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EFFECT OF BUTACHLOR, PENDIMETHALIN, IMAZETHAPYR AND OXADIARGYL ON YIELD, QUALITY AND ECONOMICS OF BERSEEM FODDER (*TRIFOLIUM ALEXANDRINUM* L.)

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SUMMARY

A field experiment was conducted during winter (**rabi**) season of 2013-14 at Research Farm of Department of Agronomy, CCS Haryana Agricultural University, Hisar to study the effect of butachlor, pendimethalin, imazethapyr and oxadiargyl on yield, quality and economics of berseem fodder (*Trifolium alexandrinum* L.). The experiment was laid out in randomized block design using three replications with 15 herbicidal treatments with a weedy check, comprising four herbicides at different rates and time of application viz., butachlor at 1000 and 1500 g/ha, pendimethalin at 750 and 1000 g/ha as PRE, imazethapyr at 50, 75 and 100 g/ha as PPI, PRE and 3 WAS and oxadiargyl at 75 and 100 g/ha as PRE along with unweeded control (weedy check). The treatment where imazethapyr was applied at 100 g/ha as post-emergence (3 WAS) was found significantly superior from other treatments and recorded higher plant height (41.6 cm), number of tillers (161/m^2), green fodder and dry matter yield (859.8 and 117.0 q/ha), crude protein content (20.8%), crude protein yield (24.3 q/ha), IVDMD (57.3%), DDM (68.4 q/ha) and benefit :cost ratio (1.77).

Key words : Berseem, *Trifolium alexandrinum* L., herbicides, fodder yield, quality

Egyptian clover, commonly known as berseem (*Trifolium alexandrinum* L.), is one of the most important winter season leguminous fodder crops in India and also known as '*King of the Fodders'*. It is also cultivated in Pakistan, Turkey, Egypt and countries of Mediterranean region. In India, it is grown in North, Central, North-Western and North-Eastern regions and occupying around 2 million hectare area under fodder cultivation (Ram and Sheoran, 2009). It is a well-known green forage crop to stimulate milk production in dairy animals. It remains soft and succulent at all stages of crop growth. It provides fodder over a long period from November to May in 4-5 cuttings, under irrigated conditions (Rani *et al.*, 2017). Because of its slow growth in the initial stages, wider ranging yield reduction in the crop on account of weeds is well documented. The importance of weed control in forage production should not be overlooked, especially when the high investment is associated with berseem and other legume forages. Some weeds are unpalatable to livestock or in some cases may be poisonous.

Weeds particularly *Coronopus didymus*, *Cichorium intybus, Spergula arvensis, Melilotus indica, Medicago denticulata, Rumex dentatus* and *Lathyrus aphaca* among broadleaf weeds, and *Phalaris minor, Polypogon monspeliensis and Poa annua* are the weeds found associated with berseem and give more competitional stress by robbing the crop for essential nutrients, light, moisture and space (Singh, 2012).Weed competition substantially reduces the green forage yield and consequently, it causes reduction up to 30-40 per cent besides deteriorating quality of green forage, if not controlled during critical period of crop-weed competition (Jain, 1998b).Therefore, it is imperative to create an environment that is detrimental to weeds and favourable to the crop. Herbicides offer a great scope to control weeds, but not all the herbicides are selective to berseem and effective against infesting weed species. Keeping the above facts in view, a field study was conducted using different pre and post- emergence herbicides in berseem to evaluate their efficacy on yield and yield attributing characters, quality parameters and economics of the crop.

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MATERIALS AND METHODS

The experiment was carried out at Research Farm of Department of Agronomy, CCS Haryana Agricultural University, Hisar during 2013-14 in a randomized block design with three replications. The general features of this region are semi-arid climate with hot and dry winds during summer and severe cold in winter. The soil of the experimental field was sandy loam in texture with pH and EC of 8.2 and 0.39 dS/m, respectively, having available nitrogen, phosphorus and potassium (129, 21 and 291.61 kg/ha, respectively).The planting was done on 12 November, 2013 in a plot size of 5 × 4 m for 16 weed control treatments. Butachlor at 1000 and 1500 g/ha; pendimethalin at 750 and 1000 g/ha as PRE, imazethapyr at 50, 75 and 100 g/ha as PPI, PRE and 3 WAS, and oxadiargyl at 75 and 100 g/ha as PRE were sprayed by using back pack sprayer fitted with two nozzle flat fan boom, delivering 500 litre water/ha. The pre-emergence herbicides were sprayed 3 days after sowing prior to emergence of weed as well as crop and the post-emergence herbicide was applied after three weeks of sowing of crop. Weedy check plot was compared with herbicides on yield and yield contributing characters, quality parameters and economics of berseem. The crop was fertilized with the recommended dose of fertilizer, a uniform dose of 20 kg N through urea and 80 kg P_2O_5 through SSP (single super phosphate) per hectare was applied for better growth and proper nutrition of crop. Variety HB-1 was sown by using seed rate of 25 kg/ha and five cuts were taken. The data recorded on different parameters of plant height (cm), number of tillers/m^2, green fodder and dry matter yield (q/ha), crude protein content (%), crude protein yield (q/ha), IVDMD (%) and DDM (q/ha) were subjected to statistical analysis, and the mean differences were evaluated by critical difference (C. D.) test at 5 per cent level of significance.

RESULTS AND DISCUSSION

Effect on Yield and Yield Contributing Characters

The significant difference was observed among different treatments of herbicides regarding plant height, number of tillers, green fodder and dry matter yield (Table 1). The mean of all the five cuts showed maximum plant height (41.6 cm) and number of tillers (161/m^2) with the application of imazethapyr at 100 g/ha as post-emergence (3 WAS). This result is in contrary with the findings of Pathan and Kamble (2012). They reported that weedy check recorded significantly maximum plant height (44.5 cm) than rest of the treatments. This might be due to the more weed density per unit area, might have created more competition for the sunlight with the berseem crop and resulted in more plant height in weedy check. Same result was arrived at by Jain (1998b).

TABLE 1
Effect of different herbicides on growth, total green fodder and dry matter yield of berseem

Treatment	Rate (g/ha)	Time of application	Plant height (cm)	No. of tillers/m^2	Green fodder yield (q/ha)	Dry matter yield (q/ha)
Butachlor	1000	PRE	38.8	140	785.1	100.2
Butachlor	1500	PRE	40.7	149	821.6	107.3
Pendimethalin	750	PRE	28.6	92	296.7	44.3
Pendimethalin	1000	PRE	27.1	65	237.8	36.1
Imazethapyr	50	PPI	37.2	113	689.0	81.0
Imazethapyr	75	PPI	39.5	127	803.5	93.7
Imazethapyr	100	PPI	40.3	143	814.6	101.9
Imazethapyr	50	PRE	37.2	129	695.8	82.0
Imazethapyr	75	PRE	38.3	138	726.8	87.4
Imazethapyr	100	PRE	39.7	146	786.6	98.5
Imazethapyr	50	3 WAS	37.9	140	803.6	100.5
Imazethapyr	75	3 WAS	39.6	145	849.5	109.1
Imazethapyr	100	3 WAS	41.6	161	859.8	117.0
Oxadiargyl	75	PRE	38.2	137	719.7	89.0
Oxadiargyl	100	PRE	39.5	144	762.5	95.3
Weedy check	-	-	39.4	137	766.6	97.6
LSD (P=0.05)	-	-	5.3	11.0	61.5	9.5

The total green fodder and dry matter yield are presented in Table 1. The data pertaining to green fodder and dry matter yield revealed that treatment post-emergence (3 WAS) application of imazethapyr at 100 g/ha recorded significantly higher values of green fodder and dry matter yield (859.8 and 117.0 q/ha, respectively) than rest of the treatments which was followed by lower dose of imazethapyr i. e. 75 g/ha (849.5 and 109.1 q/ha, respectively). The selective action of the imazethapyr was the reason for better control of weeds which resulted in poor crop-weed competition during critical crop growth period, ultimately resulting in very meagre competition of weeds to crop in respect to moisture, space, sunlight and nutrition reflected in better growth and development of crop and ultimately improving yield contributing characters and yield. It may be inferred that weed free environment can facilitate better growth and crop development and ultimately through herbicides with higher berseem green fodder and dry matter yield. These results are in corroboration with the findings of Kumar and Dhar (2008) and Pathan and Kumble (2012).

Quality Parameters

No significant difference was observed for crude protein content and *in vitro* dry matter digestibility (IVDMD) among the treatments at all the cuttings (Table 2). The crude protein yield and digestible dry matter (DDM) exhibited superiority with all the herbicide treatments over the control except pendimethalin. The crude protein yield and digestible dry matter were conversely related with dry matter yield. Significantly higher crude protein yield (24.3 q/ha) and digestible dry matter (68.4 q/ha) were recorded with the application of imazethapyr at 100 g/ha as post-emergence (3 WAS). These results of the present study confirm the findings of Kumar and Dhar (2008).

ECONOMICS

The gross returns, net returns and B : C ratio of the treatments were calculated to find out the economic viability of the agronomic practices imposed. The data presented in Table 2 show that lowest gross and net returns were recorded under the application of pendimethalin at 1000 g/ha as PRE. Significantly higher gross returns, net returns and B : C of Rs. 128970, 55971 and 1.77, respectively, were realized with imazethapyr at 100 g/ha as compared to rest of the treatments which was followed by imazethapyr at 75 g/ha as post-emergence (3 WAS).

TABLE 2
Effect of different herbicides on quality and economics of berseem

Treatments	Rate (g/ha)	Time of application	Crude protein content (%)	Crude protein yield	IVDMD (%)	DDM (q/ha)	Economics		
							Gross returns (Rs./ha)	Net returns (Rs./ha)	B : C ratio
Butachlor	1000	PRE	19.7	19.8	54.9	56.3	117765	45360	1.63
Butachlor	1500	PRE	20.1	21.6	55.5	60.8	123240	50615	1.70
Pendimethalin	750	PRE	19.7	8.8	53.8	24.4	44505	-28735	0.61
Pendimethalin	1000	PRE	19.9	7.2	53.8	19.8	35670	-37978	0.48
Imazethapyr	50	PPI	19.3	15.8	53.8	45.3	103350	30868	1.43
Imazethapyr	75	PPI	19.8	18.6	54.5	52.5	120525	47784	1.66
Imazethapyr	100	PPI	20.1	20.6	55.6	57.5	122190	49191	1.67
Imazethapyr	50	PRE	19.4	16.0	55.6	47.2	104370	31888	1.44
Imazethapyr	75	PRE	19.9	17.5	55.6	49.8	109020	36279	1.50
Imazethapyr	100	PRE	20.1	19.9	55.7	55.8	117990	44991	1.62
Imazethapyr	50	3 WAS	19.9	20.1	54.9	55.5	120540	48058	1.66
Imazethapyr	75	3 WAS	20.5	22.5	55.7	61.8	127425	54684	1.75
Imazethapyr	100	3 WAS	20.8	24.3	57.3	68.4	128970	55971	1.77
Oxadiargyl	75	PRE	19.9	17.8	53.6	49.3	107955	35637	1.49
Oxadiargyl	100	PRE	20.0	19.2	54.8	52.4	114375	41938	1.58
Weedy check	-	-	19.0	18.6	51.7	51.4	114990	43025	1.60
LSD (P=0.05)	-	-	NS	1.50	NS	3.8			

NS–Not Significant.

This might be due to reduced crop-weed competition during the crop growth period, resulted in higher uptake of nutrient, resulted in more accumulation of the dry matter ultimately resulted in the yield thereby increasing monetary returns as reported by Pathan and Kamble (2012). The obtained results are in good accordance with the findings of Kumar and Dhar (2008) and Jha *et al*. (2014).

CONCLUSION

On the basis of data on yield and yield contributing characters, quality parameters and economics of berseem, it can be concluded that post-emergence (3 WAS) application of imazethapyr at 100 g/ha and butachclor 1500 g/ha as pre-emergence were effective in recording maximum plant height and number of tillers thereby increased yield and monitory returns, thus these were found more remunerative.

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