A MECHANICAL DEVICE FOR ERADICATION OF SUBMERGED AQUATIC WEEDS

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This paper embodies details and method of operation of a mechanical device developed for eradication of submerged aquatic weeds. The economics of operation is also discussed.

INTRODUCTION

Eradication of underwater weeds presents a formidable problem in reclaiming derelict water areas for fish culture and maintaining them thereafter. The important methods attempted for eradication of the underwater weeds in India are: 1) Clearing by manual labour, 2) Use of weedicides and chemicals and 3) Biological control by introducing fishes and the like which subsist on the weeds.

Of these, the manual method is quite suitable for small and shallow waters. Biological method such as introducing grass carp etc, which use the weeds as food has not met with appreciable success due to the sheer volume of weeds to be controlled. The chemical method is suitable for larger areas (Ramachandran, 1960, 1962) but has certain important drawbacks (Alikunhi 1957). The chemicals used for killing the weeds being toxic are often injurious to fish and other aquatic life as well as to the animals which depend on the water spread for their normal sustenance. The use of these toxic substances require expert supervision and their costs and handling charges are quite often prohibitively high. Further, chances of regeneration of the vegetation are also relatively more and in many cases the chemical, which has lost its initial toxicity acts as a manure. Removal of dead weeds as a result of chemical treatment also poses a problem.

Investigations were, therefore, undertaken to develop for deweeding, a mechanical device which will be portable, simple and economical for operation by ordinary fishermen.

DESCRIPTION OF EQUIPMENT

The equipment developed consists of a rake for uprooting the weeds, an engine driven winch for pulling the rake, a barge (float) or trolley for installation of the winch and engine and a boat for operating the rake.

Barge: Fig. 1 shows the details of the barge.

This is a floating platform, approximately 4m x 3.5 m, built by using 12 nos of oil drums of 225 litres capacity each. The barrels are connected by 75 x 40 mm M. S. channels by bolting them to 50 mm x 50 mm M. S. angles, welded to the barrels. A winch, similar to a two-drum trawl winch (Fig. 1 a) is installed on the barge and is coupled to a 10 H. P. diesel engine, running at 1500 rpm and having a 3 : 1 reduction gear and a clutch.

Rake: Details ot the rake which was developed after a number of trials are given in Figs. 2a and 2 b.

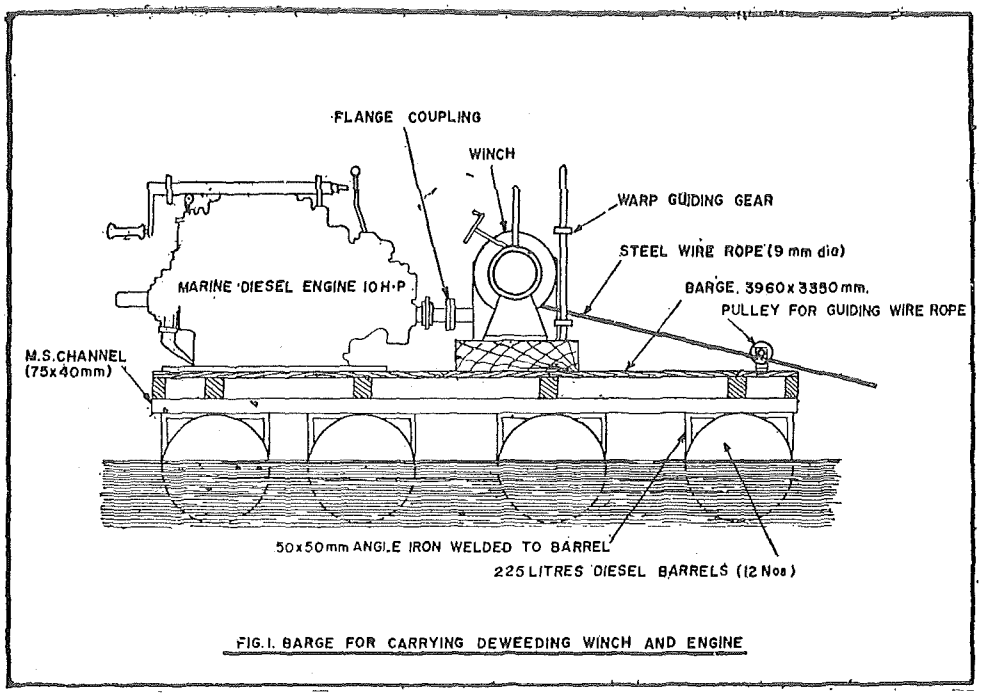

FIG. 1. BARGE FOR CARRYING DEWEEDING WINCH AND ENGINE

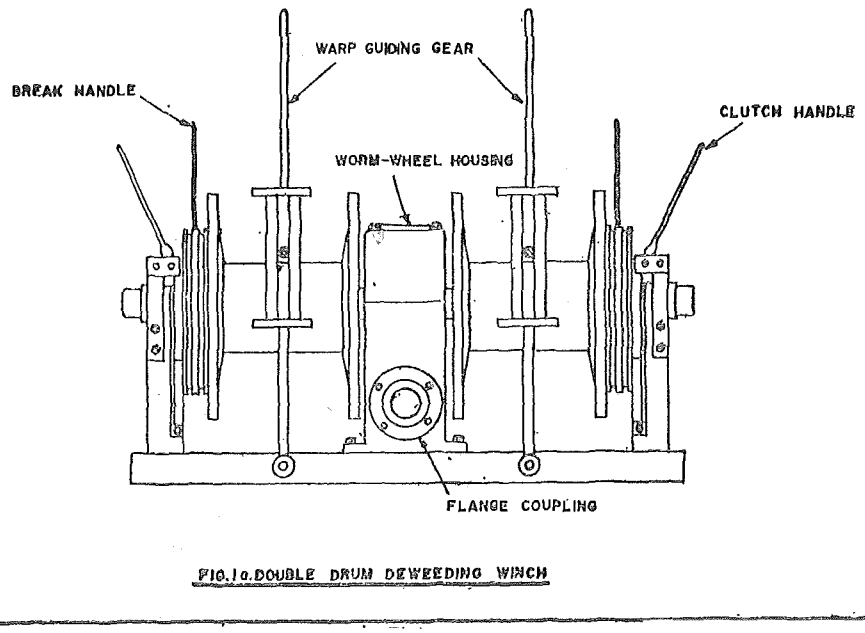

FIG. 1a. DOUBLE DRUM DEWEEDING WINCH

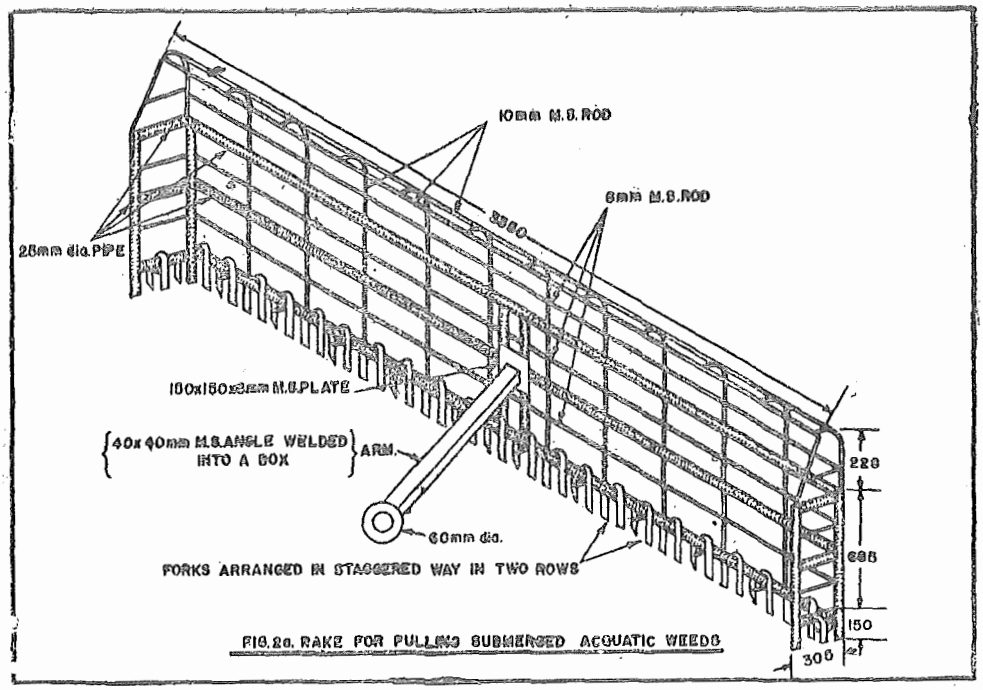

FIG.2a. RAKE FOR PULLING SUBMERGED ACQUATIC WEEDS

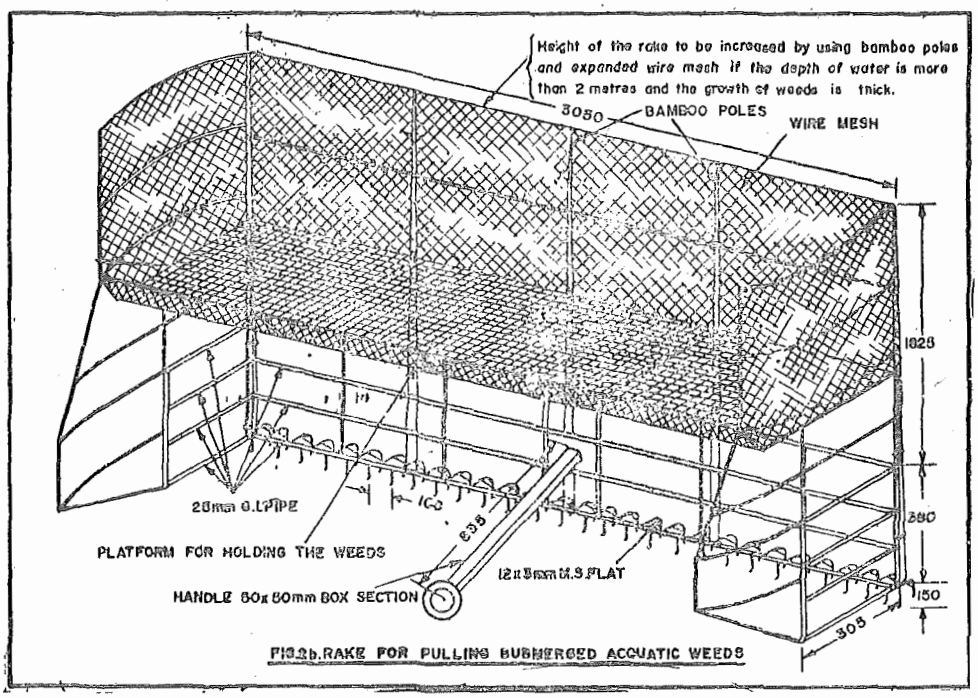

FIG.2b. RAKE FOR PULLING SUBMERGED ACQUATIC WEEDS

It has a rectangular frame work with curved sides and top to prevent escape of the weeds as the rake is pulled. Forks of 150 mm length are welded all along the bottom, in two rows and in a staggered manner for pulling the weeds with roots. An arm is welded at the middle of the rake slightly below its geometric centre.

METHOD OF OPERATION.

The equipment was operated in the following four combinations to work out the most efficient and economical method*.

*Removal of the uprooted weeds from the rake and their subsequent handling was carried out manually throughout.

1) Partially mechanised operation with one rake, 2) Partially mechanised operation with two rakes, 3) Fully mechanised operation with one rake and 4) Fully mechanised operation with two rakes.

Partially mechanised operation with one rake. The method of operation of this equipment is schematically shown in Fig. 3.

The barge is kept near the bank and the wire rope is taken through two or more pulleys fixed on the ground. The free end of the warp is connected to the arm of the rake by means of a removable shackle.

The rake is kept on a boat (Fig. 4) on brackets specially provided for this purpose The wire rope in the winch is then slowly unwound and sufficient length of this is collected in the boat. This is necessary, since it is not possible to row the boat simultaneously while the warp is paid off the winch, as the wire rope gets entangled with the weeds and offers too much resistance to the movement of the boat. The rake is taken to the spot where the weed is to be removed and dropped into the water. The winch is now engaged and the rake uproots the weeds and carries them to the bank, as it is pulled through the weed infested area. The weeds are manually removed from the rake and dumped on the bank. By this time the boat also comes back. (It is not necessary to row the boat while coming back. The boat is pulled along with the rake by tieing a float-line on to the rake and holding the line as soon as the rake is dropped into the water.) The rake is again loaded on the boat and this process is repeated by dropping the rake in adjacent spots successively. It is possible to clear a semi-circular area the radius of which is equal to the effective length of the wire rope in each drum, before moving the barge to another place. No stay or any such arrangement is required for holding the barge, as it keeps its position by butting against the bank. The front portion of the barge has additionally been strengthened for this purpose.

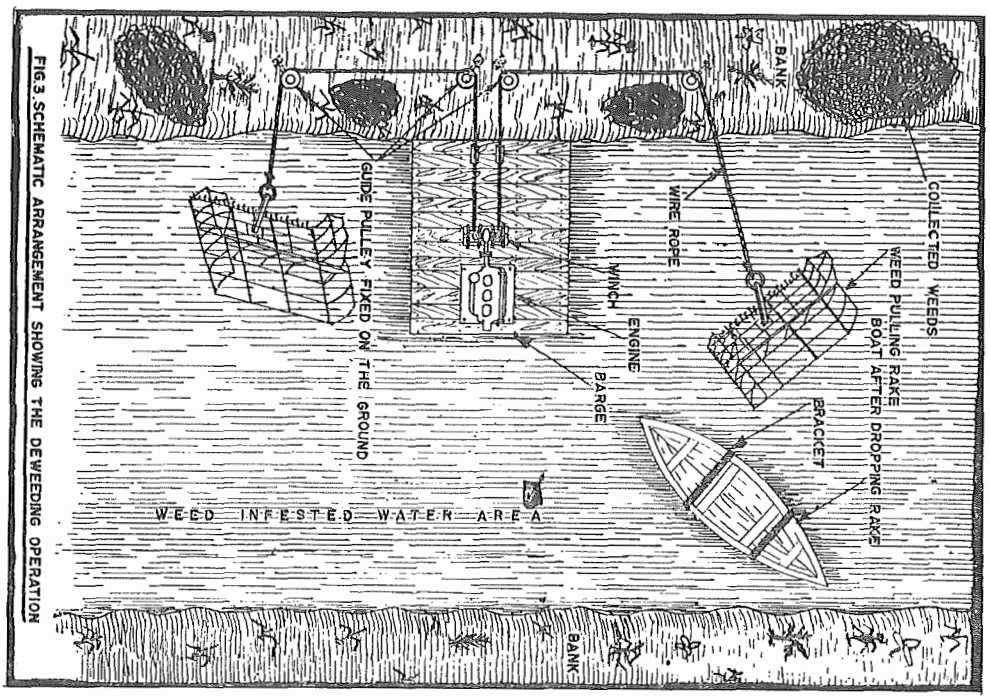

FIG.3. SCHEMATIC ARRANGEMENT SHOWING THE DEWEEDING OPERATION

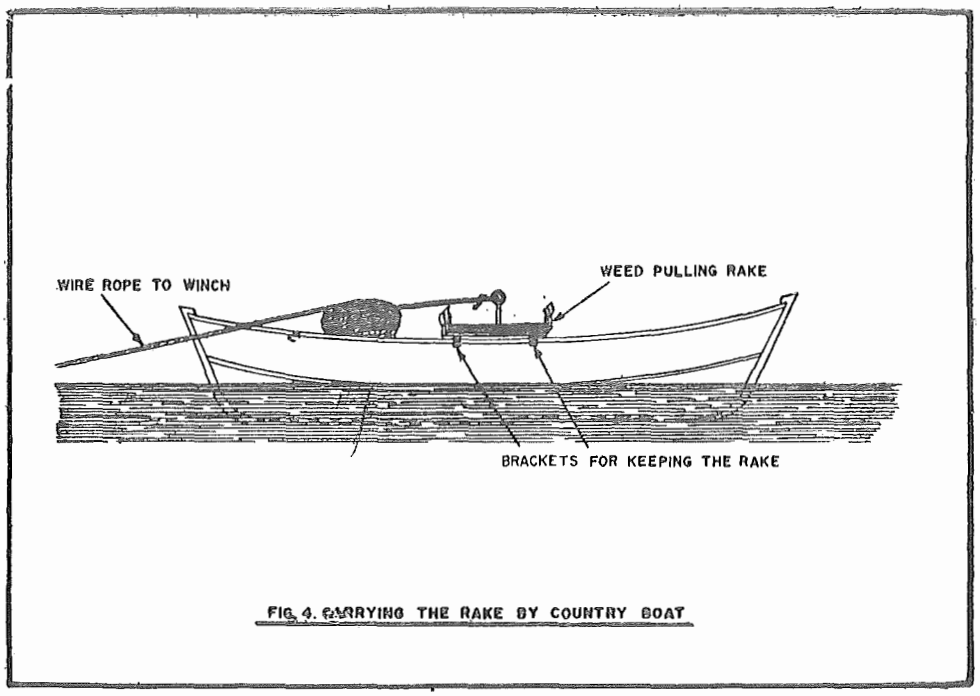

FIG. 4. CARRYING THE RAKE BY COUNTRY BOAT

Partially mechanised operation with two rakes. This is the same as the one rake operation except that two rakes are used by utilizing both the drums of the winch. When one rake is pulled to the bank, the other one is loaded on the boat thereby saving the time taken for removing the weeds from the rake just then pulled. This increases the speed of operation considerably.

Fully mechanised operation using one rake: In this method both the dropping and hauling of the rake is mechanised. All arrangements are the same as for partially mechanised operation except that a powered boat is used for carrying and dropping the rake. A 10 H. P. outboard motor with a large propeller is used to propel the boat. Alternatively a 5 H. P. inboard diesel engine can also be used for this purpose.

The boat is brought near the bank, the stern facing the bank. The rake is lifted and hooked to the "quick-release-mechanism" fitted to the boat (Fig. 5).

In this method it is not necessary to collect the warp in the boat beforehand since the engine has sufficient power to propel the boat as well as to pull the warp as it is paid off the winch.

Fully machanised operation using two rakes: In this arrangement two rakes are operated instead of one by using both the drums of the winch.

Results and discussion

Results of the trials are presented in Table I.

This equipment is found to be quite effective in clearing underwater, rooted weeds such as Hydrilla, Naias, Nymphea, Lotus, etc which are commonly found in various parts of India. This method is not quite suitable for removal of reeds, grass and vallisneria. These weeds however do not present, any serious problem so far as pisiculture is concerned. It is possible to obtain upto 95% clearance by using this equipment. The cost of clearance per hectare using this device ranges between Rs. 150–241 while the manual method costs Rs 333–379. This method is not only

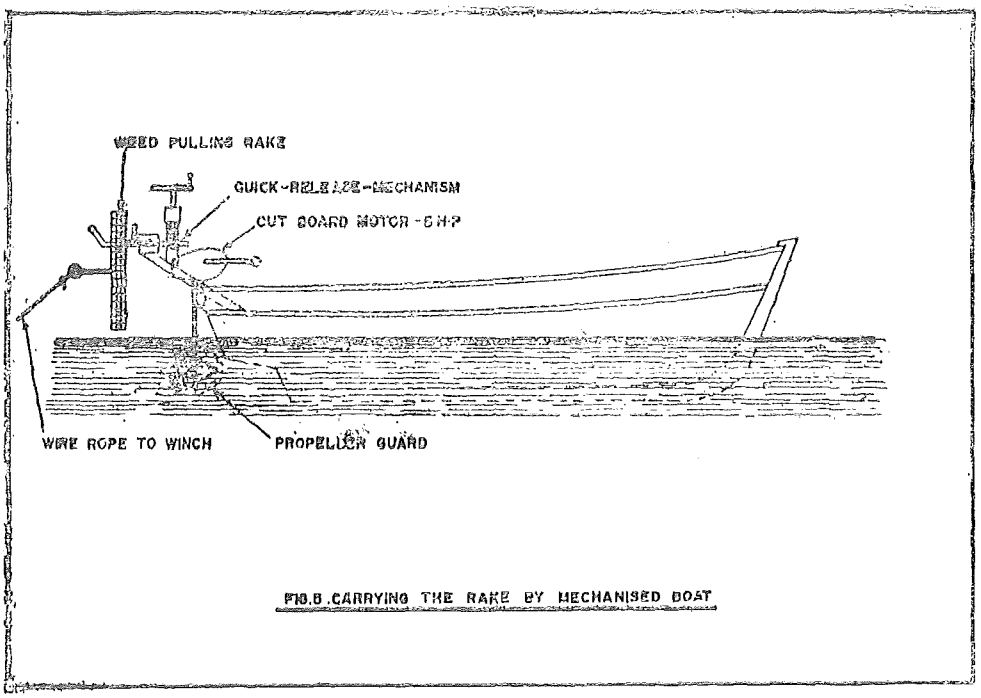

FIG.8 CARRYING THE RAKE BY MECHANISED BOAT

cheaper compared to manual method but possesses other advantages too which can be summarised as follows:

1) This equipment can be used in any place irrespective of the depth of water, 2) No harmful chemical is introduced and does not interfere with normal usage of the water for drinking, bathing etc. 3) The rake releases poisonous gases entrapped at the bottom as it ploughs through mud and 4) This can be operated by ordinary fishermen with a little training.

Even though the fully mechanised operation, using two rakes was found to be the most economical method, considerable difficulty was experienced in keeping the course of the boat and navigating it through the weed infested water. This method can be used with advantage where the growth of weeds is sparse or where the first half to one meter depth of water from surface is free from weeds.

From the trials it is concluded that partially mechanised operation using two rakes with engine driven winch installed on a barge is the most suitable method for medium size water areas upto about 15 hectares and having a depth range of 1.5 to 5 metres. Where the water area is small, say 5 hectares and below, a single drum winch coupled to a 5 H. P. diesel engine and installed on a portable trolley can be used. Only one rake will be used in this case. The estimated capital cost of equipment in the former case is Rs 12,000 while in the latter case it works out to Rs 8,000.

This equipment will not however be suitable for larger water areas because of the comparatively slow rate of clearing. Work is in hand to develop a faster method suitable for larger water areas.

Problem of Regeneration of the Weeds: After clearing the weeds it is noticed that there is some regeneration after a period of 2 to 3 months. This regeneration is mainly out of the broken parts of the weeds which sink to the bottom and from left out roots and stems. It is further observed that when one type of weed is cleared completely, an entirely different type grows and chokes the waters. It is however expected that two or three repeated operations at suitable intervals,

TABLE I COST OF OPERATION OF DIFFERENT COMBINATIONS.

Cost of diesel oil/litre = Rs 0.88
Cost of petrol/litre = Rs 1.00
Labour charges for skilled worker Rs 6/- for 8 man hrs.
Labour charges for unskilled worker Rs 4/- for 8 man hrs.

Depth range of water = 5—3.5 metre
Tpye of underwater weeds. = Hydrilla, Naias, Nymphea, Lotus etc.

Sl No.	Description of the type of operation	Total period of operation (Hrs.)	Diesel oil used in main engine (litres)	Petrol used in out board motor	Total cost of fuel (4+5) Rs	Unskilled labour (man hrs)	Wages for unskilled labour Rs	Skilled labour (man hrs)	Wages for skilled labour Rs	Total cost of operation 6+8+10 Rs	Area cleared (sq. metre)	Cost for clearing 1 hectare (10,000sq. metres) Rs	
1	2	3	4	5	6	7	8	9	10	11	12	13	
1.	Partially mechanised operation with one rake.	8.0	12.0	Nil	10.56	64	32.00	8	6.00	48.56	2200	220.60	
		12.0	17.40	,,	15.31	96	48.00	12	9.00	72.31	3000	241.00	
2.	Partially mechanised operation with two rakes	5.00	9.60	Nil	8.45	50	25.00	5	2.75	37.20	2200	169.00	
		9.00	18.70	,,	16.46	90	45.00	9	6.75	68.21	4100	166.50	
3.	Fully mechanised operation with one rake.	7.00	12.20	14.0	25.26	56	28.00	7	5.25	58.52	3600	162.60	*
		10.00	18.50	19.5	38.78	80	40.00	10	7.50	83.23	4800	173.50	
4.	Fully mechanised operation with two rakes.	8.00	15.20	18.5	31.88	80	48.00	8	6.00	85.88	5700	150.50	
		10.5	20.00	21.65	39.20	106	163.00	10.5	7.88	110.08	6500	189.20	
5.	Manual method	8.0	...	...	...	80	40.00	...	...	40.00	1200	333.60	**
		6.5	...	...	...	66	32.50	...		32.50	860	379.00	

NOTE: Interest and depreciation on the capital cost has not been taken into account.

* Considerable difficulty was experienced in keeping the course of the boat due to the warp getting entangled with the weeds.

** The weeds were not pulled with roots. Speed of clearing was slow.

with simultaneous fish culture will keep the weeds under control.

Best Period for Removal of Weeds: Most of the weeds grow luxuriantly during monsoon and their growth is the thickest just after monsoon. These start decaying within 2—3 months after the end of the monsoon and by the time summer approaches this process is almost complete.

The best period for clearing the weeds is therefore after the end of the monsoon but before the weeds start decaying.

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