

A short reportage on

Studying the multiple usage of Water Hyacinth



Activity Period
June 2007-May 2008

Reported by

Gourab Ghosh/Soumen Purkait
Under the technical guidance from ENRE, DRCS
Report is available at www.drcsc.org

Submitted to

Green Grant Foundation



Index

Objective

Area and Target Group

Activity Calender

Orientation Programme

Activity Report

A. Baseline

B. Current utilization pattern of Water Hyacinth

C. Water Hyacinth Calendar

D. Use as fodder

E. Propagation of Water Hyacinth

F. Composting from Different parts of Water Hyacinth

G. Making compost

H. Workshop on Craft making from Water Hyacinth

I. Popularizing the idea of utilizing Water Hyacinth

J. Field trial by using Compost

Annexure: Additional Report

Water hyacinth is an aquatic weed growing in fresh water lakes, rivers, ponds etc. It was originated from South America and distributed throughout the tropics. But it appears as a potential problem in our state as well as other areas by creating blockages in ponds, canals, Rivers etc and become a threat to other aquatic flora and fauna due to its phenomenal growth rate. There are various technologies that have already been adopted to reduce the hazards of water hyacinth but the benefits are temporary and sometimes costly too.

Our Objectives

Our objective is to involve the local community, especially children

- To find strategies for turning the water hyacinth into worthy resources
- To teach children how to design an experiment.
- To make them understand the benefits of compost & vermicompost as opposed to FYM, synthetic fertilizer etc.
- To make them realize that with proper technology and management, problems can be converted into useful resources.
- To grow their co-operative attitude with group based activity.
- To enhance the interaction between children and their natural surroundings.

Project Area and Target Group

Children of the age group 12-18 from three districts of West Bengal (i.e. East Medinipur, South 24 Pgs and North 24 Pgs) have been involved in this work. There are 12 groups, each containing 10-25 children. Details are given below :-

GROUP SUMMARY

| Sl. No. | Network Organization | District | No of group | Group Name | No of students |
|---------|--------------------------------------------|----------------------|-------------|------------------------------------------------------|----------------------|
| 1. | Bagaria Relief Welfare Ambulance Society | South 24 Parganas(S) | 2 | Rajarampur students group Belpukur Students group | 13 16 |
| 2. | Dhainchabari Sister Nivedita Smriti Sangha | East Medinipur | 1 | Dhainchebari Kisore Bahini Kisori | 15 |
| 3. | Sundarika Bartika | South 24 Parganas(S) | 1 | | 16 |
| 4. | Swanirvar | North 24 Parganas(S) | 4 | Sabuj Agra Mukul Pratibadi Titumir | 21 21 20 25 |
| 5. | Phulbari Sundarban Gramin Bikash Kendra | South 24 Parganas(S) | 1 | Sabuj Bahini | 7 |

| | | | | | |
|-------|-----------------|----------------|-----------|---------------------------------------------------------------------------------------------------------|------------------|
| 6. | KJKS | East Medinipur | 3 | Sandhani Kisore kisori Bahini Bharat Kisore Kisori ahini Kochi Pata Kisore Kisori Bahini | 13 11 9 |
| Total | Organisation: 6 | Districts: 3 | Group: 12 | | Children: 187 |

Activity Calendar

| | | |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| Orientation | Orientation programme was organized with 8 teachers from the partner organization. | 29 th & 30 th June, 07 |
| | Shot sessions with the children at their villages regarding the objective of this project, group formation, activities, planning etc. | From 15 th September – 15 th October, 07 |
| Activity by the children | Mapping of water sources in their villages and identify the sources of water hyacinth. | From 1 st September-1 st October, 07 |
| | Observation & documentation of flowering stage, growth stage, suppression etc through out the year. | From July, 2007- February 2008 |
| | Survey and documentation of current utilization pattern of water hyacinth. | From 1 st September-1 st October, 07 |
| Simple trial | Drying the different parts of water hyacinth | From 10 th October, 07 – December,07 |
| | Small trial on the growth/reproduction rate of water hyacinth | From 8 th September, 07 – December, 07 |
| | Small trial on the decomposition rate of different parts of water hyacinth by using simple parameters. | Form 23 rd August, 07 – End of November |
| | Trial by using compost on vegetables. | From March, 2008 |
| Small technical sessions | Training on good quality compost making from water hyacinth in a cost efficient manner and in small scale. | 15 th December, 08 – 24 th December, 08 |
| | A three days' workshop on paper making, packing material, other handicraft etc from water hyacinth. | 3 rd -5 th January, 08 |
| Campaign in the locality | Poster display | From March,08 |
| Trial in the field | Comparative Field trial | April, May 08 |

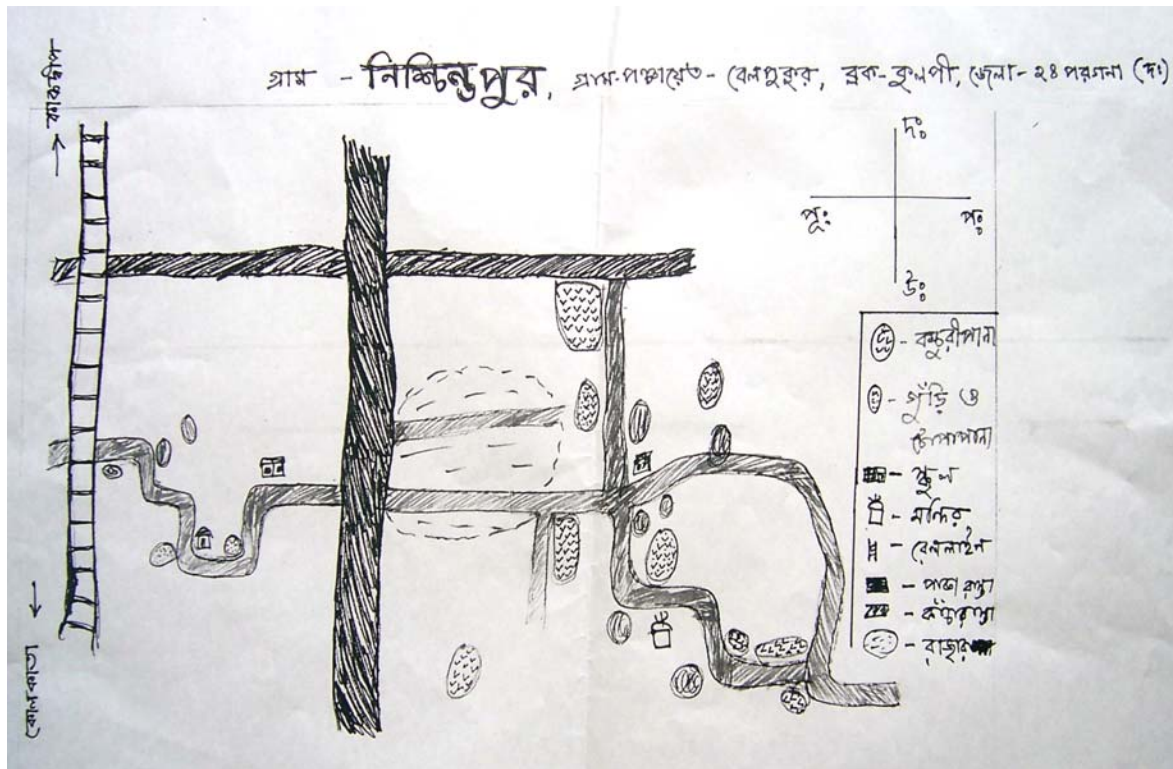
Orientation Programme



Orientation programme was organized separately for teachers and students. At first, 8 teachers from 7 organizations were invited for a two days orientation programme at Shaym Nagar Training Unit of DRCS. Gourab Ghosh along with Surjakanta Das from ENRE, was there as resource persons. The objective of the training was to make an year round plan and demonstration on compost making procedure from water hyacinth and other related matters.

Orientation to students was given by visiting their site individually. The process of survey, experiment setting for simple trial and compost making were introduced during those camps.

Activity Report



A. Map showing Water Hyacinth dominant water bodies of one representative village

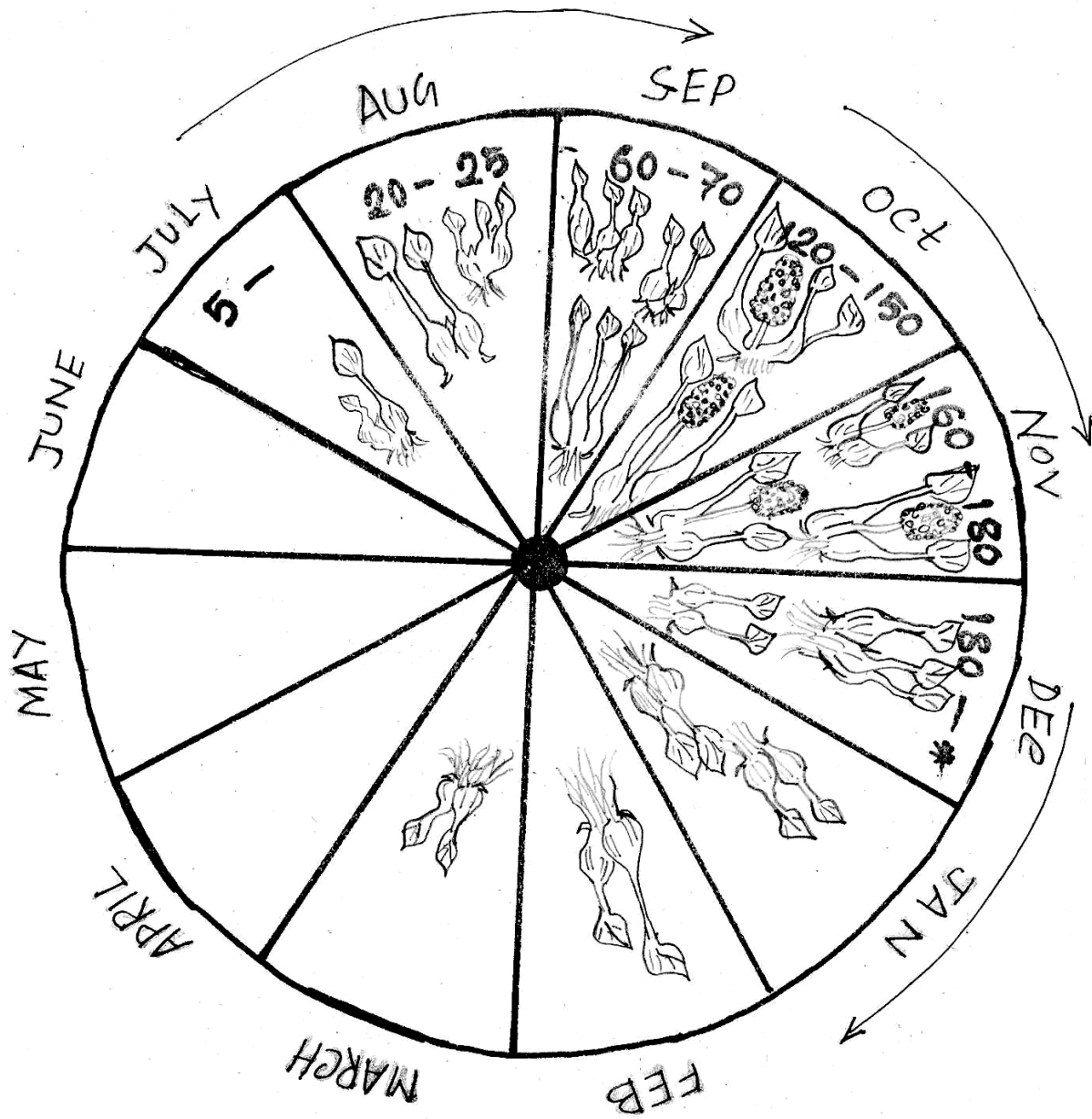
(Village- Nischintapur, G.P.- Bel pukur, Block- Kulpi, Dist.- South 24 Parganas) done by Sabuj Kisore Kisori Bahini. Similar kind of activity were done by other 11 groups.

B. Summary of current utilization pattern of water hyacinth (data collected from all project area by the students

| Different uses | Method of using |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fodder | Green water hyacinth leaves are collected and Used as fodder, animal doesn't like it very much, and initially it is mixed with other food supplements. The leaved has to be chopped, then only it will be easier to digest. |
| Fuel | Whole plant body is dried and used as fuel for cooking. |
| Soil enhancer | Chopped leaves and stems are used as composting material. |
| Mulch on soil | Used as mulching material for growing potato, taro, elephant foot yam etc. |
| Water purifier | Water hyacinth plants are applied in the dirty ponds to purify water |
| Water cooler | In summer, when water becomes extremely hot, water hyacinth is used in the ponds so that it keeps the temperature of the water under control to save the fishes. |



Children doing survey



C.Documentation made by students on growing stage, flowering stage and suppression of water hyacinth (Done by Sandhani Kisore Kisori Bahini, Village- Jamuasankarpur, Block-Kanathi III, Dist.- East Medinipur)

D.Trial on Water Hyacinth as Fodder

Group Name- Dhainchebari Kisore Kisori Bahani, East Medinipur



Students interviewed 10 individuals who have their own cows and feed their cows with Water hyacinth. Villagers given their views as follows-

| Individuals | Cow gives more milk | Cow gives less milk | Other Remarks |
|-------------|---------------------|---------------------|-------------------------------------------------------|
| 1 | Yes | No | Density of milk reduces |
| 2 | Yes | No | Density of milk reduces also cow dung density reduces |
| 3 | Yes | No | Do |
| 4 | Yes | No | Cow dung smells bad |
| 5 | Yes | No | Milk does not tests well |

Students Remarks: In villages many people use water hyacinth as a fodder but it does not make good quality milk and dung.

N.B.- Same data has collected by the student groups from Swanirvar(North 24 Parganas) and Kankuramosat Relief Welfare Society(South 24 Parganas).

E. Simple trial on Propagation of Water Hyacinth

Organization: Bagaria Relief Welfare Society, South 24 Pgs

Starting Date: 5th November, 07

Participants: Tumpa Maiti, Tumpa Haldar, Bandana Das, Utpal Naskar, Uttam Naskar, Pronoti Mondal

They have prepared a barricaded area in a pond and observed the growth and reproduction of 5 water hyacinth plants.

Observation: Data have maintained in every week.

| Time | No. of Water hyacinth |
|---------------|-----------------------|
| After 1 month | 31 |
| After 2 month | 167 |
| After 3 month | 769 |

From this data we can make a conclusion that water hyacinth multiplies by five times in one month.

N.B. Same trial has conducted by two groups from Swanirvar and KJKS.

F. Composting from Different parts of Water Hyacinth.

This experiment was carried out by a student group called Titumir, Organization – Swanirvar, North 24 Parganas. Twenty - five students were involved in this work. They have done this experiment in two groups separately.

Material Used: Water Hyacinth and Diluted Cow dung

Tools Used: Plastic buckets, weighing machine, thermometer and measuring tape.

Procedure: Different parts of water hyacinth are chopped separately. All buckets have labeled for their identification. The weight of empty buckets has measured. In 5 buckets different parts of water hyacinth are filed after mixing with diluted cow dung. The following ratio and materials have maintained in 5 buckets: -

1st Bucket: Root= 1kg, Cow dung= 0.5kg

2nd Bucket: Stem= 1kg, Cow dung= 0.5kg

3rd Bucket: Leaf= 1kg, Cow dung= 0.5kg

4th Bucket: Stem + Leaf= 1kg, cow dung= 0.5kg

5th Bucket: Stem+ leaf+ Root= 1kg, cow dung= 0.5kg

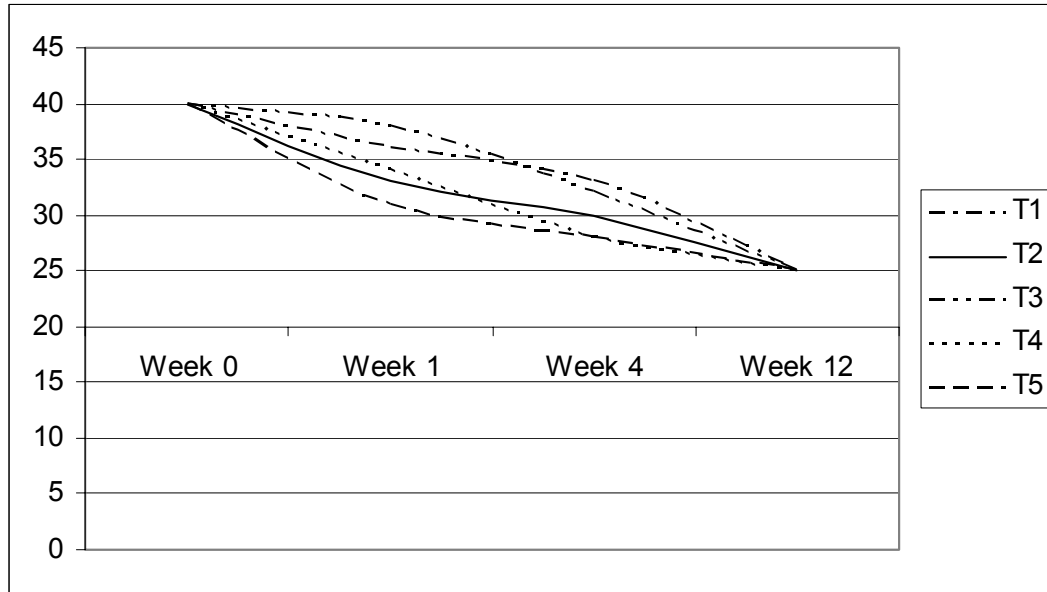


Observations:

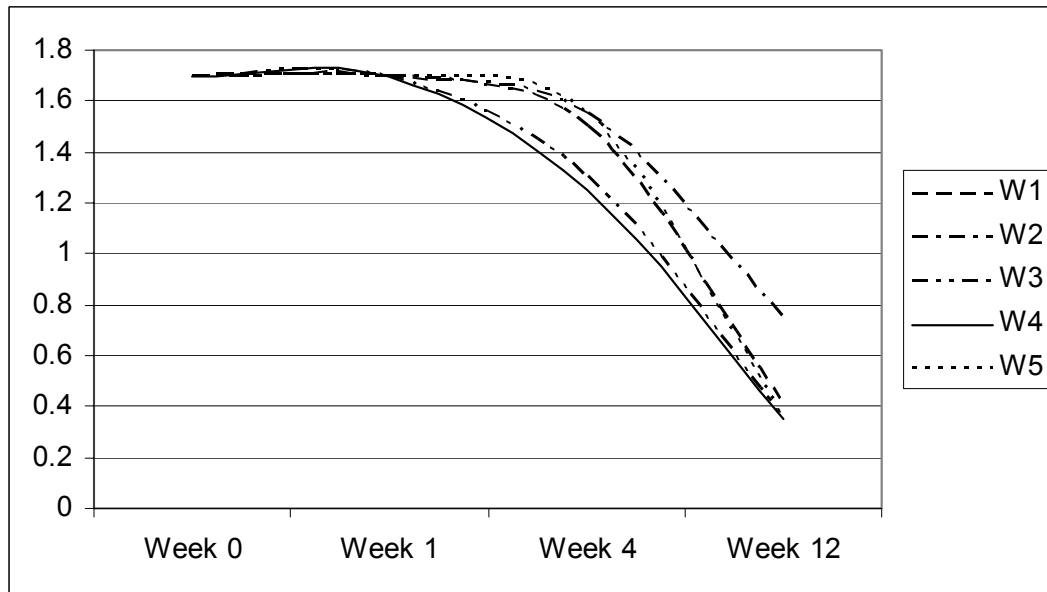
| | Date/Time of observation | Smell | Colour | Weight (in Kg.) | Quantity Reduced (Free space from top) | Temp. | Remarks if any |
|------------------------|--------------------------------------|---------------------|----------------|------------------|----------------------------------------|-------|-----------------------------------------------------------------------------|
| 1 st Bucket | Initial stage 23/08/07 | Smell from cow dung | Green-Black | 1.7 kg | 15 cm. | 40°C | |
| 2 nd Bucket | | Do | Do | 1.7 kg | 8 cm. | Do | |
| 3 rd Bucket | | Do | Do | 1.7 kg | 10 cm. | Do | |
| 4 th Bucket | | Do | Do | 1.7 kg | 10 cm. | Do | |
| 5 th Bucket | | Do | Do | 1.7 kg | 13 cm. | Do | |
| 1 st Bucket | After 14 days | No smell | Blackish | 1.7 kg | 16 cm | 36 | In upper surface yellow fern have appeared |
| 2 nd Bucket | | Very little | Green blackish | 1.7 kg | 13.5 cm | 33 | Bottom portion watery, in upper surface white small fly appeared |
| 3 rd Bucket | | Smelling | Green blackish | 1.7 kg | 9.5 cm | 38 | Cow dung and water hyacinth dried |
| 4 th Bucket | | No smell | Blackish | 1.7 kg | 12.5 cm | 34 | Cow dung and water hyacinth dried |
| 5 th Bucket | | No smell | Green blackish | 1.7 kg | 13 cm | 31 | Semi solid and white small fly appeared |
| 1 st Bucket | After 4 weeks (Turning has done) | No smell | Brown | 1.5 kg | 17 cm | 33 | After mixing and turning black material appeared and there was a bad smell. |
| 2 nd Bucket | | No smell | Brown | 1.55 kg | 15.9 cm | 30 | Water at bottom, stem has not decomposed. |
| 3 rd Bucket | | No smell | Reddish | 1.3 kg | 11 cm | 32 | |
| 4 th Bucket | | No smell | Blackish | 1.25 kg | 15.5 cm | 28 | After turning it is smelling. |
| 5 th Bucket | | No smell | Blackish | 1.55 kg | 16.5 cm | 28 | After turning it is smelling. |
| 1 st Bucket | After 3 months (Compost Preparation) | No smell | Chocolate | 0.4 kg | 17 | 25 | Have dried |
| 2 nd Bucket | | Do | Black | 0.75 kg | 15.9 | 25 | Have not dried enough |
| 3 rd Bucket | | Do | Yellow | 0.35 kg | 11 | 25 | Have dried |

| | | | | | | | |
|---------------------------|-----|----|--------|------------|------|----|-----------------------|
| 4 th Bucket | ed) | Do | Yellow | 0.45 kg | 15.5 | 25 | Have dried |
| 5 th Bucket | | Do | Black | 0.35 kg | 16.5 | 25 | Have not dried enough |

Conclusion:



Temperature curve



The weight curve

It has been concluded by the group on the basis of quality that the 4th bucket containing stem, root and cowdung has potentiality to produce good quality compost.

G. Making compost out of water hyacinth



All the 12 groups are actively involved in doing the same activity.

H. Workshop on Craft making from Water hyacinth

Date: 3rd-5th January 2008

Venue: DRCSC Project Office

Trainer: Bikram Mitra from Earth Craft

Participants: 18 participants from 7 organizations

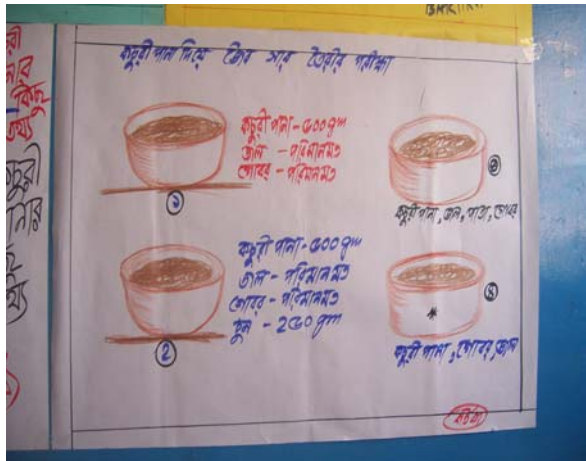
Work Done:

- Practical session on making photo frame, pen stand from dried water hyacinth paper etc.
- There was a general discussion on how students can make use of water hyacinth locally as a craft making material.
- Discussion on various uses of water hyacinth
- Small session with all teachers and group leaders regarding work progresses and constrains.



I. Popularizing the idea of utilization of Water hyacinth

Campaign has been done by all the organizations among school children and community through poster and demonstration. Students from Dhainchebari Sister Nivedita Sangha demonstrated their water hyacinth trial and water hyacinth usage pattern in their village science fair. Most of the student groups demonstrated their research in their own schools. Posters have been displayed in conspicuous places drawing the attention of general people for this promotional activity.



J. Field trial by using Compost

Student groups have done few small field trials by using compost. Most of the groups have made a comparative study with chemical fertilizer (urea) and organic fertilizer(compost from water hyacinth).



One of these trials is describe bellow:-

Name of the student group: Kalsur Kisore Kisori Bahini, Swanirvar, North 24 Parganas

Trial made: Effect of organic fertilizers in comparison with chemical fertilizers

Details: Two separate bed having same area (11ft X 3ft) was made on 21st April,2008.

Inputs used:

| Organic Bed | | | Inorganic bed | | |
|-------------|--------------------|------------------------------------|---------------|--------------------|---------------------------------|
| Date | Input | Quantity | Date | Input | Quantity |
| 24.04.08 | Compost | 7.3kg | 24.04.08 | Suphala 20:20 | 0.5kg |
| 24.04.08 | Amaranthus seed | 2 gm | 24.04.08 | Amaranthus seed | 2 gm |
| 24.04.08 | Water | 10 bucket, 1 bucket= 10 lit. | 24.04.08 | Water | 10 bucket, 1 bucket= 10 lit. |

| | | | | | |
|----------|-------|------------------------------|----------|-------|------------------------------|
| 07.05.08 | Water | 10 bucket, 1 bucket= 10 lit. | 24.04.08 | Water | 10 bucket, 1 bucket= 10 lit. |
|----------|-------|------------------------------|----------|-------|------------------------------|

Remarks: Water was not required for few days because of rain.

Observations: In two separate bed seedlings appeared on same date i.e. on 28.04.08.

| Date | Seedling's Height on Organic Bed(in inches) | Remarks | Seedling's Height on inorganic Bed(in Inches) | Remarks |
|----------|----------------------------------------------|--------------------------------|-----------------------------------------------|--------------------------------|
| 03.05.08 | 1 | High germination rate | 1 | Low germination rate |
| 08.05.08 | 3 | Fresh and green | 1.5 | Cooperatively less green |
| 13.05.08 | 6 | | 4.5 | |
| 18.05.08 | 8 | Leafy area acquires more space | 6 | Leafy area acquires less space |

Conclusion: From the above observations students decided that organic manure is giving far more better result than chemical fertilizer and it costs nothing, but only labour. Now they are making two separate trial on the same topic.

Few trials are still going on.

Annexure (A scientific Trial done simultaneously by DRCSC)

Water Hyacinth as a composting material

Anshuman Das, S.P. Raychoudhury, Mintu Mallik and Gourav Ghosh
Development Research Communication and Services Centre

Background

Water hyacinth was originated in Amazon basin and distributed through out the tropics due to its attractive purple flower. Mature plants consist of roots, rhizomes, stolon, leaves and inflorescence. Its leaves are thick, waxy and glossy with bulbous and spongy stalk. The inflorescence is spike of 8-10 flowers. The flowers are purplish blue. Each flower has 6 petals, the upper most petals with a yellow blue bordered central splotch. Its shoots consist of branched, stoloniferous rhizome. Roots are adventitious, fibrous and dark in colour. Water hyacinth reproduces both sexually and vegetatively. However, sexual reproduction is limited. Vegetative reproduction occurs by stolon under favorable condition. It has become the most problematic weed in many tropical and subtropical fresh water habitats worldwide. Our proposed project area belongs to the southern part of West Bengal where inland water bodies play important role for the livelihood of local people and environmental context as well. Water hyacinth forms thick mat over the water body and caused problems for fishing, biodiversity, river or canal transportation, irrigation, causing siltation followed by flooding and become the labour room for many vector borne diseases.

Scientific name *Eichhornia crassipes* (Martias) solms.

Common name Water hyacinth

Originated from Rich and diverse rain forests of the Amazon river basin.

Biological description An aquatic macrophyte, a monocotyledon.

Family Pontederiaceae.

Ideal condition for water hyacinth:

- High air temperature
- High relative humidity
- Long sun exposure
- pH of between 4.0 and 8.0

There are many controlling mechanisms for preventing the proliferation of water hyacinth. The main mechanisms are chemical, physical and biological control. Chemical and physical control may not be feasible. Physical control is expensive and considered as short term solution. In case of chemical control, its residual effect on environment and local dwellers is negative, where as biological control requires long time to reach population density that can make significant impact on target pest.

A. Trial for suitable technique selection of composting from water hyacinth

Water hyacinth can be converted into compost with proper management & technology. At laboratory, we tried to find out a suitable technique for making cost effective quality compost from water hyacinth in a short period.

Water hyacinth is a well known cleaner of polluted water & different pollutants (like heavy metals) are deposited in its root. So roots are generally removed in case where water hyacinth is collected from polluted water.

Models of different substrate combinations are as follows –

A. Water hyacinth: cow dung = 4:1

- A1. Water hyacinth & cow dung along with 25% green leaf.
- A2. Water hyacinth & cow dung along with DAP (1% solution).
- A3. Water hyacinth & cow dung along with cow urine.
- A4. Water hyacinth & cow dung along with curd.

A5. Available Weeds, straw & cow dung.

Mud plastering at the outside of the heap is essential in all models for restoring moisture & temperature during composting.

B. Composting by using earthworms

N.B. The size of the heap: 5' X 5' X 5' (Approx.).

Parameters:

1. Input & output ratio
2. Temperature within compost at 12 hrs intervals.
3. Nutrient value of finished product.
4. Duration of composting

Materials & methodology:

A.

Model 1:

Fresh water hyacinth: cow dung: Green leaves= 4:1:1 (by volume)

Fresh water hyacinth per layer: 8 bucket (3.5 kg/bucket)

Cow dung per layer: 2 bucket (6 kg/bucket)

Green leaves per layer: 2 bucket (3 kg/bucket)

Water per layer: 12 L

No. of layers: 6

Total wt of water hyacinth: $3.5 \times 8 \times 6 = 168$ kg

Total wt of cow dung: $6 \times 2 \times 6 = 72$ kg

Total wt of green leaves: $3 \times 2 \times 6 = 36$ kg

Total wt of raw material=276 kg

Weight of soil for mud plastering=66.1 kg

Model 2: Fresh water hyacinth: cow dung = 8:1 (by volume) along with 1% DAP solution.

Fresh water hyacinth per layer: 8 bucket (3.8 kg/bucket)

Cow dung per layer: 1 bucket (4.5 kg/bucket)

1% DAP solution per layer: 3 L

No. of layers: 7

Total wt of water hyacinth: $3.8 \times 8 \times 7 = 212.8$ kg

Total wt of cow dung: $4.5 \times 1 \times 7 = 31.5$ kg

Total volume of 1% DAP solution= $3 \times 7 = 21$ L

Total wt of raw material=244.3 kg

Weight of soil for mud plastering=36 kg

Model 3: Fresh water hyacinth: cow dung = 4.6:1 along with cow urine.

Fresh water hyacinth per layer: 8 bucket (4 kg/bucket)

Cow dung per layer: 1.75 bucket (4.8 kg/bucket)

Cow urine diluted with water in 7:1 ratio and applied at the rate of 3 L/ layer.

No. of layers: 7

Total wt of water hyacinth: $4 \times 8 \times 7 = 224$ kg

Total wt of cow dung: $4.8 \times 1.75 \times 7 = 58.8$ kg

Total wt of raw material=282.8 kg

Heap is covered with plastic sheet.

N.B. Deducted portion of cow dung is supplemented (in terms of nitrogen) with cow urine.

Model 4: Fresh water hyacinth: cow dung= 8:1 (by volume) along with curd

Fresh water hyacinth per layer: 8 bucket (3.8 kg/bucket)

Cow dung per layer: 1 bucket (6.5 kg/bucket)

No. of layers: 7

Total wt of water hyacinth: $3.8 \times 8 \times 7 = 212.8$ kg

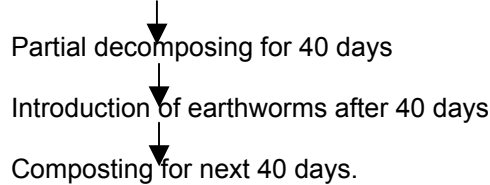
Total wt of cow dung: $6.5 \times 1 \times 7 = 46.5$ kg

50 gm curd mixed with 21 L of water & 3L of solution was sprinkled over each layer.
 Total wt of raw material=258.3 kg
 Weight of soil for mud plastering=40 kg

Model 5: Dried paddy Straw: weeds: cow dung = 2:2:1
 Dried paddy Straw per layer: 4 bucket (1.1 kg/bucket)
 Available weeds: 4 bucket (1.6 kg/bucket)
 Cow dung per layer: 2 bucket (4.8 kg/bucket)
 No. of layers: 7
 Total wt of dried paddy Straw: $1.1 \times 4 \times 7=30.8$ kg
 Total wt of weeds: $1.6 \times 4 \times 7=44.8$ kg
 Total wt of cow dung: $4.8 \times 2 \times 7=67.2$ kg
 Total wt of raw material=142.8 kg
 Heap is covered with plastic sheet.

B. Composting by using earthworms

Fresh water hyacinth mixed thoroughly with cow dung (25%)

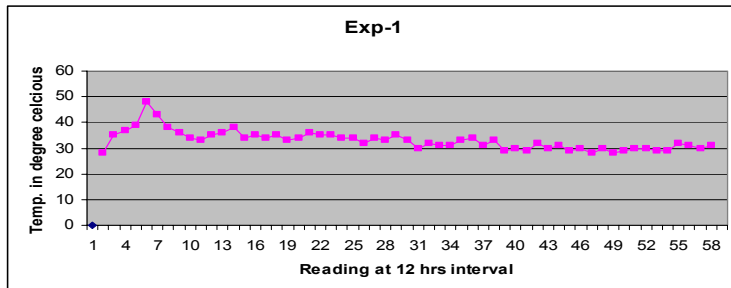


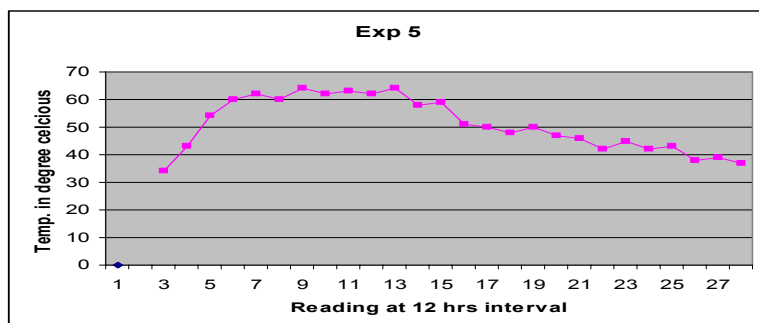
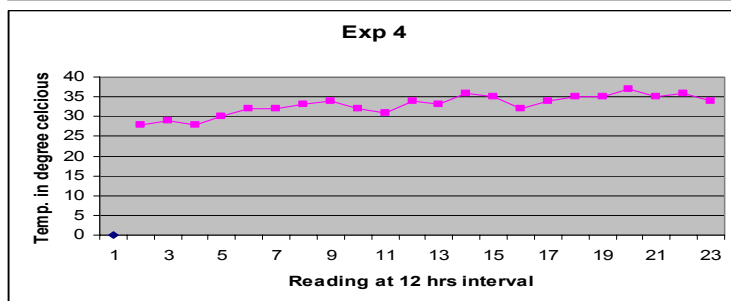
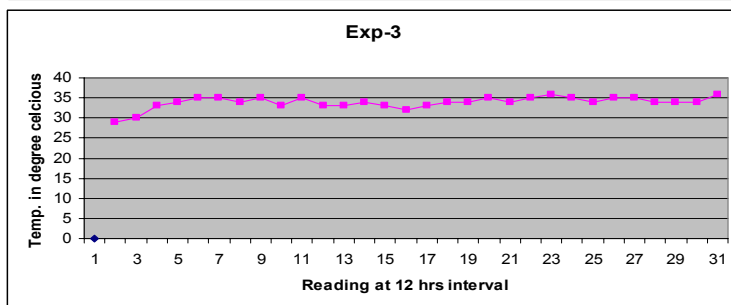
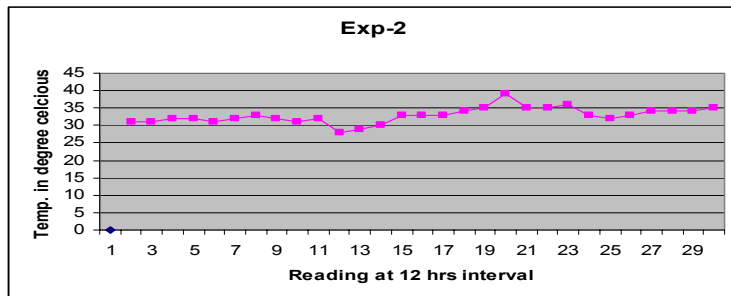
Result

1. Percentage of recovery:-

| SL. NO | INPUT(KG) | OUTPUT(KG) | % OF RECOVERY |
|--------|-----------|------------|---------------|
| 1. | 276.0 | 87.0 | 31.52174 |
| 2. | 244.3 | 65.0 | 26.60663 |
| 3. | 258.3 | 77.0 | 29.8103 |
| 4. | 282.8 | 90.0 | 31.82461 |
| 5. | 142.8 | 56.0 | 39.21569 |

2. Temperature in 12 hours' interval





Observation

The maximum rise of temperature within the compost was 48°C and could not reach the expected value of thermal composting (70-75 °C) within first three days due to fall of heavy rain. Percolation of rain water might hinder the rise of temperature up to a maximum level of and restricted within 50°C. It may affect the

decomposition rate and quality of composting. More than 50% reduction of heap's height has also been observed within a fortnight. Initial height of 4.7 ft. gradually reduced to 2 ft. after 15 days. After 30 days it became 1 ft in height (exp-1). The difference of temperature between the ambient & the innermost part of heap has been recorded within the range of 6 – 10°C.

3. Nutrient value of finished product

| | A1 | A2 | A3 | A4 | A5 |
|----------------|-------|-------|-------|-------|-------|
| pH | 7.61 | 7.88 | 7.48 | 6.64 | 7.44 |
| Organic Carbon | 14.22 | 10.35 | 25.97 | 21.25 | 14.71 |
| Nitrogen | 0.756 | 0.672 | 0.896 | 1.400 | 1.456 |
| Phosphate | 1.690 | 1.220 | 1.230 | 0.760 | 1.730 |
| Potash | 0.790 | 0.440 | 0.450 | 0.600 | 0.610 |
| C/N Ratio | 18.81 | 15.40 | 28.98 | 15.18 | 10.14 |

N.B. The size of the heap: 5' X 5' X 5' (Approx.).

4. Experimental study of composting of different parts of Water Hyacinth

- T1: Leaf of WH with 25% cow dung (by volume).
- T2: Stalk of WH with 25% cow dung (by volume).
- T3: Root of WH with 25% cow dung (by volume).
- T4: Entire plant of WH with 25% cow dung (by volume).
- T5: Leaf & stalk of WH with 25% cow dung (by volume).

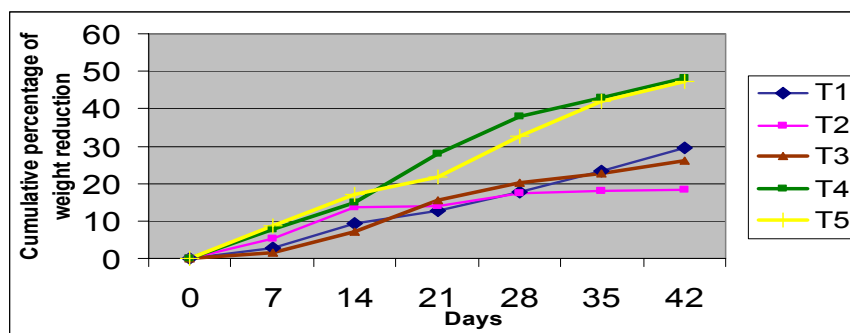
All plant materials have been chopped into small pieces prior to its use.

| Date-2.8.07 | T1 | T2 | T3 | T4 | T5 |
|------------------------------|-----------|------------|-----------|------------|------------|
| Wt of container (perforated) | 150gm | 140gm | 150gm | 135gm | 140gm |
| Wt of plant material/layer | 50gm X 4 | 100gm X 2 | 100gm X 4 | 100gm X 2 | 100gm X 2 |
| Wt of cow dung/layer | 200gm X 1 | 200gm X .5 | 200gm X 1 | 200gm X .5 | 200gm X .5 |
| Water | 100gm | 100gm | 100gm | 100gm | 100gm |
| No. of layer | 5 | 4 | 4 | 4 | 4 |
| Total wt | 2650gm | 1740gm | 2950gm | 1735gm | 1740gm |
| Initial height | 2.4cm | 1.3cm | 2.2cm | 2.0cm | 3.6cm |

Observations of total weight every 7 days interval:-

| | T1 | % Red. /week | T2 | % Red. /week | T3 | % Red. /week | T4 | % Red. /week | T5 | % Red. /week |
|--------------------|---------|--------------|---------|--------------|---------|--------------|---------|--------------|---------|--------------|
| 02.08.07 (initial) | 2.650gm | | 1.740gm | | 2.950gm | | 1.735gm | | 1.740gm | |
| 10.08.07 | 2.575gm | 2.83 | 1.650gm | 5.17 | 2.900gm | 1.70 | 1.600gm | 7.78 | 1.590gm | 8.62 |
| 19.08.07 | 2.400gm | 9.43 | 1.500gm | 13.79 | 2.735gm | 7.29 | 1.475gm | 14.99 | 1.440gm | 17.24 |
| N.B. | 2.500gm | | 1.600gm | | 2.835gm | | 1.575gm | | 1.540gm | |
| 25.08.07 | 2.400gm | | 1.580gm | | 2.580gm | | 1.320gm | | 1.440gm | |
| 01.09.07 | 2.260gm | | 1.520gm | | 2430gm | | 1.140gm | | 1.240gm | |
| 07.09.07 | 2.110gm | | 1.510gm | | 2.360gm | | 1.050gm | | 1.070gm | |
| 14.09.07 | 1.940gm | | 1.500gm | | 2.250gm | | 0.950gm | | 0.970gm | |

N.B. 100 ml water is added on 19.08.07.



Other observation

1. Height reduction (cm)

| | T1 | T2 | T3 | T4 | T5 |
|----------|---------------------------------------|-----|---------|-----|---------|
| 19.08.07 | No significant reduction is observed. | | | | |
| 25.08.07 | 1.2 | 0.3 | 0.4-0.5 | 2.1 | 0.9-1.0 |

2. Smell: No odor in finished product.

Discussion:

The following facts are observed from the results obtained from different models on composting of Water hyacinth with different amendments.

1. %Recovery of compost

Model -4: Fresh Water hyacinth: Cow dung (8:1 ratio by volume) with curd shows second maximum %recovery (31.82461%) over the others models containing water hyacinth as ingredients. Maximum % return was observed in Model 5 (39.21569%). Recovery is less compared to model 5 as water hyacinth contains high moisture

2. Raising of High Temperature during composting

Heat development is the prerequisite condition of thermal composting for destroying harmful microorganisms & weed seeds. No such significant heat development was observed (except model 5. where max. temp. raised to 65 degree celceous, maximum average temperature was within 35-40 celceous). Presence of high moisture in water hyacinth may absorbed the heat developed during composting for high specific heat capacity of water. This may be one of the reasons for non-attending the expected rise of temperature. Moreover heavy down pour during experiment may also be another reason for lowering the temperature of all the models.

3. NUTRIENT STATUS

- PH values of compost in all the models are in neutral range (6.64-7.88)
- %Organic Carbon in model-3 is highest (25.97%).Second highest is in model-4 (21.25%)
- % N content is highest (1.400%) in model-4 over all the models. An interesting observation was addition of extra Nitrogenous source in either organic form (cow urine in model-3) or inorganic form (Di-ammonium Phosphate in model-2) did not increase the N-status of compost. The excess Nitrogen might be lost either in gaseous form or percolation loss occurred during composting.
- Regarding Phosphorous & Potassium status, compost in model-4 is somehow less over other models.

4. Experiments on Composting of different parts of Water hyacinth.

It is being observed from the table & curve of %Cumulative weight reduction against time (in days) maximum reduction of weight that is composting in T-4 & T-5 treatment over the others. In case of height reduction against time, same nature observation was observed (T-4 & T-5 are superior over other treatments)

CONCLUSION

It may be revealed from the above observations and discussion, composting of water hyacinth either entire plants or only leaves and stalk portion along with cow dung in 8:1 ratio with a little bit of curd (as

starter) shows a good performance over the other models in respect of rapidity (two to two & half month) and nutrient status of compost.

Though from weight & height reduction experiments T-4 & T-5 treatments both have the same results. But T-4 (Entire plants with cow dung) is not recommended, since root parts of water hyacinth absorbed most of the heavy metals & toxic substances from the water body and helps to clean the aquatic environment. So there may be a chance of recycling the absorbed heavy metals during composting of entire plants. It is better to composting by removing the root part of the plants.

Addition of extra Nitrogen or Phosphorous source in either inorganic or organic form may not affect the composting rate or nutrient status of the produce.

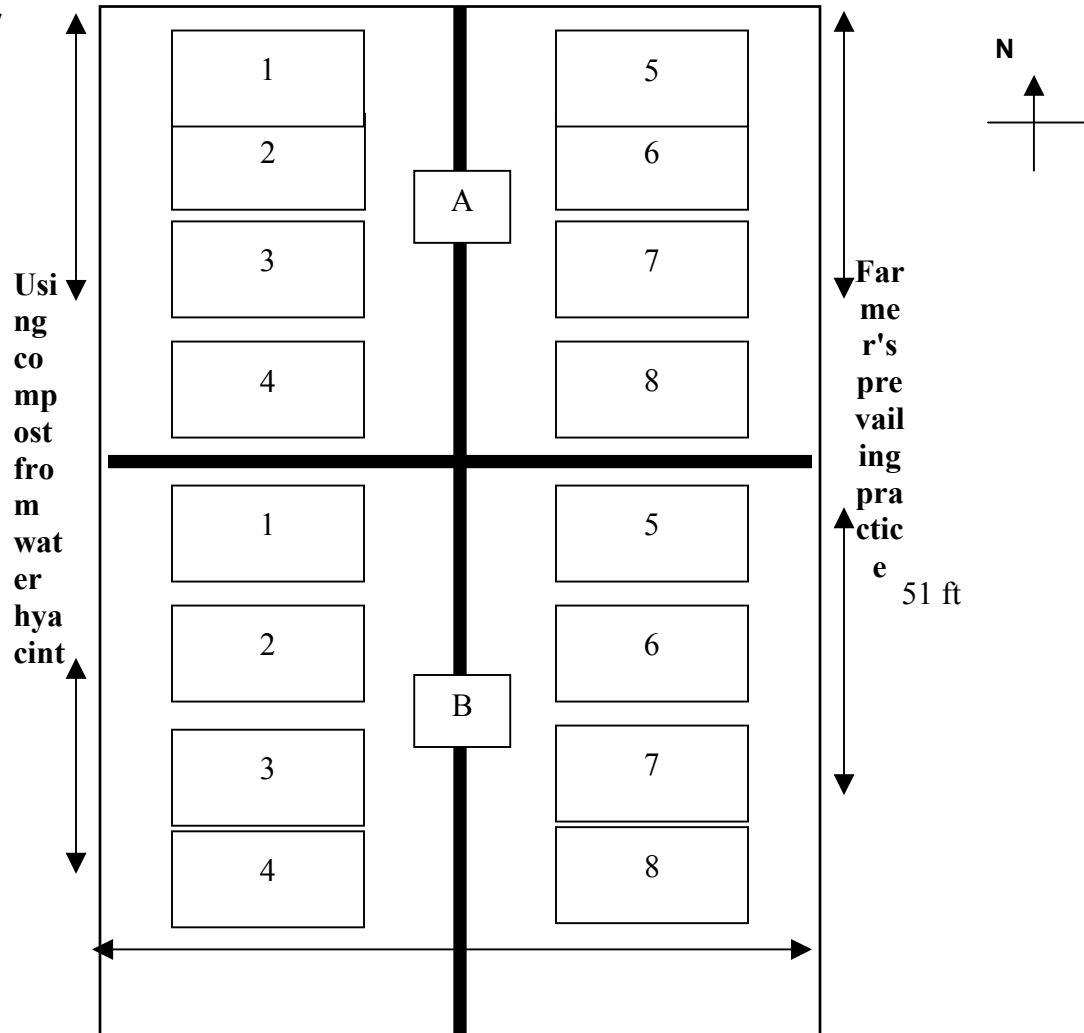
It may be concluded that chopped stalk & leaves of water hyacinth with cow dung in 8:1 ratio (by volume), with little bit of curd may turn the water hyacinth a good quality compost with high nutrient value within a very short period of time. Straw can be added as a extra source of carbon.

B. Field Trial of compost made from water hyacinth

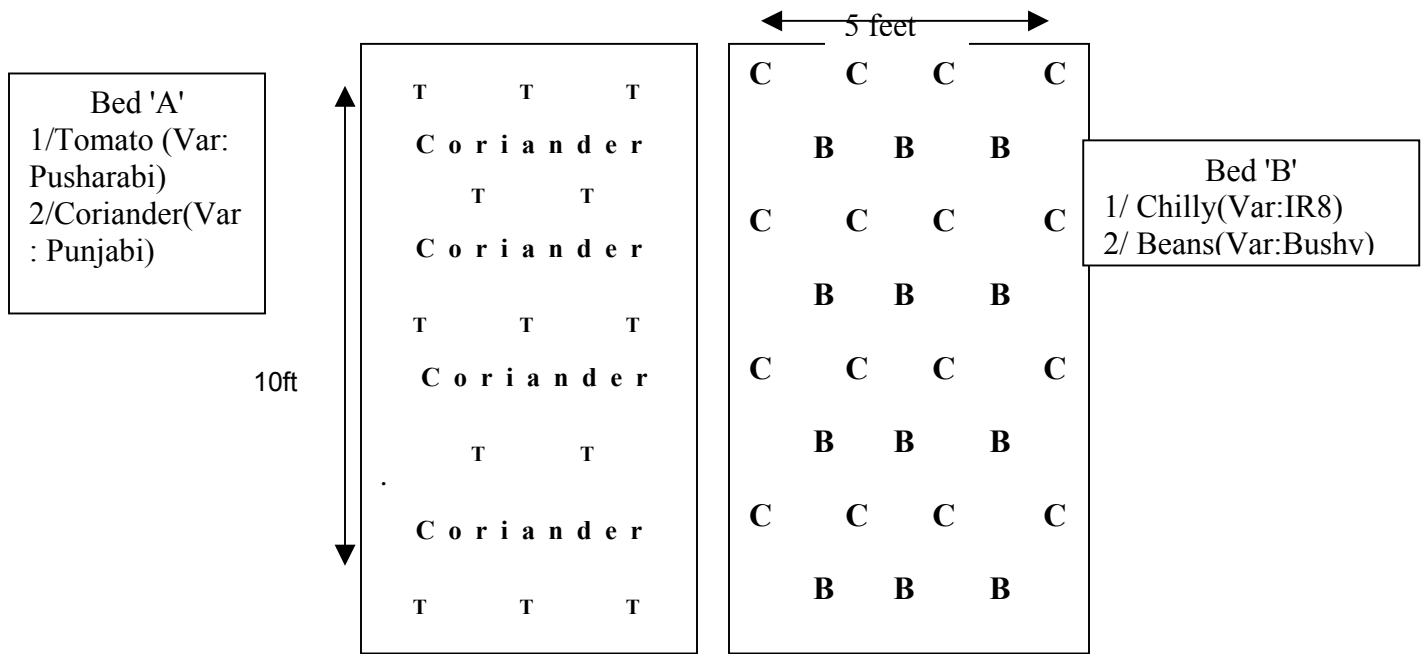
Layout of trial field

A1-A8- Tomato

B1-B8- Chilly



Crop combination on bed 'A' and 'B'



Soil preparation

| Organic practice | | Farmers' prevailing practice | |
|-------------------|----------------|------------------------------|--------------|
| Category | Quantity | Category | Quantity/bed |
| Compost (thermal) | 25 kg / bed | Grow-more -14:35:14 | 347 gm |
| Vermi compost | 250 gm / plant | Micro-Nutrient | 34.7 gm |

** Raw material of Thermal compost – Straw, Water hyacinth , Cow dung

** Dried water hyacinth used as mulching .

Date of sowing & transplanting :

Bed no. mentioned as 'A'

1)Tomato

Seed bed preparation – 12-10-07

Transplanting - 08-11-07

2)Coriander

Direct sowing - 08-11-07

Bed no. mentioned as 'B'

1)Chilly

Direct sowing - 08-11-07

2)Beans

Direct sowing -08-11-07

Plant height on following date

| Date | Organic treated | | | | Chemical treated | | | |
|------|-----------------|----|----|----|------------------|----|----|----|
| | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 |
| | | | | | | | | |

| | | | | | | | | |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|
| 6/12/07 | 17" | 17" | 17.6" | 17.5" | 15.4" | 15" | 15.3" | 15" |
| 14/12/07 | 17.5" | 17.6" | 18" | 18" | 15.7" | 15.3" | 15.6" | 15.3" |
| 29/12/07 | 18" | 18" | 18.5" | 18.5" | 16" | 15.5" | 16" | 15.5" |
| 9/1/08 | 24" | 23" | 20" | 20" | 18" | 17" | 17" | 17" |
| 18/1/08 | 24" | 23" | 20" | 20" | 18" | 17" | 17" | 17" |

| Date | Organic treated | | | | Chemical treated | | | |
|----------|-----------------|------|------|------|------------------|------|------|------|
| | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 |
| 6/12/07 | | | | | | | | |
| 14/12/07 | 6.5" | 6.5" | 6.5" | 6.5" | 6.5" | 6.5" | 6.5" | 6.5" |
| 29/12/07 | 8" | 8" | 9" | 8.5" | 7" | 7" | 6.8" | 6.5" |

Date of irrigation with necessary information :

| Sl. No | Date of irrigation | Used water | | | |
|--------|--------------------------------|------------------------|------------------------|-----------|-----------|
| | | Bed A1-A4 for each bed | Bed A5-A8 for each bed | Bed B1-B4 | Bed B5-B8 |
| 1 | 17/12/07 | 50 ltr | 50 ltr | 50 ltr | 50 ltr |
| 2 | 06/01/08 | 20 ltr | 20 ltr | 20 ltr | 20 ltr |
| 3 | 15/01/08 | 10 ltr | 10 ltr | 10 ltr | 10 ltr |
| | on going (tube well installed) | | | | |

Pest &/or disease infection and preventive measures taken :

| Sl. no. | Bed no. / plant combination | Pest attack or disease | Preventive measures | Remark's |
|---------|------------------------------------------------------------------------------------------|------------------------------------------------------------|--------------------------------------------------------------------------|------------------------------------------------------------------|
| 1 | Bed A1-A4 with organic treatment crop combination – Tomato + Coriander | Virus affected by white fly | 50 ml of tulsi leaf extract with 250ml of cow milk sprayed over the crop | White fly are removed Remaining plants have no infection. |
| 2 | Bed A5-A8 with chemical pesticide treatment crop combination – Tomato + Coriander | appear small crustacean virus affected by white fly | Omed Metacid oil with diathion | No change |
| 3 | Bed B1-B4 with organic treatment crop combination – Chili + Beans | No pest attacked | - | - |
| 4 | Bed B5-B8 with chemical pesticide treatment crop combination – chili + Beans | No pest attacked | - | - |

Information about flowering time & crop yield :

| Sl. no. | Bed no./ Plant combination | Flowering date (when at least 50% per bed) | Crop yield |
|---------|-------------------------------------------------------------------------------|--------------------------------------------|--------------------------------------------------------------------------------------------------|
| 1 | Bed A1-A4 with organic treatment crop combination – Tomato + Coriander | 25/12/07 | First fruiting time 29/12/07 Tomato= 30.8kg (11plant*4 bed*0.700kg) Coriander= 2kg |
| 2 | Bed A5-A8 with chemical pesticide treatment crop combination – | 10/01/08 | Tomato= 22kg from 4 bed Coriander= 1.8kg |

| | Tomato + Coriander | | |
|---|---------------------------------------------------------------------------------|--------------------------------------|---|
| 3 | Bed B1-B4 with organic treatment crop combination – Chili + Beans | Flowering on 20/02/08 (in 4plant) | - |
| 4 | Bed B5-B8 with chemical pesticide treatment crop combination – chili + Beans | No flower appered | - |

Findings:

1. Chilli & beans did not show very good result. However, in WH compost treatment flower appeared.
2. Tomato and coriander showed very good result. The flowering of WH compost treatment was earlier, the yield and test of coriander and tomato was better compared to conventional chemical treatment.
3. The tomato from WH compost treatment beds were productive for longer time, the shelf life of tomato was also long.
4. There were pest attack in both the cases, but beds with WH compost treatment, pests were removed after organic treatment.

*** The laboratory trial was done at DRCSC, Shyamnagar Biolab and the field trial was done at Dakshin Chatra, N 24 Parganas with the help from a farmer Mr. Ashok Das. Indienhilfe, Germany has supported us for this study. The study was done during May 2007- March 2008.*