



# Comparative study of new molecules of herbicides on growth and weed control in soybean

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**Abstract :** The present investigation was carried out during *Kharif* season of 2012 at the Research cum Instructional Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The experiment comprised of eight weed management practices *viz.*, W<sub>1</sub>- Sulfentrazone @ 300 g a.i. ha<sup>-1</sup> as PE, W<sub>2</sub>- Sulfentrazone @ 360 g a.i. ha<sup>-1</sup> as PE, W<sub>3</sub>- Pendimethalin @ 1 kg a.i. ha<sup>-1</sup> as PE, W<sub>4</sub>- Metribuzin @ 750 g a.i. ha<sup>-1</sup> as PE, W<sub>5</sub>- Imazethapyr @ 100 g a.i. ha<sup>-1</sup> as PoE, W<sub>6</sub>- Odyssey 70 WG (imazethapyr 35% + imazamox 35%) @ 100 g a.i. ha<sup>-1</sup> as PoE, W<sub>7</sub>- Hand weeding twice at 20 and 40 DAS and W<sub>8</sub>- Untreated control. Experiment was laid out in Randomized Block Design with four replications. The soybean variety JS 97-52 was grown as test crop. The result of the experiment indicated that the growth characters like plant height, number of branches and dry matter production was maximum under hand weeding twice at 20 and 40 DAS which was found comparable with sulfentrazone @ 360 g a.i. ha<sup>-1</sup> as PE, sulfentrazone @ 300 g a.i. ha<sup>-1</sup> as PE and imazethapyr @ 100 g a.i. ha<sup>-1</sup> as PoE. These treatments also showed minimum weed index. Hand weeding twice at 20 and 40 DAS, sulfentrazone @ 360 g a.i. ha<sup>-1</sup> as PE and imazethapyr @ 100 g a.i. ha<sup>-1</sup> as PoE were also gave highest weed control efficiency.

**Key Words :** Soybean, Growth, Weed control efficiency, Weed index

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## INTRODUCTION

Soybean [*Glycine max* (L.) Merrill] known as a wonder crop of twentieth century because it contains about 40-42 per cent high quality protein, 20-22 per cent edible oil, 20-30 per cent carbohydrates, 4.5 per cent minerals, 3.7 per cent fibre, 8.1 per cent water, large amount of phosphorus, high level of amino acids such as lysine, leucine, lecithin and vitamins. It is able to leave residual nitrogen effect for succeeding crop equivalent to 35-40 kg N ha<sup>-1</sup>. Soybean can tolerate mild drought as well as floods. This characteristic has made soybean to fit well in sustainable agriculture. Soybean due to its various uses is rightly called "Golden Gift" of nature to mankind. In India, soybean occupies an area of 10.18 m ha, with production potential of 12.28 million tonnes and average productivity of

1207 kg ha<sup>-1</sup> (Anonymous, 2012). The productivity of soybean is less in India as compared to world average (2490 kg ha<sup>-1</sup>). Global area and production of soybean is 102 m ha and 254 million tonnes, respectively (Anonymous, 2011). The soybean grown in rainy season faces severe weed competition. Weed competition in soybean at early stage of crop growth is critical, as it causes yield losses upto 10 to 86 per cent depending upon weed infestation. The critical period of crop-weed competition in soybean is reported to be first 45 DAS (Panneerselvam and Lourduraj, 2000).

Most prominent weed species found in soybean are *Echinochloa crusgalli*, *Cynodon dactylon*, *Corchorus* spp., *Cyperus rotundus*, *Euphorbia* spp., *Commelina benghalensis*, *Parthenium hysterophorus*, *Setaria glauca*, *Eclipta alba*, *Phyllanthus niruri*, *Acalypha indica*,

*Trianthema portulacastrum*, and *Alysicarpus rugosus* (Behera *et al.*, 2005). The traditional method of weed control *i.e.* hand weeding is tedious and time consuming (Yadav *et al.*, 2009). 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 herbicides not only improve crop yield but also make available labour for other productive activities (Kurchania *et al.*, 1989). Hand weeding is a traditional and effective method of weed control, but 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 soybean reveals their efficiency against either monocotyledonous or dicotyledonous weeds. Hence, their mixtures may broaden the window of weed management by broad-spectrum weed control (Bineet *et al.*, 2001). Now-a-days a few herbicides like imazethapyr, quizalofop and fenoxaprop are available, which can be used safely in soybean (Sharma *et al.*, 2009). Recent investigations have revealed that imidazolinones group of herbicide is very effective in controlling the weeds in soybean (e.g. imazethapyr). These herbicides are active against broad leaf and grassy weed, but their effects are variable at different places depending on the soil type intensity and type of weed flora, rainfall etc. (Yadav *et al.*, 2009).

In agriculture point of view, Chhattisgarh state is divided into three sub agro climatic region in Chhattisgarh plains, Bastar plateau and Northern hill zone with three types of soils *viz.*, *Bhata (Entisols)*, *Matasi (Inseptisols)*, 45.5 per cent, *Dorsa (Alfisols)* 10.0 per cent and *Kanhar (Vertisols)* 25.0 per cent of the total net cultivated area. In Chhattisgarh, the upland unbanded *bharri (Kanhar)* occupies 10.0 per cent (3.4 lakh ha) area. This structure is most suitable for cultivation of soybean in *Kharif* season. Alleviating weed competition through weed management practices especially involving new herbicides have been found to be effective in enhancing crop yield of soybean. The use of selective herbicide in soybean seems to be effective and economical. Although several post and pre-emergence herbicides have been used by the farmers of the state to maximize the crop- weed competition, but here is always scope to work on newer herbicides for effective, timely and economical control of weeds for efficient utilization of applied inputs. Therefore, it is of paramount importance to evaluate new herbicides for controlling weeds in agro-ecological situation of Chhattisgarh plains.

## MATERIAL AND METHODS

A field experiment was conducted at Research cum Instructional Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during *Kharif* season of 2012-13. The soil of experimental field was clayey in texture, low in nitrogen (219.78 kg), medium in phosphorus (13.87 kg) and high in potassium

(365.31 kg) with neutral pH (7.12). The preparation of field was done when the soil reached to the working condition. The field was prepared with tractor drawn plough followed by two cross harrowing to obtain a well pulverized seed bed. The weed and crop residues removed to get weed and stubble free seed bed. Finally, it was leveled with the help of tractor driven leveler. The experiment was laid out in Randomized Block Design, comprising four replications and eight treatments which included sulfentrazone 48 per cent F 300 g a.i., sulfentrazone 48 per cent F 360 g a.i., pendimethalin 30 EC as pre-emergence, metribuzin 70 WP as pre-emergence, imazethapyr 10 SL as post-emergence, imazethapyr 35 per cent + imazamox 35 per cent 70 WG as post emergence, hand weeding twice at 20 and 40 DAS and untreated control. Soybean variety 'JS 97-52' (Jawahar Soybean 97-52) was grown as a test crop. It is released from JNKV, Jabalpur. This variety has potential to provide high yield in varied ecoedaphic situation. It is multiple resistant against major diseases including yellow mosaic virus and root rot, resistant/moderately resistant to stem borer and defoliator and tolerant to excessive moisture stress. Excellent regarding germinability, field emergence and longevity. Duration of crop is 98-102 days. Crop was sown with spacing of 45×5 cm during the last week of June using the seed rate of 75 kg ha<sup>-1</sup> and fertilizer dose was 25, 60 and 40 kg/ha of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O, respectively at the time of sowing. Weed management practices were adopted as per the treatments, manually. The observation of weeds were recorded at 60 DAS by placing a quadrat of 0.25 × 0.25 m randomly at four spots in each plot and changed to m<sup>2</sup> basis.

## RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

### Growth attributes :

Significantly taller plants were observed under hand weeding twice at 20 and 40 DAS (W<sub>7</sub>) as compared to other treatments, however it was found comparable with imazethapyr @ 100 g a.i. ha<sup>-1</sup> as PoE (W<sub>5</sub>), odyssey 70 WG (imazethapyr 35% + imazamox 35%) @ 100 g a.i. ha<sup>-1</sup> as PoE (W<sub>6</sub>), sulfentrazone @ 360 g a.i. ha<sup>-1</sup> as pre-emergence (W<sub>2</sub>), sulfentrazone @ 300 g a.i. ha<sup>-1</sup> as PE (W<sub>1</sub>) and pendimethalin (1 kg a.i. ha<sup>-1</sup>) as PE (W<sub>3</sub>). The minimum plant height was registered under Untreated control (W<sub>8</sub>). The maximum plant height in above treatments might be due to the favourable growing conditions in view of low crop-weed competition (Kushwah and Vyas, 2005). Minimum plant height under untreated control could be due to the competitive stress for available resources to be shared by the crop and weeds (Singh *et al.*, 2003).

The highest number of branches plant<sup>-1</sup> was recorded

under Hand Weeding twice at 20 and 40 DAS ( $W_7$ ) as compared to other treatments, however it was found comparable with Sulfentrazone @ 300 g a.i. ha<sup>-1</sup> as PE ( $W_1$ ), Sulfentrazone @ 360 g a.i. ha<sup>-1</sup> as PE ( $W_2$ ) and Imazethapyr @ 100 g a.i. ha<sup>-1</sup> as PoE ( $W_5$ ). The minimum number of branches plant<sup>-1</sup> was registered under Untreated control ( $W_8$ ) (Table 1). The highest number of branches plant<sup>-1</sup> might be due to the reduction in crowding effect or weed population among the crop plants, which facilitate more space, nutrients, light, and moisture and reduces the competition ultimately resulting in more number of branches plant<sup>-1</sup>. These results are conformity with those reported by Vyas and Jain (2003), Kushwah and Vyas (2005).

Maximum dry matter plant<sup>-1</sup> was observed under hand weeding twice at 20 and 40 DAS ( $W_7$ ), however it was found at par with odyssey 70 WG (imazethapyr 35% + imazamox 35%) @ 100 g a.i. ha<sup>-1</sup> as PoE ( $W_6$ ), imazethapyr @ 100 g a.i. ha<sup>-1</sup> as PoE ( $W_5$ ), sulfentrazone @ 360 g a.i. ha<sup>-1</sup> as PE ( $W_2$ ) and sulfentrazone @ 300 g a.i. ha<sup>-1</sup> as PE ( $W_1$ ). The minimum dry matter plant<sup>-1</sup> was registered under untreated control ( $W_8$ ). The higher dry matter accumulation plant<sup>-1</sup> in above treatments might be due to lesser population of weeds which facilitate better utilization of resources and reduces the competition ultimately resulting in more dry matter accumulation plant<sup>-1</sup>. Similar results were reported by Tiwari *et al.* (2006). The lowest dry matter accumulation was recorded under untreated control at all the time intervals of observations. It might be due to adverse effect of excessive crop-weed competition as evident from maximum dry matter production of weeds which resulted in reduction of nutrient uptake and dry matter accumulation by crop. Similar results were reported by Deore *et al.* (2008).

#### Weed attributes :

Maximum weed index was noticed under untreated control ( $W_8$ ) which was 40.79 per cent whereas minimum weed index was registered under sulfentrazone @ 360 g a.i. ha<sup>-1</sup> as PE ( $W_2$ ) followed by imazethapyr @ 100 g a.i. ha<sup>-1</sup> as PoE ( $W_5$ ) (Table 1). It was observed that weed index was substantially

lowered when sulfentrazone either applied @ 300 g a.i. ha<sup>-1</sup> or 360 g a.i. ha<sup>-1</sup> and it showed the weed index of 10.38 per cent and 7.59 per cent, respectively. Weed index indicate the reduction in yield due to weed competition as compared to the maximum attained seed yield. The maximum weed index under untreated control was due to the fact, there was minimum seed yield also reported maximum weed index under untreated control.

Highest weed control efficiency was noted under treatment hand weeding twice at 20 and 40 DAS ( $W_7$ ) followed by sulfentrazone @ 360 g a.i. ha<sup>-1</sup> as PE ( $W_2$ ), odyssey 70 WG (imazethapyr 35% + imazamox 35%) @ 100 g a.i. ha<sup>-1</sup> as PE ( $W_6$ ), sulfentrazone @ 300 g a.i. ha<sup>-1</sup> as PE ( $W_1$ ), imazethapyr @ 100 g a.i. ha<sup>-1</sup> as PoE ( $W_5$ ), metribuzin @ 750 g a.i. ha<sup>-1</sup> as PE ( $W_4$ ) and pendimethalin @ 1 kg a.i. ha<sup>-1</sup> as PE ( $W_3$ ). Lowest weed control efficiency was observed in untreated control ( $W_8$ ). These results might be due to owing to less weed density and production of dry matter by weeds in the treated plots. Similar results were observed by Pramila *et al.* (2004).

#### Conclusion and recommendation :

On the basis of results obtained, it can be concluded that hand weeding twice at 20 and 40 DAS had registered higher growth, minimum weed competition and highest weed control efficiency of *Kharif* soybean under *Vertisols* condition of Chhattisgarh plain as compared to other weed management practices. The next best performing treatments were sulfentrazone @ 360 g a.i. ha<sup>-1</sup> as PE, sulfentrazone @ 300 g a.i. ha<sup>-1</sup> as PE and imazethapyr @ 100 g a.i. ha<sup>-1</sup> as PoE. The same experiment can be repeated for one or more years to get some concrete findings. It can also be tested under different intercrop combinations. Detailed investigation regarding control of different weeds through cultural, mechanical and chemical weed management practices need to be evaluated in combination with different organic and inorganic materials. Studies should be conducted for allelopathic effect as well as on residual effect of newer herbicides in soybean grown as

**Table 1 : Growth, weed control efficiency and weed index in soybean as affected by weed management practices**

Weed management practices		Dose (a.i. ha <sup>-1</sup> )	Plant height (cm)	Number of branches plant <sup>-1</sup>	Dry matter accumulation (g plant <sup>-1</sup> )	Weed index (%)	Weed control efficiency (%)
$W_1$	Sulfentrazone 48 % F	300g	80.3	11.1	32.96	10.38	87.92
$W_2$	Sulfentrazone 48 % F	360g	81.5	11.4	32.98	7.59	93.38
$W_3$	Pendimethalin 30 EC	1 kg	77.7	10.2	26.26	25.61	64.25
$W_4$	Metribuzin 70 WP	750g	76.6	9.9	26.07	33.05	76.72
$W_5$	Imazethapyr 10 SL	100g	80.9	11.3	31.12	8.40	88.05
$W_6$	Odyssey (imazethapyr 35% + imazamox 35%) 70 WG	100g	79.1	10.9	30.26	21.26	83.39
$W_7$	Hand weeding twice	–	82.2	11.7	38.46	–	97.52
$W_8$	Untreated controll	–	71.6	7.3	25.05	40.79	–
	SEm ±		1.6	0.2	3.72	–	–
	C.D. (P=0.05)		4.7	0.7	10.93	–	–

sole as well as under intercropping system. Detail study is needed to identify the best integrated weed management practices under rainfed soybean based intercropping in different agro-climatic zones of Chhattisgarh.

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