J. Soil Sci. and Agric. Eng., Mansoura Univ., Vol. 5(1): 107-119, 2014

sMANUFACTURING A NEW DEVICE SUIT FOR MECHANICAL CONTROL WATER-HYACINTH PLANTS.

Elyamani, A.E.; R.M. EL- Marhomy and S.A.Shalabey
Agric. Eng. Res, Inst.,ARC,Dokki,Giza, Egypt.

ABSTRACT

Anew prototype device for mechanical control water-hyacinth plants must be adapted using local materials. The attempt was to get rid of water-hyacinth plants from small canals and waterways through season 2013 at El-Shakeiloba village, El-berolos lake, Kafr El-Sheikh Governorate. It was evaluated under different conditions included machine forward speed, gathering reel speed and mean of water level height on field capacity, productivity, gathering efficiency, chopping efficiency, power consumption and operation cost. The results showed that the new prototype device produced maximum of field capacity and productivity of 49.93 m²/min and 6.017 Mg/h recorded with forward speed of 0.5 m/s, gathering reel speed of 0.94 m/s and water level height more than 150 cm. Meanwhile, maximum value of gathering efficiency was 98.82% and minimum value of machine losses was 1.18 % recorded with forward speed of 0.26 m/s, gathering reel speed of 0.94 m/s and water level height more than 150 cm. Besides, maximum of chopping efficiency was 87.41% recorded with forward speed of 0.26 m/s, and gathering reel speed of 0.56 m/s . Whereas, minimum value of power consumption and operation cost were 10.285 kW and 24.55 L.E/h respectively, recorded with forward speed of 0.26 m/s, gathering reel speed of 0.56 m/s and water level height more than 150 cm.

INTRODUCTION

Water pollution is one of the most serious problems of today’s civilization. The consumption of water has been doubling on every twenty years but the reduction of this period is expected if today’s trends in water use continue (Velasevic and Djorovic, 1998).Aquatic plants play an important role in aquatic systems worldwide because they provide food and habitat to fish, wildlife and aquatic organisms. Plants stabilize sediments, improve water clarity and add diversity to the shallow areas of lakes. Unfortunately, nonnative plants that are introduced to new habitats often become a nuisance by hindering human uses of water and threaten the structure and function of diverse native aquatic ecosystems. Significant resources are often expended to manage infestations of aquatic weeds because unchecked growth of these invasive species often interferes with use of water, increases the risk of flooding and results in conditions that threaten public health. In mechanical harvesting, cutting operations are combined with plant removal. Occasionally, there are separate cutting and harvesting boats. More often, the harvesters have both a sickle-bar cutting blade with a conveyor belt that loads the cut material on a boat. Disposal vehicles carry the plant material away. One neglected aspect of harvesting operations is disposal of plant material. The plant material is generally more than 90% water and not suitable as a feed and cannot be sold or made into anything truly useful. The common response is to use it as mulch. Due to the disposal problem, some recent machine designs have included a shredder, chopper, or grinder to dispose of the plant material back into the lake. Although some concern has been expressed to the release of nutrients, the actual amount of nutrients released is small relative to other sources. A more realistic concern, at least in southern water bodies, is the attraction of large carnivores to the "chum" resulting from chopped fish and other organisms that are a "by-catch". Water hyacinth in Egypt has come into its own widely separated section around canals as an aquatic weed. The nutritional value of this weed was investigated by some workers (khalil et al.,1975). Water hyacinth is fast growing perennial aquatic macrophyte (Reddy and Sutton, 1984). It is a member of pickerelweed family, this tropical plant spread throughout the world in late 19th and early 20th century (Wilson et al., 2005). Today it is well known for its reproduction potential (de Casabianca and Laugier, 1995) and as a plant that can double its population in only twelve days (Apiris, 2005). Water hyacinth is also known for its ability to grow in severe polluted waters (So et al., 2003). E. crassipens is well studied as an aquatic plant that can improve effluent quality from oxidation ponds and as a main component of one integrated advanced system for treatment of municipal, agricultural and industrial wastewaters (Sim, 2003; Wilson et al., 2005; Chua, 1998; Mangabeira et al., 2004; and Maine et al., 2001). To regret water hyacinth is often described in literature as serious invasive weed (Wilson et al., 2005; Maine et al., 1999; So et al., 2003; Singhal and Rai, 2003) and it is ranked on eight place in the list of world’s ten most serious weeds (Reddy and Sutton, 1984). Mechanical, chemical and biological control methods are commonly used to control WH (Julien et al., 2001), but no one method is suitable for all situations (Gopal, 1998). Mechanical control includes harvesting by hand or machine (Villamagna &Murphy, 2010). The use of machinery to remove WH from water bodies is the most effective non-polluting control method (Mara, 1976), especially in critical areas such as hydro-electric dams and ports. The main advantage to the use of mechanical harvesting is the simultaneous removal of nutrients and pollutants from the water body, and may therefore act as a means of slowing or even reversing eutrophication (Wittenberg & Cock, 2001). Mechanical harvesting of WH has also resulted in rapid increases in dissolved oxygen, and improved suitability of the habitat to support fish (Perna & Burrows, 2005). However it requires recurring efforts involving machine and labour inputs (Mara,1976). Mechanical removal with harvesters is not suitable for large mats. Studies have shown that costs of mechanical harvesting are on average US$ 600 to 1,200 per hectare (Wittenberg & Cock, 2001).McComas (1993) listed a large number of hand implements and other small-scale devices for mechanical control. These techniques are most appropriate for localized nuisance problems of both nonindigenous and native plants. Wanda (1997) reported that, mechanical control operations have so far consisted solely of chopping and dumping of the chopped pieces of water hyacinth and other weeds into the lake. Regrowth of the chopped weed is likely to take place, especially if most of the natural enemies are destroyed during chopping. In addition, shallow areas of the lake are likely to fill up with vegetation, especially along the shoreline, leading to drying up and subsequent reduction in the size of the lake. The use of machines to destroy or remove water hyacinth has limitations, including their inability to move around a large lake. The future of mechanical control options should be reassessed.

MATERIALS AND METHODS

The main experiments were carried out in El-Shakeiloba Village, El-Berolos lake, Kafr El-Sheikh region during summer 2013 on waterways have broaden about 20m width. Water hyacinth is very big problem in more Egyptian canals, in spite of the fact that, Water hyacinth still gathered manually in Egypt. Whereas, this method consumed a lot of time, hard work and high cost. The aim of this present study is to modify and manufacture small device to suit gathering Water hyacinth plants from small and medium canals and waterways. Some physical properties and characteristics of water hyacinth plants were measured and summarized in Table1.

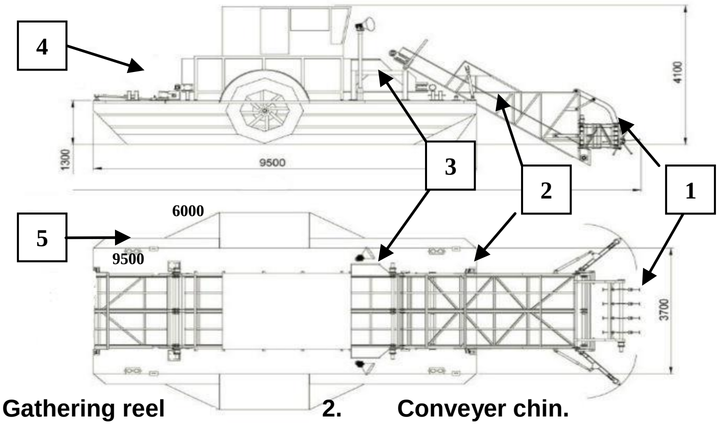
Table 1 : Specifications of used Water hyacinth plants.

No. of sample	No. of plants in m²	Mean of one plant weight, g	Mean of one plant length, cm	Mean of green part length, cm	Mean of root length, cm	green part weight, g	Root weight, g
1	11	240	84	37	47	140	100
2	10	270	79	32	47	130	90
3	12	230	75	35	40	135	95
4	9	235	89	41	48	142	93
5	13	258	86	33	53	139	92
Total average	**11**	**246.6**	**82.6**	**35.6**	**47**	**130.1**	**92.4**

A new device specifications :

Fig.1 and 2 is shown the photography and engineering drawing of a new device. it was manufactured to gathering Water hyacinth plants from small and medium canals and waterways Where it is designed to demonstrate the introduction of small boat and the boat was managed by a special engine motor 30 hp (22kW) also, a new device was worked with other engine motor 20 hp (14.7kW). The general specifications of anew water hyacinth gathering device was composed of header used in gathering Water hyacinth plants from small and medium canals and waterways, inclined conveyer suit for raising gathering Water hyacinth plants to chopping room which contain chopping drum have 0.3 m diameter used for cutting water hyacinth plants into small pieces then, a device had throw out tube for transporting small chopped pieces into water canal again. Also, machine is composed of reel rotor is installed on the four surrounding plant, each of which contains a number twenty fork length of 0.5 m each. The top half of this rubber cushions covered with thorns. And these symptoms are managed through the gearbox derives movement of hydraulic motor is installed within the framework and is linked to this-vice are all at the front of the machine and get rotational speed appropriate is transferred to front reel with the arms rotating through the gearbox special by the result of the rotation. They are collecting plants from mid- canal or waterway and pay into the machine, including moving the plants to rig horizontal you expel these plants out of the machine or to fund a private collection, under the influence of centrifugal forces and thus it facilitates assembly plants from the sides and the middle waterway .

Fig. 1: A new prototype device for mechanical control water-hyacinth plants



1. **Gathering reel**
2. **Conveyer chin.**
3. **Chopper room.**
4. **Motor engine.**
5. **The boot body.**

Fig. 2: An elevation and plan of a new prototype device for mechanical control water-hyacinth plants

The main parameters were as follows:

A– The forward speed of machine levels were : 0.26, 0.33, 0.4 and 0.5 m/s.

B– The speed of gathering reel levels were : 0.56, 0.75 and 0.94 m/s.

C– High water in the waterway levels were : (50-100, 100-150 and >150 cm).

Measurements:

1-Effective field capacity and field efficiency:

Field capacity was calculated according to the following equation:

$$EFC = 1/Ti, \quad m^2/min. \qquad \ldots\ldots 1$$

Where:

Ti = Effective planting time, h.

2-Productivity:

The water hyacinth plants yield was determined for manual and mechanical methods, a number of samples were taken from different locations for each treatment at random and then weighted and integrated to determine the average of plants yield per m².

3- Gathering efficiency:

Gathering efficiency was estimated by the following formula:

$$\eta g = \frac{Wg}{Wt} \times 100\% \quad \ldots\ldots 3$$

Where:

ηg **=** gathering efficiency**, %;**

Wg = the weight of the plants collected from unit area , kg / m²; and

Wt = total weight of plants per unit area, kg / m².

4- Chopping efficiency:

Chopping efficiency was estimated by the following formula:

$$\eta c = (100 - \frac{Wu}{Ws}) \times 100\% \quad \ldots\ldots 4$$

Where:

ηc **=** chopping efficiency**, %;**

Wu = the weight of unchopped plants in sample, kg ;and

Ws = total weight of plants in sample, kg.

5-Calculation of power consumption:

Estimation of the required power was calculated using the following formula (Hunt, 1984):

$$Pr = [FC\ (1/3600)\ \rho E \times L.C.V. \times 427 \times \eta thb \times \eta m \times 1/75 \times 1/1.36],\ kW \quad \ldots\ldots 5$$

Where:

FC = the fuel consumption, l/h;

ρE = the density of fuel, kg/l (for gasoline = 0.72);

L.C.V = the lower calorific value of fuel, 10000 k.Cal/kg;

ηThb = thermal efficiency of the engine, (for Otto engine = 25%);

427 = thermo- mechanical equivalent, kg.m/k.cal ;and

ηm = mechanical efficiency of the engine (for Otto engine = 85%).

6-Machine losses percentage:

Plants that were left in the waterway after the machine was considered the proportion of loss caused by the machine. And had to be assembled manually and then weighed and assigned to the total weight of the plants in this area. **The percentage of the machine has been estimated using the following equation:**

$$ML = \frac{WL}{Wt} \times 100\% \quad \ldots\ldots 6$$

Where:

ML **=** machine losses, %;

WL = the weight of waterway plants per unit area left after passing the machine, kg ;and

Wt = total weight of waterway plants per unit area, kg.

7- Total cost requirements:

The total cost need for operation was estimated by the following formula (Hunt, 1984):

$$\text{Operating cost} = \frac{\text{Machine cost ,L.E/h}}{\text{Yield output , Mg/h}} , \quad \text{L.E/Mg} \ldots\ldots 7$$

Here, machine cost was determined by the following formula **(Hunt, 1984)**

$$C= p/h\ (1/a + i/2 + t + r) + (0.9\ w.s.f) + m/144 \ldots\ldots 8$$

Where:

c	=	hourly cost , L.E/h.	0.9	=	factor accounting for lubrication
p	=	price of machine , L.E.	w	=	engine power, hp
a	=	life expectancy of the machine ,h.	s	=	specific fuel consumption, l/hp.h.
h	=	yearly working hours, h/year.	r	=	repairs and maintenance ratio.
i	=	interest rate/year.	m	=	monthly average wage ,L.E.
t	=	taxes ratio	f	=	fuel price , L.E/l
144	=	reasonable estimation of monthly working hours.			

RESULTS AND DISCUSSION

Performance characteristics of water hyacinth device :

a) effective field capacity:

Results as shown in Fig. 3 indicated the effect of forward speed, gathering reel speed and mean of water level height on the effective field capacity of water hyacinth gathering process. Where, the effective field capacity of water hyacinth were increased with increasing all of forward speed, gathering reel speed and mean of water level height at all experiment levels. Also, the value of theoretical field capacity were 34.1, 41.1, 48.4 and 56.3 m²/min, respectively. Results shown too that, the maximum of effective field capacity was 49.93 m²/min, recorded at forward speed of 0.5 m/s, gathering reel speed of 0.94 m/s and mean of water level height of more than 150 cm. From the results it became clear that, the forward speed was more influential factor in the field capacity. Also results showed that, the field capacity was increased significantly with increasing of water level height, waterways and that's where it was a help to the movement of the machine more easily than it leads to increase field capacity of a new prototype device for mechanical control water-hyacinth plants in unit time and thus increase the efficiency of field.

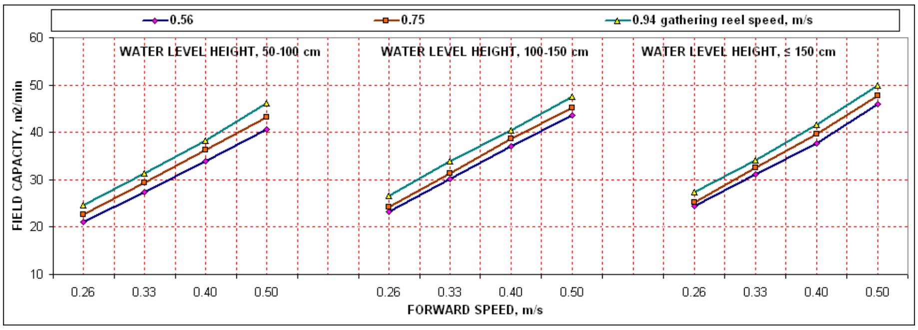


Fig. 3: Effects of forward speed, gathering reel speed and water level height on effective field capacity, m²/min.

B) Productivity:

Fig. 4 illustrates the effect of forward speed, gathering reel speed and mean of water level height on productivity. Increasing all of forward speed, gathering reel speed and mean of water level height trend to increase productivity. The maximum of productivity value was 6.017 Mg/h recorded with forward speed of 0.5 m/s, gathering reel speed of 0.94 m/s and mean of water level height more than 150 cm. While, the minimum value of productivity was 2.472 Mg/h recorded at forward speed of 0.26 m/s, gathering reel speed of 0.56 m/s and mean of water level height from 50 - 100 cm.

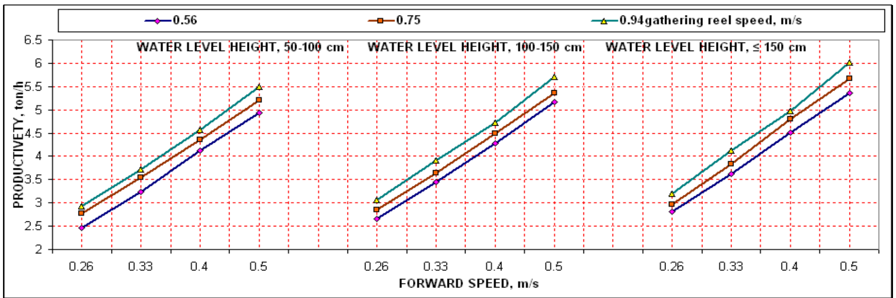


Fig. 4: Effects of forward speed, gathering reel speed and water level height on productivity, Mg/h.

C) Gathering efficiency:

The results presented in Fig. 5 show the effect of forward speed, gathering reel speed and mean of water level height on gathering efficiency. It is clear that, gathering efficiency was increased with increasing both of gathering reel speed and mean of water level height. While, it was decreased with increasing of forward speed. Maximum percentage of gathering was 98.82 % recorded with forward speed of 0.26 m/s, gathering reel speed of 0.94 m/s and mean of water level height more than 150 cm. While, the minimum percentage of gathering efficiency was 67.19 % recorded with forward speed of 0.5 m/s, gathering reel speed of 0.56 m/s and mean of water level height from 50–100 cm. Where, increasing of forward speed and gathering reel speed increase the front directing of plants into direction of conveyer loading to overload them reduced. From the results it became clear that the high water level in the waterway was the most influential factor in gathering efficiency, and because the high level of water makes plants floating away from the bottom and thus be more free in their movement can be assembled using the least amount of ability and increasing the speed of rotation of the cylinder assembly and also with the increase of water level height in streams it was a help to the movement of the machine more easily than was conducive to increasing the efficiency of the assembly of the machine and thus increase productivity.

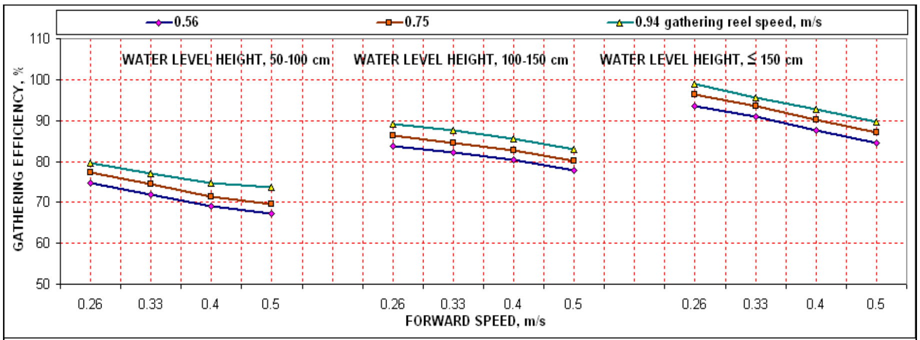


Fig. 5: Effects of forward speed, gathering reel speed and water level height on gathering efficiency, %.

D) Chopping efficiency:

Obtained results as shown in Fig. 6 indicated that, chopping efficiency was decreased with increasing forward speed and gathering reel speed. This is due to the increase in the rate of feed plants to chopping unit which increases the load on the chopping cylinder decreases the efficiency of chopping. Also, The maximum percentage of chopping efficiency was 87.41% recorded with forward speed of 0.26 m/s and gathering reel speed of 0.56 m/s. While, the minimum percentage of chopping efficiency was 78.72 % recorded at forward speed of 0.5 m/s and gathering reel speed of 0.94 m/s.

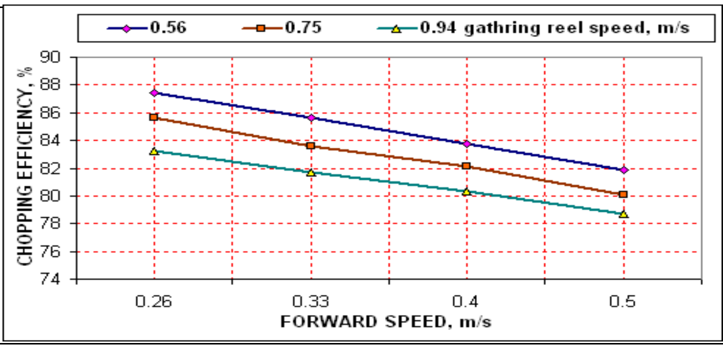


Fig. 6: Effects of forward speed and gathering reel speed on chopping efficiency, %.

E) Power consumption:

Data of machine power consumption as affected by different variables are shown in Fig. 7. The results show that, power consumption was had directly proportional with both of forward speed and gathering reel speed and it was had inversely proportional with mean of water level height. Power consumption tend to increase with increasing both of forward speed and gathering reel speed while it was decreased with increasing of mean water level height. Moreover, the maximum value of power consumption was 13.695 kW recorded with forward speed of 0.5 m/s, gathering reel speed of

0.94 m/s and mean of water level height from 50–100 cm. While, minimum value of power consumption was 10.285 kW recorded with forward speed of 0.26 m/s, gathering reel speed of 0.56 m/s and mean of water level height more than 150 cm. From the results it was clear that the power consumed was significantly less when the high water level in the waterway and it is easier for the machine to be in motion, and the plants are in free mode allowing compiled with the least amount of power consumed compared with the low level of water in the waterway.

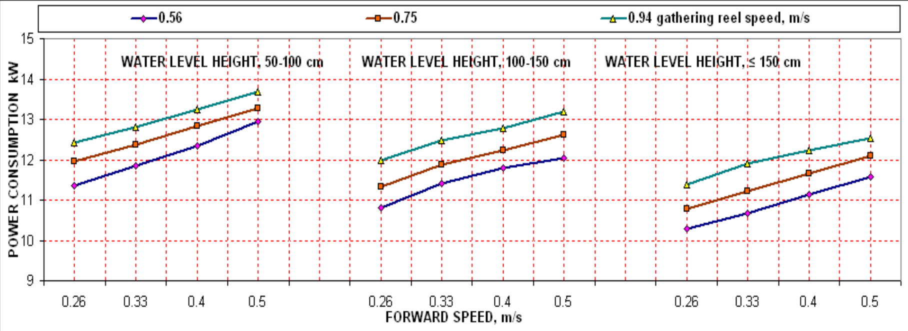


Fig. 7: Effect of the machine forward speed, gathering reel speed and water level height on power consumption, kW.

F) Machine losses :

Data and results of machine losses as affected by different variables are shown in Fig. 8. Results show that, machine losses decreased as gathering reel speed and mean of water level height increased. While, machine losses increased as forward speed increased. Also, results indicated that, machine losses have low percentage at all treatments with mean of water level height more than 150 cm. The minimum percentage of machine losses was 1.18% recoded with forward speed of 0.26 m/s, gathering of reel speed of 0.94 m/s and mean of water level height more than 150 cm. While, the maximum percentage of machine losses was 14.49 % recorded with forward speed of 0.5 m/s, gathering reel speed of 0.56 m/s and mean of water height from 50-100 cm. It can be concluded that, with the increase in water level in the waterways have been increasing the efficiency of the machine in the assembly plants, because the machine is in motion and the easiest plants to be in free mode allowing compiled and therefore was less than plants left in the waterway without assembling and so significantly.

G)Machine cost analysis :

Determination of operation machine cost as affected by different variables are shown in Fig. 9. The results indicated that, operation machine cost tend to increase with increasing both of forward speed and gathering reel speed while it was decreased with increasing of mean of water level height. Also, from above results it is clear that, forward speed was more influential factor on operation cost. Minimum value of operation cost was 24.55 L.E/h recorded with forward speed of 0.26 m/s, gathering reel speed of 0.56 m/s and mean of water level height more than 150 cm.

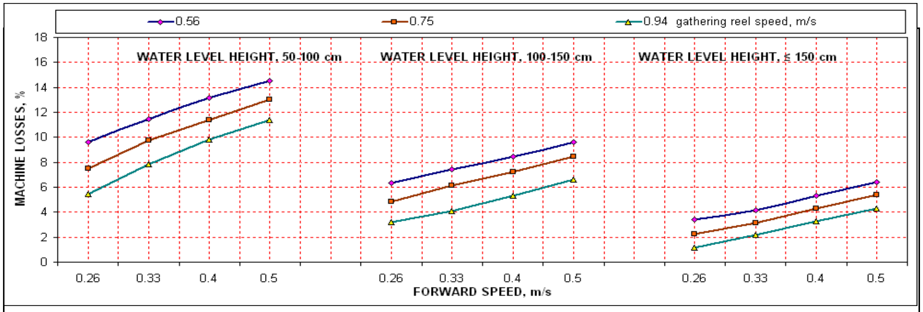


Fig. 8: Effects of forward speed, gathering reel speed and water level height on machine losses, %.

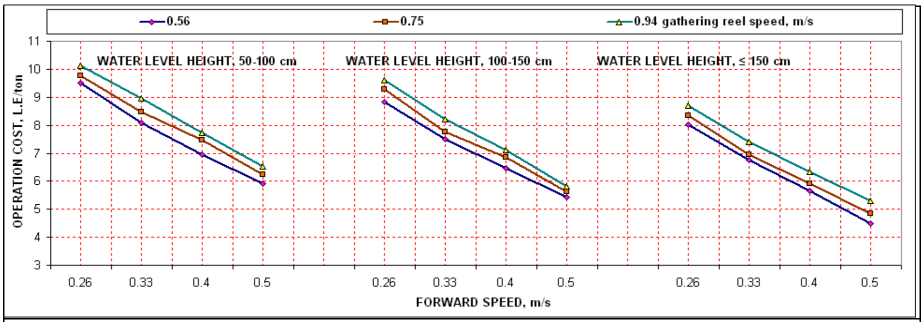


Fig. 9: Effects of forward speed, gathering reel speed and water level height on operation machine cost, L.E/h.

Conclusion

The aim of the present study is to test and evaluation a new manufactured device for harvesting water hyacinth plants from small canals and waterways. Evaluation the performance included study the effect of forward speed, gathering reel speed and water level height on some of water hyacinth device performance characteristics. The obtained results can be concluded as follows:

1- At determination all of field capacity and productivity for manufactured device, its were agreed directly relation with all of forward speed, gathering reel speed and with water level height. The maximum value of field capacity and productivity were 49.93 m^2/min and 6.017 Mg/h recorded with forward speed of 0.5 m/s, gathering reel speed of 0.94 m/s and water level height more than 150 cm.

2- Gathering efficiency was increased with increasing both of gathering reel speed and water level height. While, it was decreased with increasing forward speed. Maximum percentage of gathering efficiency was 98.82% recorded with forward speed of 0.26 m/s, gathering reel speed of 0.94 m/s and water level height more than 150 cm.

3- Chopping efficiency was decreased with increasing both of forward speed and gathering reel speed. While, it was not effect by water level height. Also, maximum percentage of chopping efficiency was 87.41% recorded with forward speed of 0.26 m/s, gathering reel speed of 0.56 m/s.
4- Machine losses was decreased with increasing all of forward speed, gathering reel speed and water level height.
5- Power consumption was agreed directly with increasing both of forward speed and gathering reel speed. While, it was agreed reversely relation with increasing water level height.
6- Minimum value of operation cost was 24.55 L.E/h recorded with forward speed of 0.26 m/s, gathering reel speed of 0.56 m/s and water level height more than 150 cm.

REFERENCES

"Apiris-invasive nonindigenous plants in florida." http://plants.ifas. ufl. edu/hyacin2. html (11/18/2005) "Aquatics"
http://pss.uvm.edu/pss123/aquatics.html (11/18/2005)

Chua, H. (1998). Bio-accumulation of environmental residues of rare earth elements in aquatic flora Eichhornia crassipes (Mart.) Solms. in Guangdong Province of China. The Science of Total Environment 214, 79-85.

de Casabianca, M.-L. and Laugier, T. (1995). Eichhornia crassipes production on petroliferous wastewaters: effects of salinity. Bioresource Technology 54, 39-43.

Gopal, B. (1998). Aquatic weeds: from weed control to plant management. In: Monteiro, A., et al.(Eds.) Management and ecology of aquatic plants. Proceedings of the 10th EWRS International Symposium on Aquatic Weeds, Lisbon, Portugal, 21-25 September 1998.Doorwerth: European Weed Research Society. pp. 357-360.

Hunt, D. (1984). Farm power and machinery management. 8^{th} ed. Iowa state univ., press Ames, USA pp: 364-368.

Julien, M.H., Griffiths, M.W. & Stanley, J.N. (2001). Biological control of water hyacinth 2. The moths Niphograpta albiguttalis and Xubida infusellus: biologies, host ranges, and rearing,releasing and monitoring techniques. Canberra, Australia.

Khalil A.A.;Khalifah M.M.; Hamdy S.M. and Kosba M.A. (1975). Dried water hyacinth as a partial substitute for corn in a chick starter diet. Alex J Agric Res 1:47-51

Maine, M.A.; Duarte, M.V. and Sune, N.L. (2001).Cadmium uptake by floating macrophytes. Water Research 35, 11, 2629-2634.

Maine, M.A.; Sune, N.L.; Panigatti, M.C. and Pizarro, M.J. (1999). Relationships between water chemistry and macrophyte chemistry in lotic and lentic environment. Arch. Hydrobiol. 145 (2), 129-145.

Mangabeira P.A.O.; Labejof, L.; Lamperti, A.; de Almeida, A-A.F.; Oliveira, A.H.; Escaig, F.; Severo, M.I.G.; da C. Silva, D.; Saloes, M.; Mielke., M.S.; Lucena, E.R.; Martinis, M.C.; Santana, K.B.; Gavrilov, K.L.; Galle, P. and Levi-Setti, R. (2004). Accumulation of chromium in root tissues of Eichhornia crassipes (Mart.) Solms. in Cachoeira river – Brazil. Applied Surface Science 231-232, 497-501.

Mara, M.J. (1976). Estimated costs of mechanical control of water hyacinths. Journal ofEnvironmental Economics and Management 2(4), 273-294.

McComas, S. (1993). LakeSmarts: The First Lake Maintenance Handbook. Terrene Institute, Washington District of Columbia.

Reddy, K.R. and Sutton, D.L. (1984). Water hyacinths for Water Quality Improvement and Biomass Production. J. Environ. Quality 13, 1-8.

Perna, C. & Burrows, D. (2005). Improved dissolved oxygen status following removal of exotic weed mats in important fish habitat lagoons of the tropical Burdekin River floodplain, Australia. Marine Pollution Bulletin 51(1-4), 138-148.

Sim, C.H. (2003). The use of constructed wetlands for wastewater treatment. Water International – Malaysia Office, 24.

Singhal, V. and Rai, J.P.N. (2003). Biogas production from water hyacinth and channel grass used for phytoremediation of industrial effluents. Bioresource Technology 86, 221-225.

So, L.M.; Chu, L.M. and Wong, P.K. (2003). Microbial enhancement of CU2+ removal capacity of Eichhornia crassipes (Mart.). Chemosphere 52, 1499-1503.

Velašević, V. and Đorović, M. (1998). Uticaj šumskih ekosistema na životnu sredinu. Šumarski fakultet,Beograd.

Villamagna, A.M. & Murphy, B.R. (2010). Ecological and socio-economic impacts of invasive water hyacinth (Eichhornia crassipes): a review. Freshwater Biology 55(2), 282-298.

Wanda, F.M. (1997). The impact of water hyacinth Eichhornia crassipes (Mart.) Solms (Pontederiaceae) on the abundance and diversity of aquatic macroinvertebrates in northern Lake Victoria, Uganda. MSc Thesis, Delft, The Netherlands, International Institute of Infrastructural, Hydraulic and Environmental Engineering.

Wilson, J.R.; Holst, N. and Rees, M. (2005). Determinants and patterns of population growth in water hyacinth. Aquatic Botany 81, 51-67.

Wittenberg, R. & Cock, M.J.W. (2001). Invasive Alien Species: A Toolkit of Best Prevention and Management Practices. Wallingford, Oxon, UK: CAB International

تصنيع جهاز جديد يناسب المقاومة الميكانيكية لنباتات ورد النيل.

عاطف عزت اليمانى , رفعت محمد غازى المرحومى و سمير عبد الحميد شلبى
قسم بحوث نظم ميكنة العمليات الزراعية – معهد بحوث الهندسة الزراعية- الدقى -الجيزة - مصر

ورد النيـــل يعد من أهم الحشائش السائدة سريعة النمو والانتشار بالقنوات والترع والمصارف المصرية. وهذه النباتات تغطى مساحة سطحية مائية قدرها حوالي 14928000م٢تقريبا(وزارة الزراعة, نشرة فنية رقم :2011/5) . ونظرا لخطورة انتشار هذا النبات وتأثيره على الموارد المائية المصرية والتي تتمثل في تبخر كميات هائلة من المياة من أسطح النيل والمجارى المائية الفرعية بالإضافة إلى إعاقة الملاحة والصيد فأنة يتم مقاومته بطرق ميكانيكية أو كيماوية أو بيولوجيه لمنع تراكمه بالمسارات المائية. ومن خلال هذا البحث تم تصنيع آلة جديدة يمكن أن تساهم في التغلب على ورد النيل عن طريق تجميعه داخل وحدة رفع خاصة تتكون من مضرب دوار مثبت على محيطة أربعة ازرع على كل منها يحتوى على عدد عشرة شوك طول كل منها 50سم. النصف الأعلى من هذه الشوك مغطى بوسائد مطاطية. وهذه العوارض تدار عن طريق صندوق تروس جانبي يستمد حركته من موتور الإدارة خاص ذات قدرة 20 حصان (14.7ك.وات) بينما يتم إدارة القارب عن طريق موتور ذات قدرة 30 حصان (22 ك.وات). ونتيجة لدورانها فأنها تقوم بتجميع النباتات من الترعة أو المجرى المائي وتدفعه إلى داخل حيز عمل الآلة ومنها تتجه النباتات إلى بريمة أفقية مزود ببعض الشفرات التي تقوم بفرم و طرد هذه النباتات إلى خارج الآلة تحت تأثير قوى الطرد المركزي ليتم دفنها تحت سطح الماء وبالتالي فأنة يتم التخلص منها.

المعاملات التجريبية للدراسة:

أ- سرعة التقدم الأمامية حيث يتم إجراء الدراسة عند ثلاثة سر عات(0.26, 0.33, 0.4, 0.5م/ ث) .

ب- سرعة دوران مضرب التجميع حيث يتم إجراء الدراسة عند ثلاثة سرعات(0.56, 0.75, 0.94 م/ث).

ج- ارتفاع منسوب المياة في المجرى المائي(50-100 , 100- 150 , >150 سم) .

القياسات المطلوبة:

السعة النظرية والفعلية للآلة - إنتاجية الآلة, ميجا جرام/ساعة - كفاءة تجميع النباتات, ٪ - كفاءة الفرم ,% - النسبة المئوية للنباتات المتروكة دون تجميع ,٪ - القدرة اللازمة للعملية, ك.وات - تكاليف التشغيل للآلة, جنيها/ميجا جرام.

وقد أمكن الحصول على النتائج التالية :-

1- كل من السعة الحقلية والإنتاجية للآلة المصنعة كانت تتناسب طرديا مع كل من سرعة التقدم و سرعة مضرب التجميع و ارتفاع مستوى المياة في المجرى المائي .وكانت أقصى قيم لها هي49,93م٢/د و 6,017 ميجا جرام/ساعة على الترتيب .سجلت عند سرعة تقدم 5, م/ث, سرعة دوران مضرب التجميع 0,94 م/ث,و مستوى ارتفاع المياة في المجرى المائي اكبر من 150 سم.

2- كفاءة تجميع النباتات كانت تزداد بزيادة كل من سرعة دوران مضرب التجميع و ارتفاع مستوى المياة بالمجرى المائي بينما كانت تقل بزيادة سرعة التقدم. أقصى نسبة لها كانت 98,82 ٪ سجلت عند سرعة تقدم 0,96 كم/ساعة, سرعة مضرب التجميع 0,94 م/ث,و مستوى ارتفاع المياة في المجرى المائي اكبر من 150 سم.

3- كفاءة الفرم كانت تقل بزيادة كل من سرعة التقدم و سرعة دوران مضرب التجميع وذلك لزيادة معدل التلقيم بينما كانت لا تتأثر بارتفاع مستوى المياة فى المجرى المائى. أقصى نسبة لها كانت 87,41٪ سجلت عند سرعة تقدم 0,26 م/ث , سرعة دوران مضرب التجميع 0,56 م/ث.

4- فاقد الآلة كان يقل مع زيادة كل من سرعة التقدم للالة و سرعة دوران مضرب التجميع و ارتفاع مستوى المياة في المجرى المائي.

5- القدرة المستهلكة كانت تتناسب طرديا مع زيادة كل من سرعة تقدم الالة و سرعة دوران مضرب التجميع بينما كانت تتناسب عكسيا مع زيادة ارتفاع مستوى المياة فى المجرى المائي.

6- اقل تكاليف تشغيل للآلة كانت24,55 جنية/ساعة سجلت عند سرعة تقدم 0,26م/ث, سرعة مضرب التجميع 0,56 م/ث,و مستوى ارتفاع المياة في المجرى المائي اكبر من 150 سم.

قام بتحكيم البحث

أ.د/ ماهر ابراهيم عبد العال	**كلية الزراعة - جامعة المنصورة**
أ.د/ ابراهيم صلاح يوسف	**مركز البحوث الزراعيه**