, 1995–96; II_2, 1996–97; III_3, 1997–98
N_{25}, 25 kg N/ha; P_{20}, 20 kg P_2O_5/ha; K_{10}, 10 kg K_2O/ha
Recom., Recommended; $N_{37.5}$ (37.5 kg N/ha), P_{30} (30 kg P_2O_5/ha), K_{15} (15 kg K_2O/ha); N_{50} (50 kg N/ha), P_{40} (40 kg P_2O_5/ha) and K_{20} (20 kg K_2O/ha)

Table 2. Effect of FYM and chemical fertilizers on yield of linseed

Treament	Seed yield (kg/ha)			
	1995–96	1996–97	1997–98	Mean
Organic manure				
No FYM	897	971	829	899
FYM@5 tonnes/ha	1,187	1,392	1,345	1,308
CD (P=0.05)	86	77	54	74
Fertility level (kg/ha)				
$N_{25}P_{20}K_{10}$(50% of the recommended dose)	765	945	822	844
$N_{37.5}P_{30}K_{15}$ (75% of the recommended dose)	1,112	1,220	1,122	1,151
$N_{50}P_{40}K_{20}$(recommended dose)	1,242	1,381	1,317	1,313
CD (P=0.05)	105	94	66	90

Table 4. Effect of FYM and chemical fertilizers on available N, P, K, and organic carbon in soil after harvest of last linseed crop

Treatment	Available (kg/ha)			
	Nitrogen	Phosphorus	Potassium	Organic carbon (%)
Organic manure				
No FYM	305	17.5	234	0.65
FYM@5 tonnes/ha	356	14.2	240	0.91
CD (P=0.05)	11.0	1.32	11.0	0.040
Fertility level (kg/ha)				
$N_{25}P_{20}K_{10}$ (50% of the recommended dose)	315	12.8	225	0.64
$N_{37.5}P_{30}K_{15}$ (75% of the recommended dose)	330	13.6	239	0.80
$N_{50}P_{40}k_{20}$ (recommended dose)	348	13.9	246	0.90
CD (P=0.05)	14.0	1.62	14.0	0.045

Table 5. Effect of FYM and fertilizer application of net returns (Rs/ha) and net returns/Re investment of linseed

Treatment	Net returns ('000 Rs/ha)			Net returns/Re investment (Rs/Re)		
	I	II	III	I	II	III
FYM level						
No FYM	10.14	11.32	10.62	1.30	1.39	1.59
FYM @ 5 tonnes/ha	15.94	19.74	18.90	2.04	2.44	2.34
CD (P=0.05)	1.71	2.02	1.07	0.15	0.25	0.15
Fertility level (kg/ha)						
$N_{25}P_{20}K_{10}$ (50% of the recommended dose)	7.40	10.80	9.78	0.93	1.34	1.42
$N_{37.5}P_{30}K_{15}$ (75% of the reconmmended dose)	13.84	15.89	15.24	1.65	1.87	2.06
$N_{50}P_{40}K_{20}$ (recommended dose)	16.24	19.00	19.27	1.89	2.20	2.42
CD (P=0.05)	2.42	2.85	1.31	0.190	0.31	0.18

I, 1995–96; II, 1996–97; III, 1997–98

further. Hence it is imperative to supplement the chemical fertilizers with moderate levels of 5 tonnes/ha of FYM to realize the full potential of linseed yield.

Soil

Available N, P, K, and organic carbon increased significantly with the application of FYM @ 5 tonnes/ha (Table 4). Similarly, with increase in fertility levels from 50% to 100% of recommended dose of chemical fertilizer resulted in significantly highest values of all these available nutrients with 100% of chemical fertilizers at the end of experimentation.

Economics

The FYM application @ 5 tonnes/ha recorded increase in net returns (Rs/ha) over the control (no FYM) during 1995–96, 1996–97 and 1997–98 (Table 5). Net returns/rupee investment were also more with FYM than no FYM application.

Similarly, the recommended dose of N, P_2O_5, K_2O ($N_{50}P_{40}K_{20}$) showed 119.5, 76 and 97% increase over that of 50% of the recommended dose of N, P_2O_5, K_2O; and 17.3, 19.6 and 24.4 % over 75% of the recommended dose of N, P_2O_5, K_2O during 1995–96. 1996–97 and 1997–98 respectively. Net returns/rupee investment were also higher with the recommended dose of $NP_2O_5K_2O$ than the other 2 treatments.

Thus supplementing application of chemical fertilizers even at the recommended level of application at 50 kg N, 40 kg P_2O_5 and 20 kg K_2O ha with 5 tonnes/ha FYM not only resulted in realization of higher yield potential but also improved the overall per ha returns and returns/Re investment, on silty clay soils of the mid-hills of Himachal Pradesh.

REFERENCES

Badiyala, D., Singh, C.M. and Kumar, Suresh. 1998. Fertilizer management in flax (*Linum usitatissimum*). *Indian Journal of*

Agricultural Sciences **68**(6) : 302–303.

Dubey, M.P. 2001. Response of late planted linseed verieties to nitrogen levels under rainfed conditions. *Indian Journal of Agronomy* **46**(3) : 547–551.

Pandey, Ajay and Chatterjee, D. 1995. Studies on yield and sustainable value index in linseed. *Advances in Agricultural Research in India* **3** : 70–75.

Sarode, P.V., Napkhade, K.T. and Sagore, B.N. 1997. Correlation and regression studies in linseed nutrition. *Research Journal, Punjabrao Krishi Vidyapeeth* **21**(1) : 13–15.

Sharma, Arjun and Hungsingi, Gururaj. 1996a. Performance of two linseed genotypes at different spacings and nitogen levels under irrigated consitions. *Karnatak Journal of Agricultural Sciences* **9**(1) : 16– 20.

Sharma, Arjun and Hungsingi, Gururaj. 1996b. Influence of genotypes, spacing and nitrogen application on yield and nutrient uptake of linseed. *Journal of Mahrashtra Agricultural Universities* **21**(1) : 137.

Singh, N.B. and Verma, K.K. 1999. Response of linseed cultivars to nitrogen under late sown irrigated conditions. *Indian Journal of Agronomy* **44**(1) : 164–167.