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Imidazolinone herbicides for weed control in greengram

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ABSTRACT

A field experiment to study the efficacy of imidazolinone herbicides in greengram was conducted during *Kharif* seasons of 2012 and 2013. Ten weed control treatments *viz.* imazethapyr at 50 and 70 g, premix of imazethapyr + imazamox at 60 and 70 g/ha, both applied as post-emergence at 20 days after sowing; pendimethalin 1000 g and premix of pendimethalin + imazethapyr at 800, 900, 1000 g/ha, both applied as pre-emergence, along with two hand weedings and weedy check were evaluated. Imazethapyr alone and its premixes with pendimethalin and imazamox recorded effective control of mixed weed flora and produced significantly higher greengram seed yield than weedy check. Pendimethalin alone did not control *Commelina benghalensis* and recorded lower seed yield. All the herbicides were safe to crop.

Key words: Greengram, Herbicides, Imazethapyr, Seed yield, Weed control

Greengram (*Vigna radiata* (L.) R. Wilczek) occupies a prominent place among major pulse crops of India and is inseparable ingredients of vegetarian diet, being one of the cheapest sources for protein. Weed infestation is one of the major constraints in greengram grown in *Kharif* (monsoon) season and full season competition with the weeds cause yield reduction to the extent of 25-100% (Punia *et al*. 2004, Malik *et al*. 2005). The crop needs a weed free period of first 30 days, as the crop is short stature and suffers badly if weeds are not controlled at early stages (Mirjha *et al*. 2013). The magnitude of loss as a result of crop-weed competition depends upon type of weed species, associated with crop, their densities and duration of competition with crops.

Weed emergence in greengram begins almost with the crop emergence leading to crop-weed competition from initial stages. *Trianthema portulacastrum* germinates at the same time as greengram crop and completes its life-cycle within 30 days and grassy weeds like*; Dactyloctenium aegyptium* and *Echinochloa colona* germinate with the onset of rains (Punia *et al*. 2013). The conventional methods of weed control (hoeing or hand weeding) are labour intensive and uneconomical and may cause damage to the crop. Chemical weed control is not common as the use of herbicides may be uneconomical due to low yield potential of greengram (Reddy 2004). The available pre- and post-emergence herbicides like pendimethalin, imazethapyr are able to check the emergence and growth of annual weeds (Chhodavadia *et al*. 2013). This study was done to find out the relative efficiency of imidazolinone herbicides when applied alone or as premix in greengram.

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MATERIALS AND METHODS

The experiment was conducted at Research Farm, Department of Agronomy, Punjab Agricultural University, Ludhiana (Punjab) during *Kharif* 2012 and 2013. The soil of the experimental site was loamy sand with normal soil reaction (pH=7.4) and electrical conductivity (0.15 dS/m). The soil was low in organic carbon (0.30 %) and available nitrogen (261.7 kg/ha) and medium in available phosphorus (12.5 kg/ha) and potassium (169.1 kg/ha). The experiment was laid out in randomised complete block design with ten treatments including pendimethalin 1000 g/ha applied as pre-emergence, premix of imazethapyr + pendimethalin 800, 900 and 1000 g/ha applied as pre-emergence; imazethapyr 50, 70 g/ha applied at 20 days after sowing (DAS), premix of imazethapyr + imazamox 60, 70 g/ha applied at 20 DAS; two hand weedings at 20 and 40 DAS and weedy replicated thrice. The crop was sown with hand drill with seed rate of 20 kg/ha keeping 30 cm row to row spacing using cv. *'SML 668'* during 2012 and cv. '*PAU 911*' during 2013. The pre-emergence herbicides were applied within two days of sowing with knap sack sprayer fitted with flat fan nozzle that delivered 500 liter water/ha whereas post-emergence herbicides were sprayed using 375 l/

ha of water at 20 DAS when weeds were at 3-4 leaf stage. All other recommended package of practices for crop cultivation was followed. The data of weed count and dry matter was taken at 40 DAS. The data on crop growth, yield attributes and seed yield was recorded at harvest. The data was analysed using 'CPCS1' statistical software. The analysis of individual years was done and comparisons were made at 5 per cent level of significance.

RESULTS AND DISCUSSION

Effect on weeds

The major weeds in the experimental field included *Commelina benghalensis, Digitaria sanguinalis, Eleucine indica, Trianthema portulacastrum, Amaranthus viridis* and *Cyperus rotundus* during 2012; only grasses *viz, Dactyloctenium aegyptium, Commelina benghalensis, Digitaria sanguinalis and Acrachne racemose* were recorded during 2013. All the weed control treatments, except pendimethalin 1000 g/ha and imazethapyr 50 g/ha, provided effective control of grasses, broad-leaves (BLW) and sedges and created weed free conditions till first 40 days of sowing during 2012 (Table 1). The pendimethalin was ineffective against sedges and lost its efficacy after 20 days of application against grasses and broad-leaves. Imazethapyr at lower dose provided effective control of broad-leaves however it was poor on grasses and sedges. During 2013, pendimethalin + imazethapyr provided effective control of all the grass weeds and created weed free conditions till first 40 days of sowing. Higher pressure of *Commelina benghalensis* in pendimethalin treated plots increased weed dry matter (Table 2). Imazethapyr at its both levels and premix of imazethapyr + imazamox were relatively poor on *Acrachne* and *Commelina* but controlled *Dactyloctenium aegyptium* and *Digitaria sanguinalis.*

Effect on yield attributes and seed yield

The crop was heavily infested with yellow mosaic virus and hence the yields were very lower and differential effect of weed control treatments on seed yield and yield attributes disappeared during

Table 1. Effect of different weed control treatments on weeds at 40 DAS in greengram during *Kharif* 2012

Treatment	Dose (g/ha)	Weed population/m^2			Weed dry matter g/m^2		
		Grasses	BLW	Sedges	Grasses	BLW	Sedges
Pendimethalin	1000	3.4 (11)	4.3 (18)	5.2 (27)	7.7 (62)	9.7 (101)	6.3 (40)
Imazethapyr	50	2.2 (7)	1.0 (0)	1.8 (3)	2.8 (14)	1.0 (0)	1.2 (1)
Imazethapyr	70	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)
Imazethapyr + pendimethalin	800	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)
Imazethapyr + pendimethalin	900	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)
Imazethapyr + pendimethalin	1000	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)
Imazethapyr + imazamox	60	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)
Imazethapyr + imazamox	70	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)
Hand weeding at 20 and 40 DAS	-	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)
Weedy check	-	10.7 (119)	4.9 (23)	2.1 (7)	20.6 (432)	10.8 (118)	5.8 (33)
LSD (P=0.05)		1.8	0.9	1.0	2.7	2.5	0.8

Table 2. Effect of different weed control treatments on weeds at 40 DAS in greengram during *Kharif* 2013

Treatment	Dose (g/ha)	Weed population (no/m^2)				Weed dry matter (g/m^2)
		Commelina benghalensis	*Dactyloctenium aegyptium*	*Digitaria ciliaris*	*Acrachne racemose*	
Pendimethalin	1000	5.7 (32)	1 (0)	1 (0)	1 (0)	24.2 (586)
Imazethapyr	50	2.2 (7)	1 (0)	1 (0)	2.9 (15)	6.6 (105)
Imazethapyr	70	1.5 (2)	1 (0)	1 (0)	2.6 (11)	2.2 (7)
Imazethapyr + pendimethalin	800	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
Imazethapyr + pendimethalin	900	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
Imazethapyr + pendimethalin	1000	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
Imazethapyr + imazamox	60	1.5 (2)	1 (0)	1 (0)	2.4 (9)	2.4 (9)
Imazethapyr + imazamox	70	1.5 (2)	1 (0)	1 (0)	2.1 (5)	2.3 (8)
Hand weeding at 20 and 40 DAS	-	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
Weedy check	-	4.3 (18)	3.5 (11)	1.8 (3)	8.5 (75)	34.3 (1176)
LSD (P=0.05)	-	1.3	0.9	0.4	2.5	5.4

Figures in parentheses are original values. Data were subjected to square root transformations

Table 3. Effect of different weed control treatments on greengram yield and yield attributes of greengram

Treatment	Dose (g/ha)	Plant height at harvest (cm)		Branches/ plant		Pods/plant		Seed yield (kg/ha)		B:C
		2012	2013	2012	2013	2012	2013	2012	2013	
Pendimethalin	1000	66.4	63.5	5.1	4.8	19	14.3	192	502	0.82
Imazethapyr	50	60.5	74.7	5.2	7.1	20	24.3	177	701	1.02
Imazethapyr	70	61.9	73.8	4.9	7.2	16	24.8	196	715	1.04
Imazethapyr + pendimethalin	800	58.8	74.2	4.8	6.7	14	26.7	179	737	1.07
Imazethapyr + pendimethalin	900	68.3	77.2	6.2	6.7	23	24.3	188	775	1.12
Imazethapyr + pendimethalin	1000	63.0	76.3	6.1	7.3	24	25.9	188	862	1.25
Imazethapyr + imazamox	60	64.7	72.0	5.2	6.7	19	22.7	188	672	0.98
Imazethapyr + imazamox	70	65.7	70.7	5.9	7.1	22	26.3	188	676	0.98
Hand weeding at 20 and 40 DAS	-	73.8	72.7	6.5	7.1	26	27.2	188	843	1.19
Weedy check	-	53.1	64.8	4.4	4.7	11	13.5	210	435	0.77
LSD (P=0.05)	-	NS	5.5	NS	0.7	NS	3.7	NS	220	-

2012. During second year of study, all the post-emergence herbicides treatments recorded significantly higher greengram seed yield and yield attributes such as plant height at harvest, branches/ plant and pods/plant as compared to weedy check and were at par to two hand weedings (Table 3). Greengram yield attributes and seed yield was significantly lower in pendimethalin treated plots as compared to the post emergence herbicides treatments due to more weed dry matter in former. These results are in agreements with Raj *et al.* (2012) that higher seed and haulm yields with higher weed control efficiency were obtained with two hoeing at 20 and 40 DAS and was followed by pendimethalin as pre-emergence 0.75 kg/ha + one hand weeding at 40 DAS. All the herbicides were safe to the crop.

Economics

Pre-emergence application of imazethapyr + pendimethalin 1000 g/ha recorded the highest B:C ratio and it was followed by lower doses of 900, 800 g/ha and two hand weedings at 20 and 40 DAS (Table 3). Lower benefits were obtained when pendimethalin as pre-emergence and imazethapyr + imazamox as post-emergence were applied for weed control.

Hence, post-emergence application of imazethapyr alone or its pre-mix with pendimethalin/ imazamox can be adopted for effective control of weeds in greengram.

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