

# BIOLOGICAL METHODS OF WEED MANAGEMENT

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**Weed management:** Biological methods of weed management with their advantages & disadvantages.

## Concept of Biological Control

Biological weed control is the use of natural enemies (Animal, insect, mite, pathogen etc.) to reduce weed population to an economically acceptable limit.

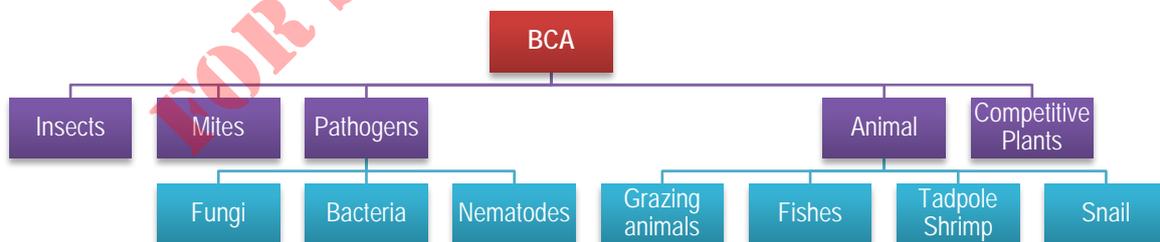
Biological control attempts primarily to reduce weed population to a density that will not cause economic damage.

By nature biological control organisms are selective in their food preferences and cannot provide broad-spectrum control that is achievable with other methods. Where a single weed species is a major problem and a biological agent is available for its control, however, the method provides an economical and relatively permanent solution. The basic concept of biological weed control is based on the prey-predator relationship.

## Biological Control Agent (BCA) or Bio agent

The organisms which are used as natural enemies to control the weeds are called Bio agent.

The important bio agents which are engaged in controlling weeds are as follows –



## Insects BCA:

Insects have been the major BCA for terrestrial weeds. There are large number of plant feeding insects, they frequently have a higher degree of host specificity, and they have the capacity to destroy both vegetative and reproductive parts of host plants. Insects that were found effective belong to Lepodeptera, Hemiptera, Coleoptera, Diptera etc.

### Some examples of insect BCA:

| Name of Insect BCA                                   | Target Weed                                    |
|--|--|
| Larvae of <i>Crocidosema lantana</i>                 | Lantana ( <i>Lantana camera</i> )              |
| <i>Dactylopius indicus</i> , <i>D. opuntiae</i> etc. | Prickly pear ( <i>Opuntia</i> spp.)            |
| <i>Bactra vermosana</i>                              | Cogon grass ( <i>Imperata cylindrica</i> )     |
| <i>Sameodes albigullatis</i>                         | Water hyacinth ( <i>Eichhornia crassipes</i> ) |
| <i>Bactra vercuntona</i>                             | Yellow Nutsedge ( <i>Cyperus rotundus</i> )    |

### Mites BCA

Mites were first found useful in controlling prickly pear (*Opuntia* spp.) in Australia in 1920-22. But later discovery of more efficient insect enemies reduced its importance as a weed bio agent. (Dodd, 1940). Of late gall mite has shown promising against the weed *Chondrilla juncea* in Australia.

### Pathogen BCA

In the recent years plant pathogens have become a good biological agent in controlling problem weeds. However, a few have been proved highly successful. Weeds are indeed susceptible to pathogenic organisms, but in many cases the organisms causes localized damage rather than destroying the whole plant. Common examples are: Fungi, bacteria, nematode etc. Two types of pathogens are available:

1. Host specific – generalized attack
2. Tissue specific – particular tissue or plant part

### Some examples of pathogenic BCA:

| Name of Pathogen             | Target Weed                                  |
|------------------------------|--|
| <i>Alternaria macrospora</i> | Malvacious plants                            |
| <i>Cercospora rodmanii</i>   | <i>Eichhornia crassipes</i> (Water hyacinth) |
| <i>Fusarium roseum</i>       | <i>Hydrilla verticillata</i> (Hydrilla)      |
| <i>Puccinia chondrillina</i> | <i>Chondrilla juncea</i> (Skeleton weed)     |
| <i>Rhizoctonia solani</i>    | <i>Eichhornia crassipes</i> (Water hyacinth) |
| <i>Aeremoneum zanatum</i>    | <i>Eichhornia crassipes</i> (Water hyacinth) |

### Animal BCA

Higher animals can also be used for controlling weeds in different situations.

#### a. Grazing animals: Cow, goat, geese etc.

i. **White Chinese Geese:** Used for grassy weed control in orchards, vineyards, nursery areas and row crops like beans, potatoes, onions etc. They will consume almost all immature grasses and nutsedges and reportedly prefer Bermuda grass and Johnson grass. They also nibble emerging perennial grass shoots until the plants starve and

eventually die. Three to five geese per acre are adequate for severely infested fields. However, access to water bodies and supplemental feeding is essential.

**Limitations:**

- Not suitable for grass crops
- Do not eat broadleaf weeds

**ii. Goats and cows:** Goats and cows can selectively be grazed in orchards and plantation crops like tea, coffee and in some row crops which they do not prefer.

**b. Fishes:**

Certain fresh water carp fish consume large quantities of aquatic weeds and they are very suitable to relieve water bodies of their massive growth of noxious aquatic weeds. Common carp *Cyprinus carpio* and the white amur (Chinese grass carp) are promising species for aquatic weed control. White amur eats more than its own body weight in weeds daily and it grows at a rate of 5 kg/year attaining 50 kg or more body weight at its full size (Gupta, 1973). Unlike bio agent insects, herbivorous fishes are not much food specific. They feed upon a wide range of plants and therefore, they control a variety of aquatic weed.

However, grass carp should be kept confined, because of possible injury to rice and other grass crops. Irrigation channels should be closed at both ends when these fishes are released.

- Limitations:**
- Not suitable for rice and other grass crops.
  - Highly dangerous for irrigated rice fields.

**c. Tadpole shrimp:**

Used for controlling weeds in transplant rice field in Japan. It does not feed on rice; 20-30 population per sq. meter may provide good control; feeding preference is on newly emerged weeds.

**Limitation:**

- Not suitable for direct seeded rice.

**d. Snail**

*Marisa cornuarietis* and certain other water snails have been found to voraciously feed upon several submerged aquatic weed species and algae. *Marisa* also feeds upon the roots of *Eichhornia crassipes* (Water hyacinth) and *Pistia stratiolis* and leaves of *Salvinia*.

**Competitive plants**

Certain wild plants may be highly competitive and at the same time less harmful than some of our problem weeds. Yeo (1971) found that *Eleocharis acicularis*, slender spike rush possessed these two characters. It is a short, very fast growing aquatic plant that could cover the canal bottom rather rapidly disallowing the obstructing tall weeds from establishing there.

## Criteria of a successful bio agent

A successful bio agent is-

- i. host specific
- ii. adjustable to new environment
- iii. rapid feeder of the target weed
- iv. easy to multiply and
- v. effective on several of the weeds

## Steps in a weed biological control program

The following outlines the steps involved in a typical biological control program:

1. choosing the target weed
2. native-range surveying
3. choosing the best potential agent
4. host-specificity testing
5. release approval
6. mass rearing, release and evaluation
7. non-target impacts.

## Advantages of Biological Weed Control

- Non toxic
- Non laborious
- Does not hamper the soil properties, environment and soil micro-organism
- No mechanical injury to plant
- Economic
- No pollution or degradation to the environment

## Disadvantages of Biological Weed Control:

- Weed shift
- Slow process
- Shift in host specificity
- BCA is sensitive to environment and weather conditions
- Not suitable for diverse and complex weed problem
- Total control is not possible.