REPORT ON THE USE OF ALKALI SOIL AND SODIUM CARBONATE AS SEALANTS FOR CONTROLLING SEEPAGE LOSSES IN FISH PONDS

COLLABORATIVE RESEARCH PROGRAMME

CENTRAL INLAND FISHERIES RESEARCH INSTITUTE • BARRACKPORE

AND

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FOREWORD

Soil seepage has been identified as one of the limiting factors in achieving optimum production in fish ponds in many parts of the country. The problem is further accentuated in warm belts like Bihar, Uttar Pradesh, Punjab, Haryana and Rajasthan, where water evaporation is of a very high order. Various attempts have been made from time to time to reduce vertical and lateral seepage of water with lining of pond beds with cement/concrete, bentonite, polythene material etc. But they are too expensive for the low income fish operators. The problem of seepage control in fish ponds was taken up at my suggestion at Karnal and implemented in active collaboration with the Central Soil Salinity Research Institute, Karnal. The studies have been extremely promising and form bthe basis of this bulletin. The results may be viewed only as general guidelines in view of limited experiments done.

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Seepage of soil has been one of the limiting factors in aquaculture. The country has large tracts with this problem. The problem is further accentuated when aquaculture ponds on seepage soil are located in warm belts where evaporation is extremely high like Bihar, U.P., Punjab, Haryana, Rajasthan and Gujarat.

Many methods, to control seepage, have been suggested e.g., lining the pond beds with cement/concrete, bentonite, polythene lining etc. Apart from certain problems associated with each of them they are invariably considered to be very expensive. Observations on the dug out ponds, constructed on alkali soils at Karnal have shown that seepage losses in such soil are less than 5 mm/day. The studies conducted on chemical sealants indicated that sodium carbonate (Na_2CO_3) is quite effective for controlling seepage in ponds with calcium aggregated soils.

The studies were conducted in three phases viz. :

1. Laboratory studies on 30 x 30 cm cross section columns.
2. Miniponds (1 x 1 x 1 m) with 1 : 1 side slope.
3. Fish ponds (0.02 ha)

In this report, the results on the use of alkali soils and sodium carbonate as sealants for controlling seepage losses in fish ponds are presented.

Contd. 2/-

MATERIAL AND METHODS

The experiments were conducted in three nursery ponds having an area of 0.02 ha each during 1981 to 1984. The ponds are situated on the northern side of Western Yamuna Canal. The average depth is 1.5 m. There were three treatments viz. T1 = Control, T2 = Sodium carbonate and T3 = Sodic soil (having pH above 10.1). The soil and water characteristics were noted. The seepage rates were also calculated before treatment.

i) Control.

ii) Sodium carbonate

The chemical available in the market as washing soda was incorporated on slightly wet pond beds @ 1% by weight of normal soil required to form 0.5 cm thick lining. This works out to be 750 kg of Na_2CO_3 per hectare bed area. To check seepage from the sides of the ponds a small channel was constructed near the periphery of the ponds and Na_2CO_3 at same application rate as for pond beds, was made to seep through channel with intermittent filling of channel with water.

iii) Alkali soils

The soil having pH 10 or above was collected from nearby agriculture fields and spred on the pond bed to the thickness of 3 cm. The soil was compacted manually. For sides, Na_2CO_3 was applied as in (ii) above.

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iv) After treatments, fish fry and fingerlings were reared to observe the effect of the sealants on the growth of fish.

RESULTS

The results are shown in Table I.

Rearing of fish in treated nursery ponds

After the treatment, the nursery ponds were stocked with carps spawn, fry and fingerlings in 1982, '83 and 1985. The average survival of fish was 64.3% in the nursery pond treated with sodium carbonate, 42.6% in pond treated with sodic soil and 27.6% in the pond received nil treatment. The prevalance of disease infection was less in treated ponds.

The observations recorded on plankton and water qualities indicated that application of sodium carbonate has not affected fish growth and survival in any manner; and addition has helped to check the seepage losses.

Conclusions

(i) The alkali soils (having pH 10 or above) are very effective to control seepage losses but expensive when it is to be transported from far off places. The total requirements for 1 ha is 750 tonnes/ha bed area.

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(ii) Where alkali soils are not available in the vicinity seepage losses could be minimized by using sodium carbonate (washing soda) by mixing the chemical @ 750 kg/ha at the bottom. The sodium carbonate is also to be applied at the same rates for sides in the shallow channels constructed parrelel to the side of the pond and making it seep with water in 2-3 spells to form a sort of impermeable barrier. After 3 years the infilteration rates have started increasing gradually and it is necessary to reapply the Na_2CO_3 treatment.

(iii) Further studies are necessary on the use of chemical sealants to prevent seepage losses in the ponds particularly having stony, sandy (silt and clay less than 40%) and gravelly surface.

(iv) The results of fish seed rearing in treated nursery ponds indicated no adverse effect on fish survival and growth.

Table-II- Physico chemical properties of normal and alkali soils.

Table-III-Operational costs of sealants used for sealing one hectare of permeable pond bed.

TABLE : 1

The changes in the soil and water properties due to different treatments

Property	Pond I Treatment 1 Control		Pond II Treatment 2 $Na_2 Co_3$		Pond III Treatment 3 Sodic Soil	
	B	A	B	A	B	A
1. Soil pH 0-15cm	6.7	6.6	6.6	8.0	6.8	8.7
15-30cm	6.7	6.6	6.7	7.2	6.6	7.3
2. Soil Ec						
0-15cm	0.30	0.32	0.40	0.45	0.28	0.28
15-30cm	0.35	0.37	0.46	0.41	0.27	0.34
3. Water pH	7.8	7.6	7.7	7.9	7.8	8.5
" Ec	170	180	170	250	180	230
4. Seepage loss Before treatment mm/day	10	-	14	-	18	-
After 30 days	-	10	-	11	-	8
After 120 days	-	4.5	-	5.5	-	2.5
After 2 years	-	8.5	-	4.5	-	2.5
After 3 years	-	9.5	-	7.0	-	3.2

B = Before Treatment
A = After Treatment

TABLE : 2

Physico-Chemical properties of normal and alkali soils *

Depth (cm)	Mechanical composition Sand	Silt	Clay	Textural group	Saturation	ECe mmhos/cm.	pH	ESP
				Normal Soil				
0-10	62.2	20.3	14.8	Loam	29.6	0.92	7.9	8.9
10-34	55.0	27.6	17.5	Silty loam	30.2	0.48	8.1	10.9
34-57	45.7	28.3	25.2	Silty loam	32.5	0.87	8.3	13.8
57-125	45.6	25.7	26.3	Clay loam	32.4	1.04	8.5	14.7
125-185	63.8	19.6	15.3	Loam	28.7	0.92	8.4	17.2
				Alkali Soil				
0-10	67.4	18.5	11.8	Loam	29.6	19.82	10.5	96.2
10-48	57.2	25.3	16.7	Loam	33.5	10.96	10.5	89.6
48-88	46.1	29.2	23.5	Silty loam	35.1	3.72	10.1	91.3
88-110	28.6	31.5	28.2	Loam	33.6	1.42	9.4	80.9
110-175	43.6	23.4	17.6	Loam	32.5	0.92	9.4	66.6

* Bhumbla et al.(1973). Soils of the experimental farm, Karnal, C.S.S.R.I. Bulletin No.1.

TABLE : 3

Operational costs of sealants used for sealing one hactare of permeable pond bed

Treatment	Specification	Material required for one ha.of pond bed area	Cost of material Rs.	Cost of Labour Rs.	Misc. expenditure Rs.	Total Cost Rs.	
1. Control	Nil	-	-	-	-	-	
2. Sodium carbonate	Mixed @ 1% by weight of normal soil required to form .5cm thick lining on the bed and chemical used in trencius to seep	1500 Kg	7000/-	1500/-	700/-	9200/-	
3. Alkali Soil	Soil having pH 10.0 or above spread on pond bed to make 3cms thickness.	750 tonnes (transportation etc.with 5 km radius)	3000/-	2800/-	500/-	6700/-	Total 8000/-
	+ Sod. Carbonate treatment on sides as in (2).	-	-	-	-	1700/-	