PREVENTIVE METHODS OF WEED CONTROL

SS Rana
Sr Scientist
Email: ranass_dee@yahoo.com
Pre-requisite of a Successful Weed Management Programme

- Knowledge of the biology of weeds
- Nature of weed problem
- Must be planned for the whole farm
- Must follow up programme of weed prevention measures
**Steps Taken Prior to Choosing WC Strategy**

- Identify the weed problem
- Know what control methods are available
- Evaluate the benefit/risk of each method/combination of methods
- Choose the methods: most effective with least harm to himself and environment
- Know the correct use of weed control method
WEED MANAGEMENT STRATEGIES

- Preventive Measures
- Eradication Methods
- Management/Control Methods
CONTROL V/S ERADICATION

- Weed eradication is the **complete removal** of all live plant parts and seeds from an area.
- It is an **expansive adventure** since it costs more than that of the land.
- Besides complete **elimination of all vegetation is not warranted** as many of them are useful.
- Eradication of some noxious weeds such as **Cuscuta and Lantana** needed.
- Eradication should start when the weeds are small and limited in growth and spread.
**Weed Control v/s Weed Management**

- Concept of weed management instead of control is important (Threshold and Critical period of crop-weed competition)
- 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
- The systems approach is called integrated weed management (IWM)
PREVENTIVE METHODS

Measures those prevent or arrest the introduction, establishment and spread of weeds.
In practice, it also include farm hygiene that prevent the every year production of seeds, tubers and rhizomes of the weed species already present on the farm.
All practices that help discourage the weeds from becoming a problem over time, form the subject of weed prevention
No weed management programme can be successful if adequate and timely preventive measures are not taken
ONE YEAR OF SEEDING IS SEVEN YEARS OF WEEDING

- Nature has provided weeds with a number of devices that help them to be disseminated widely.
- The troubles that weeds create in crops, soil and water bodies are therefore, summed in the adage ‘one year of seeding is seven year of weeding’.
PREVENTION IS BETTER THAN CURE

- To avoid a situation of one year of seeding is seven years of weeding, a wise step is to follow the principle of ‘Prevention is better than cure’.
- Keeping in view the economic and practical feasibility, the preventive weed management measures should be followed to check their menace.
Use Weed Free Crop Seeds

- Avena fatua and Brassica in small grains
- Cuscuta in lucerne
- Chichory in berseem
- Other weed seeds in grasses
## Weed species designated as objectionable according to Seed Act 1966

<table>
<thead>
<tr>
<th>Crop</th>
<th>Weed</th>
<th>Permissible seed admixture limits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Objectionable</td>
</tr>
<tr>
<td>Paddy</td>
<td>Wild rice or red rice</td>
<td>0.01%</td>
</tr>
<tr>
<td>Wheat</td>
<td>Bindweed (Convolvulus)</td>
<td>0.01%</td>
</tr>
<tr>
<td>Rape and Mustard</td>
<td>Mexican poppy (Argimone)</td>
<td>0.1%</td>
</tr>
<tr>
<td>Egyptian clover</td>
<td>Chicory</td>
<td>0.05%</td>
</tr>
<tr>
<td>Lucerne</td>
<td>Dodder</td>
<td>0.5%</td>
</tr>
<tr>
<td>Methi</td>
<td>Senji (Melilotus)</td>
<td>0.1%</td>
</tr>
<tr>
<td>Lettuce</td>
<td>Wild lettuce</td>
<td>0.1%</td>
</tr>
<tr>
<td>Cucurbit</td>
<td>Wild Cucurbit</td>
<td>0.0</td>
</tr>
<tr>
<td>Okra</td>
<td>Wild Okra</td>
<td>0.0</td>
</tr>
</tbody>
</table>
RICE AND WILD RICE
WHEAT AND CONVOLVULUS ARVENSIS
BRASSICA AND ARGIMONE MAXICANA
Berseem and Cichorium intybus
LUCERNE AND DODDER
WEED FREE CROP SEEDS CAN BE ACHIEVED BY

- Production of weed free crop seeds at Government farms or at farmers field itself with frequent inspection
- Cleaning the crop seeds before storage as well as at sowing time, using seed cleaning devices
- Use farm machinery free from weed seeds
**Mimicry**

- The *resemblance of one organism to another* or to an object in its surroundings for concealment or protection from predators.
- Crop mimicry is defined as the phenomenon whereby weeds develop morphological and or biochemical close resemblance to the life history of crop as to be mistaken for the crop and thus evade eradication.
TYPES OF CROP MIMICRY

Vegetative: a situation where close similarity in appearance occurs between weeds and crops at seedling and vegetative stages e.g.

1. wild rice (*Oryza longistaminata*) in cultivated rice;
2. wild sorghum (*Sorghum halepense*) in cultivated sorghum;
3. wild sugarcane (*Saccharum spontaneous*) in sugarcane
Sorghum halepense

- Growth trial of *Sorghum* species at seedling stage. Note the broader leaf (far left) of the *Eu-sorghum, S. propinquum* compared with the *Para-Sorghum, Stiposorghum* and *Heterosorghum* species.
Saccharum spontaneum
Types of Mimicry (contd.)

Seed mimicry is a situation whereby the similarities between weeds and crops is observed in seed weight, size and appearance e.g. similarity in seeds of upland rice and those of itch grass (*Rottboellia cochinchinensis*)
Rottboellia cochinchinensis
Biochemical mimicry: this is a situation in which a weed develops resistance to a herbicide that has been used
CONTAMINATION OF MANURE PITS

- FYM serves as notorious source
- Composting temperature of 65-95°C maintained for 4-5 months to devitalize weed seeds
- Vermicompost may also be a potential source/medium of weed seed dispersal
Weeds infesting FYM
Vermiweeds
**Movement of Weeds with Other Farm Resources**

- Livestock
- Farm machinery
- Nursery stock (*Echinochloa* Spp. & *Oryza sativa* var. *fatua*)
- Gravel, sand, Soil

![Image of livestock and weeds]
XANTHIUM SP
Bidens pilosa

Spiny pigweed
Achyranthes aspera L
KEEP NON CROP AREAS CLEAN

- Irrigation & drainage ditches
- Fence lines
- Farm boundaries
- Terrace risers and Bunds
- Non-cropped area
- Paths, roads and railway lines
KEEP VIGILANCE

Parthenium hysterophorus - Non crop areas
Phalaris minor, Poa annua, Polygonum sp. - Wheat
Water hyacinth - Aquatic weed
ALLIGATOR WEED (ALTERNANTHERA PHILOXEROIDES)
Infestation of *Bracharia*, a new weed
Other new weeds

*Syndrilla*

*Polygonum*
LEGAL MEASURES

- Check inter-state and inter-country movement of noxious weeds
- Very recently the Indian Plant Quarantine Authorities made it compulsory to declare plants before entry
FIRE weed (WIND DISSEMINATION)
SCHEDULE-VIII
[See Clause 3 (12) and 8 (1)]
LIST OF QUARANTINE WEED SPECIES

1. Abutilon theophrasti
2. Agrostemma githago
3. Alectra sp.
4. Allium vineale
5. Ambrosia artemisiifolia
6. Ambrosia maritima
7. Ambrosia psilostachya
8. Ambrosia trifida
9. Ammi visnaga
10. Apera-spica-venti
11. Arceuthobium oxycedri
12. Avena sterilis
13. Baccharis halimifolia
14. Bromus diandrus
15. Bromus rigidus
16. Bromus secalinus
17. Cardus pycnocephalus
Quarantine Weed Species (Contd.)

18. Cenchrus tribuloides
19. Centaurea diffusa
20. C. maculosa
21. C. melitensis
22. C. solstitialis
23. Chondrilla juncea
24. Cichorium endivia
25. C. pumilum
26. C. spinosum
27. Cordia curassavica
28. Cuscuta australis
29. Cynoglossum officinale
30. Desmodium tortuosum
31. Echinochloa crus-pavonis
32. Echium plantagineum
33. Emex australis
34. Emex spinosa
35. Froelichia floridana
36. Helianthus californicus
37. H. ciliaris
38. H. petiolaris
Quarantine Weed Species (Contd.)

39. *H. scaberrimus*
40. *Heliotropium amplexicaule*
41. *Ipomoea coccinea*
42. *Leersia japonica*
43. *Lolium rigidum*
44. *Matricaria perforatum*
45. *Mimosa pigra*
46. *Orobanche cumana*
47. *Phalaris paradoxa*
48. *Polygonum cuspidatum*
49. *P. perfoliatum*
50. *Proboscidea lovisianica*
51. *Raphanus raphanistrum*
52. *Rumex crispus*
53. *Salsola vermiculata*
54. *Senecio jacobaea*
55. *Solanum carolinense*
56. *Striga hermonthica*
57. *Thesium australe*
58. *T. humiale*
59. *Vicia villosa*
60. *Viola arvensis*
61. *Xanthium spinosum*
3. Permits for Import of plants, plant products etc.

(12) No consignment of seed or grain shall be permitted to be imported with contamination of quarantine weeds, which are listed in Schedule-VIII unless the said consignment has been devitalized by the exporting country and a certificate to that effect has been endorsed in the phytosanitary certificate issued by the exporting country. Every application for quarantine inspection and clearance shall be made in Form PQ 15.

8. Permit required for import of plants and plant products –
(1) No consignment of plants and plant products, if found infested or infected with a quarantine pest or contaminated with noxious weed species shall be permitted to be imported.
CULTURAL AND GOOD CROP HUSBANDRY METHODS

Added tools
GOOD CROP HUSBANDRY METHODS

PROPER CROP STAND

* Selection of most adapted crops & varieties
* Use of high viability seeds
* Preplant seed and soil treatment
* Adequate seed rates
* Proper planting time and method
* Timely gap filling
SELECTIVE CROP STIMULATION

* Application of soil amendments like gypsum or lime
* Addition of farm-yard manure
* Application of suitable fertilizers and manures as side / band dressed
* Foliar application of fertilizers to wide row crops
* Inoculation of crop seeds
**Proper Planting Method**

* Seedbed preparation and planting of crops with a minimum time lapse during kharif
* Plough planting
* Furrow planting during summer
* Transplanting
**Proper Planting Time**

- Early planting during kharif by presowing irrigation
- Late planting of wheat during winters
# Crop Rotation

<table>
<thead>
<tr>
<th>Weed</th>
<th>Crop</th>
<th>Substitute crop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avena fatua</td>
<td>Wheat</td>
<td>Pea, Gram Mustard</td>
</tr>
<tr>
<td>Phalaris minor</td>
<td>Lucerne</td>
<td>Wheat Mustard</td>
</tr>
<tr>
<td>Cuscuta (Dodder)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
STALE SEEDBED

A stale, seedbed is one where 1 to 2 flushes of weeds are destroyed before planting of any crop

Advantage: Crop germinate in weed free environment
Smother Cropping
Summer Fallowing
Minimum Tillage
Lowering Area Under Bunds
Flooding and Drainage
PHYSICAL (HAND WEEDING)
Physical (Mechanical Weeding)
MECHANICAL WEEDING DEVICE - THE DIAGONAL WEEDER
THERMAL
WEED
CONTROL

Pesticide-free thermic weed control with a weed burner on a potato field in Dithmarschen

IWM: Vegetables and field crops
HAND WEEDING TOOLS
LONG HANDLED WEEDEARS

- Long handle weeders allow weeding operations without bending of the operator thus reducing drudgery to the operator and increase the capacity. These are Circular blade weeder (1), Garden rake (2), V blade multipurpose weeder (3), Grass slasher (4) and Long handle hand fork (5) costing Rs70/-, Rs 100/-, Rs 70/-, Rs 70/- and Rs. 70/- respectively. With these implements, labour saving to the extent of 60-65% can be achieved over traditional methods.
WHEEL HOE

IWM: Vegetables and field crops
Twin Wheel Hoes

IWM: Vegetables and field crops
CONO WEEDERS
ASPEE POWER WEEDER

ASPEE POWER WEEDER is being preferred by the farmers as the most durable, efficient, & labour saving weeding equipment, which can be used for agriculture purpose. Aspee Power Weeder is equipped with two stroke 49.8 cc petrol engine with recoil starter. Small straight shaft is provided for power transmission from engine to the gear box. Sturdy carbon steel blades are provided for weeding purpose.
PROBLEMS OF PHYSICAL METHOD

- Labour, time consuming, back breaking methods
- Leading to mechanical injury
- Performed only under ideal conditions

IWM: Vegetables and field crops
**Stale Seed Bed Technique**

- First irrigation is applied to the field.
- The field is then ploughed thoroughly at optimum moisture status and levelled.
- The field is left as such for about a fortnight or so to allow germination of weeds. Sufficient soil moisture particularly at the upper 3-5 cm layer/stratum will result in weed seed germination.
- Control the emerged weeds by a non-residual herbicide, e.g. paraquat, glyphosate, glufosinate-ammonium, or by shallow cultivation with spike–tooth harrow, spring–tooth harrow etc. Thus the germination of initial 2 or more flushes of weeds are facilitated/pampered/induced and later destroyed.
- Thereafter plant the crop with minimum soil disturbance to avoid exposing new weed seed to favourable germination conditions.
SOIL SOLARIZATION

It is an effective method for the control of weeds, soil-borne diseases and insect-pests.

Basic principle
The light received from the sun is in the form of electromagnetic short waves, which easily pass through the transparent polyethylene films and reach the soil. As a result soil is heated up and emits long wave radiation which cannot pass through transparent polythene films and result in trapping of heat.
USE OF MULCHES

IWM: Vegetables and field crops
Weed management in Organic Potato
**BIOLOGICAL MANAGEMENT**: BIOLOGICAL WEED CONTROLLING USING INSECTS, PATHOGENS, FISH AND SNAILS (BIO AGENTS) APPEARS TO BE IDEAL FOR REDUCING THE INPUTS OF HERBICIDES. SOME PROMISING EXAMPLES INCLUDE:

<table>
<thead>
<tr>
<th>Weed</th>
<th>Bio control agent</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Alternanthera philozeroid</em></td>
<td><em>Cassida</em> sp.</td>
</tr>
<tr>
<td><em>Salvania molesta</em></td>
<td><em>Paulinia acuiminata</em> (insect) and <em>Myrothecium rovidium</em> (fungus)</td>
</tr>
<tr>
<td><em>Eichhornia crossipes</em></td>
<td><em>Alternaria eichhornia</em> (pathogen) and <em>Neochetina bruchi</em> (insect)</td>
</tr>
<tr>
<td><em>Cyperus rotundus</em></td>
<td><em>Bactra minima</em> (insect) and <em>Athespacula cyperi</em> (weevil)</td>
</tr>
<tr>
<td><em>Parthenium histerophrous</em></td>
<td><em>Zygograma bicolorata</em> and <em>Smicronyx lutulentus</em></td>
</tr>
</tbody>
</table>

IWM: Vegetables and field crops
Biological weed control is not established in vegetables as well as field crops other than rice and wheat.
# Bio Herbicides:

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

IWM: Vegetables and field crops
BIO-TECHNOLOGY IN WEED CONTROL

- The microbial toxins and allelochemicals could be manipulated to produce commercial herbicides. Bioherbicides Collego and Biopolaris are used for controlling grass and broad-leaved weeds in rice.

- In India, bioherbicides for weed control have not yet developed to the extent of practical application.
PRE-SOWING AND POST-HARVEST STRATEGY

- Clean cultivation- free of weeds
- Go with stale seed bed or Summer ploughing or one or two sprays of paraquat/glyphosate to avoid seed setting
- It is advisable not to cultivate below the top 1-2 cm soil, otherwise a further flush of weed may emerge
- After crop harvest, the appropriate timing of cultural operations to clear the land can aid future weed management by reducing the persistence of freshly shed seeds left on the soil surface (paraquat).
Condition after harvest

Glyphosate/paraquat spray