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APPLICATION OF OXADIARGYL SOLUTIONS FOR CONTROL OF DUCKWEED (*LEMNA MINOR*) IN FRESHWATER AQUACULTURE PONDS

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ABSTRACT ■ This work emphasize on to find out the effective dose ratio of Oxadiargyl solution for control of duckweed (*Lemna minor)* in intensive Indian Major Carp (IMC) culture pond and their impact on non target animals. Experimental results revealed that application of Oxadiargyl is very much effective for controlling *Lemna minor*. The optimum dose selected for the field trial is 450 mg /liter of water and it is not only effective in controlling 90% weed growth but also does not show any sign of harm to non target organisms. Moreover, it increases the dissolved oxygen content in water body. Pathological test of experimental fishes does not show any deviation of hematological parameter i.e. hemoglobin percentage of *Labeo rohita* is 2.9 gm and simultaneously it indicates the effectiveness of chemical potentialities of the weedicide. So Oxadiargyl is very much effective for duck weed control and it helps the fish farmers in cost effective way to solve weed growth problem. Hence, the farmers can achieve maximum production beyond their expectation. The production cost is minimizing due to minimum expenses for weed control and also income will be high due to much more production of fish. Therefore, weedicide application for controlling duck weed is less expensive than manual labour.

Key words: Duckweed, fish production, chemical control, optimum dose, Indian Major Carp.

INTRODUCTION

Aquatic plants are the main source of biomass production in aquatic ecosystem (Esteves, 1998). They conserve solar energy as chemical energy for the development of food chain of aquatic fauna. During photosynthesis these plants add oxygen to water which are later utilized by various aquatic lives (fish, crustacean) to satisfy their respiration need. Aquatic vegetation helps in reducing the pollution load of water bodies by absorbing several pollutants. Thus in reality without aquatic vegetation, water bodies would be just 'wet desert'. On the other hands the excessive growth of these plants may cause a number of inconveniences related to water supply, transportation, fishing, energy production and proliferation of disease among others. From an environment point of view, some fast growing species may suppress other less aggressive species which are required in sufficient number to maintain diversity, or

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may negatively modify some of the physical characteristics of water (Cardoso *et al* , 2003). *Lemna minor* is a free floating weed which has a severe importance in aquaculture but it has negative impact on fish. It is controlled by manual, biological & chemical method. Manual control is very costly and though biological control is eco-friendly but it takes longer time. So, chemical control is very much effective to control the weeds because it saves both in time and operation cost. Chemical control is done by herbicide or weedicide. The *Eichhornia crassipes* (Water hyacinth) may be controlled through the application of 9 ml Gramoxone (24% paraquat dichloride) and 1 ml surfactant per 1000 ml of water. It was not only effective in controlling 90% weed growth but also did not harm to non-target organisms (Mandal *et. al.* 2009).

Duckweeds are also functions as a bioremediator by effectively filtering contaminants such as bacteria, nitrogen, phosphates, and other nutrients from naturally occurring bodies of water, constructed wetlands and waste water. Duck weed is a free-floating aquatic plant and these rapidly-growing plants have found uses as a model system for studies in community ecology, basic plant biology, in ecotoxicology, in production of biopharmaceuticals, and as source of animal feeds for agriculture and aquaculture. The duckweed used for toxicity testing of pollutants in waste waters (Wang, 1992; Barber *et al*., 1995; Verma, 2007). The aquatic plant *Lemna minor* represent a high growth rate and have been used for removal of heavy metals from polluted water bodies (Maine *et al*., 2001; Cardwell et al., 2002). Inspite of these, it creates severe problems in respiration by clogging gills of fishes at the time of farming.

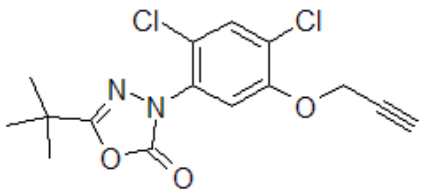
MATERIALS AND METHODS

The experimental work is carried out at WBCADC centre at Dalapatipur of Debra Block under Paschim Medinipur district of West Bengal. The dimension of pond was 44ft length; 32ft width; 1408 sq ft surface area and the volume of pond were 12672 cu ft. *Lemna minor* is commonly known as duckweed. It is a floating freshwater aquatic plant with one, two or three leaves, each with a single root hanging in the water; as more leaves grow, the plants are divided and become separate individuals. The root is 1-2 cm long. The leaves are oval, 1-8 mm long and 0.6-5 mm broad, light green with three (rarely five) veins, and small air spaces to assist flotation.

Taxonomic status of *Lemna minor* (Linnaeus, 1758)

Kingdom – Plantae
Subkingdom – Viridaeplantae
Division – Tracheophyta
Subdivision – Spermatophytina
Class – Magnoliopsida
Order – Alismatales
Family – Araceae
Genus – *Lemna*
Species - *minor*

The Indian major carps especially *Labeo rohita* are used as experimental fish species in aquaculture pond to which weedicide is being used for control of duckweed. The fingerlings of *Labeo rohita* has released at the ratio of 10,000 pieces per hectre water area. The Oxadiargyl is an effective weedicide having chemical name 5-tert-butyl-3-[2,4-dichloro-5-(2-propynyloxy) phenyl]-1,3,4-oxadiazol-2(3H)-one and empirical formula is $C_{15}H_{14}Cl_2N_2O_3$ and structural formula is as-



It is widely used in Bangladesh, Bulgaria, Cameroon, Chile, China, Colombia, Costa Rica, Croatia, Cuba, Dominican Republic, Ecuador, Egypt, France, Guatemala, India, Indonesia, Iran, Iraq, Israel, Italy, Ivory Coast, Japan, Korea (South), Mauritius, Myanmar, Nicaragua, Nigeria, Pakistan, Panama, Peru, Philippines etc. The physico-chemical analysis of water i.e. most of these properties like, water temperature, pH, DO, alkalinity etc. are measured as the methods developed by APHA, 2005 with appreciable degree of accuracy. The spraying solution has been prepared manually with combination of water and Oxadiargyl compound. After properly compilation of the solution, it has spread with hand sprayer in experimental pond infested with *Lemna minor*.

RESULTS AND DISCUSSION

The weed is found in freshwater aquatic environment including pond, canal, ditches etc. The weed causes severe harms in respiration by clogging gills during the culture practices. After 6 months culture period, the experimental pond is severely infested with *Lemna minor* and results are recorded in different phases and tabulated below:

From the outcome results, it is indicated that too much weedicides application is causing severe harm to the fishes, but at a proportionate dose ratio i.e. Water: Oxadiargyl = 4:3, it not only destroy *Lemna minor* but also does not create any harm to non-target organisms. Therefore, 4:3 ratio is very much effective to control overgrown *Lemna minor* in a cost effective manner.

The results of physico-chemical parameters of water have been recorded in following table:

DATE & TIME	DOSE RATIO	PERIOD OF ACTON ON *Lemna minor*	EFFECT ON FISH
05/07/2010 2.00 pm	Water: oxadiargyl = 1:1 (lt) (gm)	*Lemna minor* started destroying in next day and fully destroyed in 6 – 7th days.	15 % fish are died
12/07/2010 2.00 pm.	Water: oxadiargyl = 4:3 (lt) (gm)	*Lemna minor* started destroying in next day and fully destroyed in 4th days.	No one has been died
19/07/2010 2.00 pm	Water: oxadiargyl = 2:1 (lt) (gm)	*Lemna minor* started destroying in next day and fully destroyed in 8th days.	60 % fishes are died

DATE	WATER TEMPERATURE (°C)	pH	DO (mg/lit)	ALKALINITY (mg/lit)
Before application of weedicide	31	7.2	5.65	97.45
05/07/2010	32	7.5	8.73	94.12
12/07/2010	31	7.3	8.22	93.50
19/07/2010	32	7.2	8.38	98.00

The tabulated result does not indicate any change after employing Oxadiargyl solutions in freshwater fish culture pond but also increases the dissolved oxygen level that was very much essential for surviving of aquatic animals. Pathological report of hematological test does not indicate any deviation of hemoglobin percentage. Haemoglobin percentage of experimental fish species was 2.9 gm %.

It can be mentioned herewith that Oxydiargyl is one of the chemicals with which very few work have been done. Analysis of results showed that application of Oxadiargyl is very much effective in controlling *Lemna minor*. The optimum dose of selected for the field trial (i.e. 450 mg /lit of water) is not only effective in controlling 90% weed growth but also does not show any sign of harm to non-target organisms . The weeds are 90% killed. So Oxadiargyl is very much effective for weed control. The DO and pH level of the water gradually increases after spraying of Oxadiargyl solutions.

The economics of the chemical treatment as well as manual control are as follows:-

Item of inputs	Rate/ Ratio	Manual operation	Weedicide application
Labour	No. of labour – 5 Charges - Rs. 50/- Four times in a week (i.e, 5 x 4 x 50)	Rs. 1000/-	
	In one year (1000 x 12)	Rs. 12000/-	
Labour	No. of labour – 1/month Charges – Rs. 50/- Annually cost		Rs. 600/-
Hand sprayer	Hire charge Rs. 30/-/ Annual cost		Rs. 360/-
Weedicide	Total cost Rs. 120/-		Rs. 120/-
		Total cost- Rs. 12000/-	**Total cost- Rs. 1080/-**
		Surplus from weedicide control	**Rs. 10,920/-**

The number of labour was 5 and pay Rs.50/- per person in a week, in one month they have been paid 5 x 4 x 50 = 1000/- and in a year it becomes Rs.1000 x 12 = 12000 /- . On the other hand, for weedicide application, one labour is sufficient round the month. The weedicide cost is 120/-, annual hand sprayer cost is 360/-, labour cost is 50/per month and annual labour cost is about Rs.50 x 12=600/- . The total cost involved in a year is about Rs. (120+360+600)-= 1080/-. So, the weedicide application is very much cheaper method than manual labour and saved amount was Rs. 10,920/-. In this way we can minimize the labour cost during the culture period and also achieve maximum fish production per unit water area.

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