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VK Tiwari
Department of Agronomy, College of Agriculture, IGKV, Raipur, Chhattisgarh, India

Rajveer Singh Yadav
Department of Agronomy, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, Uttar Pradesh, India

Ramesh Mahajan
Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya Gwalior, Madhya Pradesh, India

Balkrishina Namdev
Mahatma Gandhi Chitrakoot Gramoday Vishwavidyalaya Chitrakoot, Satna, Madhya Pradesh, India

Santosh Kumar
Department of Agronomy, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, Uttar Pradesh, India

Correspondence
VK Tiwari
Department of Agronomy, College of Agriculture, IGKV, Raipur, Chhattisgarh, India

Effect of weed management practices on yield attribution of urdbean under late sown

VK Tiwari, Rajveer Singh Yadav, Ramesh Mahajan, Balkrishina Namdev and Santosh Kumar

Abstract
A field experiment was carried out during *kharif* season of 2012 at the Research Cum Instructional Farm, Indira Gandhi Krishi Vishwavidyala, Raipur to find out appropriate sowing date and weed management practices of blackgram. The experiment was laid down in split plot design with three replication. There were three date of sowing assigned in main plot and the weed management practices assigned in sub plot The soil of the experimental field was clayey in texture (*Vertisols*) with low N, medium P and high K content. Result revealed that the highest plant population was recorded under August 9 sowing over rest of sowing dates. Significantly the higher yield and its attribute was noted under August 9 sowing over other dates tested. Among the weed management practices, application of imazethapyr 35 % + imazamox 35 % (Odyssey 70 WG) @ 75 g ha^{-1} + HW at 35 DAS (W_6) produced significantly higher yield and its attribute. However, it was found at par with pendimethalin (PE) @ 1 kg ha^{-1} + HW at 25 DAS (W_4). Among different weed management practices, application of imazethapyr 35 % + imazamox 35 % (Odyssey 70 WG) @ 75 g ha^{-1} + HW at 35 DAS (W_6) performed better over other weed management practices under the agro-climatic condition of Chhattisgarh plains.

Keywords: weed management, yield attribution

Introduction
Pulses are grown in Chhattisgarh the around 8.68 lakh hectare are out of which 2.14 lakh hectare in kharif and 6.54 lakh hectare in rabi. Urdbean is one of the major kharif pulse of upland grown in 1.92 lakh hectare are with productivity of 396 kg/ha (Anonymous 2012) [1]. Slow initial growth of urdbean and favourable condition for weed multiplication and a wide spectrum of heterogeneous weed flora, which gradually become a serious limitation for low productivity of urdbean. Most prominent weed species found in urdbean field are Trianthema portulacastrum, Cyprus rotendus, Euphorbia hirta, and phyllanthus niruri. Uncontrolled weeds at critical period of crop-weed competition reduce the yield of urdbean to tune of 80-90% depending upon type and intensity of weed infestation (Kumar *et al*. 2001) [7].

In spite of the importance of this crop in our diet and in agricultural production system, the productivity of urdbean is very low in India as well as in Chhattisgarh due to various agronomic reasons, among them weed infestation is one of the major limiting factors in production, especially during rainy (kharif) season. Uncontrolled weeds at critical period of crop-weed competition caused a reduction of 80-90% in yield depending upon type and intensity of weed infestation (Kumar *et al*., 2001) [1]. To control weed, the traditional method of weed control *i.e.* hand weeding, although is effective but it is expensive, tedious and time consuming (Yadav *et al.*, 2009) [15]. Moreover, hand weeding and mechanical weeding are difficult due to continuous rainfall and less availability of labours at the critical stage of crop-weed competition. Use of herbicide not only improve crop yield but also makes available significant labour for other productive activities.

The crop-weed competition starts from the beginning, since the crop and weed emerge simultaneously, thus, warrants the suitable weed management practices to get effective, timely and economical control of weeds in urdbean. In Chhattisgarh special spreading type of local. The efficacy of pre-plant and pre-emergence herbicides for weed control is reduced by various climatic and edaphic factors. Untimely and continuous rains, as well as unavailability of labour at peak time are main limitations of manual weeding. The only alternative that needs to be explored, is the use of post-emergence herbicides. The screening of such herbicides in pulses reveals their efficiency against either monocotyledonous or dicotyledonous weeds. Hence, their mixtures may broaden the window of weed management through broad spectrum weed control (Bineet *et al.*, 2001) [6]. Hence present investigation was under taken to identify suitable herbicide, their appropriate rate and time of application for urdbean during kharif season.

Methodology

A field experiment was conducted during rainy (kharif) season of 2012 at Research Farm of Indira Gandhi Agriculture University, Raipur. The soil of the experimental field was clayey (Vertisols) in texture, low in available nitrogen, medium in available phosphorus and high in available posassium status coupled with neutral pH. The experiment was laid down in split plot design with three replication. There were three date of sowing assigned in main plot August 9 (D1), August (D2) and August 27 (D3) and the weed management practices assigned in sub plots. Weedy check (W_1), Hand weeding at 20 DAS (W_2), Pendimethalin PE @ 1 kg ha^{-1} (W_3), Pendimethalin PE @ 1 kg ha^{-1} (W_3) + HW at 25 DAS (W_4), Imazethapyr 35 % + Imazamox 35 % (Odyssey 70 WG) @ 75 gha^{-1} at 20 DAS (W_5), Imazethapyr 35 % + Imazamox 35 % (Odyssey 70 WG) @ 75 g ha^{-1} (W_5) + HW at 35 DAS (W_6), Pendimethalin PE @ 1 kg ha^{-1} (W_3) + Imazethapyr 35 % + Imazamox 35 % (Odyssey 70 WG) @ 75 g ha^{-1} at 20 DAS (W_5) (W_7), Chemical stale seed bed Gyphosate @ 1200 g ha^{-1} 10 days (W_8). Sowing was done (local spreading type) with a seed rate 20 kg/ha with a spacing of 30 cm row to row. A basal dose 20kg/ha N, 16kg/ha P, 20 kg/ha K and 20 kg/ha S was applied uniformly.

Results and discussion

Total weed density

Among date of sowing, total weed density at all the growth intervals and at harvest were found non-significant. Among different weed management practices, it was observed that infestation of weeds was increased with time in all treatments. Data revealed that at early stage of observation (20 DAS) herbicide applied as pre- emergence i.e. pendimethalin @ 1 kg ha^{-1} + HW at 25 DAS (W_4) recorded significantly minimum total weed density over other weed management practices and it was found comparable with results of treatment pendimethalin (PE) @ 1 kg ha^{-1} + imazethapyr 35% + imazamox 35% (Odyssey 70 WG) @ 75 g ha^{-1} 20 DAS (W_7).

At 40 and 60 DAS as well as at harvest significantly minimum weed density was recorded with the application of imazethapyr 35 % + imazamox 35 % (Odyssey 70 WG) @ 75 g ha^{-1} + HW at 35 DAS (W_6) over the other weed management practices. The result was comparable with treatment pendimethalin @ 1 kg ha^{-1} + HW at 25 DAS (W_4). The maximum weed density was found under weedy check plot (W_1) at all stages of crop. Hand weeding found very effective to control the all type of weeds, during all the stages of crop growth might be due to its effectiveness. All types of herbicides applied in this trial were found effective to control different type of weeds might be attributed because of selectivity nature as well as dose applied. Application of early post emergence herbicide imazethapyr 35% + imazamox 35% (odyssey 70 WG) @ 75 g ha^{-1} checked the germinating weeds during the early stage of crop period and this was supplemented with hand weeding (W_6) which minimized the crop-weed competition. Pre emergence application of pendimethalin (W_7) affected the hypocotyls of the germinating weed seeds, thereby reducing the weed density at the initial stage of crop growth period and minimize the crop-weed competitions. Supplementation of hand weeding (W_4) was effectively controlled the growth of entire weeds during critical stages of crop growth. Our results are in agreements with the finding of Begum and Rao (2006) [3, 4] who also reported that application of imazethapyr @ 63 g ha^{-1} (PoE) was most effective against sedges and broad leaf weeds. Randhawa *et al.* (2002) [10] also reported that pre-emergence application of pendimethalin @ 1.5 kg ha^{-1} was effective to control weeds during early stages of crop. The weed density was significantly highest in weedy check which was due to absence of suitable weeds management practices. The variations in total weed density at all the growth intervals was observed due to effect of different weed management practices which influenced weed density Rathi *et al.*(2004) [11] also reported similar findings.

Yield attributes

Significantly highest pods plant^{-1}, seeds pod^{-1}, seeds plant^{-1} and 100 seed weight were recorded from the plots where crop was sown on 9th August as compared to other date of sowing (Table 1). Whereas, the lowest pods plant^{-1}, seeds pod^{-1}, seeds plant^{-1} and 100 seed weight were noted on August 27 sowing. Maximum yield attributes in earlier date of sowing might be due to higher number of branches and flowers plant^{-1} with adequate supply of soil-moisture and nutrients. Similar observations have been reported by Singh and Mann (2004) [13] and Singh and Sekhon (2007) [12].

Among various weed management practices, application of imazethapyr 35 % + imazamox 35 % (Odyssey 70 WG) @ 75 g ha^{-1} + HW at 35 DAS (W_6) gave significantly highest pods plant^{-1}, seeds pod^{-1}, seeds plant^{-1} and 100 seed weight followed by pendimethalin (PE) + HW at 25 DAS (W_4) and pendimethalin (PE) @ 1 kg ha^{-1} + imazethapyr 35% + imazamox 35% (Odyssey 70 WG) @ 75 g ha^{-1} 20 DAS (W_7). The pods plant^{-1}, seeds pod^{-1}, seeds plant^{-1} and 100 seed weight was noted under weedy check (W_1).

It is quite clear from the data that interaction effects of date of sowing and weed management on pods plant^{-1}, seeds pod^{-1}, seeds plant^{-1} and 100 seed weight were significant. The treatment combination of August 9 x imazethapyr 35 % + imazamox 35 % (Odyssey 70 WG) @ 75 g ha^{-1} + HW at 35 DAS recorded significantly maximum yield traits followed by the treatment combination of August 18 x imazethapyr 35 % + imazamox 35 % (Odyssey 70 WG) @ 75 g ha^{-1} + HW at 35 DAS. The increase in yield attributes in treatment combination August 9 x imazethapyr 35 % + imazamox 35 % (Odyssey 70 WG) @ 75 g ha^{-1} + HW at 35 DAS (W_6) might be due to timely sowing resulted higher number of branches and effective control of weeds also provide proper space, maximum light interception moisture and nutrient absorption for better growth and development of crop plants resulted better translocation and distribution of photosynthesis from source to sink. Similar observations have been reported by Singh and Mann (2004) [13].

Yields

Effect of date of planting on seed yield, stover yield and harvest index are presented in Table 1. Blackgram sown on August 9 produced significantly higher seed yield (646.96 kg ha^{-1}) and stover yield (1270.05 kg ha^{-1}). However, the lowest seed yield (506.22 kg ha^{-1}) and stover yield (1035.95 kg ha^{-1}) were noted with planting on August 27. All the planting dates differed significantly from each other. The superiority of growth characters *viz.* branches, dry matter accumulation, number of nodules and weight as discussed earlier may be the possible reasons for the production of seed and stover yield under August 9 planting. The results are in accordance with the findings of Soomrao and Khan (2003) [14] and Bhaskar (2005) [5].

Among various weed management practices, application of imazethapyr 35% + imazamox 35% (Odyssey 70 WG) @ 75

g ha^{-1} + HW at 35 DAS (W6) gave significantly higher seed yield (864.96 kg ha^{-1}) and stover yield (1565.64 kg ha^{-1}) followed by with pendimethalin (PE) + HW at 25 DAS (W_4). While, the lowest seed yield (312.50 kg ha^{-1}) and stover yield (709.94 kg ha^{-1}) were noted under weedy check (W1). The capacity of plants to produce seed yield depends not only the size of photosynthetic system, its efficiency and length of time for which it is active but also affected by translocation and distribution of photosynthates from source to sink. The final build-up of yield is cumulative function of all yield parameters (Begum and Rao, 2006) [3, 4]

Weed index (%)

It is quite clear from Table 1 that maximum weed index was found under weedy check (W_1) (63.87%) due to the fact that there was minimum seed yield, whereas minimum weed index was found in pendimethalin (PE) + HW at 25 DAS (W_4) (24.47%). This might be due to effective weed control during critical stage of crop growth periods gave congenial environment for better growth and development of crop plant which turn optimum grain yield. This is in agreement with findings of Banjara *et al*. (1999) [2]. The maximum weed index under weedy check was due to the fact that there was minimum seed yield under weedy check because of severe crop-weed competition during critical period of crop growth.

Plant population (No. m^{-2})

In general plant population recorded at 20 DAS ranged between 21.57 to 25.89 plants m^{-2} whereas plant population at harvest ranged from 19.50 to 24.42 plants m^{-2} (Table 2). Optimum plant population is a pre-requisite for obtaining high grain yield (Nandan and Kumar, 2005) [8]. The results revealed that date of sowing caused significant variation in the plant population of Urdbean both at 20 DAS and at harvest stage, but non-significant differences in plant population were counted under the different weed management practices.

Sowing of blackgram at August 9th recorded significantly higher number of plants metre^{-2} at 20 DAS and at harvest as compared to other date of sowing. Whereas, the lowest plant population was observed when crop was sown on August 27th at 20 DAS and at harvest. There was no substantial improvement in the plant population count with different weed management practices and the differences were not large enough to reach the level of significance. The plant population is prime factor for getting maximum yield. The maximum yield potential of individual plant achieved when less crop – weed competition for different growth factors resulted proper utilization of light, water and nutrients etc.

Table 1: Total weed density at successive stage, yield and yield attributes, and weed index of blackgram as influenced by date of sowing and weeds management practices

Treatment	Total weed density (m^{-2})				Yield attributes				Yields (Kg ha^{-1})		Weed index (%)
	20 DAS	40 DAS	60 DAS	At harvest	Pods $plant^{-1}$	Seeds pod^{-1}	Seeds $plant^{-1}$	100-seed weight	Seed	Stover	
Date of sowing											
D_1: August 9	66.28	56.45	62.54	68.16	15.70	8.72	139.85	4.66	646.96	1270.05	-
D_2: August 18	65.06	55.20	59.48	65.10	14.09	8.02	113.53	4.53	562.10	1105.82	-
D_3: August 27	63.51	52.72	57.81	62.81	13.04	7.67	101.12	4.33	506.22	1035.95	-
SEm±	0.96	1.15	1.38	1.04	0.30	0.16	3.81	0.05	17.18	36.82	-
CD (P=0.05)	NS	NS	NS	NS	1.18	0.62	14.94	0.21	67.45	144.5	-
Weed management											
W_1	88.19	123.00	139.04	144.04	10.78	7.18	78.26	4.29	312.50	709.94	63.87
W_2	83.70	45.27	47.00	52.00	14.59	8.03	116.38	4.48	581.86	1184.94	32.73
W_3	38.44	49.72	53.39	58.39	13.78	7.96	110.09	4.42	526.96	1051.23	39.08
W_4	34.38	26.94	29.67	34.67	16.12	8.86	144.13	4.60	653.27	1309.31	24.47
W_5	81.31	48.17	52.11	57.11	13.82	7.96	110.31	4.43	542.74	1093.70	37.25
W_6	82.21	24.88	28.28	33.28	17.49	9.45	168.52	4.98	864.96	1565.64	-
W_7	35.77	30.28	33.49	38.49	14.64	8.10	118.75	4.47	602.00	1205.31	30.40
W_8	75.60	90.06	96.56	104.89	13.01	7.55	98.91	4.40	489.81	978.12	43.37
SEm±	1.09	0.99	1.62	1.65	0.45	0.26	5.78	0.13	19.16	40.91	-
CD (P=0.05)	3.11	2.84	4.61	4.72	1.29	0.75	16.50	0.38	54.68	116.74	-

Table 2: plant population and total dry matter production of weed index of blackgram as influenced by date of sowing and weeds management practices

Treatment	Plant population (No. m^{-2})		Total dry matter production of weeds (g m^{-2})			
	20 DAS	At harvest	20 DAS	40 DAS	60 DAS	At harvest
Date of sowing						
D_1: August 9	25.89	24.42	4.81 (22.65)	4.76 (22.16)	6.38 (40.28)	7.79 (60.14)
D_2: August 18	22.79	21.39	4.66 (21.26)	4.70 (21.63)	6.23 (38.37)	7.66 (58.18)
D_3: August 27	21.57	19.50	4.43 (19.17)	4.56 (20.37)	6.13 (37.08)	7.54 (56.31)
SEm±	0.30	0.56	0.49	0.30	0.51	0.49
CD (P=0.05)	1.18	2.19	1.92	1.17	1.99	1.91
Weed management						
W_1	22.96	21.00	5.15 (26.01)	8.15 (65.89)	10.72 (114.44)	11.99 (143.44)
W_2	23.44	21.78	5.00	3.49	5.44	6.68

			(24.56)	(11.72)	(29.11)	(44.11)
W_3	22.91	21.63	4.20 (17.17)	5.07 (25.17)	6.02 (35.80)	7.16 (50.80)
W_4	23.78	22.26	4.12 (16.50)	3.10 (9.10)	4.54 (20.10)	5.97 (35.10)
W_5	23.15	21.78	4.95 (24.00)	3.53 (12.00)	5.44 (29.11)	6.89 (47.00)
W_6	24.03	22.63	4.97 (24.17)	3.02 (8.61)	4.48 (19.61)	5.92 (34.61)
W_7	23.62	21.96	4.14 (16.66)	3.45 (11.44)	4.81 (22.61)	6.17 (37.61)
W_8	23.44	21.11	4.44 (19.17)	5.26 (27.17)	6.19 (37.83)	8.57 (73.00)
SEm+	0.37	0.41	0.81	0.61	0.57	1.60
CD (P=0.05)	NS	NS	2.31	1.74	1.63	4.56

Total dry matter production of weeds (g m^{-2})

There was significant variation in dry matter production due to different treatment and significant and significantly highest dry matter production was observed with August 9th sowing (Table 2). However, it was found at par with sowing on August 18 at 20 DAS, 40 DAS and at 60 DAS. The lowest total dry matter of weeds was found with sowing on August 27. Higher dry matter production might be due the more congenial environmental available for growth and development of weeds.

Weed management practices also showed significant variation on total dry matter production of weeds. It was observed that application of imazethapyr 35 % + imazamox 35 % (Odyssey 70 WG) @ 75 g ha^{-1} + HW at 35 DAS (W_6) resulted in the lowest weed dry matter production during all this stages of observation except at 20 DAS where in application of pendimethalin @ 1 kg ha^{-1} + HW at 25 DAS (W_4) recorded the lowest weed dry matter production and significantly at par with pendimethalin (PE) @ 1 kg ha^{-1} + imazethapyr 35% + imazamox 35% (Odyssey 70 WG) @ 75 g ha^{-1} 20 DAS (W_7) and pendimethalin (PE) @ 1 kg ha^{-1} (W_3). At 40 and 60 DAS imazethapyr 35 % + imazamox 35 % (Odyssey 70 WG) @ 75 g ha^{-1} + HW at 35 DAS (W_6) recorded lower weed dry matter production which was statically at par with application of pendimethalin @ 1 kg ha^{-1} + HW at 25 DAS (W_4). Whereas, at harvest imazethapyr 35 % + imazamox 35 % (Odyssey 70 WG) @ 75 g ha^{-1} + HW at 35 DAS (W_6) recorded lowest weed dry matter production over other treatment and it was at par with treatment pendimethalin @ 1 kg ha^{-1} + HW at 25 DAS (W_4) and pendimethalin (PE) @ 1 kg ha^{-1} + imazethapyr 35% + imazamox 35% (Odyssey 70 WG) @ 75 g ha^{-1} 20 DAS (W_7). The data revealed that all weeds were controlled effectively by hand weeding during all stages of crop growth. All type of herbicides applied in this trial were found effective to control different types of weeds might be because of its nature of selectivity as well as appropriate dose of application. Dry matter production of weeds was significantly highest in weedy check might be due to absence of suitable weed management practices, which leads to accumulation of more dry matter in weeds up to harvest. These results are in conformity to the findings of Banjara *et al.* (1999) [2] and Raman *et al*. (2005) [9].

Conclusions

On the basis of results of present investigation it can be concluded that sowing of blackgram (Locally available spreading type) on August 9 was found superior over August 18 and August 27 sowing respect to respect of growth characters, yield attributes and yield. Among different weed management practices, application of imazethapyr 35 % + imazamox 35 % (Odyssey 70 WG) @ 75 g ha^{-1} + HW at 35 DAS (W_6) performed better over other weed management practices under the agro-climatic condition of Chhattisgarh plains.

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