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Integrated weed management in groundnut (*Arachis hypogaea*)- wheat (*Triticum aestivum*) crop sequence

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ABSTRACT

A field experiment was conducted during *kharif-rabi* season of 1993-94, 1995-96, 1996-97 and 1997-98 to find out the best integrated weed-management approach in groundnut *(Arachis hypogaea* L.) - wheat [*Triticum aestivum* (L.) emend. Fiori & Paol.] crop sequence on Vertisols. Results indicated that fluchloralin 0.9 kg/ha pre-emergence + hand-weeding (HW) and interculture (25, 45 and 60 DAS) in groundnut and pendimethalin 1.0 kg/ha pre-emergence + HW 30 DAS in wheat was most effective against weeds and provided highest grain yield as well as net return. Herbicides applied in groundnut crop did not leave any phytotoxic effect on the succeeding wheat crop.

Key words : Integrated weed management , Groundnut, Wheat, Crop sequence, Weeds, Economics

Groundnut-wheat sequence is a predominant cropping system in Saurashtra region of Gujarat. Under Saurashtra conditions uncontrolled weeds reduce the yield of rainy season (*kharif*) groundnut by 54 to 71 % and of wheat by 14% (Anon., 1998). The importance of integrated approach is well established instead of adopting only one weed - control method (Bhan and Malik, 1983). Adequate information is available for weed management in the individual crop of the sequence separately, but information of carry-over effects of herbicides on the succeeding crop of the sequence is meagre. Hence the present investigation was undertaken on groundnut - wheat sequence.

MATERIALS AND METHODS

An experiment was conducted at Gujarat Agricultural University, Junagadh during rainy *(kharif)* –winter *(rabi)* seasons of 1993-94, 1995-96, 1996-97 and 1997-98. The total rainfall received during these years was 523.8, 856.4, 738.2 and 858.7 mm respectively. The soil of the experimental site was Vertisol, having pH 7.86 to 8.20, EC 0.28 to 0.44 dS/m, and available N 216.4 to 318.3 kg/ha, available P 17.8 to 31.8 kg/ha and available K 268.8 to 481.6

kg/ha. The experiment was laid out in randomized block design with three weed-management treatments {fluchloralin 0.9 kg/ha pre-emergence supplemented either with 1 hand-weeding (HW) and interculture (IC) (25 DAS), 2 HW and 2 IC (25 and 45 DAS) or 3 HW and 3 IC (25, 45 and 60 DAS) in treatment M_1, M_2 and M_3 respectively to *kharif* groundnut, replicated four times. Hand-weeding and interculturing were performed simul-taneously in intra- and inter-row spaces respectively. Six weed-management treatments, viz. S_1 = 1 HW 30 DAS, S_2 = pendimethalin 1.0 kg/ha pre-emergence; S_3= 2,4-D 1.0 kg/ha 30-35 DAS; S_4 = S 2 + S_1; S_5 = S_2 + S_3; and S_6 = unweeded control, were administered to wheat crop as sub-plots. The *kharif* plots were considered main plots and the experiment was conducted in split-plot design. Groundnut variety 'GG 2' wheat and variety 'GW 496' were used. Two life-saving irrigations were applied in groundnut during 1993-94 but sufficient rainfall occurred in the rest of the years. Wheat crop was given 10, 12, 10 and 10 irrigations during 1993-94, 1995-96, 1996-97 and 1997-98 respectively. Both the crops were grown under recommended packages of practices. The spray volumes of herbicides were used @ 500 and 1,000 litres/ha for pre- and post-emergence (30-35 DAS) respectively, sprayed with manually operated knapsack sprayer fitted with flat fan nozzle. Weeds density was recorded from a 0.5625 m^2 quadrate. Yield data on crops and dry weight of weeds were recorded at harvest. All the data were statistically analysed.

RESULTS AND DISCUSSION

Groundnut

Effect on weeds: The experimental plots were infested with *Cyperus rotundus* L. (18.95 %), *Echinochloa colonum* (L.) Link. (17.01 %); *Eluropus villosus* (15.35 %), *Cyperus iria* L. (12.17 %), *Leucas aspera* Spreng. (12.03 %) and other weeds (24.49 %) during the *kharif* season.

Table 1. Effect of weed-management treatments on weeds, yield and net return in *kharif* groundnut (pooled data of 4 years)

Treatment	Weed-dry weight (kg/ha)	Pod yield (kg/ha)	Haulm yield (kg/ha)	Weed density (No./m^2)	Net return (Rs/ha)
M_1 : Fluchloralin 0.9 kg/ha pre-em. + 1 HW & 1 IC (25 DAS)	2,120	825	1,110	32.56	9,795
M_2 : Fluchloralin 0.9 kg/ha pre-em. + 2 HW & 2 IC (25 & 45 DAS)	1,243	1,085	1,378	29.50	12,442
M_3 : Fluchloralin 0.9 kg/ha pre-em. + 3 HW & 3 IC (25, 45 & 60 DAS)	281	1,312	1,581	18.22	14,539
C.D. (P=5%)	1,095	275	141	NS	-

Pooled data (Table 1) revealed that dry weight of weeds was influenced significantly by different weed-management treatments. Fluchloralin 0.9 kg/ha supplemented with 3 HW and 3 IC (25,45 and 60 DAS) recorded the lowest weed-dry weight (281 kg/ha) and remained significantly superior to fluchloralin 0.9 kg/ha supplemented with 1 HW and 1 IC (25 DAS), which registered the highest weed-dry weight (2,120 kg/ha). Thus the *kharif* groundnut needed integration of fluchloralin 0.9 kg/ha with 3 HW and 3 IC. Agasimani *et al.* (1992) also reported similar results.

Effect on crop: The pooled data of 4 years (Table 1) showed that pod and haulm yields were significantly influenced by the different weed-management treatments. Fluchloralin (0.9 kg/ha) along with 3 HW and 3 IC (25,45 and 60 DAS) gave significantly higher pod (1,312 kg/ha) and haulm (1,581 kg/ha) yields over fluchloralin (0.9 kg/ha) supplemented with 1 HW and 1 IC (25 DAS) but it was on a par with fluchloralin (0.9 kg/ha) along with 2 HW and 2 IC (25 and 45 DAS) for pod yield. Agasimani *et al.* (1992) reported effective control of weeds by fluchloralin 1.0 kg/ha + 3 hoeings and consequent higher pod yield.

Economics: Highest net return (Rs 14,539/ha) was accrued under fluchloralin (0.9 kg/ha) + 3 HW and 3 IC (25, 45 and 60 DAS) followed by fluchloralin 0.9 kg/ha + 2 HW and 2 IC (Rs 12,442/ha). These two treatments recorded 49 and 27 % higher net returns respectively over fluchloralin 0.9 kg/ha + 1 HW and 1 IC (25 DAS).

Wheat

Effect of weeds: Experimental field was infested by *Echinochloa colonum* (L.) Link. (54.03 %), *Cyperus rotundus* L. (14.53 %), *Digera arvensis* Forsk. (14.25 %), *Eluropus villosus* (5.52 %), *Physalis minima* L. (3.26 %) and other weed species (8.41 %). Pooled data (Table 2) indicated that there was no residual effect of treatments given to *kharif* groundnut on the weed density and dry-weed weight recorded in the succeeding wheat. Only the direct effect of weed-management treatments was significant in wheat on these two characters. All the treatments significantly reduced the weed density and weed-dry weight) compared with the unweeded control except 2, 4-D 1.0 kg/ha 30-35 DAS. The lowest dry weight of weeds (24 kg/ha) was observed under pendimethalin 1.0 kg/ha + 1 HW 30 DAS. This treatment also registered the highest (93.0 %) weed-control efficiency. The results are in line with the findings of Patel and Upadhyay (1990) and Singh (1996).

Effect on crop: Grain and straw yields (Table 2) were not affected significantly due to the residual effect of the weed-management treatments given to the preceding groundnut. Only direct effect of weed-management treatments was found significant on grain and straw yields than unweeded control. The highest grain (4,486 kg/ha) and straw (5,547 kg/ha) yields were obtained under pendimethalin (1.0 kg/ha) + 1 HW 30 DAS. These findings are also substantiated by those of Patel and Upadhyay (1990) and Singh (1996).

Economics: The highest net return (Rs 340,028/ha) was accrued under 2,4-D 1.0 kg/ha 30-35 DAS, closely followed by pendimethalin 1.0 kg/ha + 1 HW 30 DAS

Table 2. Residual (*kharif* groundnut) and direct (*rabi* wheat) effect of treatments on weed-dry weight, grain yield, straw yield, weed density, weed- control efficieny (WCE) and net return in wheat (pooled data of 4 years)

Treatment	Weed-dry weight (kg/ha)	Grain yield (kg/ha)	Straw yield (kg/ha)	Weed density (No./m^2)	WCE (%)	Net return (Rs/ha)
Main plots (residual effect of kharif groundnut)						
M_1	234	4,312	5,300	17.59	-	-
M_2	154	4,254	5,227	12.33	-	-
M_3	114	4,397	5,292	11.02	-	-
CD (P = 5%)	NS	NS	NS	NS	-	-
Subplots (direct effect in wheat)						
S_1 : 1 HW 30 DAS	103	4,343	5,372	14.33	72	33,117
S_2 : Pendimethalin 1.0 kg/ha pre-em.	117	4,291	5,370	8.85	68	33,180
S_3 : 2,4-D 1.0 kg/ha 30-35 DAS	317	4,242	5,203	22.41	13	34,028
S_4 : $S_2 + S_1$	24	4,486	5,547	5.48	93	33,948
S_5 : $S_2 + S_3$	78	4,273	5,286	2.48	79	32,615
S_6 : Unweeded control	365	4,090	4,858	28.33	-	33,104
CD (P=5%)	189	134	173	12.08	-	-
Interaction (main × subplot)	NS	NS	NS	NS	-	-

(Rs 33,948/ha). These two treatments gave increment of Rs 924 and Rs 844 over unweeded control, whereas there was a loss of Rs 489 under pendimethalin 1.0 kg/ha pre-emergence + 2,4-D 30-35 DAS.

To get higher yield and net return from *kharif* groundnut-wheat crop sequence, fluchloralin 0.9 kg/ha pre-emergence + 3 HW in intra-row space and 3 IC in inter-row space (25, 45 and 60 DAS) in *kharif* groundnut and pendimethalin 1.0 kg/ha + 1 HW 30 DAS in wheat are beneficial under south Saurashta conditions.

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