



EFFECTIVE CHEMICAL WEED MANAGEMENT IN COTTON

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Introduction

Cotton (*Gossypium spp.*) is a significant cash crop crucial to the worldwide textile industry. In the early stages of its life cycle, cotton exhibits slow growth, and the wider row spacing creates a favorable environment for various weed categories to thrive. This, in turn, poses a challenge as these weeds compete for both water and nutrients, consequently hindering the growth of the cotton crop. Weeds represent significant limitations that diminish crop yields as they contend with crops for essential resources such as nutrients, moisture, light, and space. In cotton crops, weed control is combining several techniques to reduce weeds' negative effects on crop development and growth. Managing weed growth is essential to mitigate these negative impacts on crop yield. A strong weed competition during the early stages of crop growth has a detrimental effect on the production of cotton.

Why chemical methods are effective

Weed management in cotton involves various approaches, including physical, mechanical, cultural, chemical, and integrated methods. While physical (hand-pulling, hoeing), mechanical (tillage, mowing), and cultural (crop rotation, mulching) methods are effective, they tend to be labor-intensive and costly. These methods require significant manual labor, machinery, and time, making them less economically feasible for large-scale cotton farming.

On the other hand, chemical methods involve the use of herbicides, which are relatively more cost-effective and easier to apply on a large scale. Herbicides can be selectively used to target specific weeds without harming the cotton crop, allowing for efficient and widespread control. This makes chemical methods a preferred choice for many cotton farmers, especially in large

commercial operations, due to their lower cost, time efficiency, and ease of application compared to physical, mechanical, and cultural methods.

Weed flora in cotton

Weeds pose a significant risk to cotton yields because they fiercely compete with one another for vital resources including sunshine, water, fertilizer, and space. Therefore, it is essential to implement timely weed control and precisely identify weeds associated with cotton crops.

Amaranthus palmeri, *Amaranthus retroflexus*, *Ambrosia artemisiifolia*, *Chenopodium album*, *Convolvulus arvensis*, *Cucumis melo*, *Cynodon dactylon*, *Cyperus rotundus*, *Digitaria sanguinalis*, *Eleusine indica*, *Portulaca oleracea*, *Solanum nigrum*, *Sorghum halepense*, and *Xanthium strumarium* are the most common weeds in cotton crops.

Crop weed competition in cotton

In natural ecosystems, crops and weeds engage in a competitive struggle for resources, vying for survival and dominance. This interaction is known as crop-weed competition. Weeds compete with cotton for vital resources such as nutrients, water, sunlight, and space. So, effective management of weed competition is crucial for maximizing cotton yield and quality.

Weeds germinating simultaneously with the crop pose greater harm compared to those that emerge later. There exists a specific time interval before and after which the presence of weeds does not lead to any noticeable decrease in crop yield. In cotton, the crucial time for crop-weed competition is between 15 and 60 days.

Weed effects on cotton yield

Cotton is a significant commodity in the global economy. Weeds create losses in agricultural production situations such as lower

crop yields, worse crop quality, higher irrigation and harvesting expenses, lower land value, harm to animals, and crop damage from insects and illnesses these weeds harbor. There was a 74% loss in cotton crop production in Tamil Nadu due to intense weed competition. One of the main reasons for low agricultural output worldwide is luxuriant weed growth. Weeds cause two kinds of yield losses. The primary loss is the direct yield reduction brought on by competition, followed by the secondary loss brought on by a decrease in crop quality.

Chemical Weed Management in Cotton

In agriculture, herbicides are necessary to provide successful weed control. Choosing the right herbicides and applying them at the correct time are critical factors for the efficient control of weeds in all cotton production systems. Effectively managing weeds requires the essential application of both pre-emergent residual herbicides in the soil and post-emergent herbicides.

Pre-emergent herbicides

Pre-emergence application of soil-active herbicides is typically performed on the soil surface. These herbicides need to have the capacity to penetrate the upper 3.5 to 4 cm of soil, facilitated by irrigation, to effectively eliminate germinating weeds.

Post-emergent herbicides

Applying a foliage-active herbicide after the emergence of both crops and weeds is known as post-emergence chemical control. They are taken up by the leaf of the plant and frequently moved to other plant sections.

Pre + Post emergence

- Grass and broad-leaved weeds were more effectively controlled in cotton when pendimethalin (1 kg ha⁻¹) was applied, followed by a directed spraying of fomesafen (0.5 kg ha⁻¹) + fluazifop-butyl (0.375 kg ha⁻¹) 30 days after emergence.
- Weed population was decreased for the treatment of pendimethalin at 1.0 kg ha⁻¹ at 3 DAS and quizalofop-p-ethyl at 50 g ha⁻¹ at 30 DAS.

- A significant decrease in weed density was seen upon applying pendimethalin at 1.0 kg ha⁻¹ and propaquizafop-p-ethyl at 62.5 g ha⁻¹ at 60 DAS post-emergence.
- Applying 1000 g/ha of pendimethalin prior to emergence, and then 65.7 g/ha of halosulfuron-methyl at 20 DAS.

Conclusion

In summary, maintaining the health of the crop and maximizing cotton production depend on efficient weed control. Weeds present a major difficulty since they compete with essential nutrients, especially during the early phases of cotton development. Though they work well, traditional weed-control techniques are labor-intensive and not as practical for large-scale enterprises. Chemical approaches are more economical and efficient since they employ pesticides that are specifically targeted. It has been demonstrated that using herbicides strategically may greatly reduce weed competition, improving crop growth and production in cotton cultivation.

Table 1. Herbicides suitable for weed management in cotton

S No	Suitable herbicides	Dosa ge	Applicati on	Weed control
1	Pendimethalin	0.5 - 1.5 kg ha ⁻¹	Apply before weed emergence - 3 DAS	Annual grasses and broadleaf weeds
2	Trifluralin	0.75 - 1.5 kg ha ⁻¹	Immediately following treatment, the soil must be integrated	Annual grasses and broadleaf weeds.
3	Pyrithiobac sodium	50 g ha ⁻¹	30 DAS	Broadleaf weeds
4	Quizalofop - ethyl	50 - 75 g ha ⁻¹	15 - 45 DAS	Annual and perennial grass

5	Propaquizafop	75–150 g ha ⁻¹	25 DAS	Annual and perennial grasses
6	Fenoxaprop-p-ethyl	50 - 60 g ha ⁻¹	25 - 45 DAS	Annual and perennial grasses
7	Halosulfuron methyl	40 to 140 g	30 DAS	Broadleaf and sedge