Bulletin No. 6/2013

INSITU JUTE (*Corchorus olitorius l.*) RETTING IN LOW VOLUME WATER IN POLYETHYLENE LINED MICRO POND USING NATIVE CULTURE AND POLY CULTURE IN AND AROUND IT

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Correct citation

A.K. Ghorai, H.Chowdhury, D.K. Kundu, Mukesh Kumar, M.K. Tripathi and B.S. Mahapatra. 2013. Insitu Jute (*Corchorus Spp I.*) Retting Using Native Culture In Low Volume Water In Polyethylene Lined Micro Pond And Poly Culture In and Around It, Central Research Institute for Jute and Allied Fibres (ICAR), Barrackpore, Kolkata – 700 120, 20 p.

Published by

Prof. (Dr.) B.S. Mahapatra, Director
Central Research Institute for Jute and Allied Fibres
Kolkata 700120 , Barrackpore, W.B.

Printed at

Eastern Printing Processore
93 Dakhsindari Road, Kolkata - 48

FOREWORD

Jute is normally retted in ditches/ponds/road side canals under muddy/repeatedly charged water which often reduces the fibre colour, its lustre, involves loss of organic matter and incurs sizeable cost in carrying the material from the field to the retting spot. Now a days, less rainfall at the time of jute harvest has posed a serious threat to jute cultivation due to lack of retting water. Hence, an alternative retting technique requiring less volume of retting water is urgently necessary. Insitu jute retting technique in polyethylene sheet lined micro pond has been developed at CRIJAF, Barrackpore with much less requirement of water (ground /rain water 1:1, v/v) using native culture. Good quality fibres with desired colour and lustre can be obtained by this technique. The technique will be of immense help to the jute farmers under drought condition.

I congratulate the team for their commendable effort in preparing this bulletin which will be instrumental in disseminating valuable information on retting of jute and mesta under deficit rainfall in rainfed and drought environment. I strongly believe that this publication will guide the researchers, students, development official, extension personnel, policy makers and all the people who are striving hard for over all development of jute.

B. S. Mahapatra
Director
(CRIJAF)

CONTENTS

Introduction

Jute is normally retted in ditches/ponds/road side canals under muddy/repeatedly charged water which often reduces the fibre colour and its lustre (Photo 1 & Photo 2), involves loss of organic matter and incurs sizeable cost in carrying the

Photo 1. Conventional jute retting in shallow muddy water with soil and banana pseudo stems as weight material

material from the field to the retting spot. Now a days, less rainfall at the time of jute harvest has posed a serious threat to jute cultivation due to lack of retting water. Hence, an alternative retting technique requiring less volume of retting water is necessary. Insitu jute retting technique in polyethylene sheet lined micro pond has been developed at CRIJAF, Barrackpore with much less requirement of water (ground water/rain water, 1:1, v/v) using native culture. Good quality fibres with desired colour and lustre can be obtained by this technique. The technique will be of immense help to the jute farmers under drought condition.

Photo 2. Black (shyamla) coloured poor quality jute fibre extracted from conventional retting in road side ditches

Materials and methods

A. Micro pond construction for retting with ground water

In jute field, a shallow circular micro pond (80 m^2 or 2 decimal i.e. 2 per cent of

an acre) has to be dug with dimensions of 6.5 m floor diameter and 7.5 m top internal diameter, 1.10 m pond depth with an earthen embankment raised up to 0.6 m from the surface. The embankment's width basal will be 1.2 m and top width will be 1 m. The pond has to be lined with polyethylene/silpaulin sheet (200 GSM) of size, 9.6 m x 9.6 m (Photo 3) and using its 'O" rings the silpaulin sheet has to be firmly tied with bamboo pegs (20-30 in numbers) fixed on the embankments. Before lining, the pond floor and its sides should be treated with insecticide furadon 3G (500g) and celphos tablets should be inserted on embankments round the periphery to save the lining from rodent attack. Using ground water, it is enough to ret jute/mesta harvested from 33.33 decimal, i,e. 1/3rd of an acre approximately. Jute plants (120 days old) of an acre can be ret here if jute is sown (cv. JRO-204, suitable for early sowing) in 1/3rd acre each time at 15 days staggering interval starting from 20th March. Retting period of 110 days old jute/mesta plants will vary from 12-15 days. The retting duration will extend by 5 days due to every 10 days increase in plant age beyond 110 days.

Photo 3. Micro pond and its lining with silpaulin/polyethylene sheet and circular straw bed as cushion material along the bottom periphery for insitu jute retting using ground water.

B. Micro pond construction for retting with rainwater

The micro pond pond (120 m^2, or 3 decimal) should be dug at the lowest corner of the jute field which will facilitate jute retting effectively collecting runoff water from the jute field itself through a pre constructed field drains connected to this micro pond. **If the soil has 3-4 m deep clay layer, then the pond may not require lining**. In coarse soil, it should be lined with silpaulin/polyethylene

sheet (200 GSM, of size 10.8 m x 10.8 m) and tied with bamboo pegs (20-30 in numbers firmly embedded on the embankment). Before lining, the pond soil should be treated with insecticide furadon 3G (500g) and celphos tablets should be inserted in the embankment round the periphery to save the lining from rodent attack. In case of rainwater retting, the tank depth will be 1.25 m deep from pond floor having a raised embankment of 0.30 to 1 m height around (depending on water holding capacity of soil) it with 8 m floor diameter and 10 m top internal diameter. The basal width of the embankment will be 1.5 m approximately (Photo 4a&4b). The excess water after retting can be utilised for life saving irrigation during severe drought. If severe drought prevails within 20 days of jak, pump irrigation may be required to keep jute bundles under water.

Photo 4a. Micro pond for insitu jute retting using collected runoff water from jute field (60, 000 lit approx.)

Photo 4b, After rainwater harvesting upto 60,000 litre, this micro pond with a raised embankment (4.0') of dug out soil, can retain 1,00,000 lit of water (lined with 42 ' X 42' size sipaulin sheet), if it is filled up by pump from standing water available in the field itself during heavy rain to sustain jute retting and jute-rice-rabi cropping sequence.

Native retting culture developement

Four to five days before steeping jute bundles, knee dip natural culture have to be developed in the micro tank. To develope retting culture in micro pond, add 50 to 60 kg soil from a known retting site which contains sufficient native retting propagules, 50-60 kg chopped tender suunhemp plants (30-40 days old), 500g molasses, 500g (N:P:K:10:26:26) and 1 kg ammonium sulphate or one kg urea. The culture will be ready by four days. For this purpose sunnhemp (250g seed)

Photo 5. Culture development in micro pond using sunnhemp with other additives using ground water

Photo 6. Culture development in micro pond using sunnhemp with other additives in harvested rain water

should be sown around jute field (60 days after its sowing) as boarder crop. In case of ground water, fill knee dip ground water in the micro pond 4-5 days ahead of jute stepping and add the culture materials as described [Photo 5 & 6].

Jute steeping in micro pond

Before keeping the jute bundles in tank, the sharp bases of the jute plants have to be blunted as far as possible by ramming the bundles on hard surface to avoid damage to the silpaulin sheet. Harvested jute bundles have to be arranged radially up to three layers keeping its base and twigs towards periphery and centres alternately in the pond. The jute bundles should be arranged in such fashion that the jute twigs of the middle layers remain in between the bases of first and 3rd layers (and must exceeds their bases by 16-18" which are normally dissolved after retting, Fig 7a). As the twigs ret faster, it will supply the inoculum to the bases which take more time to ret. In this manner the, the base of the middle layer also remains in between twigs of the 1st and the third layer and rets in proper time. The bundles need to be interlocked each other with thin jute chords made of chads (<1.5 m length). After arranging each layer

of jute bundles, lay five to six rows of small jute bundle (3-4" diameter) across jute layers to provide a space in between jute layers to facilitate uniform retting (Photo 7b).

Fig 7a. In micro pond Jute bundles are arranged radialyy in three alternate layers where the twigs of middle layer (in between 1st and 3rd layers) are exposed by 18 inches.

Photo 7b. Small jute bundles (10-12 jute reeds) placed across the jute bundles to keep space in between jute layers for uniform retting.

Jute jak and weight materials for uniform retting

Jute bundles should be covered with rotten straw/aquatic weed (6" depth) and place 40 bags (40 kg each approx.) of sand/stones or soil filled leak proof cemented bags as weight material over it (Photo 8 &9). The whole system is called jute jak. **Care should be taken so that over weight has not given on jaks which will not allow jute retting**. After absorbing water for 5-6 days, the jute jak will go below the water surface. If needed 4-5 soil filled bags can be added and it should be noticed that, the jute jak remains at least 3-4" below water surface during retting period.

For ground water, fill the micro pond full to the brim with ground water by pump. It may require three to four additional irrigations depending on rainfall (for 1 hour each) up to the end of retting. After retting is over, the rim is cut 1 feet deep to drain out tanned retted water from the pond and it is diverted to rice field for irrigation. If water is maintained full to the brim, under good rainfall condition, the dark tanned water is naturally drained out and yields good colour fibre (Photo 9). This simulates the natural retting environment with slow moving water as in a river or stream. Jute steeping in micro pond has been shown in photo 10 wherin runoff rain water was collected before retting process. The jute bundles have to be carefully kept in the pond water to avoid rupture in the silpaulin/polyethylene sheets. Steeping of mesta is also done in the similar fashion where in perforated balck polyethylene sheets can also be used as cover materials which boosts retting temperature (Photo 11).

Photo 8 & 9. Adding cover (rice straw) and weight material (soil filled cement bags) over jute layers . Ground water is filled full to the brim for easy drainage of tanned water by rain itself

Photo 10. Jute steeping in micro pond in collected rainwater through runoff and covered with rice straw and weight material by soil filled cement bags


Photo 11. Mesta steeping in micro pond using ground water and polyethylene cover to increase retting water temparature in winter months and its extraction on pond embankment

Interim care of jute jak for quality fibre extraction :

The jak has to be trampled 3 to 4 times from 7 days of steeping onwards, for uniform distribution of retting microbes around jute bundles. This time some of the soil filled bags (5-6) should be removed so that over compaction of the jak inside water is avoided. The maturity of the jak (Photo 12) has to checked by randomly pulling jute reeds from different layers before fibre extraction.


Photo 12. Well ret jute bundles under straw jak.

Photo 13. Diversion of nutrient rich water from retting tank to rice field for irrigation.

To get golden colour fibre the dark tanned water should be drained off and diverted to rice field for nutrient rich irrigation with an one feet deep cut on the embankment (photo 13).

The pond should be again filled with ground water. Before final extraction, a solution of lime (2 kg/15L water) to be added along the periphery (Photo 14) of the pond to prevent itching by germs of retting tank during fibre extraction.

After retting, initially (30-40 bundles) the fibres have to removed by single plant extraction method on the embankment (Photo 15) as very less water is available in the retting pond itself. After it, the fibre can be extracted in the pond water itself sitting around pond embankment (photo 16).

During extraction, where ground water is available, it may be applied in the pond at a point at least 5-6 feet away from the point of fibre extraction/washing to avoid contact of fibres with the fresh water to prevent blackening of fibres.

Photo. 14. Jak opening and addition of lime solution along periphery for sanited fibre extraction

Photo 15. Initial fibre extraction around pond bases to cope up with shortage of spaces

Photo 16. Fibre extraction around the micro pond embankments

In case of water shortage, initial fibres should be washed in fresh pond or canal water. Fibres have to be dried in airy and sunny day on its embankment on bamboo hangings. One hundred and thirty days old mesta retting was completed by 10 days of jak and we got higher grade mesta fibre with better strength (25-27g/Tex) and lusture. In a year 3-4 consecutive retting's are done.

Removal of adhered barks from bottom:

The basal portion of retted jute should be bitten with wooden or bamboo mallets (photo 17) to remove bark from jute fibre bases. The extracted fibres bases can also be freed from barks by biting it on hard surfaces (brick/slab etc, or by bitting extracted fibre bases with mallets (Photo 18).

Photo. 17. Malleting by bamboo mallets to remove adhered barks from jute fibres bases

Photo. 18. Removal of bottom adhered barks by biting fibre bases on hard surfaces (brick) or by malleting the bases with bamboo mallets on pond embankment

Fibre colour and grade

We got golden colour and lustrous jute fibre (photo 19 & 20) from this method of retting (grade 2-3) over conventional retting in roadside ditches and dirty canals (Photo 21).

Photo. 19. Golden coloured fibre from micro pond using ground water

Photo 20. Golden coloured and lustrous fibre obtained from insitu retting.

Photo. 21. Dark colour poor quality fibre from traditional retting system

Retting Duration

Using ground water, jute (123 days old) retting was completed by 14-15 days of steeping. The retting of jute depends on age of harvest. The 130 days old jute took 20 to 25 days to ret completely. For 145 days old jute, the retting duration was 27-30 days. But the retting in consequent 2nd and 3rd shift was much faster (12-18 days) depending on age of jute plants. It took 30 litre of water to ret 1 Kg jute fibre over 127 lit/kg under conventional retting. The retting duration varies according to age of jute plants and existing water temperature.

Silpaulin/Polyethylene removal and storage

Remove silpaulin/polyethylene sheet after retting and store it after drying for use in next 4 to 5 consecutive years (total of 12-16 number of retting operations can be made). Three people are necessary to carefully remove the silpaulin sheet from the pond. It need to be washed with water without mud. The perforation if any can be repaired using araldite and additional polyethylene sheets.

Weather parameters of micro pond, natural retting pond and atmosphere during retting

The weather parameters e.g, maximum temperature (2.00 PM), minimum temperature (8.00 AM) of the conventional pond , micro retting tank and atmosphere, rainfall amount and humidity of air were recorded during retting

Date	Micro Pond Max Temp		Natural Pond Max Temp		Maximum Ambient	Micro pond Min Temp.		Natural pond Min. Temp.		Minimum Ambient
(2011)	5 cm	10cm	5 cm	10cm	temp.	5 cm	10cm	5 cm	10cm	Temp.
25th July	31	28.5	28	26	32	29	27	27	26	26.5
26th July	32	29	29	26	33.6	30	28.5	28	27	26.5
27th July	33	31.5	31	29	33.8	29	28	28	27	26.5
28th July	34	32	32	29	33.4	29.5	28.5	28	28	27.2
29th July	37	34	32	30	34	30	29	29	28	26.9
30th July	39	34	31.5	30	34	30.5	29	29	28	27.5
31st July	39	35	31	30	35.5	31	30	28	28	27
1st August	35	33	30	29	35	30	29	28	27	28.5
2nd August	33	31	31	29	36.1	30	29.5	28	27	29
3rd August	33	31	30	28	34.2	30	29	28	27	27
4th August	28.5	31	29	27	32.6	30	29	27	27	27.3
5th August	29	28	30	28	33.2	29	28	28	27	25.8
6th August	30	29	29	28	30.2	28	28	27	27	26.2
7th August	30.5	29	30	28.5	29.5	28.5	27.5	28	27	25

Table 1. Water temperature of micro pond and natural pond and ambient temperature during retting process

period. The pH of the retting water varied from 6.28 to 6.42. From the data it was recorded that the retting water temperature (5-10 cm depth) of micro pond (2 decimal) was higher than natural retting pond (around 20 decimal) both at 8.00 am and 2 PM . The water temperature of micro pond at 5cm and

10 cm at 2 PM ranged from 28.5 to 39°C and 28 to 35°C respectively. The pond temperature at 5cm and 10 cm at 2 PM ranged from 28.5 to 32°C and 26 to 30°C respectively (Table 1). The water temperature of micro pond at 5cm and 10 cm at 8AM ranged from 28 to 31°C and 27 to 30°C respectively. The natural retting pond temperature at 5cm and 10 cm at 8 AM ranged from 27 to 29°C and 26 to 28°C respectively (Table 1). Maximum and minimum air temperature ranged from 32 to 36°C and 25 to 29°C respectively. The micro retting pond got a total of 117.6 mm rain in 14 days which helped in natural drainage of tanned water which helped in getting better colour and lustrous fibre. The pictorial presentation of weather parameters are given in Fig 1,2and 3.

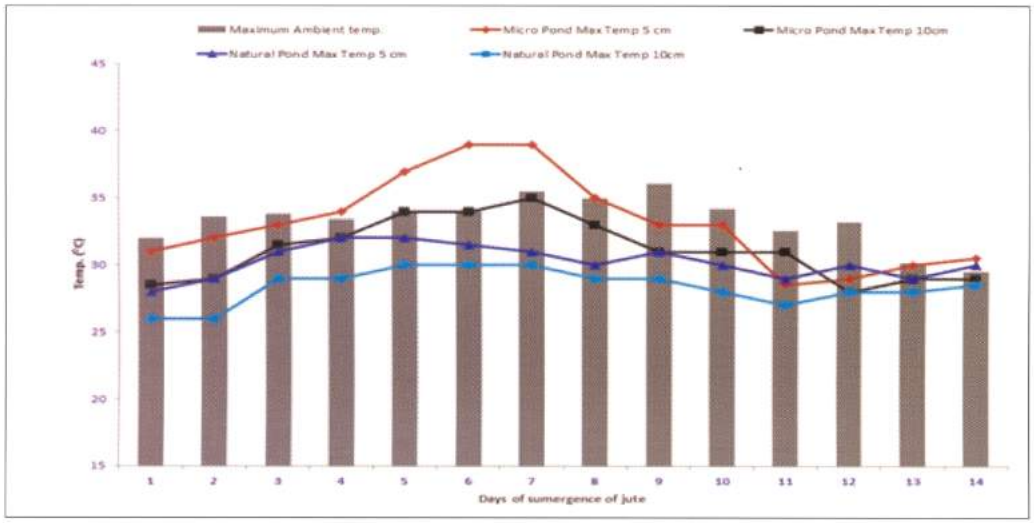

Figure.1 Temperature (max)variation in pond during retting process

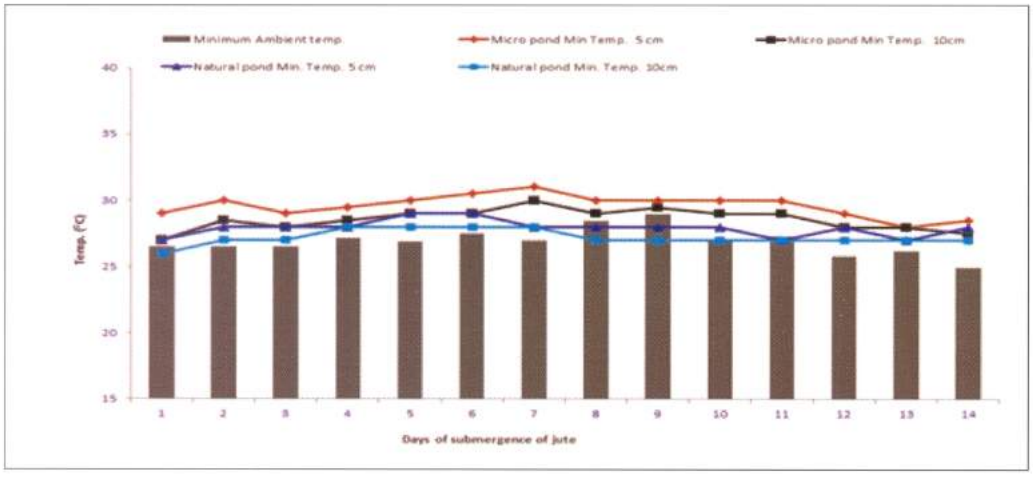

Figure.2 Temperature (min) variation in pond during retting

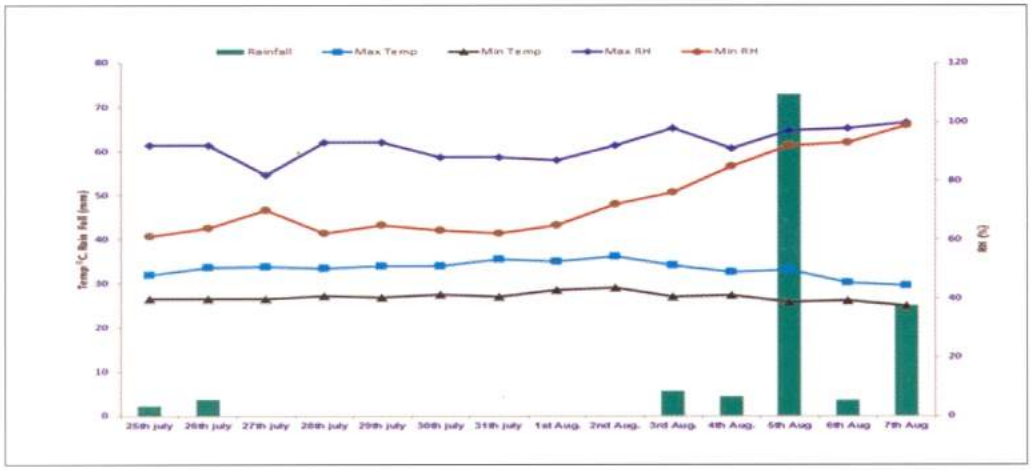

Figure 3. Weather parameters during retting process

Poly culture in and around micro tank round the year

Grow cauliflower, broccoli, basil leaf, dioscorea, brinjal, snake gourd or other vegetables on embankment round the year to increase net return from the excavated area and realize the cost of excavation and silpaulin sheet (Photo 22,23 & 24). Pond floor can be utilized to grow vegetable, cereals (rice) and other crops as per farmers convenience (Photo 25). The Micro tank can also be used as rainwater harvesting tank, using runoff water (upto 1 lakh lit) if additional ponded water is lifted by 3 HP in it during water stagnation in jute field due to heavy rain (Photo- 26).

Photo 22. Broccoli grown on pond embankment and pisciculture in it to realize price of polyethylene/silpaulin sheet.

Photo 23. Brinjal and *Dioscorea alata* on pond embankment

Photo 24. Other vegetables like, basil leaf, snake gourd , *Dioscorea alata* etc grown along retting tank embankment

Photo 25. Micro pond floor being used for cabbage and summer rice cultivation and embankment with vegetables

Photo 26. Rain water harvesting with higher storage (1 lakh litre) using dug out soil for jute retting and sustain jute –rice –rabi crops in sequence.

Jute manures from retting tank

Around 10 cement bag full well rotten jute manures are collected each year after removal of polyethylene sheet for use in vegetable crops (photo 27).

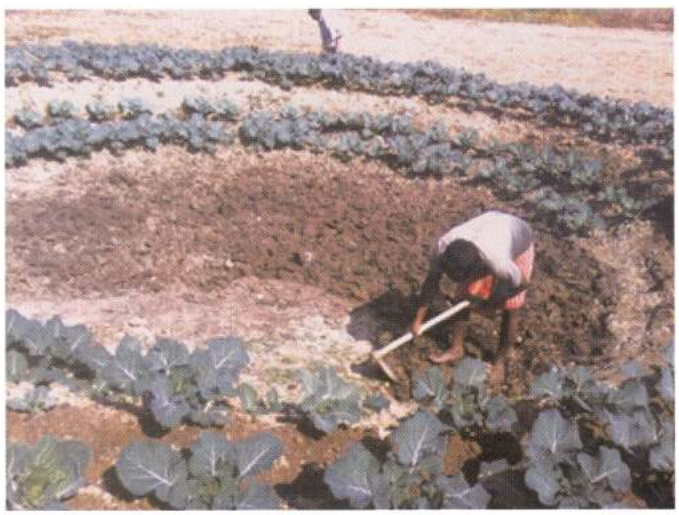

Photo 27. Collection of jute manures from pond from retting tanks

This amount of crop waste from jute retting is normally lost annually in conventional retting which is thus conserved in insitu retting method. The dug out pond floor thus will be again fertile after one year of jute retting. Field/vegetable crops can be grown in this floor as per farmers choice.

Use of micro retting tank as water harvesting structure and pisciculture.

If the pond is dug at a lowest spot, this micro retting tank (area 120 m^2 or 3.00 decimal and 1.2 m depth, lined with silpaulin sheet 36 feet x 36 feet) can be used as a micro water harvesting structure from a catchment area of 1/3rd acre to sustain jute-rice-oilseed/pulse cropping system under deficit rainfall situation (>50%). The tank must have a raised embankment around it of 1 m height (depending on water holding capacity of soil), with 8m floor diameter and 10 m top internal diameter. The basal width will be 1.5 m approximately. Land requirement will be only 3 per cent of an acre.Collecting surface run off, this micro reservoir can store 60,000 lit of water approximately. If ponded rain water from jute/rice field is further pumped into the water reservoir, then another 40.000 lit of water i.e., a total of 1,00,000 litre water can be stored in this tank (Photo 26). Under present changing climatic scenario, its adoption in

Photo 28. Tilapia

Haul of wallking fish

Singhi (cat fish)

community scale, will minimize the runoff loss of rainfall, 40 to 50 per cent of which usually flows to rivers, lakes and seas every year. If the soil is clay in nature pisciculture can also be adopted in it. After removal of silpaulin or polythene sheets, air breathing fishes like, cat fish, tilapia, walking fish etc can be grown with in the pond (photo 28). It can also be used as nursery tank for rearing of fish fingerlings. The major carps (150-200 g each) became 600-700 g is size in a year in this polyethylene lined micro tank when feeded with kitchen wastes (Photo 29).

Photo 29. Major carp, rohu

Economics of the system

Expenditure involved in the process

Around Rs.7800 is necessary to develop the system. The cost of silpaulin sheet is around Rs. 4000 and excavation cost of the pond will vary from Rs. 1200-Rs.3000 depending on type of soil and type of ponds. While using ground water in a retting cycle, 5 to 6 hours irrigation water is necessary costing around Rs. 400 only. Cost of used cemented bags is around. Rs.200 (50 bags). Cost of bamboo pegs and ropes Rs. 100.00 only. Cost of ammonium sulphate, urea and molasses Rs.100. If properly maintained, the life of silpaulin sheet is around 5-6 years. Thus yearly expenditure is around Rs. 1300-1580 for 5-6 years. The pond have to be excavated 1 feet each year to remove the excess tank silt.

Return from the system

Using this retting method, the net return from this 1.8 to 2 decimal land is

Sl.No.	Items	Description	Gross return (Rs.) from retting system in micro pond	Gross return from Jute-rice-rice cropping system in 2 decimal area
1.	Saving in transport of jute bundles (360 nos/ acre) to retting sites	20 man days @ Rs.150/day	Rs.3000.00	Rs. 1500
2.	Grade improvement due to colour, strength etc for 14 quintals/acre	Grade 2-3 @ Rs.200/q	Rs. 2800	
3.	Return from vegetable cultivation from pond embankment round the year	Broccoli, cabbage, cauliflower, brinjals, pumpkin, gourds, yam, amorphaphalus etc	Rs.3000	
4.	Manure from pond floor	10 bags @ Rs. 30/ bag	Rs.300	
Total			Rs. 7450	Rs.1500

Table 2. Comparative economic performances of same area (1.8 to 2 decimal) involved in insitu jute retting including its allied activities and jute-rice-rice cropping system, in a year.

around Rs.7450/year (Table 2). This higher revenue is generated from

i) elimination of cost of carrying of jute bundles to distant retting spots

ii) increase in fibre price due to higher grade

iii) return from vegetables grown round the year on the embankment and from

iv) cost of fishes grown in the retting tank. The retting water increased the yield of scented rice. cv. Chiniatap by 1 q/ha (costing Rs.2000/q) over irrigation it by ground water alone

Return from jute-rice-rice cropping system :

Return from jute-rice-rice cropping system from this land area (1.8 -2 decimal) is around Rs.1500/ha/year only.

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Published by

CENTRAL RESEARCH INSTITUTE FOR JUTE AND ALLIED FIBRES
(*Indian Council of Agricultural Research*)
Barrackpore, Kolkata 700120 , West Bengal
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