A REVIEW ON WEED MANAGEMENT IN GROUNDNUT (ARACHIS HYPOGEA L.)

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ABSTRACT

Groundnut or peanut is highly susceptible to weed infestation because of its slow growth in the initial stages up to 40 DAS, short plant height and underground pod bearing habit. Unlike other crops, weeds interfere with pegging, pod development and harvesting of groundnut during different stages of crop growth besides competing for essential resources. Therefore, weeding has to be completed before pegging. Groundnut weeds comprise diverse plant species from grasses to broad-leaf weeds and sedges and cause substantial yield losses (15-75%) which are more in bunch type than in virginia groundnut. 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 cultivation and in this review, various physical, chemical and mechanical methods that curtail the growth and spread of weeds have been discussed. The common weed management practice for groundnut is pre-emergence application of selective herbicides like pendimethalin or fluchloralin followed by one hand weeding. Thus use of herbicides is one of the options left with the farmers to eliminate crop weed competition at early growth stage of crop. Hence, a brief review is presented on the nature of weed spectrum in groundnut, competition between crops and weeds, their effect on growth and yield, different weed management practices for groundnut.

KEYWORDS: Weed Management, Groundnut

INTRODUCTION

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 cashew nut. In India, groundnut was grown on 6.22 million ha during 2008-09 with a total production of 7.34 million tonnes and an average productivity of 1180 kg ha⁻¹. In Tamil Nadu it occupied 0.54 million ha land with a total production of 1.05 million tonnes with a productivity of 1957 kg ha⁻¹ during 2008-09. In India, the share of Tamil Nadu is 8.59 per cent in area, 11.44 per cent in production and 0.51 per cent in productivity (Agricultural statistics, 2009).

Groundnut contributes about 40 per cent to the total oilseeds production in the country. At this level of contribution the projected demand for groundnut by 2020 AD will be about 14 million tonnes with the present production level of around 8.2 million tonnes. Therefore, a gap of about 5.8 million tonnes needs to be bridged. This calls for a growth rate of about 2.2 per cent annum⁻¹ in production. This growth has to come mainly from the increase in productivity. At present, average yield in the kharif is around 900 kg ha⁻¹ and the rabi is around 1500 kg ha⁻¹. A fair projection for enhanced productivity with sustainability by 2020 AD will be about 1100 kg ha⁻¹ (about 22% increase) for kharif groundnut and 2000 kg ha⁻¹ (about 25% increase) for rabi groundnut (CRIDA, 2004). But both production and productivity especially of kharif groundnut have shown highly fluctuating trends. Walia et al. (2007) reported that there is an urgent need to explore the possibilities for increasing the productivity through better understanding of the constraints in production of oilseed crops especially in groundnut.
WEED DIVERSITY AMONG SOIL TYPES

At Aliyar Nagar in Tamil Nadu, *Acalypha indica*, *Chenopodium album*, *Euphorbia hirta*, *Cynodon dactylon* and *Cyperus rotundus* were the major weeds under sandy loam soil conditions (Kavimani et al., 1991). Guggari et al. (1995) reported that *Cyperus rotundus*, *Digitaria arvensis*, *Dactyloctenium aegyptium*, *Dinebra retroflexa*, *Eleusine stagnina*, *Oscimum canum*, *Euphorbia hirta*, *Phyllanthus fraternus*, *Amaranthus spinosus*, *Digeria muricata*, *Legasca mollis*, *Trichodesma indium*, *Tribulus terrestris*, *Tridax procumbens* and *Commelina benghalensis* were major weeds in red sandy loam soil of Tamil Nadu. Subrahamaniyan and Arulmozhi (1998) documented that *Trianthema portulacastrum*, *Dactyloctenium aegyptium*, *Digitaria sangunalis*, *Euphorbia hirta*, *Cyperus rotundus* and *Cynodon dactylon* were the predominant weed species of groundnut fields in red sandy loam soil.

*Cyperus rotundus*, *Cynodon dactylon*, *Panicum repens* and *Dactyloctenium aegyptium* were the dominant weed species in sandy loam soils at Vridhachalam region of Tamil Nadu (Manickam et al., 2000). Suryawanshi et al. (2001) noticed that the predominant weeds in medium black soil were *Amaranthus viridis*, *Parthenium hysterophorus*, *Acalypha indica*, *Cyperus rotundus*, *Cynodon dactylon*, *Panicum repens*, *Eclipta alba* and *Trianthema portulacastrum*. Thimmegowda et al. (2007) stated the predominant weeds in sandy loam soil were *Digitaria marginata*, *Dactyloctenium aegyptium*, *Chloris barbata*, *Echinochloa colonum*, *Eleusine indica*, *Commelina benghalensis*, *Amaranthus viridis*, *Lagasca mollis*, *Euphorbia hirta*, *Euphorbia geniculata*, *Borreria hispida*, *Portulaca oleracea*, *Ageratum conyzoides*, *Spillanthus acmella*, *Acanthosperum hispidum*, *Cleome monophylla*, *Phyllanthus niruri*, *Achyranthus aspera* and *Cyperus rotundus*.

According to Senthilkumar (2009) the major weed flora of groundnut were *Digitaria sanguinallis*, *Echinochloa colonum* and *Cynodon dactylon* among grasses, the only sedge *Cyperus rotundus* and among broad leaved weeds *Croton sparsiflorus* were predominant in sandy clay loam soil. Kasar and Chavan (2010) observed that the prominent weeds in clay loam soil were *Euphorbia geniculata*, *Physalis minima*, *Digeria arvensis*, *Lagasca mollis*, *Acalypha indica* and *Phyllanthus niruri* among the dicots and *Denebra arabica*, *Commelina benghalensis*, *Poa annua*, *Cyperus rotundus* and *Cynodon dactylon* among the monocots.

CRITICAL PERIOD OF CROP WEED COMPETITION

Critical period of crop weed competition is the prime factor, which decides the growth and yield of groundnut. The productivity of groundnut was reported to be reduced considerably when weed competition occurs during the early stages of crop growth. The critical period of weed competition in groundnut ranged from four to nine weeks (Yaduraju et al., 1980). Weeds cause much damage to the groundnut crop during the first 45 days of its growth. The most critical period of weed competition is from three to six weeks after sowing.

The average yield loss was about 30 per cent whereas, under poor management conditions, yield loss by weeds upto 60 per cent had been reported (Dayal et al., 1987). Kalaiselvan et al. (1991) stated that weed free condition from 15 to 40 days after sowing was essential for getting maximum yield. Everaarts (1992) suggested an initial weed free period of 15 days from sowing and subsequently the competition should be avoided during 35 to 60 DAS for profitable crop yield. Varaprasad and Shanti (1993) and Murthy et al. (1994) reported yield losses to the tune of 35 to 80 per cent due to weed competition in groundnut.

Suresh and Nanjappa (1994) reported that the pod and haulm yield decreased with increased crop weed competition up to harvest and the highest pod yield was realized under completely weed free condition. Maintaining weed free environment resulted in maximum yields in groundnut as reported by Paulo et al. (2001). Groundnut yield decreased
with increasing time of weed interference with all type of weed species (Zimdhal, 2004). At ICRISAT, 100 per cent of groundnut yield losses caused by weed competition at critical stage of crop (Singh and Oswalt, 2005). Wesley et al. (2008) reported that the critical period of grass weed control was found to be from four to nine weeks after planting whereas, the critical period of broad leaved weeds control was from two to eight weeks. It is important to remove weeds in groundnut at 15, 30, 45, 60 days after sowing and upto maturity to maximize yield and net returns (Nambi and Sundari, 2008).

**EFFECT OF COMPETITION ON GROWTH COMPONENTS**

The increased plant height and reduction in leaf area and crop dry matter production and inhibition of pegging in groundnut due to severe weed infestation was reported that Brar and Mehra (1989). Pannu et al. (1991) reported that the partitioning of biomass in groundnut was significantly affected due to presence of weeds during the whole season and also LAI and CGR were significantly less in the plots kept weedy.

Growth and yield attributing characters like leaf area, total dry matter production, pods plant$^{-1}$ and test weight were favourbly influenced by weed management treatments over unweeded check (Vijaykumar, 1992). Weed free environment increased the plant height and dry matter production in groundnut (Singh and Giri, 2001; Pandian and Nambi, 2002).

**EFFECT OF COMPETITION ON YIELD AND YIELD COMPONENTS**

Yield of groundnut was reduced by 25 to 70 per cent depending on the intensity of weed infestation (Prusty et al., 1990). According to Americanos (1994) groundnut crop is highly sensitive to competition by weeds and yield reduction could be severe reaching upto 70 per cent. The productivity of groundnut was affected due to competitive stress of weeds causing reduction in pod yield by 17 to 84 per cent (Ghosh, 1995).

The loss of yield in groundnut due to weeds depends on the density and type of weed flora and the loss may range from 17 to 96 per cent (Rajendran and Lourduraj, 1999). Groundnut pod yield was reduced upto 62 per cent in a multispecies weed complex (Paulo et al., 2001). Weedy conditions in the unweeded control treatment reduced pod yield by 30 to 36 per cent as compared to integrated weed control method (Jhala et al., 2005). Clewis et al. (2007) reported that presence of weeds in groundnut reduced harvesting efficiency and increased yield losses upto 40 per cent.

**WEED MANAGEMENT METHODS**

A much wider range and intensity of weeds occur in groundnut. Weeds vary in their growth habit and life cycle. Therefore, no single weed control method may provide effective control of weed. Various weed management practices are in vogue in groundnut and each has its own merits and demerits.

Weed control is achieved through direct methods (hand weeding, herbicide application and mechanical weeding) used within systems and indirect methods such as land preparation, water management, planting method and fertility management. The final choice of any weed control method depends on its effectiveness and economics.

**MANUAL AND CULTURAL METHODS**

Meyyappan and Kathiresan (2005) opined that hand weeding twice significantly increased the kernal yield of groundnut upto 2.42 times than unweeded control in clay loam soils of Tamil Nadu. Madhavi et al. (2008) reported that the farmers practice of hand weeding twice on 20 and 40 DAS resulted in lower weed dry matter and higher pod yield (1496 kg ha$^{-1}$)in rabigroundnut compared with application of pendimethalinat 1.0 kg ha$^{-1}$ (714 kg ha$^{-1}$). Naim et al. (2010) reported that the hand weeding twice at 2nd and 4th weeks after sowing was effective to control weeds and recommended to improve vegetative growth of groundnut in North Kordofan of Sudan.
CHEMICAL METHOD

In modern agriculture, herbicides are commonly used as an alternative method to traditional methods of hand weeding at initial period for better control of weeds. In India however the herbicide consumption is only 15 per cent of total pesticide consumption. However, the consumption of herbicide in India has increased rapidly from 4100 metric tonnes (MT) in 1988-89 to 11,000 MT in 2001-02 (Arya et al., 2008). The selection of herbicides will depend on the crop type, its potential use, the variety, crop growth stage, condition of the foliage, soil type and weeds present in the field (Davies and Welsh, 2002).

PRE EMERGENCE HERBICIDE APPLICATION

Pre emergence application of soil active herbicides could be appropriate not only in minimizing early weed control, but also for reducing the demand on labour during peak period cultivation and to avoid at least one or two intercultivations during first 3-4 weeks and control weeds in inter row as well as in the intra row (Baker and Terry, 1991). Guggari et al. (1995) observed that 30 to 55 per cent of the weeds can be controlled by pre-emergence application of herbicides. However, when combined with one hand weeding the weed control was upto 85 per cent. In groundnut nodule formation, weed control index and pod yield were maximum with pre-emergence application of pendimethalin at 1.0 kg a.i ha$^{-1}$ (Deshmuk and Dev, 1995). Jain et al. (2000) confirmed that pre-emergence application of pendimethalin at 1.5 kg ha$^{-1}$ reduced the weed density, weed biomass and increased the weed control efficiency as well as number of pods plant$^{-1}$ and weight of pods. Whereas, Nayak et al. (2000) reported that the higher weed control efficiency was found in pendimethalin at 1.0 kg ha$^{-1}$ which was on par with two hand weeding on 25 and 40 DAS.

Kushwah and Kushwaha (2001) also reported that pre-emergence application pendimethalin at 1.0 kg ha$^{-1}$ supplemented with one hand weeding resulted in higher weed control efficiency and benefit cost ratio. Application of pendimethalin at 0.5 kg a.i ha$^{-1}$ at 50 days after sowing preferably with receipt of rain was found to be highly effective in controlling Celosia spp., and gave a pod yield of 900 kg ha$^{-1}$, compared to weed free condition under arid alfisols (AICRPDA, 2003). Sequential application of metolachlor 1.0 kg ha$^{-1}$ immediately after sowing reduced the population and dry matter production of grasses, sedges and broad leaved weeds in groundnut (Kanagam et al., 2005). Integration of hand weeding with pre-plant application of fluchloralin at 0.67 kg ha$^{-1}$ and trifluralin at 0.75 kg ha$^{-1}$ and pre-emergence application of pendimethalin at 0.75 kg ha$^{-1}$, oxyfluorfen at 0.25 kg ha$^{-1}$ and alachlor at 1.25 kg ha$^{-1}$ resulted significant reduction in dry matter production by weeds as compared to the recommended weed management practice (Walila et al., 2007).

Pre-emergence application of pendimethalin at 1.0 kg ha$^{-1}$ recorded lower weed population, higher pod and haulm yields due to control of weeds at early stage was reported by Bhatt et al. (2008). According to Patel et al. (2008) under shortage of labour, pendimethalin at 1.0 kg ha$^{-1}$ as pre-emergence application with one interculturing at 25 DAS recorded lower weed dry weight and higher weed control efficiency in summer groundnut.

Higher profitable pod yield of summer groundnut could be obtained by keeping the crop weed free condition with pendimethalin at 0.75 kg ha$^{-1}$ coupled with one hand weeding at 45 days after sowing (Raj et al., 2008). Chinnamuthu et al. (2009) observed that higher dry pod yield was recorded with pre-emergence application of metelechlor at 0.75 kg ha$^{-1}$ followed by hand weeding twice. Pre emergence application of metolachlor at 1.0 kg ha$^{-1}$ followed by one hoeing and HW twice on 25 and 45 DAS increased the yields of groundnut and castor crops during kharif season (Manickam et al., 2009). Bhondve et al. (2009) reported that pre-emergence application of pendimethalin at 0.75 kg ha$^{-1}$ supplemented with hoeing at 25 DAS is the effective and economical weed control practice for kharif groundnut in vertisol under Pune region of Maharastra.
MECHANICAL METHOD

Mechanical weed control is comparatively faster and less labour intensive than hand weeding (Chivinge, 1990). Power weeder was found useful for weeding in between standing rows of cash crops like cotton, tapioca and grape. The weeder could cover an average of one ha day\(^{-1}\) of eight hours. The cost of weeding by this machine came to only one-third of the weeding cost by manual labourers (Tajuddin, 2006). Mechanical weed control not only uproot the weeds between the crop rows but also keep the soil surface loose, ensuring better soil aeration and water intake capacity (Yadav and Pond, 2007). Weed morphology and stage of growth would influence the selection and efficacy of weeding implement. It is found that the physical damage by burial to 1 cm depth is effective for controlling weeds followed by cutting at the soil surface (Rajakumar, 2008). Gore et al. (2010) reported that cycle hoe weeder produced significantly highest grain yield and found to be effective in controlling grass as well as broad leaved weeds (69 and 44%) and (63 and 67%) at 30 and 60 DAS in soybean. Effective and economical weed management in rainfed pigeonpea was obtained either by pre-emergence application of pendimethalin at 0.75 kg ha\(^{-1}\) on 3 DAS followed by one weeding with oleo weeder on 45 DAS or pre-emergence application of pendimethalin at 0.75 kg ha\(^{-1}\) on 3 DAS followed by one weeding with wheel hoe weeder on 45 DAS (Gowsalya et al., 2010).

ECONOMICS OF WEED MANAGEMENT

Sardana et al. (2006) reported that benefit cost ratio of groundnut was highest with the use of fluchloralin at 0.75 kg ha\(^{-1}\) (1.55) followed by oxyfluorfen at0.25 kg ha\(^{-1}\) (1.35) and pendimethalin at 0.75 kg ha\(^{-1}\) (1.34). The lowest income and benefit cost ratio were recorded under weedy check. The highest net returns as well as cost benefit ratio over two years were obtained with pre-plant application of trifluralin at 1.25 kg ha\(^{-1}\) and it was followed by pre-emergence application of oxyfluorfen at 0.50 kg ha\(^{-1}\) followed by one hand weeding and pre-emergence application of pendimethalin followed by one hand weeding (Walia et al., 2007). Tomar et al. (2009) reported that pre-emergence application of pendimethalin at 1.0 kg ha\(^{-1}\) registered highest pod yield of 1884 kg ha\(^{-1}\), net return of Rs.25070 ha\(^{-1}\) and benefit cost ratio of 4.60.

CONCLUSIONS

Pre-emergence application of pendimethalin or fluchloralin or oxyfluorfen herbicides followed by one hand weeding on 40 DAS, can keep the weed density and dry weight below the economic threshold level and increase the pod yield and net return in groundnut.

REFERENCES


