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Effect of weed management practices on quality, weed count, weed dry matter and weed control efficiency in linseed

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ABSTRACT

An experiment was conducted during Rabi 2018-19 and 2019-20 at Research Farm of Birsa Agricultural University, Kanke, Ranchi, Jharkhand to study the "Effect of weed management practices on quality, weed count, weed dry matter and weed control efficiency in linseed". The treatments replicated thrice and comprised of weed management practices *viz.*, T₁-Weedy Check, T₂-Hand weeding twice at 30 and 60 DAS, T₃-Metribuzin 250 g/ha + Oxyflourfen 125g/ha (Pre.), T₄-Pendimethalin 1 kg/ha (Pre.) *fb.* metsulfuron methyl 4 g/ha (Post.), T₅-Imazethapyr 75 g/ha (Post.), T₆-Oxyflourfen 125 g/ha (Pre.), T₇-Metsulfuron methyl 4 g/ha (Post.), T₈-Clodinafop 60 g/ha (Post.), T₉-Clodinafop 60 g/ha + metsulfuron methyl 4 g/ha (Post.) and T₁₀-Oxadiargyl 80 g/ha (Pre.). Application of Hand Weeding twice at 30 and 60 DAS was found superior in terms of oil content (38.91%) and oil yield (586.80 kg/ha) in pooled data. Also, analysis of pooled data revealed that Hand Weeding Twice at 30 and 60 DAS resulted in minimum total weed count (1.21 and 3.12 respectively), total weed dry matter (1.18 and 3.50 g/m² respectively) and maximum weed control efficiency (97.03 and 79.95% respectively) when labours are easily available followed by post emergence application of clodinafop @ 60 g/ha+ metsulfuron methyl @4 g/ha in case of labours scarcity or it could be an alternative of hand weeding twice.

Key words: Linseed, Herbicide, Oil content, Oil yield, Weed count, Weed dry matter, Weed control efficiency

Introduction

Linseed (*Linum usitatissimum* L.) is an important oil-seed and flax crop of India. It is one of the oldest crops, cultivated in almost all countries of the world for oil, fibre and seed purpose. It has various health benefits due to presence of high content of omega 3, which is having tremendous medicinal values; hence farmers are interested to grow linseed for higher productivity with improved package and practices. It is mainly grown on marginal and sub

marginal soils under rainfed conditions. Maximum area of this crop comes under as utera during Rabi season (Agrawal *et al.*, 2014). In the Indian region, it accounts for about 4.68 lakh ha with total production of 1.63 lakh tones (Anonymous, 2012). While in Jharkhand it is cultivated over 0.26 lakh ha with production of 0.16 lakh MT and its average yield is 6.12 q/ha (Directorate of Economics and Statistics, Ministry of Agriculture and Farmers' Welfare, New Delhi, 2013-16).

Linseed is rich in protein (20%), oil (41%) and di-

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etary fibre (28%). Linseed is basically an industrial oilseed crop and its each and every part is endowed with commercial and medicinal importance (Marchenkov *et al.*, 2003). It is grown mainly for seeds which are used for extracting oil as well as fibre which is used for manufacturing of linen. The seed of linseed contains about 33-47 percent oil. It contains 35-70% linolenic acid (Omega-3 fatty acid), the factor which reduces blood cholesterol concentration.

Being an important oilseed crop, its average productivity in India as well as in Jharkhand is very low in comparison to other countries of the world, The weed management is one of the important constants for higher productivity. Weeds can be controlled by different methods such as manual, mechanical and chemical methods. Usually, for the weed management, farmers do manual weeding, but manual weed management is always arduous, expensive, time consuming, uneconomical and needs to be often repeated at different intervals, as compared to chemical weed management. Weed management with herbicides is an effective, quick in action, and time saving (Ahmed *et al.*, 2005). Therefore, experiment has been conducted for evaluating herbicides for harnessing optimum yield of linseed by controlling of weeds.

Materials and Methods

A field experiment was conducted in upland areas of Research Farm of the Birsa Agricultural University, Kanke, Ranchi (23°17' N latitude, 85°10' E longitude and 625 m above mean sea level), India, during *rabi* seasons of 2018-19 and 2019-20 respectively to evaluate the "Effect of weed management practices on quality, weed count, weed dry matter and weed control efficiency in linseed". Linseed variety taken for experimentation was "Divya". The experiment was laid out in Randomized Block Design with ten treatments comprising of weed management practices *viz.*, T₁-Weedy Check, T₂-Hand weeding twice at 30 and 60 DAS, T₃-Metribuzin 250 g/ha + Oxyflourfen 125g/ha (Pre.), T₄-Pendimethalin 1 kg/ha (Pre.) *fb.* metsulfuron methyl 4 g/ha (Post.), T₅-Imazethapyr 75 g/ha (Post.), T₆-Oxyflourfen 125 g/ha (Pre.), T₇-Metsulfuron methyl 4 g/ha (Post.), T₈-Clodinafop 60 g/ha (Post.), T₉-Clodinafop 60 g/ha + metsulfuron methyl 4 g/ha (Post.) and T₁₀-Oxadiargyl 80 g/ha (Pre.) and were replicated thrice. Soil of the experimental plot was sandy loam

in texture having low carbon (0.34 %) and nitrogen (178.6 Kg/ha), and medium in phosphorous (15.23 Kg/ha) and potassium (184.64 Kg/ha), slightly acidic in nature (pH 5.6). Size of experimental plot was 5 m X 3 m. The mean minimum and maximum temperature throughout the cropping season ranged from 2.2 °C to 38.1 °C respectively during 2018-19, while during 2019-20 the mean minimum and maximum temperature ranged from 2.0 °C to 37.6 °C respectively. Total rainfall recorded during crop period was 66.80 mm in the first year and 393.90 mm in second year of experimentation. The recommended fertilizer dose applied was 80 kg N: 40 kg P₂O₅: 20 kg K₂O /ha supplied through urea, single super phosphate and muriate of potash, respectively. Linseed was sown manually in rows by using 30 kg/ha seed rate with 30 cm row spacing. The recommended package of practices was applied to all the treatments. All observation on quality parameters, weed count, weed dry weight and weed control efficiency were recorded from the marked area of the net plot. All the data obtained from the experiment were put to statistical analysis by adopting appropriate method of "Analysis of Variance" as suggested by the Gomez and Gomez (1976). Critical difference (CD) at 5% level of significance was worked out to determine the difference between the treatments.

Results and Discussion

Effect of weed management practices on seed and stover yields in linseed

Different weed management practices influenced the seed and stover yields of linseed (Table 1). Results revealed that Hand Weeding twice at 30 and 60 DAS recorded with significantly higher seed yield (14.96 q/ha) as compared to Metribuzin 250 g/ha+ Oxyflourfen 125g/ha (Pre.), Pendimethalin 1 kg/ha(Pre.) *fb.* metsulfuron methyl 4 g/ha (Post.), Imazethapyr 75 g/ha (Post.), Clodinafop 60 g/ha(Post.), Clodinafop 60 g/ha+ metsulfuron methyl 4 g/ha(Post.) and statistically superior to rest of the treatments. Moreover, analysis of data revealed that Hand Weeding twice at 30 and 60 DAS resulted in significantly higher stover yield (30.43 q/ha) which was at par with all the treatments while significantly superior over Weedy Check (16.68 q/ha).

These results can be attributed due to marked enhancement in yield attributes and improved weed

Table 1. Effect of weed management practices on seed yield, stalk yield, oil content and oil yield of linseed

Treatments	Seed yield(q/ha)			Stover yield (q/ha)			Oil content (%)			Oil yield (kg/ha)		
	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled
Weedy Check	7.12	7.76	7.44	15.82	17.53	16.68	34.02	34.69	34.35	243.62	270.76	257.19
Hand weeding twice	14.26	15.66	14.96	29.61	31.25	30.43	38.49	39.34	38.91	553.18	620.43	586.80
Metribuzin 250 g/ha + Oxyflourfen 125 g/ha (Pre.)	12.92	14.19	13.55	28.06	29.72	28.89	37.15	37.95	37.55	481.86	540.44	511.15
Pendimethalin 1 kg/ha (Pre.) fb. metsulfuron methyl 4 g/ha (Post.)	13.33	14.60	13.97	28.23	29.96	29.10	37.56	38.37	37.96	502.77	564.28	533.53
Imazethapyr 75 g/ha (Post.)	12.51	13.94	13.23	27.60	29.34	28.47	36.74	37.49	37.11	460.46	523.71	492.09
Oxyflourfen125 g/ha (Pre.)	11.58	12.99	12.29	27.13	28.77	27.95	35.81	36.54	36.18	417.59	477.36	447.48
Metsulfuron methyl 4 g/ha (Post.)	11.83	13.10	12.47	27.16	28.87	28.02	36.06	36.80	36.43	426.70	482.17	454.43
Clodinafop 60 g/ha (Post.)	12.71	14.03	13.37	27.84	29.55	28.70	36.94	37.71	37.32	469.61	529.14	499.37
Clodinafop 60 g/ha + metsulfuron methyl 4 g/ha (Post.)	13.51	14.91	14.21	28.55	30.19	29.37	37.74	38.57	38.15	509.85	575.27	542.56
Oxadiargyl 80 g/ha (Pre.)	11.20	12.47	11.84	26.32	28.04	27.18	35.43	36.14	35.79	398.92	452.62	425.77
SE(m)±	0.74	0.77	0.76	1.44	1.44	1.44	1.44	1.59	1.50	43.08	47.95	45.44
CD at 5%	2.31	2.40	2.31	4.47	4.49	4.48	NS	NS	NS	134.10	149.26	141.42
CV%	10.64	9.98	10.26	9.35	8.83	9.08	6.81	7.35	7.04	16.71	16.49	16.57

control. The treatment, which had higher yield attributing characters and better weed control, produced higher grain and straw yield. The minimum seed yield was recorded under Weedy check, which was attributed due to more weed growth and poor yield attributing characters. These results were in conformity with the findings of Marwat *et al.* (2005), Meena *et al.* (2011) and Mahere *et al.* (2000).

Effect of weed management practices on quality parameters in linseed

The data on oil content (%) and oil yield (kg/ha) is presented in Table 1. The different treatment combination did not affect the oil content. However, pooled data revealed that the highest oil content (38.91%) was observed with the application of Hand Weeding twice. The significant higher oil yield (586.80 kg/ha) was obtained in the treatment where application of Hand Weeding twice was applied which remained at par with rest of the treatments except weedy check (257.19 kg/ha) and Oxadiargyl 80 g/ha (Pre.) (425.77 kg/ha). This might be due to higher yield of linseed in Hand Weeding twice treatment that increased the quality parameter of linseed in both the years and in pooled data also. These findings are in conformity with Mahere *et al.*, (2000) and Dwivedi (2018).

Effect of weed management practices on total weed count, total weed dry matter and weed control efficiency in linseed

The experimental plots during the course of investigation were infested with numerous weeds. Pooled data showed that total weed count (Table 2s) at 30 DAS was recorded significantly minimum in Hand Weeding twice (1.21) followed by clodinafop @ 60 g/ha+ metsulfuron methyl @ 4 g/ha (post) (3.76) and significantly highest in weedy check (5.72). Likewise, total weed count at 60 DAS was also found statistically minimum in Hand Weeding (3.12) as comparable to rest of treatments while maximum in Weedy Check (6.85).

Results of pooled analysis (two-year experimentation) revealed that total weed dry matter (Table 2) was significantly observed least in Hand Weeding twice at 30 DAS (1.18 g/m²) and at 60 DAS (3.50 g/m²) over all the treatments however reported maximum in Weedy Check (5.30 g/m² at 30 DAS and 6.89 g/m² at 60 DAS).

Reduction in dry weight of weed accumulation leads to maximization of weed control efficiency

Table 2. Effect of weed management practices on total weed count and total weed dry matter in linseed

Treatments	Total weed count (No./m ²)						Total weed dry matter (g/m ²)					
	30 DAS			60 DAS			30 DAS			60 DAS		
	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled
T ₁ =Weedy Check	5.64 (31.35)	5.79 (33)	5.72 (32.18)	6.79 (45.74)	6.9 (47.24)	6.85 (46.49)	5.22 (26.87)	5.38 (28.42)	5.30 (27.65)	6.84 (46.46)	6.94 (47.89)	6.89 (47.18)
T ₂ =Hand weeding twice	1.19 (0.91)	1.22 (1)	1.21 (0.96)	3.04 (8.76)	3.19 (9.72)	3.12 (9.24)	1.17 (0.87)	1.18 (0.89)	1.18 (0.88)	3.43 (11.32)	3.57 (12.29)	3.50 (11.81)
T ₃ =Metribuzin 250 g/ha + Oxyflourfen 125 g/ha (Pre.)	4.17 (16.93)	4.3 (18)	4.24 (17.47)	5.39 (29.06)	5.25 (30.43)	5.32 (29.75)	3.96 (15.21)	4.06 (16.01)	4.01 (15.61)	5.21 (26.70)	5.33 (27.92)	5.27 (27.31)
T ₄ =Pendimethalin 1 kg/ha (Pre.) fb. metsulfuron methyl 4 g/ha (Post.)	3.92 (14.83)	4.1 (16.33)	4.01 (15.58)	4.69 (22.61)	4.8 (23.54)	4.75 (23.08)	3.83 (14.15)	3.99 (15.38)	3.91 (14.77)	4.77 (22.84)	4.89 (24)	4.83 (23.42)
T ₅ =Imazethapyr 75 g/ha (Post.)	4.62 (20.98)	4.78 (22.33)	4.7 (21.66)	5.79 (33.06)	5.91 (34.45)	5.85 (33.76)	4.24 (17.51)	4.36 (18.49)	4.30 (18.00)	6.03 (36.54)	6.14 (37.79)	6.09 (37.17)
T ₆ =Oxyflourfen125 g/ha (Pre.)	5.06 (25.23)	5.21 (26.67)	5.14 (25.95)	6.24 (38.44)	6.35 (39.79)	6.30 (39.12)	4.81 (22.62)	4.94 (23.89)	4.88 (23.26)	6.41 (40.76)	6.51 (41.95)	6.46 (41.36)
T ₇ =Metsulfuron methyl 4 g/ha (Post.)	4.66 (21.3)	4.81 (22.67)	4.74 (21.99)	6.17 (37.87)	6.27 (39.15)	6.22 (38.51)	4.39 (18.93)	4.52 (19.93)	4.46 (19.43)	6.22 (38.41)	6.32 (39.68)	6.27 (39.05)
T ₈ =Clodinafop 60 g/ha (Post.)	4.19 (17.08)	4.34 (18.33)	4.27 (17.71)	5.53 (30.09)	5.65 (31.43)	5.59 (30.76)	4.19 (17.14)	4.29 (17.94)	4.24 (17.54)	5.36 (28.94)	5.48 (30.15)	5.42 (29.55)
T ₉ =Clodinafop 60 g/ha + metsulfuron methyl 4 g/ha (Post.)	3.66 (12.93)	3.85 (14.33)	3.76 (13.63)	4.63 (21.15)	4.78 (22.56)	4.71 (21.86)	3.37 (10.93)	3.56 (12.19)	3.47 (11.56)	4.59 (20.70)	4.72 (21.93)	4.66 (21.32)
T ₁₀ =Oxadiargyl 80 g/ha (Pre.)	5.32 (27.81)	5.46 (29.33)	5.39 (28.57)	6.46 (41.25)	6.55 (42.54)	6.51 (42.54)	4.9 (23.67)	5.01 (24.65)	4.96 (24.16)	6.57 (43.17)	6.67 (44.48)	6.62 (43.83)
SE(m)±	0.16	0.15	0.16	0.36	0.36	0.36	0.16	0.16	0.16	0.34	0.40	0.40
CD at 5%	0.49	0.48	0.48	1.13	1.11	1.12	0.51	0.50	0.50	1.04	1.23	1.24
CV%	6.48	6.05	6.26	11.49	11.00	11.25	7.11	6.70	6.90	10.47	12.12	12.36

(pooled data in Table 2). With the application of Hand Weeding twice (inter-culturing) at 30 and 60 DAS recorded highest weed control efficiency (97.03 and 79.95% respectively), which was followed by treatment clodinafop @ 60 g/ha+ metsulfuron methyl @ 4 g/ha (post) having weed control efficiency of 57.50%at 30 DAS and 53.40 % at 60 DAS. Whereas, minimum weed index (0.00 at 30 and 60 DAS) was reported under Weedy Check.

Better control of weeds in Hand Weeding twice at 30 and 60 DAS was due to less infestation of weed at later stage of crop growth along with cultural practices gave maximum weed control efficiency (Table 3) which was followed by clodinafop @ 60 g/ha+ metsulfuron methyl @ 4 g/ha (post). Frisen and freer (1991), Husain *et al.*, (2015), Chhaganiya, H. J. *et al.*, (2018) and Singh *et al.*, (2019) also observed lower weed count, dry weight of weed and maximum weed control efficiency in Hand Weeding twice treatment compared to chemical weed control and weedy check in linseed.

Conclusion

On the basis of two years experimentation, it can be concluded that Hand Weeding twice at 30 and 60 DAS recorded the significantly minimum number of total weed count, total weed dry matter and maximum weed control efficiency with increased quality followed by the post application of clodinafop @ 60 g/ha+ met sulfuronmethyl @ 4 g/hain linseed. For effective quality of lin-

Table 3. Effect of weed management practices on weed control efficiency in linseed

Treatments	Weed Control Efficiency (%)					
	30 DAS			60 DAS		
	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled
T ₁ =Weedy Check	0	0	0	0	0	0
T ₂ =Hand weeding twice	97.08	96.97	97.03	80.66	79.24	79.95
T ₃ =Metribuzin 250 g/ha + Oxyflourfen 125 g/ha (Pre.)	45.96	45.42	45.69	37.45	36.5	36.98
T ₄ =Pendimethalin 1 kg/ha (Pre.) fb. metsulfuron methyl 4 g/ha (Post.)	52.62	50.44	51.53	48.21	47.95	48.08
T ₅ =Imazethapyr 75 g/ha (Post.)	33.12	32.37	32.75	26.94	26.33	26.64
T ₆ =Oxyflourfen125 g/ha (Pre.)	19.75	19.39	19.57	15.55	15.39	15.47
T ₇ =Metsulfuron methyl 4 g/ha (Post.)	31.89	31.15	31.52	16.86	16.8	16.83
T ₈ =Clodinafop 60 g/ha (Post.)	45.47	44.41	44.94	33.25	32.55	32.90
T ₉ =Clodinafop 60 g/ha + metsulfuron methyl 4 g/ha (Post.)	58.58	56.42	57.50	54.17	52.62	53.40
T ₁₀ =Oxadiargyl 80 g/ha (Pre.)	11.19	11.03	11.11	9.52	9.68	9.60
SE(m)±	3.19	3.61	3.40	2.65	2.91	2.78
CD at 5%	9.93	11.23	10.24	8.24	9.05	8.78

seed and weed management it could be an alternative of Hand Weeding twice at 30 and 60 DAS.

Conflict of Interest

The authors declare that the research was conducted in the absence of any potential conflict of interest.

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