SATNET ASIA
Innovation network for food security and poverty reduction

Biointensive School Gardens

Enhancing nutritional and agro-biodiversity outcomes

Technology fact sheet | 10 / October 2014

Key facts

- Production of nutritionally rich, local vegetable varieties in schools to supplement the school feeding programme.
- Focal points for education about the environment, conservation of vegetable agro-biodiversity, food culture, nutrition and a healthy lifestyle that can benefit parents, guardians and schoolchildren.
- Venues for teaching the importance of dietary diversity (greens, legumes and root crops as a source of nutrients and fibre).

What is a biointensive school garden?

- School gardens are 50 m² to 1,000 m² plots where children learn how to grow vegetables using organic methods. Practical gardening sessions are combined with theoretical lessons in the school curriculum.
- Biodiverse school gardens represent organic systems with a low carbon footprint. They employ climate-smart practices such as planting trees around the garden to manipulate the ecosystem and produce green fertilizer, composting, cover cropping in the dry season, and use of climate-smart deep-dug garden beds.
- The gardens serve as potential focal points for educating children about the environment, conservation of agro-biodiversity, food culture, nutrition and a healthy lifestyle.
- Different types of vegetables with emphasis on nutritionally rich local varieties are cultivated using eco-friendly and appropriate crop rotation practices. This allows beneficial organisms to thrive, enhances year-round availability of vegetables, prevents soil stress and increases the quality of the school nutrition programme.
- The technology enables schools to produce their own fertilizer and promotes self-reliance in the use of planting material by saving seeds. Less resources are required with the employment of multiple techniques such as mixed cropping of annuals and perennials, active fallow in the dry season which coincides with the school vacation and cover-cropping of legumes. The cover crops serve as green manure at the start of the following school year.
- By selling the garden produce, children earn income for the school while developing their business, managerial, organizational and decision-making skills which will help them do well when they grow up.
- Development of culturally acceptable recipes that are appetizing for schoolchildren, promotes the utilization of indigenous vegetables in the school feeding programme.

Where it works

- A school garden can be developed in a rural or urban setting. It is especially recommended for a school with a high proportion of malnourished (under- and over-nourished) children.
- The programme is being implemented in rural schools in the Philippines and Indonesia.
- There must be a reliable and clean water supply for the garden. Alternatively, rainwater can be collected from the roof of the school building and stored.
- It is crucial to have a committed group composed of the school administrator, agriculture teacher, extension agents and school feeding coordinator to promote, support and implement the programme.

Figure 1. School garden

Technological aspects

- **In the beginning:** It is important to find a 'garden leader' or 'garden manager' with a deputy (e.g. the school principal and an experienced teacher or gardener from the community). This person should be backed by a small team of competent people (e.g. a head teacher, parents, caretaker and a health worker) who have the interest, authority, commitment, experience and contacts. This group can be used to develop a network of volunteers, helpers and supporters.
- **Size of the garden:** The garden can be of any size from a window box to a field. If education is the main objective, then three or four small beds (1m x 2m each) can be used to demonstrate a model of a kitchen garden. For younger children, a bed of 0.6 m x 1 m and for older ones, 1 m x 1.5 m are sufficient to ensure that they do not step on the vegetables. If the focus is on producing food, much more space is needed (around 10 m long). Some school gardens in urban areas range between 50 m² and 1,000 m². There should be a minimum of one bed for each class.

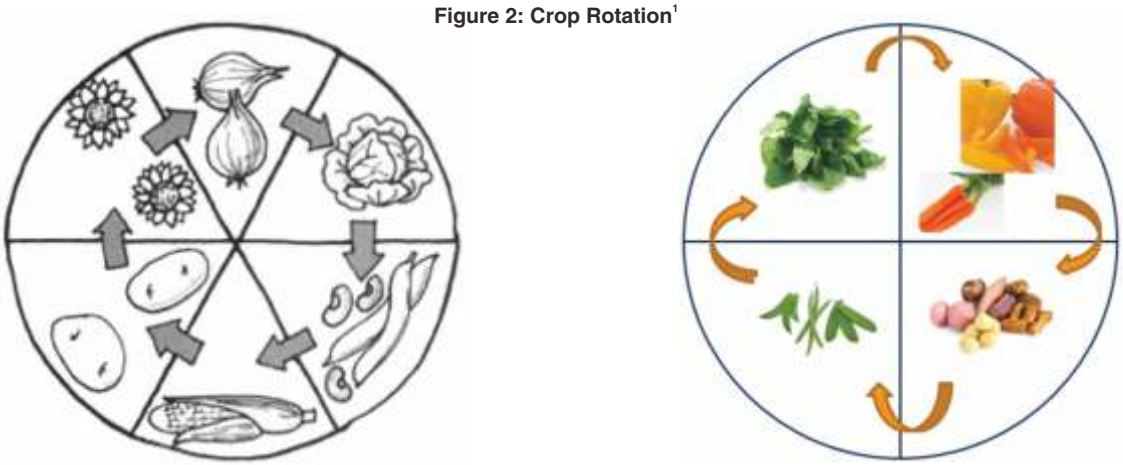
- **Soil and garden bed preparation:** Deep-dug and raised beds are recommended. Garden beds that are 30 cm deep allow roots to grow deeper and store water for a longer period of time. In areas with acidic soil, locally available materials such as ash, pulverized eggshells and compost must be added during the garden preparation stage. Alkaline soil can be corrected through the incorporation of compost.
- **Cultivation:** Local vegetables, fruits and trees which are easy to cultivate should be chosen. The crops should fit in with local food habits, have high nutritive value and should not be difficult to prepare (e.g. green leafy vegetables, yellow and orange fruits and vegetables). A variety of crops is better than cultivating only one or two types. Most importantly, children should be involved in decision-making about the planting schedule. The annual production cycle consists of eight months for active production and four months for restoration of the soil. A mixed cropping system is followed for multiple production within the year. Production methods should be simple so that parents and children can replicate the system at home.
- **Crop rotation:** This does not overburden the soil and plants are not easily attacked by pests and disease. Plants use different amounts of nutrients and produce certain nutrients in return. Rotate heavy nutrient feeders with heavy nutrient producers to allow the soil to regain nutrients used up by one kind of plant. Leguminous crops should be planted next to heavy nutrient users such as fruit-bearing vegetables. Effective crop rotation is based on using the right botanical families of the crops to ensure that vegetables from the same botanical family are not grown one after the other on the same plot as this will result in pests and diseases being carried over from one crop to another; crops from the same family have similar nutrients and growing them in the same season will not provide the nutrient diversity needed for a healthy diet. Small schoolchildren have little knowledge of vegetable botanical families and to ensure a scientifically sound crop rotation in school gardens, the cropping sequence can be based simply on the plant part or the colour of the vegetable that is consumed.

Table 1. Patterns of crop rotation

Basis of crop rotation	Planting season 1	Planting season 2	Planting season 3	Planting season 4
Plant part consumed	Leafy vegetable	Fruit-bearing vegetable	Root crop	Legume
Colour of vegetable consumed	Yellow/orange/ red vegetable	Dark green leafy vegetable	Starchy vegetable	Beans/peas

- **Green manure:** This can be obtained from cover crops or trees (e.g. leguminous trees like *Gliricidia sepium*) which can be grown around the school. Besides providing a continuous supply of fertilizer, the trees will also make a significant contribution to carbon sequestration. The trees are grown at a distance of 1 m from the school boundary. After 9-12 months, the upper branches are cut, leaving at least 1 m of stem for regrowth. The leaves are incorporated into the soil of the garden beds. The leaves should be allowed to decompose for up to 14 days before planting. Pruning of the trees is not recommended in summer. Other cover crops are rice bean *(Vigna umbellata)*, cowpea/black bean *(Vigna unguiculata)*, peanut *(Arachis hypogaea)*, lablab bean *(Lablab purpureus)* as well as jack bean *(Canavalia ensiformis)*.
- **Composting:** Compost can be produced using organic matter such as kitchen waste, plant material if it is not too big, wood ash or cotton cloth. The first layer of the composting pile should be coarse material like sticks and branches, followed by the organic material. After building up the pile, water it and make holes in it for air circulation. It is necessary to cover the compost with cloth or grass to keep it warm and damp. Turn the compost over after a few weeks

Figure 2: Crop Rotation[1]



[1] Left: FAO (2005) Setting up and running a school garden, available from ftp://ftp.fao.org/docrep/fao/012/a0218e/a0218e.pdf, and right: AVRDC – The World Vegetable Center.

and continue this process for a period of three months. When the compost is moist, crumbly, dark and light in weight, it can be used in the garden.

- **Intercropping:** This helps to utilize and conserve the soil and protect plants. Tall plants next to small ones (e.g. maize next to cabbage, broccoli next to spinach/lettuce, fruit trees with vegetables); deep-rooted plants next to shallow-rooted plants (e.g. maize with sorghum and pigeon pea); climbing plants next to ground plants (e.g. beans, passion fruit or corn next to lettuce, carrots, onions or squash); and broad leaves next to narrow leaves (e.g. cabbage with carrots).
- **Protection against predators:** A fence, hedge, wall or other local practice can be used. For 'greening' the garden, a 'living fence' like prickly pears (Indian Fig, *Opuntia ficus-indica*) can be used. The additional benefit of a living fence is that its roots bind the soil and it produces edible fruits. Neem trees *(Azadirachta indica)* can also be used as a 'living fence' against insects. Additional benefit of a 'living fence': aesthetic appeal and shade all round the year. For the plant nursery, a table can be used with a frame covered with fronds as a roof against the sun.

Economic aspects

- Initial cost of a school garden: Basic equipment (for about 40 users). The tools can be borrowed from the children's homes and should not be too heavy for small children. The cost of the seeds and seedlings can be kept low if the school garden starts on a small scale and grows over a few years, reproducing its own seed. Local plant seeds are cheaper and safer. Sponsors, charities or the government can provide a grant for more expensive equipment.
- The initial cost of a school garden in the Philippines is about PHP 50,000 ($1,163), required to construct a seedling nursery and purchase tools and equipment needed for the maintenance of the garden (see Table 2).
- The main economic benefit for schools is the money saved by not having to purchase vegetables and self-reliance.
- Since most vegetables produced are consumed by the schoolchildren, it is difficult to estimate the economic benefit. The example of an isolated case of tomato production from a school garden is cited here (see Table 3), acknowledging that a diversity of crops are cultivated and should be taken into account.

Enviromental aspects

- Only small amounts of water and no energy are required.
- Positive impact on local biodiversity and natural biological processes.
- Does not require chemical fertilizers and does not produce non-biodegradable waste material.

Table 2. Cost of a school garden in the Philippines

Material/ Equipment	Unit cost (PHP)	Quantity	Cost (PHP)	Cost ($) $1=PHP 43
Wheel barrow	3 000.00	3	9 000.00	209.30
Spade	450.00	3	1 350.00	31.40
Shovel	250.00	2	500.00	11.63
Hoe	450.00	4	1 800.00	41.86
Watering can	150.00	4	600.00	13.95
Water barrel	450.00	4	1 800.00	41.86
Rake	150.00	3	450.00	10.47
Bolo	280.00	4	1 120.00	26.05
Reaper	400.00	3	1 200.00	27.91
Hose			1 000.00	23.26
Hand shovel	60.00	6	360.00	8.37
Pruning shear	250.00	3	750.00	17.44
Assorted seeds			3 500.00	81.40
Seedling bag	100.00	6	600.00	13.95
Seedling tray	50.00	8	400.00	9.30
Basket	150.00	4	600.00	13.95
Nursery/green house	25 000.00	1	25 000.00	581.40
		Total	**50 030.00**	**1 163.49**

Table 3. Cost analysis of a tomato project in the Philippines

	Product	Quantity	Sale price per unit	Total value
INCOME	Tomato	50 kg	$2 per kg	$100
			TOTAL	**$100**

	Item	Quantity	Cost per unit	Total cost
COSTS	Seeds	5 packets	$2	$10
	Fertilizer	5 bags	$5	$25
	Paper bag	100	$10 per 100	$10
	Market license	1	$5	$5
	Transport	4 trips to market	$3	$12
	Hire of tools			$4
			TOTAL	**$66**
EXPECTED PROFIT				**$34**

Source: FAO (2005) *Setting up and running a school garden*, p. 73

Social aspects

- Renewed thinking about production systems and alternatives.
- Increased food production to meet nutritional needs and earn income from excess production.
- Simultaneous reduction in malnutrition and acquisition of agricultural skills by local communities.

- The nutrition education can have a positive impact on parents/guardians and schoolchildren.

Figure 3. Indonesian schoolgirls harvest a crop of greens[2]

Labour requirement

- Much of the work will be done by the pupils (around 9-14 years old), but they should be helped by volunteers (parents, community members, other students and ex-students) and the gardener, in case the school has one. Such help is especially needed for the heavy work such as preparing the site. It is most important that the children participate as learners and not as the labour force. The first priority is that they should enjoy their time in the garden and learn from it, instead of feeling punished or having to do unpleasant work.
- Ideally, garden time and lesson time should complement one another. The latter should be used for organizing, discussing, planning, setting up experiments and observations as well as documenting garden activities and events. To run a small garden and get the optimal educational benefit, about an hour each of garden time and lesson time is needed weekly.
- Additionally, the teachers and the garden manager should organize garden work and lessons, encourage volunteers, help children, contact sponsors, write reports, attend meetings and involve school cooks and caretakers. A good garden manager delegates work to responsible pupils and to a garden support group. The additional time required for teachers and the garden manager depends on the garden size.

Issues for replication

- Unsuitable conditions: Regions with insufficient water, flood-prone areas, soil difficult to prepare for planting.
- Shortage of motivated supporters.
- Children might not like the food (cook must be creative to make food that the children enjoy eating).

Contacts

Ms. Irish Baguilat, BIG Program Coordinator, International Institute of Rural Reconstruction (IIRR). Email: irish.baguilat@iirr.org, philippines@iirr.org

Useful links

- http://www.treehugger.com/culture/setting-up-and-running-a-school-garden-toolkits-for-teachers.html
- http://www.iirr.org/images/uploads/Integrated_Approach_to_Address_Food_and_Nutrition_Security_in_the_Philippines.pdf
- http://www.agrowingculture.org/2011/10/the-use-of-green-manurecover-crops-for-relay-cropping-in-northern-thailand/
- http://newsinfo.inquirer.net/624497/bahay-kubo-veggies-thrive-in-school-gardens
- http://schoolnutritionphils.wordpress.com/2014/07/25/strengthening-the-school-nutrition-program-in-the-philippines-2/

[2] http://vgts.avrdc.org/media/vgts-newsletter/

SATNET Asia
CAPSA-ESCAP
Jl. Merdeka 145
Bogor 16111, INDONESIA
P: +62 251 8343277, 8356813
F: +62 251 8336290
E: satnet@satnetasia.org
www.satnetasia.org

This project is funded by the European Union

This publication has been produced with the assistance of the European Union. The contents of this publication are the sole responsibility of ESCAP and can in no way be taken to reflect the views of the European Union.