



P-ISSN: 2349-8528  
E-ISSN: 2321-4902  
IJCS 2017; 5(4): 231-234  
© 2017 JEZS  
Received: 17-05-2017  
Accepted: 18-06-2017

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## International Journal of Chemical Studies

### Herbicidal effect of imazethapyr and its ready-mix with imazemox on weed control efficiency in 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<sup>-1</sup> as pre plant incorporation, Imazethapyr @ 80 g ha<sup>-1</sup> as pre plant incorporation, Imazethapyr @ 70 g ha<sup>-1</sup> as pre emergence, Imazethapyr @ 80 g ha<sup>-1</sup> as pre emergence, Imazethapyr @ 70 g ha<sup>-1</sup> at 3-4 leaf Stage, Imazethapyr @ 80 g ha<sup>-1</sup> at 3-4 leaf Stage, Imazethapyr + imazemox (RM) @ 70 g ha<sup>-1</sup> as pre emergence, Imazethapyr + imazemox (RM) @ 80 g ha<sup>-1</sup> as pre emergence, Imazethapyr + imazemox (RM) @ 70 g ha<sup>-1</sup> at 3-4 leaf Stage, Imazethapyr + imazemox (RM) @ 80 g ha<sup>-1</sup> at 3-4 leaf Stage, Pendimethalin @ 1000 g ha<sup>-1</sup> as pre emergence, Imazethapyr + Pendimethalin (RM) @ 1000 g ha<sup>-1</sup> as pre emergence, Hand weeding at 20&40 DAS, Weed free and Weedy check.

The result shows that at 30, 60 DAS and at harvest, highest weed control efficiency (93.0, 79.0 and 81.6 %) were recorded with two hand weeding at 20 and 40 DAS. At 30 DAS among the herbicidal treatments (78.1 %) was recorded with PRE application of Imazethapyr + Pendimethalin (RM) @ 1000 g ha<sup>-1</sup> followed by PRE application of Imazethapyr @ 80 g ha<sup>-1</sup> (71.5 %). At 60 DAS, among the herbicidal treatments, maximum weed control efficiency (63.8%) was recorded with POE application of imazethapyr + imazemox (RM) @ 80 g ha<sup>-1</sup> followed by POE application of imazethapyr + imazemox (RM) @ 70 g ha<sup>-1</sup> (61.5%). At harvest, significantly highest weed control efficiency (78.1%) was recorded with POE application of imazethapyr + imazemox (RM) @ 80 g ha<sup>-1</sup> followed by POE application of imazethapyr + imazemox (RM) @ 70 g ha<sup>-1</sup> (75.3%).

**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<sup>-1</sup> and in U.P on an area 78,000 ha with production 45,000 ton and productivity 577 kg ha<sup>-1</sup> (Anonymous, 2011)<sup>[2]</sup>. 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)<sup>[4]</sup>.

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 *Rhizobium* (Upadhyay *et al.* 1999)<sup>[11]</sup>. 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<sub>1</sub>, B<sub>2</sub> C and calcium, phosphorus and potassium (Singh, 1998)<sup>[9]</sup>.

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) [3] 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) [8, 10] 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) [6] and pendimethalin, alachlor and fluchloralin (Mishra and Singh, 1993) [7]. Imazethapyr is a new herbicide of imidazolinone group registered for use in soybean, groundnut and other legumes (Herbicide Handbook USA, 2002) [5]. Imazethapyr can be applied as pre-plant

incorporation, pre-emergence, and post-emergence to control grasses and broadleaved weeds in pulse crops (Anonymous 2006) [1]. Early post emergence application of imazethapyr at 40-75 g ha<sup>-1</sup> proved to be effective herbicide in *kharif* green gram replacing Pendimethalin across the zones (Anonymous 2011) [2].

### 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° 40' North and longitude of 77° 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 semi arid with hot summers and extremely cold winters. Wide temperature variations *i.e.* maximum temperature exceeds even 46°C during the hot summer month May and June and minimum temperature occasionally touches 2 °C 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.

### Treatment details

Sr. No.	Treatments	Symbols
1.	Imazethapyr @ 70 g ha <sup>-1</sup> as pre plant incorporation	T <sub>1</sub>
2.	Imazethapyr @ 80 g ha <sup>-1</sup> as pre plant incorporation	T <sub>2</sub>
3.	Imazethapyr @ 70 g ha <sup>-1</sup> as pre emergence	T <sub>3</sub>
4.	Imazethapyr @ 80 g ha <sup>-1</sup> as pre emergence	T <sub>4</sub>
5.	Imazethapyr @ 70 g ha <sup>-1</sup> at 3-4 leaf Stage	T <sub>5</sub>
6.	Imazethapyr @ 80 g ha <sup>-1</sup> at 3-4 leaf Stage	T <sub>6</sub>
7.	Imazethapyr +imazemox (RM) @ 70 g ha <sup>-1</sup> as pre emergence	T <sub>7</sub>
8.	Imazethapyr +imazemox (RM) @ 80 g ha <sup>-1</sup> as pre emergence	T <sub>8</sub>
9.	Imazethapyr +imazemox (RM) @ 70 g ha <sup>-1</sup> at 3-4 leaf Stage	T <sub>9</sub>
10.	Imazethapyr +imazemox (RM) @ 80 g ha <sup>-1</sup> at 3-4 leaf Stage	T <sub>10</sub>
11.	Pendimethalin @ 1000 g ha <sup>-1</sup> as pre emergence	T <sub>11</sub>
12.	Imazethapyr + Pendimethalin (RM)@ 1000 g ha <sup>-1</sup> as pre emergence	T <sub>12</sub>
13.	Hand weeding at 20&40 DAS	T <sub>13</sub>
14.	Weed free	T <sub>14</sub>
15.	Weedy check	T <sub>15</sub>

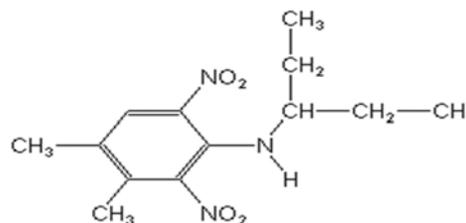
The experiment was conducted in randomized block design with three replications and 15 treatments.

### 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 <sub>13</sub> H <sub>19</sub> N <sub>3</sub> O <sub>4</sub>

Structural formula;



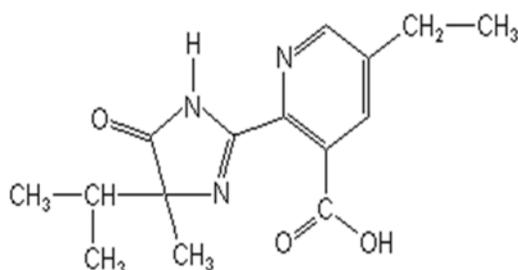
### Mode of action of imazethapyr

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 <sub>15</sub> H <sub>19</sub> N <sub>3</sub> O <sub>3</sub>

Structural formula;

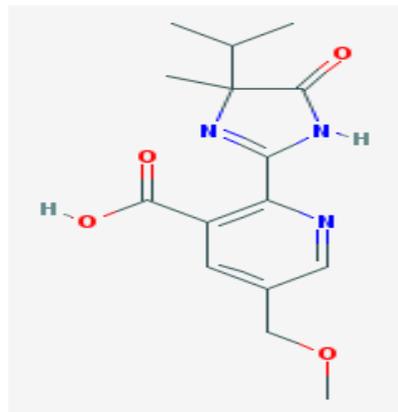


#### Mode of action of imazemox

It inhibits the enzyme acetohydroxy acid 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 <sub>15</sub> H <sub>19</sub> N <sub>3</sub> O <sub>4</sub>

Structural formula;



#### Weed control efficiency (%)

Weed control efficiency (WCE) was calculated at 30, 60 DAS and at harvest by using the following formula.

$$WCE = \frac{DMC - DMT}{DMC} \times 100$$

Where,

DMC = Dry matter production of weeds/m<sup>2</sup> in weedy check

DMT = Dry matter production of weeds/m<sup>2</sup> in the treatment to be compared

#### Results and discussion

The weed control efficiency analysis shows the result at 30, 60 DAS and at harvest, highest weed control efficiency (93.0, 79.0 and 81.6 %) were recorded with two hand weeding at 20 and 40 DAS. At 30 DAS among the herbicidal treatments maximum weed control efficiency (78.1 %) was recorded with PRE application of Imazethapyr + Pendimethalin (RM) @ 1000 g ha<sup>-1</sup> followed by PRE application of Imazethapyr @ 80 g ha<sup>-1</sup> (71.5 %). At 60 DAS, among the herbicidal treatments, maximum weed control efficiency (63.8%) was recorded with POE application of imazethapyr +imazemox (RM) @ 80 g ha<sup>-1</sup> followed by POE application of imazethapyr +imazemox (RM) @ 70 g ha<sup>-1</sup> (61.5%). At harvest, significantly highest weed control efficiency (78.1%) was recorded with POE application of imazethapyr +imazemox (RM) @ 80 g ha<sup>-1</sup> followed by POE application of imazethapyr +imazemox (RM) @ 70 g ha<sup>-1</sup> (75.3%). Hand weeding at 20 and 40 DAS provides the efficient weed control by removing the weeds completely. In any other chemical practices there is less scope to control and remove the weeds from the operation plot. This character makes the hand weeding became the efficient method of weed control.

#### Effect of various weed control treatments on weed control efficiency

Treatments	WCE (%)		
	30 DAS	60DAS	At harvest
Imazethapyr @ 70 g ha <sup>-1</sup> as pre plant incorporation	70.0	35.0	47.0
Imazethapyr @ 80 g ha <sup>-1</sup> as pre plant incorporation	70.0	35.3	47.7
Imazethapyr @ 70 g ha <sup>-1</sup> as pre emergence	70.5	38.4	48.5
Imazethapyr @ 80 g ha <sup>-1</sup> as pre emergence	71.5	40.5	48.2
Imazethapyr @ 70 g ha <sup>-1</sup> at 3-4 leaf Stage	60.0	59.8	58.2
Imazethapyr @ 80 g ha <sup>-1</sup> at 3-4 leaf Stage	64.7	61.3	60.1
Imazethapyr +imazemox (RM) @ 70 g ha <sup>-1</sup> as pre emergence	68.1	52.8	60.0
Imazethapyr +imazemox (RM) @ 80 g ha <sup>-1</sup> as pre emergence	69.2	53.8	60.0
Imazethapyr +imazemox (RM) @ 70 g ha <sup>-1</sup> at 3-4 leaf Stage	61.5	61.5	75.3
Imazethapyr +imazemox (RM) @ 80 g ha <sup>-1</sup> at 3-4 leaf Stage	67.8	63.8	78.1
Pendimethalin @ 1000 g ha <sup>-1</sup> as pre emergence	70.2	33.2	44.2

Imazethapyr + Pendimethalin(RM)@ 1000 g ha <sup>-1</sup> as pre emergence	78.1	53.0	62.1
Hand weeding at 20&40 DAS	93.0	79.0	81.6
Weed free	100	100	100
Weedy check	00	00	00
S Em ±	2.6	2.0	2.3
CD at 5%	7.8	6.0	6.7

### Conclusion

The highest weed control efficiency (93.0, 79.0 and 81.6 %) was recorded with two hand weeding at 20 and 40 DAS. Pendimethalin @ 1000 g ha<sup>-1</sup> as pre emergence (70.2, 33.2 and 44.2) and Imazethapyr @ 70 g ha<sup>-1</sup> as pre emergence (70, 35.3 and 47.7) showed less weed control efficiency than other treatments except weedy check.

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