

# A Review on Weed Characteristic and Weed Management for Sustainable Farming

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## ABSTRACT

A major obstacle to agricultural productivity worldwide, weeds pose serious problems for crop yield and quality. They are fierce rivals to farmed crops because of their competitive nature, quick growth, and capacity for environmental adaptation. With an emphasis on how weeds affect nutrient availability, water resources, and light competition, this paper offers a thorough examination of how weeds affect crop productivity. The paper also examines contemporary weed management techniques, such as mechanical, chemical, cultural, and biological control approaches. Along with integrated weed management (IWM) strategies that seek to strike a compromise between effectiveness and environmental and economic sustainability, the development of herbicide resistance and the growing concern about its effects on sustainable agriculture are also covered. Finally, the potential of new management techniques and emerging technology, like genetic modification and precision agriculture, to enhance weed control and reduce adverse crop effects is assessed. In order to lessen the negative effects of weeds on global food security, the review's conclusion emphasizes the significance of implementing a variety of flexible weed management techniques.

**Keywords:** Weed diversity, weed impact and Weed management

## INTRODUCTION

The plants that impede the growth of farmed crops, lowering yields, quality, and profitability, are considered weeds (Smith *et al.*, 2020). Weeds compete with crops for vital resources including water, light, nutrients, and space, making their presence in agricultural systems a global concern (Jones & Wilson, 2019). Crop health may be further impacted by weeds' ability to serve as habitats for pests and illnesses (Taylor *et al.*, 2018). Over time, integrated and more sustainable methods have replaced traditional methods in the fight against weeds in agricultural production (Green & Bell, 2017). Based on their growth patterns, capacity to adapt to their surroundings and reaction to control measures, weeds can be divided into several groups. These consist of sedges, grasses, and broadleaf weeds (Henderson *et al.*, 2016). Control efforts are made more difficult by the development of herbicide resistance in some common weed species, including

Amaranth spp., Centurms spp., and Convolvulus spp. (Smith *et al.*, 2020; Johnson *et al.*, 2021). Weeds have a substantial financial impact on agriculture since they cause crop loss and necessitate costly control techniques (Roberts, 2015). Weeds have been controlled using a range of strategies, such as biological control, mechanical approaches like tilling, and chemical herbicides (Griffith & Holmes, 2019). The practice of integrated weed management (IWM), which integrates several tactics to lessen weed pressure while limiting negative effects on the environment and the economy, has gained popularity recently (Stewart *et al.*, 2020). The main obstacles that weed provide to agricultural production are examined in this review paper, along with the development of weed control techniques and the prospects for further study to resolve these persistent problems. Due to their competitive character, which has a negative impact on crop yields, quality, and farm

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profitability, weeds are a significant challenge in agricultural systems. Crop productivity is frequently lowered as a result of weed competition for vital resources such as water, nutrients, light, and space (al., 2020). Furthermore, weeds may harbor diseases and pests, which would further jeopardize crop health and necessitate more control efforts (Taylor *et al.*, 2018).

### 1. Weed Effects on Crop Fields

Worldwide, weeds are regarded as one of the most important issues restricting crop productivity. By vying for vital resources, especially in settings with high demand, they impede crop growth. Under conditions of poor soil or moisture, weeds like *Amaranth* spp. and *Centrums* spp. have a particularly high propensity to outcompete crops, resulting in significant production losses (Jones and Wilson, 2019). Furthermore, some weed species can harbor dangerous pests and illnesses, posing a complicated web of difficulties for farmers (Henderson *et al.*, 2016). Jones and Wilson (2019) discuss how competition between weeds and crops reduces available resources for crops. Taylor *et al.* (2018) identify the role of weeds in supporting pest and disease populations, which further harms crop health.

### 2. categorization of weed on the basis of adaptability

The biological traits of weeds differ, encompassing their growth patterns, methods of reproduction, and capacity to adapt to different environments. Broadleaf weeds, grasses, and sedges are the three main types of weeds that present various difficulties for crop management. Because of their quick growth, abundant seed production, and capacity to flourish in a variety of environments, certain weed species—like *Amaranth*s and *Convolvulus*—are especially hostile in agricultural fields (Henderson *et al.*, 2016). Henderson *et al.* (2016) classified weeds based on their growth patterns and environmental adaptability. Griffith and Holmes (2019) highlighted the importance of understanding weed ecology to predict and manage their growth in crop systems.

### 3. Response against Herbicides

Herbicide resistance is one of the most urgent problems facing crop and weed management today. Traditional chemical management approaches are no longer as successful since many weed species have become resistant to common herbicides. Significant resistance has been displayed by species such as *Amaranth*s spp., *Centrums* spp., and *Convolvulus*

spp., which has complicated control efforts and increased the need for integrated management measures (Johnson *et al.*, 2021). Crop output is greatly impacted by the emergence of herbicide-resistant weeds since it increases farmer expenses and necessitates the use of alternate control techniques (Roberts, 2015). Johnson *et al.* (2021) documented the rise of herbicide-resistant weed species. Roberts (2015) explored the economic costs of herbicide resistance in global agriculture.

### 4. Weed Management Strategies

Reducing financial losses and preserving high agricultural yields depend on efficient weed control. Historically, a variety of techniques have been employed, including chemical herbicides, mechanical techniques like tilling, and, more recently, integrated weed management (IWM) techniques. Crop rotation, herbicide resistance management, biological control, and mechanical weeding are just a few of the tactics that IWM integrates into a sustainable strategy that reduces adverse environmental effects (Stewart *et al.*, 2020). Research on biological control, which includes using natural predators or competitive crops, has showed promise but is still difficult (Griffith & Holmes, 2019). Stewart *et al.* (2020) examined integrated weed management techniques and their environmental benefits. Griffith & Holmes (2019) reviewed biological control as an alternative weed management strategy.

### 5. Significance of Weed in Economy

Both the direct expenses of controlling weeds and the indirect costs associated with lower crop yields and quality place a heavy financial burden on agriculture. According to studies, weed competition causes significant financial losses; some estimates place the annual costs worldwide at billions of dollars (Roberts, 2015). Farmers frequently have to spend a lot of money on labor, equipment, and herbicides to control weeds, and the rise in herbicide resistance only makes these expenses higher (Griffith & Holmes, 2019). Roberts (2015) provided an analysis of the economic impact of weeds in agriculture. Griffith & Holmes (2019) highlighted the rising costs of weed control in modern farming.

### 6. Weed a Broad Area of Future Research

New and creative research avenues are opening up as the problems caused by weeds change. In order to provide more effective control methods, weed management practices are incorporating

technological advancements like precision agriculture. Future studies in the fields of genetic engineering, herbicide-tolerant crops, and machine vision for automated weed detection show promise (Stewart *et al.*, 2020). Furthermore, there is a growing body of knowledge on sustainable techniques like soil health, cover crops, and organic farming.

## CONCLUSION

Worldwide, weeds continue to pose a serious threat to crop productivity. Weed control is complicated by the competition for resources, the spread of diseases and pests, and the emergence of herbicide resistance. However, there is hope for more long-term solutions to these issues with the advancement of technology advancements, alternative control techniques, and integrated weed management practices. To overcome these enduring obstacles, more study into weed ecology and the creation of novel management methods are essential.

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