



Effect of different doses of fomesafen + fenoxaprop + chlorimuron-ethyl (ready-mix) against weeds in soybean

Rajendra Patel, Jitendra Patidar* and K.K. Jain

Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh 482004, India

*Email: jitendrapatidar90-coaagr@pau.edu

Article information

DOI: 10.5958/0974-8164.2021.00080.0

Type of article: Research note

Received : 12 June 2021

Revised : 18 October 2021

Accepted : 21 October 2021

KEYWORDS

Chlorimuron-ethyl, Fomesafen, Fenoxaprop, Ready-mix formulation, Soybean, Weed management

ABSTRACT

Field experiment was conducted at Research Farm, Department of Agronomy, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) during (rainy season) *Kharif* 2018. Ten weed control treatments comprising of five doses of ready-mix formulation (ready-mix) of fomesafen + fenoxaprop + chlorimuron-ethyl (187, 234, 280, 327 and 584 g/ha), imazethapyr (100 g/ha) alone and combined with fluazifop-p-butyl + fomesafen (222 g/ha) as early post-emergence (PoE), hand weeding (HW) twice at 15 and 30 days after seeding (DAS), weed free and weedy check were laid out in randomized complete block design with three replications. The fomesafen + fenoxaprop + chlorimuron-ethyl (ready-mix) 327 g/ha as early post-emergence (early PoE) recorded lower weed density and biomass, with 98.0 and 99.0% weed control efficiency (WCE) of monocot and dicot weeds, respectively. The higher seed yield (1.91 t/ha) was recorded with fomesafen + fenoxaprop + chlorimuron-ethyl 327 g/ha and it was at par with HW twice (2.11 t/ha) and weed free plots (2.15 t/ha). The highest dose of fomesafen + fenoxaprop + chlorimuron-ethyl (584 g/ha) was found effective against monocot and dicot weeds but caused phytotoxicity on crop and reduced seed yield marginally (1.73 t/ha).

Weed infestation is the major constraint in soybean [*Glycine max* (L.) Merrill] production in rainy season (Vollmann *et al.* 2010). The lack of weeds control during critical period of crop-weed competition (20-40 DAS) results in appreciable loss in the yield (58-85%) of soybean, depending upon type and weed intensity (Kewat *et al.* 2000). Although hand weeding is an effective weed control measure, it is very costly which farmers could not afford. Herbicide usage is one of the alternate options for control of weeds. In the recent past, the ready-mix of herbicides comprising of two molecules like fomesafen + fenoxaprop-p-ethyl, quizalofop-p-ethyl + fomesafen and fomesafen + clodinafop are widely used for controlling the weeds in soybean. Currently, ready-mix of three herbicide molecules are also available and being used for effective control of mixed weed flora in the soybean crop. Thus, the present study was conducted to evaluate the efficacy of ready-mix fomesafen + fenoxaprop + chlorimuron-ethyl to manage weeds in soybean.

A field experiment was conducted at Research Farm, Department of Agronomy, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) during (rainy season) *Kharif* 2018. Ten weed control treatments comprising: fomesafen 12.5% + fenoxaprop 10% + chlorimuron-ethyl 0.9% micro

encapsulated (ME) (ready-mix) five doses *i.e.*, 187, 234, 280, 327 and 584 g/ha; imazethapyr at 100 g/ha; fluazifop-p-butyl 11.1% SL + fomesafen 11.1% SL (ready-mix) at 222 g/ha; hand weeding twice at 15 and 30 days after seeding (DAS); weed free and weedy check control. The soil of the experimental field was sandy clay loam in texture, neutral in reaction (7.1) and medium in organic carbon (0.60%). The five doses of fomesafen + fenoxaprop + chlorimuron-ethyl (ready-mix) were used as early post-emergence application (early PoE) (at 15 DAS at 3-4 leaf stage). Herbicides were applied at a volume of 500 litres of water/ha at 15 DAS using knapsack sprayer fitted with flat fan nozzle in water (500 litre/ha). The observations on weeds were recorded at 30 days after herbicide application (DAA). Weeds were counted using quadrat of 0.25 square meter (0.5 x 0.5 m), and data obtained were expressed as density (numbers/m²). The percent composition of weed flora was estimated from weedy check plot. The relative density of individual weed was estimated using formula of Mishra (1968). The weed dry weight (weed biomass) from different treatments plots under all the treatments was recorded by removing weeds (counted for weed density) species wise from 0.25 square meter quadrat by placing it at four places in each plot. The weeds thus obtained

were first sun dried and thereafter kept in paper bags and dried in oven at 60 °C for 48 hours till constant weight is obtained, dry weight was recorded and expressed as weed biomass (g/m²). The data on weed density and biomass were subjected to square root transformation to normalize their distribution (Gomez and Gomez 1984).

Effect on weeds

The weeds infested in experiment field mainly comprised of monocots: *Echinochloa colona*, *Cyperus iria* and dicots: *Sida acuta*, *Mollugo pentaphylla*, *Phyllanthus urinaria*. The density and biomass of all the weeds were maximum in weedy check at all the growth intervals (Table 1 and 2) due to continues growth of weeds as no weed control measures were adopted. The fomesafen + fenoxaprop + chlorimuron-ethyl (ready mix) at the lowest dose (187 g/ha) early PoE caused appreciable reduction in density and biomass of grassy and broad- leaved weeds (Table 1 and 2) but reduction was more pronounced when fomesafen + fenoxaprop + chlorimuron-ethyl ready mix was applied at higher rate *i.e.* from 234 to 584 g/ha was

applied. The hand weeding twice at 15 and 30 DAS reduced the density and biomass of weeds to the maximum extent, when compared to herbicide-based treatments, due to removal of all catogories of weeds during the course of hand weeding as observed earlier by Singh and Jolly (2004), Sharma *et al.* (2017) and Gidesa and Kebede (2018).

Weed control efficiency (WCE) of a treatment has strong negative correlation with weed biomass. Therefore, the trend of treatments for increased WCE was in order of weed biomass. The highest weed control efficiency (98.24%) was attained with fomesafen + fenoxaprop + chlorimuron-ethyl (ready-mix) 584 g/ha early PoE (Table 3) followed by application of fomesafen + fenoxaprop + chlorimuron-ethyl (ready-mix) 327 g/ha early PoE (97.19%) due to lower weed biomass. The WCE was also higher (98.18%) with hand weeding twice.

Effect on soybean

Among the yield attributes, namely pods per plant were higher in the weed free plot and two hand weeding at 15 and 30 DAS followed by combined application of fomesafen + fenoxaprop +

Table 1. Effect of weed control treatments on weeds density in soybean at 30 days after herbicide application

Treatment	Weed density (no./m ²)				
	<i>Echinochloa colona</i>	<i>Cyperus iria</i>	<i>Sida acuta</i>	<i>Mollugo pentaphylla</i>	<i>Phyllanthus urinaria</i>
Fomesafen + fenoxaprop + chlorimuron-ethyl 187 g/ha early PoE	3.41(10.67)	2.64(6.00)	1.99(3.00)	1.91(2.67)	1.63(1.67)
Fomesafen + fenoxaprop + chlorimuron-ethyl 234 g/ha early PoE	3.00(8.00)	2.30(4.33)	1.82(2.33)	1.72(2.00)	1.52(1.33)
Fomesafen + fenoxaprop + chlorimuron-ethyl 280 g/ha early PoE	2.08(3.33)	1.88(2.67)	1.63(1.67)	1.52(1.33)	1.28(0.67)
Fomesafen + fenoxaprop + chlorimuron-ethyl 327 g/ha early PoE	1.72(2.00)	1.52(1.33)	1.38(1.00)	1.41(1.00)	1.14(0.33)
Fomesafen + fenoxaprop + chlorimuron-ethyl 584 g/ha early PoE	1.28(0.67)	1.38(1.00)	1.28(0.67)	1.14(0.33)	1.14(0.33)
Imazethapyr 100 g/ha early PoE	1.99(3.00)	2.29(4.33)	1.72(2.00)	1.91(2.67)	1.72(2.00)
Fluazifop-p-butyl + fomesafen 222 g/ha early PoE	1.82(2.33)	1.82(2.33)	1.52(1.33)	1.82(2.33)	1.38(1.00)
Hand weeding twice at 15 and 30 days after sowing	1.63(1.67)	1.52(1.33)	1.49(1.33)	1.61(1.67)	1.52(1.33)
Weed free	1.00(0.00)	1.00(0.00)	1.00(0.00)	1.00(0.00)	1.00(0.00)
Control (weedy check)	6.73(44.33)	6.53(41.67)	4.97(23.67)	9.49(89.00)	4.16(16.33)
LSD (p=0.05)	0.34	0.44	0.44	0.35	0.42

*Figure in parentheses is the original values

Table 2. Influence of weed control treatments on weeds biomass in soybean at 30 days after herbicide application (DAA)

Treatment	Weed biomass (g/m ²)				
	<i>Echinochloa colona</i>	<i>Cyperus iria</i>	<i>Sida acuta</i>	<i>Mollugo pentaphylla</i>	<i>Phyllanthus urinaria</i>
Fomesafen + fenoxaprop + chlorimuron-ethyl 187 g/ha early PoE	4.68(20.9)	3.58(11.88)	2.42(4.92)	1.56(1.44)	1.82(2.37)
Fomesafen + fenoxaprop + chlorimuron-ethyl 234 g/ha early PoE	3.88(14.08)	2.99(8.06)	2.18(3.78)	1.36(0.88)	1.71(1.97)
Fomesafen + fenoxaprop + chlorimuron-ethyl 280 g/ha early PoE	2.49(5.20)	2.34(4.75)	1.64(1.70)	1.25(0.56)	1.33(0.82)
Fomesafen + fenoxaprop + chlorimuron-ethyl 327 g/ha early PoE	1.84(2.48)	1.79(2.25)	1.37(0.96)	1.19(0.42)	1.17(0.42)
Fomesafen + fenoxaprop + chlorimuron-ethyl 584 g/ha early PoE	1.33(0.83)	1.58(1.68)	1.27(0.65)	1.06(0.13)	1.15(0.37)
Imazethapyr 100 g/ha early PoE	2.60(5.88)	3.17(9.19)	2.06(3.36)	1.53(1.36)	1.89(2.64)
Fluazifop-p-butyl + fomesafen 222 g/ha early PoE	2.25(4.11)	2.29(4.29)	1.82(2.37)	1.49(1.21)	1.50(1.40)
Hand weeding twice at 15 and 30 days after sowing	1.72(1.98)	1.53(1.36)	1.36(0.91)	1.15(0.33)	1.27(0.61)
Weed free	1.00(0.00)	1.00(0.00)	1.00(0.00)	1.00(0.00)	1.00(0.00)
Control (weedy check)	11.95(141.9)	9.23(84.17)	5.55(29.82)	7.26(51.67)	4.98(23.85)
LSD (p= 0.05)	0.48	0.64	0.49	0.17	0.51

*Figure in parentheses is the original values

Table 3. Influence of weed control treatments on the weed control efficiency, yield attributes, yields, weed index and benefit-cost ration of soybean

Treatment	WCE (%)		Pods/ plant (no.)	Seed yield (t/ha)	Stover yield (t/ha)	Weed index (%)	B:C ratio
	Monocot	Dicot					
Fomesafen + fenoxaprop + chlorimuron-ethyl 187 g/ha early PoE	89.00	90.02	31.79	1.24	2.56	42.41	1.37
Fomesafen + fenoxaprop + chlorimuron-ethyl 234 g/ha early PoE	92.00	92.43	34.89	1.41	3.00	34.48	1.56
Fomesafen + fenoxaprop + chlorimuron-ethyl 280 g/ha early PoE	95.95	94.94	40.51	1.68	3.22	21.90	1.83
Fomesafen + fenoxaprop + chlorimuron-ethyl 327 g/ha early PoE	97.97	97.19	51.59	1.91	3.65	11.03	2.08
Fomesafen + fenoxaprop + chlorimuron-ethyl 584 g/ha early PoE	98.73	98.24	41.77	1.73	3.57	19.48	1.87
Imazethapyr 100 g/ha early PoE	94.42	91.60	36.33	1.43	3.11	33.62	1.60
Fluazifop-p-butyl + fomesafen 222 g/ha early PoE	97.02	94.68	47.99	1.88	3.56	12.59	2.06
Hand weeding twice at 15 and 30 days after sowing	98.91	98.15	57.76	2.11	4.04	1.72	1.73
Weed free	100.00	100.00	60.59	2.15	4.15	0.00	1.14
Control (weedy check)	-	-	27.05	1.04	2.63	51.72	1.20
LSD (p=0.05)	-	-	2.61	0.11	0.21	-	-

chlorimuron-ethyl (ready-mix) 327 g/ha PoE. Excellent growth and development of soybean plants under these treatments environment during critical period of crop growth might have resulted in superior yield attributes with these treatments as compared to other treatments which had greater crop weed competition right from early growth stages and ultimately resulted in lesser values of yield attributes as observed by Raghuvanshi *et al.* (2005), Shete *et al.* (2007) and Kadam *et al.* (2018).

Among all the treatments, the minimum number of seed and stover yield was recorded under weedy check plot (1.04 and 2.63 t/ha) where weeds were allowed to grow throughout crop season. The higher seed and stover yield were recorded when fomesafen + fenoxaprop + chlorimuron-ethyl (ready-mix) applied at 327 g/ha early PoE (1.91 and 3.65 t/ha), which was significantly superior over check herbicide imazethapyr 100 g/ha and lower doses of the ready- mix herbicide. The application of fomesafen + fenoxaprop + chlorimuron-ethyl at highest dose (584 g/ha) gave effective control of weeds which resulted in lower density and biomass of weeds but also reduced soybean yield marginally (1.73, 3.57 t/ha seed and stover yield, respectively) due to phytotoxicity of it on soybean plants. However, all the herbicidal treatments were found to be inferior to weed free and hand weeding twice which recorded maximum seed and stover yield (2.15 and 4.15, 2.11 and 4.04 t/ha, respectively).

The maximum reduction in yield (51.72%) due to weed competition occurred in weedy check plots, where weeds were not controlled throughout the crop season. Application of fomesafen + fenoxaprop + chlorimuron-ethyl (ready-mix) at 327 g/ha recorded lower yield reduction (11.03%) due to weed competition and was superior over other treatments except hand weeding twice that recorded 1.72% reduction due to weed competition. The application

of fomesafen + fenoxaprop + chlorimuron-ethyl (ready-mix) at 327 g/ha early PoE recorded maximum B: C ratio (2.08).

It was observed that application of fomesafen + fenoxaprop + chlorimuron-ethyl (ready-mix) at 327 g/ha as early-post-emergence application gave effective control of diverse weed flora, and was more remunerative without any phytotoxicity on soybean crop.

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