Review of Optimization of Peanut Yield Through Effective Weed Management: Strategies and Challenges in India

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ABSTRACT

Peanuts, often called the "king" of oilseeds, play a crucial role in India's agricultural economy, serving both food and commercial purposes. In the 2021-22 period, India produced 10.01 million tonnes of peanuts, with Rajasthan alone contributing 1.75 million tonnes. However, to meet the anticipated demand of 15 million tonnes by 2030, an annual productivity increase of 1-1.5% is necessary. A significant challenge in peanut cultivation is weed competition, which can severely impact yields. Effective weed management is critical, with losses reported up to 60% under poor control. The critical period for weed competition in peanuts spans from four to nine weeks after planting.

Various studies have highlighted the effectiveness of different weed control methods. Pre-emergence herbicides, such as pendimethalin, have been shown to significantly reduce weed populations and enhance peanut yields. Combining these herbicides with manual weeding or mechanical methods provides optimal results. Mechanical weeding, in particular, is noted for its efficiency and cost-effectiveness, as it not only removes weeds but also improves soil aeration and water absorption.

Integrated weed management, which combines chemical, mechanical, and manual methods, is essential for sustainable peanut farming. This approach ensures higher yields and economic viability, making it crucial for meeting future demand. Continuous research and innovation in weed management practices are necessary to address the dynamic challenges faced by peanut farmers. This review underscores the importance of strategic weed control in boosting productivity and ensuring the long-term success of peanut cultivation in India.

KEYWORDS: Weed Management, Groundnut, Pre-emergence, Herbicide, Oilseed

INTRODUCTION

Peanuts or peanuts (*Arachis hypogaea L.*) are called the "king" of oilseeds. It is one of the most important food and commercial plants of our country. Peanuts are also known as miracle nuts and poor man's nuts. Total fruit production in India during 2021-22 is 10.01 million tonnes with an average of 1863 kg ha^{-1}. (agricoop.nic.in). Rajasthan produced 1.75 million tonnes of groundnuts in 2021-22 with an average yield of 22.53 quintals/ha.

Groundnuts contribute around 40% of the total groundnut production in the country. At this stage, the demand for peanuts is expected to be around 15 million tons by 2030, and the current production is expected to be around 10.01 million tons. Therefore, a difference of approximately 4.99 million tons needs to be made. This requires a growth in output of about 1 $^{-1}$% per year. This growth is mainly due to increased productivity. However, yield and productivity of groundnut, especially kharif, show a highly variable trend. Wali et al. (2007) reported that there is a need to investigate the possibility of increasing productivity through better understanding of the constraints in oilseed crops (especially groundnut).

WEED DIVERSITY AMONG SOIL TYPES

Gugari et al. (1995) reported that *Cyperus rotundus, Digitaria arvensis, Dactyloctenium aegyptium, Dinebra rhoflexa, Eleusine stagnina, Oscimum canum, Euphorbia hirta, Phyllanthus fraternus, Amaranthimum canum, Euphorbia hir, Amaranthimum canum, Euphorbia hir, s, Tridia causimum ionals, Triroanthus spp. ranthus, Tridia procumbens* and *commelina* are the dominant weeds in the red sandy soils of India. Subrahamanian and Arulmozhi (1998) stated that purslane, Corn rings, crab grass, spurge, cyperus and bermuda grass are the dominant weeds in groundnut in red sandy soils. Suryawanshi et al. (2001) stated that the main plants in the middle were amaranth, white flower, amaranth, cyperus rotunda, bermudagrass, white millet, eclipta grass and purslane. Timegorda et al. (2007) stated that the main plants in sandy loam soil are crabgrass, corn ring, Scutellaria barbata, barnyard grass, goose grass, commelina, amaranth, euphorbia, euphorbia, euphorbia, *Borrelia hirsutum*, purslane Amaranth, Zoideus, *Spillanthus acm*, *Cleome monophylla. Phyllanthus niruri, Achyranthus aspera* and *Cyperus rotundus*. According to the research of Senthilkumar (2009), the main plants of peanut in sandy loam soils are crabgrass, barnyard grass and bermuda grass, and in sandy loam soils, only sedge and broad-leaved plants are croton. Kasar and Chavan (2010) found that the dominant plants of monocots in clay loam soil were *Euphorbia geniculata, Physalis minima, Digeria arvensis, Lagasca Morris (Lagasca mollis), Acalypha indica* and *Phyllanthus niruri dactylon*.

CRITICAL PERIOD OF CROP WEED COMPETITION

The timing of crop competition is an important factor in determining peanut growth and yield. It has been reported that peanut production decreases when there is weed competition in the early stages of crop growth. The critical period for weed competition in peanut is four to nine weeks (Yaduraju et al., 1980). Weeds can cause significant damage to peanuts during the first 45 days of growth. The prime time for plant competition is three to six weeks after planting. While the average yield loss is around 30%, yield loss due to weeds has been reported to be up to 60% under poor control.

Suresh and Nanjappa (1994) reported that with the increase in weed competition in pre-harvest crops, fruit and stem yield decreased and the highest work was done in plantless conditions. Maximum peanut yield can be achieved by maintaining a weed-free field, reported by Paulo et al.

(2001). Peanut yield decreases during the period when weeds are used, associated with the increase in weed species (Zimdhal, 2004). According to ICRISAT, 100% of groundnut losses are due to weed competition during the critical period of the crop (Singh and Oswalt, 2005). Wesley et al. (2008) stated that the critical period for grass control is 4 to 9 weeks after planting, while for general weed control it is 2 to 8 weeks. It is important to remove groundnut plants after 15, 30, 45, 60 days after planting and let them grow and re-net (nambi and sundari, 2008).

EFFECTS OF COMPETITION ON GROWTH

Brar and Mehra (1989) reported that there was an increase in plant height, a decrease in leaf yield and dry yield in peanuts, and that pinning in peanuts was prevented due to severe disease. Pannu et al. (1991) reported that peanut distribution was significantly affected by the availability of vegetation throughout the season, with LAI and CGR decreasing in prairie soils. good power. A weed-free environment increases plant height and enhances drying of peanuts (Singh and Giri, 2001; Pandian and Nambi, 2002). %, depending on grass use (Prusty et al., 1990). Americanos (1994) reported that peanut crops are sensitive to weed competition and yield reductions can be as high as 70%. Peanut production is affected due to severe competition from weeds, resulting in a decrease of 17% to 84% in peanut yield (Ghosh, 1995). Peanut shell yield has decreased by 62% in many species (Paulo et al., 2001). In the weed-free control, weed reduced yield from 30% to 36% compared to the mixed weed control (Jhala et al. 2005). Cleves et al. (2007) reported that the presence of weeds in peanuts decreased but the yield increased by 40%. Plants differ in their growth and life cycles. Therefore, there is no single weed control method that is effective in combating weeds. There are many popular weed control methods in peanuts, each with their own advantages and disadvantages.

Weed control is done by direct methods used in the system (manual weed control, herbicide application and mechanical weed control) and indirect methods such as land preparation, water management, planting methods and productivity management. The final choice of any weed control method depends on its benefits and economics. Madhavi et al. (2008) reported that farmer's application of hand weeding at 20 and 40 DAS resulted in dry pea grass compared to application of pendimethalin at 1.0 kg ha^{-1} (714 kg ha^{-1}). -one). Naim et al. (2010) reported that manual weeding twice at 2 and 4 weeks after planting could control weeds well and was recommended to improve the growth of peanuts in North Kordofan, Sudan.

METHODS

In today's agriculture, antibiotics are often used as an alternative to pesticides in the early stages to better control plants. However, pesticide use accounts for only 15% of the total pesticide use in India. However, pesticide use in India increased rapidly from 4,100 metric tons in 1988-89 to 11,000 metric tons in 2001-02 (Arya et al. 2008). The choice of herbicide depends on the type of crop, potential use, variety, crop growth stage, foliar disease, soil type and plant response (Davies and Welsh, 2002).

PRE-EMERGENCE HERBICIDE APPLICATION

Pre-emergence application of soil-active herbicides not only reduces early weed control, but

also reduces the need for work during the peak tillage period and eliminates the need for at least one. Apply Intertill or more twice during the first 3-4 weeks and control weeds between and within the row (Baker and Terry, 1991). Gugari et al. (1995) found that 30% to 55% of weeds could be controlled by preapplication of herbicides. However, when combined with weed alone, weed control increases up to 85%. Weed control index and pod yield are highest with pre-emergence application of 1.0 kg a.i ha^{-1} pendimethalin during nodulation in peanut (Deshmuk and Dev, 1995). Jain et al. (2000) showed that pre-emergence application of pendimethalin at 1.5 kg ha^{-1} reduced plant density, plant biomass and increased fruit $plant^{-1}$ and pod weight as well as weed control. Whereas, Nayak et al. (2000) reported that 1.0 kg ha^{-1} pendimethalin had high weed control and compared to two-handed weeding at 25 and 40 DAS.

Kushwaha and Kushwaha (2001) also reported that pre-emergence application of 1.0 kg ha^{-1} of pendimethalin supplemented with a elm grass resulted in a higher rate of weed control and cost effectiveness. Application of 0.5 kg a.i ha^{-1} pendimethalin 50 days after planting, preferably with rain, has been shown to be effective in controlling the pest with a yield of 900 compared to plant-free disease insects.

Continuous application of 1.0 kg ha^{-1} metolachlor immediately after planting reduces the abundance and dry matter produced by grasses, sedges and broadleaf weeds in peanut (Kanagam et al., 2005). Application of 0.67 kg ha^{-1} fluclofen and 0.75 kg ha^{-1} trifluralin before plant care and planting, and use of 0.75 kg ha^{-1} pendimethalin, 0.25 kg ha^{-1} oxyfluorfen and oxyfenacet before the emergence test. Amine addition 1 .25 kg ha $^{-1}$ led to a reduction in hay compared to the recommended control weed (Walia 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 METHODS

Mechanical weeding is faster and requires less effort than using grass (Chivinge, 1990).

Electric weeders have been found to be effective in growing commercial crops such as cotton, cassava and fruits. On an average, the plants can cover one hectare of land for eight hours a day. The cost of a plant using this machine is only one-third of the cost of a factory using manual labor (Tajuddin, 2006). Mechanical weeding not only removes weeds from the crop line but also loosens the soil, increasing aeration and water absorption (Yadav and Pond, 2007). The morphology and growth stage of the plant will influence the selection and effectiveness of weeding equipment. Studies have shown that dead body buried to a depth of 1 cm is effective in controlling the plants after cutting the soil (Rajakumar, 2008). Gore et al. (2010) reported that circulating hoe weeder had the best weed and broadleaf efficiency and control in soybean with (69% and 44%) and (63% and 67%) values at 30 and 60 DAS. Effective weed control and health of rainfed fruits can be achieved by pre-emergence application of 0.75 kg ha^{-1} pendimethalin at 3 DAS followed by a single application of oleo weed remover at 45 DAS or by pre-emergence application of 0.75 kg ha^{-1} pendimethalin at 45 DAS.

THE ECONOMICS OF WEED MANAGEMENT

Sardana et al. (2006), the highest yield value of peanut was 0.75 kg ha^{-1} (1.55) when fluclofen was used, followed by oxyfluorfen 0.25 kg ha^{-1} (1.35) and oxyfluorfen 0.75 kg ha^{-1} (1, 34) reported that it was used. pendimethalin. Income and benefit-cost ratio are lowest in the control facility. The best return and yield over two years is a pre-application of 1.25 kg ha^{-1} trifluralin followed by a pre-application of 0.50 kg ha^{-1} Oxifant followed by a single application. and sorting. pendimethalin behaves like a single plant (Walia et al. 2007). Tomar et al. (2009) reported that application of 1.0 kg ha^{-1} pendimethalin before emergence resulted in a maximum yield of 1884 kg ha^{-1}, a net return of 25070 ha^{-1} and a result-price ratio of 4.60.

CONCLUSION

This concludes, effective weed management is crucial for maximizing peanut yields in India. Combining pre-emergence herbicides with manual and mechanical methods offers optimal results. Continuous innovation and tailored strategies are necessary to meet the growing demand for peanuts, ensuring sustainable and profitable peanut farming.

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