

WEED MANAGEMENT: IMPROVING THE PRODUCTION POTENTIAL OF CROPS

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Weed management is an important component of plant protection improving the production potential of crops. It includes management of the weeds in a way that the crop sustains its production potential without being harmed by the weeds. Weeds are the plants that grow without being harmed by the weeds. Weeds are the plants that grow without human



efforts and are not wanted. They grow in the fields where they compete with crops for water soil, nutrients, light, and space, and thus reduce the crop yields. Weeds are also act as alternate hosts that harbor insects, pests and diseases and other micro-organisms. Weeds reduce the quality of marketable agricultural produce and render harvesting difficult, leading to increased expenditure on labour, equipment and chemicals for their removal. Weeds are also a nuisance and a fire hazard along railway lines, roads, right-of- ways, airports, forest and industrial sites. Weed management is done through the mechanical, cultural and



chemical means. Use of biological control methods in field crops is being considered, but still not much in use. Use of herbicides is an important method in the modern concept of much in use. Use of herbicides is an important method in the modern concept of weed-management technology. In some crops, the yields are reduced by more than 50% due to weed infestation. The losses caused by weeds in some of the important crops are given in Table 1. **Characteristics of weeds:** Weeds are also like other plants but have special characteristics that tend to put them in the category of unwanted plants.

– Most of the weeds specially annuals produce enormous quantity of seeds, e.g. wild oats (*Avena fatua*), produces 250 seeds per plant, whereas wild amaranth (*Amaranthus viridis*) produces nearly 11 million seeds. It has been observed that among 61 perennial weeds, the average seed-production capacity was 26,500 per plant.

– Weeds have the capacity to withstand adverse conditions in the field, because they can modify their seed production and growth according to the availability of moisture and temperature. They can germinate under adverse soil-moisture conditions, have short period of plant growth, generally grow faster rate and produce seed earlier than most of the crops growing in association.

– Weed seeds remain viable for longer period without losing their viability, e.g. annual meadow grass (*Poa annua*) and scarlet pimpernel (*Anagallis arvensis*) remain viable for about 8 years; creeping thistle (*Cirsium arvense*) for 20 years and field bind weed (*Convolvulus arvensis*) for about 50 years.

– Weed seeds have a tremendous capacity to disperse from one place to another through wind, water and animals including man. Many of times, weed seeds

Table 1 : Loss in crop yields due to weeds

Crop	Reduction in yields due to weeds (%)	Crop	Reduction in yield due to weeds (%)
Rice	41.6	Groundnut	33.8
Wheat	16.0	Sugarcane	34.2
Maize	39.8	Sugar beet	70.3
Millets	29.5	Carrot	47.5
Soybean	30.5	Cotton	72.5
Gram	11.6	Onion	68.0
Pea	32.9	Potato	20.1

mimic with the crop seeds due to their size and get transported from one place to another.

Crop-weed competition: Weeds compete with crop plants for nutrients, moisture and light. The degree of competition is dependent on weed flora, time of weed emergence, relative density of crop plants and weeds, the duration of competition, etc. Competition is set in motion when supply or availability of resources are limited for the unrestricted growth of both crop and weeds. When the crop seeds are planted weeds seed also germinate along with them. The stage at which there is maximum impact of weeds on crop growth is termed as critical period of weed competition, which usually varies between 15 to 60 days after sowing depending upon the crop, crop duration, time of weed emergence, weed flora and intensity and soil and climatic conditions. There will be least or no damage done by the weeds, once the crop is established and the canopy covers the ground. Irrespective of what method of weed control is practised, it must be ensured that the weeds are kept at low level during the critical periods of weed competition. This will ensure higher efficiency of inputs used and in turn recording maximum potential crop yields.

Principles of weed management: In order to reduce the negative implications of weeds on crop growth and yield, weed have to be controlled efficiently. To do the job successfully, a thorough understanding of weed biology in the crop environment becomes essential. Prevention, control and eradication are the keys in weed management.

Prevention: Prevention involves procedures that inhibit or delay weed establishment in areas that are not already inhabited by them. These practices restrict the introduction, propagation and spread of weeds on a local or a regional level. Preventive measure include cultural practices such as

- Seed cleaning,
- Use of weed-free seed,
- Manure and machinery,
- Controlling weeds on field bunds, and irrigation canals,
- Screening irrigation water,
- Restricting movement of farm animals, etc.

Prevention is highly cost effective, as establishment of any new weed is going to create problem for many year.

Eradication: Eradication is the total elimination of a weed species from a field, area or region. It requires the complete removal of seeds and vegetative parts of a weed species in a defined area. It is usually attempted only in small area or areas with high value crops because of the difficulty and high costs associated with eradication practices.

Control: Control practices reduce or suppress weeds but do not necessarily result in the elimination of any particular weed species. Weed control, therefore, is a matter of degree and depends upon the goals of the people involved, effectiveness of the weed control tactic used and the abundance and tenacity of the weed species present. There are 4 general methods of weed control: Physical, cultural, and biological.

Physical methods: Hand pulling or hand weeding, hoeing, tillage mowing, burning, flooding, smothering etc. are examples of physical methods of weed management, involving the use of physical energy through implements either manually or bullock drawn or power operated. Farmers mostly resort to hand weeding with the help of hand chisel (kharpi), hand hoe, spades, etc. It is one of the most commonly used methods but is back breaking, time consuming and costly. Pre-planting or post-planting tillage is practical and has been found as economical methods of weed control. The use of soil turning plough, disc and spring tooth harrows and the dug foot, blade and bukher-type cultivators are some of the implements being used to keep weed growth under control. However, adverse soil conditions such as too dry or too wet soil limit their use.

Cultural methods: Weeds are better competitors than crop plants for light, water, nutrients and space. However, good cropping practices can change the conditions in such a way as to enable the crop plants to compete with the weeds successfully or to reduce their interference to the minimum, and thus prevent them from acting as impediments to increase in crop production. Quality seed with good germination will give the crop a vigorous and close stand, and would enable the crop plants to steal a march on the weeds. Varieties well adapted to a season will compete better with the weeds than those poorly adapted to it. The plant breeder have to evolve quick-growing and short duration varieties of crop plants with larger leaf area and good branching or tillering ability and the agronomists have to work out the proper seed rate, depth, time and method of sowing, and the use of the most appropriate method of irrigation and manuring in a given cropping system.

Some crops can compete better with weeds. For instance, the crop like sorghum, cowpea are good competitors, whereas others such as groundnut, lentil are poor competitors. Close row crops compete better with the weeds than wide row crops. Similarly, the crops and varieties having early and faster growth during the cropping season compete better than those growing slowly during the early part of their growth, e.g. pigeonpea. The fodder crops in general, grow faster and thick sowing technique results in dense growth crops, thereby

smothering the weeds effectively.

Crop rotations are required to minimize the dominance of a particular weed in the cropping system. Intercropping, particularly growing of a fast growing crop such as cowpea, soybean, etc. in wide spaced crops like maize, pigeon pea or sugarcane would reduce weed competition. Similarly, converting inter-row spaces with mulches (plant residues, paper, plastic, etc.) also contain weed growth.

Biological method: In this method, the natural enemy of a weed plant is used to control the weed. The requirements for the success in this method are:

- The weed species must have been introduced and in the process if introduction must have been freed from its natural parasites or predators.

- The natural predators and parasites must be introduced to prey upon or parasitize the weeds but they in turn must have been freed from parasites in order to carry out their work for destruction unhampered.

- The destructive agents must be highly specialized so they these are able to thrive even under starvation condition on agricultural plants of the new habitat. Root-borers, stem-borers and internal seed-or fruit feeders are more highly specialized than the foliage feeders.

An outstanding example of biological control of plant is that of prickly pear (*Opuntia* spp.) in Australia. Another noteworthy example is of destruction of Lantana with the help of *Telenemia scruplosa*. Attempts are under way for the biological control of nutgrass in Hawaii. Water hyacinth can also be controlled through the use of *Neochetina bruchi* and *N. eichhorniae*. Successful control of *Parthenium hysterophorus* has been reported with the help of Mexican beetle *Zygogramma bicolorata*. The use of geese to control weeds in cotton is popular in some areas in South-West America. The young geese selectively feed on Johnson grass (*Sorghum halepense*) without

harming cotton. The eradication of prickly pear by using the cochineal insect (*Dactylopius tomentosus*) in Maharashtra and Tamil Nadu is the best example of biological control in India. At the Indian Fisheries Laboratory, Bhopal, it was observed that grass carp (*Ctenopharyngodon idella*) controls effectively the submerged water vegetation comprising *Najas minor*, *Hydrilla verticillata*, *Ceratophyllum demersum*, *Lemna minor* etc. Claims are also made in India of the control of kans grass (*Saccharum spontaneum*) by growing basket grass, whose roots are supposed to excrete some substance or substances inhibitory to kans.

Integrated weed management: In nature a balance has been struck among all the components, both living (biotic) and non-living (abiotic) of an environment. This ecosystem concept has much relevance in that all the components co-exist in perfect unison, each component satisfying its own niche. The introduction of a foreign element, e.g. a herbicide, may create some serious upheavals in the ecosystem. Further, the continuous use of a herbicide may eliminate all the susceptible weed species and its place may be taken over by some resistant ones, or the existing ones may develop resistance. All these eventualities have to be borne in mind when recourse is taken to chemical weed control. One of the ways to avert such a situation consists of using low doses of herbicides, in rotating herbicides just like a crop rotation and alternating intelligently chemical and non-chemical methods in weed management. An integrated weed management may be defined as the combination of two or more weed-control methods at low input levels to reduce weed competition in a given cropping system below the economical threshold level. It has proved to be a valuable concept in a few cases, though much is still to be done to extend it to the small farmers' level.

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