LECTURE-18

AQUATIC AND PROBLAMATIC WEEDS AND THEIR MANAGEMENT

Almost all the water bodies have plants growing in them. Presence of plants in water bodies is essential for the conversion of solar energy into chemical energy for the development of aquatic fauna like fish, prawns etc. and for the continuous addition of oxygen to water during photosynthesis. If the water plants due to overgrowth make such water bodies unfit and take the shape of noxious aquatic vegetation, these may be referred as aquatic weeds. Aquatic weeds are the greatest problem in fishing, irrigation and efficient water supply. Because of scarce water supply and high population it has almost become imperative in every country to save water from the ravages of aquatic weeds. Some major aquatic weeds are;

WATER HYACINTH

Origin and Distribution Water Hyacinth (*Eichhornia crassipes)* which is native to the Amazon basin, Brazil, became widespread throughout the world, also due to its attractive appearance. It is commercially available as an ornamental for ponds. At present it occurs as a weed throughout tropical and subtropical regions of the world, including North and South America, Africa, Asia, Australia and New Zealand. It is considered the worst aquatic weed in the world.

Morphology and Biology

This perennial herbaceous plant is a floating freshwater hydrophyte. It belongs to the Family *Pontederiaceae.* The flowers are bluish purple, large and self-fertile. The seeds are produced in large numbers and are contained in capsules, each capsule containing up to 300 seeds. The seeds can remain viable for 5-20 years. The plant can also

WATER LETTUCE

Origin and Distribution

The area of origin of Water Lettuce (*Pistia stratiotes* L.), is most probably South America. The plant spread widely and at present occurs in all continents, except Europe and Antarctica. Probably the initial spread took place through ballast water in ships from South America.

Morphology and Biology

This perennial freshwater hydrophyte is a herbaceous floating plant belonging to the Family *Araceae*. It consists of a rosette of pale green leaves, prominently veined and it resembles a small lettuce plant. Water Lettuce has velvety-hairy, erect leaf blades, a very short stem and long feathery roots suspended in water. The flowers are bisexual. The plant reproduces and spreads rapidly by means of stolons and seeds. The seeds are easily carried by water for long distances, since they float during the first two days after they reach maturity. Both Water Lettuce and Water Hyacinth can bioaccumulate heavy metals.

WATER FERN

Origin and Distribution

Water Fern (*Salvinia molesta*) is native of South America. The plant was introduced to Sri Lanka in the 1930s and has rapidly spread since then, now occurring in tropical and subtropical regions worldwide. The species is commercially available for aquariums and ponds and thus it was initially introduced and may still contribute to its spread.

Morphology and Biology

Water Fern is a free-floating fern belonging to the Family *Salviniaceae* that lives in freshwater systems. Stagnant or slowly moving waters are the habitats most favourable to its growth. It consists of a horizontal rhizome that floats just below the water surface and produces at each node three leaves. The plant does not have roots. The submerged leaf serves as roots by absorbing water and nutrients. Hairs on the aerial leaves allow the plant to float. Individual plants are up to 30 cm long. Their growth is extremely fast, allowing the population to double within about one week. Water Fern readily reproduces vegetatively, by fragmentation of the rhizome, small fragments allowing the development of new infestations.

Problems

All these weeds develop dense mats on the surface of the water and becoming a major weed problem. The main problems arising from the growth of these weeds are

- an enormous water loss through evapotranspiration, that alters the water balance of entire regions
- clogging rivers and canals and related problems
- the impediment to water flow, that increases sedimentation, causing flooding and soil erosion
- hampering fishing and dramatically reducing the catch and the source of food and income for local populations
- a drastic change in the physical and chemical properties of water and in the environment in the water bodies invaded, with detrimental effects on plants and animals;
- interfering with the activity of hydroelectric power stations

- a serious threaten to agricultural production, following the blockage of irrigation canals and drainage systems.
- hampering fishing
- hampering navigation
- indirectly affects human health, since it provides a suitable breeding habitat for pests and vectors of diseases.

Management

An integrated and to the extent possible an environment-friendly approach is to be employed for management of aquatic weeds. Aquatic weed-control measures can broadly be grouped into the following categories.

Preventive

The success of preventive weed-management programmes varies with the weed species, its means of dissemination and the amount of efforts applied. Preventive weed-management programmes usually require community action through the enactment and enforcement of appropriate laws and regulations.

Mechanical

This has both, advantages and limitations. Advantages include utilization of available man-power; is environment friendly, yields immediate results, is non-selective with fewer chances of permitting ecological shifts in aquatic flora; lessens mass nutrient load of eutrophic water bodies, helping indirectly in diminishing the future weed populations; reduces dependence on import of herbicides; harvested weeds may have various utilities as feed, manure, energy source etc; and most importantly can be exercised in any localized areas of water bodies. The limitations include limited effectiveness as in some cases the weeds re-grow from their rootstocks, rhizomes and the like spreading weeds new areas; labour-intensive and expensive and sometime removal of weeds may deplete water bodies of their nutrients limiting growth of planktons. The methods include, netting, erecting barriers, chaining, dredging, draining, use of water-weed cutters, submergence, shading, cleaning of irrigation waters etc.

Biological

Biological methods of management require the use of organisms that have been used for biological control, are diverse and include various types of animals and plants like insects, fishes, pathogens, nematodes etc. Biological management is more complex than chemical weed control because it requires (a) long-term planning, (b) multiple tactics, and (c) manipulation of cropping system and direct interaction with the environment.

Use of several species of herbivorous fishes which feed on submerged aquatic weeds include *Tilapa sp*., *Ctenopharyngodon idella*, and other species. Observations are also available for rodents, snails etc. The use of insects like *Neochetina bruchi* and *N. eichhorniae* for control of water-hyacinth, and *Cyrtobagous salviniae* for control of *Salvinia molesta* has been found effective in India.

Problamatic weeds

Weed control practices often have an effect on the weeds, on a year by year basis. Before the development of herbicides, growers relied heavily on tillage as a tool for controlling and suppressing weeds. Once herbicides became a valuable tool, some of the problem weeds found in predominantly tillage based management practices began to fade and new problematic weeds began to fill the gap. As our habits change, specific weeds will exploit the new niches we create and become the more dominant species.

Some of the weeds like *Cyperus rotundus*, *Cynodon dactylon*, *Eleusine indica* etc., are listed as world's worst weeds. *Cyperus rotundus* is the most problamatic weed present in 92 countries, followed by *Cynodon dactylon* in 80 countries. Both weeds are perennial, mainly propagated by vegetative means and also by seeds. *Cyperus rotundus* is a problem weed in 52 crops while *Eleusine indica* in 46 crops. Some of the world's worst weeds are listed below,

Weed Ranking	Common Name	Botanical Name	Occurrence in no. of	
			Crops	Countries
1	Nut grass	*Cyperus rotundus*	52	92
2	Bermuda grass	*Cynodon dactylon*	40	80
3	Banyard grass	*Echinochloa colonum*	36	61
4	Jungle grass	*Echinochloa crusgalli*	35	60
5	Goose grass	*Eleusine indica*	46	60
6	Jhonson grass	*Sorghum halapense*	30	53
7	-	*Imperata cylindica*	35	73
8	Water hyacyinth	*Eichornia crassipes*	-	-
9	-	*Portulaca oleracea*	45	81
10	Fat hen	*Chenopodium album*	40	47
11	Large crab grass	*Digitaria saugunialis*	33	56
12	Field bund weed	*Convolvulus arvensis*	32	44

Pictures

Cyperus rotundus 	*Cynodon dactylon* 	*Echinochloa colonum* 
Echinochloa crusgalli 	*Eleusine indica* 	*Sorghum halapense* 
Imperata cylindica 	*Eichornia crassipes* 	*Portulaca oleracea* 

Chenopodium album	*Digitaria sauguinalis*	*Convolvulus arvensis*
		

PERENNIAL WEED MANAGEMENT

Prevention

The most basic and effective of all methods to control perennial weeds is prevention. As discussed earlier, there are several means of weed seed dispersal, most of which can be prevented. Ensuring clean crop seed, animal feed, and hay is the most important measure in preventing seed dispersal. Other methods of prevention include cleaning field machinery and harvest equipment when moving between fields, proper long-term manure storage to reduce seed viability after passing through animals' digestive tracts, and maintenance of weed-free irrigation water.

Crop rotation can be another effective method to prevent the establishment of perennial weeds. The most effective crop rotations for this purpose include not only crops that compete well with perennial weeds, but also those that allow the use of herbicides to control perennial seedlings.

MECHANICAL WEED CONTROL

Cultivation, when combined with other management tactics, can be used to control seedlings before energy-storing vegetative tissue has accumulated. Mechanical control no longer is effective after energy has been stored in underground vegetative tissue. In fact, cultivation of established perennials can spread weeds by cutting roots and moving them to new areas.

Perennial weeds are more common in reduced-tillage fields, where there is little soil disturbance to disrupt the development of below-ground storage organs. Once perennial weeds are established in reduced-tillage fields, cultivation is ineffective and might increase the spread of vegetative roots.

In pasture and forage crops, frequent mowing or cutting can prevent weed seed production and reduce the amount of energy stored in below-ground structures. Most important, maintenance of a vigorous crop stand through proper fertility and water management, seeding density, and variety selection will allow the competitive ability of the crop to suppress perennial weed growth. This simple "hands-off" approach requires little additional input or management, but can greatly reduce weed seed production and root growth.

CHEMICAL WEED CONTROL

Perennial weed control with herbicides must be repeated for 2 to 3 years and combined with other management tactics such as mowing. The key is to get the herbicide into the roots. Herbicide activity relies on foliar absorption and transport from the leaves to the root system. Young leaves move nutrients from the root in an upward, above-ground direction, while more mature leaves transport photosynthetic products to the root system for storage. Thus, the most effective herbicide activity occurs as the product is transported to the roots with the products of photosynthesis.

Herbicides are most effective on perennial weeds in the early fall, when weeds are transporting energy to the roots before winter dormancy. Treatment just before and during flower bud initiation also is effective, as the herbicide will be carried with photosynthetic products to the roots. To ensure the presence of sufficient mature foliage, apply postemergent herbicides either 1 to 2 weeks before cultivation or mowing, or after weed regrowth is at least 8 inches tall.

BIOLOGICAL WEED CONTROL

Biological control is a slow process, and results are not guaranteed. Therefore, it is used most appropriately as a component of an integrated weed management system that relies on multiple tactics for perennial weed control. For example, the fungus *Concholiobolus lunatus* kills barnyardgrass seedlings with fewer than two leaves, but growth of larger plants is only slowed and plants recover. However, when the fungus is combined with a sublethal dose of atrazine (a dose that injures but does not kill the barnyardgrass), larger barnyardgrass plants can be controlled better than when atrazine is used alone.

INTEGRATED WEED MANAGEMENT

Management of perennial weeds is most successful when multiple tactics are employed, such as the combination of chemical, mechanical, and cultural control. Integrated weed management, when combined with prevention and control of weeds outside of crop production areas, provides the best long-term management of perennial weeds.