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RESEARCH ARTICLE

Bio-efficacy of fenoxaprop-p-ethyl 9 EC for grassy weed control in groundnut (*Arachis hypogaea*)

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SUMMARY

Groundnut crop is highly susceptible to weed infestation because of its slow growth in this initial stage up to 40 days, short plant height and underground pod habit. A field experiment was conducted for two consecutive years (*Kharif* 2011 and 2012) at instructional farm of Rajasthan College of Agriculture, Udaipur, Rajasthan to study the bio-efficacy of fenoxaprop-p-ethyl 9 EC for grassy weed control in groundnut. The experiment was laid out on sandy clay loam soil by adopting Randomized Block Design which included six treatments *viz*., T_1= Fenoxaprop-p-ethyl 9EC at 625 ml/ha, T_2= Fenoxaprop-p-ethyl 9EC at 750 ml/ha, T_3= Fenoxaprop-p-ethyl 9EC at 875 ml/ha, T_4= Quizalofop ethyl at 750 ml/ha, T_5=Two hand weedings (1st at herbicide application and 2nd at 20-25 DAS and T_6=Untreated control. Variety TG-37-A was taken during two *Kharif* seasons as test crop. Result revealed that spray of fenoxaprop-p-ethyl 9EC at 875 ml/ha significantly reduced the total number of grassy weed flora and weed dry matter *i.e. Echinochloa* spp. in groundnut crop at all the stages of crop growth at 14, 28 and 42 days after treatment over control, two hand weedings, quizalofop ethyl at 750 ml/ha and fenoxaprop-p-ethyl 9EC at 625 ml/ha. The highest yield of groundnut (27.26 q/ha) was obtained in the treatment fenoxaprop-p-ethyl 9EC at 875 ml/ha followed by fenoxaprop-p-ethyl 9EC at 750 ml/ha and quizalofop ethyl at 750 ml/ha. Weeds significantly reduced the vegetative growth attributes measured.

Key Words : Groundnut, Fenoxaprop-p-ethyl 9EC, *Echinochloa* spp, Weed flora, Weed dry matter, Yield

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Groundnut or peanut (*Arachis hypogaea* L.) is known as the 'king' of oilseeds. It is one of the most important food and cash crop of our country. Groundnut is also called as wonder nut and poor men's cashewnut. In India, groundnut was grown on 8.55 million ha during 2011-12 with a total production of 9.44 million tonnes and an average productivity of 1104 kg ha^{-1} (Agricultural statistics, 2012-13). Groundnut play an important role in the dietary requirements of resource poor women and children and haulms are used as livestock feed. It contains 48-50% oil and 26-28% protein, and is a rich source of dietary fibre, minerals, and vitamins. The low yield of groundnut is attributed to many factors. Among them, many folds losses caused by weeds are of serious nature. Uncontrolled weed problems reduce the groundnut yield by 54-71 per cent in rainy season (*Kharif*) during early period of the crop.

Weeds play an important role in the proper stand establishment of the growing crop, which ultimately affect the productivity and quality at the end of the growing season. In this period, less crop canopy coverage favors strong competition with weeds causing considerable reduction in yield. This crop is generally grown as sole crop during rainy

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season (June to October) in India under rainfed situation. Slow growth habit of peanut in early growth stages encourages rapid growth of weeds and results in severe crop-weed competition and reduced yield. Weeds pose serious problem and weeds alone cause 17 to 84 % yield losses in peanut. Pre-emergence herbicides have certain limitations in their applications and are being used indiscriminately and in-judiciously without due consideration of specific weed species prevailed under specific field situations. With the changing scenario of weed management, farmers are in a need of effective post-emergence (Postem) herbicides for control of annual grassy weeds in peanut. Weedicides is the largest growing segment of crop care products, especially in India. With the labour costs incresing everyday, the cost for manual weeding is increasing and the role of weedicides is increasing every day. Herbicide efficiency has been found to be better when applied with other mechanical weed control practices. Certain herbicides applied as pre-emergence or post emergence help in controlling weeds at early growth period (Mutnal, 2006).

Further, growth in weed can be easily kept under check by certain cultural practices like hand weeding and inter cultivation (Agasimani *et al.*, 1992). Hence, the present study was conducted on the two year basis to study the bio-efficacy of fenoxaprop-p-ethyl 9 EC for grassy weed control in groundnut at Maharana Pratap University of Agriculture and Technology, Rajasthan.

MATERIAL AND METHODS

A field experiment was conducted to study the bio-efficacy of fenoxaprop-p-ethyl 9 EC for grassy weed control in groundnut during two *Kharif* seasons 2011 and 2012 at Agronomy Farm, Rajasthan College of Agriculture, Udaipur. It is situated in the lap of Aravali hills at $24^0$35' N latitude and $74^0$42' E longitude with an altitude of 579.5 meters above sea level. The experimental site is characterized by typical sub-humid climatic conditions with mild winters and moderate summers. Soil samples were drawn before commencement of the experiment from the average depth of 0-15 cm and a composite sample was prepared to a certain physical and chemical properties. The soils of the experimental site was clay loam in texture, slightly alkaline (pH 8.3) in reaction, medium in available nitrogen (218.00 kg/ha), phosphorus (21.16 kg/ha) and high in potassium (344.00 kg/ha). The field was prepared by giving one ploughing with tractor drawn M.B. plough followed by two cross harrowing and planking. The experiment was laid out in Randomized Block Design having four replications with treatments : T_1-Fenoxaprop-p-ethyl 9EC at 625 ml/ha, T_2-Fenoxaprop-p-ethyl 9EC at 750 ml/ha, T_3-Fenoxaprop-p-ethyl 9EC at 875 ml/ha, T_4- Quizalofop ethyl at 750 ml/ha, T_5-Two hand weedings (1st at herbicide application and 2nd at 20-25 DAS and T_6-Untreated control. Variety TG-37-A was taken during two *Kharif* seasons as test crop. Before sowing 15 kg N / ha and 60 kg P_2O_5 / ha and 250 kg / ha gypsum were applied. At the time of sowing 25 kg $FeSO_4$ / ha was also applied. Opening furrow at 30 cm, sowing was done manually on 01 July, 2011 and 04 July, 2012 by placing two seeds at 25 cm spacing in each row. The dominant weed species was *Echinochloa* spp. Weed count recorded at pre treatment, 14, 28 and 42 days after treatment and it was expressed as number/m^2. The data were subjected to $\sqrt{X}$ + 0.5 transformations to normalize their distribution. Weed dry matter collected at 14, 28 and 42 days after treatment were dried at 70^0 C for 24 hours and weighed. Three irrigations were applied to the crop. The yield was based on mean value of five randomly selected sample plants from each plot.

RESULTS AND DISCUSSION

The experimental findings obtained from the present study have been discussed in following heads:

Effect of fenoxaprop-p-ethyl 9EC on weed population:

The results of the trial indicated that application of fenoxaprop-p-ethyl 9EC effectively controlled annual grassy weeds. Data given in Table 1 indicate that spray of fenoxaprop-p-ethyl 9EC at 875 ml/ha significantly reduced the grassy weed flora *i.e. Echinochloa* spp. in groundnut crop at 14 days after treatment over control, fenoxaprop-p-ethyl 9EC at 625 ml/ha, quizalofop ethyl at 750 ml/ha and two hand weedings during both the years and on pooled basis and which was at par with fenoxaprop-p-ethyl 9EC at 750 ml/ha. There was significant per cent decrease in grassy weed flora with fenoxaprop-p-ethyl 9EC at 875 ml/ha 14 days after treatment *i.e.* 128.84, 18.64, 13.63 and 10.30 per cent over control, fenoxaprop-p-ethyl 9EC at 625 ml/ha, quizalofop ethyl at 750 ml/ha and two hand weedings.

At 28 days after treatment, data revealed that the best treatment was recorded at two hand weeding. Spray of fenoxaprop-p-ethyl 9EC at 875 ml/ha significantly reduced the grassy weed flora *i.e. Echinochloa* spp. in groundnut crop over control, fenoxaprop-p-ethyl 9EC at 625 ml/ha and quizalofop ethyl at 750 ml/ha during both the years and on pooled basis and was at par with fenoxaprop-p-ethyl 9EC at 750 ml/ha. There was significant per cent decrease in grassy weed flora with Fenoxaprop-p-ethyl 9EC at 875 ml/ha at 28 days after treatment *i.e.* 111.97, 13.96 and 11.25 per cent over control, fenoxaprop-p-ethyl 9EC at 625 ml/ha and quizalofop ethyl at 750 ml/ha (Table 1).

Data given in Table 1 indicate that spray of fenoxaprop-p-ethyl 9EC at 875 ml/ha significantly reduced the grassy weed flora *i.e. Echinochloa* spp. in groundnut crop at 42 days after treatment over control, two hand weedings, fenoxaprop-p-ethyl 9EC at 625 ml/ha, quizalofop ethyl at 750 ml/ha and fenoxaprop-p-ethyl 9EC at 750 ml/ha during both the years and on pooled basis. There was significant per cent decrease in grassy weed flora flora with fenoxaprop-p-ethyl 9EC at 875 ml/ha at 42 days after treatment *i.e.* 103.88, 29.18, 21.55,

Table 1 : Effect of fenoxaprop-p-ethyl 9EC application on numbers of weeds (*Echinochloa* spp.) in groundnut crop

Treatments	Numbers of weed count in per metre square											
	Pre treatment			14 DAT			28 DAT			42 DAT		
	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled
T_1 (Fenoxaprop-p-ethyl 9EC at 625ml/ha)	14.00 (196.00)	14.81 (219.25)	14.40 (207.63)	7.20 (51.88)	7.64 (58.32)	7.42 (55.10)	7.74 (59.88)	8.26 (68.32)	8.00 (64.10)	8.92 (79.63)	9.24 (85.50)	9.08 (82.56)
T_2 (Fenoxaprop-p-ethyl 9EC at 750ml/ha)	14.07 (198.00)	14.89 (221.75)	14.48 (209.88)	6.34 (40.25)	6.84 (46.75)	6.59 (43.50)	7.06 (50.00)	7.53 (56.75)	7.29 (53.38)	7.56 (57.15)	8.76 (76.75)	8.16 (66.95)
T_3 (Fenoxaprop-p-ethyl 9EC at 875ml/ha)	14.04 (197.25)	14.91 (222.50)	14.48 (209.88)	6.09 (37.13)	6.53 (42.75)	6.31 (39.94)	6.78 (46.08)	7.26 (52.75)	7.02 (49.42)	7.22 (52.13)	8.53 (72.75)	7.87 (62.44)
T_4 (Terga super at 750ml/ha)	13.99 (195.75)	14.82 (219.65)	14.41 (207.70)	7.04 (49.65)	7.30 (53.25)	7.17 (51.45)	7.68 (59.08)	7.95 (63.25)	7.81 (61.16)	8.51 (72.58)	9.12 (83.25)	8.81 (77.91)
T_5 (Two hand weeding: 1st at time of herbicide application and 2nd at 25 days after first hand weeding)	13.95 (194.50)	14.81 (219.34)	14.38 (206.92)	6.72 (45.19)	7.19 (51.75)	6.96 (48.47)	4.47 (20.18)	7.84 (61.50)	6.16 (40.84)	10.28 (105.72)	9.03 (81.50)	9.65 (93.61)
T_6 (Untreated Control)	13.89 (193.00)	14.73 (216.97)	14.31 (204.98)	14.24 (202.71)	14.65 (214.63)	14.44 (208.67)	14.81 (219.38)	14.95 (223.44)	14.88 (221.41)	15.08 (227.38)	15.39 (236.75)	15.23 (232.06)
S.E.±	0.14	0.15	0.10	0.15	0.13	0.10	0.21	0.17	0.13	0.17	0.16	0.12
C.D. (P=0.05)	NS	NS	NS	0.47	0.38	0.29	0.63	0.50	0.39	0.51	0.49	0.34

Values are √x + 0.5 transformed and actual values are in parenthesis

Table 2 : Effect of fenoxaprop-p-ethyl 9EC application on weed dry matter and seed yield of groundnut crop

Treatments	Total Weed dry weight (g per metre square)									Seed Yield (q/ha)		
	14 DAT			28 DAT			42 DAT					
	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled
T_1 (Fenoxaprop-p-ethyl 9EC at 625ml/ha)	4.55 (20.64)	4.80 (23.19)	4.68 (21.92)	4.94 (24.40)	4.80 (23.32)	4.87 (23.86)	5.63 (31.71)	5.84 (34.24)	5.73 (32.98)	20.04	24.27	22.15
T_2 (Fenoxaprop-p-ethyl 9EC at 750ml/ha)	4.04 (16.30)	4.21 (18.00)	4.12 (17.15)	4.64 (21.52)	4.75 (22.75)	4.69 (22.13)	4.72 (22.36)	5.52 (30.53)	5.12 (26.45)	23.95	28.18	26.06
T_3 (Fenoxaprop-p-ethyl 9EC at 875ml/ha)	3.93 (15.49)	4.06 (16.88)	4.00 (16.18)	4.49 (20.24)	4.56 (21.06)	4.53 (20.65)	4.68 (21.88)	5.59 (21.09)	4.64 (21.48)	25.14	29.37	27.26
T_4 (Terga super at 750ml/ha)	4.48 (20.06)	4.76 (22.90)	4.62 (21.48)	4.89 (23.89)	5.01 (25.20)	4.95 (24.54)	5.46 (29.80)	5.76 (33.18)	5.61 (31.49)	20.60	24.83	22.71
T_5 (Two hand weeding: 1st at time of herbicide application and 2nd at 25 days after first hand weeding)	4.38 (19.14)	4.54 (20.94)	4.46 (20.04)	4.14 (17.12)	4.93 (24.54)	4.54 (20.83)	6.49 (42.09)	5.71 (32.68)	6.10 (37.39)	17.62	21.85	19.74
T_6 (Untreated Control)	8.63 (74.40)	9.28 (86.34)	8.95 (80.37)	9.40 (88.40)	9.44 (89.18)	9.42 (88.79)	9.57 (91.56)	9.73 (94.88)	9.65 (93.22)	8.69	12.92	10.81
S.E.±	0.12	0.31	0.17	0.12	0.26	0.15	0.13	0.23	0.13	0.73	0.83	0.55
C.D. (P=0.05)	0.37	0.93	0.48	0.38	0.79	0.42	0.40	0.68	0.38	2.19	2.50	1.59

Values are ?x + 0.5 transformed and actual values are in parenthesis

17.94 and 9.24 per cent over control, two hand weedings, fenoxaprop-p-ethyl 9EC at 625 ml/ha, quizalofop ethyl at 750 ml/ha and fenoxaprop-p-ethyl 9EC at 750 ml/ha. The efficacy of fenoxaprop-p-ethyl 9EC in killing annual grassy weeds was higher at higher rates of application. Fenoxaprop-p-ethyl 9EC did not control broad-leaved (dicot) weeds in the crop. Greater weed control efficiency with postem application of fenoxaprop-p-ethyl 9EC was observed only when it was applied on lush green (succulent) annual grassy weeds. Under moisture stress situations with weeds showing wilting symptoms, efficacy of fenoxaprop-p-ethyl 9EC was greatly reduced due to nonabsorption of applied herbicide. Similar findings were also reported by Brar and Mehra, 1989 and Chinnamuthu *et al.* (2009).

Effect of fenoxaprop-p-ethyl 9EC on weed dry matter:

Data given in Table 2 indicates that spray of fenoxaprop-p-ethyl 9EC at 875 ml/ha significantly reduced the weed dry matter in groundnut crop at 14 days after treatment over control, fenoxaprop-p-ethyl 9EC at 625 ml/ha and quizalofop ethyl at 750 ml/ha during both the years and on pooled basis and was at par with two hand weedings and fenoxaprop-p-ethyl 9EC at 750 ml/ha. There was significant per cent decrease in weed dry matter with fenoxaprop-p-ethyl 9EC at 875 ml/ha at 14 days after treatment *i.e.* 123.75, 17.00 and 15.50 per cent over control, fenoxaprop-p-ethyl 9EC at 625 ml/ha and quizalofop ethyl at 750 ml/ha.

At 28 days after treatment, data revealed that the spray of fenoxaprop-p-ethyl 9EC at 875 ml/ha significantly reduced the weed dry matter in groundnut crop over control during both the years and on pooled basis and was at par with fenoxaprop-p-ethyl 9EC at 625 ml/ha, quizalofop ethyl at 750 ml/ha, fenoxaprop-p-ethyl 9EC at 750 ml/ha and two hand weeding (Table 2). There was significant decrease (%) in weed dry matter with fenoxaprop-p-ethyl 9EC at 875 ml/ha at 28 days after treatment *i.e.* 107.95 per cent over control.

Data given in Table 1 indicate that spray of fenoxaprop-p-ethyl 9EC at 875 ml/ha significantly reduced the weed dry matter in groundnut crop at 42 days after treatment over control, two hand weedings, fenoxaprop-p-ethyl 9EC at 625 ml/ha, quizalofop ethyl at 750 ml/ha and fenoxaprop-p-ethyl 9EC at 750 ml/ha during both the years and on pooled basis. There was significant per cent decrease in weed dry matter with fenoxaprop-p-ethyl 9EC at 875 ml/ha at 42 days after treatment *i.e.* 107.97, 31.47, 23.49, 20.91 and 10.34 per cent over control, two hand weedings, fenoxaprop-p-ethyl 9EC at 625 ml/ha, Quizalofop ethyl at 750 ml/ha and Fenoxaprop-p-ethyl 9EC at 750 ml/ha. In groundnut crop season, all the treatments differed significantly for total weed population and weed weight at different stages of crop growth. Similar results were found with Patel *et al.* (2008) and Raj *et al.* (2008).

Effect of fenoxaprop-p-ethyl 9EC on yield:

Data revealed that (Table 2) the spray of fenoxaprop-p-ethyl 9EC at 875 ml/ha significantly increased the seed yield in groundnut crop over control, two hand weedings, fenoxaprop-p-ethyl 9EC at 625 ml/ha and quizalofop ethyl at 750 ml/ha during both the years and on pooled basis which was non-significant with fenoxaprop-p-ethyl 9EC at 750 ml/ha. There was significant per cent increase in yield with fenoxaprop-p-ethyl 9EC at 875 ml/ha *i.e.* 60.34, 27.59, 18.75 and 16.70 per cent over over control, two hand weedings, fenoxaprop-p-ethyl 9EC at 625 ml/ha and quizalofop ethyl at 750 ml/ha on pooled basis. The groundnut pod yield differed significantly due to weed control treatments. Fenoxaprop-p-ethyl 9EC at 875 ml/ha recorded highest pod yield (27.26 q ha^{-1}) but lowest with weed free check (19.74 qha^{-1}). Significantly lowest pod yield was recorded in weedy check (19.74 q ha^{-1}). This is in conformity with the results of Walia *et al.* (2007) and Tomar *et al.* (2009).

Conclusion:

The spray of fenoxaprop-p-ethyl 9EC @ 875 ml/ha was found effective in controlling dominant grassy weeds in groundnut crop and increased the seed yield of groundnut.

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