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Weed management in berseem

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ABSTRACT

Experiments was conducted during *Rabi* season of three consecutive years from 2012 to 2015 to study the effect of weed management on forage and seed yield of berseem (*Trifolium alexandrinum* L.) in medium black soil. The treatment combinations were application of pre-emergence herbicides *viz*. pendimethalin and oxyflourfen and post-emergence herbicide, *viz*. imazethapyr in different proportion along with weedy check (control). Based on the pooled mean data for three years, it was revealed that green fodder, dry matter and crude protein yields (34.39, 4.53 and 0.81 t/ha respectively) were significantly higher in treatment combination of oxyflourfen 0.1 kg/ha + imazethapyr 0.1 kg/ha immediate after harvest of first cut. The same treatment combination recorded highest seed yield (0.47 t/ha) and straw yield (5.87 t/ha) with net monetary returns of ` 1,34,048/ha, benefit cost ratio of 3.43 and maize fodder equivalent yield of 72.68 t/ha. The lowest weed dry matter yield (0.05 t/ha) and highest weed control efficiency (80.97%) were recorded in same treatment combination.

Key words: Berseem, Forage yield, Seed yield, Weed management, Weed control efficiency

Berseem (*Trifolium alexandrium* L.), a potential winter forage legume, is one of the most popular crop in North, North-West and central parts of India. It is well known green forage crop to stimulate milk production in dairy animals. Due to its excellent and quick re-growing ability and long durational nutritious green fodder availability (November to April), the crop is grown under irrigated condition. Because of its slow growth in the initial stages, yield reduction in the crop on account of weeds is well documented. Weeds particularly *Cichorium intybus* found associated with berseem and give more computational stress by robbing the crop of essential nutrients, light, moisture and space (Thakur *et al.* 1990). Weed competition substantially reduces the green forage yield and consequently, it causes reduction up to 30-40% besides deteriorating quality of green forage, if not controlled during critical period of crop-weed competition (Jain 1998a). Therefore, there is need to create an environment that is detrimental to weeds and favourable to the crops. Physical methods of weed control are very costlier, labour intensive and sometimes it is not possible due to non availability of labours. Under such situation, chemical weed control offers a better alternative to manual weeding. Since, meager information is available on the comparative studies of different weed control practices in berseem, the present investigation was undertaken to evaluate the bio efficacy of herbicide alone or in combination with use of two different herbicides in sequence for managing the weeds in berseem.

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MATERIALS AND METHODS

Experiment was conducted at Central Research Station, Urulikanchan of BAIF, Pune during three consecutive years in *Rabi* 2012-13 to 2014-15 to study the effect of weed management on forage and seed yield of berseem (*Trifolium alexandrinum* L.). The soil of the experimental field was sandy clay in texture, low in available nitrogen (147 kg/ha), high in available phosphorus (43 kg/ha) and medium in available potassium (195 kg/ha). It was moderately alkaline in reaction (pH 7.29) with 0.59 dSm^{-1} electrical conductivity and organic carbon content was 0.52%. The experiment consisting of 10 treatments (Table 1) was laid out in randomized block design replicated thrice. The gross and net plot size was 4.0 x 3.0 m and 3.40 x 2.40 m respectively.

The treatment combinations were application of pre-emergence herbicides *viz*. pendimethalin, oxyflourfen and post-emergence herbicide, *viz*. imazethapyr in different proportion along with weedy check. Herbicides were sprayed with manually operated knapsack sprayer fitted with flat fan nozzle at spray. Pre-emergence herbicides were sprayed two days after sowing prior to emergence of weed as well as crop and post-emergence herbicide was applied immediately after harvest of Ist cut for fodder. The crop was given the recommended dose of fertilizers *i.e.* 20 kg N, 80 kg P_2O_5 and 40 kg K_2O/ha. The

variety '*Wardan*' was sown at 30 cm apart by using seed rate of 25 kg/ha. First two cuts were taken for green forage and after harvesting of second cut for fodder, the crop was left for seed production. Harvesting of seed was done in the month of May. From each plot, representative fresh plant sample was taken in each cut to estimate the dry matter content for computing dry matter yield of fodder.

The weed count (monocot and dicot) and its dry weight were recorded from each plot by using a quadrate method (1.0 x 1.0 m) at harvest of last cut for seed. The weed count and weed dry weight values were transformed for statistical analysis. The weed control efficiency (WCE) and weed index (WI) were calculated as per the standard formula suggested by Gill and Vijayakumar (1969). Soil fertility status (pH, E.C., O.C., N, P and K) was determined using the standard methods described in (AOAC, 1995). The growth and yield observations were recorded at every cut and samples were analysed in laboratory by using standard analytical methods. The pooled data for three years was statistically analysed.

RESULTS AND DISCUSSION

Weed count

The data revealed that treatment of weedy check recorded significantly higher grasses (monocot), broad-leaved (dicot) and total weed count/m^2 at harvest than rest of the treatments (Table 1). However, significantly minimum monocot, dicot and total weeds (44.33, 6.33 and 50.66/m^2) were observed in treatment oxyflourfen 0.10 kg/ha followed by imazethapyr 0.10 kg/ha immediate after harvest of I^{st} cut. The results were in accordance with Pathan and Kamble (2012) and Pathan *et al.* (2013).

Weed dry weight

The weed dry weight was significantly higher (0.27 t/ha) in weedy check as compared to rest of the treatments. Whereas, treatment oxyflourfen 0.10 kg/ha followed by imazethapyr 0.10 kg/ha immediate after harvest of I^{st} cut registered the lowest (0.05 t/ha) dry weight of weed at harvest (Table 1). The results were in accordance with the findings of Jain (1998a), Tamrakar *et al.* (2002), Pathan and Kamble (2012) and Pathan *et al.* (2013).

Weed control efficiency

Pre-emergence application of oxyflourfen 0.10 kg/ha followed by post-emergence application of imazethapyr 0.10 kg/ha immediate after harvest of I^{st} cut recorded maximum (80.97 %) and significantly superior weed control efficiency over rest of the treatments. The higher weed control efficiency might be due to reduced dry weight of weeds in treatment oxyflourfen 0.10 kg/ha + imazethapyr 0.10 kg/ha (immediate after harvest of I^{st} cut) as compared to weedy check (Table 1). This observation was in agreement of Stidham and Singh (1991), Jain (1998a), Tiwana *et al.* (2002), Pathan and Kamble (2012) and Pathan *et al.* (2013).

Prajapati *et al.* (2015) recorded that weed dry weight was significantly less (48.73 g/0.25 m^2) due to application of pendimethalin 1.0 kg/ha + imazethapyr 0.15 kg/ha applied immediate after 1^{st} cut resulting in higher weed control efficiency (43.53%).

Table 1. Weed count, weed dry weight and weed control efficiency as influenced by different treatments in berseem crop

Treatment	Species wise weed count/m^2			Weed dry matter yield (t/ha)	Weed control efficiency (%)
	Monocot	Dicot	Total		
Pendimethalin 0.30 kg/ha	65.50	11.17	76.67	0.16	40.13
Pendimethalin 0.40 kg/ha	64.83	11.33	76.16	0.12	52.14
Pendimethalin 0.50 kg/ha	69.67	11.50	81.17	0.13	50.87
Oxyflourfen 0.10 kg/ha	59.50	8.17	67.67	0.11	59.07
Imazethapyr 0.10 kg/ha (immediate after harvest of I^{st} and II^{nd} cut)	97.50	10.50	108.00	0.12	55.55
Oxyflourfen 0.10 kg/ha + imazethapyr 0.10 kg/ha (immediate after harvest of I^{st} cut)	44.33	6.33	50.66	0.05	80.97
Pendimethalin 0.30 kg/ha + imazethapyr 0.10 kg/ha (immediate after harvest of I^{st} cut)	63.00	10.67	73.67	0.11	57.61
Pendimethalin 0.40 kg/ha + imazethapyr 0.10 kg/ha (immediate after harvest of I^{st} cut)	84.67	11.17	95.84	0.11	56.42
Pendimethalin 0.50 kg/ha + imazethapyr 0.10 kg/ha	99.83	13.50	113.33	0.11	57.38
Weedy check	120.83	17.17	138.00	0.27	0.00
LSD (P=0.05)					7.41

Yield parameters

Data pertaining to yields (Table 2) revealed that, treatment pre-emergence application of oxyflourfen 0.10 kg/ha followed by post-emergence application of imazethapyr 0.10 kg/ha immediate after harvest of Ist cut recorded significantly higher yield values of green fodder, dry matter, crude protein, seed and straw (34.39, 4.53, 0.81, 0.47 and 5.87 t/ha, respectively) than rest of the treatments. The selective action of oxyflourfen and imazethapyr was the reason for better control of grassy and broad-leaves weeds resulted in poor crop weed competition during critical crop growth period,which resulted meager competition of weeds to crop in respect to moisture, space, sunlight and nutrition which caused better growth and development of crop. For improving yield quality parameters and broad-spectrum weed control. Stidham and Singh (1991) reported that imidozolinone herbicides inhibit acetolactate syntase which is essential for leucine, valine and isoleucine synthesis. It may be inferred that weed free environment facilitated better growth and crop development with higher berseem green forage and seed yield. These results were similar with the findings of Tamrakar *et al*. (2002), Tiwana *et al*. (2002), Pathan and Kamble (2012) and Pathan *et al.* (2013).

Prajapati *et al.* (2015) found that the green forage (2283.80 q/ha), dry forage (31.93 t/ha) and crude protein yield (7.60 t/ha) was significantly more due to imazethapyr 0.15 kg/ha applied immediately after 1st and 2nd cut but seed yield was significantly more due to oxyflourfen 0.10 kg/ha + imazethapyr 0.15 kg/ha (immediate after 1st cut) *i.e*. 0.67 t/ha compared to remaining herbicidal treatments.

Economics

The economics studies (gross monetary returns, net monetary returns, maize fodder equivalent yield and benefit: cost ratios) are presented

Table 2. Effect of different treatments on yield of berseem crop

Treatment	Yield (t/ha)				
	Green forage	Dry matter	Crude protein	Seed	Straw
Pendimethalin 0.30 kg/ha	23.11	3.07	0.57	0.35	4.73
Pendimethalin 0.40 kg/ha	19.68	2.61	0.49	0.34	4.13
Pendimethalin 0.50 kg/ha	17.44	2.23	0.41	0.32	3.85
Oxyflourfen 0.10 kg/ha	24.56	3.01	0.56	0.39	5.09
Imazethapyr 0.10 kg/ha (immediate after harvest of Ist and IInd cut)	19.64	2.48	0.47	0.36	3.93
Oxyflourfen 0.10 kg/ha + imazethapyr 0.10 kg/ha (immediate after harvest of Ist cut)	34.39	4.53	0.81	0.47	5.87
Pendimethalin 0.30 kg/ha + imazethapyr 0.10 kg/ha (immediate after harvest of Ist cut)	28.22	3.87	0.71	0.41	5.22
Pendimethalin 0.40 kg/ha + imazethapyr 0.10 kg/ha (immediate after harvest of Ist cut)	23.75	3.22	0.59	0.37	4.96
Pendimethalin 0.50 kg/ha + imazethapyr 0.10 kg/ha	21.07	2.66	0.50	0.35	4.38
Weedy check	13.52	1.74	0.31	0.23	3.08
LSD (P=0.05)	2.24	0.29	0.05	0.02	0.53

Table 3. Effect of different treatments on economics of berseem crop

Treatment	Gross monetary returns (x10^3 `/ha)	Cost of cultivation (x10^3 `/ha)	Net monetary returns (x10^3 `/ha)	Maize fodder equivalent yield (t/ha)	Benefit: cost ratio
Pendimethalin 0.30 kg/ha	135.06	42.80	92.26	49.95	3.16
Pendimethalin 0.40 kg/ha	122.45	42.25	80.19	43.42	2.90
Pendimethalin 0.50 kg/ha	111.76	42.47	69.28	37.54	2.63
Oxyflourfen 0.10 kg/ha	146.82	48.49	98.32	53.25	3.03
Imazethapyr 0.10 kg/ha (immediate after harvest of Ist and IInd cut)	124.88	52.19	7.27	39.37	2.40
Oxyflourfen 0.10 kg/ha + imazethapyr 0.10 kg/ha (immediate after harvest of Ist cut)	189.31	55.26	134.04	72.68	3.43
Pendimethalin 0.30 kg/ha + imazethapyr 0.10 kg/ha (immediate after harvest of Ist cut)	160.27	49.01	111.26	60.22	3.27
Pendimethalin 0.40 kg/ha + imazethapyr 0.10 kg/ha (immediate after harvest of Ist cut)	139.90	48.24	91.66	49.65	2.90
Pendimethalin 0.50 kg/ha + imazethapyr 0.10 kg/ha	128.75	47.33	81.42	44.09	2.72
Weedy check	83.71	45.77	37.94	20.57	1.83
LSD (P=0.05)			8.68	4.66	0.18
Selling rate (Rs./q) of berseem for green fodder (275), seed (18500) and straw (127.5)					

in Table 3. Pre-emergence application of oxyflourfen 0.10 kg/ha followed by post-emergence application of imazethapyr 0.10 kg/ha immediately after harvest of Ist cut recorded maximum gross monetary returns (` 1,89,313/ha) net monetary returns (` 1,34,048/ha) and B:C ratio (3.43) compared to rest of the treatments. It was followed by pendimethalin 0.3 kg/ha + imazethapyr 0.10 kg/ha (immediate after harvest of Ist cut) for B:C ratio (3.27). This might be due to reduced crop weed competition during the crop growth period resulting in higher uptake of nutrient and more accumulation of dry matter, thereby increasing monitory returns. The results were in accordance with Pathan and Kamble (2012) and Pathan *et al.* (2013).

It was concluded that the application of oxyflourfen 0.10 kg/ha + imazethapyr 0.10 kg/ha in berseem (var. *Wardan*) recorded highest green fodder, dry matter and crude protein yields to the tune of 34.39, 4.53 and 0.81 t/ha, respectively with net monetary returns of ` 1,34,048/ha, benefit cost ratio of 3.43 and maize fodder equivalent yield of 72.68 t/ha. The same weedicide combination was recorded highest seed yield (0.47 t/ha), straw yield (5.87 t/ha) and weed control efficiency (80.97%) with lowest weed dry matter yield (0.05 t/ha). This treatment was found to be most productive and remunerative.

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