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ORGANICALLY WEED MANAGEMENT

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Introduction:

Throughout the world, economic crop production is impossible without a well planned weed management programme. Weed problem persists because of the inability to cope with their great reproduction capacity and massive recycling potential. As there are many kinds of weeds with varying germination periods and highly differing lifecycles, weed management requires an integrated approach based on through knowledge of biology and ecology of the species. Integrated weed management (IWM) involves the concept of multiple tactics of weed management, maintenance of weed population below economic injury level and conservation of environmental quality. A successful IWM strategy has the principle of enhancing farmers' profitability, environmental protection and responsiveness to consumer preference.

In organic farming weeds can be managed by the following methods which are practically applicable at farmer fields;

A: Preventive methods:

Preventive method of weed control include use of weed free crop seeds, weed free manure (well rotted manure and compost), clear equipments and elimination of weed infestation in and around irrigation channels and cultivated fields.

B: Cultural methods:

Following cultural methods *i.e.* sowing of cover crops/ smother crops, crop rotation, and crop diversification; inter cropping line sowing/ time, maintaining optimum plant population (seed rate), drip irrigation and well rotted compost/ manure also reduce weed problems.

Smother crops are highly competitive with the weed species infesting an area for light, nutrients and moisture. The crops such as barley, millet, sorghum, alfalfa, clover, cowpea, sesbania, sunflower etc. So, we can say healthy crop is best weed killer/ manager in organic farming.

C: Mechanical methods:

This method includes practices like hand weeding, hoeing, mowing, flooding, mulching (dead mulch: organic mulch and dead mulch is further divided in synthetic and live mulch), burning and tilling the soil for the reduction of weeds. In addition to new approach of weed management i.e. resource



conservation technologies such as bed planting, broad bed furrow planting, zero tillage, FIRBs, ridge and furrow rotary tillage, and intra crop row weeder operation are also useful to minimize weed population.

D: Soil solarization:

Soil solarization means heating of soil. It can be defined as a method of heating the surface soil by using transparent polythene films placed on moist soil to trap short waves solar radiation during hot summer months (may-June). This is an eco-friendly technology used to kill weed seeds, pests and diseases in soil which was developed by Israeli scientist Yaacov Katan. It involves mulching of soil with clear plastic polythene films so as to trap the solar heat / energy in the surface soil. As a result, earth /soil are heated up and emits long-wave terrestrial radiation, which cannot pass through transparent polythene films and results in build-up or trapping of heat. The resultant temperature increase would be lethal to soil pathogens, nematodes and weeds. A thickness of 50 to 100 micron (0.05 to 0.1 mm) of transparent polythene films was more effective in controlling weeds. Generally solarization period for 4-6 weeks or 2-6 weeks is highly effective depending the intensity of sunlight during summer months or during dry season in tropical countries. Under solarization soil temperature increases 8-10 and 6-7° C in 0-5 and 5-10 cm soil depth, respectively. This method can be use where air temperature goes up to 45 °C during summer months.

F: Allelopathy:

Inter-weed-competition determined by allelopathy can be manipulated in the natural control of weeds. Natural compounds released by some plants inhibit or prevent the growth of nearby plants. Marigold flowering plant is found to suppress the growth of parthenium. Thistle exudation inhibits the growth of oats. Wheat, oats & peas suppress the growth of *Chenopodium album*. The crop residues from alfalfa, sunflower, wheat, corn and soybean are toxic to weeds.

H. Thermal Weed Control :

Flamers : Flamers are useful for weed control. Thermal weed control involves the use of flaming equipment to create direct contact between the flame and the plant. This technique works by rupturing plant cells when the sap rapidly expands in the cells. **Propane** – fuelled models of flamers / Butane gas are the most commonly used. Flaming dose not burn weeds to

ashes; rather the flame rapidly raises the temperature of the weeds to more than 130 °F. The sudden increase in temperature causes the plants cell sap to expand, rupturing the cells walls. For greatest flaming efficiency, weeds must have fewer than two true leaves.

Infrared weeders:

Infrared weeders (infra weeder lady) are a further development of flame weeding in which the burners heat ceramic or metal surfaces to generate the infrared radiation directed at the target weeds. ex.

I. Freezing

Freezing would be advantageous only where there is an obvious fire risk from flaming. Liquid nitrogen and solid carbondioxide (dry ice) can be used for freezing weeds.

Various test systems using electrocution, microwaves and irradiation have also been evaluated for weed control purposes, but high energy inputs, slow work rates and the safety implications for operators have hampered developments. Lasers have been shown to inhibit the growth of the *Eichornia crasipes* (water hyacinth) but did not kill the weed completely. Weed control using ultraviolet light has been patented but remains at an experimental stage.

G. IWM strategies:

Weeds vary so much in their growth habit and life cycle under different ecosystems and growing seasons that no single method of weed management can provide effective weed control. Continuous use of one method of weed control creates problems of buildup of weeds that are tolerant to that particular method of weed control. Similarly, shift in weed flora from annual grasses to sedges and appearance of resistant biotypes due to continuous use of some herbicides has been reported. Long term strategy to minimize weed problem is through IWM than with weed control. Major components of IWM include:

- Monitoring weeds, shifts in weed flora, appearance of resistant weeds and introduction of new weeds,
- Emphasis on ecological, biological and biotechnological methods of environmental safety, and

Low cost agronomic strategy for weed management in IWM systems.

- Stale seedbed is very effective in rabi season with two irrigation
- Balanced fertilizer use,
- Higher plant population,
- Intercropping / relay cropping, and
- Use of competitive cultivars,
- Supplement herbicide use at minimum possible rate.
- Slash weeding
- Brown manuring in standing rice crop

Biological management:

Biological weed control using insects, pathogens, fish and snails (bio agents) appears to be ideal for reducing the inputs of herbicides. Some promising examples include:

S.N.	Weed species	Bio-agent	Remarks
1.	Prickly pear Cactus	<i>Cactoblastis cactorum</i>	By leaf feeding beetle
2.	Water hyacinth	<i>Neochetina bruchi</i> <i>Alternaria eichhornia</i>	By leaf eating weevil & fungus
3.	Parasitic weed <i>Orobanche</i> sp.	<i>Fusarium oxysporum</i> and fly (<i>Sipha maidis</i>)	Fungus & Insects both are used
4.	<i>Cyperus</i> <i>Rotundus</i>	<i>Bactra minima</i> and <i>Athespacuta cyperi</i>	By leaf eating insect
5.	<i>Parthenium</i> <i>hysterophorus</i>	<i>Zygogramma bicolorata</i> and <i>Smicronyx</i> <i>lutulentus</i>	By leaf eating insect
6.	<i>Alternanthera</i> <i>philozerooid</i>	<i>Cassida</i> sp.	By leaf eating insect
7.	<i>Salvania molesta</i>	<i>Paulinia acuiminata</i> (insect) and <i>Myrothecium rovidium</i> (fungus)	Fungus & Insects both are used



Bioherbicides:

Although herbicides are effective for weed control, there has been increasing concern about their safety for food products, their adverse effect on environment and widespread weed resistance to herbicides. These factors along with rising prohibitive costs have provided the impetus to develop alternative weed management strategies. In this contest, biological control has an alternative or supplement weed management appears to play a major role in crop production. Biological approach includes bio control agents such as insects, nematodes, fungi and bacteria as well as plant based chemicals that exhibit herbicidal properties. A bio-herbicide is a plant pathogen use for weed control through application of its inoculums. A list of bio-pesticides is given in Table below.

Bioherbicide	Bioagent	Target weed	Crop
DeVine	<i>Phytophthora palmovora</i>	<i>Morrenia odorata</i>	Citrus groves
Collego	<i>Colletotrichum gloeosporioides</i>	<i>Aschyynomene virginica</i>	Rice
Biomal	<i>Colletitrichum gloeosporioides</i>	<i>Malva pusilla</i>	Row crops
Biopolaris	<i>Bipolaris sorghicola</i>	<i>Sorghum halepense</i>	Rice and wheat
BioChon	<i>Chondrostereum purpureum</i>	<i>Prunus serotina</i>	Forests
Emmalocera sp	Stem boring moth	<i>Echinochloa</i> sp	Rice and wheat
Tripose	Shrimp	<i>Echinochloa</i> sp	Rice and wheat
Uromyces rumicis	Plant pathogen	<i>Rumex</i> sp	Rice and wheat
Gastrophysa	Beetle	<i>Rumex</i> sp	Rice and wheat
Bactra verutana	Shoot boring moth	<i>Cyperus rotundus</i>	Rice and wheat

Stale seed bed:

It involves the removal of successive flushes of weeds before sowing a crop. Weeds that germinate after land preparation are destroyed mechanically, manually or chemically. In mechanical or manual method, soil disturbance should be as shallow as possible.

Crop stand:

Closure the spacing or higher the seed rate, better the crop can compete with weeds due to its smothering effect on weeds.

Nutrient management:

Nutrient application should be timed (Nutrient source, quantity, method and application time) to prevent weed proliferation and yet to obtain maximum benefit from the applied nutrient.

Intercropping and Relay cropping:

Intercropping upland rice with groundnut, soybean, or green gram minimizes weed density leading to yield advantage. A pulse crop is usually broadcast as relay crop into

standing rice crop 10-15 days before harvest. As soon as rice crop is harvested the pulse crop cover the field in dry season and suppress the weed growth.

Cultivars:

High yielding cultivars are less competitive against weeds than traditional cultivars. For rainfed areas, heavy tillering varieties of medium stature may be better suited than semi-dwarf varieties.

Herbicides:

Non chemical methods of weed control when integrated with one manual weeding (mechanical or mechanizing weeding + one hand pulling/weeding) are as effective as standard rice herbicides at different ecosystems throughout the country.

Slash weeding: Slash weeding is to be done between the plants. Weeds under the base of the plants shall be cleaned and put as mulch around the plant base.
