

ROLE OF HERBICIDE IN CASTOR BASED INTERCROPPING SYSTEM

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Field experiments were conducted at North West and Western zones of Tamil Nadu during *Kharif* season to study the seed hardening techniques and weed management for productivity enhancement in Groundnut + castor intercropping system under rainfed conditions. In *Kharif* 2006 and 2007 the effect of seed hardening in groundnut (0.5 per cent CaCl_2 and normal seed) and weed management practices (unweeded check, hoeing and weeding on 20 and 40 DAS, weeding with star type weeder on 20 DAS + hoeing and weeding on 40 DAS, pre-emergence application of pendimethalin @ 1.0 kg a.i. ha + hoeing and weeding on 40 DAS and pre-emergence application of metolachlor @ 1.0 kg a.i. ha + hoeing and weeding on 40 DAS) in groundnut + castor inter cropping system. In respect to groundnut, seed hardening with 0.5 per cent CaCl_2 treatment recorded the highest speed of emergence, field emergence, vigour index, plant height, LAI, CGR, RGR, DMP, number of matured pods, pod yield and haulm yield. Irrespective of the locations chlorophyll content, soluble protein, hundred kernel weight and oil content were however not influenced by CaCl_2 seed hardening. Among the weed management practices studied, pre-emergence application of metolachlor @ 1.0 kg a.i. ha + hoeing and weeding on 40 DAS recorded the highest weed control efficiency and lowest weed dry matter production at 20 DAS, while at 40 DAS hoeing and weeding on 20 and 40 DAS recorded the highest weed control efficiency. In the overall experimental results it is concluded that groundnut seeds treated with 0.5 per cent CaCl_2 and pre-emergence application of metolachlor @ 1.0 kg a.i. ha followed by one hoeing and weeding on 40 DAS increased the yields of groundnut and castor crops during *Kharif* season.

Keywords : Castor; Groundnut; Intercropping system; Weed management.

Introduction

Groundnut (*Arachis hypogaea* L.) is an important oilseed crop in India which ranks first in acreage (6.4 million ha) and accounts for 23.87 per cent of the total groundnut area and contributes 20.89 per cent (7.21 million tonnes) to the world production. The average productivity of groundnut in India is 1125 kg/ha which is far below the world's average pod yield of 1149 kg/ha (www.agricoop.nic.in). In Tamil Nadu, groundnut is being cultivated in an area of 0.59 million ha with the production and productivity of 0.92 million tonnes and 1552 kg/ha, respectively. Inadequate soil moisture after sowing causes poor germination and weed competition at early stages leads to yield reduction in rainfed areas. Use of pre germinated seeds for sowing has a great potential for maintenance of desired level of plant population. By using pre-germinated seed, 19 and 17 percent increased field emergence and yield respectively, were achieved in groundnut. Weed menace is one of the major constraints in groundnut production. The yield losses in groundnut due to the weed competition could be as high as 77 per

cent. Besides competing for nutrients, soil moisture and sunlight, weeds inhibit pegging, pod development and interfere with harvest of groundnut. Weed competition is critical up to 10 weeks after sowing^{2,3}. Chemical weed control is the best alternative to provide weed free environment during early stages of the crop. However, regrowth and resistant species of weeds at the later stages pose problem in using chemicals alone. Hence, integrated weed management is the only solution to keep the weeds under check⁴.

Material and Methods

The experiments were conducted at Elachipalayam village of Namakkal district and Panamarathupatty village of Salem district of Tamil Nadu. The soils of experimental fields ranged from the sandy clay loam (Elachipalayam) to Red sandy loam type (Panamarathupatty). The nutrient status of the experimental field in Elachipalayam village (sandy clay loam) was low in N (198 kg/ha), medium in phosphorus (12 kg/ha) and high in potash (560 kg/ha). The nutrient status of the experimental field in Panamarathupatty (Location I- red sandy loam) was low

in N (188 kg/ha), high in phosphorus (41kg/ha) and medium in potash (244 kg/ha) whereas in the second location of the same village (sandy clay loam) was also low in N (235 kg/ha), medium in phosphorus (18 kg/ha) and potash (252 kg/ha). The experiment was laid out in Factorial Randomized Block Design by keeping two factors of seed hardening techniques and weed control methods, viz. normal seed (dry seed) and seed hardened with 0.5 per cent CaCl_2 in the factor one, and five weed control methods unweeded check, hoeing and weeding on 20 and 40 DAS, weeding with star type weeder on 20 DAS + hoeing and weeding on 40 DAS, pre-emergence application of pendimethalin (1kg a.i./ha) + hoeing and weeding on 40 DAS and pre-emergence application of metolachlor (1kg a.i./ha) + hoeing and weeding on 40 DAS in factor two; replicated thrice.

Good quality seeds of groundnut were treated with carbendazim @ 2 g/kg, 24 hrs before sowing to protect the seed from seed borne diseases. At the time of sowing, seeds were inoculated with TNAU-14 rhizobial culture and shade dried for 15 minutes before sowing. The groundnut seeds subjected to seed hardening were thoroughly cleaned and processed using 9/64" sieve. The processed seeds were soaked in 0.5 per cent CaCl_2 in 1:0.6 ratio of seed to solution for 6 hours and subsequently shade dried to bring back its original moisture content to 12 per cent and sown by adopting a spacing of 30 X 10 cm. For every six rows of groundnut one row of castor was maintained with inter row spacing of 60 cm similar to the farmers practice in the study area. Like wise the normal seeds of sorghum subjected to seed hardening treatment were thoroughly cleaned and processed using 6/6 RP sieve. The processed seeds were soaked in 2 per cent KH_2PO_4 for 6 hours and subsequently shade dried to bring back its original moisture content to 12 per cent. Then the hardened seeds were coated with carbendazim @ 2 g/kg, *Azospirillum* @ 40 g/kg seed and shade dried for 24 hours to bring back its original moisture content.

The herbicides viz., pendimethalin (1kg ai/ha) and metolachlor (1kg ai ha) were applied in a spray volume of 900 litres of water ha^{-1} using a knapsack sprayer fitted with a flat fan nozzle as pre-emergence herbicides on 3 DAS of groundnut. Hoeing and weeding was done using star type weeder as per the technical programme.

Results and Discussion

Weed management : Groundnut crop is exposed to maximum weed competition during early stages due to late emergence and establishment of crop⁵. Hand weeding is also not done commonly at the early stages of the crop for the same reason. Further, hand weeding is laborious

and time consuming. Under such situation, chemical control of weeds is very much essential to keep the crop relatively free from weed competition⁶. Different weed management practices exerted significant difference on root length at all the stages. The lengthier root and higher root DMP were recorded under two hoeing and weeding on 20 and 40 DAS, while significant increase in root volume was observed with pre-emergence application of metolachlor @ 1kg a.i./ha + hoeing and weeding on 40 DAS.

The groundnut pod yield was significantly increased by hand weeding twice which was 120 per cent higher over control during Kharif 2003 and 100 per cent increased over control both the location. However, the yield obtained under hand weeding was comparable with Metolachlor spray. Unlike herbicides, the crop was kept weed free by hand weeding and hoeing on 20 and 40 DAS. Though early growth of weeds were controlled by herbicides, the late emerging weeds resurgence and reflexh weeds and resistance weeds become a major threat in the metolachlor applied treatments. Vijayakumar *et. al.*⁷ reported that hand weeding twice resulted in higher groundnut pod yield and pigeon pea seed yield under pigeon pea + groundnut inter cropping situation though it was on par with chemical control. Due to the complete removal of weeds in hand weeding treatment, the higher efficiency might have obtained, unlike hand weeding. Though the weeds were totally not controlled, the application of herbicides restrain the growth of weeds. This made the difference between chemical weeding and manual weeding. Sukhadia⁸ reported that inter-cultural and hand weeding at 20 and 40 DAS recorded lower dry weight of weeds, higher weed control efficiency, lower weed persistence index and higher crop resistance index, the same treatment also gave the highest pod yield and haulm yield in groundnut though it was statistically at par with other herbicide treatments. When biomass and yield components were higher for a particular treatment certainly the treatment must be higher yield in respect of groundnut because of higher dry matter production higher pod yield. Higher pod yield due to increase in yield parameters like number of matured pods plant⁻¹, pegging percentage and hundred kernel weight were reported earlier.

Castor : The NPK uptake was significantly influenced by twice hand weeding. However, it was on par with metolachlor + one hand weeding. Effective control of weeds right from germination of crops might have allowed the crop to utilize the resources effectively and this could be the reason for higher DMP which ended with higher crop NPK uptake. Similar findings were reported by

Table 2. Effect of treatments on yield attributing characters and yield of groundnut under intercrop (mean data of two year).

Treatments	DMP (kg/ha)	Matured pods plant ⁻¹	Shelling percentage	Pod yield (kg/ha)	Haulm yield (kg/ha)	Harvest index
Seed hardening						
Control	4903	10.3	70.78	1065	4530	0.133
CaCl ₂ 0.5%	5140	10.9	71.46	1193	4832	0.130
SEd	101.0	0.37	0.62	25.6	107.3	0.008
CD (0.05)	193.0	0.81	NS	54.7	226.0	NS
Weed management						
W ₁	2541	7.2	68.85	659	2818	0.108
W ₂	5940	12.5	72.28	1311	5418	0.130
W ₃	5404	10.8	71.19	1174	4849	0.131
W ₄	5538	11.1	71.52	1235	5093	0.129
W ₅	5686	11.4	71.77	1286	5227	0.131
SEd	395.0	0.83	1.42	79.0	346.3	0.015
CD (0.05)	830.0	1.74	NS	166.0	727.3	NS

Sreedevi *et al.*⁹ It was reported that the increased castor yield in treatments involving either metolachlor or twice hand weeding was due to less competition by the weeds with the crop. The lower weed density and poor growth of weeds in these treatments was not sufficient to compete with the crop plants and resulted in increased seed yield. The lowest seed yield was recorded in unweeded control due to severe weed competition signifying the importance of weed management for increased yield.

Further in addition to the weed control treatments at the time of groundnut harvest several weeds might have either uprooted or destroyed. This might be the another reason for better crop growth and higher NPK uptake under twice hand weeding as well as metalachlor + one hand weeding.

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