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Response of Summer Blackgram (*Phaseolus mungo* L.) to different Sowing Time and Weed Management Practices

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Abstract: *A field investigation on "Response of summer blackgram (*Phaseolus mungo *L.) to different sowing time and weed management practices" was conducted during summer season 2015 at AICRP on Irrigation Water Management, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra). The experiment was laid out in a factorial randomized block design with three replications. Eighteen treatment combinations consisting of three levels of sowing times i.e. 3rd week of Feb. (16th February) (D_1), 1st week of March (2nd March) (D_2), 3rd week of March (17th March) (D_3) and six levels of weed management i.e. Weedy check (control) (W_1), weed free up to harvest (W_2), pendimethalin @ 1 kg a.i. ha^{-1} (PE) (W_3), pendimethalin @ 1 kg a.i. ha^{-1} (PE)* fb *imazethapyr @ 75 g a.i. ha^{-1} (PoE) at 20 DAS (W_4), imazethapyr @ 75 g a.i. ha^{-1} (PoE) at 20 DAS (W_5), one hoeing at 20 DAS* fb *one hand weeding at 40 DAS (W_6). The predominant weed flora observed in the experimental plot were* Cynodon dactylon, Cyperus rotundus, Digera arvensis, Parthenium hysterophorus, Euphorbia geneculata, Euphorbia thymifolia *and* Portulaca oleracea. *Total weed count and weed dry matter was higher under 3rd week of March sowing and in weedy check. Weed control efficiency was recorded highest under 1st week of March sowing and in treatment one hoeing at 20 DAS & one hand weeding at 40 DAS. Weed index was recorded the highest under 3rd week of March sowing and in treatment weedy check. Sowing on 1st week of March (D_2) recorded significantly the highest seed (11.04 q ha^{-1}) and stover yields (14.40 q ha^{-1}) of summer blackgram. Likewise weed free up to harvest treatment gave significantly highest seed (12.19 q ha^{-1}) and stover yields (15.98 q ha^{-1}) and was at par with one hoeing at 20 DAS* fb *one hand weeding at 40 DAS and pendimethalin @ 1 kg a.i. ha^{-1} (PE)* fb *imazethapyr @ 75 g a.i. ha^{-1} (PoE) at 20 DAS. The highest net monetary returns (₹25923) with B: C ratio (1.97) was obtained in 1st week of March sowing. Similarly the highest net monetary returns (₹28492) with B: C ratio (2.05) was obtained from treatment one hoeing at 20 DAS & one hand weeding at 40 DAS followed by pendimethalin @ 1 kg a.i. ha^{-1} (PE)* fb *imazethapyr@ 75 g a.i. ha^{-1} (PoE) at 20 DAS (₹27671) and B: C ratio (2.02) and treatment weed free up to harvest with net monetary returns (₹27785) and B: C ratio (1.92).*

Keywords: *Blackgram, imazethapyr, pendimethalin, weed control efficiency, yield and economics*

INTRODUCTION

Pulses, "The wizard of the health" owes a strategic position in agriculture economy of India. They are wonder gift of nature to the living universe and are the real gateway of sustainable agriculture looking to the nutrition point of view. The interesting aspect of grain legumes is their unique ability to fulfill their own nitrogen requirement, quick maturity, versatile adaptive nature in different agro-climatic and soil situations, providing crop cover against erosion and adds organic matter through leaf falls.The country is the largest producer of pulses, accounting 22 per cent of the total world production of pulses. However, availability of pulses capita^{-1} in country is very less (30-35 g capita^{-1}) as compared to recommendations of WHO (80 g capita^{-1}). Due to this, around 80 million children of the country are still protein energy under nourished (Mondal *et al.* 2004). Hence, there is a prime need of time to

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increase the average pulse productivity where blackgram can play a crucial role to fulfill protein requirement.

Among the pulses, blackgram *(Phaseolus mungo* L. Hepper) is commonly known as Urd or Udid, Mash or Mungo and belonging to family leguminosae. It is originated from India and central Asia. The grain contains 24 per cent protein and also contain considerable amount of amino acids like lysine, methionine and cystine (Poehlman, 1991). Also, it is a good source of fat 1.4 per cent, mineral 3.2 per cent and carbohydrates 60 per cent. Being leguminous crop, it improves soil fertility in terms of atmospheric nitrogen fixation to the soil by about 70-90 kg ha^{-1} through symbiosis and improves the fertility and health of soil (Gupta & Prasad, 1982). In India, blackgram is mostly grown in Andhra Pradesh, Bihar, Madhya Pradesh, Maharashtra, Uttar Pradesh, West Bengal, Punjab, Haryana, Tamil Nadu, Karnataka, Orissa and Gujarat with an area of about 3.5 million ha with a total production of 1.5 to 1.9 million tones with an average productivity of 500 kg ha^{-1} (Anonymous 2015). About 70 per cent of world's blackgram comes from India. For summer blackgram, germination is affected due to low temperature if sowing is done early and if the crop is sown late, there are chances of damage from rain. It is, therefore, necessary to find out optimum period of sowing for blackgram in summer season for obtaining higher production.Similarly among several factors responsible for low yields of pulse crops in India, weed infestation is considered one of the major factors. Blackgram often suffers severe weed competition especially during early growth phases. Being a short duration and initially slow growing, blackgram is heavily infested with narrow and broad leaved weeds and sedges which compete with crops, resulting in yield reduction to the tune of 30-50 per cent (Mishra, 1997). It needs more attention to control weeds during summer as it grows more vigorously due to more sunshine and irrigation (Jain and Jain, 1997). Therefore, it is indeed essential to control weeds by any means during critical period of competition to exploit full yield potential of this crop.

MATERIALS AND METHODS

The experiment was conducted during summer 2015 at AICRP on Irrigation Water Management, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra). The experiment was laid out in a factorial randomized block design with three replications. Eighteen treatment combinations consisting of three levels of sowing times i.e. 3rd week of Feb. (16th February) (D_1), 1st week of March (2nd March) (D_2), 3rd week of March (17th March) (D_3) and six levels of weed management i.e. Weedy check (control) (W_1), Weed free up to harvest (W_2),Pendimethalin @ 1 kg a.i. ha^{-1} (PE) (W_3), Pendimethalin @ 1 kg a.i. ha^{-1} (PE) *fb* imazethapyr @ 75 g a.i. ha^{-1} (PoE) at 20 DAS (W_4), Imazethapyr @ 75 g a.i. ha^{-1} (PoE) at 20 DAS (W_5), one hoeing at 20 DAS *fb* one hand weeding at 40 DAS (W_6) were evaluated in factorial randomized block design with three replications. The experimental field has flat topography. Soil of the experimental field was clayey in texture and placed in fertility scale of low, medium and high rating for available nitrogen, phosphorus and potassium, respectively. The soil was found slightly alkaline in reaction.

Blackgram variety TAU 1 was sown at 30 cm × 10 cm spacing using a seed rate of 12 kg ha^{-1} and post emergence application done at 20 days after sowing. The weed count and weed dry matter were subjected to square root transformation "*(X+0.5)* to normalize the distribution.

RESULT AND DISCUSSION

Weed flora

The major weed flora observed in the experimental field included *Cynodon dactylon*as monocot weed while *Digera arvensis, Parthenium hysterophorus, Euphorbia geneculata, Euphorbia thymifolia, Portulaca oleracea* as dicot weeds *and Cyperus rotundus*as sedge weed. It was observed that dicot weeds found the maximum than monocot and sedges in each treatment. The major dicot weeds observed were *Digera arvensis, Parthenium hysterophorus, Euphorbia geneculata, Euphorbia thymifolia, Portulaca oleracea* but

most dominating weeds were *Parthenium hysterophorus, Euphorbia geneculata* at all stage of crop growth. Similar results were also reported by Chin and Pandy (1991), Gogoi *et al.* (1992) and Modak *et al.* (1995).

Effect of sowing time

Sowing time had no significant effect on plant population. Second sowing time D_2 (1st week of March) recorded appreciably or significantly higher values of almost all the growth parameters viz., plant height, number of branches plant^{-1}, number of root nodules plant^{-1}, number of leaves plant^{-1}, leaf area plant^{-1} and dry matter accumulation (g plant^{-1}) at 28, 42, 56 DAS and at harvest except in early stages (14 DAS). However, it was statistically identical with first sowing time 3rd week of February (16th February) (D_1). Significantly the lowest values were recorded under third sowing time 3rd week of March (17th March) (D_3) in all of the growth attributing characters. Sowing on 3rd week of February (D_1) took significantly the maximum days to 50 per cent flowering but it was at par with 1st week of March (D_2). Whereas, the least number of days to 50 per cent flowering were recorded in 3rd week of March (D_3).Yield attributing characters viz., number of pods plant^{-1} were significantly influenced by different sowing time treatments while other characters like number of seeds pod^{-1}, pod length and 100 seed weight showed non-significant influence. Significantly higher numbers of pods plant^{-1} were recorded under 2nd March (D_2) sowing which were statistically at par with 16th February (D_1) sowing. Significantly the lowest number of pods plant^{-1} was recorded under 17th March (D_3) sowing. Different sowing times showed significant effect on the seed yield. Significantly maximum seed yield (11.04 q ha^{-1}) was recorded in treatment D_2 (1st week of March sowing) but found at par with treatment D_1 (16th February sowing). Significantly the lowest seed yield production was produced under the treatment D_3 (3rd week of March sowing). Higher yield during 1st week of March sowing was mainly owing to favorable temperatures and humidity during their growth period and better nodulation resulting in better growth. From the economics point of view, 2nd March (D_2) sowing registered higher net returns of ₹ 25923 ha^{-1} with benefit: cost ratio was of 1.97 which was closely followed by treatment D_1 (16th February sowing) with net returns of ₹ 23760 ha^{-1} and benefit: cost ratio was1.91. The results confirm the findings of Gupta and Lal (1989), Panwar and Sharma (2004), Kumar *et al.* (2008) and Gangwar *et al.* (2013).

Effect weed management

Weed population and dry weight of total weeds were markedly higher under weedy check (W1). Significantly lower weed population at 14 DAS was observed in pendimethalin @ 1 kg a.i. ha^{-1} (PE) *fb* imazethapyr @ 75 g a.i. ha^{-1} (PoE) at 20 DAS (W_4) followed by pendimethalin @ 1 kg a.i. ha^{-1} (PE) (W_3). However, at 28, 42, 56 DAS and at harvest significantly lower weed population observed in one hoeing at 20 DAS & one hand weeding at 40 DAS (W_6) followed by pendimethalin @ 1 kg a.i. ha^{-1} (PE) *fb* imazethapyr @ 75 g a.i. ha^{-1} (PoE) at 20 DAS (W_4). So far dry weight of weeds at harvest is concerned, all the treatments of weed management differed significantly from each other and remained in $W_6<W_4<W_3<W_5<W_1$ order of their significance. Weed free up to harvest (W_2), One hoeing at 20 DAS & one hand weeding at 40 DAS (W_6) and pendimethalin @ 1 kg a.i. ha^{-1} (PE) *fb* imazethapyr @ 75 g a.i. ha^{-1} (PoE) at 20 DAS (W_4) had significantly influenced most of the growth attributes of blackgram and recorded higher values, for plant height, number of branches plant^{-1}, number of leaves plant^{-1}, leaf area plant^{-1} and dry matter production plant^{-1} recorded and found superior to rest of the weed management practices. Treatment of weed free up to harvest (W_2) recorded significantly higher number of pods plant^{-1} and pod length and it was at par with one hoeing at 20 DAS & one hand weeding at 40 DAS (W_6) and pendimethalin @ 1 kg a.i. ha^{-1} (PE) *fb* imazethapyr @75 g a.i. ha^{-1} (PoE) at 20 DAS (W_4). However, effect of weed management practices on number of seeds pod^{-1} and 100 seed weight was found non-significant. The seed yield (q ha^{-1}) differed significantly due to different weed management

practices. The highest (12.19 q ha^{-1}) seed yield was recorded by the treatment weed free up to harvest (W_2) but it was at par with treatments one hoeing at 20 DAS & one hand weeding at 40 DAS (W_6) and pendimethalin @ 1 kg a.i. ha^{-1} (PE) *fb* imazethapyr @ 75 g a.i. ha^{-1} at 20-25 DAS (W_4). The lowest seed yield of blackgram was found in the treatment comprising weedy check (W_1). The highest net returns of ₹ 28,492 ha^{-1} with benefit: cost ratio was 2.05 obtained from treatment one hoeing at 20 DAS *fb* one hand weeding at 40 DAS (W_6) followed by pendimethalin @ 1 kg a.i. ha^{-1} (PE) *fb* imazethapyr @ 75 g a.i. ha^{-1} (PoE) at 20 DAS (₹ 27671) and B: C ratio (2.02) and treatment weed free up to harvest with net monetary returns (₹ 27785) and B: C ratio (1.92).

Table 1.
Total weed count m^{-2} as influenced periodically by different treatments

Treatments	*Mean weed count m^{-2}*				
	14 DAS	*28 DAS*	*42 DAS*	*56 DAS*	*At harvest*
Sowing time (D)					
D_1 : 3rd week of Feb. (16th Feb.)	3.81	3.93	3.98	4.34	4.51
	(16.43)	(18.76)	(20.15)	(23.31)	(24.98)
D_2 : 1st week of March (2nd March)	3.56	3.62	3.63	4.07	4.16
	(14.31)	(15.89)	(16.82)	(20.43)	(21.37)
D_3 : 3rd week of March (17th March)	4.07	4.32	4.38	4.74	4.82
	(18.76)	(22.59)	(24.04)	(27.76)	(28.53)
SEm±	0.06	0.06	0.04	0.05	0.05
CD at 5%	0.16	0.16	0.13	0.14	0.15
Weed management (W)					
W_1 : Weedy check (control)	5.30	6.70	7.19	7.71	7.83
	(27.64)	(44.69)	(51.42)	(59.20)	(60.98)
W_2: Weed free up to harvest	0.71	0.71	0.71	0.71	0.71
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
W_3 : Pendimethalin @ 1 kg a.i. ha^{-1} (PE)	3.75	4.63	4.74	5.08	5.26
	(13.76)	(21.06)	(22.08)	(25.42)	(27.31)
W_4 : Pendimethalin @ 1 kg a.i. ha^{-1} (PE) *fb*	3.42	3.99	4.15	4.42	4.64
W_4 : imazethapyr @ 75 g a.i. ha^{-1} (PoE) at 20 DAS	(11.31)	(15.56)	(16.87)	(19.20)	(21.20)
W_5 : Imazethapyr @ 75 g a.i. ha^{-1} (PoE) at 20 DAS	4.75	5.30	5.38	5.73	5.78
	(22.20)	(27.83)	(28.64)	(32.42)	(33.09)
W_6 : One hoeing at 20 DAS *fb* one hand weeding	4.95	2.39	1.83	2.67	2.76
W_6 : at 40 DAS	(24.09)	(5.34)	(2.99)	(6.75)	(7.20)
SEm±	0.08	0.08	0.06	0.07	0.07
CD at 5%	0.23	0.23	0.18	0.20	0.21
Interaction (D x W)					
SEm±	0.14	0.14	0.11	0.12	0.13
CD at 5%	NS	NS	0.31	0.35	NS
General mean	3.81	3.95	4.00	4.39	4.50

Table 2.
Weed dry matter at harvest as influenced by different treatments

Treatments	*Dry weight of weeds (g m^{-2})*
Sowing time (D)	
D_1 : 3rd week of Feb. (16th Feb.)	5.68(39.33)
D_2 : 1st week of March (2nd March)	5.43(36.13)
D_3 : 3rd week of March (17th March)	5.83(41.40)
SEm±	0.06
CD at 5%	0.17
Weed management (W)	
W_1: Weedy check (control)	9.96(98.87)
W_2 : Weed free up to harvest	0.71(0.00)
W_3 : Pendimethalin @ 1 kg a.i. ha^{-1} (PE)	6.16(37.56)
W_4 : Pendimethalin @ 1 kg a.i. ha^{-1} (PE) *fb* imazethapyr @ 75 g a.i. ha^{-1} (PoE) at 20 DAS	5.56(30.47)
W_5: Imazethapyr @ 75 g a.i. ha^{-1} (PoE) at 20 DAS	6.69(44.27)
W_6 : One hoeing at 20 DAS *fb* one hand weeding at 40 DAS	4.79(22.57)
SEm±	0.08
CD at 5%	0.23
Interaction (D x W)	
SEm±	0.14
CD at 5%	NS
General mean	5.64

Table 3.
Seed yield, stover yield and harvest index of blackgram as influenced by different treatments

Treatments	*Seed yield (q ha^{-1})*	*Stover yield (q ha^{-1})*	*Harvest index (%)*
Sowing time (D)			
D_1 : 3rd week of Feb. (16th Feb.)	10.46	13.91	42.75
D_2 : 1st week of March (2nd March)	11.04	14.40	43.24
D_3 : 3rd week of March (17th March)	8.99	12.88	41.03
SEm±	0.28	0.34	1.01
CD at 5%	0.80	0.96	NS
Weed management (W)			
W_1 : Weedy check (control)	7.32	10.77	40.78
W_2 : Weed free up to harvest	12.19	15.98	43.21
W_3 : Pendimethalin @ 1 kg a.i. ha^{-1} (PE)	9.47	13.09	41.78
W_4 : Pendimethalin @ 1 kg a.i. ha^{-1} (PE) *fb* imazethapyr @ 75 g a.i. ha^{-1} (PoE) at 20 DAS	11.52	14.75	43.86
W_5 : Imazethapyr @ 75 g a.i. ha^{-1} (PoE) at 20 DAS	8.79	12.36	41.36
W_6 : One hoeing at 20 DAS *fb* one hand weeding at 40 DAS	11.70	15.44	43.06
SEm±	0.40	0.47	1.43
CD at 5%	1.14	1.36	NS
Interaction (D x W)			
SEm±	0.69	0.82	2.48
CD at 5%	NS	NS	NS
General mean	10.16	13.73	42.34

Table 4.
Economics of blackgram as influenced by different treatments

Treatment	*Gross monetary returns (₹ ha^{-1})*	*Cost of cultivation (₹ ha^{-1})*	*Net monetary returns (₹ ha^{-1})*	*B : C Ratio*
Sowing time (D)				
D_1 : 3rd week of Feb. (16th Feb.)	49857	26098	23760	1.91
D_2 : 1st week of March (2nd March)	52571	26648	25923	1.97
D_3 : 3rd week of March (17th March)	43014	27198	15816	1.58
SEm±	1262	-	1262	-
CD at 5%	3628	-	3628	-
Weed management (W)				
W_1 : Weedy check (control)	35071	24134	10937	1.45
W_2 : Weed free up to harvest	58029	30244	27785	1.92
W_3 : Pendimethalin @ 1 kg a.i. ha^{-1} (PE)	45226	26362	18864	1.72
W_4 : Pendimethalin @ 1kg a.i. ha^{-1} (PE) *fb* imazethapyr @ 75 g a.i. ha^{-1} (PoE) at 20 DAS	54806	27135	27671	2.02
W_5 : Imazethapyr @ 75 g a.i. ha^{-1} (PoE) at 20 DAS	42026	24777	17249	1.70
W_6 : One hoeing at 20 DAS *fb* one hand weeding at 40 DAS	55726	27234	28492	2.05
SEm±	1785	-	1785	-
CD at 5%	5131	-	5131	-
General mean	48481	26648	21833	-

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