Water Hyacinth Control through Integrated Weed Management Strategies in Tanzania

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Abstract

Integrated weed management (IWM) strategies are having a significant impact on water hyacinth control in Tanzania. Water hyacinth has been reduced by over 70% within a period of 3 years. This has been achieved mainly through biological control, manual removal, quarantine regulations, and management of nutrient enrichment. Through manual removal, 60 landing beaches in Lake Victoria were kept free of water hyacinth. Through biological control, two weevils, *Neochetina eichhorniae* and *N. bruchi*, have established with adult populations of up to 30 per plant. There has been a significant reduction in water hyacinth plant population density, from 45 to 7 plants per 0.5 m^2, and large reductions in surface area covered and biomass. Maintenance and construction of wetlands have been used to minimise nutrient loading in lakes, ponds, rivers and satellite lakes. The management of water hyacinth in rivers and ponds that are acting as potential sources of infestation has recently begun.

WATER hyacinth is considered to be the most serious aquatic weed in Tanzania. This free-floating plant of South American origin (Bennet 1967; Jayanth 1988) was observed for the first time in Tanzania in 1955 in the River Sigi and 1959 in the Pangani River. In 1955 it was gazetted as a noxious weed. In recent years, water hyacinth has spread faster, and the most serious infestation is in Lake Victoria (Labrada 1995). In 1995, about 700 ha of the shoreline including bays and gulfs were affected and by 1998 the coverage was estimated at 2000 ha (LVEMP 1999). Water hyacinth has posed serious environmental and socioeconomic problems in the use and management of water resources.

To mitigate the water hyacinth problem in Tanzania, and in Lake Victoria in particular, integrated weed management (IWM) strategies with emphasis on a biological control program were initiated in 1995 under the Lake Victoria Environment Management Project (LVEMP), which is a comprehensive, regional-level environmental program. Under this project, each of the riparian countries of Kenya, Uganda, and Tanzania carries out water hyacinth control in the Lake Victoria within its boundaries. This paper discusses the use of IWM strategies to control water hyacinth in Tanzania, focusing on success achieved so far.

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IWM Strategies

Tanzania has integrated biological control, manual removal of water hyacinth at strategic sites in collaboration with local communities, quarantine regulations and management of nutrient influx into rivers, ponds and lakes to attain sustainable management of water hyacinth.

Biological control

Work towards biological control of water hyacinth in Tanzania was started in May 1995 when 418 water hyacinth weevils (*Neochetina eichhorniae* and *N. bruchi*) were imported from the IITA Biological

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Control Centre for Africa, Benin into Tanzania and mass-reared at Kibaha National Biological Control Centre. By June 1995, the weevils had multiplied to over 2000 insects. Between July 1995 and June 1996, 9000 adult weevils were released into the Sigi and Pangani rivers. *Neochetina* weevils were released into Lake Victoria for the first time during 1997 and were followed by subsequent releases covering all the weed-infested bays, gulfs, ponds and satellite lakes. Eleven (8 community and 3 Institute managed) weevil-rearing units were built around Lake Victoria each with 20 to 50 plastic tanks with 500 L capacity. Adult weevils were held on plants to lay eggs. Adults were then removed and the plants with eggs placed into the field. Assessment of spread and impact of the weevils is done regularly at both release and recovery sites.

Physical control of water hyacinth

Physical control involves manual removal of the weed using simple tools and equipment. This is aimed at keeping landing beaches, water sources, pumps, and recreational areas free from water hyacinth. The local communities and non-government organisations are constantly involved in identifying and clearing infested sites. Hand tools and protective gear worth 14.5 million Tanzanian shillings (ca US$20,000) have been provided to the community by the government to enhance manual removal work.

Quarantine regulations

To prevent the spread of water hyacinth to weed-free areas, legislation is also being used in Tanzania. A draft of 'Water Hyacinth Control Regulations' was prepared in September 1999 based on *National Plant Protection Act* (No. 13 of 1997).

Control of nutrient enrichment

The nutrient conditions and the tropical environment provide fertile conditions conducive to rapid growth and proliferation of water hyacinth. This project identifies the different types of nutrients and other environmental factors that promote water hyacinth proliferation in lakes, ponds, and rivers.

Results

A generally dramatic success in combating water hyacinth infestation has been realised so far in Tanzania, particularly in Lake Victoria. Water hyacinth is no longer a menace in the Lake Victoria Basin. Biological control has worked very well.

- The water hyacinth infestation in the Lake Victoria has been reduced by over 70% over a period of 3 years.
- Data from ground survey in Lake Victoria has revealed only localised water hyacinth infestations and most of the landing beaches are weed-free.
- Plants estimated to contain approximately 30 million eggs of the weevils were placed in the field.
- Preliminary weevil impact data (7 months) from stabilised water hyacinth mats have revealed a significant reduction in plant population from 45 to 7 plants/0.5m^2 (Fig 1).
- Through manual removal, more than 60 landing beaches in Lake Victoria are kept water hyacinth-free.
- The reproductive index of water hyacinth in Lake Victoria has fallen from 6 to an average 0.5 ramets per plant (Fig 2).
- Both *N. eichhorniae* and *N. bruchi* have equally established in release and recovery sites (adult populations of up to 30 per plant) but the efficiency of each species has yet to be determined.
- A survey has revealed the existence of eight water hyacinth infested ponds in the Lake Victoria basin with coverage ranging from less than 1 ha to 35.5 ha and weevils have been released in some of them.
- Nitrogen and phosphorus have been identified as important nutrients in Lake Victoria. They come mainly from industrial, domestic and agricultural effluents.

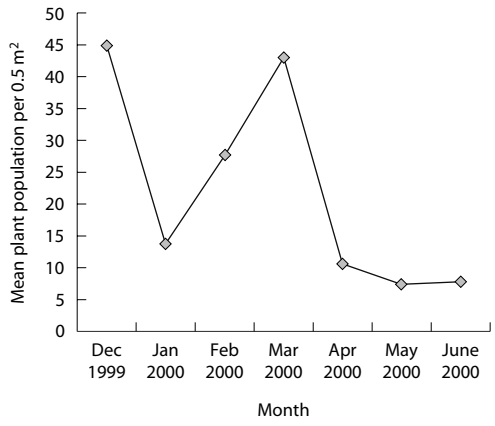

Figure 1. Changes in plant population

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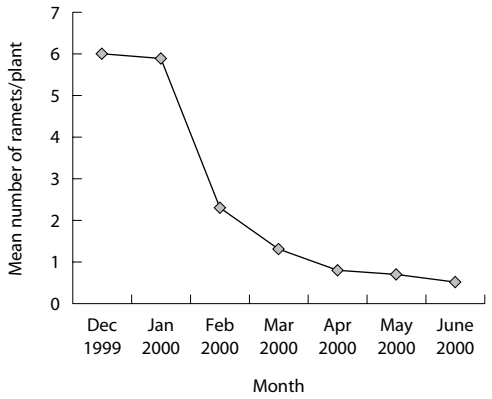

Figure 2. Changes in the number of ramets per plant

- Wetlands have been constructed and maintained to decrease nutrient loading into the lake.
- Ecological succession is evident in water hyacinth management sites whereby pure water hyacinth is invaded mainly by water sedges (*Cyperus* sp.).

Conclusions

The benefits of IWM strategies in dealing with water hyacinth have been demonstrated in Tanzania. Water hyacinth in Lake Victoria has been tremendously reduced. However, there is a continuous inflow of water hyacinth (0.2 to 0.8 ha/day) into Lake Victoria from the Kagera and Mara rivers. Furthermore, resurgence of water hyacinth has been observed in some parts of the water hyacinth managed areas, mainly from seed reserves, and there is a pressing need to manage them. The continuous presence of water hyacinth in the lake and the conditions that supported its rapid spread are still in place. Future work to prepare for any renewed infestation should include:

- research on the relationship between *Neochetina* weevils and water hyacinth;
- examining the possibility of using other water hyacinth control methods;
- carrying out socioeconomic impact assessment of the water hyacinth management strategies in Tanzania; and
- development of a surveillance system that would provide timely information regarding the location, relative size and rate of increase of water hyacinth mats along the shoreline. A network of observers (mainly fishermen) will be developed to report any charges in hyacinth coverage within the area.

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