EFFECT OF INTEGRATED WEED MANAGEMENT ON YIELD, YIELD ATTRIBUTES AND ECONOMICS OF LINSEED (*Linum usitatissimum* L.)

CHHAGANIYA[1] H. J., A. P. PATEL[2], A. M. PATEL[3], A. J. PATEL[4] AND D. D. PATEL*[5]

DEPARTMENT OF AGRONOMY
N.M.COLLEGE OF AGRICULTURE
NAVSARI AGRICULTURAL UNIVERSITY
NAVSARI-396450 (GUJARAT)

***Email:ddpatel@nau.in**

1. *M.Sc.(Agri.) Student, N.M. College of Agriculture, N.A.U., Navsari, Gujarat*
2. *Associate Professor, College of Agriculture, N.A.U., Waghai, Gujarat*
3. *Assistant Research Scientist, Office of the Directorate of Research, N.A.U., Navsari, Gujarat*
4. *Assistant Professor, Department of Agronomy, N.M.C.A., N.A.U., Navsari, Gujarat*
5. **Principal, Polytechnic in Agriculture, N.A.U.,, Bharuch, Gujarat*

ABSTRACT

Field experiment was conducted on deep black soil of the College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari during rabi season of 2014-2015 to study the effect of integrated weed management on yield, yield attributes and economics of linseed (Linum usitatissimum L.). Potential economic production of linseed can be secured by keeping the field weed free with interculturing (IC) + hand weeding (HW) at 20 and 40 DAS which was followed by application of pendimethalin @ 750 g/ha as pre-emergence + interculturing and hand weeding at 30 DAS.

KEY WORDS: Economics, Isoproturon, Linseed, Oxyfluorfen, Pendimethalin, Quizalofop ethyl, Weed management

INTRODUCTION

Linseed or flax is among the oldest crop plants cultivated for the purpose of oil and fiber. It belongs to the genus *Linum* and family Linaceae. The botanical name, *Linum usitatissimum* was given by Linnaeus in his book "Species Plantarum" (Linnaeus, 1857). It is an annual herbaceous plant with shallow root system. The common names flax and linseed are used in North America and Asia, respectively, for *L. usitatissimum*. Oilseed varieties and fiber varieties are specialized development of this species (Millam *et al*., 2005). The cultivars grown primarily for seed/oil purpose are relatively short in height and possess more secondary branches and seed bolls (seed capsule). The cultivars grown for fiber purpose are tall growing with straight culms and have fewer secondary branches. Every part of linseed plant is utilized commercially, either directly or after processing. Seed contains 33 to 47 per cent oil. A small quantity is directly used for edible purposes. About 20 per cent of the total oil produced is used at farmer level and the rest 80 per cent oil goes to industries in various forms, such as boiled oil, borated oil, eposidized oil, aluminated oil, urethane oil, isomerized oil *etc*. The oil (>66%) is rich in linolenic acid and is a perfect drying oil. The seed of linseed content nutrient value per 100 g is carbohydrates 28.88 g, sugars 1.55 g, fat 42.16 g, protein 18.29 g and dietary fibers 27.39 g (Anonymous, 2013).

The present weed control practices are characterized by intensive use of manual labour and animal power. Both of

them are in short supply and increasingly became uneconomical. Adverse soil and climatic conditions prevent timely removal of weeds through manual and mechanical means. Linseed having less branching habit, small leaf area and show growth during initial growth period, it complete poorly with weeds and often suffers from severe weed competition. Unchecked weed growth has been reported to reduce grain yield of linseed to the tune of 34.2 per cent (Mani *et al*., 1968). Weeds the essential component of agro-ecosystems, interfere with crops and lead to enormous crop losses (Vaid *et al*., 2010).

Weeds infestation imposes serious constraints in realizing higher yields. Hand weeding and interculturing between the rows are the conventional methods of weed control. These methods are troublesome due to labour problem in weeding peak and unavailability of suitable intercultural implements. Under such circumstances suitable integrated weed-management practices remains the only choice for the farmers. Broad-leaf and grassy weeds are commonly associated with this crop which is itself of similar nature. Therefore effective control of these weeds with the use of selective herbicide is difficult and need the integration of intercultural and hand weeding operations also (Angiras *et al*., 1991).

MATERIALS AND METHODS

A field experiment was conducted during *rabi* season of 2014-2015 at the College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari. The experiment was conducted in randomized block design with twelve treatments *i.e.* T_1:Pendimethalin @ 750 g/ha as pre-emergence, T_2:Oxyfluorfen @ 60 g/ha as pre-emergence, T_3:Isoproturon @ 750 g/ha as post-emergence at 15-20 DAS, T_4 : Quizalofop ethyl @ 75 g/ha as post-emergence at 15-20 DAS, T_5: T_1 fb IC and HW at 30 DAS, T_6: T_2 fb IC and HW at 30 DAS, T_7: T_3 fb IC and HW at 30 DAS, T_8: T_4 *fb* IC and HW at 30 DAS, T_9:T_1 + T_4, T_{10}:1 HW at 20 DAS, T_{11}: Weed free (IC *fb* HW at 20 and 40 DAS) and T_{12}:Weedy check with three replications. The experimental soil was deep black having 235 kg ha^{-1} available N, 38 kg ha^{-1} available P_20_5 and 463 kg ha^{-1} available K_20 with 7.6 pH. Linseed local variety was sown on 20 November 2014 at 30 x 10 cm spacing. Observation regarding yield attributing characters *i.e.* number of capsules $plant^{-1}$, number of seeds capsules $plant^{-1}$ and seed yield and Stover yield were noted at harvest. The data were analyzed statistically by adopting the standard procedures described by Panse and Sukhatme (1985).

RESULT AND DISCUSSION

Effect of weed management practices on yield attributing characters and yield

A perusal of data in Tables 1 indicated that number of capsules $plant^{-1}$ (56.01) and number of seeds $capsules^{-1}$ (8.40) significantly increased under treatment weed free i.e. IC follow by HW at 20 and 40 DAS (T_{11}) being at par with T_5, T_6, T_8 and T_7 might be due to periodical application of pre and post emergence herbicides and removal of weeds by hand weeding. Which might has maintained high soil fertility status and moisture content, as less removal of plant nutrients and water through weeds. Similarly, seed yield (810 kg/ha) and stover yield (2391 kg/ha) were also found significantly higher under treatment weed free i.e. interculturing followed by hand weeding at 20 and 40 DAS (T_{11}) which was remained at par with treatments T_5 (Pendimethalin @ 750 g/ha as PE *fb* IC and HW at 30DAS), T_8 (Quizalofop ethyl @ 75 g/ha as PoE at 15-20 DAS *fb* IC and HW at 30DAS), T_6 (Oxyfluorfen @ 60 g/ha as PE *fb* IC and HW at 30 AS) and T_7 (Isoproturon @ 750 g/ha as PoE at 15-20 DAS *fb* IC and HW at 30 DAS). This might be due to effective control of weeds under these treatments, which provided better nourishment and reflected in to higher number of seeds per capsule and capsules per plant. Vedharethinam *et al*.

(2004) reported similar results in sunflower, Jain and Jain (2016) in linseed.

All weed control methods established their superiority over weedy check in respect of seed yield, stover yield and yield attributing characters by virtue of reduced weed competition. Angiras *et al*. (1991) also reported that herbicidal treatments produced significantly higher seed yield over unweeded check in linseed. Mishra *et al*. (2003) also recorded higher yield in hand weeding treatment than chemical weed management in linseed.

Effect of weed management practices on economics

So far economics is concerned (Table 2), among the various weed management treatments, weed free (interculturing followed by hand weeding at 20 and 40 DAS) secured maximum net realization of ₹ .52623 ha^{-1} with highest BCR of 3.72, which was closely followed by net realization of ₹ .51954 ha^{-1} and BCR of 3.71 under treatment T_5 (Pendimithaline @ 1 kg ha^{-1} as PE *fb* IC and HW at 30 DAS). Weedy check (T_{12}) recorded the lowest net realization of ₹ .30996 ha^{-1} with lowest BCR of 2.97. Similar finding was reported by Kapur and Singh (1992), Husain *et al*. (2003), Mishra *et al*. (2003), Kumar and Nagaich (2013) in linseed.

CONCLUSION

Based on the results from the experimentation, it seems quite logical to conclude that potential economic production of linseed can be secured by keeping the field weed free with interculturing (IC) + hand weeding (HW) at 20 and 40 DAS which was followed by application of pendimethalin @ 750 g/ha as pre-emergence + interculturing and hand weeding at 30 DAS.

REFERENCES

Anonymous (2007). AICCIP, Project coordinated report Vol.I, 2006-07, pp. 4-5.

Angiras, N. N., Badiyala, D. and Singh, C. M. (1991). Comparative efficacy of herbicides for weed control in flax (*Linum usitatissimum* L.), *Indian Journal of Weed Science*, **23**(3-4): 19-23.

Anonymous(2013). *www.wikipedia.org/ linseed*.

Husain, K., Tiwari, A. N. and Singh, K., (2003). Bio-efficacy of isoproturon and 2,4-D in linseed grown under irrigated conditions of Uttar Pradesh. *Indian Journal of Weed Science*, 35: 153.

Jain, D. N. and Jain, V. (2016). Weed management with pre and post emergence herbicides in linseed (Linum usitatissimum L.). *Indian journal of weed Science*, **48**(1): 93-94.

Kapur, B. L. and Singh, C. M. (1992). Efficacy of different herbicides for controlling weeds in flax (*Linum usitatissimum* L.) under mid-hill conditions of Himachal Pradesh. *Indian Journal of Weed Science*, **24**(3&4): 89-91.

Kumar, P. and Nagaich, V. P. (2013). Studies on bio-efficacy of new herbicides for weed management in irrigated linseed. *Progressive Research*, 8 (Special): 219-220.

Linnaeus, C. (1857). Species Plantarum. The Royal Society of London, London, UK, pp: 300.

Mani, V. S., K. C. Gautam and T. K. Chakraborty, 1968. Losses in crop yield due to weed growth. PANS (C). 14: pp. 23-27.

Millam, S., Bohus, O. and Anna, P. (2005). Plant cell and biotechnology studies in *Linum usitatissimum* - A review. *Plant Cell Tissue Organ Cult*., **82**: 93-103.

Mishra, J. S., Shingh, V. P. and Yaduraju, N. T. (2003). Bio-efficacy and economics of herbicidal weed control in irrigated linseed (Linum usitatissimum L.). *Indian Journal of Weed Science*, **35**(1-2): 154-155.

Panse, V. G. and Sukhatme, P. V. (1985). Statistical methods for Agricultural

workers, ICAR, New Delhi, pp. 187-197.

Vaid, S., Daizy, R., Batish Singh, H. P. and Kohli, R. K., 2010. Phytotoxic effect of eugenol towards two weedy species. *The Bioscan*. **5**(3): 339-341.

Vedharethinam, R., Sundari, A., Kalaisudarson, S. and Kumar, S. M. (2004). Economic of integrate weed management practices in sunflower based intercropping system. *Indian Journal of Weed Science*, **36**(3&4): 308

Table 1. Effect of weed management on yield attributes and yield of linseed.

Treatments		Number of capsules per plant	Number of seeds per capsule	1000 Seed weight (g)	Seed yield (kg/ha)	Stover yield (kg/ha)
T_1	Pendimethalin @ 750 g/ha as PE	47.54	7.13	6.33	668	2056
T_2	Oxyfluorfen @ 60 g/ha as PE	46.08	7.10	6.25	642	2039
T_3	Isoproturon @ 750 g/ha as PoE at 15-20 DAS	44.43	6.97	6.14	631	2024
T_4	Quizalofop ethyl @ 75 g/ha as PoE at 15-20 DAS	45.84	7.03	6.14	657	2053
T_5	Pendimethalin @ 750 g/ha as PE *fb* IC and HW at 30DAS	52.54	8.07	6.65	801	2358
T_6	Oxyfluorfen @ 60 g/ha as PE *fb* IC and HW at 30 AS	50.44	7.83	6.53	720	2220
T_7	Isoproturon @ 750 g/ha as PoE at 15-20 DAS *fb* IC and HW at 30 DAS	49.75	7.37	6.37	711	2206
T_8	Quizalofop ethyl @ 75 g/ha as PoE at 15-20 DAS *fb* IC and HW at 30DAS	50.32	7.60	6.37	798	2351
T_9	Pendimethalin @ 750 g/ha as PE + Quizalofop ethyl @ 75 g/ha as PoE at 15-20 DAS	48.68	7.15	6.41	688	2061
T_{10}	1 HW at 20 DAS	41.28	6.63	6.02	635	2045
T_{11}	Weed free (IC *fb* HW at 20 and 40 DAS)	56.01	8.40	6.76	810	2391
T_{12}	Weedy check	36.71	5.33	6.26	510	1982
	SEm±	2.20	0.41	0.22	34	112
	CD(P=0.05)	6.46	1.23	NS	99	328
	C.V.%	8.04	10.06	6.24	8.5	9.0

Table 2. Effect of weed management on economics of linseed.

Treatments		Seed Yield (kg ha^{-1})	Stover yield (kg/ha)	Gross return (₹ ha^{-1})	Cost of cultivation (₹ ha^{-1})	Net return (₹ ha^{-1})	BCR
T_1	Pendimethalin @ 750 g/ha as PE	668	2056	59608	17099	42508	3.49
T_2	Oxyfluorfen @ 60 g/ha as PE	642	2039	57477	16534	40943	3.48
T_3	Isoproturon @ 750 g/ha as PoE at 15-20 DAS	631	2024	56552	16629	39922	3.40
T_4	Quizalofop ethyl @ 75 g/ha as PoE at 15-20 DAS	657	2053	58719	18269	40449	3.21
T_5	Pendimethalin @ 750 g/ha as PE *fb* IC and HW at 30DAS	801	2358	71154	19199	51954	3.71
T_6	Oxyfluorfen @ 60 g/ha as PE *fb* IC and HW at 30 AS	720	2220	64260	18634	45626	3.45
T_7	Isoproturon @ 750 g/ha as PoE at 15-20 DAS *fb* IC and HW at 30 DAS	711	2206	63498	18729	44768	3.39
T_8	Quizalofop ethyl @ 75 g/ha as PoE at 15-20 DAS *fb* IC and HW at 30DAS	798	2351	70893	20369	50523	3.48
T_9	Pendimethalin @750 g/ha as PE+ Quizalofop ethyl @ 75 g/ha as PoE at 15-20 DAS	688	2061	61223	19619	41603	3.12
T_{10}	1 HW at 20 DAS	635	2045	56935	17249	39685	3.30
T_{11}	Weed free (IC *fb* HW at 20 and 40 DAS)	810	2391	71973	19349	52623	3.72
T_{12}	Weedy check	510	1982	46746	15749	30996	2.97

Selling price: ***1. Seed per kg 80 ₹*** ***2. Stover per kg 3 ₹***

[MS received : June 15, 2017] ***[MS accepted : June 26, 2017]***