

# ECO-CLUB MANUAL

## (FOR ECO-CLUB INCHARGES)

2012



स्वाध्यायान्मा प्रमदः

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## CHAPTER

# 8

## GREEN SCHOOL CAMPUS

To achieve the objective of creating environmental awareness amongst the future generation, the Ministry of Environment and Education has been implementing several schemes and programmes. One of such measures is eco clubs. Eco-clubs are environment clubs which are formed in various educational institutes, started in 1998 with 100 schools in Delhi. Eco Clubs play an important role in creating environmental awareness amongst the future generation. 2000 Eco-Clubs have been established in Government, Aided, Private, Public Schools and Colleges of NCT of Delhi.

Now the Department of Environment provides a grant of Rs. 20, 000 to each eco-club on annual basis for undertaking various eco- friendly activities. The major activities carried out by these eco-clubs include tree plantations, clean drives, awareness programmes like quiz, essay-writing competitions, nature trails etc. The perceptions of the teachers reveal that the status of environmental education is not much encouraging. A lot has to be done with respect to curricula, development of teaching-learning material, modes of transaction, co-curricular activities, and providing reinforcement for attainment of the objectives of environmental education. . The Green Team is the heart of the Green Schools process, both organizing and directing activities at the school. Consisting of the stakeholders of the school environment - students, teachers, custodians, facilities managers, parents and school board members - the Green Team is democratic and can often be run by the students themselves. Whatever the type of school or age group, student involvement in the committee is essential. This group can be charged with coordinating many of the greening activities, making recommendations to relevant school decision-makers, and facilitating communication among -- and actions by -- the whole school community. Use our tips for starting your Green Team.

- 1) **Adopt an Environmental Vision Statement or Planet Pledge:** Each school produces its own vision statement, setting out what the students and/or school community are striving to achieve. The Environmental Vision Statement or Planet Pledge is displayed in various places within the

school and is recognized by the students and other school community members as a statement of beliefs and intents. This statement is often in the words of students, and can be an inspiring classroom, art, or school-wide assembly project. Such statements can also be accompanied by a resolution from the school board, Parent Teacher Association, the Green Team, or other school bodies (see the sample school board resolution and sample policies on our [Take Action](#) page). Use our [Four Pillars Graphic](#) to help you understand and define the key components of a Green School.

- 2) **Conduct a School Environmental Survey or Audit:** To identify priorities for action, begin with conducting a review of your school’s environmental impact. Students are involved in this work at every step, from assessing the level of waste from school lunch, to checking the building for inefficiencies such as leaky taps, or electrical equipment left on overnight. The school and the Green Team can work with local organizations, businesses, or other resource people or experts during the review. Take the [“How Green is Your School Quiz”](#) and see how you rate. Find other examples of environmental surveys and audit tools on our [Resources](#) page, under Curricula. We’ve also got lots of ideas and resources on our [Curriculum Ideas for Hands-On Audits](#) page. These audits can be fun and really help educate the school community about the health and environmental impacts of the school.
- 3) **Create A Green School Action Plan:** Use the results of your environmental survey or audit to identify priorities of the key areas where you want to make change and create an action plan. It is important to set realistic and achievable targets to improve environmental performance at the school so kids and adults can take pride in tangible accomplishments in the short term. And it is important to set long-term, inspiring and challenging targets to move beyond the status quo and foster greater environmental improvements. The action plan could involve and promote, for example, a school recycling program; eco-friendly, non-toxic cleaning materials; carpooling; energy conservation like turning off lights, computer monitors and printers; or a school garden. See the “sample school board resolution” and “Steps Forward” on our [Take Action](#) page for examples of policy resolutions, and specific action items under a range of environmental and health topics. [Download a sample worksheet](#) (Word doc) to help create a one-year work plan.
- 4) **Monitor and Evaluate Progress:** The Green Team, students, or other school community members can assist with monitoring and evaluating progress on the priorities in the action plan. This could involve conducting an annual environmental audit to monitor levels of waste, recycling, energy use, purchases of environmentally-preferable products, and financial savings and/or costs. [Use these ecological footprint tools](#) combined with [our resources on school audits](#). The information from the monitoring is needed to ensure that progress towards the goals and targets is made and that the action plan is modified, if necessary. It also ensures that environmental education is an ongoing process in the school, since students can be responsible for the annual audits. The basic data collected over time can show the waste, pollution, and energy avoided - big motivators for people to continue the efforts.
- 5) **Integrate Greening into the Curriculum:** Greening activities can be integrated into existing curricula in science, art, humanities, math, language arts, or electives. Using the school as a hands-on laboratory offers opportunities for real-world problem-solving. Students can undertake study of themes such as energy, water, forests, toxic pollution, and waste. The whole school should be involved in practical initiatives - for example, saving water, recycling materials and saving energy. Outdoor education and time spent in nature locally - whether the schoolyard, a park, or a field trip - is a critical component of a hands-on, place-based, experiential education. Where environmental education is not part of the regular curriculum, recommendations can be made by the Green Team as to how these themes can be incorporated. See our [Teach Stewardship](#) and [Resources](#) pages for a [Sustainable Curricula Directory](#), examples of environmental curricula, on-line quizzes, and other

teaching and learning resources, including reviews of books and other media with environmental themes. No need to reinvent the wheel - there are loads of existing curricula you can use!

- 6) **Inform, Involve, and Celebrate!** : Honour, celebrating, and communicating about achievements are critical components of a Green School! Greening programs can often unify the whole school and strengthen community relations. Your school might consider partnering with external organizations from the community to benefit from their experience and expertise. In some schools, environmental consultants have offered to take part in the environmental review process. Many local government agencies and utilities offer free advice on energy, recycling, and hazardous waste management. Schools should also consider the wider community when preparing action plans - for example, schools could offer to be the local recycling point or to be a drop-off for Community Supported Agriculture boxes. Some schools get involved with clean-up or habitat restoration at nearby parks or share their experiences in other ways. A communication and publicity program keeps the school and the community informed of progress through classroom displays, school assemblies, newsletters, or other press coverage. Communicating is key to spreading success and inspiring more actions. Annual Earth Day celebrations - organized around April 20 - can offer an opportunity to showcase actions taken by the school and bring together the school and wider community.

The number of studies has also been carried out to reflect upon the role of eco club students in creating environment awareness. Case study from the eco club of presentation convent school in Delhi (2006) showed the effective use of three R's- reduce, recycle, reuse, it is recycling waste paper generated in school started with small recycling paper machine in the school they have move on to recycling machine which can load 10 kg in one operation. Eco club students recycled paper once a week and generated around 100 chart papers from 10 kg of paper waste. So in order to familiarize students with linkage between education and environment; and how healthy living conditions in schools can be enhanced, a project on Green School Programme was initiated at DIET Daryaganj with collaboration from Centre for Science and Environment (CSE) is a public interest research and advocacy organization based in New Delhi. Through in this project pupil teachers were trained to use Green School Manuals prepared by CSE in assessing environment of their schools during School Experience Programme, which would lead to betterment in environmental conditions. The study reflected that status of eco club in schools was on the average. Majority of the sampled schools were involved in number of activities related to environment such as plantation, rain water harvesting but not all. As suggestion mentioned by the teachers training on eco clubs need to be increased and involvement of NGOs with school was also strengthened. Moreover encouragement among stakeholder need to be emphasized as the participation by schools in environmental programmes at different level was low. Over and all there seems to be lack of planning and organization. The structure of eco club in schools need to reorganize as respondents reported that eco club should not be responsibility of eco club in charge only but each and every personnel in school should be include in it. In future following more environment activities can be conducted to make school green

### 1. **Lighting:**

**Switch to CFLs:** Ask school to switch all light bulbs to CFLs. CFLs provide the same light as incandescent but use less energy and last longer. Switching to CFLs is one of the easiest ways to reduce your campus footprint and save money. Check out these CFL facts from Energy Star:

- ◆ Install **occupancy sensor lights** that turn on and off automatically based on room activity.
- ◆ Ask your school to order “Turn off Lights” **switch decals** as a friendly reminder to turn lights off on your way out.
- ◆ *Use compact fluorescent light bulbs* .This is a good bit of advice for those students, teachers and school staff members who are living or working in school campus. These bulbs might be

slightly more expensive than regular ones, but will decrease your energy intake, last longer and ultimately save you money. Lamp light is a lot more pleasant and environmentally efficient than overhead dorm lighting.

2. **Go tray less:** Join several schools in going tray less at dining halls in an effort to conserve water and reduce food waste. Need to get food to go? Ask if your school provides reusable to-go boxes, and if not, bring your own.
3. **Natural cleaning products:** Encourage your school to purchase and use environmentally-friendly cleaning products. These [Enzymatic Cleaners](#) from Green Irene are safe for both you and your students, and the environment. [Seventh Generation](#) products are also a great choice.
  - ◆ Ask residence halls to keep a **supply** of environmentally- friendly cleaning products at the front desk so students can sign them out as needed.
  - ◆ Keep environmentally-friendly detergent in campus laundry rooms. **Bonus Points:** Keep drying racks in laundry rooms to encourage air drying, or set up a residence hall air drying rack rental system.
  - ◆ Check out Ithaca College's [Green Cleaning Commitment](#).
4. **Recycle:** Your school can significantly reduce its footprint by supplying recycled products and offering recycling options.
  - ◆ Ask computer labs and administrative offices to use recycled paper.
    - a. Advertise Eco Font and **double sided printing** options on computer screen backgrounds! Teachers and students both usually don't mind if they read papers that are printed using both sides of the paper. This is a huge way to save on paper. Also, to save ink, use the low quality settings on items that don't need to look too nice or that are just text. Lastly, think about what you're printing out. If you can show someone the website on a screen, do it. You don't need to print it out.
  - ◆ Buy recycled napkins for dining halls and recycled toilet paper for campus facilities. We're not telling you to eat cleaner, but we're telling you to not overdo it in good restaurants. Generally, a lot of fast food and take out is eaten by students, which means a lot of napkins get grabbed on the way out. Limit the amount you grab!
  - ◆ Set up **recycling stations** at residence halls where residents can drop off light bulbs, batteries, paper, aluminum, cardboard, and glass to be recycled. Supply residents with in-room recycling bins to make it easier for them.
  - ◆ Hold an e-waste day where residents and even community members can drop off electronic wastes to be recycled.
5. **Walk, bike, and limit the use of your car:** Most campuses, especially those that are trying to become a more eco-friendly campus, have pretty good public transit. Walking or cycling will not only help make your campus and nearby region a green area, but will help you avoid the pollution. If you must drive, try to find others who need to as well, and [carpool](#) to save emissions. Starting a bike or car share program on campus is a great way to get students, faculty, and employees to use a clean, efficient mode of transportation.
6. **Install water-filtration fountains:** Decrease your school's footprint by installing more water fountains on campus to encourage less plastic water bottle use.
  - ◆ You can order customized reusable water bottles with your school logo through the campaign.
  - ◆ Carry a water bottle. Not only will this save the environment by decreasing the amount of plastic waste on your campus, but will also help keep you hydrated and your metabolism high. A water bottle can be refilled at any water fountain and can easily be drunk in class or while riding a bike, car, train or bus.

7. **Energy Efficiency:** Let your school know that it can save money while helping the environment by using more energy-efficient appliances.
  - ◆ Tackle Vampire Energy by providing **power strips** to residents and administrative offices.
  - ◆ Encourage your school to buy energy-efficient **appliances** for residence halls, dining halls, and campus offices. Hamilton College received Energy Star certification for two of its residence halls.
  - ◆ Installing energy-efficient **hand dryers** saves both energy and paper waste.
8. **Conserve Water:**
  - ◆ **Install dual-flush toilets:** Boston University installed dual-flush toilets on campus to help conserve water. Check out their dual-flush toilet information and facts on their sustainability website.
  - ◆ Ask Housing to provide dorm bathrooms with **shower timers**. Read how 16 students at Seattle University save over 1,000 gallons of water a week by using shower times here.
  - ◆ Install **low-flow shower heads** in showers to conserve water.
9. **Vacations and Break**
  - ◆ **Email students** a few days before break to remind them to turn lights off, unplug appliances, and to turn down thermostats before leaving for break.
  - ◆ Ask campus facilities and operations to decrease building energy use by going into “**break mode**”
  - ◆ Make a website or Face book group that students can ask for and offer **carpool** rides.
10. **Go Paperless:**
  - a. Save trees, energy, and money by going paperless!
  - b. Ask to submit assignments through e-mail and if they don’t mind posting assignments and readings online.
  - c. Encourage clubs and groups to advertise on white boards instead of posting flyers.
  - d. Use refillable binders instead of notebooks. This is a simple way to save waste. Whenever the session is done you can take out your notes, staple and save, then use the binder for the next session.
  - e. If you really want to take an extra step to make your campus greener, Increase use of laptop/desktop/tablet etc. to take and compile notes.
  - f. The amount of paper student goes through per year is insane; between class notes, scrap copies, term papers, student newspapers, graphs and pictures printed out plus countless other random items add up. We know that these things can’t be avoided, but the way you handle the use of all the paper can really help create a better green campus. Look for recycling bins by garbage bins, dorms, restaurants and classrooms.
11. **Buy recycled goods as much as possible.**
  - ◆ Paper, cleaning products and water are products that can be purchased as a recycled good. They’re slightly more expensive than the normal products, but it’s worth it to make a green campus.
  - ◆ Buy used clothing. Usually thought of as something to do to save money, it is also good for the environment! Recycling clothes minimizes the use of resources to make clothing and puts a dent in the problem of worldwide sweatshops

Its not only during the period of eco club or environment education when you devote significant classroom time to exploring issues of environmental awareness and stewardship. Whether you teach biology, history, or language arts, the Web is a rich and ever-growing resource, with curriculum ideas for integrating environmental issues into lesson plans. But where to begin? That will be your decision, but we’ll help you get started. We’ve compiled a cross section of seven activities and projects in detail and



with ideas for every grade level. Some can be completed within a few class periods and others require more time, but all are sure to get your students -- and you -- thinking about what can be done to preserve our school campus, colony, district, state, country and in turn increasingly fragile planet.

## Vermicomposting

Welcome to this lesson on Vermicomposting or worm composting.

- We will cover the characteristic and differences in the garden variety worms and the Red Wigglers.
- Reproduction and life cycle.
- Small medium and large scale worm bin/digesters, other type of worm operations and equipment.
- Talk about the uses of castings. And lastly we will set up a small bin.
- Later we are going to introduce some worms into to curing pile at UNC.  
The process of utilizing worms and microorganisms to consume/convert organic wastes into nutrient-rich humus like material is known as vermicomposting. Actually it is worm castings or worm poop!
- Utilizing earth worms and microorganisms to convert organic waste into a nutrient-rich humus like material known as vermicompost (worm castings)
- *Eisenia fetida*, commonly called 'Red Wiggler', 'Manure Worm' or 'Tiger Worm'.

### Characteristics of garden worms

Knight crawler or dew worm (*Lumbricus terrestris*).

~ Not a composter.

~ Garden variety worm are soil- dwelling species that tunnel & borrow.

~ Do not consume large volumes of organic material.

~ Will not reproduce well while being confined.

~ Live several feet below surface.

~ Feed on the surface at night.

~ Require cool (45 F or 7.2 ° C) temperature.

### COCOON



### VERMICOMPOSTING HOME MADE



## VERMI-REPRODUCTION

A worm is sexually mature when they develop that band about 1/4 - 1/3 the distance back from the head. This band is called the clitellum's and it contains the reproduction organs. Worms are asexual (do not need a partner)but as a rule they do use a partner. What happens is that the worms find each other, then crawl facing each other and line up the clitellum's side by side. They each excrete a mucus like substance that encompasses them both. They both will then exchange both egg and sperm into this material. After the exchange has taken place, the worms then separate and the mucus like material then starts to harden. The worms then crawl out of this material, which creates a cocoon. This cocoon is a fertilized egg sac. 3-6 weeks after being deposited in the bedding, 1 – 7 worms can hatch. Within 6 weeks of hatching those worms are capable of reproducing. Limiting factors on population growth are food source, temperature, pH, moisture and living area. Pretty much the same parameters as a adult.

Home made version – drill a few holes for air and drainage

Works, inexpensive – a better way would be to drill 2” holes and use 2” soffet vents.

### CAN – O – WORMS



### WORM FRIENDLY BIN



### MIDSCALE VERMICOMPOSTING



### MIDSCALE VERMICOMPOSTING



## Windrow Beds      Utilization of Worm Casting



Above ground bin that could be easily insulated and green house heater cables installed to maintain a comfortable environment for the worms. Manual and labour intensive to harvest.

Vermicycle, Tarboro, NC 15000 LBS/Day Hog Manure

### Raw Material

- Pit with PVC sheet or brick and cement tank or wooden boxes to house earthworms.
- Coconut fiber, rice husk, sugar cane bagasse, saw dust, chopped rice/wheat straw, cow dung, green foliage, vegetable remnants, discarded parts of fruits, droppings of animals

### Process

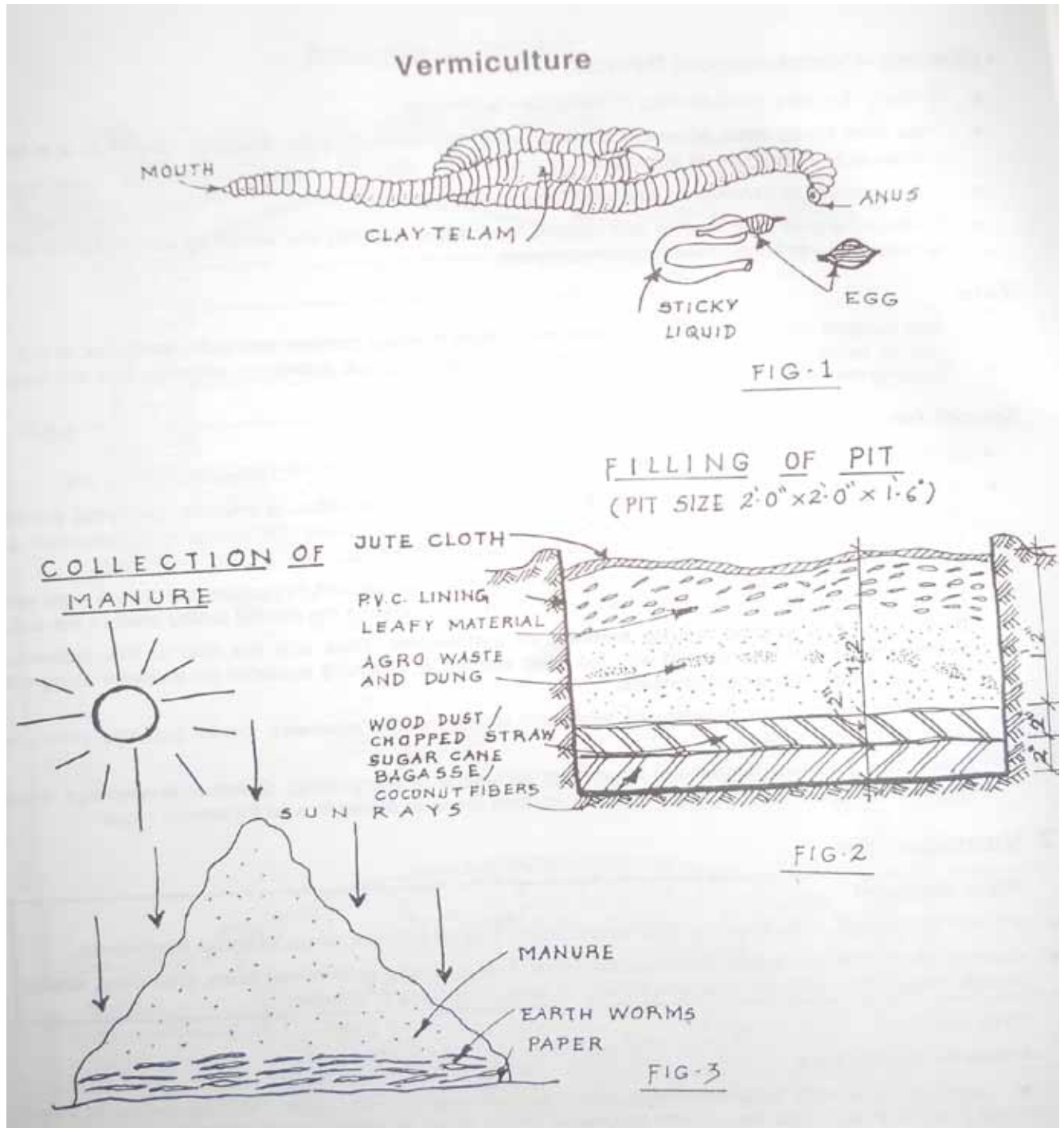
- Select a place away from direct heat, strong sunlight and incessant rains.
- Dig a pit measuring 2 feet x 2 feet x 2 feet. Line the pit with polythene (PVC) sheet to arrest the escape of the earthworms. (brick and cement tank or wooden boxes can also be used).
- The pit is systematically filled with four layers of waste. First layer i.e., bottom of the pit is filled up to 2 inches with coconut fiber/husk or sugarcane bagasse. Second layer is 2 inches thick, consisting of saw dust/chopped rice/wheat straw.
- Dampen the bed by sprinkling water. Third layer is the earthworm food, this includes an admixture of cow dung, green foliage, vegetable remnants, discarded parts of fruits, dropping of horses, pigs, sheep or biogas slurry, human excreta, paper or scrap of cardboards etc.
- This feed should be spread till a height of 6 to 8 inches.
- Release about 100 earthworms on the top of the waste bed without hurting them.
- These earthworms will start penetrating to the bottom.
- Once all these earthworms disappear, cover the surface with jute bags and keep them wet by sprinkling water in a judicious way.
- The jute may be turned upside down thrice in the first week, twice in the second week and only once in the third and following weeks, without causing any disruption to the top layer.
- Water and heat inside the tank assist the organic matter to decay and the earthworms to proliferate, both occurring simultaneously.
- By 4 to 5 weeks, the heat inside the pit will start reducing and will come down to 15-18° C).
- When it does not appear warm when felt by hands, that means that the manure is ready for use.
- From one tank, 50 Kg of manure is produced.
- Spread a plastic paper on the ground and empty the contents of the tank slowly in sunlight making

a pyramid like heap.

- Let this heap remain in direct sunlight for about half an hour, which will induce the earthworms to penetrate deep and reach the bottom. Now the upper layers of organic manure can be lifted slowly.
- Later the earthworms at the bottom may be separated from one another and deposited in the re-filled tank.

### Precautions

- Rubber, metal, brass pieces are disliked by the earthworms.
- Salt, chilly ginger, soap or soap water as well as insecticides destroy the earthworms; hence all these things ought to be avoided.
- Be careful of rodents, insects, birds etc. which feed on the earthworms.



## Castings Utilization

Used in potting soil blend (10% max.).

Used to inoculate soils with beneficial microbes.

Excellent source of beneficial bacteria, fungi, nematodes for compost tea brewing.

Sales potential - \$ 16 per pound (2 oz pouch) / \$ 320 – 800 Pound tote

## Herbal garden



### Aims of this activity:

- Sustainable management of Medicinal and Aromatic Plants (MAP) for plant based drug industries and Traditional Health Practitioners
- Conservation of biodiversity
- Promoting the MAP as a rural livelihood package
- Popularizing the traditional medicine as a creditable and safe health programme so as to integrate with primary healthcare

### Objectives:

- Sensitize students about importance of medicinal plants
- Develop skills in students to maintain gardens
- Involve community in garden development
- Learning and sharing

### History of medicinal plants/herbs in India

- Plant based medicine is ancient (Ayurveda, Unani, Siddha, Homeo).
- Self reliance medical care system
- Usage in modern & traditional system of medicine

### Pre-requisites at school level for setting up a herbal garden

- Presence of compound wall
- Water facility throughout the year
- Ownership of land by school
- Land area in the school of the size 1/10 of hectare (1000 sq.mt) for developing herbal gardens

- Willingness of the school to develop a herbal garden

***Mentha piperata* (Peppermint)**

- Leaves are used.
- Peppermint oil is largely used as a flavouring agent for confectionery as well as toothpastes and mouthwashes.
- The historical use is for easing intestinal cramping, reducing gas production and generally soothing intestinal irritation.
- Has the ability to reduce pain and tension.



***Ocimum basilicum* (Marua Basil)**

- Grown for their ornamental foliage as well as their culinary usage.
- Helpful in boosting immune system of our body.



***Bryophyllum calycinum***

- Leaves
- Magic leaf prevents ulcer.
- Has the effect of dissolving kidney stones.
- Practice is to cleanse the leaves and eat them every morning for 40 days to dissolve stones.



***Catharanthus roseus* (Sadabahar)**

- Whole plant.
- Used to treat diabetes in Europe.
- Juice from leaves used to treat wasp stings.
- In Hawaii, the plant is boiled to make a poultice to stop bleeding.
- In China, used as astringent, diuretic & cough remedy.
- In S. America used as homemade remedy to ease lung congestion and inflammation of sore throats.



***Cymbopogon citratus* (Lemon Grass)**

- Leaves
- Used as insect repellent and carminative.
- Used against coughing, asthma, bladder disorders and headaches.
- Used in herbal teas and confectionery.
- Its oil is widely used as a fragrance in perfumes and cosmetics.



***Costus Ingneus***

- Leaves
- Its extracts have up to 300 times the sweetness of sugar.
- Its sweet taste has a slower onset and longer duration than that of sugar.
- Is being administered to diabetics to lower the blood glucose level.



***Adhatoda vasica* (Vasaka)**

- Leaves, Flowers and bark.
- Used in mucolytic and expectorant drugs.
- Leaf extract used for treatment of bronchitis and asthma.
- It relieves cough and breathlessness.
- Gives relief in pyorrhoea and in bleeding gums.



### ***Urginea indica* (Van Pyaj)**

- Root
- Used as a diuretic.
- Frequently employed in dropsy.
- Used against bronchitis .
- Used in combination with other stimulating expectorants.



### ***Ocimum americanum* (American tulsi)**

- Leaves
- Used as mosquito repellent.
- Leaves made into paste with condiments and eaten raw.
- Boosts immune system.



### ***Plantago psyllium* (Isabgol)**

- Used since prehistoric times as herbal remedies.
- The herb is astringent, anti-toxic, antimicrobial, anti-inflammatory, anti-histamine & diuretic.
- Externally, a poultice of leaves is useful for insect bites.
- *P. psyllium* seed useful for constipation, irritable bowel syndrome.
- Plantain seed husks expand and become mucilaginous when wet, which is used in laxative.



### ***Elettaria* (Cardamom)**

- Used to break up kidney stones and gall stones.
- Was used as antidote for both snake and scorpion venom.
- Also used as a spice and as an ingredient in traditional medicine in systems of the traditional Chinese medicine in China, in Ayurveda in India.
- Green cardamom is broadly used in South Asia to treat infections in teeth and gums, to prevent & treat throat troubles, congestion of the lungs , inflammation of eyelids & digestive disorders.



### ***Trachyspermum copticum***

- It is also traditionally known as a digestive aid, a relief for abdominal discomfort due to indigestion & also used as an antiseptic.
- In southern parts of India, dry ajwain seeds are powdered and soaked in milk, which is then filtered and fed to babies. Many assume it relieves colic in babies, and for children it also improves digestion and appetite.
- In the northern part of India, it is often consumed after a heavy meal.



### ***Bixa orellana***

- It has long been used by American Indians to make body paint, especially for the lips, which is the origin of the plant's nickname, **lipstick tree**.
- It has a distinct flavor of its own, it can be used to
- color & flavor rice instead of the expensive saffron.



## Benefits of Herbal Garden

- **Students**
  - ◆ Awareness & low cost school first aid
  - ◆ Conservation practices
  - ◆ Waste management
- **Community**
  - ◆ Farmers awareness
  - ◆ Conservation of local species

## WASTE MANAGEMENT



### What is waste Management

- Waste management is the collection, transport, processing or disposal, managing and monitoring of waste materials.
- The term usually relates to materials produced by human activity, and is generally undertaken to reduce their effect on health, the environment or aesthetics.

### Methods of disposal

- **Landfill:** Disposing of waste in a landfill involves burying the waste, and this remains a common practice in most countries.
- **Incineration:** Incineration is a disposal method in which solid organic wastes are subjected to combustion so as to convert them into residue and gaseous products.

### REASONS FOR IMPROPER MANAGEMENT OF WASTE

- Lack of planning for waste management while planning townships
- Lack of proper institutional set up for waste management, planning and designing in urban local bodies
- Lack of technically trained manpower and funds.
- Lack of community involvement
- Lack of expertise and exposure to city waste management using modern techniques / best



- practices
- Lack of awareness creation mechanism
- Lack of Management Information Systems

## RECOMMENDED APPROACHES TO WASTE MANAGEMENT

1. Possible Waste Management Options :
  - (a) Waste Minimisation
  - (b) Material Recycling
  - (c) Waste Processing (Resource Recovery)
  - (d) Waste Transformation
  - (e) Sanitary Landfilling – Limited land availability is a constraint in Metro cities.
2. Processing / Treatment should be :
  - (i) Technically sound
  - (ii) Financially viable
  - (iii) Eco-friendly / Environmental friendly
  - (iv) Easy to operate & maintain by local community
  - (v) Long term sustainability

## RECOMMENDED APPROACHES TO WASTE PROCESSING & DISPOSAL

- I WEALTH FROM WASTE (PROCESSING OF ORGANIC WASTE)
  - (A) WASTE TO COMPOST
    - (i) AEROBIC / ANAEROBIC COMPOSTING
    - (ii) VERMI-COMPOSTING
  - (B) WASTE TO ENERGY
    - (i) REFUSE DERIVED FUEL (RDF) / PELLETIZATION
    - (ii) BIO-METHANATION
- II RECYCLING OF WASTE
- III SANITARY LANDFILLING
- IV TREATMENT OF BIO-MEDICAL WASTE SEPARATELY

### REDUCE :

- Do not buy products with excessive amounts of packaging.
- Buy fresh foods rather than canned foods.
- Reduce energy and water use.
- Turn off taps, fans and lights when not in use.

### REUSE :

- Reuse scrap paper
- Reuse old tin cans, e.g., for storage or decorative purposes.

### RECYCLE :

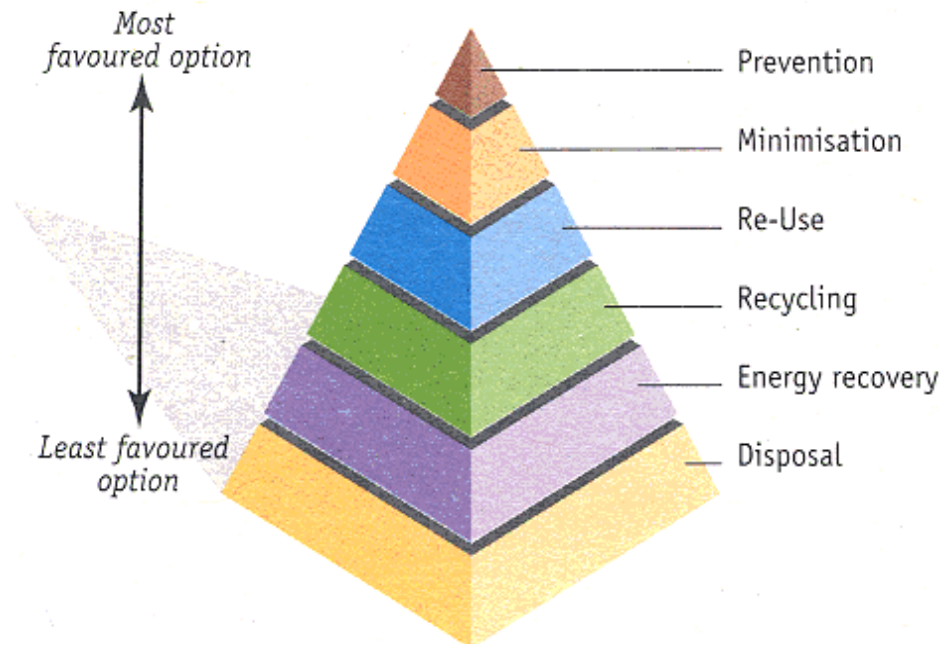
- Segregate garbage into biodegradable(Green bins), recyclable( Blue bins) and Non biodegradable/ Hazardous( Black bins).

### DISPOSE :

- Dispose off the garbage properly using different types of bins provided.



## WASTE MANAGEMENT HIERARCHY



## MUSHROOM CULTIVATION

### What is Mushroom :

- Mushrooms neither belong to the plants nor to animals.
- They belong to a separate group of organisms called fungi.
- They lack the usual green matter, grow on dead and decaying organic materials.
- The fruiting body umbrella like or various other shapes, size and colour.
- Mushrooms are known for their nutritive and medicinal value.

### Mushrooms for health :

- Mushrooms, are called 'white vegetables' or 'boneless vegetarian meat'
- Mushrooms are quite nutritious and possess many medicinal properties.
- High availability of lysine and tryptophan amino acids usually absent in cereals.

- Ideal food for patients suffering from hypertension, diabetes and obesity.
- Mushrooms a good source of protein 15 % to 30 % protein of their dry mass.
- Achieve great health benefits in regulation of blood cholesterol, immune system boost and anti-tumor, anti-cancer properties

### Mushroom Production & Types :

- World 5,00,000 laks ton/ year
- India 40-42,000 ton/ year
- Types of Mushroom
- Button Mushroom (*Agaricus bisporus*)
- Dhingri / Oyster (*Pleurotus spp*)
- Paddy straw (*Volvariella volvacea*)
- Milky Mushroom (*Calocybe indica*)

### Cultivation Season in North India :

- October to March ----- White Button
- May to Mid August-----Paddy straw
- Mid August to mid April---- Dhingri
- February to April ----- Milky Mushroom

### Properties of Mushrooms :

- Rich proteins, less fat, less carbohydrate and salts.
- Rich in fiber and Have high Vitamin B12 and folic acid content uncommon in vegetables.
- High lysine and amino acids usually absent in cereals.
- Ideal food for patients suffering from hypertension, diabetes and obesity.

### Substrates for *Pleurotus spp.* :

- *Agaricus* compost
- Rice straw
- Wheat straw
- Maize stalks & cobs
- Paper
- Hardwood logs, chips and sawdust
- Seed hulls
- Broadleaf “straw”
- Cotton wastes
- Coffee consumer-growing wastes

### Cultivation Method :

- Cut the straw 3-5 cm
- Soak overnight in water
- Drain out Excess water next day
- Add @ 7gm bavastin/100Lit water+ 125ml formaldehyde before soaking in water
- Or Steam 2 Hrs (Eliminates sugars, removes the waxy layer, helps decomposition and growth ,free of competing organisms



## Spawning & Filling

- Add 2-6% spawn in wet paddy straw
- Fill in perforated 40x30 cm black polythene up to 2/3 capacity
- Incubate in dark humid, well aerated room with 22-25°C , 80-85% RH for 10-15 days
- The area should be completely clean to avoid contamination.
- The substrate moisture should be around 75% ).

## Incubation :

- During the first 24 hours, the mushrooms grow little while adapting to the medium.
- Increased growth starts about 48 hours after seeding, depending on ambient conditions.
- During this vegetative state of the mushroom, the temperature has to be between 22 and 26°C.
- Optimally, the incubation period should not exceed 17 to 22 days.

## For Production :

- Cut open polythene & place one feet away on perforated racks fruiting structures appear in a few (five) days.
- When this happens, the humidity and temperature conditions will have to be 90 – 95 RH and 24 - 26°C, respectively.

## Harvest :

- Cut the crop when fully developed, leaves twisting from the margin
- Cut larger ones first, leaving the smaller for later.
- The bodies are removed by cutting the base of the stalk with a clean, sharp blade.
- 4 - 6 days after harvesting, the next sprouts begin to appear. 15 kg substrate may produce 3 to 4 harvests; 80% production obtained during first two harvests. (1.5Kg Dry Straw = 6kg Wet straw) --- 1 Kg Yield Fresh



*P. Corpoque*



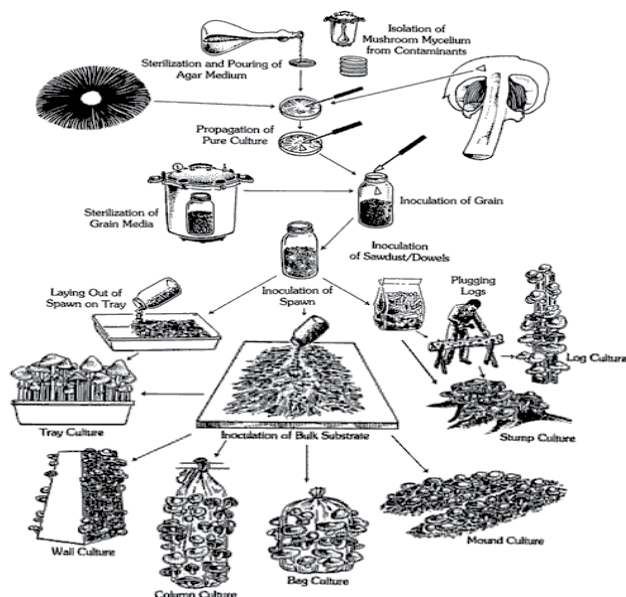
*Block on Racks (Perforated)*



*King Oyster (P. erhengii)*



*Pearl Oyster*



## Rainwater Harvesting

### What is Rainwater harvesting?

It is the process of collecting and storing water for future productive use.

**Rainwater harvesting** is the accumulating and storing, of rainwater for reuse, before it reaches the aquifer. It has been used to provide drinking water, water for livestock, water for irrigation, as well as other typical uses given to water.



### What is rooftop rainwater harvesting?

Since it is quite easy to collect rainwater falling on roofs, rooftop rainwater harvesting is the process of collecting rainwater falling on rooftops in a tank or sump for future productive use.

### Why rooftop rainwater harvesting in schools?

Many schools presently do not have a reliable source of water for drinking and other use.

The school rooftop rainwater harvesting system seeks to provide a source of water for all purpose such as toilet flushing, cooking, washing hands and feet before eating and after toilet use, hygiene and finally if the rainwater is treated well for drinking purpose.

This is especially important in areas where there is Fluoride, Nitrate, Iron or salt in the groundwater and therefore it is unfit for consumption. In these places the rainwater harvesting tank can provide mineral free water for consumption.

Rainwater collected from the roofs of houses, tents and local institutions can make an important contribution to the availability of drinking water. It can supplement the sub soil water level and increase urban greenery.

### How much rainwater can be collected?

This depends on the rooftop area, the size of the tank and the rainfall at that place. For example in a place where it rains 500 mm and the roof area is 100 square meters, the rainwater falling on the roof is 50,000 liters. Some amount of it will be absorbed by the roof and some amount will be lost in the collection process. If we assume 80% can be collected then 40,000 liters of rainwater is available for collection.

Depending on the size of the rainwater tank and the distribution of rainfall even a 3000 liter tank may be sufficient to collect all this 40,000 liters of rainwater. We must however keep on using the rainwater in the tank and not wait for summer to use it.

By painting an information board, and keeping a small rain gauge in the school, a good school can involve students in monitoring rainfall, total rain in a year, water collected in the rainwater tank and teach them how to ensure good maintenance of the system.

## SYSTEM COMPONENTS

### What are the parts of the roof top rainwater harvesting system?

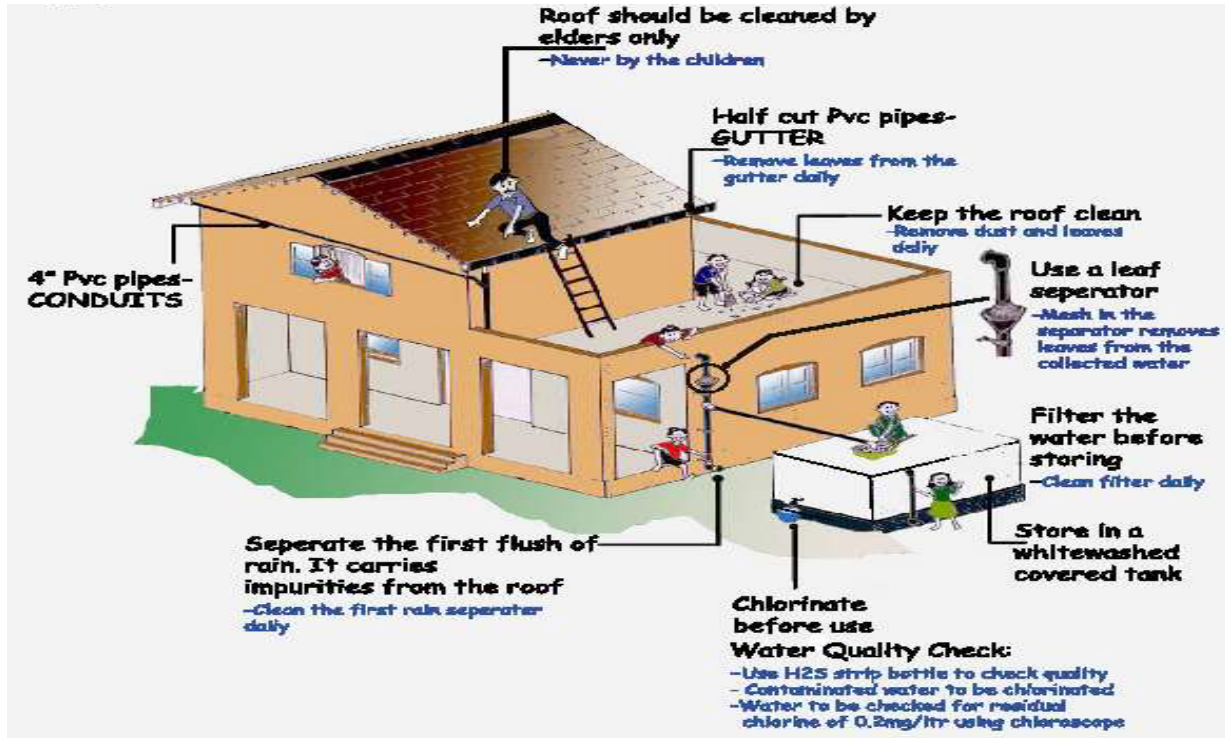
**ROOF** – The existing roof is made use of to collect rainwater. Since rainwater is pure as it falls from the sky it is necessary that the roof be kept clean for it to remain pure when it is collected. This means the roof will need to be swept and cleaned daily during the rainy season.

This should be carefully done by an adult (never by children unless it is accessible and safe) equipped with the necessary implements such as a ladder, broom and a brush if necessary.

Some schools will have shady trees to cover the roof. However leaves falling from the roof will cause

blockage in the gutters and pipes. The leaves can also colour the water and cause it to decompose and smell. Therefore, roofs should invariably be completely cleaned of all leaves, dust, bird droppings etc. using a broom. Water should only be used if necessary as most times a dry sweeping with a broom will be enough.

When cleaning the roof with water be careful to keep the first rain separator open so as not to allow the dirt to come into the filter and the tank.



**PVC GUTTERS:** The gutters of PVC collect the rainwater from the roof and transfer it to the filter. On sloping roofs, PVC gutters can pick up leaves, dust, small twigs and other organic matter. The gutters need to be cleaned regularly at least weekly once. During the rainy season the PVC gutters should be inspected and cleaned daily. The gutters are fixed to the roof or to the walls with clamps. The clamps hold the gutter or pipes to the wall or to the roof firmly and allow small slope in the system to enable water to flow in one direction.



A clean PVC gutter to catch every drop of rain

The clamps sometimes may come off due to various reasons. The clamps should be fixed immediately whenever it is seen to be loose or when it has come off.

At all times the PVC gutters or pipes should slope in the direction of the storage tank and not away from it. The PVC gutters should always have an end cap at the end where rainwater begins to flow in the direction of the tank.

**DOWNPIPES:** PVC down pipes brings the water from the rainwater gutters or pipes vertically down. They should invariably be clamped firmly to the wall and should never be loosely fixed. Always check that the down pipe is firmly fixed and if necessary replace or tighten the clamp whenever necessary.



**End cap for the gutter**

**FIRST RAIN SEPARATOR:** The first rain separator or a washout pipe as it is called, has a valve or an end cap to allow the first little amount of rainwater to be collected separately. This has most of the dust and dirt in it. The first rain separator also is used when the roof is being cleaned or when rainwater is NOT to be collected.



**First rain separator with end cap on the wall**

It is important to ensure that the first rain separator is always kept in the closed position and never left open. After every rain it should be opened carefully and the waste water allowed to flow out. The pipe should then be cleaned and the valve or the end cap closed.

Sometimes the first rain separator can get jammed due to the dirt or dust in it. In such a situation the valve or the end cap should be carefully replaced by a good plumber.

**LEAF TRAP:** Where the roof of a school has lots of leaves falling from a tree or trees a conical leaf trap can be placed in the vertical down pipe. This has a mesh on top. The mesh prevents small leaves, twigs and other material from entering the pipe and blocking it or choking the filter. The material collected on the leaf trap if any must be removed at regular intervals and daily during the rainy season.

**FILTER:** A gravel, sand and 'netlon' mesh filter is designed and placed on top of the storage tank. This filter is very important in keeping the rainwater in the storage tank clean. It removes silt, dust, leaves and other organic matter from entering the storage tank.



**A good filter with mesh and gravel on top**

The filter media should be cleaned daily after every rainfall event. Clogged filters prevent rainwater from easily entering the storage tank and the filter may overflow. The sand or gravel media should be taken out and washed before it is replaced in the filter.

**STORAGE TANK:** The rainwater **storage tank** collects all the filtered rainwater and keeps it for future use. The storage tank is made above the ground and on a platform. It can also be an underground sump in some cases.

The tank is invariably painted white on the outside. This is done to keep the water inside cool and prevent the growth of bacteria. Every year the tank must be white washed neatly.



**Rainwater storage tank**



The tank also will be sealed from the top either with concrete slabs or any local stone. It must be ensured that the top cover is permanent and always fully covered. This will prevent the growth of algae or bacteria in the tank. In no case should it be opened. If there are small cracks in the joints they should be sealed with cement mortar immediately. Mosquitoes and dust should never be allowed in to the stored rainwater tank.

The tank should also be completely water tight. If there is any leak in the tank or even dampness, the problem should be addressed immediately with the help of a trained engineer.

**OVERFLOW PIPE:** The storage tank will have an overflow pipe from the top of the tank. In case of heavy rain, the overflow pipe will allow the excess rain water to be safely disposed of without causing any flooding. The size of the overflow pipe should be the same as that of the inlet pipe. It will have a mesh at the bottom to prevent rats, squirrels and cockroach from coming in.



**Overflow pipe with mesh**

The mesh should be checked weekly and if torn or open should be repaired or replaced immediately. It should also be ensured that the overflow water is drained away effectively to a pit, plant or storm water drain and not allowed to cause flooding.

**TAP:** A tap is provided in every tank to draw the rainwater out. Sometimes a tank can have more than one tap. Invariably it is found that children play with the pipe outlet or the tap and it is damaged. Children should be taught not to stand on the pipe or to play with the tap. A broken tap will result in the entire system going to waste as all the collected rainwater will flow out.



**A tap and a drain out pipe firmly anchored to tank**

If there is no tap on the tank or if it is broken, no rainwater will be collected in the tank when it rains. Ownership of the system should be created and the taps taken care of and inspected daily.

If there is any leak in the tap, that too should be taken care of by replacing the washer or by getting a good plumber to repair it immediately.

Where the taps are located the area will be cemented to drain out any waste water from the site. This drain out water will be lead into a pit or a plant whichever is available.

**WATER QUALITY CHECK:** If the roof, the gutter, the first rain separator and the filter is kept clean, the collected rainwater will be crystal clear. This is an indication that good maintenance is being followed.

If the water is however dirty in colour or it smells bad, then it means that the system is not being kept clean.

Even if the water is clear and does not smell still it must be checked for micro-biological contamination. The checking should daily for the first one month and then weekly if the water is clear and not foul smelling. For this one must use a H<sub>2</sub>S strip test bottle. Wash your hands thoroughly with soap. With clean hands the sealed bottle should be opened. From the tap in the rainwater storage tank fill the bottle to the mark provided.

Close the cap tightly. Bring the bottle back to a safe place in a room. Observe for 24 to 48 hours. If the water turns black in the bottle then it is micro-biologically contaminated and requires treatment before being used for drinking. If the water colour stays brown, then the water is fit for drinking.



**H<sub>2</sub>S strip test bottle: If the water turns black in the bottle then it is micro-biologically contaminated.**

**WATER QUALITY TREATMENT:** Though rainwater as it falls from the clouds is very pure, it does pick up dirt, dust and bacteria once it falls on the roof. It is very necessary to therefore check the quality of the water before using it for consumption.

Once it is established that the rainwater is not micro-biologically contaminated it can then be consumed directly. However if the H<sub>2</sub>S strip test suggests that water has bacteria in it, it must then be treated before it can be used for drinking.

The method suggested for treating for bacteria is chlorination. Liquid chlorine or chlorine tablets are available for treatment of water. Depending on the volume of the rainwater in the tank, chlorine needs to be added to disinfect the water. Chlorination should be carried out every time there is rain and a fresh infusion of water into the tank.

Using a chloroscope, residual chlorine of 0.20 mg/litre should be established before the water is used for drinking.

Another form of deactivating bacteria and making water fit for consumption is called SODIS – **Solar disinfection** of water. In this method, rainwater is kept in a PET bottle or a glass bottle in the sun for 6 hours. One side of the bottle is painted black.



**Solar disinfection or SODIS using a bottle painted half black**

The black surface is kept on the ground. With a combination of UV disinfection and infra red heat sterilization the water becomes fit for consumption. In cloudy weather the bottles need to be kept in the sun longer.



**Rainwater Harvesting Project at RPVV, Surajmal Vihar, Delhi**

## BOTTLE PLANTS

Given the stale air circulating in most urban homes, indoor plants have difficulty flourishing unless they're plied with bushloads of TLC. A terrarium (which is a glass container used to grow and display plants) allows us to go slow on the intense personalized attention by creating a growth environment that requires very little care. Closed terrariums, happy in their humidity filled surroundings, actually thrive on neglect. They need nothing from the outside world except a little indirect sunlight. The plants transpire moisture through their leaves, which then condenses on the glass, and flows back to the soil. This 'rain effect' allows the terrarium to go for weeks without watering. Plants like money plant, spider plant, wandering jews, syngonium, cacti and succulents make for great terrarium residents. Exotic plants like ivy and nana can also go into these bottled gardens. But remember, the thumb rule for the selection of the plant is that it should be slow-growing.



### Step – 1

First get together all the ingredients, so to speak. You will require an untinted glass bottle, bowl or aquarium tank as well as a glass, stopper or lid to seal the garden (avoid using corks as they absorb water, depriving the plants of moisture); gravel chips, soil, small stones, brick pieces, sand, charcoal and leaf mould or manure. Small rocks, stone figurines and shells do well as accessories.



### Step – 2

Line the bottom of the container, that is about one inch or one-fifth of the container, with pea-sized gravel (the kind used in aquariums work well ). This ensures that there is ample drainage for water. Place shells or coloured stones before introducing the gravel if you wish to beautify the piece.



### Step - 3

Create a thin layer of charcoal (about one - fourth of an inch) above the gravel base. Charcoal purifies the air inside the container. The amount of charcoal you put in depends on the size of the glass container you are using. A small jar will require just two to three small pieces of charcoal whereas a large jar will require anything from five to six big pieces.



### Step - 4

Sterilize the soil beforehand by drying it under the sun and weeding out unwanted roots. Mix some compost manure with the soil in equal proportions and fill about one-fifth of the container with this mix. If you want, you can even moisten the soil mix and then bake it for 20 minutes.



### Step - 5

Select the plant which is to be grown. Ideally, it should be of non-flowering variety, adaptive to moist atmosphere and have a slow growth rate. Also remember to match the size of the fully grown plant to the size of the container.



### Step - 6

Spray water sparingly so as to just wet the soil. Don't water too much. Cover the container with the lid and place it where it can get bright but indirect light. Don't put it under direct sunlight as this will increase the temperature inside the container. If the inside walls of the container (whatever the size) become foggy, remove the lid till the condensed water droplets evaporate. For the final touch, add coloured gravel, shells or marbles.



## PAPER RECYCLING

*Recycling paper is important for many reasons. Our energy supply and space are not unlimited, so recycling paper increases the sustainability of both these and many other important aspects of our environmental impact.*

### Resource Conservation

*One of the primary reasons to recycle paper is to conserve resources. The primary product used to make paper is wood pulp. Recycling paper reduces the amount of wood pulp needed, and that in turn, reduces the number of trees that are cut down. Trees are a vital part of a balanced ecosystem. Although many paper manufacturers own land specifically for tree farming and replace cut trees with seedlings for future use, tree growth is very slow. Additionally, there is energy used and pollution created by cutting and transporting the trees to the mill.*

### Landfill Space

*Although there is debate regarding whether or not we're running out of landfill space, there's little argument about the main component in our landfills: paper. Every tonne of paper takes more than 3.3 cubic yards of landfill space. According to the Environmental Protection Agency (EPA), forty percent of landfills' content is paper. And the proportion of paper in landfills has remained steady over the decades despite the rise of computers and the Internet. Although paper breaks down much easier than plastics and other forms of waste, it does not decompose very readily when compacting in a landfill.*

### Incineration Reduction

*Besides saving landfill space, when people recycle paper, there's reduced need for trash incineration. Some municipalities burn trash rather than storing it in landfills. By diverting paper out of the trash stream, there is less to burn, so there's less need for incinerators and less ash output and air pollution.*

### Energy Conservation

*Manufacturing paper from recycled paper fiber requires less energy than making paper from virgin wood pulp. In fact, making recycled paper is estimated to use 60 to 70 percent less energy, and the paper industry is the third largest user of energy in the U.S. In addition to saving energy, recycled paper manufacturing uses about 50 percent less water than its virgin counterpart and significantly reduces water pollution in the process as well.*

### It's Versatile

*People should recycle paper because there's a wide range of products that can be created from recycled paper. Although paper fibers cannot be recycled indefinitely, like glass and aluminum, it is possible to recycle paper fibers about six or seven times. Each time paper is recycled, it becomes a lesser grade but is still a useful product. By the end of the fibers' usefulness, they can be made into pressboard, tissue or even insulation.*

### Reduces Global Warming

*In today's world the importance of recycling is becoming greater of a concern both for the general public and also to the economy. Recycling has become a major issue as scientific research has been suggesting for years that the earth is being depleted too fast to sustain a healthy balance. The earth's natural resources are being consumed at a rate that reinforces the idea that we are living for today and*

*the future generations will be paying for the consequences. Recycling along with reducing consumption is our best means to counter the damage we have been doing to the earth for centuries. The importance of recycling is now held in such a high regard even famous people are taking up the plight. We have to educate the world on the effects of global warming, how we can reduce the causes of global warming. A major part reducing the warming is how we can recycle much of what we use instead of turning it into unusable waste. Recycling is incredibly important as a means to reduce poisonous emissions into the atmosphere and also to spare our natural resources.*

## **The various steps in the process of Paper Recycling are:**

### **STEP 1**



#### **Waste paper torn and soaked in water**

- *Waste paper is torn into small pieces and kept in a large tub.*
- *They are soaked in water for two hours.*
- *Fenugreek seeds (Methi seeds) can be soaked along with the paper to increase the strength of recycled paper.*

### **STEP 2**

*This is an electrically powered mini-beater or a hydrapulper.*

*Pulp is made ready in this hydrapulper for making paper*

- The soaked paper is put into the hydrapulper along with soaked fenugreek seeds.
- Water is poured into the hydrapulper.
- The lid is closed.
- It is switched on and run for 20-30 minutes.
- This pulp is well beaten and smooth.
- We can add colours to this pulp and beat it for a few seconds.



### STEP 3

*This is a univat with a unique deckle and mould frame system.*



Univat is filled with water and the deckle and mould frame system is slowly immersed in water.



The paper pulp is transferred to the deckle and mould frame, mixed thoroughly with water and lifted slowly. The quantity of pulp transferred depends on the thickness of the paper required.



### STEP 4

A wooden board is placed on a table. A piece of thin cotton wet cloth is neatly spread on the board without any wrinkles.



The frame is carefully lifted and turned over the cloth. At least ten sheets can be stacked on top of each other separated by the thin cotton cloth.





Another wooden board is placed on this stack of sheets and pressed to squeeze out excess water.



## STEP 5

*This is a manual screw press. It is used to squeeze out water from the recycled paper sheets.*



The stack of sheets along with the two wooden boards, one at the top and one at the bottom of the papers is placed in the screw press. It is rotated like a screw till most of the water is squeezed from the paper.



## STEP 6

After squeezing out excess water by the screw press, the sheets of papers are separated and dried in the Sun.



The dry paper is peeled out from the cotton cloth the next day and straightened with a calendaring machine or a hot iron.



After this the paper is ready for use or sale.



## WEALTH FROM WASTE

**Saving paper is saving trees.** It takes **17** fully grown trees to make **one tonne of paper**.

If each child saves **one sheet** of paper a day, then **40,000 trees** are saved per year by the students of **Delhi** alone.

Recycling paper is an endeavour not only towards saving precious paper but also towards **saving energy, water, chemicals** utilised in paper making and **reducing garbage**.

Recycling of paper creates widespread awareness in individuals of how they can **save our environment**. Each one of us can turn waste paper and cotton rags into useful and valuable products. At the same time it **eliminates pollution**.

It is the **best gift** we can give to **Mother Earth**.

## PRODUCTS MADE FROM RECYCLED PAPER



*Paper Bags*



*Pencil Stand and Gift Box*



*File Covers*



*Lamp Shade*



*Paper Flowers*



*Photo Frame*



*Slip Pad Box*