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Effect of sowing management and herbicides on the weed dynamics of berseem (*Trifolium alexandrinum*)

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Abstract

A two-year field experiment was conducted to assess the effect of different dates of sowing and chemical weed control on the weed indices in berseem during the *rabi* seasons of 2020-2021 and 2021-2022 under AICRP on Forage Crops, Department of Agronomy, College of Agriculture, Jabalpur (MP). Twenty treatment combination comprising of four dates of sowing in main plots and five herbicidal control treatments as sub-plot treatments were laid out in split-plot design and replicated thrice. The dominant weed flora found in the experimental field was *Chenopodium album*, *Cichorium intybus*, *Medicago truncatula*, *Cyperus rotundus*, *Anagallis arvensis* and *Cuscuta reflexa*. The results indicated that *Medicago truncatula* and *Cichorium intybus* had highest relative density among all other weeds. The early sowing of berseem on 15th October had lesser number of weeds as compared to delayed sowing i.e. 30th October, 15th November and 30th November. The application of Oxyfluorfen 100 g/ha + Imazethapyr 15 g/ha after first and second cutting resulted in lower weed density of most of the weeds, followed by post emergence application of Oxyfluorfen 100 g ai/ha + Imazethapyr 15 g ai/ha after first cutting (55 DAS), Pyroxasulfone 125 g ai/ha as early post emergence (14 DAS), Pyroxasulfone 125 g ai/ha as pre emergence over control treatment.

Keywords: Egyptian clover, imazethapyr, oxyfluorfen, relative density, weed flora

Introduction

Berseem (*Trifolium alexandrinum*) is one of the cultivated clovers, domesticated in Egypt and later introduced to other parts of the world. It is now widespread in the irrigated regions of West and South Asia. Among the berseem growing countries, India is having highest area around 2 million ha followed by Egypt (1.1 million ha) and Pakistan (0.71 million ha) (Muhammad *et al.*, 2014; Pandey and Roy, 2011) [8, 11]. It is an annual leguminous crop, well adapted to the semi-arid to sub-tropical conditions with good nitrogen fixing ability. The berseem fodder is highly palatable due to its succulency and is also highly nutritious (20% CP and 62%TDN) for livestock. Low fodder production and lesser feed availability are the major limiting factors for increasing livestock productivity in India, particularly in Madhya Pradesh. Sowing of berseem in second fortnight of October gives maximum green forage yield including seed yield (Baig, 2000) [1]. However, delay in sowing from 15th October to 15th November decrease fresh and dry forage yield but increase the seed yield (Virendra *et al.*, 2000) [12]. The sowing of berseem in mid-week of October to first week of November is delayed, due to late harvesting of kharif season crops as well as farmers engagement in other field activities.

Being a winter season crop, several weeds infest berseem crop *Cuscuta reflexa*, *Cichorium intybus*, *Anagallis arvensis*, *Melilotus indica*, *Lathyrus aphaca*, *Cirsium arvense*, *Cyperus rotundus*, *Chenopodium album* and *Rumex dentatus*. These weeds cause substantial reduction (30-40%) in yields besides deteriorating the quality of green forage, if they are not controlled during critical period of crop-weed competition (Jain, 1998) [3]. As a result, in order to maximize output, the crop should be kept weed-free for 35 to 40 days following seeding. Hand weeding and inter-culture operations are excellent weed control approaches, although they are time consuming (Kauthale *et al.*, 2016) [6]. Reduced labour availability in the agricultural sector not only raises production costs but also severely limits timely weeding operations, resulting in a decline in both the quality and quantity of fodder and seed. As a result, chemical weeding looks to be a logical alternative for broad-spectrum weed management in this circumstance. As different dominant weeds can compete with berseem and is not readily controlled by herbicide, suitable thermal environment for sowing along with herbicidal control

of weeds in berseem needs to be adjudged to reduce its menace in berseem. Therefore, bio-efficacy of herbicides viz., Oxyfluorfen, Imazethapyr and Pyroxasulfone must be assessed against complex weeds in berseem so as to ensure supply of quality berseem seed and fodder to the farmers of Madhya Pradesh.

Materials and Methods

The experiment was conducted during *rabi* season of 2020-2021 and 2021-2022 under AICRP on Forage Crops, Department of Agronomy, College of Agriculture, Jabalpur (MP). The soil of the experimental field was sandy clay loam in texture, medium in organic carbon (0.61%), available nitrogen (365.20 kg N ha⁻¹) and phosphorus (17.97 kg P₂O₅ ha⁻¹) but high in available potassium (308.12 kg K₂O ha⁻¹). The soil was nearly neutral in reaction (7.24 pH) and concentration of soluble salts (0.35 ds m⁻¹) is below to the harmful limit. Twenty treatments comprising of four dates of sowing viz., October 15th, October 30th, November 15th and November 30th as a main plots treatments and these were superimposed with five Herbicidal weed control i.e. Pyroxasulfone 125 g ai/ha as pre emergence, Pyroxasulfone 125 g ai/ha at 14 DAS, Oxyfluorfen 100 g ai/ha + Imazethapyr 15 g ai/ha after first cutting (55 DAS), Oxyfluorfen 100 g ai/ha + Imazethapyr 15 g ai/ha after first (55 DAS) and second (85 DAS) cutting and control as a sub plot treatments and laid out in a split plot design with three replications. Berseem variety JB 05-9 was sown in the experimental field with recommended package of practices. Full doses of nitrogen (20 kg ha⁻¹), P₂O₅ (80 kg ha⁻¹) and K₂O (40 kg ha⁻¹) was applied as basal application through urea, single super phosphate, and muriate of potash respectively. Different observations on weeds were recorded during the investigation.

Results and Discussion

Dominant weed flora

The dominant weeds found in the experimental field were

Chenopodium album, *Cichorium intybus*, *Medicago truncatula*, *Cyperus rotundus*, *Anagallis arvensis* and *Cuscuta reflexa*. Species wise data were recorded from weedy check plots. Among the dicot weeds, *Medicago truncatula* (37.48%) and *Cichorium intybus* (27.74%) were predominant as both attained higher values of relative density of weeds. However, other weeds Like *Cyperus rotundus*, *Anagallis arvensis*, *Chenopodium album* and *Cuscuta reflexa* marked their presence in good numbers (13.79, 11.21, 9.78 and 5.59%, respectively). Almost similar weed flora associated with berseem was also reported by Wasnik *et al.* (2017) [13] and Pal (2019) [10].

Weed density

The mean data of two seasons (*Rabi* 2020–21 and 2021–22) for the density of total weed as influenced by various sowing dates and weed management applications at 60 DAS are given in Table 1. The lowest density of total weeds was observed in early sowing on October 15th (73.31 m⁻²) as compared to delayed sowing done on October 30th (83.67 m⁻²), November 15th (93.46 m⁻²), and November 30th (104.44 m⁻²) at 60 DAS. The density of total weeds recorded at 60 DAS was affected significantly due to weed control treatments in berseem. The density of total weeds was highest in control plots where no weeding was done. But it was reduced statistically due to applied herbicidal weed control treatments. Application of Oxyfluorfen 100 g ai/ha + Imazethapyr 15 g ai/ha after first and second cutting caused significant reduction in density of total weeds (54.79 m⁻²) and proved significantly superior over to Oxyfluorfen 100 g ai/ha + Imazethapyr 15 g ai/ha after first cutting (55.20 m⁻²), Pyroxasulfone 125 g ai/ha as early post emergence (78.72 m⁻²), Pyroxasulfone 125 g ai/ha as pre emergence (120.53 m⁻²) and control treatment. The application of Imazethapyr at first and second cutting interferes with the process of photosynthesis leading to reduced growth, necrosis and killing of weed species over a period of time. Similar results were also reported by Pathan *et al.*, (2013) [9] and Kantwa *et al.*, (2019) [5].

Table 1: Effect of dates of sowing and herbicidal weed control practices on weed intensity at 60 DAS

Weed density (no./m ²) at 60 DAS							
Date of sowing	<i>Chenopodium album</i>	<i>Cichorium intybus</i>	<i>Medicago truncatula</i>	<i>Cyperus rotundus</i>	<i>Anagallis arvensis</i>	<i>Cuscuta reflexa</i>	Total
D1- October 15 th	3.75	19.17	30.7	10.43	7.49	1.77	73.31
D2- October 30 th	5.73	20.62	34.14	12.36	8.72	2.1	83.67
D3- November 15 th	6.83	22.5	37.07	13.33	10.23	3.5	93.46
D4- November 30 th	8.91	24.66	39.33	14.68	11.86	5.00	104.44
SEm±	0.04	0.08	0.07	0.07	0.04	0.03	0.33
C.D.	0.16	0.27	0.25	0.24	0.15	0.09	1.16
Herbicidal weed control							
W1- Pyroxasulfone 125 g ai/ha as pre emergence	10.04	30.36	44.47	15.82	14.3	5.54	120.53
W2 -Pyroxasulfone 125 g ai/ha at 14 DAS	4.77	17.19	33.7	10.62	9.42	3.02	78.72
W3- Oxyfluorfen 100 g ai/ha + Imazethapyr 15 g ai/ha after first cutting	2.66	14.14	25.23	8.01	4.92	0.24	55.2
W4- Oxyfluorfen 100 g ai/ha + Imazethapyr 15 g ai/ha after first and second cutting.	2.73	14.07	24.87	8.12	4.73	0.27	54.79
W5- Control	13.76	37.4	51.52	21.1	17.45	9.8	151.03
SEm±	0.85	0.58	0.89	0.24	0.87	0.63	3.69
C.D.	2.25	1.15	2.99	0.68	2.41	1.8	12.54

Table 2: Effect of dates of sowing and herbicidal weed control practices on total dry weight of weeds at 30, 60 and 90 DAS (mean of two seasons)

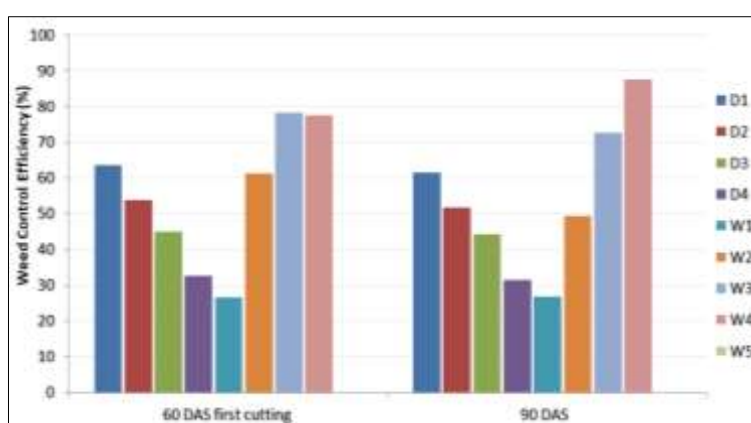
Total dry weight (g/m ²)			
Dates of sowing	30 DAS	60 DAS	90 DAS
D1- October 15 th	3.76 (7.76)	5.03 (24.81)	8.04 (64.10)
D2- October 30 th	4.38 (10.94)	5.67 (31.69)	8.86 (78.05)
D3- November 15 th	5.03 (24.81)	6.20 (37.91)	9.54 (90.52)
D4- November 30 th	5.73 (32.31)	6.74 (44.91)	10.52 (110.20)
SEm±	0.05	0.06	0.13
C.D.	0.19	0.20	0.47
Herbicidal weed control			
W1- Pyroxasulfone 125 g ai/ha as pre emergence	4.34 (18.37)	7.22 (51.69)	11.50 (131.72)
W2 -Pyroxasulfone 125 g ai/ha at 14 DAS	3.14 (9.31)	5.63 (31.24)	9.72 (94.19)
W3- Oxyfluorfen 100 g ai/ha + Imazethapyr 15 g ai/ha after first cutting	5.11 (25.79)	4.20 (17.10)	7.03 (48.91)
W4- Oxyfluorfen 100 g ai/ha + Imazethapyr 15 g ai/ha after first and second cutting.	5.13 (25.83)	4.25 (17.61)	4.74 (22.05)
W5- Control	5.90 (34.31)	8.24 (67.32)	13.21 (174.10)
SEm±	0.09	0.10	0.16
C.D.	0.26	0.28	0.45

The dry weight of total weeds recorded at 30, 60 and 90 DAS was affected significantly due to applied weed control treatments in berseem. The dry weight of total weeds was highest in control plots where no weeding was not done. But it was reduced statistically due to applied herbicidal weed control treatments. Application of Pyroxasulfone 125 g ai/ha as early post emergence caused significant reduction in dry weight of total weeds (3.14 gm⁻²) and proved significantly superior over its pre emergence application Pyroxasulfone 125 g ai/ha (4.34 gm⁻²), Oxyfluorfen 100 g ai/ha + Imazethapyr 15 g ai/ha after first cutting (5.11 gm⁻²), Oxyfluorfen 100 g ai/ha + Imazethapyr 15 g ai/ha after first and second cutting (5.13 gm⁻²) and control plots (5.90 gm⁻²). However, at 60 DAS, application of Oxyfluorfen 100 g ai/ha + Imazethapyr 15 g ai/ha after first cutting caused significant reduction in the dry weight of total weeds (4.20 gm⁻²) and also gives similar results in Oxyfluorfen 100 g ai/ha + Imazethapyr 15 g ai/ha after first and second cutting (4.25 gm⁻²) and found statistically superior results over Pyroxasulfone 125 g ai/ha applied as early post emergence (5.63 gm⁻²), 125 g ai/ha as pre emergence (7.22 gm⁻²) and weedy check plots (8.24 gm⁻²). At 90 DAS, application of Oxyfluorfen 100 g ai/ha + Imazethapyr 15 g ai/ha after first (55 DAS) and second cutting (80 DAS) appreciably decreased the dry weight of total weeds (4.74 gm⁻²) and proved to be statistically superior to the application of Oxyfluorfen 100 g ai/ha + Imazethapyr 15 g ai/ha (7.03 gm⁻²) after first cutting (55 DAS), Pyroxasulfone 125 g ai/ha as early post emergence (9.72 gm⁻²), Pyroxasulfone 125 g ai/ha as pre emergence (11.50 gm⁻²)

and Control treatment (13.21 gm⁻²). Similar findings were also reported by Virendra *et al.*, (2000) ^[12] and Kewat *et al.*, (2005) ^[75].

Weed Control efficiency

Weed control efficiency was affected appreciably due to dates of sowing and weed control treatments in berseem (Fig. 1). The weed control efficiency was minimum under weedy check plots where weed control was not done. But it was increased markedly in plots receiving the herbicidal weed control. Application of Oxyfluorfen 100 g ai/ha + Imazethapyr 15 g ai/ha after first cutting gives maximum weed control efficiency of *Cyprus rotundus*, *Chenopodium album*, *Cichorium intybus*, *Medicago truncatula*, *Anagallis arvensis* and *Cuscuta reflexa* at 60 and 90 days stages (78.23% and 72.59%) followed by Pyroxasulfone 125 g ai/ha at early post emergence done at 60 and 90 DAS (61.24% and 49.24% respectively) and Pyroxasulfone 125 g ai/ha as pre emergence (26.49% and 26.73%) However, Oxyfluorfen 100 g ai/ha + Imazethapyr 15 g ai/ha after first (55 DAS) and second (85 DAS) cutting curbed the dry matter production of weeds and recorded maximum weed control efficiency (77.44% and 87.53% respectively) and proved superior over other weed control treatments. The application of Imazethapyr at first and second cutting interferes with the process of photosynthesis leading to related growth, necrosis and killing of weed species over a period of time. Similar views also reported by Chopra & Saini (2017) ^[25] and Jha *et al.*, (2014) ^[4].

**Fig 1:** Effect of dates of sowing and herbicidal weed control practices on weed control efficiency at 60 and 90 DAS (mean of two seasons)

Conclusion

Based on the foregoing findings, it was concluded that application of Oxyfluorfen 100 g ai/ha + Imazethapyr 15 g ai/ha after first and second cutting curb the growth of *Cuscuta reflexa* and other weeds. Sowing of berseem on 15th October reduce the weed growth and gave higher green fodder productivity. Therefore, the results of the experiment clearly indicated that it might be one of the possible ways to reduce weed infestation and enhanced fodder productivity in Central India.

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