

Benefits of Maintenance Control of Waterhyacinth

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Three of the main criticisms of the public concerning the use of herbicides to control waterhyacinths are: (a) the quantity of chemical used to control the plants, (b) the amount of organic material deposited on the lake or river bottom by the dead waterhyacinths and (c) the increased oxygen demand and lower dissolved oxygen (D.O.) levels created by the decaying plant material. Management personnel have implemented waterhyacinth maintenance programs designed to address these three issues (3), however no quantitative data have been collected to document the predicted benefits of maintaining low levels of waterhyacinths. Numerous studies have been conducted to correlate the growth of waterhyacinths with dissolved oxygen levels (4,6,7) and detrital accumulation (1,2,5,6). However, no studies have been conducted to correlate the maintenance control of waterhyacinths with the D.O. levels, amount of organic sedimentation, and quantity of herbicide utilized on an annual basis. In order to test this relationship, ten waterhyacinth plants were planted in each of 18 concrete vaults at the Center for Aquatic Weeds in Gainesville, Florida. The plants were maintained at six maximum levels of coverage (3) replicates each) i.e. zero, 5%, 25%, 50%, 100% and 100% unsprayed. For example, when the waterhyacinths increased to 25 plants (equivalent to 5% coverage) in the three

5% tanks they were chemically treated with 2,4-D to the original 10 plants; when the plants reached 25, 50, or 100% coverage in other predetermined tanks they were sprayed back to 5% coverage. In the tanks labeled 100% unsprayed, the plants were allowed to completely cover the water surface and no herbicide control was conducted. Records were maintained on the number of times each tank was treated with 2,4-D and the quantity of herbicide solution utilized over the one-year study period. Once spraying operations were initiated, biweekly D.O. measurements were made. At the end of one year, the live plants remaining after the winter freeze were removed, the tanks were drained, and the organic sediments were dried and weighed.

The amount of herbicide used under the six different treatment levels is shown in Table 1. In the most intensely managed tanks (5% coverage), eight separate treatments were required throughout the year. This was twice the number required at the 50% level and four times more than at the 100% level of coverage. However, at the 5% level only 17 milliliters of spray solution was required during each spraying, whereas four times that amount was required at 50% and ten times (175 mls) more herbicide solution was required for each spraying at the 100% level of coverage. Calculations of the total amount used throughout the one year study period and extrapolation of the data to a per

acre base's indicates that 1.7 lbs of herbicide (less than one half gallon*) would be required to maintain the plants at the 5% maintenance level, whereas 3.3 lbs (.83 gallon*) would be required at the 50% coverage level and 4.5 lbs. (1.13 gallons*) of herbicide would be required at the 100% coverage level. This latter amount is 2.65 times more than that required to maintain the plants at the 5% maintenance level.

The annual amount of detrital material deposited by the six levels of waterhyacinth management is shown in Table 2. At the 5% coverage level only 0.39 inches of drained sediment accumulated in the tanks. This amount is essentially the same as the 0% coverage level. These amounts were almost doubled at the 25 and 50% coverage levels. The 100% coverage level deposited almost two inches or four times more sediment than the 5% maintenance level. The unsprayed waterhyacinth produced almost four inches of sediments or ten times more than the 5% level. The higher amount in the 100% unsprayed tanks is due to the deposition of large quantities of frost killed waterhyacinths and the lack of organic decomposition of these plants prior to sediment measurement. This fact is also evident in the average

*4.0 lbs 2,4-D acid per gallon of concentrate

Table 1. Annual Herbicide Usage Under Various Waterhyacinth Management Schedules

Percent of Area Covered Prior to Control	Number of Times Sprayed	Average Volume 2,4-D solution per treatment (ml)	Average Total Volume 2,4-D solution per tank (ml)	Total Amount 2,4-D assuming 1 Acre Pond (lbs)
0	0	0	0	0
5	8	17	136	1.7
25	7	34	238	3.1
50	4	63	252	3.3
100	2	175	350	4.5
100 (Unsprayed)	0	0	0	0

Table 2. Annual Organic Sedimentation Caused by Various Waterhyacinth Management Schedules

Percent of Area Covered Prior to Control	Average Sediment Depth (inches)	Average Percent Organic Content	Sediment Deposition (Tons/acre, dry weight)	
			Total	Organic
0	0.35	35	2.4	0.9
5	0.39	54	2.5	1.3
25	0.67	59	2.5	1.5
50	0.71	59	3.2	1.9
100	1.90	70	4.2	2.9
100 (unsprayed)	4.02	80	6.5	5.2

percentage organic content and appearance of the sediments. In the 5, 25, and 50 coverage tanks, the sediments were unconsolidated, finely divided with few plant parts identifiable, and ranged between 54 to 59% organic matter. In the 100% and 100% unsprayed tanks, the sediments were more consolidated and plant parts more easily identifiable. These sediments had undergone less decomposition and averaged between 70 and 80% organic content, respectively. In terms of total amount of sediment deposited per acre on an annual basis the unsprayed waterhyacinths deposited 6.5 tons/acre (dry weight) which is approximately 2.7 times more than the 5% maintenance level. The organic portion of these sediments was 5.2 tons/acre in the unsprayed tanks which was four times the amount (1.3 tons/acre) in the 5% coverage tanks. It is interesting to note that the amount of sediments deposited in the 100% tanks is exactly equal to that reported (4.2 tons/acre) for the

renovation of a citrus pond completely covered with waterhyacinths (1).

Biweekly D.O. levels associated with the various treatment levels are shown in Table 3. As expected the D.O. levels are higher in the tanks with fewer waterhyacinths. This is due to a higher percentage of open water which allowed diffusion of oxygen from the atmosphere, and less oxygen demand created by decaying waterhyacinths, more solar radiation entering the water column which allowed greater production of D.O. by phytoplankton. In a similar study which evaluated the effects of various levels of waterhyacinths on fish production (4), it was observed that reductions in phytoplankton growth in ponds with 10 and 25% waterhyacinth coverage resulted in much lower fish production due to a reduction in the food base. However, the presence of 5% cover by waterhyacinth did not significantly affect fish production (4).

An additional observation made

during the study was the amount of live waterhyacinths which survived the severe freeze during January, 1985. During this freeze approximately 3-4 inches of ice was observed on the surface of most of the tanks. Two weeks following the freeze waterhyacinths in all the tanks appeared brown and completely killed, however two months later when the experiment was ended the 100% coverage unsprayed tanks contained an average of 90 live plants (only ten plants were stocked in each tank initially. No live plants remained in the 5 or 25% coverage tanks. This is caused by the insulating nature of the waterhyacinth which reduces the heat loss from the water surface and the insulation of the plant meristem by the high amounts of plant material in the large "bull" hyacinths (2,6).

In summary, it is evident that maintenance of waterhyacinths at low levels (less than 5% coverage) can (a) reduce annual herbicide usage by a factor as great as 2.6, (b) reduce organic

Table 3. Effects of various levels of waterhyacinth management schedules on dissolved oxygen concentration

Percent of Area Covered Prior to Control	Average Dissolved Oxygen Concentration mg/l
0	10.3
5	9.3
25	4.0
50	1.6
100	1.3
100 (unsprayed)	2.0

deposition by a factor of 4.0, (c) prevent the depression of dissolved oxygen concentrations, and (d) accentuate the killing effects of winter

freezes on the waterhyacinth. Data such as these can be extremely useful in explaining the benefits of the maintenance of waterhyacinth control to the concerned public.

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