

Research Article

Herbicidal Response on Yield and Quality of Berseem (*Trifolium Alexandrinum* L.) Under Slight Acidic Soil Condition of JharkhandBirendra Kumar^{1*}, J. K. Kerketta² and Uday Kumar Singh³¹Department of Agronomy, ²Faculty of Forestry ³and KVK, Petarwar, Bokaro
Birsra Agricultural University, Kanke, Ranchi, Jharkhand-834006.**Abstract**

A field experiment was conducted under All India Coordinated Research Project on Forage Crops with the collaboration of Agrostology unit of College of Veterinary Science and Animal Husbandry Ranchi (Jharkhand) to study the Herbicidal response on production and quality of Berseem (*Trifolium alexandrinum* L) under medium land, slight acidic condition of Jharkhand. The field experiment was conducted during Rabi 2011 -12, 2012- 13 and 2013-14. The soil of experimental plot slightly acidic with pH 6.4 crop faced narrow leaf, broad leaf weeds and sedges problem. The different treatment combinations were made with 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 concluded 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), Total green fodder yield equivalent (563.97 q/ha), Seed yield (2.48 q/ha), Crude protein yield (13.70 q/ha) as well as weed control efficiency (77.89 %) and Weed index (0.23 %).

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, and Quality of Berseem.

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Introduction

Berseem (*Trifolium alexandrinum* L.), is a best winter forage legume, not only in Jharkhand, but it is one of the most popular fodder crop in North, North-West and central parts of India so called *King of Fodder*. It is well known nutritive green fodder crop to improve milk ability 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 ideally suited under irrigated condition. Because of its slow growth in the initial stages and simultaneously fast growth of different weeds, reduction in the green fodder production and fall in its quality is also possible. Among the different weeds, *Cichorium intybus* is one of the major obnoxious Berseem crop associated weed which give more nutrient and moisture stress [1].

Consequently, it causes substantial reduction (25-30%) in green fodder production, besides deteriorating the quality of seeds [2]. 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. Under such situation, chemical weed control offers a better alternative to manual weeding. Since, meagre information is available on the comparative studies of different weed control practices in Berseem, the present investigation was undertaken to evaluate the Effectiveness of herbicides on yield and quality of Berseem (*Trifolium alexandrinum* L) under medium land slight acidic condition of Jharkhand.

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 Jharkhand. 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 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 with 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 quadrate 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 [2] and [4]. 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 around 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. 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 betters the efficacy Hazra and Sinha (1996).

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

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 relative weed index will be with reference to the T₃ on GFY basis and further this can be converted into actual weed Index with using weed control efficiency factor and total green fodder yield equivalent.

Result and Discussion

Effect on weed

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 were 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 resulted significantly lesser number of 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** (7.66 g) which was significantly lesser than other chemical used. This is due to more effectiveness of pendemethaline at 0.4 kg a.i/ ha than its higher dose as well as other chemical used. [5] 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%).



Figure 1 Visit of experimental field of Berseem by Dr. S. Bora (Chief scientist, PBG), AAU, Jorhat & Dr. Amit Jha (Agronomist), JNKVV, Jabalpur as monitoring experts during 2012-13.



Figure 2 View of Berseem plot applied herbicide Pendimethalin @ 0.4 kg a.i./ ha during 2013-14.

Similar result were also reported by [6] which gives confirmaty about the effectiveness against narrow, broad as well as sedges. The results were in accordance with the findings of [7], [8] and [9].

Weed control efficiency and Weed Index

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 1).

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

Treatments	Original value		Transformed value		Weed control efficiency (%)	Relative Weed Index (%)
	Total weeds	dry weight (g/m ²)	Total weeds	dry weight (g/m ²)		
T1 – Weedy check (Control)	174.55	40.22	13.25	6.40	0	35.19
T2 – Pendimethalin @ 0.3 kg a.i / ha	72.77	19.00	8.58	4.47	52.05	17.92
T3 – Pendimethalin @ 0.4 kg a.i / ha	54.66	8.89	7.46	3.13	77.89	0
T4 – Pendimethalin @ 0.5 kg a.i / ha	71.77	15.34	8.53	4.04	61.50	16.72
T5 – Oxyflourfen @ 0.100 kg a.i / ha	65.55	20.33	8.15	4.61	46.39	15.82
T6 – Imazethapyr @ 0.100 kg a.i. ha-1 *	77.55	14.00	8.86	3.87	64.02	25.50
T7 – Oxyflourfen @ 0.100 kg a.i / ha+Imazethapyr @ 0.100 kg a.i / ha **	62.11	15.00	7.94	4.00	61.78	30.28
T8 – Pendimethalin @ 0.300 kg a.i / ha+Imazethapyr @ 0.100 kg a.i / ha **	80.55	7.66	8.98	2.94	80.22	7.45
T9 – Pendimethalin @ 0.400 kg a.i / ha+Imazethapyr @ 0.100 kg a.i / ha **	89.00	14.33	9.48	3.88	63.13	15.97
T10 – Pendimethalin @ 0.500 kg a.i / ha+Imazethapyr @ 0.100 kg a.i / ha* *	82.22	16.00	9.12	4.11	60.08	19.33
S. Em ±	4.43	1.83	0.23	0.19	3.58	1.43
CD at 5 %	13.26	5.47	0.68	0.59	10.73	4.27
CV%	9.23	18.54	4.36	8.23	10.95	13.43

*Immediate after harvest of Ist and IInd cut, **Immediate after harvest of Ist cut only.

The significantly lower relative 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** (7.45%). These observations of WCE and WI reflects that, the efficacy of (T₃) Pendimethalin @ 0.4 kg a.i / ha and and (T8) Pendimethalin @ 0.300 kg a.i / ha+ Imazethapyr @ 0.100 kg a.i / ha** were more over other combinations of chemical and doses. The significantly lowest Weed Index (0.23 %) was recorded under Pendimethalin @ 0.4 kg a.i./ha, which reflects the more effectiveness of Pendimethalin @ 0.4 kg a.i / ha over other herbicides. [5] Also reported the similar result and this was due to effectiveness of herbicide.

Table 2 Yield, quality and weed Index (%) of untreated and herbicidal treated fodder Berseem under medium land condition (Pooled)

Treatments	Fodder study (q/ha)				Crude Protein (%)	Crude Protein yield (q/ha)	Total green fodder yield equivalent (q/ha)	Weed Index (WI) (%)
	Green fodder yield	Dry fodder yield	Seed yield	Straw yield				
T1 – Weedy check (Control)	310.29	67.48	2.54	4.96	17.25	11.88	402.12	36.99
T2 – Pendimethalin @ 0.3 kg a.i / ha	393.05	66.58	2.80	3.58	18.35	12.46	499.03	14.96
T3 – Pendimethalin @ 0.4 kg a.i / ha	478.97	74.96	2.48	4.17	18.00	13.77	563.97	0.23
T4 – Pendimethalin @ 0.5 kg a.i / ha	398.72	64.72	2.34	4.03	17.75	11.73	473.14	20.85
T5 – Oxyflourfen @ 0.100 kg a.i / ha	403.17	58.96	2.16	3.67	17.58	10.58	463.68	22.91
T6 – Imazethapyr @ 0.100 kg a.i. ha-1 *	356.63	59.18	2.20	3.74	19.17	11.55	420.44	32.80
T7 – Oxyflourfen @ 0.100 kg a.i / ha+Imazethapyr @ 0.100 kg a.i / ha **	333.86	55.95	2.00	3.47	18.48	10.52	382.71	41.36
T8 – Pendimethalin @ 0.300 kg a.i / ha+Imazethapyr @ 0.100 kg a.i / ha ** *	443.25	73.34	1.90	4.10	18.23	13.68	486.34	17.85
T9 – Pendimethalin @ 0.400 kg a.i / ha+Imazethapyr @ 0.100 kg a.i / ha **	402.39	51.16	1.85	3.50	18.59	9.68	440.55	28.18
T10 – Pendimethalin @ 0.500 kg a.i / ha+Imazethapyr @ 0.100 kg a.i / ha **	386.18	53.14	1.75	3.82	19.14	10.37	418.41	33.17
S. Em ±	6.99	1.66	0.09	0.15	0.12	0.30	9.86	2.18
CD at 5 %	20.93	4.97	0.28	0.44	0.36	0.90	29.52	6.52
CV %	3.10	4.61	7.41	6.5	1.13	4.52	3.75	15.13

*Immediate after harvest of Ist and IInd cut. **Immediate after harvest of Ist cut only

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), dry fodder yield (74.96 q/ ha) as well as green fodder yield equivalent (563.97 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. [3] Accepted the similar types of thing for loss in fodder production.

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 / ha 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 inferior in quality of herbage produced. [8] and [9] also supported the similar result.

Effect on crude protein

Application of Pendimethalin @ 0.4 kg a.i / ha improves the quality of fodder produced in terms of Crude protein yield (13.77 q/ha) which was significantly more over other herbicidal combinations. Data showed that (T₆) Imazethapyr @ 0.100 kg a.i / ha * and (T₁₀) Pendimethalin @ 0.500 kg a.i / ha+ Imazethapyr @ 0.100 kg a.i / ha** treatments recorded at par crude protein content (19.17 %). The more crude protein content in Berseem is due to application of Imazethapyr @ 0.100 kg a.i / ha. Similar results were also recorded by [6].

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 / ha along with Imazethapyr @ 0.100 kg a.i / ha after first cutting reduces the growth of Berseem in medium land condition of Jharkhand where water was limiting factor along with prevailing climatic condition.

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