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EFFECTIVENESS OF PRE AND POST EMERGENCE HERBICIDES ON WEED INTENSITY IN LINSEED (*LINUM USITATISSIMUM* L.)

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ABSTRACT

A field experiment was carried out at College of Agriculture, Tikamgarh during *rabi*, 2013-2014 to test the efficacy of different pre and post emergence herbicides on weed intensity in linseed. The soil of the experimental area was clayey loam, which was medium in organic carbon, low in available nitrogen and phosphorus but medium in potassium content having neutral pH. Results revealed that pre emergence application of pendimethalin @ 1 kg + imazethapyr @ 1 kg a.i./ ha and two hand weeding at 20 and 40 DAS recorded the lowest density of *Cynodon dactylon* among the monocot and *Sonchus asper*, *Melilotus officinalis*, *Chenopodium album*, *Convolvulus arvensis* and *Anagallis arvensis* among dicots at 40 days after sowing as compared to rest of the treatments. Maximum grain yield was recorded in two hand weeding at 20 and 40 DAS (2003 kg/ha) and pendimethalin @ 1 kg + imazethapyr @ 1 kg a.i./ha, (1923 kg/ha) due to effective control of grassy and broad-leaf weeds in linseed. Based on the result, it can be concluded that the pre emergence application of pendimethalin @ 1 kg + imazethapyr @ 1 kg/ha significantly the lowest weed density as well as highest seed yield.

INTRODUCTION

India is an important linseed growing country in the world and it contributes 7% to the world linseed pool. At present, linseed is cultivated in about 500 thousand hectares with a contribution of 130 thousand tones to the annual oilseed production of the country. Its average productivity is 260 kg/ha (FAO STAT, 2012). Major linseed growing states in India are Madhya Pradesh, Uttar Pradesh, Chhattisgarh, Bihar, Rajasthan, Orissa and Karnataka (Chauhan *et al.*, 2009). Madhya Pradesh has largest growing area (1.26 lakh ha) and production (0.48 lakh tones) with 382 kg /ha productivity (Anonymous, 2010). The crop is being grown under input starve condition by the resource poor farmers in indo-gangetic plain, central and peninsular region of the country. Weeds are one of the major constraints in linseed production and yield loss due to weed infestation in linseed was 36% (Singh *et al.*, 1992). The crop is very poor competitor of weeds, and to obtain acceptable linseed yields, weeds should be effectively controlled (Karimmojeni *et al* 2013). Linseed crop is mainly infested with *Anagallis arvensis*, *Melilotus spp.*, *Solanum nigrum*, *Chenopodium album*, *Cyperus spp.*, *Phalaris minor* and *Eleusine indica* in *Rabi* season (Singh *et al.* 2014). Linseed plant is poor competitor with weeds with its initial slow growth and small leaves, it does not shade the ground sufficiently and hence weeds get excellent opportunity to develop (Jain and Agarwal.1998). Weed management through hand weeding although effective in reducing the weed competition but it has certain limitations such as unavailability of sufficient manpower during peak periods, high labour cost and time consuming. Keeping this in view, the present investigation was carried out to find out the efficacy of herbicides on weeds and seed yield of linseed.

MATERIALS AND METHODS

The present study entitled "Effectiveness of pre and post emergence herbicides on weed intensity in Linseed (*Linum usitatissimum* L.)" was conducted at Research farm, College of Agriculture, Tikamgarh during *rabi*, 2013-2014. The experiment was aimed to find out the efficacy of herbicides on weeds growth, yield and to determine the economic viability of herbicidal weed control in linseed. The soil of the experimental area was clayey loam, which was medium in organic carbon, low in available nitrogen and phosphorus but medium in potassium content having neutral pH and normal electrical conductivity. The experiment was laid out in "Randomized block design" with nine treatments, replicated thrice. The treatments comprised of pre emergence herbicides *viz*; pendimethalin @ 1 kg /ha, pendimethalin + imazethapyr @ 1 kg /ha and pendimethalin + imazethapyr @ 0.75 kg /ha, post-emergence herbicides *viz*; imazethapyr @ 75 g /ha, imazethapyr @ 100 g /ha, isoproturon @ 1 kg/ha and clodinafop 60 g/ha and these treatments were compared with two hand weeding at 20 and 40 DAS and weedy check. The linseed variety "JLT-26" was sown on October 27, 2013 with seed rate of 30 kg /ha in rows 30 cm apart with fertilizer dose of 80:40:20 kg/ ha. Pre-emergence herbicides

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were applied on next day of sowing. The herbicides were applied in 500 liters of water per ha by knapsack sprayer, using flat fan nozzle.

Weed population and relative weed density

The observations on population of major weeds viz; *Cynodon dactylon*, *Sonchus asper*, *Melilotus officinalis*, *Chenopodium album*, *Convolvulus arvensis*, *Anagallis arvensis* and other associated weeds were recorded, at 40 DAS. The quadrat of 1 m² (square meter) was randomly placed at four places in each plot and then the species wise and total weed count was recorded. The percentage composition of weed flora was estimated from weedy check plot. The relative density of individual weed was worked out as per formula proposed by Mishra (1968).

$$\text{Relative Density (\%)} = \frac{\text{Number of individuals of the same species}}{\text{Number of individuals of the all species}} \times 100$$

RESULTS AND DISCUSSION

Effect of weed flora

Predominant weed species observed in the experimental field consisted of grassy and Broad leaved weeds. The major weed species in the experimental plots were *Cynodon dactylon*, *Sonchus asper*, *Melilotus officinalis*, *Chenopodium album*, *Convolvulus arvensis* and *Anagallis arvensis*. These six species were most dominant, contributing about 82.77 per cent of the total weed flora. Relative density at 40 days after sowing and have been presented in the Table 1 and Figure 1. Relative density of monocotyledonous weed *Cynodon dactylon* was 18.52 % whereas among the dicotyledonous weeds *Chenopodium album* recorded the highest relative density of 22.09% followed by *Convolvulus arvensis* (12.91 %) and

Table 1: Relative density of dominant weeds at 40 DAS

Weed species	Relative density(%)
1. <i>Cynodon dactylon</i> (L.)	18.42
2. <i>Sonchus asper</i> (L.)	12.24
3. <i>Melilotus officinalis</i> (L.)	8.84
4. <i>Chenopodium album</i> (L.)	22.09
5. <i>Convolvulus arvensis</i> (L.)	12.91
6. <i>Anagallis arvensis</i> (L.)	9.18

Sonchus asper 12.24%. The higher density of *Chenopodium album* may be due to the fact that the favorable environment condition viz; temperature and moisture which the provide quick germination, vegetative growth and survival capacity as well as the greater competitive ability than the other weeds. Similar result were reported by Mishra *et al.* (2003) at Jabalpur (M.P.), found the dominance of dicot weeds viz; *Cichorium intybus* (46.7%), *Medicago hispida* (10.9%), *Vicia sativa* (3.4%), whereas the monocot weeds *Phalaris minor* (8.8%) and *Avena sterilis* sp. *ludoviciana* (2.1%) as monocot weed flora in linseed.

Efficacy against grassy weeds

clodinafop at 60 g/ha and two hand weeding at 20 and 40 DAS was significantly at par with isoproturon @ 1 kg/ha at 2-3 leaf stage of weeds in linseed, which recorded the lowest weed density at 40 days as compared to rest of the treatments (Table 2). Application of imazethapyr @ 75 g/ha at 2-3 leaf stage of weeds were however, significantly superior over untreated control, and rest of the treatments. The effectiveness of these herbicides were they reported by Sandhu *et al* (1988) observed that application of isoproturon gave effective weed control in linseed. isoproturon and clodinafop are post-emergence herbicide. It is absorbed readily into leaves and is thoroughly system after absorption by roots and foliage. They inhibit acetolactate synthase (ALS), also called acetohydroxy acid synthase (AHAS), a key enzyme in the biosynthesis of the branched-chain amino acid isoleucine, leucine, and valine, plant death result from event occurring in ALS inhibition, and isoproturon it is readily absorbed by roots and rapidly translocated by upper plant parts via the apoplastic movement. Inhibition of the hill reaction of photosynthesis is the primary site of action of isoproturon. This involves the site of oxygen evolution in PS II and prevents the formation of ATP and NADPH which are required for CO₂ fixation.

Efficacy against broad-leaved weeds

Pendimethalin @ 1 kg/ha + imazethapyr @ 1 kg/ha was at par with its lower dose, i.e. 0.75 kg/ha, imazethapyr 75 and 100 g/ha, two hand weeding at 20 and 40 DAS and alone application of Pendimethalin @ 1 kg/ha recorded lowest density of weeds at 40 days after sowing against broad-leaved weeds, viz. *Sonchus asper*, *Melilotus officinalis*, *Chenopodium album*, *Convolvulus arvensis* and *Anagallis arvensis* (Table 2) as

Table 2: Effect of herbicides on weed intensity (no./m²), seed yield (kg/ha) of linseed

Treatments	Weed intensity m ²						Seed yield (kg/ha)
	<i>Cynodon dactylon</i>	<i>Sonchus asper</i>	<i>Melilotus officinalis</i>	<i>Chenopodium album</i>	<i>Convolvulus arvensis</i>	<i>Anagallis arvensis</i>	
T ₁ - Weedy check	6.02(2.53)	4.00(2.12)	2.89(1.84)	7.22(2.77)	4.22(2.17)	3.00(1.87)	1366
T ₂ - Hand weeding Twice at 20 and 40 DAS	0.00(0.71)	0.00(0.71)	0.11(0.76)	1.00(1.22)	0.87(1.17)	0.67(1.08)	2003
T ₃ - Pendimethalin @ 1 kg/ha (Pre-emergence)	1.26(1.31)	0.78(1.13)	0.73(1.11)	2.11(1.61)	1.89(1.54)	1.02(1.23)	1686
T ₄ - Pendimethalin @ 1 kg/ha + Imazethapyr @ 0.75 kg/ha (Pre-emergence)	0.86(1.16)	0.33(0.91)	0.44(0.97)	1.78(1.50)	1.67(1.46)	1.00(1.22)	1852
T ₅ - Pendimethalin @ 1 kg/ha + Imazethapyr @ 1 kg/ha (Pre-emergence)	0.73(1.10)	0.11(0.78)	0.42(0.96)	1.56(1.43)	1.41(1.37)	0.89(1.16)	1923
T ₆ - Isoproturon @ 1 kg/ha at 2-3 leaf stage of weeds	0.33(0.88)	2.22(1.64)	2.38(1.70)	5.00(2.35)	3.27(1.93)	2.35(1.70)	1632
T ₇ - Clodinafop @ 60 g/ha at 2-3 leaf stage of weeds	(0.00)(0.71)	2.78(1.81)	2.67(1.78)	5.89(2.52)	3.67(2.03)	2.78(1.81)	1609
T ₈ - Imazethapyr @ 75 g/ha at 2-3 leaf stage of weeds	0.56(1.00)	1.00(1.22)	1.50(1.41)	2.78(1.65)	2.67(1.77)	1.67(1.47)	1713
T ₉ - Imazethapyr @ 100 g/ha at 2-3 leaf stage of weeds	0.78(1.03)	0.71(1.09)	1.22(1.31)	2.83(1.82)	2.11(1.61)	1.56(1.43)	1748
S.E.m. +	0.16	0.09	0.09	0.11	0.12	0.08	60.00
LSD (P=0.05)	0.48	0.27	0.28	0.35	0.37	0.22	120.34

*The data is subjected to square root transformation. Values in parenthesis are original values.

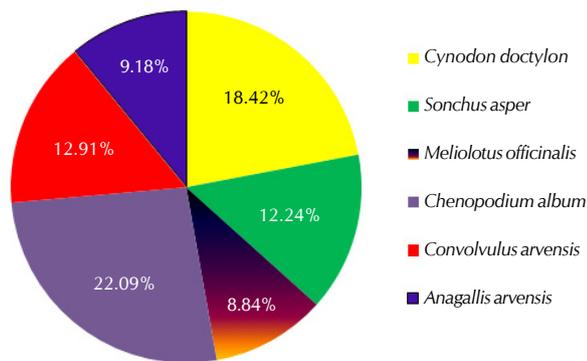


Figure 1: Relative density (%) of weed flora in experimental field at 40 days after sowing

compared to weedy check. Clodinafop 60 g/ha and isoproturon @ 1 kg/ha at 2-3 leaf stage of weeds was found to be ineffective against broad-leaved weeds. Excellent control of complex weed flora in linseed was observed with the application of Pendimethalin @ 1 kg/ha+ imazethapyr @ 1 kg /ha. The effectiveness of pendimethalin + imazethapyr as broad spectrum against weed control in linseed was also reported by Singh et al.(2014) at BHU, Varanasi they also reported that imazethapyr @ 100 g/ha was significantly superior in reducing the weed density as compared to weedy check. Application of pendimethalin + imazethapyr controlled the grassy and broad leaved weed. Its application was reduced weed intensity significantly as compared to isoproturon and clodinafop. Effectiveness of imazethapyr is due to inhibition of growth with a few hours after application, but injury symptoms usually appear after 1 & 2 week or more. Meristematic areas become chlorotic, followed by a slow general foliar chlorosis and necrosis, generally absorbed rapidly in foliage although absorption rapidly in to foliage, although absorption varies from 20 to 90 percent in 24 hour, root absorption is slower imazethapyr translocate in both xylem and phloem.

Effect of seed yield

The data on Table 2 seed yield revealed that all the weed control treatments (T_2 - T_9) recorded significantly higher seed yield over weedy check (1366 kg /ha), whereas the hand weeding twice at 20 and 40 DAS registered significantly the higher seed yield (2003 kg /ha) among all the treatments and

was at par with pendimethalin @ 1 kg a.i. + imazethapyr @ 1 kg/ ha (1923 kg /ha). Application of pendimethalin + imazethapyr @ 0.75 kg /ha yielded significantly more than alone application of pre-emergence pendimethalin post-emergence isoproturon, clodinafop imazethapyr @ 75 g /ha and but was not differ with imazethapyr @ 100 g/ha. Similar result confirmed by (Bali et. al.2016). The weed competition was negligible in hand weeded plots as they were almost completely removed from inter and intra row spaces. The crop plants grew well in weed free environment, with the results; yield attributes attained relatively greater values and finally the highest seed yield. The results are in accordance with the findings of Jain and Agrawal (1998) at Jabalpur, India, revealed that the hand weeding twice at 20 and 50 days after sowing significantly improved yield components and seed yield.

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