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Original Research Article

Economics Analysis of Linseed (*Linum usitatissimum*) Under Various Tillage and Irrigation Management Practices Grown after Rice of Chhattisgarh plain

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A B S T R A C T

Linseed is grown after rice on marginal and sub-marginal lands with low or no-fertilizers, mostly under rainfed both as relay cropping "*utera*" in paddy fallow and as upland in unbunded fields. Ph.D research on "Agro-resource management studies on growth, yield, quality and economics of linseed (*Linum usitatissimum* Linn.) grown after rice in Alfisols of Chhattisgarh plains" was conducted during *rabi* seasons of 2009-10 and 2010-11 at Research cum Instructional Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur with the specific objectives to study the effect of different tillage with varying levels of irrigation on growth, yield, nutrient uptake and economics of linseed. Two different experiments on linseed crop were undertaken during two consecutive *rabi seasons of* 2009-10 & 2010-11. The experiment was divided into horizontal and vertical plots under strip plot design. The horizontal plot was further divided into four tillage practices viz. zero tillage (T_0), harrowing once (T_1), rotavator once (T_2) and conventional tillage (T_3) and vertical plots were divided into four irrigation schedules viz. one irrigation after seeding (I_0), one irrigation at 35 DAS (I_1), two irrigations at 35 and 75 DAS (I_2) and three irrigations at 0, 35 and 75 DAS (I_3).Key words: Linseed, Economics, Management.

Keywords

Linseed (*Linum usitatissimum*), rice, irrigation

Introduction

Soil tillage is among the important factors affecting soil physical properties and crop yield. Among the crop production factors, tillage contributes up to 20% (Khurshid *et al.*, 2006). Tillage method affects the sustainable use of soil resources through its influence on soil properties (Hammel, 1989). The proper use of tillage can improve soil related constrains, while, improper tillage may cause a range of undesirable processes, e.g. destruction of soil structure, accelerated erosion, depletion of organic matter and fertility and disruption in cycles of water, organic carbon and plant nutrient.

Use of excessive and un-necessary tillage operations is often harmful to soil. Therefore, currently there is a significant interest and emphasis on the shift to the conservation and no-tillage methods for the purpose of controlling erosion process (Iqbal *et al.*, 2005).

Keeping above facts in view and considering the benefits and increased popularity of linseed, Ph.D research entitled "Agro-resource management studies on growth, yield, quality and economics of linseed (*Linum usitatissimum* Linn.) grown after rice in Alfisols of Chhattisgarh plains" was conducted during *rabi* seasons of 2009-10 and 2010-11 at Research cum Instructional Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur with the following specific objectives: to study the effect of different tillage with varying levels of irrigation on growth, yield, nutrient uptake and economics of linseed.

Materials and Methods

Location and Experimental Site

The location of the experimental site was Research cum Instructional Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) located at 21°4' N latitude and 81°39' E longitude with an altitude of 298 metre above mean sea level having sub tropical humid climate.

Climate Conditions

The climate of Raipur region is sub humid with hot and dry summer and mild winter. It comes under the Chhattisgarh plains agro-climatic sub zone of seventh agro climatic region of India i.e. eastern plateau and hills. The average annual rainfall is about 1320 mm of which about 88 % is received during a span of four months i.e. between June to September. The rainfall is largely contributed by south-west monsoon. The maximum temperature raises up to 45°C during summer and minimum temperature falls to 5-6 °C during winter season. The relative humidity reaches maximum 93 % and minimum 41 % in August and March, respectively.

Treatment Details

Two different experiments on linseed crop were undertaken during two consecutive *rabi seasons of* 2009-10 & 2010-11. The experiment was divided into horizontal and vertical plots under strip plot design. The horizontal plot was further divided into four tillage practices viz. zero tillage (T_0), harrowing once (T_1), rotavator once (T_2) and conventional tillage (T_3) and vertical plots were divided into four irrigation schedules viz. one irrigation after seeding (I_0), one irrigation at 35 DAS (I_1), two irrigations at 35 and 75 DAS (I_2) and three irrigations at 0, 35 and 75 DAS (I_3). The experiment was sown on 26th November, 2010 and harvested on 24th March, 2011.

Cost Economics

Economics of linseed production was calculated on the prevailing prices of linseed as well as inputs used. The cost of cultivation of linseed crop was calculated on the basis of prevailing prices for different inputs. The production of linseed crop was converted in to gross return (ha^{-1}) on the basis of prevailing prices in the market.

$$\text{Gross return (ha}^{-1}) = \text{Linseed yield (q ha}^{-1}) \times \text{Price of yield (q}^{-1})$$

$$\text{Net return (ha}^{-1}) = \text{Gross return (ha}^{-1}) - \text{Cost of cultivation (ha}^{-1})$$

$$\text{Benefit: Cost ratio} = \frac{\text{Net return (ha}^{-1})}{\text{Cost of cultivation (ha}^{-1})}$$

Results and Discussion

Seed yield (q ha^{-1})

The seed yield of linseed as influenced by tillage practices and irrigation schedules are presented in Table 1. The seed yield of linseed was prominently influenced by tillage practices and irrigation schedules. Linseed crop grew with conventional tillage (T_3) resulted in highest seed yield of 10.58, 10.47 and 10.52 q ha^{-1} during 2009-10, 2010-11 and on mean basis, respectively, being significantly superior compared to respective seed yield of 7.42, 7.18 and 7.30 q ha^{-1} under zero tillage (T_0). However, it was at par to treatment harrowing once (T_1) and rotavator once (T_2) during both the years and on mean basis. As regards to different irrigation schedules, linseed crop grew with three irrigation *viz.*, at sowing, 35 and 75 DAS (I_3) produced significantly higher seed yield compared to one irrigation after seeding (I_0) and one irrigation at 35 DAS (I_1), but it was at par to two irrigations at 35 and 75 DAS (I_2) during both the years and on mean basis.

Among the different tillage practices, maximum mean seed yield was obtained for treatment conventional tillage (10.52 q ha^{-1}) followed in decreasing order by rotavator once (9.27 q ha^{-1}), harrowing once (9.09 q ha^{-1}) and zero tillage (7.30 q ha^{-1}). The maximum yield in conventional tillage may be due to better pulverisation of soil resulting in proper seed and soil contact, which caused good germination (plants m^{-2}). The lowest yield was observed in treatment zero tillage because of poor seed and soil contact, as the clod size was big and did not create good tilth for proper germination of crop (plants m^{-2}). This increase in seed yield was due to significant increase in growth parameters and yield attributes such as seeds $capsule^{-1}$, and capsules $plant^{-1}$.

Seed yield increased significantly with the increase of irrigation schedule. Maximum mean seed yield (11.45 q ha^{-1}) was obtained under irrigation schedule three irrigations at 0, 35 and 75 DAS (I_3) which was 9.43 and 30.65 per cent higher than two irrigations at 35 and 75 DAS (I_2) and one irrigation at 35 DAS (I_1), respectively. This increase in seed yield was due to significant increase in growth parameters and yield attributes like seeds $capsule^{-1}$, capsules $plant^{-1}$ and test weight. The increase in grain yield and yield attributes with the higher level of irrigation were also reported by Gautam *et al.*, (2000) and Mishra *et al.*, (2002). Significantly higher growth parameters due to high irrigation levels were also reported by Roy and Tripathi (1987), Prasad and Prasad (1989), Bandopadhyay and Mallick (1996), Banga *et al.*, (1998) and Bandopadhyay and Mallick (2000).

Stalk yield (q ha^{-1})

The stalk yield of linseed as influenced by tillage practices and irrigation schedule are presented in Table 1. The stalk yield varied significantly due to tillage practices and irrigation schedules during both the years and on mean basis. A perusal of the data indicates that crop planted under conventional tillage (T_3) has been given significantly higher stalk yield than zero tillage (T_0), but it was at par to harrowing once (T_1) and rotavator once (T_2) during both the years and on mean basis.

It is clear from the result that different irrigation schedules influenced the stalk yield of linseed. Linseed crop provided with three irrigations viz., at sowing, 35 and 75 DAS (I_3) resulted in significantly higher stalk yield, being significantly superior over one irrigation after seeding (I_0) and one irrigation at 35 DAS (I_1) but remained at par to two irrigations at 35 and 75 DAS (I_2) during both the years and on mean basis. Increasing tillage also resulted in significant increase in the stalk yield. Significantly maximum stalk yield was recorded under conventional tillage (T_3) and it was 7.38 and 6.78 % higher over harrowing once (T_1) and rotavator once (T_2), respectively. This increase in stalk yield could be due to the increase in LAI, dry matter accumulation and plant height.

Table.1 Seed yield, stalk yield, biological yield and harvest index of linseed as influenced by tillage practices and irrigation schedule

Treatment	Seed yield (q ha^{-1})			Stalk yield (q ha^{-1})			Biological yield (q ha^{-1})		
	2009-10	**2010-11**	**Mean**	**2009-10**	**2010-11**	**Mean**	**2009-10**	**2010-11**	**Mean**
Tillage practices									
T_0 : Zero tillage	7.42	7.18	7.30	18.55	17.89	18.22	25.97	25.08	25.52
T_1 : Harrowing once	9.13	9.05	9.09	21.55	21.32	21.43	30.68	30.37	30.52
T_2 : Rotavator once	9.29	9.26	9.27	21.75	21.39	21.57	31.04	30.65	30.84
T_3 : Conventional tillage	10.58	10.47	10.52	23.38	22.91	23.14	33.95	33.38	33.66
SEm±	**0.60**	**0.63**	**0.63**	**0.54**	**0.59**	**0.49**	**0.97**	**1.15**	**0.95**
CD (P=0.05)	**2.08**	**2.20**	**2.18**	**1.88**	**2.07**	**1.71**	**3.38**	**4.00**	**3.30**
Irrigation schedule									
I_0 : One (After seeding)	6.46	6.38	6.42	17.53	17.39	17.46	23.98	23.78	23.88
I_1 : One (35 DAS)	7.97	7.92	7.94	20.97	20.08	20.52	28.93	27.99	28.46
I_2 : 35 and 75 DAS	10.46	10.29	10.37	22.77	22.32	22.54	33.23	32.61	32.92
I_3 : 0, 35 and 75 DAS	11.53	11.37	11.45	23.97	23.73	23.85	35.50	35.09	35.29
SEm±	**0.35**	**0.57**	**0.32**	**0.64**	**0.80**	**0.59**	**0.73**	**0.80**	**0.65**
CD (P=0.05)	**1.21**	**1.97**	**1.19**	**2.23**	**2.77**	**2.05**	**2.53**	**2.79**	**2.25**

Table.2 Economics of linseed as influenced by tillage practices and irrigation schedule

Treatment	Cost of production (Rs. ha^{-1})			Gross return (Rs. ha^{-1})			Net return (Rs. ha^{-1})			Return Re^{-1} invested		
	2009-10	**2010-11**	**Mean**	**2009-10**	**2010-11**	**Mean**	**2009-10**	**2010-11**	**Mean**	**2009-10**	**2010-11**	**Mean**
Tillage practices												
T_0 : Zero tillage	9647	10079	9863	25228	25130	25179	15581	15051	15316	1.62	1.49	1.55
T_1 : Harrowing once	9862	10558	10210	31042	31675	31359	21180	21117	21149	2.15	2.00	2.07
T_2 : Rotavator once	10157	10615	10386	31586	32410	31998	21429	21795	21612	2.11	2.05	2.08
T_3 : Conventional tillage	11047	11866	11457	35972	36645	36309	24925	24779	24852	2.26	2.09	2.17
Irrigation schedule												
I_0 : One (After seeding)	9835	10366	10101	21964	22330	22147	12129	11964	12047	1.23	1.15	1.19
I_1 : One (35 DAS)	9835	10366	10101	27098	27720	27409	17263	17354	17309	1.76	1.67	1.71
I_2 : 35 and 75 DAS	10335	10876	10606	35564	36015	35790	25229	25139	25184	2.44	2.31	2.37
I_3 : 0, 35 and 75 DAS	10709	11508	11109	39202	39795	39499	28493	27694	28094	2.66	2.41	2.53

Indirectly, it may also have contributed for higher yield because higher stalk yield.

Significantly maximum stalk yield was recorded under three irrigations at 0, 35 and 75 DAS (I_3) and it was 5.49 and 13.96 % higher over two irrigations at 35 and 75 DAS (I_2) and one irrigation at 35 DAS (I_1), respectively. Adequate available soil moisture in the root zone depth of soil due to frequent irrigation might have improved the nutrient availability, thereby increasing cell division and cell expansion which in turn increased the total dry matter production at three irrigation. Panchanathan *et al.,* (1992) observed that when the crop was supplied with adequate moisture throughout the growing period and reduction was noticed with imposition of moisture stress. This indicate that moisture supply has a direct bearing on the production of ultimate stalk yield.

Biological yield (q ha^{-1})

The biological yield of linseed as influenced by tillage practices and irrigation schedules are presented in Table 1. It is evident from the results that biological yield was greatly affected by tillage practices and irrigation schedules.

Crop planted with conventional tillage (T_3) recorded significantly higher biological yield than that produced by zero tillage (T_0) but, it was at par with harrowing once (T_1) and rotavator once (T_2) during both the years and on mean basis.

Among the different irrigation schedules, crop irrigated at sowing, 35 and 75 DAS (I_3) produced significantly higher biological yield than one irrigation after seeding (I_0) and one irrigation at 35 DAS (I_1) but, it was at par to two irrigations at 35 and 75 DAS (I_2) during both the years and on mean basis.

Economics

In agriculture, it is pre-determined that the adoption of any new technique, variety or any level of input will depend on their economic feasibility. Therefore, before making any final recommendation for commercial cultivation, it is essential to have idea about the cost involved, total out turn and net income from the same.

Keeping these point of view, gross return, cost of production and net return were calculated and the data are presented in Table 2. It is evident from the data that the investment on raising linseed was increased with increase in tillage practices and irrigation schedule. Highest average cost of production (Rs. 11457 ha^{-1}) was incurred with crop planted through conventional tillage (T_3) followed by harrowing once (T_1) and rotavator once (T_2), lowest being incurred by zero tillage (T_0). Similarly, three irrigation involved the highest cost in raising linseed.

With regards to gross returns of linseed, crop planted with conventional tillage (T_3) has given significantly higher gross income (Rs. 36309 ha^{-1}) than crop planted with zero and minimum tillage (harrowing once and rotavator once). As regards to irrigation schedules, maximum gross return (Rs. 39499 ha^{-1}) was received under three irrigations at 0, 35 and 75 DAS (I_3) followed by irrigation two irrigations at 35 and 75 DAS (I_2) and one irrigation at 35 DAS (I_1).

Net profit is the key point which provide for the economic variability of treatments. Highest net return (Rs. 24852 ha^{-1}) was obtained with conventional tillage (T_3) followed by harrowing once (T_1) and rotavator once (T_2). As regards to irrigation schedules, highest net return (Rs. 28094 ha^{-1}) was obtained under three irrigations viz., at sowing, 35 and 75 DAS (I_3) followed by two irrigations supplied at 35 and 75 DAS (I_2) and one irrigation at 35 DAS (I_1).

Highest return per rupee invested was obtained with conventional tillage (T_3) followed by harrowing once (T_1) and rotavator once (T_2) and zero tillage (T_0). As regards to irrigation schedules, highest return per rupee invested was obtained under three irrigations viz., at sowing, 35 and 75 DAS (I_3) followed by two irrigations supplied at 35 and 75 DAS (I_2), one irrigation at 35 DAS (I_1) and one irrigation after seeding (I_0).

The maximum gross and net return was noted under conventional tillage (T_3) followed by harrowing once (T_1) and rotavator once (T_2). This might be due to positive correlation with growth parameters, yield attributes and seed yield and lowering the cost of cultivation. Chitale *et al.*, (2007) and Gopinath *et al.*, (2007) also reported similar results.

Among irrigation schedules the highest gross and net return was noted with three irrigations at 0, 35, and 75 DAS (I_3) followed by two irrigations at 35 and 75 DAS (I_2). The higher gross and net income were obviously due to higher seed and stalk yield under these treatments. The higher income under higher irrigation levels were also reported by Paliwal and Singh (1979) and Tomar and Tiwari (1990).

References

Bandopadhyay, P.K. and Mallick, S. 1996. Irrigation requirement of winter maize under shallow water table condition in Damodar Valley Irrigation Command Area. *Journal of the Indian Society of Soil Science* 44 (4): 616-620.

Bandopadhyay, P.K. and Mallick, S. 2000. Effect of irrigation on water extraction pattern of winter under shallow water table condition. *Indian Journal of Soil Conservation* 28 (2): 138-142.

Banga, R.S., Singh, T. and Yadav, S.K. 1998. Effect of irrigation and fertility levels on nitrogen and phosphorus uptake in winter maize under shallow water table condition in Haryana. *Indian Journal of Soil Conservation* 26 (2): 135-136.

Chitale, S., Pandey, N. and Urkurkar, J.S. 2007. Effect of planting method, tillage and weed management on productivity and physico-chemical properties of rice (*Oryza sativa*)-wheat (*Triticum aestivum*) cropping system. *Indian Journal of Agronomy* 52 (4): 283-288.

Gautam, R.C., Pachauri, P., Singh, V. and Gaur, N.S. 2000. Response of winter maize (*Zea mays*) to irrigation schedule and fassel removal. *Indian Journal of Agricultural Sciences* 70 (2): 859-860.

Gopinath, K.A., Kumar, N., Pande, H. and Bisht, J.K. 2007. Bio- efficacy of herbicides in wheat under zero and conventional tillage systems. *Indian Journal of Weed Science* 39 (3-4): 41-46.

Hammel, J.E. 1989. Long term tillage and crop rotation effects on bulk density and soil impedance in Northern Idaho. *Soil Sci. Amer*. J., 53: 1515-1519.

Iqbal, M., Hassan, A.U., Ali, A. and Rizevanullah, M. 2005. Residual effect of tillage and farm manure on some soil physical properties and growth of wheat (*Triticum aestivum* L.). *Int. J. Agri. Biol*., 1: 54-57.

Khurshid, K., Iqbal, M., Arif, M.S. and Nawaz, A. 2006. Effect of tillage and mulch on soil physical properties and growth of maize. *International J. Agri. And Bio*- 8(5): 593-596.

Mishra, H.S., Rathore, T.R. and Savita, U.S. 2002. Water use efficiency of irrigated winter maize under cool weather condition of India. *Irrigation Science* 21 (1): 27-33.

Paliwal, S.K. and Singh, U.B. 1979. Performance of different crops after paddy in Chambal Command, Kota, Rajasthan. *Andhra Agricultural Journal* 26 (3-4): 130-132.

Panchnathan, R.M., Shrinivasulu, D., Subramanium, S. and Palaniappan, S.P. 1992. Effect of irrigation schedule and time of sowing for maize based on economic indices. *Madras Agriculture Journal* 79 (9): 505-510.

Prasad, T.N. and Prasad, U.K. 1989. Effect of irrigation, pattern of sowing and intercrop on the growth, yield and water use efficiency of winter maize. *Annals of Agricultural Research* 10 (2): 139-144. Roy, R.K. and Tripathi. R.S. 1987. Effect of irrigation and fertilizer on yield, water use efficiency and nutrient concentration in winter maize. *Indian Journal of Agronomy* 32 (4): 314-318.

Tomar, S. and Tiwari, A.S. 1990. Production potential and economics of different crop sequences. *Indian Journal of Agronomy* 35: 30-35.