

# *Weed Flora Diversity and Management in Maize Ecosystem: A Sustainable Approach for Higher Productivity*

**Divya Singh<sup>1\*</sup>, Anil Kumar Singh<sup>2</sup>, Akhilesh Kumar Yadav<sup>3</sup>  
and Akanksha Singh<sup>4</sup>**

<sup>1</sup>Subject Matter Specialist (Agronomy), <sup>3</sup>Senior Scientist Cum Head, <sup>4</sup>Subject Matter Specialist (Home Science), Krishi Vigyan Kendra Kotwa Azamgarh-I, Uttar Pradesh, India

<sup>2</sup>Professor (Agronomy), A.N.D.U.A.T Kumarganj Ayodhya, Uttar Pradesh, India

## Corresponding Author

Divya Singh

Email: singhnik2103@gmail.com



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## ABSTRACT

Maize is a major cereal crop grown extensively for food purposes, feed and industrial purposes. Weed infestation is a major constraint reducing maize productivity, particularly during early crop growth stages. Weeds compete with cultivated crops for essential resources such as nutrients, water and sunlight and space, causing substantial yield losses. Weed flora in maize mainly includes grasses, broad-leaved weeds and sedges. Integrated Weed Management (IWM), involving cultural, mechanical and chemical approaches, is considered an effective and sustainable strategy for weed control. Modern technologies such as drone spraying and AI-based weed identification are further improving weed management efficiency. This article highlights major weed flora and sustainable techniques for weed management in maize ecosystem.

## INTRODUCTION

**M**aize (*Zea mays* L.) is a widely cultivated cereal crop grown under diverse agro-climatic conditions

for grain, fodder and industrial uses. Because of its wider row spacing and slow early growth, maize crop remains highly susceptible

to weed competition during the initial growth period (Das, 2014). Weeds compete with crop plants for nutrients, water, light and space, which ultimately leads to considerable yield losses (Chhokar *et al.*, 2012). The critical crop-weed competition period in maize generally occurs between 20–45 DAS; therefore, timely weed management is essential for higher productivity.

### Weed Flora Diversity in Maize Ecosystem

Weed flora in maize fields mainly consists of grasses, broad-leaved weeds and sedges. Weed intensity varies with climate, irrigation, cropping system and management practices.

**Table 1. Major Weed Flora in Maize**

Weed Category	Scientific Name	Severity
Grassy weed	<i>Echinochloa colona</i>	High
Grassy weed	<i>Cynodon dactylon</i>	Moderate–High
Broad-leaved weed	<i>Amaranthus viridis</i>	High
Broad-leaved weed	<i>Trianthema portulacastrum</i>	High
Sedge	<i>Cyperus rotundus</i>	High

Among these, *Echinochloa colona* and *Cyperus rotundus* are highly competitive weeds.

### Critical Crop-Weed Competition

Maize is highly susceptible to weed competition during 20–45 DAS. Uncontrolled weed growth during this stage significantly causes reduction in plant growth and yield (Singh *et al.*, 2018).

**Table 2. Crop Yield Losses Due to Weeds**

Crop Stage (DAS)	Yield Loss (%)
0–15	10–15
15–30	30–45
30–45	50–70

### Effects of Weed Infestation

- Competition for nutrients, moisture and sunlight
- Reduced photosynthetic activity
- Poor crop growth and grain formation
- 30–80% decrease in crop yield
- Higher cultivation cost

### Weed Management Strategies in Maize

#### Preventive Methods

- Use certified seed
- Avoid weed-infested FYM
- Clean irrigation channels

#### Cultural Methods

- Timely sowing
- Crop rotation
- Intercropping with legumes
- Residue mulching

#### Mechanical Methods

- Hand weeding
- Hoeing
- Intercultivation

Hand weeding twice at 20 & 40 DAS effectively reduce weed population.

### Chemical Weed Management

Herbicides provide timely and economical weed control in maize.

**Table 3. Important Herbicides Used in Maize**

Herbicide	Application Time	Dose
Atrazine	Pre-emergence	0.5–1.0 kg a.i./ha
Pendimethalin	Pre-emergence	1.0 kg a.i./ha
Tembotrione	Post-emergence	120 g a.i./ha
Topramezone	Post-emergence	25 g a.i./ha

Proper herbicide selection and timing are essential for effective weed control.

### Integrated Weed Management (IWM)

Integrated Weed Management combines cultural, mechanical and chemical methods for sustainable weed control. Major components include crop rotation, interculture operations, herbicide application and mulching. IWM reduces herbicide dependence, improves weed control efficiency and enhances crop productivity (Kumar & Rana, 2017).

### Economics of Weed Management

**Table 4. Economics of Weed Management Practices**

Treatment	Net Returns (Rs./ha)	B:C Ratio
Weedy check	22,500	1.59
Hand weeding twice	58,400	2.25
Atrazine fb Tembotrione	69,500	2.52
Integrated weed management	74,300	2.57

Integrated weed management recorded maximum profitability and weed control efficiency.



### Climate Smart Weed Management

Climate-smart approaches such as residue mulching, cover cropping, conservation

agriculture and precision herbicide application help reduce environmental pollution and improve sustainability.

Recent technologies like drone spraying, GIS, AI-based weed identification and robotic weeders are improving weed management efficiency in maize cultivation.

### CONCLUSION

Weed infestation is a major factor limiting maize productivity. Timely weed management during the critical growth stage is essential for minimizing yield losses. Holistic weed management strategy involving cultural, mechanical and chemical approaches provides sustainable and economical weed control. Adoption of climate-smart technologies and precision weed management practices can further improve productivity and environmental sustainability in maize ecosystem.

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