



FACULTY OF AGRICULTURAL SCIENCES & ALLIED INDUSTRIES

Concepts of weed management- principles and methods

For designing any weed control programme in a given area, one must know the nature & habitat of the weeds in that area, how they react to environmental changes & how they respond to herbicides. Before selecting a method of weed control one, much have information on the number of viable seeds nature of dispersal of seeds, dormancy of seeds, longevity of buried seeds & ability to survive under adverse conditions, life span of the weed, soil textures moisture and (In case of soil applied volatile herbicides the herbicide will be successful only in sandy loam soil but not in clayey soil. Flooding as a method of weed control will be successful only in heavy soil & net in sandy soil) the area to be controlled.

Principles of weed control are;

- a) Prevention
- b) Eradication
- c) Control
- d) Management

Preventive weed control

It encompasses all measures taken to prevent the introduction and/or establishment and spread of weeds. Such areas may be local, regional or national in size. No weed control programme is successful if adequate preventive measures are not taken to reduce weed infestation. It is a long term planning so that the weeds could be controlled or managed more effectively and economically than is possible where these are allowed to disperse freely. Following preventive control measures are suggested for adoption wherever possible & practicable.

1. Avoid using crop that are infested with weed seeds for sowing
2. Avoid feeding screenings and other material containing weed seeds to the farm animals.
3. Avoid adding weeds to the manure pits.
4. Clean the farm machinery thoroughly before moving it from one field to another. This is particularly important for seed drills

5. Avoid the use of gravel sand and soil from weed-infested
6. Inspect nursery stock for the presence of weed seedlings, tubers, rhizomes, etc.
7. Keep irrigation channels, fence-lines, and un-cropped areas clean
8. Use vigilance. Inspect your farm frequently for any strange looking weed seedlings. Destroy such patches of a new weed by digging deep and burning the weed along with its roots. Sterilize the spot with suitable chemical.
9. Quarantine regulations are available in almost all countries to deny the entry of weed seeds and other propagules into a country through airports and shipyards.

Weed free crop seeds

It may be produced by following the pre-cautionary measures.

- i. Separating crop seeds from admixture of crop & weed seeds using physical differences like size, shape, colour, weight / texture & electrical properties.
- ii. Using air-screen cleaners & specific gravity separators, which differentiate seeds based on seed size, shape, surface area & specific gravity.
- iii. Through means of Seed certification we can get certified seeds and can be used safely because the certified seeds contain no contaminant weed seeds
- iv. Weed laws are helpful in reducing the spread of weed species & in the use of well adapted high quality seeds. They help in protecting the farmers from using mislabeled or contaminated seed and legally prohibiting seeds of noxious weeds from entering the country.
- v. Quarantine laws enforce isolation of an area in which a severe weed has become established & prevent the movement of the weed into an uninfected area.
- vi. Use of pre-emergence herbicides also helpful in prevention because herbicides will not allow the germination of weeds.

b. Eradication: (ideal weed control rarely achieved)

It infers that a given weed species, its seed & vegetative part has been killed or completely removed from a given area & that weed will not reappear unless reintroduced to the area. Because of its difficulty & high cost, eradication is usually attempted only in smaller areas such as few hectares or few thousand m² or less. Eradication is often used in high value areas such as green houses, ornamental plant beds & containers. This may be desirable and

economical when the weed species is extremely noxious and persistent as to make cropping difficult and economical.

c. Control

It encompasses those processes where by weed infestations are reduced but not necessarily eliminated. It is a matter of degree ranging from poor to excellent. In control methods, the weeds are seldom killed but their growth is severely restricted, the crop makes a normal yield. In general, the degree of weed control obtained is dependent on the characters of weeds involved and the effectiveness of the control method used.

a. Weed management

Weed control aims at only putting down the weeds present by some kind of physical or chemical means while weed management is a system approach whereby whole land use planning is done in advance to minimize the very invasion of weeds in aggressive forms and give crop plants a strongly competitive advantage over the weeds.

Weed control methods are grouped into cultural, physical, chemical and biological. Every method of weed control has its own advantages and disadvantages. No single method is successful under all weed situations. Many a time, a combination of these methods gives effective and economic control than a single method.

MECHANICAL WEED CONTROL

Mechanical or physical methods of weed control are being employed ever since man began to grow crops. The mechanical methods include tillage, hoeing, hand weeding, digging, churning, sickling, mowing, burning, flooding, mulching etc.

1. Tillage

Tillage removes weeds from the soil resulting in their death. It may weaken plants through injury of root and stem pruning, reducing their competitiveness or regenerative capacity. Tillage also buries weeds. Tillage operation includes ploughing, discing, harrowing and leveling which is used to promote the germination of weeds through soil turnover and exposure of seeds to sunlight, which can be destroyed effectively later. In case of perennials, both top and underground growth is injured and destroyed by tillage.

2. Hoeing

Hoe has been the most appropriate and widely used weeding tool for centuries. It is however, still a very useful implement to obtain results effectively and cheaply. It supplements the cultivator in row crops. Hoeing is particularly more effective on annuals and biennials as weed growth can be completely destroyed. In case of perennials, it destroyed the top growth with little effect on underground plant parts resulting in re-growth.

3. Hand weeding

It is done by physical removal or pulling out of weeds by hand or removal by implements called khurpi, which resembles sickle. It is probably the oldest method of controlling weeds and it is still a practical and efficient method of eliminating weeds in cropped and non-cropped lands. It is very effective against annuals, biennials and controls only upper portions of perennials.

4. Digging

Digging is very useful in the case of perennial weeds to remove the underground propagating parts of weeds from the deeper layer of the soil.

5. Sickling and mowing

Sickling is also done by hand with the help of sickle to remove the top growth of weeds to prevent seed production and to starve the underground parts. It is popular in sloppy areas where only the tall weed growth is sickled leaving the root system to hold the soil in place to prevent soil erosion. Mowing is a machine-operated practice mostly done on roadsides and in lawns.

6. Burning

Burning or fire is often an economical and practical means of controlling weeds. It is used to

- (a) dispose of vegetation
- (b) destroy dry tops of weeds that have matured
- (c) kill green weed growth in situations where cultivations and other common methods are impracticable.

7. Flooding

Flooding is successful against weed species sensitive to longer periods of submergence in water. Flooding kills plants by reducing oxygen

availability for plant growth. The success of flooding depends upon complete submergence of weeds for longer periods.

Merits of Mechanical Method

- 1) Oldest, effective and economical method
- 2) Large area can be covered in shorter time
- 3) Safe method for environment
- 4) Does not involve any skill Weed
- 5) Weeding is possible in between plants
- 6) Deep rooted weeds can be controlled effectively

Demerits of Mechanical Method

- 1) Labour consuming
- 2) Possibility of damaging crop
- 3) Requires ideal and optimum specific condition

Mechanical weeders

Dry Land Weeder

It is used for weeding in row crops for removing shallow rooted weeds. It has been designed ergonomically for easy operation. Useful in dryland and gardenland crops and is ideal at a soil moisture content of 8 to 10 per cent. At the extreme end of the arm 120 mm diameter star wheel is fixed. A cutting blade is fitted to the arm 200mm to the back of the star wheel the star wheel facilitates easy movement of the tool. The operating width of the blade is 120 mm. Ideal to remove shallow rooted weeds. The workable moisture content has to be 8 to 10 %

Power rotary weeder

-For mechanical control of weeds in crops such as sugarcane, tapioca, cotton, tomato and—, pulses whose rows spacing is more than 45 cm.

- The rotary weeder consists of three rows of discs mounted with 6 numbers of curved blades in opposite directions alternatively in each disc. These blades when rotating enable

cutting and mulching the soil. The width of coverage of the rotary tiller is 500 mm and the depth of operation can be adjusted to weed and mulch the soil in the cropped field.

Tractor drawn weeding cum earthing up equipment

For weeding and intercultural operations in between row crops in a single pass

An inter cultivator cum earthing up equipment was developed and fitted to a standard tractor drawn ridger. Three number of sweep type blades are affixed to the ridger frame for accomplishing the weeding operation in between standing rows of crops. Three ridger bottom fitted behind the sweep blade, work on the loosened soil mass and aid in earthing up by forming ridges and furrows. Weeding efficiency is 61 per cent.

Tractor operated multi row rotary weeder

For weeding and intercultural operations in between row crops like sugarcane, cotton,— maize, etc. in a single pass

The multi row rotary weeder consists of a set of cutting blades, which penetrate in to the soil, removing the weeds in the crop rows. The cutting blade has also been used as an inclined plane for elevating and converging the soil. The rotating blades are used to cut the weeds and pulverizing the soil. Weeding efficiency is 71 per cent.

Cono weeder

- For weeding between rows of paddy crop
- The cono weeder has two conical rotors mounted in tandem with opposite orientation. Smooth and serrated blades mounted alternately on the rotor uproot and burry weeds because the rotors create a back and forth movement in the top 3 cm of soil, the cono weeder can satisfactorily weed in a single forward pass without a push pull movement. It is easy to operate by a single operator. The weeder does not sink in puddled soil. Field capacity 0.18 ha/day. Star, Peg type and Twin hoe wheel weeding.

CULTURAL WEED CONTROL

Several cultural practices like tillage, planting, fertiliser application, irrigation etc., are employed for creating favourable condition for the crop. These practices if used properly, help in controlling weeds. Cultural methods, alone cannot control weeds, but help in reducing weed population. They should, therefore, be used in combination with

other methods. In cultural methods, tillage, fertiliser application. and irrigation are important. In addition, aspects like selection of variety, time of sowing, cropping system, cleanliness of the farm etc., are also useful in controlling weeds.

1. Field preparation

The field has to be kept weed free. Flowering of weeds should not be allowed. This helps in prevention of build up of weed seed population.

2. Summer tillage

The practice of summer tillage or off-season tillage is one of the effective cultural methods to check the growth of perennial weed population in crop cultivation. Initial tillage before cropping should encourage clod formation. These clods, which have the weed propagules, upon drying desiccate the same. Subsequent tillage operations should break the clods into small units to further expose the shriveled weeds to the hot sun.

3. Maintenance of optimum plant population

Lack of adequate plant population is prone to heavy weed infestation, which becomes, difficult to control later. Therefore practices like selection of proper seed, right method of sowing, adequate seed rate protection of seed from soil borne pests and diseases etc. are very important to obtain proper and uniform crop stand capable of offering competition to the weeds.

4. Crop rotation

The possibility of a certain weed species or group of species occurring is greater if the same crop is grown year after year. In many instances, crop rotation can eliminate atleast reduce difficult weed problems. The obnoxious weeds like *Cyperus rotundus* can be controlled effectively by including low land rice in crop rotation.

5. Growing of intercrops

Inter cropping suppresses weeds better than sole cropping and thus provides an opportunity to utilize crops themselves as tools of weed management. Many short duration pulses viz., green gram and soybean effectively smother weeds without causing reduction in the yield of main crop.

6. Mulching

Mulch is a protective covering of material maintained on soil surface. Mulching has smothering effect on weed control by excluding light from the photosynthetic portions of a plant and thus inhibiting the top growth. It is very effective against annual weeds and some perennial weeds like *Cynodon dactylon*. Mulching is done by dry or green crop residues, plastic sheet or polythene film. To

be effective the mulch should be thick enough to prevent light transmission and eliminate photosynthesis.

7. Solarisation

This is another method of utilisation of solar energy for the desiccation of weeds. In this method, the soil temperature is further raised by 5 – 10 °C by covering a pre-soaked fallow field with thin transparent plastic sheet. The plastic sheet checks the long wave back radiation from the soil and prevents loss of energy by hindering moisture evaporation.

8. Stale seedbed

A stale seedbed is one where initial one or two flushes of weeds are destroyed before planting of a crop. This is achieved by soaking a well prepared field with either irrigation or rain and allowing the weeds to germinate. At this stage a shallow tillage or non- residual herbicide like paraquat may be used to destroy the dense flush of young weed seedlings. This may be followed immediately by sowing. This technique allows the crop to germinate in almost weedfree environment.

9. Blind tillage

The tillage of the soil after sowing a crop before the crop plants emerge is known as blind tillage. It is extensively employed to minimise weed intensity in drill sowing crops where emergence of crop seedling is hindered by soil crust formed on receipt of rain or irrigation immediately after sowing.

10. Crop management practices

Good crop management practices that play an important role in weed control are

- a. Vigorous and fast growing crop varieties are better competitors with weeds.
- b. Proper placement of fertilizers ensures greater availability of nutrients to crop plants, thus keeping the weeds at a disadvantage.
- c. Better irrigation practices to have a good head start over the weeds
- d. Proper crop rotation programme
- e. Higher plant population per unit area results in smothering effect on weed growth

Merits of Cultural Method

1. Low cost for weed control
2. Easy to adopt
3. No residual Problem
4. Technical skill is not involved

5. No damage to crops
6. Effective weed control
7. Crop-weed ecosystem is maintained

Demerits of Cultural Method

1. Immediate and quick weed control is not possible
2. Weeds are kept under suppressed condition
3. Perennial and problematic weeds cannot be controlled
4. Practical difficulty in adoption .