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RESEARCH PAPER

Effect of early post emergence herbicides on weed dynamics and yield of Urdbean

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Abstract: A field experiment was conducted during *kharif* 2024-25 at the Main Agricultural Research Station, UAS, Dharwad, to evaluate the effect of early post-emergence herbicides on weed dynamics and yield of urdbean. The experiment was laid out in a randomized complete block design (RCBD) with three replications. Nine treatments were tested,consisting of pre-emergence (PE), early post-emergence (EPoE) and post-emergence (PoE) herbicides. The experimental field was infested with broadleaf weeds, grasses and sedges. Among the weed control treatments, application of Propaquizafop 2.5% + Imazethapyr 3.75% w/w ME (50 + 75 g *a.i.* ha^{-1}) RM @ 2000 g ha^{-1} as EPoE proved most effective in reducing total weed density and dry weight, enhancing weed control efficiency and improving yield attributes (pods per plant, pod weight),seed and haulm yield. However, this treatmentwas statistically comparable with Fluazifop-p-butyl 11.1% w/w + Fomesafen 11.1% w/w SL @ 250 g *a.i.* ha^{-1} RM @ 1000 g ha^{-1} as EPoE.

Key words: Herbicides, Urdbean, Weeds

Introduction

Urdbean [*Vigna mungo* (L.) Hepper] is the fourth major pulse crop in India after chickpea, pigeonpea and mungbean. In *Kharif* 2022-23, it covered 42.33 lakh ha with a production of 2.78 million tonnes and an average productivity of 600 kg ha^{-1} (Anon, 2022a). In Karnataka, urdbean was grown on 1.26 lakh ha, yielding 0.64 lakh tonnes with a productivity of 507 kg ha^{-1} (Anon, 2022b). Urdbean is mainly cultivated in marginal and rainfed areas, where poor weed management limits its yield potential. Being a rainy-season crop, it faces severe weed competition, causing yield losses of 41.2% in *summer* and 41.6% in *Kharif,* respectively (Singh, 2011). The first 20-40 days after sowing (DAS) are most critical (Saraswat and Mishra, 1993) and season-long weed competition can reduce yields by up to 87%, depending on weed type and intensity (Singh *et al.,* 2002). Weed management in urdbean involves cultural, mechanical, biological and chemical methods. Although hand weeding is effective, its use is constrained by labor shortages, high costs and untimely rains. Hence, herbicides are increasingly preferred for their efficiency and reliability. However, limited options in urdbean highlight the need to evaluate newer broad-spectrum molecules to prevent weed shifts and resistance.Early post-emergence herbicides such as fomesafen + fluazifop-p-butyl, propaquizafop + imazethapyr and acifluorfen-sodium + clodinafop-propargyl have shown promise for broad-spectrum weed control. They reduce competition during the critical period, enhance crop establishment and growthand improve yield, making them vital for sustainable weed management in urdbean. Therefore, the present experiment was conducted to evaluate most effective early post-emergence herbicides for reliable weed control in urdbean.

Material and methods

A field experiment was conducted during *Kharif* 2024 at MARS, UAS, Dharwadto study weed management in urdbean. The soil of experimental site was clay loam in texture, neutral in reaction (pH 7.22) with available nitrogen (282.15 kg ha^{-1}), phosphorus (28.03 kg ha^{-1}) and potassium (352.13 kg ha^{-1}). The experiment was laid out in a RCBDdesign with three replications, comprising nine treatments: Imazethapyr 35% + Imazamox 35% WG (70 g *a.i.* ha^{-1}) RM @100 g ha^{-1} as EPoE (T_1), Propaquizafop 2.5% + Imazethapyr 3.75% w/w ME (50+75 g *a.i.* ha^{-1}) RM @2000 g ha^{-1} as EPoE (T_2), Sodium aciflourofen 16.5% + Clodinafop Propargyl 8% EC (80+165 g *a.i.* ha^{-1}) RM @1000 ml ha^{-1} as EPoE (T_3), Fluazifop-p-butyl 11.1% w/w + Fomesafen 11.1% w/w SL 250 g *a.i.* ha^{-1} RM @1000 g ha^{-1} as EPoE (T_4), Imazethapyr 10% SL + Surfactant 2 ml l^{-1} (100 g *a.i.* ha^{-1}) @1000 g ha^{-1} as PoE (T_5), Quizalofop-P-Ethyl 5 EC (50 g *a.i.* ha^{-1}) @1000 g ha^{-1} as EPoE (T_6), Pendimethalin 30 EC @1.0 kg *a.i.* ha^{-1} as PE (T_7), a weedy checkand a weed-free treatment. Netplot size for each treatment was 3.8 × 3.6 m. Sowing was done with a seed rate of 15 kg ha^{-1}, maintaining a spacing of 30 × 10 cm. A basal dose of 25 kg N and 50 kg P, O… ha^{-1} was applied uniformly. Except for weed management practices, all other recommended cultural and plant protection measures were followed to ensure proper crop establishment. To normalize the weed data distribution, the square root transformation method ($\sqrt{X + 0.5}$) was employed.

Results and discussion

Weed flora

The important weed flora observed in the experimental plot during the study period comprised broadleaf weeds, grasses and sedges. Among the broadleaf weeds, *Alternanthera sessilis* L., *Amaranthus viridis* L., *Parthenium hysterophorus* L., *Portulaca oleracea* L., *Solanum nigrum* L., *Commelina benghalensis* L., *Digera arvensis* L., and *Phyllanthus niruri* L. were found to be dominant. In the group of grassy weeds, *Cynodondactylon* L., *Dactylocteniumaegyptium* L., *Dinebraretroflexa* L., *Digitariasanguinalis* L., and

Echinochloacolona L. were commonly observed, while among the sedges, *Cyperus rotundus* L. was the most prevalent in the study area.These findings are in agreement with the observations of Singh *et al.* (2020).

Total density and dry weight of weeds (At 30 and 45 DAS)

The chemical weed control treatments significantly reduced the weed population and biomass compared to the weedy check (Table 1). At 30 DAS, among the herbicidal weed management practices, Propaquizafop 2.5% + Imazethapyr 3.75% w/w ME @ 2000 g ha^{-1} as EPoE resulted in significantly lower total density (2.86) and dry weight of weeds (2.18), which was comparable with Fluazifop-p-butyl 11.1% w/w + Fomesafen 11.1% w/w SL @ 250 g a.i. ha^{-1} RM @ 1000 g ha^{-1} as EPoE (3.24 and 2.54, respectively). A similar trend was observed at 45 DAS, where Propaquizafop + Imazethapyr again recorded the lowest total density (3.88) and dry weight of weeds (2.88), closely followed by Fluazifop-p-butyl + Fomesafen (4.26 and 3.33, respectively). These herbicide treatments achieved yields comparable to the weed-free control, indicating that complete eradication is unnecessary; rather, maintaining weeds below the threshold during 30-45 DAS is sufficient. The higher yields obtained were directly associated with greater weed control efficiency through the reduction of grass and broadleaf biomass. Notably, the ready-mix Propaquizafop + Imazethapyr proved most effective owing to its dual action on AHAS and ACCase pathways, aligning with earlier reports in soybean by Bhimwal *et al.*(2019), Chaithanya (2021) and Kumar *et al.* (2021).

Weed control efficiency and weed index

The superior performance of Propaquizafop 2.5% + Imazethapyr 3.75% w/w ME @ 2000 g ha^{-1} as EPoE, which recorded the highest weed control efficiency (87.20 and 85.29% at 30 and 45 DAS) and the lowest weed index (1.74 %), can be attributed to its broad-spectrum efficacy and extended residual activity, ensuring prolonged weed suppression and efficient resource utilization by urdbean. This treatment was was on par with Fluazifop-p-butyl 11.1% w/w + Fomesafen 11.1% w/w SL @ 250 g *a.i.* ha^{-1} with RM @ 1000 g ha^{-1} as EPoE, which also maintained high WCE (82.15 and 80.52%) and a low weed index (7.93%), thereby minimizing weed–crop competition and enhancing urdbean yield. Conversely, Quizalofop-P-ethyl 5 EC @ 50 g *a.i.* ha^{-1} (1000 g ha^{-1}) as EPoE showed poor performance, with lower WCE (38.61 and 36.24%) and a higher weed index (45.30%), resulting in reduced yield due to inadequate suppression of weed flora(Table 1). A trend consistent with the earlier findings of Panda *et al.* (2015) and Bhimwal *et al.* (2019).

Yield and yield attributes

Among the different treatments, the ready-mix application of Propaquizafop 2.5% + Imazethapyr 3.75% w/w ME recorded significantly higher number of pods per plant (31.5), pod weight (12.69 g) and 1000-seed weight (49.07 g), all of which were statistically comparable to Fluazifop-p-butyl 11.1% + Fomesafen 11.1% SL @ 250 g *a.i.* ha^{-1} (28.2 pods, 11.71 g and 48.67 g, respectively). Comparable observations were reported by Panda *et al.* (2015) and Suryavamshi *et al.* (2018).

Table 1. Effect of different weed management practices on weed density, weed dry weight, weed control efficiencyand Weed index

Treatments	Number of pods (plant^{-1})	Weight of pods (g plant^{-1})	1000 Seed wt. (g)	Seed yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Harvest index (%)
T_1	26.5	10.95	47.73	1233	2188	33.91
T_2	31.5	12.69	49.07	1412	2650	34.88
T_3	20.2	9.10	45.93	986	1874	34.40
T_4	28.6	11.71	48.67	1323	2549	34.15
T_5	19.2	8.18	45.33	897	1701	34.76
T_6	18.4	7.82	45.30	786	1542	33.87
T_7	24.2	10.00	46.37	1123	2298	34.86
T_8	32.2	13.18	50.33	1436	2676	35.06
T_9	16.1	7.01	44.70	598	1217	33.03
S.Em±	1.03	0.43	2.06	56.95	130.09	1.34
C.D. at 5%	3.07	1.28	NS	170.76	390.04	NS

Table 2. Effects of different weed management practices on yield and yield attributes of urdbean

	Total density of weeds		Total dry weight of weeds		Weed control efficiency		Weed Index
	30 DAS	45 DAS	30 DAS	45 DAS	30 DAS	45 DAS	
T_1	14.00(3.81)*	22.00(4.72)	9.32(3.13)	16.50(4.11)	72.22	69.91	14.20
T_2	7.67(2.86)	14.67(3.88)	4.30(2.18)	7.94(2.88)	87.20	85.29	1.74
T_3	22.00(4.74)	34.00(5.86)	14.10(3.82)	24.05(4.95)	57.94	55.93	31.32
T_4	10.00(3.24)	17.67(4.26)	5.98(2.54)	10.61(3.33)	82.15	80.52	7.93
T_5	26.33(5.18)	47.33(6.91)	17.76(4.27)	28.91(5.42)	46.99	46.96	37.58
T_6	32.33(5.73)	59.66(7.76)	20.57(4.59)	34.71(5.93)	38.61	36.24	45.30
T_7	18.67(4.38)	29.34(5.46)	12.07(3.54)	19.65(4.48)	64.01	63.89	21.85
T_8	0.00(0.71)	0.00(0.71)	0.00(0.71)	0.00(0.71)	100.00	100.00	0.00
T_9	59.33(7.74)	86.00(9.30)	33.52(5.83)	54.53(7.42)	0.00	0.00	58.39

NS- Non significant

Similarly, application of Propaquizafop 2.5% + Imazethapyr 3.75% w/w ME @ 2000 g ha^{-1} as EPoE resulted in the highest seed yield (1412 kg ha^{-1}), haulm yield (2650 kg ha^{-1}) and harvest index (34.88). However, this was statistically at par with Fluazifop-p-butyl 11.1% + Fomesafen 11.1% SL @ 250 g *a.i.* ha^{-1} RM @ 1000 g ha^{-1} as EPoE, which recorded seed yield of 1323 kg ha^{-1} and haulm yield of 2549 kg ha^{-1} and harvest index (34.15), as compared to other herbicide treatments (Table 2). The improved performance of these treatments can be linked to their combined, wide-ranging and sustained weed suppression, which minimized competition for essential resources during key growth and reproductive periods. This favorableenvironment promoted better crop establishment, improved growth parameters, enhanced reproductive potential and efficient resource partitioning towards both seed and haulm production. These findings are consistent with the results of Patel *et al.* (2021) and Bagotiya *et al.* (2018) in soyabean.

Conclusion

The experimental findings indicated that early post-emergence herbicides significantly influenced the control of weeds and improved the productivity of urdbean. Among the different treatments, Propaquizafop 2.5% + Imazethapyr 3.75% w/w ME (50 + 75 g *a.i.* ha^{-1}) RM @ 2000 g ha^{-1} as EPoE and Fluazifop-p-butyl 11.1% + Fomesafen 11.1% SL (250 g *a.i.* ha^{-1}) RM @ 1000 g ha^{-1} as EPoE proved most effective in reducing the density and dry weight of weeds. These treatments recorded significantly higher seed and haulm yields, highlighting their potential as reliable and cost-effective weed management options for urdbean.

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