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Weed management in field pea with special reference to wild safflower

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ABSTRACT

Field investigations were carried out for three consecutive *rabi* seasons (2001-04) on farmers' field at Bariapur village of Jalaun district in Uttar Pradesh to develop effective weed management technology in field pea involving cultural and chemical measures for managing weed problem especially menace of *Carthamus oxyacantha*. Results revealed that metribuzin (175 g/ha) as pre-emergence followed by metribuzin (87.5g /ha) as post-emergence (after first irrigation) demonstrated satisfactory the mortality of *C. oxycantha* and other associated weeds with an overall weed control efficiency of 72.0% resulting in increased grain yield by 56.8% and greater net monetary returns (Rs 7140 /ha) with higher B:C ratio (5.49) over unweeded. Cross or bi-directional sowing reduced dry weight of weeds to the extent of 1 1% only and failed to incr ease grain yield significantly. Use of five tined hoe caused weed mor tality to the extent of 18-24% resulting in increased grain yield to the extent of 16-17%.

Key words: *Carthamus oxyacantha*, Weed control efficiency, Field pea

Field pea (*Pisum sativum*L.) is a major crop in Jalaun area of Bundelkhand region of Uttar Pradesh. Recently, *Carthamus oxyacantha* - a spiny weed has posed severe problem especially in cultivation of field pea. Reduction in grain yield has been reported to the extent of 25-35% due to the weed infestation in pea (Tewari *et al.* 1996 and Mishra and Bhan 1997). First 30-45 days after sowing have been considered to be critical for crop weed competition in this crop (Tripathi *et al.* 2001). Most of the times labourers refuse to enter in the field for various agricultural operations because of spiny nature of this weed. Considering the severity of the problem, an effort was made to develop an effective weed management technology for controlling *C. oxyacantha* through integrated approach involving herbicides, method of sowing, and use of weeding tools.

MATERIALS AND METHODS

Field investigations were carried out on farmers' field during three consecutive *rabi* seasons of 2001-02, 2002-03 and 2003-04 to develop effective and economical weed management technology with special reference to *C. oxyacantha* control in field pea crop in red soil-locally known as '*parua'* soil in Jalaun district of Uttar Pradesh. The experimental field was deficient in available N and medium in available P and K contents. Fifteen treatments consisting of different combination of sowing methods (normal and cross or bi-directional), hand weeding, hoeing (inter and intra spaces), herbicides and their stages of application were tested in randomized block design with 3 replications (Table 1). In cross sowing, seed was sown in both the directions i.e. North to South and East to West. A dwarf pea 'Swati' maturing in 125-130 days was used in this investigation. Sowing was done during second fortnight of November and harvested during last week of March in all the years of investigation. The crop was sown in rows 25 cm apart using 100 kg seed/ha. In cross sowing, half of the total seed was sown from each side. An uniform application of 18 kg N and 46 kg P_2O_5/ha through diammonium phosphate was done as basal application to the crop. In all, two irrigations were given to the crop. Metribuzin was dissolved in 500 litres of water for one hectare area basis and applied at second day after sowing through Knapsack sprayer as per treatment. In case of post-emergence application, it was applied after first irrigation at 25 days after sowing (DAS). After harvesting of the crop, glyphosate (1.2 kg/ha) was sprayed (500l/ha) on the foliage of *C. oxyacantha* to avoid further seed dissemination. Hand weeding treatments were done at 25 and 45 DAS. Inter/intra row hoeing was done at 25 DAS. Weeds were collected and counted from an area of 0.50 m^2 quadrate from four places in each treatment plot at 60 DAS and then classified into different species and their oven-dry weight was recorded. The original data on weed density were transformed using $\sqrt{X+0.05}$ before statistical analysis.

Table 1. Weed density and dry matter accumulation r ecorded under different weed control tr eatments in field pea

Treatment	Weed density (No./m^2)									Weed d
	2001-02			2002-03			2003-04			2001-2002
	C oxyacantha	*C. album*	*A. arvensis*	*C. oxyacantha*	*C. album*	*F. parviflora*	*C. oxyacantha*	*C. album*	*S. arvensis*	
Normal sowing (unweeded)	4.28 (18)	6.12 (37)	13.76 (189)	3.95 (15)	1.76 (3)	5.73 (32)	4.23 (18)	6.62 (45)	8.11 (65)	102.7
Normal sowing + 2 HW	2.03 (4)	2.79 (7)	5.13 (26)	2.76 (7)	1.15 (1)	3.11 (9)	2.64 (7)	2.05 (5)	4.57 (24)	22.2
Normal sowing *fb* inter row hoeing through five tined hoe	3.67 (13)	4.22 (17)	12.03 (144)	3.50 (12)	1.57 (2)	4.39 (19)	3.28 (11)	4.39 (19)	6.24 (39)	70.4
Normal sowing *fb* hoeing in inter and intra row spaces through five tined hoe	3.39 (11)	3.58 (12)	9.64 (92)	3.80 (14)	1.73 (3)	4.30 (18)	3.36 (11)	3.36 (11)	4.29 (18)	66.7
Cross sowing (unweeded)	3.95 (15)	5.81 (33)	11.72 (137)	4.37 (19)	1.45 (2)	5.16 (26)	4.09 (17)	6.74 (46)	7.39 (55)	88.9
Cross sowing + 2 HW	2.44 (5)	3.43 (11)	5.64 (31)	2.99 (9)	1.53 (2)	3.81 (14)	2.88 (8)	1.32 (2)	6.41 (41)	18.6
Cross sowing *fb* metribuzin (175 g /ha) + 1 HW	2.03 (4)	2.79 (7)	2.87 (8)	2.53 (6)	1.53 (2)	3.15 (9)	3.17 (10)	0.71 (0)	4.18 (17)	23.7
Normal sowing *fb* metribuzin (175 g /ha) pre-em.	2.79 (7)	1.68 (2)	2.03 (4)	3.02 (9)	1.56 (2)	4.15 (17)	3.61 (13)	2.63 (7)	4.58 (21)	23.3
Normal sowing *fb* metribuzin (262.5 g /ha) pre-em.	0.71 (0)	2.29 (5)	0.71 (0)	3.42 (11)	1.18 (1)	3.91 (15)	3.79 (14)	2.26 (6)	7.59 (57)	21.6
Normal sowing *fb* metribuzin (350 g /ha) pre-em.	2.03 (4)	0.71 (0)	2.59 (6)	2.97 (9)	1.33 (1)	3.50 (12)	2.78 (7)	0.71 (0)	4.21 (19)	16.7
Normal sowing *fb* metribuzin (175 g /ha) pre-em. *fb* metribuzin (87.5 g /ha) post-em.	1.52 (2)	0.71 (0)	0.71 (0)	2.49 (6)	0.81 (0)	2.38 (5)	1.44 (3)	1.79 (3)	4.71 (23)	24.0
Normal sowing *fb* metribuzin (175 g /ha) pre-em. *fb* metribuzin (131.25 g /ha) post-em.	1.68 (2)	2.29 (5)	2.03 (4)	2.41 (5)	0.81 (0)	2.90 (8)	2.17 (5)	0.71 (0)	4.24 (19)	29.3
Normal sowing *fb* metribuzin (175 g /ha) pre-em. *fb* metribuzin (175 g /ha) post-em.	1.68 (2)	1.95 (3)	0.71 (0)	2.53 (6)	0.94 (0)	3.45 (11)	1.91 (4)	0.71 (0)	5.01 (25)	27.1
Normal sowing *fb* metribuzin (175 g /ha) pre-em. *fb* metribuzin (175 g /ha) post- em. fb glyphosate (1.20 kg /ha) after harvesting	1.52 (2)	0.71 (0)	1.46 (2)	2.02 (5)	0.94 (0)	3.03 (9)	1.18 (1)	0.71 (0)	4.33 (19)	21.1
Normal sowing *fb* metribuzin (175 g /ha) + 1 HW	1.87 (3)	2.03 (4)	2.64 (6)	1.79 (3)	1.37 (2)	3.32 (10)	1.79 (3)	0.71 (0)	5.14 (26)	27.2
LSD (P=0.05)	1.52	1.29	5.63	1.02	NS	1.09	1.54	1.55	1.68	53.6

Transformed value $\sqrt{X+0.5}$; Figures in parentheses indicate original population; HW=hand weeding; fb=followed by

RESULTS AND DISCUSSION

Effect on weeds

The experimental field was consisted with *Carthamus oxyacantha* (18.9%) and *Chenopodium album* (20.2%) in unweeded plot during all the years of field experimentation (Table 1). *Anagallis arvensis, Fumaria parviflora* and *Spergula arvensis* were also noted to the extent of 77.5, 64.3 and 50.8% during 2001-02, 2002-03 and 2003-04 only, respectively. Weed control treatments reduced the population of *C.oxyacantha* and other associated weeds significantly during all the years except *C.album* during 2002-03. Cross sowing failed to reduce the *C.oxyacantha* population significantly in almost all treatments. Similarly, use of five tined hoes was not found as effective as manual weeding. No significant variations were found in respect of mortality of *C. oxyacantha* and other associated weeds due to increasing doses of metribuzin from 175 to 350 g/ha. Increase in the doses of metribuzin from 87.5 to 175 g/ha under post-emergence treatment was also not found advantageous in diminishing the weed population under study. Over all, the dry matter of weeds declined significantly due to the application of weed control treatments during all the years of field experimentations. Cross sowing suppressed weed growth by 11.0%. Use of five tined hoe brought about significant reduction in dry-matter accumulation of weeds showing 18.2-23.9% weed control efficiency. Normal sowing followed by two hand weeding, normal sowing followed by pre-emergence application of metribuzin (175 g/ha) supplemented with one hand weeding and normal sowing followed by pre-emergence application of metribuzin (175 g/ha) followed by post-emergence application of metribuzin

Table 2. Grain yield, weed control efficiency and economics of field pea as influenced by different weed control treatments

Treatment	Grain yield (kg/ha)			Average Mean	Weed control efficiency (%)	Additional cost over unweeded (Rs/ha)	Additional net return due to weed control (Rs/ha)	B : C ratio
	2001-2002	2002-2003	2003-2004					
Normal sowing (unweeded)	960	1211	1544	1238.33	-	-	-	-
Normal sowing + 2 HW	1744	1578	2175	1832.33	77.49	3000	4124	1.37
Normal sowing *fb* inter row hoeing through five tined hoe	1124	1489	1707	1440.00	18.20	400	2020	5.05
Normal sowing *fb* hoeing in inter and intra row spaces through five tined hoe	1291	1458	1593	1447.33	23.94	600	1908	3.18
Cross sowing (unweeded)	1044	1344	1647	1345.00	11.03	150	1130	7.53
Cross sowing + 2 HW	1816	1607	2095	1839.33	73.49	3000	4212	1.40
Cross sowing *fb* metribuzin (175 g/ha) + 1 HW	1979	1722	1755	1818.67	70.24	2000	4964	2.48
Normal sowing *fb* metribuzin (175 g/ha) pre-em.	1541	1395	1880	1605.33	62.61	800	3604	4.50
Normal sowing *fb* metribuzin (262.5 g/ha) pre-em.	1758	1460	1989	1735.67	65.18	1150	4818	4.12
Normal sowing *fb* metribuzin (350 g/ha) pre-em.	1871	1518	1938	1775.67	70.92	1400	5048	3.60
Normal sowing *fb* metribuzin (175 g/ha) pre-em. *fb* metribuzin (87.5 g/ha) post-em.	2074	1773	1978	1941.67	71.98	1300	7140	5.49
Normal sowing *fb* metribuzin (175 g/ha) pre-em. fb metribuzin (131.25 g/ha) post-em.	1983	1766	1829	1859.33	62.46	1450	6001	4.14
Normal sowing *fb* metribuzin (175 g/ha) pre-em. *fb* metribuzin (175 g/ha) post-em.	1683	1721	2033	1812.33	67.82	1600	5287	3.30
Normal sowing *fb* metribuzin (175 g/ha) pre-em. fb metribuzin (175 g/ha) post-em. *fb* glyphosate (1.20 kg/ha) after harvesting	1608	1655	1973	1745.33	69.71	3300	2783	0.84

Selling/purchase rates/wages of labour
Pea grain=Rs 12/kg; metribuzin=Rs 2500/kg; glyphosate=Rs 480/l; labour=Rs 50/day

(87.5g/ha) remained statistically at par with respect to dry-matter of weeds and demonstrated 77.5, 67.0 and 72.0% weed control efficiency, respectively. The efficacy of metribuzin in pea crop against *C. album* has also been reported in earlier studies by Tewari *et al.* (1996).

Effect on crop

On an average, uncontrolled weeds caused 32.4 and 36.2% reduction in grain yield of pea, when compared with hand weedings twice and pre-emergence application of metribuzin (175 g/ha) followed by post-emergence application of metribuzin (87.5 g/ha), respectively (Table 2). All the treatments yielded higher than weedy check except cross sowing which did not increase grain yield significantly during all the years of experimentation. The highest grain yield was recorded under metribuzin (175g/ha) as pre-emergence + metribuzin (87.5g/ha) as post-emergence treatment which recorded almost at par grain yield to that of normal and cross sowing each supplemented with two hand weedings at 25 and 45 DAS. It might be mainly due to sequential application of metribuzin which increased its efficacy that provided better control of weeds, ultimately resulting in higher grain yield. No significant increase could be visualized in grain yield due to increase in the doses of metribuzin. Normal and cross sowing coupled with two hand weedings produced grain yields statistically at par but these treatments proved significantly superior over unweeded check and produced on an average 47.9 and 48.5% higher grain yield, respectively.

Economics

Maximum net monetary return (Rs, 7140/ha) was obtained under metribuzin at 175 g/ha as pre-emergence followed by metribuzin at 87.5g/ha as post-emergence (Table 2). Application of metribuzin at 175 g/ha as pre-emergence followed by metribuzin at 131.25g/ha (Rs 6001/ha) as well as metribuzin at 175g/ha (Rs 5287/ha) as post-emergence treatments under sequential application were next in order. Cross sowing with weedy plot gave highest benefit-cost ratio (7.53) followed by metribuzin (175 g/ha) as pre-emergence + metribuzin (87.5g/ha) as post-emergence (5.49). The highest benefit-cost ratio obtained under cross sowing (unweeded) plot was mainly due to very less treatment cost.

It can be concluded from the above study that pre-emergence application of metribuzin (175g/ha) followed by post-emergence application of metribuzin (87.5g/ha) after first irrigation was found effective against reducing the dry weight of *C. oxycantha* and other associated weeds appreciably with obtaining an overall weed control efficiency of 72% resulting in increased grain yield and higher net monetary returns over unweeded check. Use of five tined hoe also suppressed weeds effectively and increased grain yield to the satisfactorily level.

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