

Research Article

Evaluation of Oxyfluorfen (23.5% EC) Herbicide on Weed Control, Economics and Profitability of Groundnut in the Western Zone of Tamil Nadu

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Abstract

Chemical weed control is a better supplement to conventional methods and forms an integral part of the modern crop production. Under chemical method of weed management, the rotation of herbicides is more essential to prevent the weeds to develop resistance to herbicides. Field experiments were conducted at the Agricultural Research Station, Bhavanisagar of Tamil Nadu Agricultural University, during *kharif* season of 2009 and 2010 to evaluate the new formulation of oxyfluorfen (23.5% EC) on weed control in groundnut and their residual effect on succeeding crops. Application of oxyfluorfen (23.5% EC) at 250 g/ha as pre-emergence can keep the weed density and dry weight reasonably at lower level and enhance the productivity of *kharif* groundnut resulting in higher economic returns. Succeeding crops like sunflower and pearl millet sown immediately after the harvest of irrigated groundnut were not affected by the residue of new formulation of oxyfluorfen.

Keywords: Groundnut, oxyfluorfen, weed control, pod yield, economics, succeeding crops

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Introduction

Weed infestation is an important limiting factor in achieving potential productivity of groundnut (*Arachis hypogaea* L.) especially of bunch type varieties which have prostrate growth and consequently poor competitive ability. Groundnut being a short stature, initially slow growing crop, needs weed free condition throughout the crop growth period. Prasad (2002) [1] reported that yield of groundnut is reduced by 70 per cent if cover by weeds is more than 50 per cent. Groundnut cannot compete effectively with weeds, particularly 3 to 6 weeks after sowing and therefore, early removal of weeds is important before flowering and during pegging [2]. Critically viewing, the manual and mechanical methods of weed control, besides being less effective, costly and time demand as well as need to be repeated at frequent intervals. Chemical weed control is a better supplement to conventional methods and forms an integral part of the modern crop production. Most of the presently available herbicides provide only a narrow spectrum weed control. Under chemical method of weed management, the rotation of herbicides is more essential to prevent the weeds to develop resistance to herbicides. In view of the above facts, an experiment on "Efficiency evaluation of new formulation of oxyfluorfen (23.5% EC) on weed control in groundnut and their residual effect on succeeding crops" was formulated with the following objectives (i) to evaluate the bio-efficacy of new formulation of oxyfluorfen (23.5% EC) on weed control in groundnut (ii) To work out economics of weed management practices in groundnut (iii) to study the residual effect of oxyfluorfen on succeeding crops.

Materials and Methods

With a view to determine the residual effect of herbicide applied to *kharif* groundnut on succeeding *rabi* sunflower and pearl millet crops, the present study was carried out during *kharif* season of 2009 and 2010 at Agricultural Research Station, Bhavanisagar, Tamil Nadu Agricultural University. The experiment was laid out in randomized complete block design with three replications with ten treatments. Treatments consisted of pre-emergence application of already registered oxyfluorfen (goal) at 200 g/ha, new formulation of oxyfluorfen (23.5% EC) at 150, 200, 250, 300 and 400 g/ha, pendimethalin 0.75 kg/ha + Hand weeding on 45 DAS, pendimethalin 0.75 kg/ha + Rotary weeding on 45 DAS, Hand weeding twice on 25 and 45 DAS and unweeded check. Groundnut variety VRI 2 was sown manually at a spacing of 30 x 10 cm at 105 kg seed/ha during first week of July 2009 and 2010. The crop was

harvested on first week of October during both the years. After harvesting of the groundnut crop to know the residual effect of herbicides, without disturbing the layout of each plot was manually prepared for sowing of succeeding crops. The data collected for groundnut was statistically analysed following the procedure given by Gomez and Gomez (2010) [3] for randomised block design. The data pertaining to weeds and germination were transformed to square root scale of $\sqrt{(X+2)}$ and analysed as suggested by Snedecor and Cochran (1967) [4].

Results and Discussion

Effect on weeds

The composition of weed flora in groundnut was predominantly consisted of eleven species of broad leaved weeds, five species of grasses and a sedge weed. The dominant grassy weed species were *Cynodon dactylon*, *Acrachne racemosa* and *Dactyloctenium aegyptium*. Among the broad leaved weeds, *Boerhaavia diffusa*, *Parthenium hysterophorus* and *Digeria arvensis* were the dominant weeds. *Cyperus rotundus* was the only sedge present in the experimental field. Application of oxyfluorfen at 250, 300 and 400 g/ha recorded more than 80 per cent WCE at 20 and 40 DAS during *kharif* 2009 and 2010, respectively (**Table 1**). This herbicide kills weed seedlings through contact action and membrane disruption, since light is required for herbicidal activity, diphenyl ether phytotoxicity is related to the process of photosynthesis and inhibition of both electron transport and ATP synthesis [5]. Application of oxyfluorfen at 400 g/ha resulted in the weed control of more than 90 per cent of weeds, but the herbicide inhibited the crop growth. Thus, broad leaved weeds were effectively controlled with the herbicide. Similar results were observed by Kumar (2004) [6], who have found that hand weeding and earthing up operation of groundnut had smothering effect on weeds at later stages and reduced the weed density.

Table 1 Effect of weed management methods on pod yield, weed index and economics of groundnut

Treatments	Kharif, 2009				Kharif, 2010			
	Pod yield (kg/ha)	WCE % at 40 DAS	Economics (Rs./ha)		Pod yield (kg/ha)	WCE % at 40 DAS	Economics (Rs./ha)	
			Net return (Rs/ha)	B:C ratio			Net return (Rs/ha)	B:C ratio
T ₁ - PE oxyfluorfen (Goal) at 200 g a.i./ha	1443	77.33	13,190	1.84	1526	81.32	14,075	1.86
T ₂ - PE oxyfluorfen at 150 g a.i./ha	1523	70.20	14,796	1.94	1622	70.29	16,001	1.97
T ₃ - PE oxyfluorfen at 200 g a.i./ha	1892	78.89	22,070	2.40	1868	80.32	20,815	2.26
T ₄ - PE oxyfluorfen at 250 g a.i./ha	2058	83.66	25,280	2.59	2072	84.05	24,185	2.45
T ₅ - PE oxyfluorfen at 300 g a.i./ha	1706	86.39	18,030	2.12	1810	85.79	19,335	2.15
T ₆ - PE oxyfluorfen at 400 g a.i./ha	1784	88.90	15,840	1.96	1713	88.68	16,965	1.98
T ₇ - Pendi. at 0.75 kg/ha + HW on 45 DAS	1643	78.83	17,275	2.11	1792	76.52	19,480	2.19
T ₈ - Pendi. at 0.75 kg/ha + RW on 45 DAS	1521	77.35	13,835	1.83	1618	76.08	15,000	1.86
T ₉ - HW twice on 25 and 45 DAS	1814	82.02	18,030	2.00	1835	82.96	18,415	1.94
T ₁₀ - Unweeded control	837	-	2,130	1.15	910	-	2,815	1.18
SEd	115	-	-	-	105	-	-	-
CD (P = 0.05)	238	-	-	-	214	-	-	-

PE - Pre emergence; HW - Hand weeding

Pod yield of groundnut

Pre-emergence application of oxyfluorfen at 250 g/ha recorded higher pod yield of 2058 and 2042 kg/ha during 2009 and 2010 respectively, due to better control of weeds at critical stages thus providing favourable environment for better growth and development leading to enhanced pod yield (Table 1). This treatment was comparable with oxyfluorfen at 200 g/ha with a pod yield of 1892 and 1868 kg/ha during both the years. According to the findings of Solanki *et al.* (2005) [7] the pod yield of groundnut was higher with pre-emergence application of herbicides due to reduced crop weed competition in early stage than post-emergence application of the same herbicides. Eventhough

the weed control efficiency was higher under oxyfluorfen at 300 and 400 g/ha but the yields were lower and the reason might be due to initial phytotoxicity symptoms on groundnut, which resulted in reduced plant population, lesser plant height, leaf area and dry matter production and finally, decreased the pod yield. Pre-emergence application of pendimethalin at 0.75 kg/ha + RW on 45 DAS registered lower pod yield compared to other weed control treatments and this might be due to partial or improper removal of *Cynodon dactylon* with rotary weeder, which recorded higher weed density, weed dry weight and higher nutrient removal by weeds. Under such surroundings the chemical weed control measures are the alternate to control the weeds [8].

Economics of groundnut

During both the year of study, the effect of different weed management treatments on the economics of groundnut cultivation showed that new formulation of oxyfluorfen at 250 g/ha recorded the higher net return and BC ratio (Rs. 25,280 and 2.51; Rs. 24,185 and 2.45). The cost of the treatment was lower with application of oxyfluorfen at 250 g/ha than the unweeded control. This was followed by application of oxyfluorfen at 200 g/ha and hand weeding twice on 25 and 45 DAS. Similar results were reported by Walia *et al.* (2007) [9] that the higher net return and benefit cost ratio was obtained by the pre-emergence application of oxyfluorfen when compared to other herbicidal treatment in groundnut. The increased additional income realized with these two treatments might be due to higher pod yield obtained due to the herbicide efficiency which would have reduced the competition between weeds and crop for water and nutrients. Even though higher weed control efficiency was obtained with higher doses of oxyfluorfen at 300 and 400 g/ha but resulted lower pod yield due to 30 to 50 per cent crop injury in early stage and plant population reduction. Similar findings were observed by Narasimha Reddy *et al.* (1998) [10] who have found that, pre-emergence application of oxyfluorfen at higher doses obtained higher weed control efficiency, but resulted in lower yield due to phytotoxicity effect on soybean.

Table 2 Residual effect of herbicides on the germination (%) and yield (kg/ha) of succeeding crops of groundnut

Treatments	Sunflower				Pearl millet			
	Rabi, 2009		Rabi, 2010		Rabi, 2009		Rabi, 2010	
	Germ. (%)	Seed yield (kg/ha)	Germ. (%)	Seed yield (kg/ha)	Germ. (%)	Grain yield (kg/ha)	Germ. (%)	Grain yield (kg/ha)
T ₁ - PE oxyfluorfen (Goal) at 200 g a.i/ha	66.58 (84.25)	938	64.79 (81.87)	924	72.04 (90.55)	715	71.31 (89.7)	722
T ₂ - PE oxyfluorfen at 150 g a.i/ha	69.29 (87.52)	871	68.16 (86.17)	857	74.21 (92.67)	654	69.59 (87.84)	661
T ₃ - PE oxyfluorfen at 200 g a.i/ha	69.82 (88.18)	958	67.02 (84.77)	944	75.46 (93.72)	688	74.59 (92.94)	695
T ₄ - PE oxyfluorfen at 250 g a.i/ha	66.78 (85.77)	984	68.33 (86.37)	970	72.34 (90.89)	728	70.66 (89.04)	735
T ₅ - PE oxyfluorfen at 300 g a.i/ha	71.19 (89.62)	968	68.26 (86.27)	954	76.06 (94.23)	736	75.15 (93.44)	743
T ₆ - PE oxyfluorfen at 400 g a. /ha	69.47 (87.70)	892	66.71 (84.37)	878	73.67 (92.18)	685	70.03 (88.34)	692
T ₇ - Pendi. at 0.75 kg/ha + HW on 45 DAS	70.18 (88.52)	932	67.35 (85.17)	918	73.58 (92.33)	712	73.09 (91.54)	719
T ₈ - Pendi. at 0.75 kg/ha + RW on 45 DAS	66.66 (84.35)	894	65.62 (82.97)	880	75.46 (93.72)	687	71.50 (89.94)	694
T ₉ - HW twice on 25 and 45 DAS	70.35 (88.72)	889	67.5 (85.37)	875	76.81 (94.87)	717	74.70 (93.04)	724
T ₁₀ - Unweeded control	68.95 (87.19)	917	66.24 (83.77)	903	73.78 (92.22)	698	72.98 (91.44)	705
S _{Ed}	8.9	62	6.3	58	9.6	72	7.3	79
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS

Figures in parthesis are arc sin transformed values; PE - Pre emergence; HW - Hand weeding

Carryover effect on succeeding crops

Results revealed that germination of succeeding sunflower and pearl millet recorded at 10 DAS was not significantly affected by residual effect of herbicide applied to groundnut. Though, the plant stand of sunflower ranged from 84 to 89 per cent and pearl millet from 87 to 94 per cent under all the treatments at 10 DAS. Further, plant height and dry weight of plants recorded at 30, 60 and 90 DAS were also unaffected due to residual effect of different doses of oxyfluorfen applied in groundnut. Yield of sunflower and pearl millet showed no distinct variation due to different dose of oxyfluorfen (**Table 2**).

This result is in line with the results of Jayakumar (2010) [11] who reported that, the pre-emergence application of oxyfluorfen in tea at higher doses of 300 and 400 g/ha did not leave any residue in the soil and there was no toxic effect beyond 60 days. It might be shown that new formulation of oxyfluorfen with different doses could be very effective against most of the broad leaved and grassy weeds in groundnut. But residual toxicity of oxyfluorfen cannot be ruled out on sensitive crops such as sunflower and pearl millet in rotation of onion crop [12].

Conclusion

Results showed that pre-emergence application of oxyfluorfen (23.5% EC) at 250 g/ha can keep the weed density and dry weight below the economic threshold level and increased the productivity of pod yield in irrigated groundnut. Oxyfluorfen herbicide with different doses recommended in groundnut was found to be safe on the carryover effect of succeeding crops and this might be due to detoxification of herbicides in soil and do not adversely affect the growth and yield parameters of the succeeding crops.

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