Principles of Weed Management

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Concept

Weed management is a combination of practices by which weed infestation is kept to the minimum for successful and profitable crop production. It involves prevention, control, and eradication. The concept of weed management can be applied as a coordinated approach to a single weed species or a complex of several species.

Concept of weed management instead of control is important. Weed control aims at putting down the weeds already present. Weed management is a system approach whereby whole land use planning is done in advance to minimize the invasion of weeds in aggressive forms and give crop plants a very strong competitive advantage over the latter.

Objectives of weed management

The primary objectives of the weed management system is to maintain an environment that is as detrimental to weeds as possible by employing both preventive and control measures through the use of physical, cultural, biological and chemical methods either alone or in combination.

The main aim of weed management is to manage the vegetation on land and water bodies in such a way as will encourage the growth of plants beneficial to humans and will suppress the remaining unwanted plants. Indiscriminate application of control measures against plants is not the objective of weed management.

The long-term objective of weed management is to avoid or reduce any adverse environmental impact of control methods and to prevent build-up of any one weed species.

Pre-requisite of successful weed management program

i. One must gain knowledge of the biology of weeds before choosing a system for their control.
ii. The nature of weed problems must be surveyed in the target area.
iii. Weed control measures must be planned for the whole farm and not just against weeds in a field.
iv. Weed control system must follow up programme of weed prevention measures.

Principles of weed management

Weed management is the process of limiting weed infestations so the crops could be grown profitably and other activities of man conducted efficiently. Weed Management principles are consistent with prevention, eradication and control.

Prevention

Prevention means stopping weeds from infesting an area. It advocates not permitting a weed alien to an area to enter into and infest that area. In true sense, it was earlier intended towards prevention of exotic weeds. In crop field situation, prevention highlights on the aspects how best the seed reservoir/bank could be exhausted, although complete exhaustion is a rare possibility. In this situation, preventing weeds to emerge from soil and grow vigorously and/or preventing existing weeds to come to seeds, tubers, rhizomes or other propagules for dissemination are considered to be preventive approaches. The weed control/management measure adopted the year before, in fact, may be a preventive approach for the coming year. Even certain cultural practices/methods such as stale seedbed; competitive crop and cultivar; time, method and rate of sowing; spacing; irrigation; time, method and rate of fertilization; intercropping; crop rotation; cover crops; etc have bearing
towards reducing growth and seed production of weeds. Thus, prevention requires a set of practices rather than a single practice to tackle the introduction and spread of weeds. Their individual effect is small, but the impact is enormous when the very/same practices followed together for a long period under certain situation.

**Preventive measures**

- Isolation of introduced livestock to prevent spread of weed seeds from their digestive tract.
- Use of well-decomposed and seed free farmyard manures and compost.
- Use of clean farm equipment and cleaning of used equipment, including combines, cultivators, and grain trucks.
- Cleaning irrigation water before it enters a field.
- Mowing and other appropriate weed control practices to prevent seed production on irrigation ditch banks.
- Inspection of imported nursery stock for weeds, seeds, and vegetative reproductive organs.
- Inspection and cleaning of imported gravel, sand, and soil.
- Special attention to fence lines, field edges, rights-of-way, railroads, and so on as sources of new weeds.
- Seed dealers and grain handlers should clean crop seed and dispose of cleanings properly.
- Fields should be surveyed regularly to identify new weeds.
- Proper crop rotation: Differentiation of crops grown over time on the same field is a well-known primary means of preventive weed control. Different crops obviously bring about different cultural practices, which act as a factor in disrupting the growing cycle of weeds and, as such, preventing selection of the flora towards increased abundance of problem species.
- Soil solarization: Soil solarization is a preventive method that exploits solar heating to kill weed seeds and therefore reduce weed emergence. High soil temperature, if lasting long enough, is able to kill the reproduction structures of weeds. To increase the solarization effect as much as possible, the soil surface must be smooth and must contain enough water to favor heat transfer down the profile and to make reproductive structure of weeds more sensitive to heat damage. For this reason, prior to solarization the soil is usually irrigated and a plastic mulch film is laid down onto the soil to further increase soil heating and to avoid heat dissipation to the atmosphere.
- Seed certification: In *Oryza rufipogon* (Wild rice) declared by law as noxious weed.
- Quarantine laws: Limited to insects and diseases, to be extended to weeds, but not yet practiced in Bangladesh.
- Use of pre-emergence herbicides: inhibits weed seed germination, kills young seedlings, keeps weed free for an extended period

**Eradication**

Weed eradication is the complete removal of all live plant parts and seeds from an area. Eradication includes the destruction of seeds as well as vegetative propagules i.e. rhizomes, tubers, creeping roots, bulbs etc.

It is taken to the belief that once a weed is eradicated from an area, it will not reappear unless introduced. Eradication is very difficult to achieve or hardly achieved in terms of complete exhaustion of seed bank and vegetative propagules of weeds from soil. On the contrary, very high dose of soil sterilants and fumigants applied for the sake of eradication unnecessarily leads to soil and water pollution. That’s why it is not or rarely desirable and its adoption is discouraged now-a-days on the ground of high cost, difficulty in accomplishment and for urges in maintaining biodiversity for pest management in crop fields.

Eradication may be adopted in certain crop fields if the reasons are justified, e.g. for perennial (*Cyperus rotundus, Cynodon dactylon, Convolvulus arvensis, Cirsium arvense* etc.) and parasitic weed control in some arable lands and noxious and invasive weed control in non-crop situations.

For eradication programme, whatever chemicals opted should be non selective and should act through soil since soil needs to be sterilized. Several soil sterilants, e.g. methyl bromide, metham, EPTC, NaClO3, chloropicrin (tear gas) and dazomet (DMTT) are recommended for the purpose. They
are of course out-dated and their rate of application is very high. Therefore, certain triazines (e.g. simazine, atrazine), phenylureas (e.g. linuron, diuron) or even phenoxyalkanoic acids (e.g. 2,4,5-T but banned in many countries) may be used for the purpose, but the dose should be much higher than recommended for usual weed control in the crop fields.

Other eradication approaches are hand pulling, deep plowing, burning etc.

In weed science as in medical science, prevention is better than control, but control is required because weeds and other pests arrive without notice and are present before their arrival can be prevented. Prevention and eradication require long-term thinking and planning.

Control

Weed control includes many techniques used to limit weed infestations and minimize competition. These techniques attempt to achieve a balance between cost of control and crop yield loss, but weed control is used only after the problem exists; it is not prevention.

Weed control techniques have been adopted widely because control is the easiest thing to do and is usually effective. The problem is known and can be seen, and actions can be tailored to the observed problem. Control techniques can be selected to meet short-term economic and agricultural planning goals. Control is easier to practice than prevention and eradication and can be put/made to work well with short-term economic or cultural planning goals.

Points to be considered for successful control

- **Habits of weed plants:** A xerophytes weed (E.g. *Alhagi camelorum*) thriving under dry and arid conditions will die if fields are flooded with water. Similarly weeds which thrive under marsh or ill drained condition of soil can be controlled by improving drainage.
- **Life cycle of the weed:** Annuals and biennials can be controlled effectively if the land is cultivated before seedling stage of weeds. Perennials require deep plowing to dig out rhizomes, bulbs, etc. vegetative part by which they propagate.
- **Susceptibilities:** Some weeds are susceptible to certain chemicals while others are not. e.g.: Dicots are susceptible to 2,4-D while monocots are not, hence 2,4-D is used to control broad leaved weeds in monocot crops.
- **Dormancy period:** While controlling dormancy weeds, period is to be considered as they have long dormancy period.
- **Resistance to adverse conditions without losing viability:** Some weed seeds have hard seed coats which enable them to remain for a long time without losing their viability, hence they should be controlled before seed formation.
- **Methods of reproduction:** Weeds propagate either by seeds, vegetative parts or by both. Seeded weeds should be removed or smothered before seed formation. Vegetative propagated weeds should be exposed to sun heat to dry and die like rhizome, bulbs, solons, etc. by deep plowing. Frequent cultivation leads to destroy green leaves & thereby exhaust the food reserves and starve the plants may have to be restored too. In weeds propagated by both mechanical and chemical methods may have to be followed.
- **Dispersal of seeds:** Weeds can be controlled or kept in check if the ways in which different weed seeds disseminate are known and counter measures are undertaken.

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Suggested readings:

**Fundamentals of Weed Science**  
Robert L. Zimdahl  
5th Edition, 2018  
Elsevier/Academic Press  

**Encyclopedia of Weed Science**  
Parmeshwar Singh  
1st Edn; 2010  
Anmol Publications Pvt.Ltd.  

**Principles of Weed Science**  
V.S. Rao  
3rd Edition; 2018  
CBS Publishers & Distributors  

**Handbook of Weed Science**  
Eiohze Maalouf  
1st Edition; 2017  
Agri Horti Press  

**Weed Science: Principles and Practices**  
Thomas J. Monaco, Stephen C. Weller and, Floyd M. Ashton  
4th Edition; 2002  
Wiley-Blackwell  

**Weed Management: Principles and Practices**  
O.P. Gupta  
3rd Edition; 2015  
Agrobios India  