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Short communication

Integrated weed management for improved yield of soybean

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Soybean (*Glycine max* (L) Merrill) is one of the important oilseed crops of the Leguminaceae family having subfamily Papilionoaceae and genus *Glycine*. It has revolutionized the agricultural economy with its immense potential for food, fuel and numerous industrial products (Gandhi 2009). It is the cheapest source of protein, therefore it is called as "poor man's meat". The biology of some weeds that occur in soybean makes it difficult to achieve effective weed control with single application of herbicides (PPI or pre- or post-emergence. Hence in order to control weeds for a longer period of crop growth there is need to apply herbicides on sequential basis (Malik *et al.* 2006 and Vijayalaxmi *et al.* 2012). Some studies (Singh *et al.* 2004 and Malik *et al.* 2006) clearly indicated that sequential application of herbicides as pre-emergence followed by post-emergence will provide more consistent weed control than any one (single application) approach. A well planned pre- *fb* post will provide more consistent weed control and helps to solve some of the problems in post-emergence herbicides. New selective post emergence herbicide *viz.*,imazethapyr,fenoxaprop-p-ethyl, propaquizafop- ethyl resulted in less weed biomass and greater yield in soybean (Deore 2008). It has alos been reported that most of the selective herbicide do not control all weeds (Mohod 2002). Therefore integrated approaches of chemical and cultural control may be more feasible and practicable.

A field experiment was conducted during *Kharif* season of 2013-14 at research farm of Phule Krishi Vidyapith; Rahuri during *Kharif*, 2013-2014.The experiment was laid out in randomized block design with eight treatments replicated thrice with combination of pre- and post-emergence herbicide along with hand weeding and hand hoeing.

The soil of experimental field was silty clay with 7.66 pH.The data on weed count and dry weight of weed were analysed using square root $(\sqrt{x+1})$ transformatio.For economy study; prevailing market price was used for different output and inputs.

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Weed flora

Predominant weeds in experiment plot were *Commelina benghalensis*, *Acalypha cilliata*, *Achyranthus aspera*, *Euphorbia geniculata*, *Alternanthera triandra*, *Digera arvensis*, *Merremia emarginata*, *Physalis minima*, *Phyllanthus niruri*, *Parthenium hysteophorus* and *Digetaria arvensis*.

Weed growth

All the treatments resulted in significant reduction in weed density and weed biomass over unweeded control. Weed free check had lowest weed density and biomass. Among combination of herbicide with mechanical method, pre-emergence application of metribuzin at 2 DAS at 525 g/ha + 1 HW at 30 DAS, recorded the lowest weed density and biomass compared to other herbicide treatments, except pre- application of treatment pendimethalin at 2 DAS cs at 677.25 g/ha + 1 HW at 30 DAS, metribuzin at 2 DAS at 525 g/ha *fb* imazethapyr + propaquizafop-ethyl as post-emergence at 20 DAS at 80 + 60 g/ha.

Highest weed control efficiency and lowest weed index were observed in weed free treatment. Among combination of herbicide with mechanical method, pre- application of treatment metribuzin at 2 DAS at 525 g/ha + 1 HW at 30 DAS (Gurjar *et al.* 2001, Kushwah and Vyas 2004) recorded the highest weed control efficiency and lowest weed index percentage over rest of herbicide treatments except pre-application of metribuzin at 2 DAS at 525 g/ha *fb* imazethapyr + propaquizafop-ethyl as post-emeregnce at 20 DAS at 80+60 g/ha.This might be due to pre-emergence application of metribuzin, which prevented emergence of monocot and grassy weeds by inhibiting root and shoot growth while imazethpyr was responsible for inhibition of acetolactate synthases (ALS) or acetohydroxyacide

Table 1. Effect of different weed management practices on weed intensity, dry weight, weed index and weed control efficiency at harvest (pooled mean)

Treatment	Total weed density (number/m^2)	Weed biomass (g/m^2)	Weed index (%)	Weed control efficiency (%)
Pendimethalin pre- at 677.25 g/ha + 1 HW at 30 DAS	4.15 (16.3)	9.31(82.3)	10.9	83.2
Metribuzin post- at 525 g/ha + 1 HW at 30 DAS	3.91 (14.3)	9.04 (80.6)	3.7	85.2
Pendimethalin pre- at 677.25 g/hafb bentazone + fenoxaprop-p-ethyl post- at 1000 + 80 g/ha at 20 DAS	7.16 (50.2)	13.4 (178.6)	36.7	48.2
Metribuzin pre- at 525 g/ha *fb* bentazone + fenoxaprop-p-ethyl post- at 1000 + 80 g/ha at 20 DAS	5.45 (28.7)	9.8 (96.8)	16.2	70.4
Pendimethalin pre at 677.25 g/ha *fb* imazethapyr + propaquizafop-ethyl post- at 80 + 60 g/ha at 20 DAS	5.49 (29.2)	10.1 (100.2)	20.7	69.9
Metribuzin pre at 525 g/ha *fb* imazethapyr + propaquizafop-ethyl post at 80 + 60 g/ha at 20 DAS	4.03 (15.2)	8.73 (75.2)	8.1	84.3
1 Hoeing at 15 DAS and 2 HW at 25 and 45 DAS (weed free)	1.95 (2.8)	2.23 (3.94)	-	97.1
Unweeded control	9.90 (96.9)	22.4 (500.3)	86.3	-
LSD (P=0.05)	0.62	0.95	2.5	9.4

Value given in parentheses are mean of original value, which are transformed to $(\sqrt{x+1})$

Table 2. Effect of weed control treatments on growth, yield attributing charactes, grain, stover yield and economics of soybean

Treatment	Plant height (cm)	No of pod/ plant	No of seed/ plant	Weight of seed/ plant	Test weigh (g)	Seed yeild (t/ha)	Stover yield (t/ha)	Net retun (x10^3 ` /ha)	B:C ratio
Pendimethalin pre- at 677.25 g/ha + 1 HW at 30 DAS	58.4	55.6	152.3	21.6	14.6	2.22	2.40	42.12	2.08
Metribuzin post- at 525 g/ha + 1 HW at 30 DAS	59.6	55.6	158.4	22.9	15.6	2.38	2.56	48.18	2.24
Pendimethalin pre- at 677.25 g/ha *fb* bentazone + fenoxaprop-p-ethyl post- at 1000 + 80 g/ha at 20 DAS	51.7	47.1	133.6	17.8	12.6	1.80	2.07	27.35	1.71
Metribuzin pre- at 525 g/ha *fb* bentazone + fenoxaprop-p-ethyl post- at 1000 + 80 g/ha at 20 DAS	57.2	52.0	148.1	21.0	14.2	2.12	2.32	39.35	2.03
Pendimethalin pre at 677.25 g/ha *fb* imazethapyr + propaquizafop-ethyl post- at 80 + 60 g/ha at 20 DAS	56.7	51.3	147.4	20.6	14.1	2.04	2.22	36.62	1.96
Metribuzin pre at 525 g/ha *fb* imazethapyr + propaquizafop-ethyl post at 80 + 60 g/ha at 20 DAS	60.3	55.6	154.3	21.7	14.6	2.28	2.46	45.74	2.21
1 Hoeing at 15 DAS and 2 HW at 25 and 45 DAS (weed free)	62.6	57.3	161.8	23.5	15.8	2.47	2.60	47.20	2.10
Unweeded control	45.6	41.7	117.2	14.2	11.1	1.32	1.47	14.26	1.42
LSD (P=0.05)	4.9	4.9	13.2	2.4	1.4	0.06	0.06	6.19	0.20

synthesis (AHAS) in broad-leaves which caused destruction of these weeds in 3-4 leaf stage and remaining monocot weeds was control by propaquizafop-ethyl and hand weeding at 30 DAS Which was critical period of soybean crop. Lowest weed control efficiency and highest weed index was observed in unweeded control due to high weed competition for growth and yield factors. One hoeing at 15 DAS and two hand weeding at 25 and 45 DAS recorded highest WCE, lowest weed index, weed dry matter and weed population (Karande 2008).

Crop growth

Integrated weed management significantly affected soybean growth attributing characters and grain yield.One hoeing at 15 DAS and two hand weeding at 25 and 45 DAS as also reported by Sankaranarayan *et al.* (2002), Chintalwar (2004) was found singnifiantly best treatment among all treatments and pre- application of treatment pendimethalin at 2 DAS at 677.25 g/ha + 1 HW at 30 DAS, metribuzin sprayed at 2 DAS at 525 g/ha + 1 HW at 30 DAS, metribuzin at 2 DAS at 525 g/ha *fb* imazethapyr + propaquizafop-ethyl as post- at 20 DAS at 80 + 60 g/ha was at par with it. This might be due to better control of weed in different stages of crop, manual weeding, interculture operation at critical stage of crop reduce crop weed competition and thereby providing better growth (plant height, branches/plant), yield attributing characters (no. of pod/plant, pod weight/plant, no of seed /plant, weight of seed/plant, test weight) and ultimately yield. The highest net monetory returns of ` 48181/ha was obtained in metribuzin at 2 DAS at 525 g/ha + 1 HW at 30 DAS. The highest benefit:cost ratio of 2.24 was observed in metribuzin at 2 DAS at 525 g/ha + 1 HW at 30 DAS,which was followed by metribuzin sprayed at 2 DAS at 525 g/ha *fb* imazethapyr + propaquizafop-ethyl as post-emergence at 20 DAS at 80 + 60 g/ha (2.21) and one hoeing at 15 DAS and two hand weeding at 25 and 45 DAS (2.10). B:C ratio is high for herbicide treatment due to low cost of treatment as compare to mechanical method.It may be concluded that combination of herbicide and mechanical method was most effective for weed control in soybean. Metribuzin sprayed at 2 DAS at 525 g/ha + 1 HW at 30 DAS was found economical viable method of managing weeds in soybean.

SUMMARY

A field experiment was carried out on the silty clay soil at Mahatma Phule Krishi Vidyapith, Rahuri (Maharastra) during *Kharif* 2013-2014. One hoeing at 15 DAS and two hand weeding at 25 and 45 DAS best treatment in respect of growth attributing character and yield attributing characters. The weed dry matter and intensity was also lowest in one hoeing at 15 DAS and two hand weeding at 25 and 45 DAS, which was followed by pre-emergence application of metribuzin at 2 DAS at 525 g/ha + 1 HW at 30 DAS, PE application of treatment pendimethalin at 20 DAS cs at 677.25 g/ha + 1 HW at 30 DAS, metribuzin at 525 g/ha *fb* imazethapyr + propaquizafop-ethyl as post-aplication at 20 DAS at 80 + 60 g/ha. Metribuzin at 525 g/ha + 1 HW at 30 DAS was economic viable due to high B: C ratio and net return.

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