Bull. Fac. Agric., Cairo Univ.,53 (2002): 377- 388.

MANUAL REMOVAL OF WATER HYACINTH *(Eichhornia crassipes)* FROM SMALL CANALS BY USING PENETRATE BARRIER

(Received: 26.9.2001)

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ABSTRACT

In a wire green house,two experiments were conducted during April and August 1999 and 2000 at the Agriculture Research Center, Giza, Egypt, to study the effect of ten air drying periods(days) on viability and regrowth of water hyacinth. Results indicated that the plants which were exposed to air drying periods from 1-8 and 1-5 days continuously during April and August can survive, while they died after these periods.

Two irrigation canals were used at Bahteem, Kalubia Governorate, to study the effect of manual removal of water hyacinth plants at regular intervals (weekly) from mid March to the 1st November 1999 and 2000. In both seasons a penetrated barrier was used before water intake in the 1st canal, but the 2nd canal was left without barrier (as control). Results showed that water hyacinth plants disappeared in the1st canal during the 2nd year, while the plants appeared in the 2nd canal(control) during the 2nd year.

***Key words**: air drying, canal with barrier, manual removing, water hyacinth.*

1. INTRODUCTION

Water hyacinth [*Eichhornia crassipes* (Mart) Solms – Laub] is a perennial free floating aquatic weed. It is cosmopolitan

throughout the tropical and subtropical regions of the world.It grows throughout the year not only in water canals but also on muddy and marshy soils (Labrada 1996).The excessive growth causes many serious problems such as clogging rivers, drainage and irrigation canals,accelerate silting up of canals and increases water loss (Labrada 1996, Orach-Meza 1996, Pieterse *et al.,* 1996 and Terry 1996). In Egypt,it is considered one of the worst aquatic weed (Khattab and El-Gharably 1986 and Labrada 1996).The methods of controlling this weed are mechanical , chemical and biological control. Biological control is used in limited scale, in addition, it has still to be developed. Meanwhile,chemical method now is not used in river Nile, because it is not safe and it has been banned where effects on non-target organisms,deoxygenation of water,high cost of herbicide usage and recolonization by untreated weeds due to misapplication.Mechanical method is not practical for using in small canals due to narrow roads beside canals,distance between trees is short and reinfestation of the canals.Meanwhile, manual removal is practical method for control water hyacinth in lightly infested canals.In India, manual cleaning is still the only method largely adopted by the farmers to get rid of this weed wherever necessary(Khattab and El-Gharably 1986, Singh and Khan 1986,Ashton and Monaco 1991, Gutierrez *et al.,* 1996, Labrada 1996, Mansor 1996, Terry 1996 , Attalla and Salib 1999).

The aim of this work was to evaluate the modified method of manual removing of water hyacinth plants weekly from the small canals for controlling it, in addition to test the viability and regrowth of water hyacinth weeds after air drying .

2.MATERIALS AND METHODS

Wire green house and canal experiments were carried out during 1999 and 2000 years.

2.1. Wire green house experiments

Two experiments were done in April and August 1999, and repeated in the same date during 2000, to study the effect of air drying (sun and air) on the viability and regrowth of water hyacinth plants.

Water hyacinth plants [*Eichhornia crassipes* (Mart) Solms-Laub] were collected from a dense stand which existed in El-Zommer

irrigation canal at Giza Governorate The plants were weighed in (g) before exposed to air drying/sun and air). Ten periods (day) exposure of air drying i.e-1,2,3,4,5,6,7,8,9and 10 days were used. After the end of each period, the plants were weighed in (g) and put in pots (27 cm in diameter and 20 cm height) filled with water. The treatment periods were arranged in complete randomized block design with 4 replicates. The lost water was calculated by the following equation:

$$\text{Lost water \%} = \frac{(W_1 - W_2) X\ 100}{W_1}$$

$$\text{Lost fresh weight \%} = \frac{W_2 X\ 100}{W_1}$$

Where W_1 is the weight of plants before air drying.

W_2 is the weight of plants after air drying.

The viability of the plants was measured by (Living) green colour do not change, and (Died) green colour changed to yellow and brown while, regrowth (R)daughter plants (off sets) appeared.

Data were statistically analyzed according to Snedecor and Cochran (1972).Means were compared using L.S.D. at the level 5% of probability.

The agrometerological data were taken after Giza Agrometerological Station , Giza,Egypt and recorded in Table (1).

Table (1): Average of max.,min. and mean of temperature, relative humidity and wind speed for Giza during April and August in 1999 and 2000 years.

PERIOD		Temperature C			Relative humidity %	Wind speed m/sec
		Max.	Min.	Mean		
1999	April	32.6	14.5	23.6	42.7	5.1
	August	41.1	25.8	33.5	44.9	3.2
2000	April	32.6	18.0	25.3	44.0	5.1
	August	39.4	25.3	32.4	46.8	4.4

2.2.Canal experiments

Two canals at Bahteem, Kalubia Governorate were used for canal experiment which was carried out at the third week of march in 1999 and 2000 years, to study a modified method of control by manual removal of water hyacinth plants weekly from the small canals.

In the first canal , a penetrated barrier (net wire) was placed before water intake to prevent water hyacinth plants to enter through the canal and allow the water to pass through it. The second canal (without barrier) was used as control.The plants were manually collected weekly from each canal by labourers provided with simple tools(forks), then they distributed the plants along both banks of the canals and left to dry under the sun (air drying).

Data of collecting plants were calculated as means, standard deviation and comparisons between treatment means using "t" test. The growth characters (plant number, leaf number and length, fresh and dry weight) were recorded .

3.RESULTS AND DISCUSSION

3.1. Wire green house experiments

3.1.1. Effect of air drying on water hyacinth plants

Results in Tables (2 and 3) show that air drying periods resulted in a significant reduction in water hyacinth fresh weight in both tested months and years. It is clear from these results that in April 1999 and 2000, the plants which were exposed continuously to air drying periods from(1–8 days) can survive but died after these periods (9–10 days). This result may be due to loss of amount of plant water (> 93 %). Regrowth and living plants were recorded during (1-4) and (5-8)days air drying, respectively Table(2).

This was true in August in both years but at (1– 5)days and (6 – 7) days in respective order.While,regrowth and living plants were recorded during (1-2) and (3-5)days air drying, respectively Table(3) .

In general,the air drying mechanism reduced the amount of water into the exposed plants where the available water reduced the viability of water hyacinth plants to live or regrowth(Larcher 1975).

Stoller and Sweet(1987) mentioned that the drying tubers of nutsedges from natural state 85 to 15% water will kill them and that the intermediate moisture contents reduced the viability. The time required to reach this critical moisture level took place(7-14)days of air drying.

These results explained why the mechanical or manual removal of water hyacinth plants did not affect controlling the plants. The plants returned again to the canals before they had completely died.

Table (2): Fresh weight of water hyacinth plants before (W_1) and after (W_2) air drying exposure periods, lost water % (LW) during April 1999, 2000, average of two seasons, fresh weight % (FW) and viability [living (L) died (D)] regrowth(R).

Day Period Exposure	10-19/ 4 / 1999			13-22/ 4 / 2000			Average 1999-2000				Viability
	Weight of plants(g)		LW %	Weight of plants(g)		LW %	Weight of plants(g)		LW %	FW %	
	W_1	W_2		W_1	W_2		W_1	W_2			
1	29.35	16.37	44.22	31.36	17.25	45.00	30.36	16.81	44.63	55.37	L-R
2	30.73	10.78	64.92	30.27	10.59	65.01	30.50	10.69	64.95	35.05	L-R
3	28.74	7.51	73.86	31.21	7.80	75.00	29.98	7.66	74.45	25.55	L-R
4	32.86	6.82	79.25	29.92	5.95	80.11	31.39	6.39	79.64	20.36	L-R
5	31.81	5.17	83.74	31.83	4.97	84.38	31.82	5.07	84.07	15.93	L
6	30.38	3.85	87.32	28.84	3.72	87.10	29.61	3.79	87.20	12.80	L
7	31.41	3.08	90.20	31.12	2.96	90.49	31.27	3.02	90.34	9.66	L
8	31.06	2.21	92.90	31.77	2.16	93.20	31.42	2.19	93.03	6.97	L
9	32.22	1.93	94.00	30.38	1.83	93.98	32.00	1.88	94.12	5.88	D
10	30.81	1.79	94.20	31.07	1.86	94.01	30.94	1.83	94.09	5.91	D
F test	NS	S	----	NS	S	----	NS	S	-----	----	----
L.S.D	------	2.02	----	----	2.20	----	----	3.94	----	----	----

Table (3): Fresh weight of water hyacinth plants before (W_1) and after (W_2) air drying exposure periods, lost water % (LW) during August 1999, 2000, average of two seasons,fresh weight %(FW) and viability [living (L) died (D)] regrowth (R) .

Day Period Exposure	12-18 /8 / 1999			15-21 /8 / 2000			Average 1999-2000				Viability
	Weight of plants(g)		LW %	Weight of plants(g)		LW %	Weight of plants(g)		LW %	FW %	
	W_1	W_2		W_1	W_2		W_1	W_2			
1	30.42	15.18	50.10	31.26	15.12	51.63	30.84	15.15	50.88	49.12	L-R
2	32.17	8.09	74.85	30.41	8.46	72.18	31.29	8.28	73.54	26.46	L-R
3	31.80	3.38	89.37	32.57	3.57	89.04	32.19	3.48	89.19	10.81	L
4	30.14	2.65	91.20	31.18	2.66	91.47	30.66	2.66	91.32	8.68	L
5	31.45	2.29	92.72	32.36	2.43	92.49	31.91	2.36	92.60	7.40	L
6	32.06	1.92	94.01	32.24	1.96	93.92	32.15	1.94	93.97	6.03	D
7	31.32	1.91	93.90	30.23	1.76	94.17	30.78	1.84	94.02	5.98	D
F test	NS	S	-----	NS	S	-----	NS	S	-----	-----	-----
L.S.D	----	1.70	----	-----	1.04	-----	----	2.95	-----	------	-----

The reason to explain why the different periods which killed the exposed plants to air drying in April and August was due to the differences of temperature and relative humidity during these periods (Table1) . These results are in agreement with those obtained by Obeid 1975, Tag El-Seed 1975, Attalla 1985,Stoller and Sweet 1987, Ashton and Monaco 1991.

3.2. Canal experiments

Results in Table (4) show that the modified control method by manual removal of water hyacinth plants weekly from canals was significant for plant growth during plant life period and floating stage in both years. Floating stage is the period from mid March to mid June (4 months) where the plants are floated from bottom to the surface of canal. Meanwhile plant life period is the period from mid March to 1st November (8 months) where the plants appear on the water till the plants completely die (Attalla 1998).

Results in Table (4) revealed that the mean differences between canal with barrier and canal without barrier from plant growth were significant in the two years.The mean values of plants No/m^2, leaves No/plant, leaf length,fresh and dry weight of whole plants at the end of floating period (n=14) and plant life period (n=34)were lower in canal with barrier than in canal without barrier in both years and the average of two years. The mean values of same characters during flooling period 21.64, 5.28, 5.16, 5.48 and 0.2 in 1st canal while, 29.21 ,5.1, 10.28, 17.07 and 1.13 in 2nd canal, respectively during 1999. The mean values and standard deviation were (8.91,,10.8), (2.17,,2.02), (2.13,,1.98),(2.26,,2.1) and (0.08,,0.08), in canal with barrier and (23.41,, 8.25), (5.63,,1.22),(16.56,, 6.29), (51.85,, 30.79) and (4.34,, 3.00), in canal without barrier respectively during 1999.

From the results in Table (4),water hyacinth plants disappeared from the canal with the barrier during 2000, the mean and standard deviation values of plants No/m^2, leaves No/plant, leaf length, fresh and dry weight of whole plants in canal without barrier were(22.56 ,, 8.48), (5.68,,1.2), (16.53,, 6.3),(51.15,, 31.99) and (4.24,, 3.35), and floating period, in during and 27.43, 5.17,10.31,17.26 and 1.13, during floating periods respectively. The average(1999-2000) had the same trend during the two periods. These results are in agreement with those obtained by Wolverton and Mc Donald 1979, Luu and

Table(4): Mean (M), standard deviation (SD) and "t" values of water hyacinth growth characters affected by manual weekly collection from canals with(W) and without (WO) presence of penetrated barrier during floating period(n=14),from mid March to mid June and plant life period (n=34) from mid March to1st November, 1999, 2000 and average1999-2000.

Collecting Period	Characters Growth		1999			2000			Average 1999 - 2000		
			W	WO	"t"	W	WO	"t"	W	WO	"t"
Floating period from mid March to mid June	Plants No.	M	21.64	29.21	5%	0.00	27.43	1%	10.82	28.32	1%
	Leaves No.	M	5.28	5.10	5%	0.00	5.17	1%	2.64	5.13	1%
	Leaf Length	M	5.16	10.28	5%	0.00	10.31	1%	2.58	10.29	1%
	Fresh weight	M	5.48	17.07	5%	0.00	17.26	1%	2.74	17.16	5%
	Dry weight	M	0.20	1.13	5%	0.00	1.13	5%	0.10	1.13	5%
Plant life period from mid March to 1st November	Plants No.	M	8.91	23.41	5%	0.00	22.56	1%	4.46	22.99	1%
		SD	10.8	8.25	---	0.00	8.48	---	5.40	7.72	---
	Leaves No.	M	2.17	5.63	1%	0.00	5.68	1%	1.09	5.67	1%
		SD	2.02	1.22	---	0.00	1.20	---	1.21	0.66	---
	Leaf Length (cm)	M	2.13	16.56	1%	0.00	16.53	1%	1.06	16.55	1%
		SD	1.98	6.29	---	0.00	6.30	---	0.99	6.29	---
	Fresh weight (g)	M	2.26	51.85	1%	0.00	51.15	1%	1.13	51.5	1%
		SD	2.10	30.79	---	0.00	31.99	---	1.05	32.11	---
	Dry weight (g)	M	0.08	4.34	1%	0.00	4.24	1%	0.04	4.29	1%
		SD	0.08	3.00	---	0.00	3.35	---	0.04	3.02	---

Getsinger 1990,Okamoto *et al.*, 1990,Delgado *et al.*, 1992, Barker *et al.*, 1996,Dunderdale and Morris 1996 and Volder *et al.*, 1997.

From the previous results, it could be concluded that the manual removal of water hyacinth with simple hand tools(forks) is probably the most widely practical method of control used to remove the weed especially from small canals. It is also impractical due to the appearance or reinfestation of weed again after removing it in the canals.Therefore, manual removal modified method to increase the effectiveness of its efforts by using barrier as wire net before water intake of canal to prevent the weed enter into the canal. In this method where water hyacinth plants removed at regular intervals(weekly) during its floating stage in presence the penetrate barrier.This method is effective and may be economical for removing isolated groups of plants in small canals, non polluting,do not harm fish and other aquatic fauna,harvested plants can be dried by air drying and utilization.

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إزالة نباتات ورد النيل يدويا من القنوات الحقلية باستخدام مانع منفذ

صفوت ابراهيم عطاالله

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مركز البحوث الزراعية-الجيزة

ملخص

١- اجريت تجربتان معمليتان فى الصوبة السلكية بمركز البحوث الزراعية – جيزة –مصر – خلال شهرى ابريل واغسطس ١٩٩٩ و٢٠٠٠ لدراسة تأثير عشر فترات تجفيف هوائي على سلوك نباتات ورد النيل. أظهرت النتائج فى السنتين أن النباتات المعرضة للتجفيف فى الفترة من ١-٨ يوم خلال شهر إبريل وكذلك فى الفترة من ١-٥ يوم خلال شهر أغسطس لم تفقد حيويتها أما النباتات المعرضة للتجفيف بعد هذه الفترة فقد ماتت.

٢- كما أجريت تجربة فى المجرى المائى فى قناتى رى بمحافظة القليوبية لدراسة تأثير الجمع اليدوى لنباتات ورد النيل بانتظام (أسبوعيا) فى الفترة من منتصف مارس إلى أول نوفمبر١٩٩٩و٢٠٠٠ حيث استخدم مانع منفذ للماء أمام مأخذ الماء لمجرى احدى القناتين مع ترك الأخرى بدون مانع. وقد أظهرت النتائج ان نباتات ورد النيل قد اختفت من المجرى المائى ذو المانع ولم تختفي(وجدت) فى االمجرى الآخر (بدون مانع) فى السنة الثانية (٢٠٠٠).

المجلة العلمية لكلية الزراعة – جامعة القاهرة – المجلد (٥٣) العدد الثالث (يوليو ٢٠٠٢):٣٧٧-٣٨٨.