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Effect of FYM Application Time and Sowing Method on Lentil (*Lens esculenta*) under Rainfed Conditions in NW Himalaya

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ABSTRACT: *A field experiment was carried out at Almora (Uttarakhand) for 3 consecutive years (2001-02 to 2003-04) to find out the effect of time of application of FYM and sowing methods on lentil (*Lens esculenta *Moench). Growth and development parameters like plant stand/m^2 and plant height were not influenced significantly with FYM application time. However, branches/ plant was significantly higher under post-sowing application of FYM (11.9) over pre-sowing FYM application (10.0). In case of yield attributes only pods/plant showed significantly higher value under post sowing application of FYM. Grain and straw yield showed 10.6 and 9.4 per cent higher yield under post sowing FYM application. Except straw yield all other parameters showed significant improvement under line sowing either with kutla or seed drill over broadcast sowing. The improvement in mean grain yield was recorded upto 14 and 17% due to line sowing with Kutla and seed drill, respectively in comparision to broadcast (6.41 g/ha).*

Key Words: *FYM Application Time, Lentil, Sowing Methods.*

Lentil (*Lens esculenta* Moench) occupies 13.2 lakh ha area in India along with a productivity of 670 kg/ha. Low productivity of lentil in the region is mainly because of continued adoption of traditional management practices. The major constraint in productivity of lentil is insufficient soil moisture during seed germination. Application of organic manure (FYM and vermicompost) results in improved moisture holding capacity, supply of micronutrients and availability of major nutrients due to favourable soil conditions (Reddy *et al.*, 1998). Tripathi and Singh (2002) reported that soil water content at field capacity and permanent wilting point increased with the application of FYM which resulted in higher yield and water use effciency. In hills, it is common practice to apply of FYM during land preparation for rainfed crops. However, application of organic manure after seed sowing on soil surface may provide mulching effect to conserve soil moisture and improve seed germination and early plant development.

The common method used for sowing seed in hills is broadcast, which requires higher seed rate for proper plant establishment. In an estimate, it is observed that about 40-50 per cent seeds when sown by broadcast are either lying on soil surface or placed very deep. The placement of seed at improper depth could inhibit the germination of seeds, which resulted in poor plant population in broadcast (Ahlawat and Rana, 1998). Another method in practice for sowing the lentil is bullock driven plough opens furrows and seed is broadcasted in the field. Thereafter planking is done to cover the seed. In this case also, seeds are not placed properly and results in poor germination and improper plant stand. In contrast, improved line sowing method gives good germination and plant stand. The advantages of improved methods of sowing were reported in rice (Mahmood *et al.*, 2002). Keeping these backdrops in mind, it is essential to find proper time of FYM application and sowing methods to maximize yield of lentil.

MATERIALS AND METHODS

A field experiment was conducted for three consecutive years (2001-02 to 2003-04) at the Experimental Farm, Hawalbagh (29°36' N latitude, 79°40' E longitude and 1250 m above msl) of Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora on sandy loam soil. On an average soil depth was 1.25 m, bulk density 1.36 Mg/m^3, field capacity 16.5 cm/m and permanent wilting point 4.1cm/m. The soil of the experimental farm was slightly acidic in reaction (pH-6.7) and low in available N (185 kg

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N/ha), medium level of P (19 kg P/ha) and K (175 kg K/ha). The total rainfall received during crop season of 2001-02, 2002-03 and 2003-04 was 238 mm, 353 mm and 133 mm, respectively (Fig. 1). The minimum temperature was -0.5,-0.8 and 0.7°C in January and maximum temperature of 30, 29 and 29°C was recorded in the month of April during three consecutive crop seasons were recorded (Fig. 1). The experiment was laid out in split plot design with 3 replications. The main-plot treatments consisted of FYM application time viz. pre-sowing (F1) and post-sowing (F2) in main plots. In case of F1, FYM @ 10 t/ha was applied at the time of land preparation along with recommended dose of fertilizers (20:40 kg NP/ha), whereas, in case of F2, recommended dose of fertilizers was added at the time of land preparation and FYM @ 10 t/ha was applied on soil surface after seed sowing. Under sub-plot treatments 4 sowing methods viz. broadcast (S1) as followed traditionally, broadcast after opening furrows (S2), line sowing with *kutla* (S3) and line sowing seed drill (S4) were used. Lentil "VL Masoor 4" at 40 kg/ha seed rate was used for the experimentation. Crop was sown during second fortnight of October and harvested in end of April to first fortnight of May. Pre-emergence herbicide Pendimethalin @ 1.0 kg ai/ha followed by one hand weeding at 50-60 DAS were used to control weeds. The observation on plant stand/m^2 was recorded at the time of flowering. Whereas, randomly five plants were selected at the time of harvesting and observation on, plant height and branches/plant, pods/plant, grains/plant and grain weight/plant were recorded.

RESULTS AND DISCUSSION

Plant Stand and Development

Plant stand and plant height did not influenced significantly due to FYM application time (Table 1). However, numerically higher values of both the above characters were recorded under post-sowing application of FYM. However, branches/plant was significantly higher (19%) in case of post-sowing application of FYM in comparison to pre-spwong application of FYM. The increase in above characters might be due to mulching effect of FYM when applied after sowing.

The significant improvement in plant stand was reported due to different sowing methods. The higher plant stand was recorded in case of line sowing with *kutla* (184 plants/m^2) followed by line sowing with seed drill (160 plants/m^2) and lowest under broadcast method of sowing (119 plants/m^2). This might be due to more precision in sowing depth in line sowing. The significantly higher (about 18-20) plant height and branches/plant were reported due to line sowing methods over broadcast. Highest value of plant height (24.6 cm) and branches/plant (11.9) were recorded under line sowing with seed drill whcich was at par with line sowing with kutla (plant height 24.5 cm and branches/plant 11.7) and significantly higher over broadcast sowing (plant height 20.8 cm and branches/plant 9.8).

Yield Attributes

Yield attributes (grains/plant, grain weight/plant and 1000 grain weight) did not affect significantly due to FYM application time except pods/plant. Significantly higher Pods/plant (18.5 per cent) was recorded under post-sowing FYM application (Table1). However, in all cases, numerically higher values were recorded in case of post sowing FYM application. The increase in yield attributes due to post sowing application might be due to better moisture supply and nutrient availability during plant growth and development.

Yield attributing characters viz. pods/plant, grains/plant, grain weight/plant and 1000-grain weight were significantly higher under line sowing in camparison to broadcast. The values of all the yield attributes except 1000 grain weight were higher under line sowing with seed drill followed by line sowing with kutla. However, in case 1000 grain weight the value was higher in case of line sowing with kutla (17.6 g) which was at par with line sowing with seed drill (16.6 g) and broadcast after opening furrows (16.6 g) and significantly higher over broadcast sowing (16.0 g). The improvement in pods/plant, grains/plant, grain weight/plant and 1000 grain weight were 26.3, 46.6, 43.5 and 7.0 per cent respectively. The yield attributes were at par for the broadcasting and broadcasting in furrows and similarly line sowing with *kutla* and seed drill. The improvement in above characters due to line sowing was mainly because of better growing conditions after seed germination and less competitive effect between plants under line sowing. The line sowing with seed drill showed the best performance for different yield attributes except 1000-grain weight where line sowing with *kutla* showed the best performance. The proper growth and development in line sowing may be the reason for improvement in yield attributes in lentil. These results are in line with findings of Hamid *et al* (2002) in soybean.

Grain and straw yield

The effect of post-sowing application of FYM was significant for grain as well as straw yield. Over all advantage of 10.6 and 9.6 per cent for grain and straw yield respectively was recorded under post sowing application of FYM in comparison to pre-sowing. Post-sowing application gave good results due to their mulching effect during long dry spells, which extended the soil moisture availability to the plants. This method is very useful during dry years as indicated from the study. Favourable effect of mulching on yield was reported by Gupta and Bhan (1997) in mustard. Harvest index did not influenced significantly due to FYM application time.

Line sowing either with kutla or seed drill gave significantly higher grain yield and harvest index over broadcast method of sowing. However, straw yield did not influenced significantly due to sowing methods. During 2001-02 and 2002-03 rainfall was good enough to support good yield of lentil. However, during 2003-04 rainfall was very less and that too erratic (Figure 1); therefore, the over all grain yield during third year of experimentation was poor (Figure 2). The highest grain yield was observed

Table 1
Effect of FYM Application Time and Sowing Methods on Lentil Growth, Yield Atributes and Yield (3 years Pooled Data)

Treatment	*Plant stand/m²*	*Plant height (cm)*	*Branches/ plant*	*Pods/ plant*	*Grains/ plant*	*Grain weight/ plant (g)*	*1000 grain weight (g)*	*Grain yield (q/ha)*	*Straw yield (q/ha)*	*Harvest index (%)*
FYM application time										
Pre-sowing	150	22.4	10.0	28.6	39.6	0.65	16.4	6.6	11.6	36.3
Post-sowing	153	23.9	11.9	33.9	44.9	0.72	17.0	7.3	12.8	36.0
CD (p=0.05)	NS	NS	1.6	1.9	NS	NS	NS	0.5	0.6	NS
Sowing methods										
Broadcast	119	20.8	9.8	27.2	33.7	0.54	16.0	6.4	12.0	35.0
Broadcast after opening furrows	145	22.7	10.3	29.1	36.6	0.65	16.6	6.5	12.1	35.3
Line sowing with *Kutla*	184	24.5	11.7	32.5	47.5	0.75	17.6	7.3	12.3	37.2
Line sowing with seed drill	160	24.6	11.9	36.3	51.4	0.80	16.6	7.5	12.7	37.0
CD (p=0.05)	17	2.1	1.5	3.4	4.2	0.06	1.0	0.6	NS	1.4

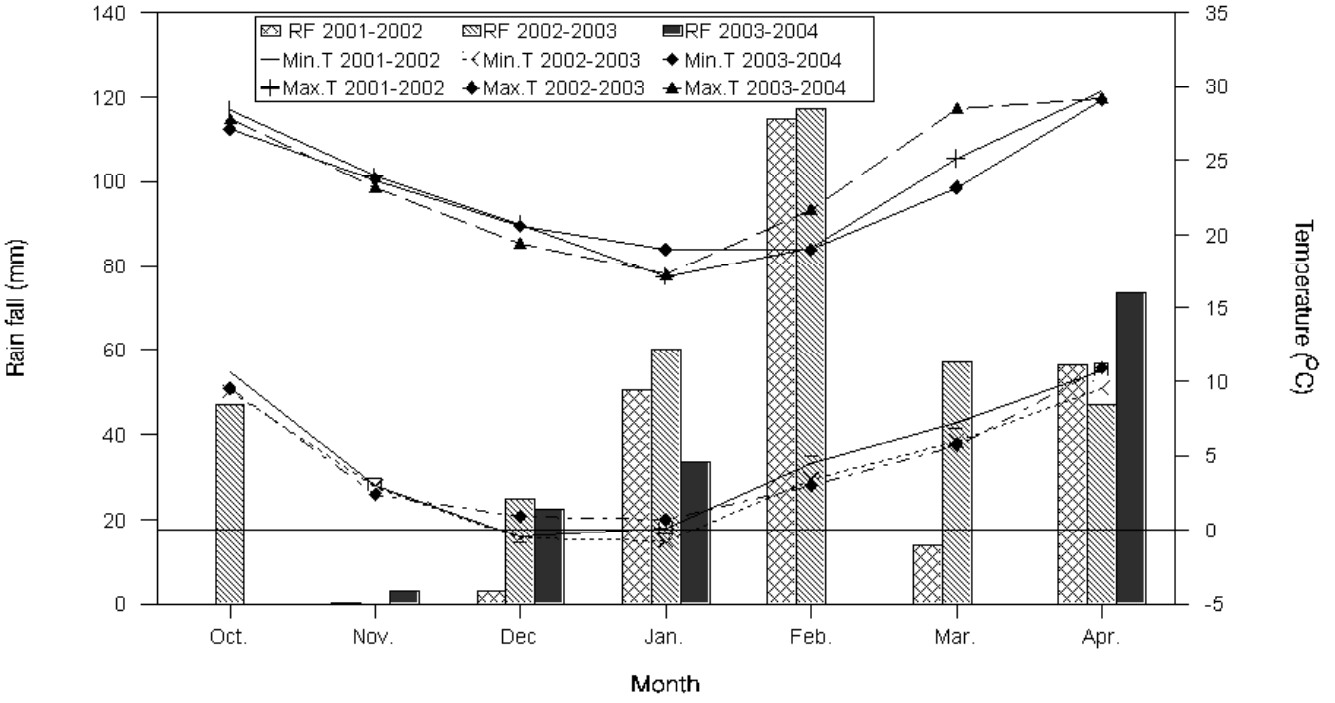

Figure 1: Monthly Mean Maximum and Minimum Temperature and Rain Fall during the Crop Growing Season

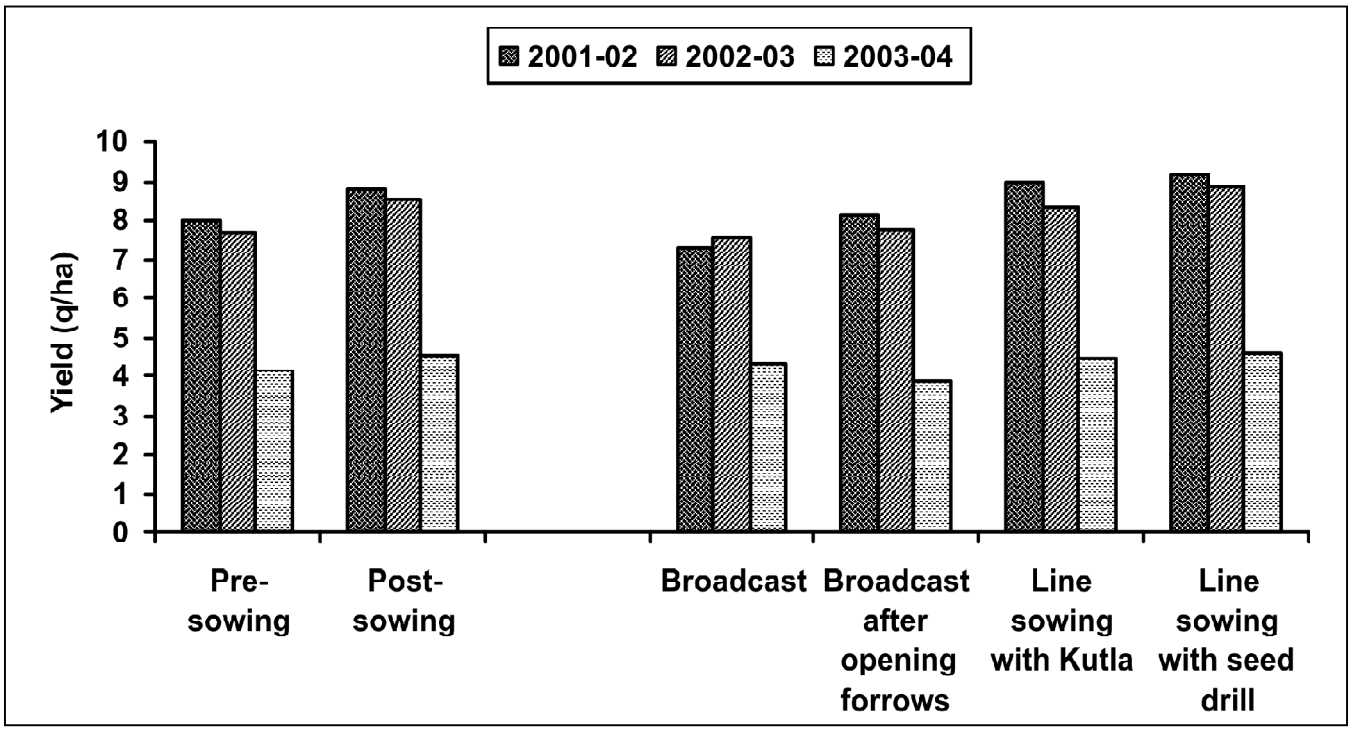

Figure 2: Effect of FYM Application Time and Sowing Methods on Lentil Grain Yield

under line sowing with seed drill (7.5 q/ha) which was at par with line sowing with kutla (7.3 q/ha) and significantly higher over broadcast sowing. The improvement in grain yields was 14 and 17 per cent due to line sowing with *kutla* and seed drill respectivly in comparison to broadcast sowing (6.4 q/ha). Similarly, harvest index was higher under line sowing with kutla (37.2 %) which was at par with line sowing withseed drill (37.0%) and significantly higher over broadcast (35%) and broadcast after opening furrows (35.3%). The higher grain yield under line sowing with *kutla* and seed drill is attributed to higher values of yield component in these treatments as evident from table 1. The good plant stand, growth and development in line sowing are the reason behind higher yield under these treatments. Whereas in contrast to these, poor plant stand and improper development of plants within field are the main reason of poor yield under broadcast techniques. At par results were obtained in line sowing with *kutla* and seed drill and similar with broadcasting and broadcasting in furrows. The higher yields in line sowing are also reported by Hamid *et al* (2002) and in seed drill sowing by Ahlawat and Rana (1998).

For the better yield of lentil under rainfed conditions, the crop should be sown in line with *kutla* or seed drill along with post-sowing application of FYM (@ 10 t/ha).

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