

Winning the Weed War: Ways and Means for Yield Improvement in Cotton

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Introduction

Cotton is a soft, fluffy and white fibrous material, develops inside a protective capsule called as a boll, which encases the seeds of the plant. It is, often referred to as the "King of Fibre", plays a crucial role in numerous industries, including ginning, textile processing, also the production of yarn, fabric, and garments. Its significant economic impact, profitability, and symbolic value have also earned it the name "White Gold", serving both as a major fibre crop and a valuable cash crop.

Cotton, with its wide spacing, slow early growth, heavy fertilizer use, and frequent irrigation, faces intense weed competition, leading to yield losses of 30-70 percent. Weeds, being highly competitive, vie for essential resources and thus hinder cotton productivity. Weed management is a critical component of cotton cultivation, as weeds compete with cotton plants for essential resources like water, nutrients, and sunlight, leading to significant yield losses. Effective weed control in cotton requires a combination of strategies to minimize the impact of weeds on crop growth, especially during the early stages of development when cotton is most vulnerable.

Weed species interfere with cotton cultivation

The prevalent grass weeds in cotton fields were *Cynodon dactylon*, *Chloris barbata*, and *Echinochloa colonum*. Among sedges, *Cyperus esculentus* and *Cyperus rotundus* were commonly found. The broad-leaved weeds present included *Boerhavia erecta*, *Cleome viscosa*, *Commelina benghalensis*, *Convolvulus arvensis*, *Euphorbia hirta*, *Phyllanthus maderaspatensis*, *Phyllanthus niruri*, *Trianthema portulacastrum*, and *Tribulus terrestris*. These weeds grow rapidly, consume essential resources, and can be resistant to many herbicides.

Critical period of crop weed competition

Cotton is highly vulnerable during the first two months of its growth, with weeds potentially causing production losses of 10 to 90%. The most critical time for competition between cotton plants and

weeds occurs between 30 and 60 days after planting, encompassing half of the crop's growth cycle. If left unchecked during this time, weed interference can severely reduce yields, sometimes by up to 90%.

Traditional Weed Control Methods

Historically, weed management in cotton has been labour-intensive, relying on manual weeding and mechanical cultivation. These methods, while effective, are time-consuming and expensive, especially in regions facing labour shortages. The growing demand for sustainable agriculture has highlighted the need for more efficient and less resource-heavy methods.

Potential options for weed management in cotton

Herbicide Use

Herbicides are commonly used for weed control in cotton. Pre-emergent herbicides are applied before weeds sprout, while post-emergent herbicides target weeds that have already emerged. However, herbicide resistance, especially in weeds like **Palmer amaranth**, has become a growing issue, leading to reduced effectiveness of certain herbicides. As a result, herbicide rotation and the use of integrated weed management strategies are becoming more critical.

Integrated weed management

To combat the limitations of relying solely on herbicides, many cotton farmers are adopting Integrated Weed Management (IWM). This approach combines different strategies to manage weeds.

- Application of **Pendimethalin** @ 3.3 l/ha three days after sowing, using a hand operated sprayer fitted with deflecting or fan type nozzle. Sufficient moisture should be present in the soil at the time of herbicide application. Along with one hand weeding on 45 DAS will keep weed free environment up to 60 DAS.
- Application of **Pendimethalin** @ 3.3 l/ha three days after sowing followed by power weeding on 25 and 45 days after sowing.
- **Crop rotation**: Alternating cotton with other crops to disrupt weed growth cycles.

- **Mulching:** Using organic or synthetic mulches to prevent weed seed germination
- **Cover cropping:** Planting cover crops to suppress weed growth by outcompeting them for resources.

Technology in Weed Management

Modern technology, such as precision agriculture tools, helps farmers monitor and manage weeds more efficiently. Drones and sensors can detect weed infestations early, allowing for targeted herbicide applications and reducing the overall usage of chemicals. Robotic weeders are also being developed to remove weeds without harming cotton plants, offering a more sustainable alternative to traditional methods.

Future Directions

Advancements in precision agriculture and herbicide technology offer new hope for effective weed management in cotton. Techniques like robotic weeders, drone monitoring, and genetically modified crops may further reduce the reliance on manual labour and improve efficiency.

Conclusion

In summary, managing weeds in cotton is a critical aspect of ensuring healthy crop development and maximizing yields. Combining traditional methods with modern techniques in an integrated approach offers the best chance of overcoming the challenges posed by weed infestations.
