International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2017; 5(4): 814-817

Received: 01-05-2017
Accepted: 02-06-2017

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

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

Bavajigudi Shobha Rathod
Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

J Ravinder
Department of Soil Science and Agricultural Chemistry, Dr.Panjab Rao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

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

Herbicidal effect of imazethapyr and its ready-mix with imazemox on yield parameters of green gram (*Vigna radiata* L.)

Akhilesh Kumar Gupta, Bollaveni Sathish Kumar, Bavajigudi Shobha Rathod and J Ravinder

Abstract
A field experiment was conducted during *Kharif* season of 2015 at Crop Research Centre Chirauri, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) The experimental soil was low in organic carbon, nitrogen and medium in available P and K. The experiment was conducted in RBD with three replications comprising fifteen weed management practices viz. Imazethapyr @ 70 g ha^{-1} as pre plant incorporation, Imazethapyr @ 80 g ha^{-1} as pre plant incorporation, Imazethapyr @ 70 g ha^{-1} as pre emergence, Imazethapyr @80 g ha^{-1} as pre emergence, Imazethapyr @ 70 g ha^{-1} at 3-4 leaf Stage, Imazethapyr @ 80 g ha^{-1} at 3-4 leaf Stage, Imazethapyr +imazemox (RM) @ 70 g ha^{-1} as pre emergence, Imazethapyr +imazemox (RM) @ 80 g ha^{-1} as pre emergence, Imazethapyr +imazemox (RM) @ 70 g ha^{-1} at 3-4 leaf Stage, Imazethapyr +imazemox (RM) @ 80 g ha^{-1} at 3-4 leaf Stage, Pendimethalin @ 1000 g ha^{-1} as pre emergence, Imazethapyr + Pendimethalin (RM)@ 1000 g ha^{-1} as pre emergence, Hand weeding at 20&40 DAS, Weed free and Weedy check. All the weed control treatments had significant effect on the grain yield, straw yield, boilogical yield and horwest index. Over the all treatments weedy check and hand weeding at 20 and 40 DAS showed possitive effect on yield parameters fallowed by POE application of imazethapyr + imazemox (RM) @ 80 g ha^{-1}.

Keywords: Weed, imazethapyr, weed control efficiency and green gram

1. Introduction

Green gram (*Vigna radiata* L.) has been grown in India since ancient times. It is also known as mungbean and golden gram. It is important short duration, predominantly rainy season pulse crop grown in many part of India. Green gram reported to be originated in India. Green gram area in India is 3.55 million ha with production about 1.82 million tonnes and productivity 512 kg ha^{-1} and in U.P on an area 78,000 ha with production 45,000 ton and productivity 577 kg ha^{-1} (Anonymous, 2011) [3]. The area of pulses crop has not increased much during the past 60-65 year except in 2011 and 2012, it showed an increase of 1.5 to 2.0 m ha. In order to ensure self sufficiency, the pulse requirement in the country is projected at 27.5 million tonnes by the year 2025. (Datta and Singh, 2015) [6].

Green gram is grown widely for use as a human food. Largely consumed as dal in northern India other used as fried snacks. It is supposed to be easily digestible and hence is preferred by patient also. It contains about 25 % protein, 60 % carbohydrate and 1.3 % fat. It can be used for both seed and forage production. It plays an important role not only in human diet, but also in improving the soil fertility through biological nitrogen fixation with Rhyzobium (Upadhyay *et al*. 1999) [14]. Green gram is grown mainly for its protein rich edible seed. It contain about 25 % protein, and several essential amino acid including lysine, which is generally found deficient in cereals and providing protein rich diet to vegetarian population of the country. It is also rich in Vitamin A, B_1, B_2 C and calcium, phosphorus and potassium (Singh, 1998) [11].

Green gram is grown as rainfed or irrigated condition in wider rows. Cultural and mechanical weed control can be practiced, but it is not always feasible due to their high cost, non-availability of labour at appropriate time, prevailing weather condition, long window of weed emergence in the growing season and continuous moisture during rainy season is a problem which make it difficult to remove within specified time when they are most potent of injury to crop So chemical methods of weed management offer good scope for harvesting a good crop of green gram.

Weed management is an important factor for enhancing the productivity of green gram, as weeds compete for nutrient, water, light and space with crop plant during early growth period. Yield losses in green gram due to weeds have been estimated to range between 30-50 %. Annual broad leaf weed, carpet weed (*Trianthema portulacastrum*) germinates at the same time as green gram and complete its life cycle within 60 days (Balyan, 1985) [4] and grassy weed, barnyard grass (*Echinochloa colona)* germinate immediately after onset of rains and irrigation, are two aggressive weed and if not controlled at proper time, can cause heavy yield losses. The extent of yield reduction due to weeds in green gram have been reported to be 42-68% (Patro and Prusty, 1994, Singh *et al*., 1995) [10, 12] depending upon intensity and type of weed flora. Thus it is necessary to eliminate weeds from crop at proper time and with suitable methods. The most commonly used herbicides for controlling weeds in green gram are trifluralin, linuron, acetachlor (Malik *et al*., 2000) [8] and pendimethalin, alachlor and fluchloralin (Mishra and Singh, 1993) [9]. Imazethapyr is a new herbicide of imidazolinone group registered for use in soybean, groundnut and other legumes (Herbicide Handbook USA, 2002) [7]. Imazethapyr can be applied as pre-plant incorporation, pre-emergence, and post-emergence to control grasses and broadleaved weeds in pulse crops (Anonymous 2006) [2]. Early post emergence application of imazethapyr at 40-75 g ha^{-1} proved to be effective herbicide in *kharif* green gram replacing Pendimethalin across the zones (Anonymous 2011) [3].

Materials and Methods

The experiment was carried out at the Crop Research Centre Chirauri farm of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P) at a latitude of 29^0 40′ North and longitude of 77^0 41′ East and at an altitude of 237 meters above the mean sea level. Meerut is located on the Delhi-Dehradun national highway road 8 km. away from experimental site. The climate of this region is sub-tropical and semiarid with hot summers and extremely cold winters. Wide temperature variations *i.e.* maximum temperature exceeds even 46^0C during the hot summer month May and June and minimum temperature occasionally touches 2^0C during winter months December to January. The total rainfall as well as its distribution in the region shows large variations. About 80 to 90 per cent of rains are received during June to September by south- west monsoon. The North-East monsoon leads to few winter rains. The mean annual rainfall is around 860 mm and the mean annual relative humidity varies from 67-83 % during the year. Soil of the experimental site has been classified as sandy loam. Field was well drained and levelled.

Table 1: Treatment details:

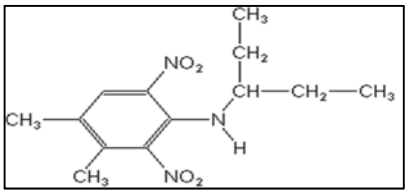
Sr. No.	Treatments	Symbols
1.	Imazethapyr @ 70 g ha^{-1} as pre plant incorporation	T_1
2.	Imazethapyr @ 80 g ha^{-1} as pre plant incorporation	T_2
3.	Imazethapyr @ 70 g ha^{-1} as pre emergence	T_3
4.	Imazethapyr @80 g ha^{-1} as pre emergence	T_4
5.	Imazethapyr @ 70 g ha^{-1} at 3-4 leaf Stage	T_5
6.	Imazethapyr @ 80 g ha^{-1} at 3-4 leaf Stage	T_6
7.	Imazethapyr +imazemox (RM) @ 70 g ha^{-1} as pre emergence	T_7
8.	Imazethapyr +imazemox (RM) @ 80 g ha^{-1} as pre emergence	T_8
9.	Imazethapyr +imazemox (RM) @ 70 g ha^{-1} at 3-4 leaf Stage	T_9
10.	Imazethapyr +imazemox (RM) @ 80 g ha^{-1} at 3-4 leaf Stage	T_{10}
11.	Pendimethalin @ 1000 g ha^{-1} as pre emergence	T_{11}
12.	Imazethapyr + Pendimethalin(RM)@ 1000 g ha^{-1} as pre emergence	T_{12}
13	Hand weeding at 20&40 DAS	T_{13}
14.	Weed free	T_{14}
15.	Weedy check	T_{15}

The experiment was conducted in randomized block design with three replications and 15 treatments.

Mode of action of pendimethalin

It act both pre-emergence that is before weed seedling have emerged and early post emergence. Pendimethalin inhibits both cell division and cell elongation in the roots and shoot meristem of the susceptible plant. The growth is inhibited directly following absorption through hypocotyls and shoot region. Germination as such is not inhibited, the plant die shortly after germination or emergence from the soil.

Group	:	Dinitroaniline
Common name	:	Pendimethalin
Trade name	:	Stomp
Active ingredient	:	30% EC
IUPAC name	:	N-(1-ethylpropyl)-2,6-dinitro-3,4-xylidine
Empirical formula	:	$C_{13}H_{19}N_3O_4$

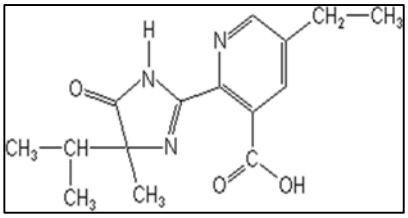
Structural formula; 

Mode of action of imazethapyr

It is absorbed by roots and foliage, trans-located throughout the xylem and phloem, and accumulated in the growing regions. Therefore, it controls the entire weeds and plants, including root or rhizome. It control both emerged and multiple flushes of shallow germination weeds. It kills the weed by inhibition of acetohydroxy acid. This causes a disruption in protein synthesis. It target the plastid enzyme

acetolactate synthase (ALS) in plant, which catalyses the first step in the biosynthesis of initial branched chain amino acids (valine, leucine and isoleucine). The ALS inhibitors thus stop cell division and reduce carbohydrate translocation in the susceptible plants. The affected plant succumbs to this herbicide completely in 7-20 days. After pre-emergence or pre plant incorporation susceptible weeds may germinate and emerge; however, normal growth stops. After post-emergence application susceptible weeds stop growing and necrosis occur within 4-8 days and provide control over 30 -35 DAS

Group	:	Imidazolinone
Common name	:	Imazethapyr
Trade name	:	Pursuit
Active ingredient	:	10%
IUPAC name	:	5-ethyl-2-[(RS)-4-isopropyl-4-methyl-5-oxo-2- imidazolin-2-yl] nicotinic acid
Empirical formula	:	$C_{15}H_{19}N_3O_3$

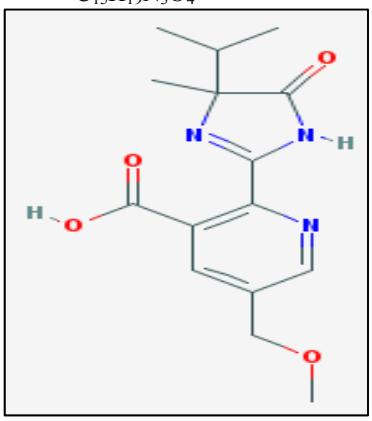
Structural formula : 

\

Mode of action of imazemox

It inhibits the enzyme acetohydroxy acd syntase (AHAS) in plant species, which is involve in the synthesis of three branched- chain aliphatic amino acids; isoleucine, leucine and valine. This inhibition disrupts protein synthesis and subsequently interferes with cell growth. Studies indicate that after application, imazemox is taken up by the foliage and trans- located throughout the plant. Susceptible weeds stop growing shortly after application and expire within 4-12 weeks.

Group	:	Imidazolinone
Common name	:	Imazemox
IUPAC name	:	(RS)-2-(4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)-5-methoxymethylnicotinic acid
Empirical formula:		$C_{15}H_{19}N_3O_4$

Structural formula; 

Grain yield (qha^{-1})

The weight of grains harvested from net plot area was recorded in Kg and finally expressed as qha^{-1}.

Straw yield (qha^{-1})

Straw yield from net plot area was computed by subtracting the grain yield from the biological yield and later converted into qha^{-1}.

Biological yield (qha^{-1})

After harvesting, the green gram crop was sun dried and then weight of net plot area harvested was recorded in Kg and expressed as qha^{-1}.

Harvest index (%)

The harvest index of Urdbean was obtained by dividing the economical yield (grains yield) with the biological yield (grains + straw) and represented in percentage.

$$Harvest \quad Index = \frac{Economic \;\; yield\,(q/ha)}{Bio\log ical \;\; yield\,(q/ha)} x100$$

Results and Discussion

Grain yield

The data revealed that all weed control treatments significantly increased the grain yield over weedy check. The maximum grain yield (1143 kg ha^{-1}) was found with weed free treatment which was significantly higher than other weed control treatments. Among the herbicidal treatments, higher grain yield (1020 kg ha^{-1}) was recorded with POE application of Imazethapyr +imazemox (RM) @ 80 g ha^{-1} followed by POE application of Imazethapyr +imazemox (RM) @ 70 g ha^{-1} (928 kg ha^{-1}) which was higher than other herbicidal treatments. Grain yield was significantly increased in weed free (242.3 %), two hand weeding (222 %) and POE application of Imazethapyr +imazemox (RM) @ 80 g ha^{-1} (205 %) than weedy check. The other herbicidal treatments also maintain their superiority over weedy check.

Straw yield

The data revealed that the maximum straw yield (1858 kg ha^{-1}) was recorded in weed free treatment followed by two hand weeding (1768 kg ha^{-1}) at 20 and 40 DAS. Among the herbicidal treatments, maximum straw yield (1652 kg ha^{-1}) was recorded with POE application of Imazethapyr +imazemox (RM) @ 80 g ha^{-1} followed by POE application of Imazethapyr +imazemox (RM) @ 70 g ha^{-1} (1553 kg ha^{-1}). Straw yield was significantly lower in weedy check in comparison to all other treatments. The other herbicidal treatments also found superiour than weedy check.

Table 2: Effect of various weed control on biological yield, Grain yield, straw yield and harvest index (%) of green gram

Treatments	Grain yield (kg ha^{-1})	Strawyield (kg ha^{-1})	Biological Yield (kg ha^{-1})	Harvest index (%)
Imazethapyr @ 70 g ha^{-1} as pre plant incorporation	430	908	1338	32.1
Imazethapyr @ 80 g ha^{-1} as pre plant incorporation	445	921	1366	32.5
Imazethapyr @ 70 g ha^{-1} as pre emergence	490	983	1473	33.2
Imazethapyr @80 g ha^{-1} as pre emergence	540	1045	1585	34.0
Imazethapyr @ 70 g ha^{-1} at 3-4 leaf Stage	835	1475	2310	36.1
Imazethapyr @ 80 g ha^{-1} at 3-4 leaf Stage	915	1530	2445	37.4
Imazethapyr +imazemox (RM) @ 70 g ha^{-1} as pre emergence	510	903	1413	36.02
Imazethapyr +imazemox (RM) @ 80 g ha^{-1} as pre emergence	570	988	1558	36.5
Imazethapyr +imazemox (RM) @ 70 g ha^{-1} at 3-4 leaf Stage	928	1553	2481	37.4
Imazethapyr +imazemox (RM) @ 80 g ha^{-1} at 3-4 leaf Stage	1020	1652	2672	38.1
Pendimethalin @ 1000 g ha^{-1} as pre emergence	544	984	1528	35.6
Imazethapyr +pendimethalin (RM) @ 1000 g ha^{-1} as pre emergence	780	1303	2086	37.3
Hand weeding at 20&40 DAS	1078	1768	2846	37.8
Weed free	1143	1858	3001	38.0
Weedy check	334	715	1049	31.4
S Em $\pm$	4.2	16.7	9.1	1.0
CD at 5%	12.3	48.0	26.2	2.9

The data revealed that the all weed control treatments increases the biological yield over weedy check. The maximum biological yield (3001 kg ha^{-1}) was recorded in weed free plot closely followed by two hand weeding at 20 and 40 DAS (2846 kg ha^{-1}). Among the herbicidal treatments, POE application of Imazethapyr +imazemox (RM) @ 80 g ha^{-1} give maximum biological yield (2672 kg ha^{-1}) followed by POE application of Imazethapyr +imazemox (RM) @ 70 g ha^{-1} (2481 kg ha^{-1}). Biological yield in other herbicidal treatments was found higher than weedy check.

Harvest index

The data revealed that all weed control treatments increased the harvest index over weedy check. The maximum harvest index (38.1) was recorded with POE application of Imazethapyr +imazemox (RM) @ 80 g ha^{-1} followed by weed free treatment (38.0). Lower harvest index (31.4) was recorded in weedy check. Among the herbicidal treatments significantly lower harvest index was recorded with PPI application of imazethapyr @ 70 g ha^{-1} (32.1)

Hand weeding and POE application of Imazethapyr +imazemox (RM) @ 80 g ha^{-1} attributed to timely control o*f weed* in early stage of crop growth and maintenance of less weed population throughout *the crop* growth period as it persisted long enough to prevent emergence of weed. All these factors resulted in better *availability of* nutrient and moisture to the crop and less weed competition on the crop *growth* and yield contributing character mainly pod per plant, grain per plant and *l000 Seed weight.* These finding are supported by the results of Chin and Pandey (1991) [5], Tewari *et al*. (2004) [13] and Ali *et al*. (2011) [1].

Conclusion

Weed management practices showed significant effect on grain yield, straw yields biological yield and harvest index. Weed free treatment was found significantly superior to rest of the weed management practices.

References

1. Ali, Shaukat, Patel JC, Desai LJ, Singh, Jitendra. Effect of herbicides on weeds and yield of rainy season green gram (*Vigna radiata L. Wilczek*). Legume Res. 2011; 34(4):300-303.
2. Anonymous. Regulation amending the food and drug regulation145 imazethapyr Canada Gazette 2006; 1401:19.
3. Anonymous. All India Coordinated Research Progarmme on MULLaRP -Project Coordinator's Report. 2010-2011, 195 pp.
4. Balyan RS. Control of Hoarse purslane (*Trianthema portulacastrum*) and *E. crusgalli* in mungbean. *Weed Sci.* 1985; 37:695-699.
5. Chin DV, Pandey J. Effect of pre and post emergence herbicide on weeds and yield of black gram (*Vigna mungo*). Ind. J. of Ag. 1991; 36 (Suppl.):276-277
6. Datta SK, Singh, BB.Production and productivity of pulses: Indian perspectives. Pulses Hand Book. 2015, 33-35.
7. Herbicide Hand Book. Imazethapyr, Weed Science Society of America Herbicide Hand Book - 8th Edition, 2002, 256-258.
8. Malik RS, Yadav A, Malik RK.. Efficiency of trifluralin, Linuronand Acetachlor against weed in mungbean (*Vigna radiata* L). Ind. J. Weed Sci. 2000; 32 (3&4):62-64.
9. Mishra OP, Singh, G. Weed management in mungbean. Integrated weed management for sustainable agriculture. In proceedings of Indian Society of Weed Sci. International symposium, Hisar, India, 18-20. 1993; 3:154-155.
10. Patro H, Prusty JC. Integrated weed management in Mungbean (*Vigna radiata* L.) Ind. J. Weed Sci. 1994; (1&2):79-80.
11. Singh K. Studies on competitive ability of summer Mungbean cultivar under different degree of weed management. M.Sc. Thesis submitted to CCS Haryana Agriculture University, 1998.
12. Singh S, Singh AN, Bhan VM. Studies on chemical control of weeds in summer Mungbean (*Vigna radiata* L.). *Ind*. J. Weed Sci. 1995; 27(2):373-374.
13. Tewari AN, Rathi JPS, Tiwari SN, Tripathi AK. Efficacy of imazethapyr a selective herbicide in green gram with special reference to *Parthenium hysterophorous* control. Farm Sci. J. 2004; 13:114-15.
14. Upadhyay RG, Sharma S, Daramwal NS. Effect of rhizobium inoculation and graded levels of phosphorus on growth and yield of summer Mungbean (*Vigna radiata L.*). *Legume Res.* 1999; 22(4):277-279.