

Integrated weed management in irrigated groundnut (*Arachis hypogaea*)

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Received : May 2002

ABSTRACT

A field experiment was conducted during the rainy (*kharif*) seasons of 1994, 1995 and 1996 under irrigated conditions on integrated weed management in groundnut (*Arachis hypogaea* L.) on loamy sand soils of Durgapura, Rajasthan. Pre-emergence application of both the herbicides pendimethalin and metolachlor @ 1.0 kg a.i./ha with 2 interculturalings at 30 and 45 days after sowing (DAS) effectively controlled the dry-matter accumulation in weed compared with the unweeded, farmers practices and sole application of these herbicides but at par with 2 hoeings and pre-emergence application of both the herbicides pendimethalin and metolachlor 1.0 kg/ha with 1 hand-weeding at 30 DAS + interculture at 30 and 45 DAS. Among the weed-control methods tried, weed-free check, both the herbicides pendimethalin and metolachlor @ 1.0 kg a.i./ha + 2 interculturalings with and without 1 hand-weeding had a pronounced effect on the yield attributes, yields and net returns as compared to unweeded crop.

Key words : Groundnut, Weed biomass, Herbicide, Weed management, Yield

Groundnut is grown during the rainy season when weed competition is quite severe. The first 3 to 4 weeks of crop-growth period are critical for weed control in groundnut (Kalaiselvan *et al.*, 1991) and uncontrolled weeds reduce groundnut yield up to 75% (Gnanamurthy and Balasubramaniyan, 1998).

Chemical control of weeds form an excellent alternative to manual weeding. However, pre-emergence application of herbicides may allow the emergence of weeds after some time. Hence the concept of integrated weed management by combining physical methods with herbicides is gaining importance. The present study was, therefore, initiated to find out an effective and economical integrated weed-control method in groundnut under irrigated conditions.

MATERIALS AND METHODS

A field experiment was conducted in loamy sand soils during the rainy seasons of 1994, 1995 and 1996 at Agricultural Research Station, Durgapura, Jaipur, under irrigated condition. The soil was low in organic carbon (0.3%), alkaline in reaction (pH 8.2), medium in available phosphorus (47 kg/ha) and available potash (200 kg/ha). The experiment comprised 9 treatments including pre-emergence application of herbicides, viz. pendimethalin and metolachlor in combination with 2 interculturalings at 30

and 45 days after sowing (DAS) compared with 1 hand-weeding at 30 DAS, weed-free (2 hand-weedings at 20 and 45 DAS, 3 interculturalings at 15, 30 and 45 DAS), farmers' practice and unweeded check (Table 1). The experiment was laid out in randomized block design and replicated 4 times. The groundnut variety 'M 13' was sown at 45 cm × 10 cm apart during first fortnight of June in each year. A basal dose of 20 kg N and 60 kg P₂O₅ was applied through urea and single superphosphate respectively. Gypsum @ 500 kg/ha applied to the crop at sowing. Irrigations (3–4) at critical growth stages of the crop were given during each year. All the recommended package of practices were followed to raise the crops. Weed samples were collected 1 m² quadrat at 60 days after sowing for weed dry matter. The weed index (WI) and weed-control efficiency (WCE) were computed as per Somani (1992).

RESULTS AND DISCUSSION

Weed dry matter

The effect of weed-management practices on weed species were alike in all the 3 years. The predominant weed species observed were *Cyperus rotundus*, *Cenchrus catharticus*, *Cynodon dactylon* and *Saccharum spontaneum* among monocots; and *Amaranthus viridis*, *Solanum nigrum*, *Commelina benghalensis* and *Tribulus terrestris* among the dicot weeds.

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At 60 days after sowing, both the herbicide treatments were alike in respect of dry weight of weeds, weed-free check reduced the weed dry matter and showed higher weed-control efficiency, followed by pre-emergence pendimethalin supplemented with 2 interculture at 30 and 45 days after sowing was also found effective in reducing the weed dry matter. However, the weed dry matter recorded with this herbicide treatments was markedly higher than that of unweeded check. The weed-control efficiency was higher with weed-free check (Table 1) or pre-emergence application of pendimethalin and metolachlor at 1.0 kg a.i./ha coupled with 2 inter-cultures at 30 and 45 DAS and without 1 hand-weeding at 30 DAS. The results are in conformity with the reports of Gnanamurthy and Balasubramanian (1998). The weed index was the maxi-

mum with unweeded control compared with other treatments (Table 1).

Under the present investigation, effectiveness of herbicidal application in reducing weed competition up to early crop-growth stage seem to be due to their adverse effects on physiology of weed growth and development, while 2 inter-cultures at 30 and 45 DAS, uprooted the prevailing weeds at this stage. However, the application of sole herbicides failed to retain their effectiveness up to later stages.

Yield attributes

Weed-free check (2 hand-weedings at 20 and 45 DAS), 3 inter-cultures at 15, 30 and 45 days after sowing or chemical control with and without the manual weeding and interculture and farmers practices recorded higher

Table 1. Effect of weed-control method on weed dry weight, weed-control efficiency and weed index in groundnut

Treatment	Weed -control efficiency	Weed index (%)	Total weed dry weight (g/m ²) at 60 DAS*
T ₁ , Pendimethalin @ 1.0 kg a.i./ha	63.02	36.28	17.35
T ₂ , Metolachlor @ 1.0 kg a.i./ha	61.59	50.95	18.02
T ₃ , Pendimethalin @ 1.0 kg a.i./ha + 2 IC at 30 and 45 DAS	89.87	3.78	4.75
T ₄ , Metolachlor @ 1.0 kg a.i./ha + 2 IC at 30 and 45 DAS	85.78	1.75	6.67
T ₅ , T ₁ + 1 HW at 30 DAS + 2 IC at 30 and 45 DAS	89.00	2.88	5.49
T ₆ , T ₂ + 1 HW at 30 DAS + 2 IC at 30 and 45 DAS	87.31		5.95
T ₇ , Farmer's practice	50.63	31.79	23.16
T ₈ , Unweeded		72.02	46.92
T ₉ , Weed-free check (2 HW at 20 and 45 DAS and 3 IC at 15, 30 and 45 DAS)	92.39	4.72	3.57
CD (P=0.05)			4.39

IC, Interculture; HW, hand-weeding; DAS, days after sowing

*Pooled

Table 2. Effect of weed-control method on yield attributes, net return and benefit : cost ratio of groundnut

Treatment	Pods/plant*	Shelling (%)*	100-kernel weight	Pod yield (q/ha)*	Net returns (Rs/ha)	Benefit : cost ratio
T ₁ , Pendimethalin @ 1.0 kg a.i./ha	12.88	67.89	65.59	16.33	11,378	2.09
T ₂ , Metolachlor @ 1.0 kg a.i./ha	12.60	61.68	65.67	12.57	6,860	1.71
T ₃ , Pendimethalin @ 1.0 kg a.i./ha + 2 IC at 30 and 45 DAS	19.88	67.39	67.35	24.66	20,028	2.71
T ₄ , Metolachlor @ 1.0 kg a.i./ha + 2 IC at 30 and 45 DAS	21.02	69.00	67.98	25.18	21,593	2.95
T ₅ , T ₁ + 1 HW at 30 DAS + 2 IC at 30 and 45 DAS	23.24	66.51	88.72	24.89	19,974	2.67
T ₆ , T ₂ + 1 HW at 30 DAS + 2 IC at 30 and 45 DAS	21.88	65.13	67.71	25.63	21,033	2.85
T ₇ , Farmer's practice	14.20	66.60	67.59	17.48	12,674	2.32
T ₈ , Unweeded	7.55	61.10	61.82	7.17	9,562	1.08
T ₉ , Weed-free check (2 HW at 20 and 45 DAS and 3 IC at 15, 30 and 45 DAS)	21.60	68.34	68.77	24.42	20,716	2.00
CD (P=0.05)	9.84	2.61	NS	4.00		

IC, Interculture; HW, hand-weeding; DAS, days after sowing

*Pooled

number of pods/plant 100-kernel weight and shelling (%) compared with unweeded (Table 2).

Among the herbicides tried, pre-emergence application of pendimethalin and metolachlor at 1.0 kg a.i./ha coupled with 2 interculturalures at 30 and 45 DAS had a pronounced effect on the yield attributes compared with unweeded. Guggari *et al.* (1995) and Sumathi *et al.* (2000) also reported the beneficial effect of herbicides in the control of weeds in groundnut crop.

The least weed competition during critical phase of crop growth exerts an important regulative function on complex process of yield formations due to better availability of water space and nutrients to the crop plants which are pre-requisite for higher metabolic activity in plants. The significant improvement in various yield attributes seems to be on account of adequate supply of metabolism.

Pod yield and economics

Significantly higher pod yields were obtained with pre-emergence application of herbicides, as the pre-emergence herbicide might have reduced the weed growth at the early phase of crop growth. Hence with the use of herbicides alone more weed dry matter was recorded at 60 DAS stage of groundnut. However, herbicides in combination with hand-weeding or 2 interculturalures retarded growth and dry matter of weeds up to harvest.

Application of pendimethalin and metalachlor + 2 interculturalures at 30 and 40 DAS over unweeded control, the increase in pod yield on pooled basis was to the tune of 207.1 and 232.1 % respectively (Table 2). This might be due to the combined action of pre-emergence application of herbicides which suppressed the initial weed growth and interculturalure, which resulted in removal of weeds which emerged later. Further, the high yield with this treatment might also be because of utilization of the available nutrients by the crop otherwise utilized by the weeds. This was supported by the lower dry weight of weeds and higher yield-attributing character under these treatments, resulting in higher pod yields. Further, the pod yields obtained with weed-free check, T₉, T₃, T₄, T₅ and T₆ treatments were at par with some difference but were signifi-

cantly superior to T₈, T₇, T₁ and T₂ treatments. Weed-free check and pre-emergence of pendimethalin application or metolachlor along with other intercultural practices gave higher net returns and benefit : cost ratio compared with either sole application of pendimethalin or metolachlor and farmers' practices treatments. The reduction in crop-weed competition under weed-control methods, markedly influenced source by virtue of higher photosynthetic and metabolic activities. It is an establishment fact that balanced source-sink relationship helps crop to achieve higher productivity. Thus, higher pod yield under least weed competition through adoption of either method of weed control. Patel *et al.* (1994) emphasized the need for adoption of herbicide spray with interculturalure for higher pod yield and monetary returns.

Thus, chemical weed control with either pendimethalin or metalachlor in groundnut fields is economically viable method whenever the labour scarcity arises during the peak season.

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