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Effect of moisture conservation on growth and yield of linseed under varying fertility levels

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ABSTRACT

A field experiment was conducted to effect of moisture conservation on growth and yield of linseed under varying fertility levels in rabi, 2015. The experiment was laid out in split plot design, keeping combinations of two mulch (no-mulch and locally available straw mulch) and three irrigation schedules (50% CPE, 75% CPE and 100% CPE) in main plots and three fertility levels (no nutrient, 75% RDF and 100% RDF) in sub plots. Plant height, number of branches plant^{-1}, dry matter accumulation plant^{-1}and yield attributes as well as seed yield and straw yield were recorded maximum with mulching and 100% CPE. However, among the fertility levels, 100% RDF recorded significantly higher values for all the growth parameters, yield attributes and yield followed by 75% RDF.

***Keywords*:** Fertility levels, irrigation, linseed and moisture conservation

Linseed (*Linum usitatissimum* L.) is an important oilseed crop and cultivated primarily for oil meant for edible as well as industrial purposes. About 80 per cent of oils is used for paints, varnishes, a wide range of coating oils, linoleum, pad and printing inks, leather finishing, its fiber has more strength and durability which blends very well with wool, cotton, silk etc. Thus, the interest in linseed for food, feed and industrial products is growing and more attention is now being given to meet the increased demand for this crop. But in recent years linseed has fallen short of the requirement due to number of reasons which water scarcity and poor management practices affects the growth, development and finally crop yield of linseed. One of the main causes for low production is the inadequate attention given to the nutritional requirements on linseed crop.

Mulching plays an important role for conserving soil moisture which favors great concern towards higher crop productivity. Moreover, Irrigation scheduling is the most important principle for higher water productivity and water use efficiency. Linseed crop also performs well at optimum dose of NPK (Agrawal *et al.*, 1999). This type ofcomparativeanalysisstill not done in Varanasi. Keeping these facts in view, the present investigation was undertaken aseffect of moisture conservation on growth and yield of linseed under varying fertility levels.

Experiment was conducted at the Research Farm of Institute of Agricultural Sciences of Banaras Hindu University, Varanasi situated at latitude of 25°18' and longitude of 83°03', altitude of 128.93 m average mean sea level. Mean annual rainfall of Varanasi is 1100 mm and 75 % occurs during the south-west monsoon season (July-September). Soils of experimental field had 208.4 kg ha^{-1} alkaline permanganate oxidisable N, 25.7 kg ha^{-1} sodium bicarbonate extractable P, 194.6 kg ha^{-1} ammonium acetate extractable K and 0.36 % organic carbon. The pH of soil was 7.4 and EC was 0.34 (dSm^{-1}). Soils were sandy clay loam in texture. The experiment was laid out in a split plot design with six main plot treatments and three sub plot treatment with replicated thrice. The first main plot having no mulch and second main plot having locally available rice straw mulchand also in main plot treatments consisted of irrigation schedule having 50% CPE, 75% CPE and 100% CPE. Sub-plot having different nutrient levels Control (No nutrient), 75% RDF and 100% RDF. Each main plot was surrounded by a buffer of 1.5 m width whereas subplot was surrounded by 0.5 m width to protect the plots from accidental irrigation and gain of water through seepage. The number of irrigation was calculated as per treatments on the basis of cumulative pan evaporation in mmday^{-1}. The fertilizer was applied through prilled urea for nitrogen, di-ammonium phosphate for phosphorus and muriate of potash for potash. Full di-ammonium phosphate, potash and 1/3 part of urea were applied at the time of manual sowing by broadcasting and 2/3 part of prilled urea was broadcasted in the three equal splits after sowing. Linseed variety T-937 was used for experimentation which was developed from CSAUAT Kanpur and matures in 125-130 days**.** The data relating to each character were analyzed as per the procedure of analysis of variance and significance was tested by " F" test (Gomez and Gomez 1984).

Effect of Mulch

Locally available rice straw mulch resulted signiûcantly more plant height (62.09 cm), Number of branches plant^{-1} (6.33) and dry matter accumulation (7.61 g plant^{-1}) at harvest (Table 1).The development of yield

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Table1: Effect of mulch, different CPE and nutrient levels on growth of linseed

Treatments	Plant height (cm)	Number of branches plant^{-1}	Dry matter accumulation plant^{-1} (g)
Mulch			
No mulching	60.79	5.56	6.30
Mulching with locally available straw	62.09	6.33	7.61
SEm (±)	**0.16**	**0.15**	**0.03**
LSD (0.05)	**0.50**	**0.48**	**0.09**
IW/CPE ratio			
50% CPE	59.24	5.68	6.22
75% CPE	60.76	5.89	6.29
100% CPE	64.37	6.00	8.35
SEm (±)	**0.19**	**0.18**	**0.03**
LSD (0.05)	**0.62**	**0.59**	**0.11**
Fertility levels ($N+P_2O_5+ K_2O$ kg ha^{-1})			
No nutrient application	54.54	5.22	5.57
75% of recommended dose of NPK	62.05	6.17	6.82
Recommended dose of NPK	67.73	6.44	8.47
SEm (±)	**0.21**	**0.22**	**0.07**
LSD (0.05)	**0.63**	**0.64**	**0.20**

Table-2: Effect of mulch, different CPE and nutrient levels on yield attributes and yields of linseed

Treatments	Number of capsules plant^{-1}	Number of seeds capsule^{-1}	1000 grain Weight (g)	Seed yield (q ha^{-1})	Straw yield (q ha^{-1})	Harvest index (%)
Mulch						
No mulching	52.15	8.14	6.21	14.98	28.72	49.80
Mulching with locally available straw	55.98	8.22	7.00	16.36	30.21	55.93
SEm (±)	**0.13**	**0.15**	**0.05**	**0.31**	**0.24**	**1.64**
LSD (0.05)	**0.43**	**0.50**	**NS**	**0.97**	**0.75**	**6.62**
IW/CPE ratio						
50% CPE	45.52	7.88	6.57	14.49	28.45	47.75
75% CPE	49.09	8.33	6.54	15.60	29.32	54.12
100% CPE	67.58	8.43	6.70	16.92	30.64	56.73
SEm (±)	**0.16**	**0.19**	**0.06**	**0.53**	**0.29**	**1.42**
LSD (0.05)	**0.52**	**0.61**	**0.21**	**1.19**	**0.93**	**4.48**
Fertility levels ($N+P_2O_5$kg ha^{-1})						
No nutrient application	41.71	7.05	6.48	9.00	22.98	29.73
75% of recommended dose of NPK	57.49	8.16	6.59	16.22	29.90	52.55
Recommended dose of NPK	62.99	9.33	6.73	21.80	35.51	76.31
SEm (±)	**0.26**	**0.29**	**0.05**	**0.43**	**0.53**	**1.76**
LSD (0.05)	**0.78**	**0.84**	**0.17**	**1.26**	**1.56**	**5.14**

attributes is dependent on the dry matter production and its translocation for the formation of yield contributing parameters in crop plants. Significantly maximum number of capsule plant^{-1} (55.98),number of seedscapsule^{-1}(8.22), seed yield (16.36 q ha^{-1}) and straw yield (30.21 q ha^{-1})were recorded with mulching as compare to No mulch (Table 2).Whereas, harvest index was found to be at par with 75% CPE. Increased value of yield attributes with mulching can be attributed to higher dry matter production and its consequent partitioning in the production of important yield components *viz*. No. of capsule and seed capsule^{-1}. Rajput *et al*., 2014 also reported similar results. These results are in line with those of (Khurshid *et al*., 2006) who reported that mulch increases the soil moisture and nutrients availability to plant roots, in turn, leading to higher grain yield.

Effect of irrigation schedules

Among the irrigation schedules, significant variation existed for growth, yield parameters and yield of linseed. 100% CPE outperformed the other two irrigation schedules i.e. 50% CPE and 75% CPEfor all the growth and yield parameters. 100% CPE recorded highest plant height (64.37 cm), number of branches plant^{-1}(6.0) and dry matter accumulation (8.35 plant^{-1}) followed by 75% CPE and 50% CPE at harvest stage (Table-1). Significantly maximum number of capsule plant^{-1}(67.58), number of seeds capsule^{-1}(8.43), seed yield (16.92 q ha^{-1}), straw yield (30.64 q ha^{-1}) and harvest index (56.73%) observed with irrigation schedule,100% RDF. Irrigation schedule 75% CPE was found to be at par with 50% CPE except harvest index (Table-2). This might be due to higher availability of soil moisture content in 100% CPE treatment which always remained above or near to field capacity.These findings are in agreement withOmidbaigi*et al.*,2001 and Yenpreddiwar *et al.*, 2007.

Effect of fertility levels

The outcomes of the study showed that among the fertility levels, 100% RDF significantly influenced the growth, growth parameters and yield of linseed.Increasing fertility levels (100% RDF) augmented more plant height (67.73 cm), branches plant^{-1} (6.44) and dry matter production(8.47 g plant^{-1}) at harvest (Table-1) which finally resulted in higher stover yield. Significantly maximum number of capsule plant^{-1} (62.99), number of seeds capsule^{-1}(9.33), seed yield (21.80 q ha^{-1}), straw yield (35.51 q ha^{-1}) and harvest index (76.31%) were recorded with 100% RDF (Table-2).This finding is in conformity with the results (Dwivedi and Dwivedi, 2005; Singh *et al*. 2013). This could be attributed to the higher seed yield obtained at adequate nitrogen levels. The similar result was also reported by Yadav *et al.*, 2010 and Singh *et al.*, 2006.

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