

Research Article

Efficacy of Different Herbicide in Berseem (*Trifolium Alexandrinum* L.) under Medium Land Condition of Jharkhand

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Abstract

A field experiment was conducted under AICRP on Forage Crops with the collaboration of Agrostology unit of College of veterinary science and Animal Husbandry, Ranchi (Jharkhand) to study the Herbicidal response in Berseem (*Trifolium alexandrinum* L.) under medium land condition. The field experiment was conducted during Rabi 2011 -12, 2012- 13 and 2013-14. The crop faced major weeds namely *Cichorium intybus*, *Medicago denticulata*, *Medicagohispida* and *Cornopus didymus*. 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 the pre emergence application of Pendimethalin @ 0.4 kg a.i./ ha resulted into less weed population (54.66), weed dry weight/m² (8.89), Green Fodder yield (478.97 q/ha), Dry fodder yield (74.96 q/ha) and weed control efficiency (77.89 %).

The treatments Pendimethalin @ 0.4 kg a.i./ ha and Pendimethalin @ 0.300 kg a.i./ ha + Imazethapyr @ 0.100 kg a.i./ ha were comparable in terms of efficacy of the herbicides.

Keywords: Berseem, Green Fodder yield, Seed yield, Weed management, Weed control efficiency, Relative Weed Index

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Introduction

Berseem is the most imperative Rabi season legume forage crop which cultivated on about 2 m ha area in India [1]. It is extensively accepted due to its multi-cut nature, quick re-growth with high fodder yield and provides the nutritious fodder to livestock from November to April. Berseem is very popular among the dairy people and successfully can be grown in all parts of Jharkhand under irrigated condition. Chotanagpur plateau is where dairy farming is one of the main alternative occupations of the farmers. Berseem can mitigate the shortage of the green fodder during the winter. Congenial soil moisture due to frequent irrigations coupled with suitable temperature as well as better nutrient availability not only increases the fodder production but also provide unique opportunity to weeds particularly *Cichorium intybus*, *Medicago denticulata*, *Trifolium flagiferum*, *Cyperus rotundus* and *Alternanthera sessilis* etc. to appear simultaneously and compete with crop for essential nutrients, light, moisture, space and causing substantial reduction in green forage yield [2]. Among the different weeds, *Cichorium intybus* is one of the major obnoxious Berseem crop associated weed which give more competition stress [3]. Consequently, it causes substantial reduction (25-30 %) in green fodder production, besides deteriorating the quality of seeds [4]. Manual removal and frequent inter row weeding are the usual control measures. However, these methods are labour intensive which causes drain of money and time. Therefore, the present study was conducted with a view to find out the most selective and potent herbicide for curbing the menace of weeds in Berseem.

Materials and Methods

A Field experiment was conducted during Rabi season 2011-12, 2012-13 and 2013-14 under All India Coordinated Project on Forage Crops at BAU, Ranchi situated at 23° 34' N latitude and 85° 31' E longitudes at an altitude of 645.45 meter above the mean sea level. It falls under humid sub tropical climatic conditions, which is characterized by the features of hot dry summers and cool dry winters. The soil of the experimental field was sandy loam in texture, slightly acidic in reaction (pH 6.4) and low in organic carbon (0.41%) and available nitrogen (238 kg/ha), medium available phosphorus (17.18 kg/ha) and medium available potassium (319 kg/ha) with normal electrical conductivity (0.34). The ten treatments namely, T1 – Weedy check (Control), T2 – Pendimethalin @ 0.3 kg a.i./ ha, T3 – Pendimethalin @ 0.4 kg a.i./ ha, T4 – Pendimethalin @ 0.5 kg a.i./ ha, T5 – Oxyflourfen @ 0.100 kg a.i./ ha*, T6 –

Imazethapyr @ 0.100 kg a.i. / ha**, T7– Oxyflourfen @ 0.100 kg a.i./ ha + Imazethapyr @ 0.100 kg a.i./ ha**. T8 – Pendimethalin @ 0.300 kg a.i./ ha+ Imazethapyr @ 0.100 kg a.i./ ha**, T9 – Pendimethalin @ 0.400 kg a.i./ ha + Imazethapyr @ 0.100 kg a.i./ ha** and T10 –Pendimethalin @ 0.500 kg a.i./ ha + Imazethapyr @ 0.100 kg a.i./ ha** were tested in a randomized block design with three replications. Pendimethalin and oxyfluorfen were applied as pre-emergence (one day after sowing) and Imazethapyr was applied as post emergence (immediately after 1st & 2nd cut). The spraying of herbicides was done by mixing with calculated amount of water. The measured quantity of herbicides and water for each plot was mixed thoroughly before spraying. Knapsack sprayer of 15 liters capacity with fine mist spray nozzle was used. The Berseem variety “*Vardan*” was shown on the flat beds in line sowing at row to row distance of 30 cm on 15th November, 2011 and 10th November during second & third years using seed rate of 25 kg/ha. The seed was treated with *Rhizobium meliloti* and 20 kg N, 60 kg P₂O₅ and 20 kg K₂O /ha were applied as basal dose through urea, single super phosphate and muriate of potash. Various observations were recorded on weed and crop parameters. The quadrat of 0.25 m² (0.5 m × 0.5 m) was randomly placed at four places in each plot and then the species wise and total weed count was recorded. The weed control efficiency and weed index were worked out as per formula given by [5] and [6]. Total three cuttings were taken after nipping (carried at about 5-7 cm height) for better re-growth at 25 DAS. The first cutting was done 55 DAS and subsequent two cuttings were done at 30 days intervals when the crop attained the height of 40- 45 cm from the ground. The yield from three cuttings and nipping were summed up to get the total green forage yield under each treatment in both the years. The crop were facilitated with assured moisture after each cutting and left for seed production after the third cutting and given light irrigations frequently at 5 to 7 days intervals until flowering and seed setting. Crop was harvested in the mid of May and the seed and stover yields were recorded. The selling rate of green fodder, dry byproduct and seeds were Rs. 300/q, 250/q and 20,000/ quintal, respectively. Weed density and weed dry matter values were subjected to square root transformation of $(x \pm 0.5)$ before statistical analysis to normalize data distribution. Experimental data were analyzed using standard statistical procedures for randomized block design.

Weed control efficiency (WCE) and Weed index (WI) has been calculate by the under mentioned formula as,

Weed control efficiency (WCE)

It indicates the percentage reduction in weed population or dry weight of weeds under treated plot compare with untreated (weedy check). It also known as weed control index and it is used to compare the different herbicide. Higher the value of WCE that means better herbicidal response.

$$\text{Weed control efficiency (WCE)} = \frac{x-y}{x} \times 100$$

Where, x = weed dry weight in weedy check and y = weed dry weight

Weed Index (WI)

It refers to the reduction in crop yield due to the presence of weed in comparison to weed free plot (Maximum yielding plot). This is used to assess the efficacy of herbicide. Lesser the weed index better the efficacy.

$$\text{Weed index (WI)} = \frac{x-y}{x} \times 100,$$

Where, x = Yield from un treated plot (hand weeding) and y = Yield from treated plot.

In this experiment as there is no any weed free treatment i.e. hand weeding so in order to calculate weed index the maximum yield produced can be consider as x in Weed index formula. Thus, calculated weed index will be with reference to the T₃.

Weather information

Average weather data of three crop years from standard meteorological week 40 to 22, *w.r.t.* Average humidity (%), Rain fall (mm), Sun shine hour, Temperature Maximum and Minimum (° C) were recorded owing to the standard procedure and technique. Data are represented through graphical representation depicted in **Figure 1**. Graph reflects that crop faces the average humidity (69.58 %), Rain fall 7.92 mm /week, Sun Shine hour (58.13hrs /week), Maximum temperature (28.26 ° C) and minimum temperature (13.23 ° C).

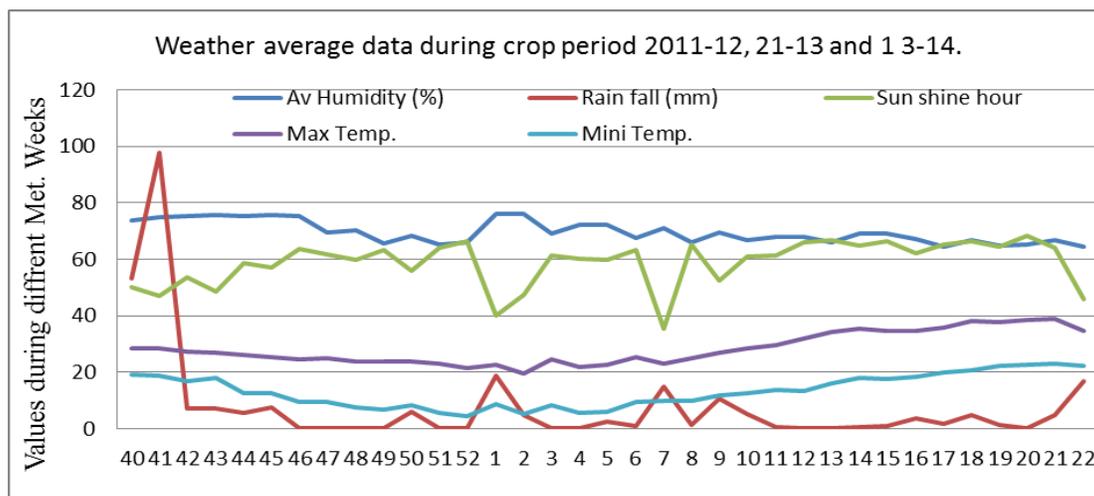


Figure 1 Average of three years on weather prevail data during crop period

Result and Discussion

Effect on weed density

Highest weed population /m² (174.55) and dry weight (40.22 g/m²) of weeds were recorded in weedy check (control) compared to different herbicidal application (**Table 1**). The crop weed competition was markedly reduced by weed control treatments which was evident from the significant decrease in weed population, dry matter accumulation, weed killing efficiency i.e. weed control efficiency and weed index. Transformed value reflects that, the application of (T₃) Pendimethalin @ 0.4 kg a.i./ ha results significantly lesser number of narrow weed/m² (22.66), Broad weed /m² (11.0), Sedges /m² (21.6) and total weed population /m² (54.66) which were at par with (T₇) Oxyflourfen @ 0.100 kg a.i./ ha+ Imazethapyr @ 0.100 kg a.i./ ha**. Weed dry matter produced/m² under (T₃) Pendimethalin @ 0.4 kg a.i./ ha(8.89 g) were at par with (T₈) Pendimethalin @ 0.300 kg a.i./ ha + Imazethapyr @ 0.100 kg a.i./ ha-1** (7.66 g) which was significantly lesser than other chemical used. This is due to more effectiveness of pendimethaline at 0.4 kg a.i / ha than its higher dose as well as other chemical used. [7] Recorded that weed dry weight was significantly less (48.73 g/0.25 m²) due to application of pendimethalin 1.0 kg/ha + imazethapyr 0.15 kg/ha applied immediate after 1st cut resulting in higher weed control efficiency (43.53%).

Table 1 Weed population and weed dry weight /m² in Berseem under medium land condition (Pooled)

Treatments	Original value					Transformed value				
	Narrow weeds	Broad weeds	Sedges	Total	dry weight	Narrow weeds	Broad weeds	Sedges	Total	dry weight
T1 – Weedy check (Control)	37.70	28.22	108.55	174.55	40.22	6.23	5.40	10.46	13.25	6.40
T2 – Pendimethalin @ 0.3 kg a.i./ ha	23.66	13.11	36.11	72.77	19.00	4.97	3.72	6.09	8.58	4.47
T3 – Pendimethalin @ 0.4 kg a.i./ ha	22.66	11.00	21.00	54.66	8.89	4.86	3.46	4.68	7.46	3.13
T4 – Pendimethalin @ 0.5 kg a.i./ ha	26.88	11.77	33.11	71.77	15.34	5.28	3.57	5.84	8.53	4.04
T5 – Oxyflourfen @ 0.100 kg a.i./ ha	25.01	13.77	26.77	65.55	20.33	5.10	3.84	5.27	8.15	4.61
T6 – Imazethapyr @ 0.100 kg a.i./ ha *	31.44	18.11	28.00	77.55	14.00	5.69	4.37	5.38	8.86	3.87
T7 – Oxyflourfen @ 0.100 kg a.i./ ha+ Imazethapyr @ 0.100 kg a.i./ ha **	24.33	10.33	27.44	62.11	15.00	5.03	3.36	5.33	7.94	4.00
T8 – Pendimethalin @ 0.300 kg a.i./ ha+Imazethapyr @ 0.100 kg a.i./ ha **	27.33	15.44	37.78	80.55	7.66	5.32	4.02	6.14	8.98	2.94
T9 – Pendimethalin @ 0.400 kg a.i./ ha + Imazethapyr @ 0.100 kg a.i./ ha **	33.11	14.11	48.77	89.00	14.33	5.84	3.86	7.05	9.48	3.88
T10 – Pendimethalin @ 0.500 kg a.i./ ha+Imazethapyr @ 0.100 kg a.i./ ha **	22.44	16.44	43.33	82.22	16.00	4.83	4.17	6.65	9.12	4.11
S. Em ±	1.06	1.23	3.64	4.43	1.83	0.10	0.15	0.26	0.23	0.19
CD at 5 %	3.18	3.70	10.91	13.26	5.47	0.30	0.46	0.79	0.68	0.59
CV%	6.71	14.08	15.36	9.23	18.54	3.30	6.64	7.30	4.36	8.23

* Immediate after harvest of I st and II nd cut. ** Immediate after harvest of I st cut only.

Similar result were also reported by [8] which gives conformity about the effectiveness against narrow, broad as well as sheds. The results were in accordance with the findings of [9], [10] and [11].



Figure 2 Field view of experimental plot along with staffs of Forage Research, BAU, Ranchi centre

Effect on green fodder yield

The pre- emergence application of (T₃) Pendimethalin @ 0.4 kg a.i./ ha produced more green fodder yield (478.97 q/ha) as well as dry fodder yield (74.96 q/ ha) (**Table 2**). The said DFY was at par with the application of (T8) Pendimethalin @ 0.300 kg a.i./ ha+ Imazethapyr @ 0.100 kg a.i./ha ** (73.34 q/ha). The results were due to less weed population which leads to less competition for nutrient and water.

Table 2 Fodder yield (q/ha) of Berseem and herbicidal efficacy under medium land condition (Pooled)

Treatments	Green fodder yield	Dry fodder yield	Weed control efficiency (%)	Weed Index (%)***
T1 – Weedy check (Control)	310.29	67.48	0	35.19
T2 – Pendimethalin @ 0.3 kg a.i./ ha	393.05	66.58	52.05	17.92
T3 – Pendimethalin @ 0.4 kg a.i./ ha	478.97	74.96	77.89	0
T4 – Pendimethalin @ 0.5 kg a.i./ ha	398.72	64.72	61.5	16.72
T5 – Oxyflourfen @ 0.100 kg a.i./ ha	403.17	58.96	46.39	15.82
T6 – Imazethapyr @ 0.100 kg a.i. / ha *	356.63	59.18	64.02	25.5
T7 – Oxyflourfen @ 0.100 kg a.i./ ha+ Imazethapyr @ 0.100 kg a.i./ ha **	333.86	55.95	61.78	30.28
T8 – Pendimethalin @ 0.300 kg a.i./ ha+ Imazethapyr @ 0.100 kg a.i./ ha **	443.25	73.34	80.22	7.45
T9 – Pendimethalin @ 0.400 kg a.i./ ha+ Imazethapyr @ 0.100 kg a.i./ ha **	402.39	51.16	63.13	15.97
T10 – Pendimethalin @ 0.500 kg a.i./ ha+ Imazethapyr @ 0.100 kg a.i./ ha **	386.18	53.14	60.08	19.33
S. Em ±	6.99	1.66	3.58	1.43
CD at 5 %	20.93	4.97	10.73	4.27
CV%	3.1	4.61	10.95	13.43

***Relative weed index (w.r.t. T3) on GFY basis

Further, (T9) Pendimethalin @ 0.400 kg a.i./ ha+ Imazethapyr @ 0.100 kg a.i./ ha ** which is just T4 + Imazethapyr @ 0.100 kg a.i./ ha show that on application of extra amount of Imazethapyr @ 0.100 kg a.i./ haat just after second and third cuts retarded the growth of Berseem resulted into significant reduction in GFY (15.89 %) as well as in DFY(31.17%). The nearly 15.25% more reduction in DFY which also reflects in deterioration in quality of herbage produced.



Figure 3 Dr Bhasker from IGFRI Jhansi and Dr KK Sharma from AAU Jorhat visiting Experimental field during 2013-14

Weed control efficiency and Weed Index

Result also showed that, the Weed control efficiency (WCE) of (T₃) Pendimethalin @ 0.4 kg a.i./ ha (77.89 %) and (T₈) Pendimethalin @ 0.300 kg a.i./ ha + Imazethapyr @ 0.100 kg a.i./ ha ** (80.32%) were at par to each other and which were highest over other herbicidal application (Table 2). The significantly lower Weed Index (WI) *w. r. t.* (T₃) Pendimethalin @ 0.4 kg a.i./ ha was recorded under (T₈) Pendimethalin @ 0.300 kg a.i./ ha + Imazethapyr @ 0.100 kg a.i./ ha-1** (7.45%). These observations of WCE and WI reflects that, the efficacy of (T₃) Pendimethalin @ 0.4 kg a.i./ ha and (T₈) Pendimethalin @ 0.300 kg a.i./ ha + Imazethapyr @ 0.100 kg a.i./ ha-1** were more over other combinations of chemical and doses.

Summery and conclusion

The effective weed controlled in berseem can be done through the pre emergence application of Pendimethalin @ 0.4 kg a.i./ ha as well as Pendimethalin @ 0.300 kg a.i./ha + Imazethapyr @ 0.100 kg a.i./ha (Imazethapyr was applied after the first and second cutting). Higher dose of Pendimethalin @ 0.500 kg a.i. along with Imazethapyr @ 0.100 kg a.i./ ha after cutting reduces the growth of Berseem in medium land condition of Jharkhand wher water is limiting factor.

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