



Weeds in Horticultural Crops: Identification, Economic Importance and Management Approaches

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Horticulture plays a vital role in agricultural development by providing fruits, vegetables, flowers, spices, plantation crops, medicinal plants and ornamental crops that contribute significantly to nutrition, employment and income generation. However, one of the major biological constraints affecting productivity and profitability in horticultural crops is the infestation of weeds. Weeds compete with crops for water, nutrients, sunlight and space, and they interfere with various cultural operations. In orchards, vegetable fields, nurseries and flower crops, uncontrolled weed growth can reduce yield, deteriorate produce quality, increase production costs and create favourable conditions for insect pests and diseases. A weed is commonly defined as any unwanted plant growing where it is not desired. The same plant may be considered a crop in one situation and a weed in another. For example, volunteer tomato plants in a cabbage field or grasses growing in a fruit orchard are considered weeds. Horticultural weeds are therefore unwanted plants occurring in horticultural ecosystems such as orchards, vegetable gardens, nurseries, polyhouses, vineyards and ornamental landscapes. Effective weed management is essential for sustainable horticulture because weeds can cause severe losses during the critical stages of crop growth (Rao, 2000).

Characteristics of Weeds

Weeds possess several biological characteristics that make them highly competitive and difficult to eradicate. These include:

- Rapid growth and early establishment.
- Production of a large number of seeds.
- Long seed viability in the soil.
- Efficient methods of dispersal through wind, water, animals and machinery.
- Ability to reproduce vegetatively through rhizomes, stolons, tubers, bulbs and roots.
- Adaptability to diverse environmental conditions.
- Tolerance to adverse weather and poor soil conditions.

Because of these characteristics, weeds often dominate cultivated fields unless appropriate management practices are adopted.

Types of Horticultural Weeds

Weeds are classified on the basis of life cycle, morphology, habitat and mode of reproduction.

1. Based on Life Cycle

a) Annual Weeds

Annual weeds complete their life cycle within one season or one year. They germinate from seeds, grow, flower, produce seeds and die.

Examples: *Amaranthus viridis*, *Chenopodium album*, *Portulaca oleracea*, *Digitaria sanguinalis*.

These are common in vegetable fields and nursery beds and are often easier to control before seed formation.

b) Biennial Weeds

Biennial weeds complete their life cycle in two years. During the first year they produce vegetative growth, while flowering and seed production occur during the second year.

Examples: Wild carrot (*Daucus carota*), burdock (*Arctium* spp.).

These weeds are less common in tropical horticultural systems but may occur in temperate regions.

c) Perennial Weeds

Perennial weeds live for more than two years and reproduce through seeds as well as vegetative structures such as rhizomes, stolons, bulbs and tubers.

Examples: *Cyperus rotundus* (nut grass), *Cynodon dactylon* (Bermuda grass), *Convolvulus arvensis* (field bindweed), *Sorghum halepense* (Johnson grass).

Perennial weeds are the most troublesome in orchards and perennial horticultural crops because they are difficult to eliminate completely.

2. Based on Morphology

a) Grassy Weeds

These belong mainly to the family Poaceae and possess narrow leaves, parallel venation and fibrous root systems.

Examples: *Cynodon dactylon*, *Echinochloa colona*, *Digitaria* spp.

b) Sedges

Sedges belong to the family Cyperaceae and are characterised by triangular stems and underground tubers or rhizomes.

Examples: *Cyperus rotundus*, *Cyperus iria*.

c) Broad-leaved Weeds

These possess broad leaves with reticulate venation and include many dicotyledonous species.

Examples: *Amaranthus* spp., *Parthenium hysterophorus*, *Chenopodium album*, *Trianthema portulacastrum*.

3. Based on Habitat

- **Terrestrial weeds:** Occur on cultivated land and orchards.
- **Aquatic weeds:** Found in irrigation channels, ponds and water reservoirs (e.g., *Eichhornia crassipes*, *Hydrilla* spp.).
- **Marshy weeds:** Grow in waterlogged or poorly drained soils.

Importance of Weeds in Horticulture

Weeds are generally regarded as harmful, but they also possess certain ecological and economic values. Therefore, understanding both the negative and positive aspects of weeds is important.

Harmful Effects of Weeds

1. Competition for Resources

Weeds compete aggressively with horticultural crops for:

- Soil moisture
- Mineral nutrients

- Sunlight
- Carbon dioxide
- Space

This competition is particularly severe during the **critical period of crop-weed competition**, resulting in poor crop establishment and reduced growth.

2. Reduction in Yield

Weeds can cause substantial yield losses in horticultural crops.

- Vegetables: 20-80% loss
- Fruit orchards: 15-60% loss
- Flower crops: reduction in flower number, size and quality
- Nurseries: poor seedling growth and lower transplant quality (Aldrich & Kremer, 1997)

3. Deterioration of Produce Quality

Weeds contaminate harvested fruits, vegetables and flowers with seeds, leaves and stems, thereby reducing market value.

4. Harbours Pests and Diseases

Many weeds serve as alternate hosts for insects, nematodes, fungi, bacteria and viruses.

Examples:

- *Parthenium hysterophorus* harbours insect pests.
- Weedy grasses may act as reservoirs for viral diseases affecting vegetables.

5. Interference with Cultural Operations

Weeds hinder:

- Irrigation
- Fertigation
- Spraying
- Pruning
- Harvesting
- Movement of machinery

Dense weed growth increases labour requirements and production costs.

6. Allelopathic Effects

Certain weeds release toxic chemicals that suppress seed germination and crop growth.

Examples: *Parthenium hysterophorus* and *Cyperus rotundus*.

7. Increased Production Costs

Repeated weeding, herbicide application and additional labour increase the overall cost of cultivation.

Beneficial Aspects of Weeds

Although weeds are undesirable in crop fields, some species provide useful ecological services.

- Protection of soil from erosion.
- Addition of organic matter when incorporated into the soil.
- Improvement of soil structure.
- Habitat for beneficial insects and pollinators.
- Medicinal uses of certain weed species.
- Fodder for livestock (e.g., *Cynodon dactylon*).

However, these benefits do not outweigh their harmful effects in commercial horticultural production.

Weed Control and Management Measures

Modern weed management emphasises Integrated Weed Management (IWM), which combines preventive, cultural, mechanical, biological and chemical methods to achieve effective and economical weed control while minimising environmental hazards.

1. Preventive Measures

Preventive weed control aims to avoid the introduction and spread of weeds.

- Use certified weed-free seeds and planting material.

- Clean farm machinery before moving between fields.
- Prevent weed seed contamination in manure and compost.
- Maintain clean irrigation channels.
- Remove weeds before flowering and seed production.

2. Cultural Control

Cultural practices improve crop competitiveness and suppress weed growth.

a) Crop Rotation

Rotating crops with different growth habits disrupts weed life cycles and reduces specific weed populations.

b) Mulching

Mulches suppress weed emergence by blocking sunlight.

Organic mulches:

- Straw
- Dry leaves
- Pine needles
- Sawdust
- Compost

Inorganic mulches:

- Black polyethylene mulch
- Silver-black mulch
- Biodegradable mulch films

Mulching is highly effective in fruit orchards, strawberry, vegetable and ornamental crops.

c) Optimum Plant Population

Closer spacing and vigorous crop canopies reduce light availability for weeds.

d) Cover Crops

Cover crops such as cowpea, clover and legumes suppress weeds through competition and shading.

e) Proper Irrigation and Fertilization

Efficient placement of water and nutrients near crop roots reduces weed growth between rows.

3. Mechanical and Physical Control

a) Hand Weeding

Hand pulling or hoeing is common in vegetable crops and nurseries.

Advantages:

- Selective
- Environment friendly
- Effective for small areas

Limitations:

- Labour intensive
- Costly
- Difficult during rainy periods

b) Intercultivation

Use of hoes, wheel hoes, cultivators and power weeders between crop rows.

c) Tillage

Primary and secondary tillage uproot weeds and bury weed seeds.

d) Mowing and Slashing

Used mainly in orchards, vineyards and lawns to prevent weed seed production.

e) Soil Solarization

Covering moist soil with transparent polyethylene sheets during hot summer months raises soil temperature sufficiently to kill weed seeds and seedlings.

4. Biological Control

Biological weed control involves the use of natural enemies.

Agents used include:

- Insects
- Fungi
- Bacteria
- Grazing animals

Examples:

- *Zygogramma bicolorata* for control of *Parthenium hysterophorus*.
- Certain fungal pathogens for aquatic weeds.

Biological control is environmentally safe and suitable for long-term weed suppression.

5. Chemical Control

Herbicides are widely used in commercial horticulture because they provide quick and economical weed control.

Classification of Herbicides

a) Pre-plant Herbicides

Applied before crop planting and incorporated into the soil.

Example: Fluchloralin.

b) Pre-emergence Herbicides

Applied after sowing but before weed emergence.

Examples:

- Pendimethalin
- Oxyfluorfen
- Atrazine (for specific crops)

c) Post-emergence Herbicides

Applied after weeds have emerged.

Examples:

- Glyphosate
- Paraquat
- 2,4-D (for broad-leaved weeds in suitable situations)

Selective and Non-selective Herbicides

- **Selective herbicides:** Kill specific weeds without injuring the crop.
- **Non-selective herbicides:** Kill most vegetation and are commonly used in orchards and non-cropped areas.

Precautions in Herbicide Use

- Select the herbicide according to crop and weed species.
- Apply the recommended dose.
- Use appropriate spray equipment and nozzle.
- Avoid spray drift.
- Wear protective clothing.
- Follow waiting periods and safety instructions.

Integrated Weed Management (IWM)

Integrated Weed Management combines multiple control methods for sustainable weed suppression.

A typical IWM programme in a fruit orchard may include:

- Clean cultivation before planting.
- Mulching around tree basins.
- Cover cropping between rows.
- Periodic mowing.
- Spot application of glyphosate on perennial weeds.
- Hand weeding near tree trunks.

Similarly, in vegetable production, the combination of pre-emergence herbicides, plastic mulching and occasional hand weeding provides excellent weed control with reduced labour requirements (Das, 2014).

Weed Management in Major Horticultural Crops

Fruit Orchards

- Basin weeding around trees.
- Organic or plastic mulching.
- Cover crops between rows.
- Glyphosate or paraquat for directed spraying.
- Mechanical mowing.

Vegetable Crops

- Pendimethalin as pre-emergence.
- Plastic mulch for tomato, chilli, cucumber and strawberry.
- Hand weeding at 20-30 days after planting.
- Intercultivation between rows.

Flower Crops

- Mulching.
- Hand weeding.
- Selective herbicides depending on the crop.
- Weed-free nursery management.

Nursery Crops

- Sterilized growing media.
- Frequent manual weeding.
- Mulching with rice husk or cocopeat.
- Careful use of low-dose herbicides.

Conclusion

Weeds are among the most important constraints limiting the productivity and profitability of horticultural crops. Their rapid growth, high reproductive capacity and adaptability make them formidable competitors for water, nutrients, sunlight and space. They reduce crop yield and quality, increase production costs and serve as reservoirs for pests and diseases. Effective weed management therefore constitutes a fundamental component of modern horticultural production systems. No single method provides complete weed control under all conditions. The most successful approach is Integrated Weed Management, which combines preventive, cultural, mechanical, biological and chemical measures according to the crop, weed flora and environmental conditions. Practices such as mulching, cover cropping, timely cultivation, judicious herbicide use and biological control can substantially reduce weed infestation while conserving soil health and environmental quality (Singh et al 2011). Adoption of integrated and sustainable weed management strategies will enhance horticultural productivity, improve produce quality and ensure long-term ecological and economic sustainability of horticultural farming systems.

References

1. Aldrich, R. J., and Kremer, R. J. (1997). *Principles in Weed Management* (2nd ed.). Iowa State University Press.
2. Das, T. K. (2014). *Weed Science: Basics and Applications*. Jain Brothers, New Delhi.
3. Rao, V. S. (2000). *Principles of Weed Science* (2nd ed.). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Singh, G., Singh, O. P., and Yadav, R. S. (2011). *Weed Management in Horticultural Crops*. Narendra Deva University of Agriculture and Technology, Faizabad, India.