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## SECTION 1:

### VALUE OF SCHOOL-BASED VEGETABLE GARDENS

*“Where schools are equipped with gardens ... opportunities exist for reproducing situations of life, and for acquiring and applying information and ideas in carrying forward progressive experiences. Gardening need not be taught either for the sake of preparing future gardeners, or as an agreeable way of passing time. It affords an avenue of approach to [the] knowledge of the place farming and horticulture have had in the history of the human race and which they occupy in present social organization. Carried on in an environment educationally controlled, they [gardens] are a means for making a study of the facts of growth, the chemistry of soil, the role of light, air, moisture, injurious and helpful animal life, etc. There is nothing in the elementary study of botany, which cannot be introduced in a vital way in connection with caring for the growth of seeds” (Dewey, 1944)*

*“When he [student] knows that the life of the plants that have been sown depends upon his care in watering them ... without which the little plant dries up... the child becomes vigilant, as one who is beginning to feel a mission in life.” (Montessori, 1912)*



**Photo credit: Department of Basic Education (2011)**

#### 1.1 Stories of success

School-based vegetable gardens have the potential to transform a barren school yard into an attractive space that reconnects children, teachers and the school-community to the environment. In addition, school-based vegetable gardens promote creative thinking, active learning and

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interpersonal skills. Below are examples of successful school-based vegetable gardens from schools participating in the First Gate Project of the University of Pretoria.





**REFLECTION ACTIVITY**

**What do you think are some of the benefits of school-based vegetable gardens? Think about possible benefits to children, their families, the school and surrounding community.**

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**1.2 Benefits of school-based vegetable gardens**

<b>Through vegetable gardens ...</b>	<b>Schools can...</b>	<b>Children can learn...</b>
<b>Gardening</b>	<ul style="list-style-type: none"> <li>⚙️ Create successful, sustainable vegetable gardens by using, for example, organic methods</li> </ul>	<ul style="list-style-type: none"> <li>⚙️ How to grow vegetables in a safe and sustainable manner</li> <li>⚙️ How to start and manage their own successful vegetable gardens at home</li> <li>⚙️ About gardening practices from teachers, community volunteers and family members</li> </ul>
<b>Nutrition</b>	<ul style="list-style-type: none"> <li>⚙️ Produce vegetables for children, their families and the school-community</li> <li>⚙️ Support children’s diets with garden produce</li> <li>⚙️ Encourage healthy eating habits of children</li> </ul>	<ul style="list-style-type: none"> <li>⚙️ How to grow vegetables for themselves and their families</li> <li>⚙️ How to improve their diet and prepare healthy meals with garden produce</li> <li>⚙️ To appreciate healthy food and change their own eating habits</li> </ul>
<b>Marketing</b>	<ul style="list-style-type: none"> <li>⚙️ Sell vegetables for an income to the school/individuals</li> </ul>	<ul style="list-style-type: none"> <li>⚙️ Business skills and entrepreneurship</li> </ul>
<b>Environment</b>	<ul style="list-style-type: none"> <li>⚙️ Improve the school environment</li> <li>⚙️ Collect rainwater, grey water and encourage helpful insects</li> </ul>	<ul style="list-style-type: none"> <li>⚙️ Develop an interest in and respect their school environment, awareness and understanding</li> </ul>
<b>Learning areas</b>	<ul style="list-style-type: none"> <li>⚙️ Reinforce curriculum-related areas</li> </ul>	<ul style="list-style-type: none"> <li>⚙️ More about specific learning areas through active, hands-on experience</li> </ul>
<b>Life skills</b>	<ul style="list-style-type: none"> <li>⚙️ Support children to survive and prosper in their communities</li> </ul>	<ul style="list-style-type: none"> <li>⚙️ How to plan, make decisions, collaborate and take responsibility</li> </ul>
<b>School and community</b>	<ul style="list-style-type: none"> <li>⚙️ Bring children, their families, teachers and the school-community together</li> </ul>	<ul style="list-style-type: none"> <li>⚙️ How to relate to adults in various ways and to be aware of gardening practices in the community</li> </ul>

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Therefore, school-based vegetable gardens can contribute to ...

- ⚙ **Academic skills:** supporting basic education and training, particularly in Life Skills, Science and Mathematics, as well as language and literacy enrichment through new concepts and vocabulary
- ⚙ **Personal development:** adding a sense of excitement, adventure and appreciation to learning, improving nutrition, diet and health, teaching the art and science of cooking with fresh products from vegetable gardens, and re-establishing the celebratory nature of a shared meal
- ⚙ **Social and moral development:** teaching sustainable development, ecological literacy and/or environmental education, the joy and dignity of work and respect for public and private property
- ⚙ **Vocational skills:** teaching basic skills, vocational competencies and vegetable production for subsistence consumption and/or trade
- ⚙ **Life skills:** teaching on food production and engaging children in community service and environmental care
- ⚙ **Community development:** where vegetable gardens serve as a focal point for community dialogue, capacity building and partnerships
- ⚙ **Food and nutrition safety:** vegetable gardens can address hunger and malnutrition at individual, family and community levels
- ⚙ **School grounds greening:** vegetable gardens provide opportunities to transform school grounds into attractive and productive learning centres, by means of hands-on activities.

### **1.3 Nutrition and health benefits**

According to the Food and Agricultural Organisation (FAO, 2014) school-based vegetable gardens support:

- ⚙ Low-cost, healthy dietary patterns and lifestyle
- ⚙ Food throughout the year
- ⚙ An opportunity to make some money

In order for community members to be well-nourished and healthy, every individual needs energy and nutrients that vegetable gardens can provide (FAO, 2014). The main classes of nutrients are Macronutrients (protein, fats and carbohydrates) and Micronutrients (vitamins and minerals). Nutrients that provide energy include carbohydrates, fats and proteins. Nutrients that promote growth and maintain bodily health are minerals, proteins and water. Nutrients that regulate bodily functions are minerals, proteins, water and vitamins (WHO & FAO, 2002; FAO, 2005; DoBE, FAO & ARC-Roodeplaat, 2011; DoBE, 2013; KZN DoE, SASA & MIET Africa, 2013).



### **1.3.1 Supplementing school feeding schemes and school kitchens**

School feeding schemes support parents, guardians and caregivers who are struggling to provide adequate and nutritious food to their children and can prevent learners from leaving school due to poverty-related hunger. School feeding schemes furthermore help to reduce absenteeism and hunger-related illnesses (Esakov & Valley, 2010). Although a school-based vegetable garden cannot feed the whole school through school feeding schemes, it can make a difference by contributing health-preserving vegetables (FAO, 2010). *“If we can start a school-based vegetable garden, we can grow, prepare and eat our own fruits and vegetables”* (FAO, 2014:9).

Vegetable gardens can provide school feeding schemes and school kitchens with regulating, building and energy-based food. Furthermore, vegetables grown from a school-based vegetable garden are fresher, healthier, more nutritious and less expensive. Vegetables from a school-based vegetable garden can provide school feeding schemes and school kitchens with a variety of food, all year round; improves and maintains well-nourished learners; strengthens community bonds and enables vegetables (food) to grow safely and healthy (FAO, 2014).

### **1.3.2 Promoting healthy diets**

*“Learners, families, cooks, school staff and the community must make the connection between growing food and good eating, and the school vegetable garden must show this connection”* (FAO, 2010:8). Schools are ideal settings for promoting healthy dietary patterns and lifestyle choices (Food and Agricultural Organization, 2005), because schools have qualified staff members to guide learners and equip them to make healthy dietary choices. Teachers are furthermore in the position to reach a large proportion of society for a number of years on a regular basis and interact with children when their dietary habits and lifestyle choices are still being shaped. Schools are also a channel for community participation through school-based vegetable gardens, can establish specific policies and hygienic practices to improve general health and dietary habits and are in a position to spread information-related messages to the community at large through family members’ involvement in their children’s Nutrition Education.

Nutrition Education can create nutritional well-being by developing healthy and supportive environments. Nutritionally literate learners will be able to search for answers to questions about food and a balanced diet and promote knowledgeable action in pursuit of health and nutrition. Nutrition Education also has a direct impact on food hygiene within families and reduces the information gap in terms of healthy diets and food practices that exist within communities. Though it

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may not relieve poverty within a short period of time, sustainable Nutrition Education over an extended period of time will start building an interest in healthy lifestyle practices, as well as establish nutritional dietary patterns (FAO, 2005).

School-based vegetable gardens in combination with nutrition education are regarded as a winning combination. According to the FAO (2010) food production alone doesn't make a huge impact on dietary practices, unless supported by nutrition education. On the other hand, nutrition education alone seldom transfers to practice. School-based gardening experience can increase learner's exposure to vegetables and might result in behavioural change (FAO, 2010).

### **1.3.3 Availability of nutritional high quality vegetables in the school-community**

The FAO envisions support to low-income communities in order to improve their food and nutrition security by growing their own vegetables in micro-gardens. Micro-gardening can be described as the cultivation of a wide range of vegetables and herbs in small spaces like old car tyres. Micro-gardening can furthermore allow poor communities to meet their needs for vitamins, minerals and plant protein. Micro-gardens are highly productive and can easily be managed by learners, women, the elderly and disabled people. A micro-garden can be grown on an area of one square metre and water requirements are modest. Micro-gardens can also help resource-constrained communities to diversify their diet (FAO, 2005).

School-based vegetable gardens sometimes supply vegetables only for a limited number of months or even weeks of the year. The effect on increased vegetable production is thus considered to be more indirect (FAO, 2010). Some of the learners who have participated in the vegetable gardening activities might for example be interested in helping their parents to establish home-based vegetable gardens. According to the FAO (2005) the multiplier effect on vegetable production within the wider community is likely to be more important than the school-based vegetable garden itself.

### **1.3.4 Supporting learner health during times of illness**

The potential of school-based vegetable gardens in improving learner's practical agricultural and nutritional knowledge is particularly valuable in the context of household food and nutrition insecurity, together with child-headed households as a consequence of HIV/AIDS (FAO, 2010). The prevalence of HIV/AIDS in South Africa also has an effect on malnutrition and hunger and adds to the financial burdens of poor communities, with an increased strain of providing enough food for all. Evidence however indicates that school-based and home vegetable gardens have the potential to ameliorate issues related to HIV/AIDS (Somerset, Ball, Flett & Geisman, 2005; FAO, 2010).

#### **1.4 Benefits related to teaching, learning, the school curriculum and policy**

The promotion of knowledge and skills about gardening are key to support poor households in becoming self-reliant. Knowledge and skills can be developed through curriculum-based content on food production (vegetables) and linking activities in the vegetable garden with learning areas such as Life Skills, Natural Sciences, Mathematics and Languages. School-based vegetable gardens provide a valuable resource to teach these learning areas, while allowing children to learn in an environment that is different from the classroom. In addition, the Nutrition Education component of the National School Nutrition Programme (NSNP) aims to promote healthy food choices and good eating patterns among school-communities.

##### **1.4.1 Bringing the curriculum to life**

A school vegetable garden can be described as an innovative teaching strategy and educational tool that assists educators to incorporate hands-on activities in their daily lessons. School-based vegetable gardens can be accompanied by nutrition education, food preparation lessons, as well as vegetable tasting opportunities, especially in Life Skills, Natural Sciences and Technology, as well as Social Sciences (Graham, Beall, Lussier, McLaughlin & Zidenberg-Cherr, 2005).

School-based vegetable gardens engage learners and educators in a dynamic environment where they have the opportunity to discover, observe, experiment, teach and learn, change, share and nurture. Research indicates that *“learning comes alive in a school garden”* and everything that is known about good teaching practices is magnified in a school garden. A school vegetable garden can be used to support learners to learn more about where their food comes from. It teaches them about making food choices for a nutritional and healthy diet, as well as eating seasonal foods that are grown locally. School vegetable gardens can enhance our understanding of how we all must work to accomplish what we want and need in our lives: *“The act of tilling the soil, planting the seed and tending the garden until harvest is an illustration of how our hard work can result in a wonderful outcome”* (Center for Ecoliteracy & Life Lab Science Program, 2007; Jones, 2008).

School vegetable gardens can also promote a sense of responsibility, sharing, communication, self-confidence and belonging to one’s community. It can indeed bring a community together: senior citizens, parents, learners, educators and other community members can work together on designing, planting and maintaining the school vegetable garden. Many helping hands can make the vegetable garden experience an enjoyable one for all the role players involved. School vegetable gardens can contribute to the quality of education through improving learners’ and

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parents' knowledge of food production and, additionally, encourage the development of home vegetable gardens. The potential role of school vegetable gardens in improving learners' agricultural and nutritional knowledge and skills is particularly valuable in the context of South Africa's child-headed households as a consequence of the HIV&AIDS epidemic (Freeman & Rees, 2003; FAO, 2004; FAO & UNESCO-IIEP, 2004; Graham & Zidenberg-Cherr, 2005; Somerset, Ball, Flett & Geisman, 2005).

Vegetable gardens have the potential to (FAO, 2005; DoBE, FAO & ARC-Roodeplaat, 2011; Sherr, Cox; Feenstra & Zidenberg-Cherr, 2013):

- ⚙️ Develop learners' understanding of vegetable production
- ⚙️ Increase learners' willingness to try and consume vegetables
- ⚙️ Teach learners to produce vegetables
- ⚙️ Raise learners' interest in a more varied diet
- ⚙️ Reduce obesity
- ⚙️ Improve health-related knowledge
- ⚙️ Enhance academic instruction
- ⚙️ Create and sustain an interdisciplinary curriculum that focuses on improving community health and the environment
- ⚙️ Improve nutritional and health status by increasing vegetable consumption in poor communities
- ⚙️ Create a successful, sustainable vegetable garden using organic methods
- ⚙️ Improve interpersonal relationships and skills, group cohesion and a strengthened school spirit
- ⚙️ Support learners in terms of social, emotional and cognitive development, while increasing their environmental knowledge and awareness
- ⚙️ Improve science-processing skills and science achievement marks
- ⚙️ Increase opportunities for hands-on, active learning experiences
- ⚙️ Increase critical thinking, analytical and problem-solving skills
- ⚙️ Improve the integration of mathematics, natural sciences, social sciences, life skills and other subjects
- ⚙️ Develop a sense of ownership, responsibility and patience
- ⚙️ Promote good nutrition, healthy food and eating habits
- ⚙️ Improve personal skills including social skills, self-efficacy, self-esteem, as well as a positive attitude towards school
- ⚙️ Increase overall life skills and self-understanding

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- ☀ Promote exercise and improved physical well-being
- ☀ Increase psychological well-being and learners' ability to work towards personal goals
- ☀ Serve as a source of food for improving learners' diets, health and nutritional knowledge (FAO, 2005; DoBE, FAO & ARC-Roodeplaat, 2011)

Schools are furthermore ideal settings for promoting healthy dietary patterns and lifestyle choices through school-based vegetable gardens. According to the FAO (2005) schools:

- ☀ are in the position to reach a large proportion of society for a number of years on a regular basis
- ☀ have qualified staff members to guide children and equip them to make healthy dietary choices
- ☀ interact with children at a critical stage when their dietary habits and lifestyle choices are still being shaped
- ☀ can be a channel for community participation through school-based vegetable gardens
- ☀ can establish policies and hygienic practices to improve general health and dietary habits
- ☀ are in a position to spread information-related messages to the surrounding community at large, through family members' involvement in the school-based vegetable garden.

### **1.4.2 Opportunity for creative teaching and skills development of learners**

School-based vegetable gardens are regarded as a valuable food source which can benefit learners' diet and health, and provide an alternative area to them for learning about nutrition, nature and agriculture (despite previous believes that learning can only occur inside the classroom). Establishing a school-based vegetable garden and gaining gardening experience may well inspire learners in an alternative manner to become excited about science and nutrition. Both their creative skills and physical fitness can benefit from such an undertaking.

School vegetable gardens have the potential to create enthusiasm for learning more about plants, positively influence healthy food consumption patterns, present a vehicle for nutrition intervention, foster team building and provide teaching tools for encouraging a healthy lifestyle and hygiene. Furthermore, school vegetable gardens can provide learners with several opportunities to better understand their relationship with the environment and promote cooperative learning through group activities (FAO, 2005).

Therefore, the school vegetable garden will help learners gain a better understanding of nutrition, food origins, ecosystems and life cycles. At the same time, they can acquire practical agricultural skills that last a lifetime. School-based vegetable gardens can furthermore serve as a 'laboratory' for

teaching agricultural skills and nutrition, but can also support practical work related to social sciences, mathematics, reading and writing.

### **1.4.3 Complying with DBE policy and recommendations**

*Sustainable Food Production in Schools* is a sub-programme of the National School Nutrition Programme (NSNP) and encourages schools to focus on:

- ⚙ Nutrition Education
- ⚙ Sustainable use of natural resources and gaining related knowledge
- ⚙ Practical skills on food production.

The objectives of the National School Nutrition Programme (NSNP) are to:

- ⚙ Enhance learning capacity through school feeding programmes
- ⚙ Promote and support food production
- ⚙ Improve food security in school communities
- ⚙ Strengthen Nutrition Education in schools and communities.

In short: the NSNP encourages schools to start vegetable gardens. This will allow schools to provide vegetables together with school feeding scheme meals, in order to increase the nutritional value of the meals provided to learners (Esakov & Valley, 2010). In South Africa, the NSNP aims to unite school-based vegetable gardens, school feeding schemes and nutrition education (FAO, 2010). The main aim of a school-based vegetable garden must however be to educate learners how to plant, nurture and harvest vegetables in order to have healthy food available.

Every learner must have an opportunity to take part in food production so as to acquire the necessary knowledge and skills. However, using the garden to punish learners must be avoided at all cost - garden work must never involve long hours or be too frequent. Learners can be divided into groups or according to classes so that they can take turns working in the garden and thus share responsibilities. Each grade may be responsible for a specific plot. A thirty-minute period per week should be enough for each class to do garden activities. Younger learners can for example remove stones, weed and help with harvesting. Older children can prepare the soil, plant seeds, water plants and harvest vegetables (FAO, 2005; Center for Ecoliteracy & Life Lab Science Program, 2007; DoBE, FAO & ARC-Roodeplaat, 2011).

## **1.5 School-community development in poverty contexts**

School-based vegetable gardens provide meaningful opportunities for school-communities to interact, work cooperatively with each other and develop the practice of vegetable gardening. In return, this will impact positively on community development, as household vegetable gardens can improve access to food, generate income for families and ultimately improve household food and nutrition security. Through school-based vegetable gardens communities can learn business skills that can enhance self-sustainability.

### **1.5.1 Source of income for teachers and parents**

School-based vegetable gardens have the potential to foster entrepreneurial skills in the area of vegetable production (FAO, 2010) and to contribute to household economy. To sell vegetables as an income may be an indispensable function of a successful school-based vegetable garden, but it must be balanced by educational and social aims. Selling vegetables to make money should have an educational dimension. Local shops or even markets can possibly provide outlets for selling vegetables, as well as information and guidance regarding sales and marketing. Local vendors can be consulted to sell vegetables (like carrots, green beans etc.) as snacks. Families can possibly buy the vegetables at half price.

### **1.5.2 Opportunity for meaningful participation and self-worth**

When vegetable gardening is not regarded as a chore or form of punishment, it can be deeply motivating. Enthusiasts of school-based vegetable gardens are never tired of seeing and tasting the season's crops, experimenting with new crops and methods or even battling with pests and diseases. The best motivational factor for those involved in school-based vegetable gardens is a sense of achievement. In addition, one of the most powerful motivations is the sense of ownership (FAO, 2005). School-based vegetable gardens have the potential to cultivate relationships that may not normally be developed with an indoor classroom setting (SHIP & Department of Health, 2011).

### **1.5.3 The role of volunteers**

School-based vegetable gardens are more successful when community volunteers are interested and involved. It is a good idea to involve volunteers from the start during the planning and discussions about the vegetable garden. This will influence commitment, help spread the workload and stimulate interest in the school's activities. School-based vegetable gardens can furthermore engage community volunteers, especially women, in training and skills development. It supports empowerment and can build a sense of achievement, self-worth and confidence.

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Involvement in school-based vegetable gardens will expand volunteers' knowledge of nutritional issues at community level. Volunteers can for example organise a garden clean-up day and demonstrate gardening techniques. They can also help to dig, weed, clear bushes, together with the provision of tools and seeds. In addition, volunteers can talk to children about what they are doing in the garden (FAO, 2005).





## SECTION 2: BASIC REQUIREMENTS TO ESTABLISH SCHOOL-BASED VEGETABLE GARDENS



### REFLECTION ACTIVITY:

What do think are required to establish a school-based vegetable garden?

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## **2.1 Requirements for a school-based vegetable garden**

Running a sustainable vegetable garden project requires not only agricultural knowledge but also “people skills” and common sense. Other qualities that might be useful are enthusiasm, organizational and motivational skills. Commitment is however the most important prerequisite for a successful and sustainable vegetable garden (FAO, 2005; DoBE, FAO & ARC-Roodeplaat, 2011).

The most important aspects to keep in mind when planning a vegetable garden are climatic conditions, water availability and quality, soil type and suitability, layout of the garden, location and size of the plots, and crop choice. Crop choice will be based on the suitability and nutritional value of crops, together with proper fencing (DoBE, FAO & ARC-Roodeplaat, 2011).

### **2.1.1 Basic requirements and gardening tools**

The basic requirements for a vegetable garden are (DoBE, FAO & ARC-Roodeplaat, 2011):


- ☀ good quality water
- ☀ compost (self-produced)
- ☀ external sources of advice and support
- ☀ funds for buying seeds, fertilizer, pesticides and garden tools
- ☀ proper fencing.

In terms of gardening tools, the following are required for a 20 x 20 m plot (Bremner & Pusey, 1999; FAO, 2005):

- ☀ A panga to clear away grass and bushes
- ☀ Wheel barrow/s
- ☀ Hoes
- ☀ Spades
- ☀ Watering cans
- ☀ Hose pipe
- ☀ Rakes
- ☀ Buckets
- ☀ Garden forks
- ☀ Hand shovels
- ☀ A 30m tape measure

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⚙️ Stakes, sticks and string.

Gardening tool	Quantity	Gardening tool	Quantity
Wheel barrow 	1	Rakes 	1
Hoes 	1	Buckets 	2
Spades 	1	Garden forks 	1
Watering cans 	1	Hand shovels 	1
Hose pipe 	1	Knapsack sprayer 	1
Stakes 	As needed	Tape measure 	1
String 	As needed	Sticks 	As needed

### **2.1.2 Human resources**

Managing a school-based vegetable garden requires not only agricultural knowledge, but also people skills. Tasks such as who is responsible for acquiring tools, seeds and seedlings, for the garden layout and crops to be planted, for sponsorship and advice, supervision, and who will manage income and expenses have to be clearly defined.

Accurate records must be kept with regard to material and financial support from sponsors. Any form of support (large or small) should be acknowledged by the school (Department of Basic

Education, 2011). The Departments of Education, Agriculture, Forestry and Fisheries, Health, Rural Development, Water and Environmental Affairs, local municipalities should be involved together with learners, teachers and the community.

### **⚙️ Committed involvement**

Individuals who are involved in a school-based vegetable garden project should be positive about the garden and have the desire to make a difference in the school-community. Commitment, community support and involvement are important requirements for a successful school-based vegetable garden.

### **⚙️ Leadership support**

An identified characteristic of successful school leaders who have been proactive in establishing support networks is that of “*building on what they already have in their schools*” (Marneweck, Bialobrzaska, Mhlanga & Mphisa, 2008:22). Any project has much more chance of success if school leaders take ownership and are positively involved in the project. Furthermore, school leaders need to be creative and skilled in the development of strategies to address challenges regarding school-based vegetable gardens. Usually the school leader will have a vision for a school-based vegetable garden, created from an insightful understanding of the school-community. School leaders need to be knowledgeable and skilled at identifying and mobilising resources within the school and beyond, which might enable them to set up and sustain successful school-based vegetable gardens for children and the community (Marneweck *et al.*, 2008).

### **⚙️ Supportive partners**

School-based vegetable gardens will thrive and be successful if supported by the local Department of Basic Education, school principal, parents and the community. A crucial task is thus the establishment of partnerships with people and organisations that can help bring together the resources needed to successfully start the school-based vegetable garden (Food Security Network, 2011). The school-based garden leader or manager (champion or dedicated coordinator) can be the school principal, an experienced teacher or an experienced gardener from the community. The champion or dedicated coordinator should be backed by a small team who are committed, interested and have experience. A wider network of partners can be built up at a later stage. Much of the work can be done by the learners, with the help from volunteers (parents, community members, volunteers), as well as the school caretaker/gardener if there is one, especially for

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heavier work (preparing the site). Children should however not be a labour force. They must enjoy their time in the garden and learn from it (FAO, 2005).

Volunteers from the community (parents and families) will become interested in school-based vegetable gardens if they can see the value of such gardens. The local community, as a whole, will generally reveal a considerable pool of know-how and certainly knows a lot about vegetable gardening (FAO, 2010; Cederstrom, 2002). In the most successful school-based vegetable gardens both teachers and non-teachers contribute in terms of knowledge and skills. Life skills and natural science teachers can advise on nutrition, food preparation, food conservation, sales and marketing. Other teaching staff may also use the vegetable garden in their own teaching.

### ***Tips for keeping partners involved?***

- ⚙ Hold regular meetings
- ⚙ Put notices in school newsletters
- ⚙ Write a garden newsletter (or have a garden corner in the school newsletter)
- ⚙ Involve everyone in decision-making (especially children)
- ⚙ Create visible signage around the school
- ⚙ Have children do art for and at the garden
- ⚙ Host social events, such as seasonal festivals, and events for the school-community
- ⚙ Post tasks to make working in the garden easy
- ⚙ Arrange field trips for the garden team (e.g. farmers markets, other gardens)
- ⚙ Make room for team members' input
- ⚙ Establish a clear, easy plan for on-going maintenance
- ⚙ Find ways to integrate the garden into the school curriculum
- ⚙ Solicit media attention
- ⚙ Solicit help from local businesses
- ⚙ Do research and write grants to obtain funding
- ⚙ Hold plant sales
- ⚙ Extend gratitude / acknowledgements
- ⚙ Start a school garden website.

**“You need to know three things to run a  
successful school garden:  
*How to cultivate people*  
*How to cultivate plants and*  
*Where to go for help”.*  
Guy, 1996**

### **2.1.3 Roles and responsibilities of the role-players in a garden**

First of all you need to choose a vegetable garden leader or project manager. This may be the school principal, an experienced teacher or an experienced gardener from the community. He or she should be backed by a small team who, among them, have commitment, interest, experience and authority. A passion for gardening is central to all of these.

As example, a school-based vegetable garden team can thus consist of the school principal, experienced teachers, 3 to 5 parents or community members, the learners, 3 to 5 food handlers and the school caretaker. In time, a wider network of helpers can be built up. The project manager, or coordinator, should have a colleague who can act as deputy when necessary. It is also a good idea to establish an executive team of senior learners who are able to carry on without much supervision.

Passion and commitment, together with support from the school principal, deputy principal, teachers and parents are crucial for the successful establishment of a sustainable school-based vegetable garden project. When deciding on the roles and responsibilities of the various people involved in the project, it is always good to identify the goals that you want to reach. Next, specific people should be tasked with specific responsibilities, and target dates need to be set. All people involved should be clear on who is responsible for acquiring the tools, seeds and seedlings, laying out the garden and planting the crops, getting sponsorships and advice, supervising the gardener, managing income and expenses, etc. (Freeman & Rees, 2003; FAO, 2005; Center for Ecoliteracy & Life Lab Science Program, 2007; DoBE, FAO & ARC-Roodeplaat, 2011). You may want to use a table such as the following when initiating a garden at your school:

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<b>Goals and tasks for starting a vegetable garden</b>	<b>Target date</b>	<b>Date done</b>	<b>Responsible person(s)</b>
<b>Site selection and preparation</b>			
<b>Designing the garden</b>			
<b>Vegetable selection</b>			
<b>Installation of work schedules</b>			
<b>Curriculum development</b>			
<b>Financial support</b>			
<b>Acquiring tools</b>			
<b>Acquiring seeds and seedlings</b>			
<b>Income and expense management</b>			

### **2.2 Starting a vegetable garden**

The school-based vegetable garden site you choose must be (Bremner & Pusey, 1999; FAO, 2005; Department of Agriculture, 2006):

- ⚙ Near water
- ⚙ Have good soil
- ⚙ Have the right level that water will drain well; if you plant on sloping terrain, you can build a number of terraces, but this is a very big job
- ⚙ Have sun most of the day – if there is some shade for a few hours, rather plant leafy crops
- ⚙ Sheltered from the wind, frost and animals; a wall hedge or fence can provide protection; make use of the bushes and trees you dig out when you clear the spot to make a fence.

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When deciding how big to make the garden, take the following into account (Department of Agriculture & ARC, 2006):

- ⚙ Water availability during the dry season
- ⚙ The vegetables you wish to grow
- ⚙ Time available to work in the vegetable garden.

### **2.2.1 Choosing a suitable site with quality soil**

Level ground is the most suitable choice for a vegetable garden. If the land has already been cultivated, determine which crops were grown before, as the same crop should not be planted repeatedly (crop rotation). If nothing has been planted on the selected site before, you first need to remove rubbish, rocks, roots and grasses. Look around and see what can be used on the site, such as established trees that can provide shade to people, plants and compost, or fallen leaves that can be used for compost or mulch. Stones can be used for making walls, marking out or decorating garden beds or paths, whilst old car tyres make good container gardens. Plastic bottles can become watering cans and buckets.

After choosing the site, investigate the soil, as healthy vegetables need fertile soil. Soil acts as the mechanical support for plants and serves as a reservoir for nutrients, water and beneficial organisms. Soil consists of four basic ingredients: decomposed rock, organic matter, air and water. Soil also contains many living microscopic and macroscopic plants and animals such as insects, earthworms, fungi and bacteria (Bremner & Pusey, 1999; Freeman & Reese, 2003; Department of Agriculture, 2006; DoBE, FAO & ARC-Roodeplaat, 2011).

The ideal soil has a fairly loose, brittle and crumbly structure and is important to (Faber, Laurie & Venter, 2006):

- ⚙ physically support the plant
- ⚙ store and supply water
- ⚙ supply air to the roots of the plant
- ⚙ supply essential nutrients and minerals to the plant
- ⚙ be free of root diseases.

Soil is made up of organic and inorganic matter (DAFF, 2010). The organic matter is the rotting particles (small bits) of plants and animals, while the inorganic matter is particles of weathered rock and minerals. The spaces between the small particles that make up the



## *School-Based Vegetable Gardens: A Guide to Sustainable Practices*

soil are filled with air or water. Plants such as algae and lichen, and animals such as earthworms, moles and termites live in soil. They improve the movement of air (aeration) and remove water from the soil (drainage). Some organisms in soil, such as bacteria, break down organic matter and other compounds into plant food (nutrients) which can be easily absorbed and used by plants.

Soil preparation is essential for:

- ⚙️ Creating good conditions for the germination of seeds
- ⚙️ Better root development
- ⚙️ Better water absorption and drainage
- ⚙️ Better absorption and utilization of nutrients
- ⚙️ Improved management of weeds, pests and diseases
- ⚙️ Removal of perennial weeds.

The first step of soil preparation involves to loosen the soil and to make sure that all the weeds are taken out. Then, apply fertilizer, when necessary. Break up any clods, and even out and moisten the soil. It is important that plots are free from clods and weeds, and that the soil is moist (DoBE, FAO & ARC-Roodeplaat, 2011). Soil colour indicates the following (DAFF, 2010):

- ⚙️ **Red, brown:** well drained
- ⚙️ **Grey:** poor drainage
- ⚙️ **Dark topsoil** (top layer where plants get their nutrients): high nutrient content
- ⚙️ **Dark subsoil** (layer under the topsoil): heavy clay, especially if also sticky when wet.

### **Soil types**

A soil analysis can be done by local agricultural services or by means of a field test, taking hands full of soil and investigating the texture. Soil types are classified into sandy, clay and loamy soil. The soil type has a big influence on how water moves and how much water is available for uptake by the plant roots. Water moves quickly in sandy soil. In loamy soil water moves at a moderate speed and flows both sideways and downwards. In clay soil water moves very slowly and may take a long time to penetrate deeply (Collective School Garden Network, 2012). Soil is a vital resource for growing crops. Although vegetables can grow in almost any kind of soil, they will grow easier in some soil types than in others.



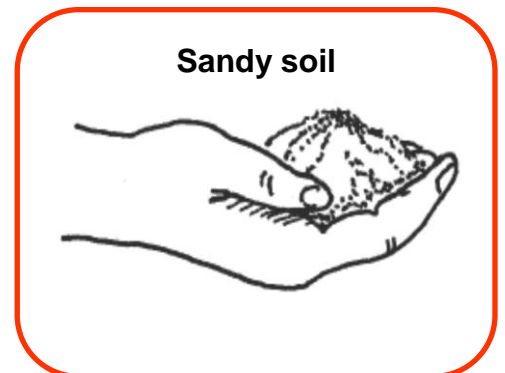
**SANDY SOIL** does not hold water well - water filters through too quickly for plants to absorb a sufficient amount. Sandy soil feel gritty, are not sticky when wet and remain loose when dry.

***Advantages of sandy soil***

- ⚙ During moist periods roots can grow quickly
- ⚙ Sandy soil is easy to cultivate.

***Disadvantages of sandy soil***

- ⚙ Dry out quickly
- ⚙ Lose nutrients quickly in case of too much rain or irrigation
- ⚙ Is eroded easily by wind.



***Improving the quality of sandy soil***

Add manure and compost as well as surface mulches if these materials are available, because they will help to conserve nutrients and water and will reduce erosion.

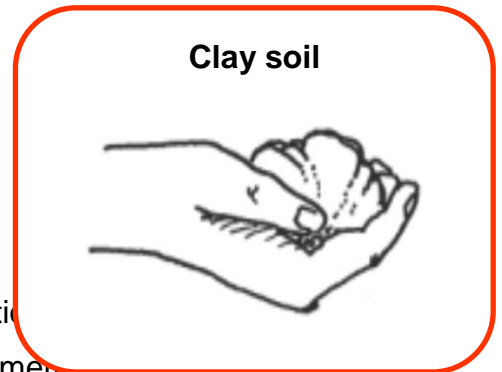
**CLAY SOIL** is very sticky and holds water for long periods. Clay forms a solid mass when dry. It holds water well, but is poorly aerated. Clay soil feels sticky when wet and forms large, hard clods when dry.

**Advantages of clay soil**

- ⚙ Clay soil holds nutrients and water well.

**Disadvantages of clay soil**





- ⚙ Clay soil needs large quantities of water once dry
- ⚙ Clay soil is difficult to cultivate
- ⚙ Clay soil becomes waterlogged in case of too much rain or irrigation
- ⚙ It forms a hard surface crust on drying, which restricts seedling emergence
- ⚙ It restricts root growth.



**Improving the quality of clay soil**

- ⚙ Try not to cultivate when wet
- ⚙ Add compost or manure if available to help soften up clay
- ⚙ Surface mulches will reduce crusting and promote seedling emergence.

**LOAMY SOIL** is healthy soil. It consists of clay particles, sand particles, organic matter and micro-organisms (small creatures that keep soil healthy). Loamy soil allows air to circulate and holds water well. Loamy soil is the ideal mixture of sand, silt and clay.

<p><i>To test the soil type:</i></p> <p>Roll the soil into a sausage between your hands and try to form a circle.</p> 	<p>Clayey soil</p> 	<p>Sandy-loam soil</p> 
	<p>Sandy soil</p> 	

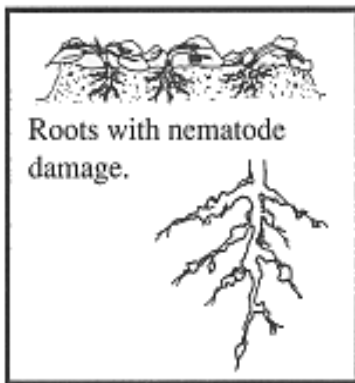
(Directorate Communication, National Department of Agriculture & Directorate Agricultural Land and Resources Management, 1999)

**Tips for involving learners when working with soil in a school-based vegetable garden**

- ⚙ Always discuss, demonstrate and review safety rules with children before handing tools out. Suggested rules include holding the point down, putting tools away when not in use and keeping the metal parts below the hips
- ⚙ When working with a large group of children or small children, consider using hand tools instead of large tools to prepare the soil
- ⚙ Make sure every child has his/her own job, whether it is adding compost to the soil, breaking up clods, or pulling out stubborn weeds
- ⚙ Make sure children are spaced safely apart so they do not interfere with each other's tools
- ⚙ When children are working with tools, keep your eyes on all of them. Enforce the rules consistently and provide an alternative activity for any child who is not using tools safely
- ⚙ Musical shovels: A fun digging activity is to circle children around the area that needs to be worked and have them turn the soil in front of them while music plays (or is sung by everyone). When the music stops, students rotate to a different position. This is fun, and keeps the soil from being over dug in some spots.

**SOIL**

If there are diseases or nematodes in the soil, treat the soil before planting.



*Always start by preparing the seed-bed.*

Water the soil and wait until it is moist.



Dig deep and turn over the soil.



Break up the big lumps of soil.



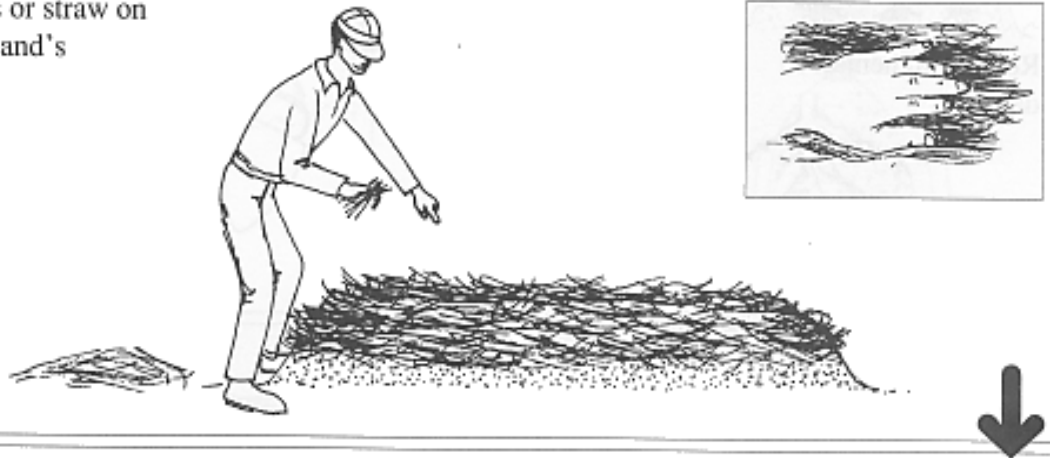
Level the soil with a rake.



**Treating the soil**

Heat is the cheapest way to kill pests in the soil.

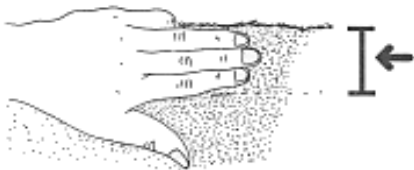
Put a layer of dry grass or straw on the seed-bed, about a hand's breadth deep.



Burn the grass or straw.  
Leave the ashes on the seed-bed.



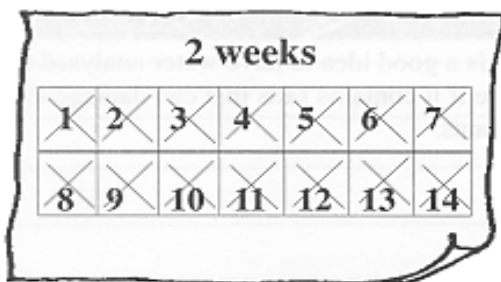
The top layer of about 3 fingers deep is now free from pests.



Do not dig the soil or rake again before planting.



Plant the seed or seedlings after about 2 weeks.



Cover the soil between the seedlings with grass or straw so that it does not dry out too quickly.



### **2.2.2 Considering weather conditions, sunlight and access to water**

Vegetables need at least eight hours of sunlight, but in hot climates some shade in the afternoon is helpful. In very windy areas, crops can be protected by windbreakers, planted across the direction in which the wind blows to reduce the damage caused by strong winds.

Water supply is extremely important, as water is the most basic plant growth requirement. Vegetables take a lot of water and will grow and produce less if water is limited. Without enough water, vegetables will ultimately die. Good water supply will leave you free to decide when to plant and when to harvest. When considering access to enough water, questions such as the following may be considered: *If water is scarce, can you improve the supply? Can you harvest rain water from roofs? Can you conserve water by using grey water from washing dishes and clothes? What kind of water beds will be best? Which crops flourish in dry conditions?*

#### **⚙ Water thoroughly and deeply**

When you irrigate, make sure water soaks the soil well below the surface into the zone where the roots are growing. Deep, thorough irrigation encourages roots to grow even deeper, increasing their ability to mine water and nutrients and anchor themselves firmly. When seeds are first planted and when seedlings are young, watering must be frequent and does not need to go deep. When plants have past the seedling stage, it can be watered more thoroughly and less often.

#### **⚙ When do plants need more water?**

Regular monitoring is the first step. If you see the leaves looking dull or less vibrant, it might be the first sign that plants need more water. Wilting indicates that water is seriously limited. These could however also be symptoms of damage caused by pests or diseases. Thus, you also need to check the soil moisture. The squeeze test can help you determine whether the soil needs more water: dig down into the soil and grab a hand full. You need to water when:

- ⚙ Sandy soil won't retain its shape when squeezed into a ball
- ⚙ Loamy soil looks dry and won't form a loose ball under pressure
- ⚙ Clay soil won't form a ball unless squeezed.

## WATER

Water the plants with clean water.



Dirty water causes diseases.



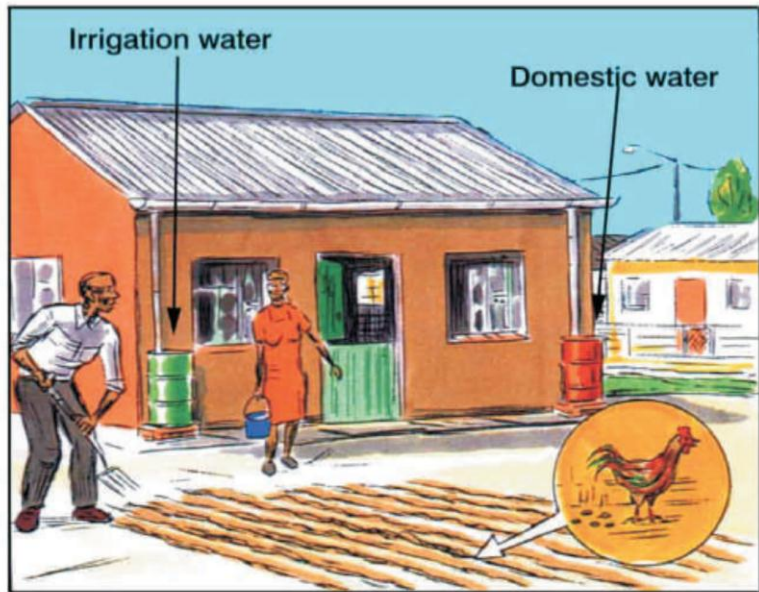
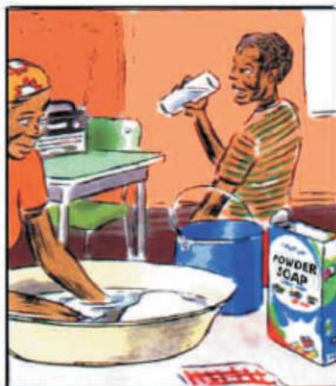
It is a good idea to have water analysed to see if it contains salts that can damage the plants.

### **Tips for 'water wise' vegetable gardens**

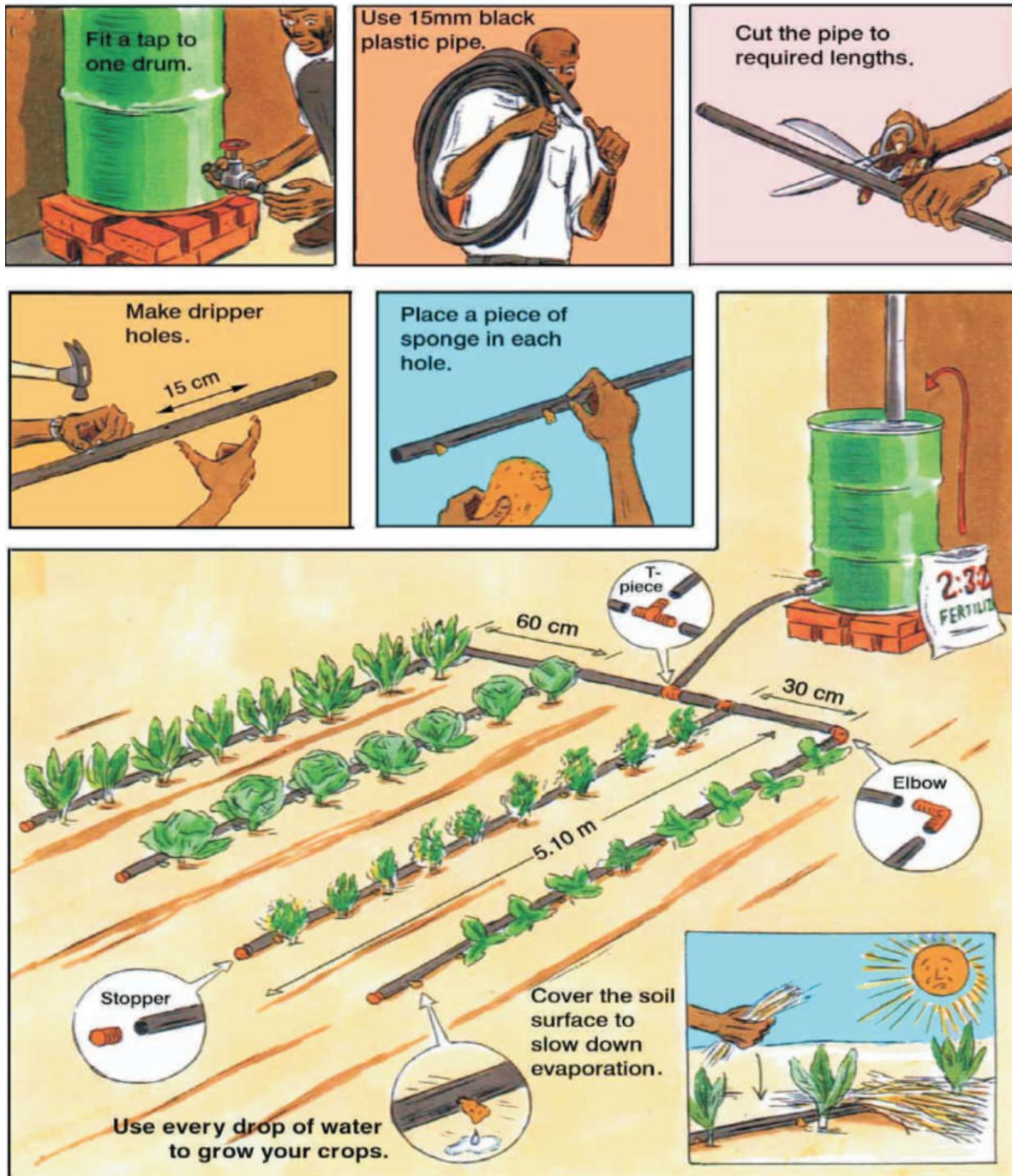
- ⚙ Keep pathways narrow
- ⚙ Avoid walking in the beds as this compacts soil
- ⚙ Add compost regularly to the beds to help the soil retain water
- ⚙ Keep the beds flat to prevent water running away from the plants
- ⚙ Group plants according to their water needs to conserve water
- ⚙ Always keep the beds well mulched – a 5 cm layer of dry veld grass clippings or straw is good mulch for seedlings
- ⚙ Water between 6pm and 6am to ensure minimal water loss through evaporation.



**MAKING THE MOST OF RAINWATER**







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## School-Based Vegetable Gardens: A Guide to Sustainable Practices

### ☀ Protecting plants from too much sun

Vegetables need plenty of sunlight (at least eight hours a day). In hot climates, some form of shade will however help in the mid-afternoon. Think about the following: *Where will you plant delicate vegetables? What can you use for shade (trees, walls, tall plants)?*

The following temperature adaption of vegetables can be considered when planning your vegetable garden:

Cool season	Moderate season	Warm season
Beetroot	Beans	Sweet potato
Broccoli	Carrot	Butternut squash
Brussels sprout	Onion	Pumpkin
Cabbage	Potato	Cucumber
Cauliflower	Tomato	Green mealie
Lettuce		Pepper
Onion		Green beans
Pea		
Swiss chard (spinach)		
Herbs		
Garlic	Rosemary	Origanum
Parsley		Basil
		Thyme

### 2.2.3 Knowing when to plant what

You may be guided by the information below, in terms of the guidelines for planting different kinds of vegetables:

## *School-Based Vegetable Gardens: A Guide to Sustainable Practices*

<b>Crop</b>	<b>Soil pH</b>	<b>Months for planting / sowing</b>	<b>Planting method</b>	<b>Seed needed g/100m<sup>2</sup></b>	<b>Plant spacing between plants (cm)</b>	<b>Plant spacing between rows (cm)</b>	<b>Number of plants per 100m<sup>2</sup></b>	<b>Time to harvesting (days)</b>	<b>Months for harvesting</b>
<b>Bean (bush)</b>	6.0-6.5	Feb-Mar Aug-Oct	Direct sowing	750-1200	5-10	40-60	1500-5000	60-90	May-Jun Oct-Dec
<b>Beetroot</b>	5.8-7.5	Feb-Apr Aug-Sep	Direct sowing	60-80	8-15	30-45	1500-3400	90-105	Apr-Jun Nov-Jan
<b>Cabbage</b>	6.0-7.0	Feb-Apr Aug-Sep	Transplanting	5-15	35-50	50-70	300-500	80-120	Jun-Jul Nov-Dec
<b>Carrots</b>	6.0-6.5	Feb-Mar Aug-Sep	Direct sowing	25-35	5-7	30-40	3600-6700	80-120	May-Jul Nov-Feb
<b>Cucumber</b>	6.0-6.8	Jan-Mar Jul-Sep	Direct sowing	20	50	120-150	130-170	60-100	Mar-Jun Sep-Dec
<b>Green mealies</b>	5.5-6.8	Sep-Nov	Direct sowing	100-150	30	100-120	300-500	90-120	Dec-Feb
<b>Lettuce</b>	6.5-7.0	Feb-May	Transplanting	15-30	30	40-60	560-830	84-105	May-Sep
<b>Onion</b>	6.0-7.0	Mar-Apr	Transplanting	30-50	5-8	20-25	5000-7000	90-180	Aug-Dec
<b>Pepper</b>	5.5-7.0	Aug-Oct Jan-Feb	Transplanting	10	40-60	75-100	170-330	100-150	Nov-Jun Apr-May
<b>Potato</b>	5.0-6.5	Aug-Nov	Direct planting	400-600 tubers	25	75-100	400-570	90-140	Mar-May
<b>Pumpkin</b>	5.5-7.5	Aug-Nov	Direct sowing	25-35	50-90	200-270	40-100	120-150	Jan-May
<b>Spinach</b>	6.0-6.5	Feb-Apr Aug-Oct	Transplant / direct	80	15-25	40-60	700-1700	40-120	Apr-Jun Sep-Jan
<b>Sweet potato</b>	5.6-6.5	Oct-Jan	Direct planting	330-600 cuttings	30	80-120	280-440	120-150	Mar-Jul
<b>Tomato</b>	6.0-6.5	Aug-Nov	Transplanting	5-10	40-50	150	130-170	100-145	Jan-Apr

⚙ **Doing crop rotation when planting**

Crop rotation is one of the most basic principles of vegetable production and should always be practised. It's best described as a system of crop production in which various crops are grown in such a way that no crop is planted on the same piece of land more than once in three to four planting cycles. To keep soil rich and healthy it is essential to implement crop rotation, in other words to have a different crop from a different plant family in the bed every season. The cycle of changing crops should last at least four years. To alternate deep-rooted crops and shallow-rooted crops can also give the different levels of soil a rest (FAO, 2005).

While crop rotation is recommended for improving soils and for conservation purposes, its greatest benefit lies in the reduction of disease levels in the soil. Failure to practise crop rotation will result in an increased rate of infestation, in turn leading to higher pest management costs. Crop rotation might also reduce unwanted insect populations and perennial weed infestations (Faber, Laurie & Venter, 2006).

The main crop families to be rotated are (FAO, 2005; DoBE, FAO & ARC-Roodeplaat, 2011):

Crop family	Examples
Legumes	Beans, peas, cowpeas
Solanums	Tomatoes, potatoes, peppers, chillies, eggplants
Cucurbits	Cucumber, squash, pumpkins, marrows
Brassicac	Cabbage, broccoli, cauliflower, radish
Root crops	Carrots, onions, beet, sweet potatoes, amadumbi
Leafy crops	Swiss chard,

If you are going to grow the same kind of crop in the same place season after season, the nutrients that the plant needs will be exhausted quickly. Usually the plants will grow weak and stunted, and may more easily be under attack from pests and diseases (FAO, 2005).

**Important aspects to keep in mind about crop rotation (FAO, 2005):**

- ⚙ Rotate over at least three seasons, but five or six is even better
- ⚙ Change the crop family every time and not just the individual crop
- ⚙ Leave at least a 1 metre distance when planting the same crop again
- ⚙ Grow green manure as part of your crop rotation plan, such as cereal grains (millet, oats) and beans. These plants put organic matter back and also rebuild the soil. Dig them in before they flower, or cut and leave as mulch
- ⚙ Leave one field/bed fallow, with no crops, as part of the crop rotation plan. This gives the soil a chance to rest
- ⚙ Grow sunflowers as part of your crop rotation plan. Their roots go deep into the soil for nutrients and water
- ⚙ Some good combinations: grow corn after legumes; grow potatoes after corn; and grow brassicas after onions

**Keep the following factors in mind when planning crop rotation:**

⚙ ***Environment***

Make sure the soil is suitable for possible crops. Take into account the soil depth and texture. Study the climate over the various seasons when deciding which crop can be grown successfully at different times of the year.

⚙ ***Diseases and pests***

Crops belonging to the same family, e.g. cabbage, cauliflower and broccoli or tomato, potato and eggplant, are often attacked by the same group of pests and diseases. Related crops should therefore not be included in successive plantings or even in the same 3 year rotation program.

⚙ ***Weeds***

Crops which do not grow very tall and are therefore easily overgrown by weeds such as carrots, lettuce or onions should follow crops in which weeds were well controlled.

⚙ **Nutritional requirements**

1. Crops with high nitrogen requirements, such as cabbage, should follow a leguminous crop such as green beans and peas which fix atmospheric nitrogen.
2. Certain crops such as carrots and beetroot can be damaged by the application of too much organic manure. These crops should be planted later in the succession after organic manure application to crops such as tomatoes, which respond well to organic fertilizing.
3. Crops which use large quantities of nutrients, such as cabbage, should follow crops with lesser needs such as pumpkin or less efficient feeders such as potatoes in order to make use of residual nutrients.

⚙ **Companion planting**

Companion planting involves growing plants together that complement and assist each other. Companion planting is a natural way to protect plants. Planting particular plants together can attract good insects and drive pests away. In general, mixed crops and strong smells repel garden enemies, while flowers attract beneficial insects. Flowers which attract beneficial insects are camomile, carrots, celery, coriander, dill, mint, parsley, rosemary and thyme. Strong smelling plants which repel pests are aloe vera, basil, chilli, chives, garlic, ginger, lavender, onions and thyme. Special combinations that works well include: basil repels tomato hornworms; mint, thyme and camomile drive cabbage moths away; thyme and lavender deter slugs.

The following vegetables grow well together:

Beetroot	Onions
Carrots	Peas, lettuce, onions and tomatoes
Cabbage	Potatoes, onions and celery
Pumpkin	Mealies
Beans	Potatoes, carrots and cabbage

⚙ **Intercropping**

Intercropping (growing different crops near one another) helps to utilise and conserve soil and protect vegetables. A multi-layered vegetable garden, with plants of different heights, is a form of intercropping that makes the most of garden space and sunshine. Putting plants with different needs together cuts competition: tall plants next to small ones (maize with cabbage, broccoli with spinach/lettuce); deep-rooted plants next to shallow-rooted plants (maize with sorghum); climbing

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plants next to ground plants (beans or corn with lettuce, onions, carrots or squash); and broad leaves next to narrow leaves (cabbage with carrots).

### **Checklist for healthy plants**

Ensuring that plants are healthy is an important strategy for good gardening. Plants should be monitored regularly and treated immediately. The following checklist covers the main points:

- ⚙️ Have the plants grown? What stage are they at?
- ⚙️ Are the plants looking well? Are there signs of pests or diseases? Are there any fallen leaves, eaten leaves, yellow leaves or fungus?
- ⚙️ Is the soil dry? Is anything too wet?
- ⚙️ Which insects/worms/animals are around? Are there plenty of beneficial creatures?
- ⚙️ Is everything well mulched? Where do we need more mulch?
- ⚙️ How good is the protection against predators?
- ⚙️ Is anything getting too much wind, sun or shade?
- ⚙️ Is anything overcrowded?
- ⚙️ Are there a lot of weeds near the plants?
- ⚙️ Does anything need tying up or spreading out?
- ⚙️ What needs tidying up? Burning? Cutting back? Cutting down?
- ⚙️ How good are the supplies of compost and mulch?

### **⚙️ Some thoughts on vegetable pests and insects in the garden**

A vegetable pest is any organism that competes with humans through lowering the quantity or quality of crops that are being produced. Almost all known pests are insects however, most insects are NOT pests. Insects only become pests when they cause economic losses in crops. Some pests are wide feeders, attacking a wide range of plants while others only attack specific crops. Some insects, on the other hand, are predators which will eat harmful insects and act as so-called “pest police”. Others are pollinators which fertilise plants, such as ladybugs, the praying mantis, ground beetles, soldier beetles, centipedes and hoverflies or robber flies, spiders, scorpions, small wasps, bees and butterflies.

### **⚙️ Information on plant diseases**

Plant diseases can be described as mainly microscopic organisms which live at the expense of plants. It includes bacteria, fungi and viruses. The spreading of plant diseases occur through the wind (spread over long distances); rain and overhead irrigation (spread over short distances); runoff

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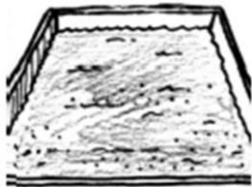
and flood irrigation; insects; infected seeds, seedlings and vegetative planting material (spread over very long distances, even between countries); boots and shoes worn by people; equipment used in the garden (e.g. garden forks, hoes, pruning scissors); and plants left in the garden from the previous season. If you remain aware of these possibilities you can take the necessary care to limit the spread of plant diseases.

### **2.2.4 Planting good quality seeds and seedlings**

In order to establish a successful vegetable garden you need seeds which are strong and disease-free. Seeds and cuttings from the community are usually well adapted to the climate. If you buy seeds, they tend to be more expensive. According to the FAO (2005) it is advisable to buy seeds commercially and use them within the specific period.

Local seed retailers can also be approached for donations. Another option is to take seeds from your own plants if they are non-hybrids. This is regarded as the cheapest solution. The last option is also more educational as children can learn how to select, collect and store seeds (FAO, 2010).

**1. Make a seed bed with fine rich soil.**



*No lumps, sticks or stones*

**2. Weed well.**



*Get the roots out*

**3. Flatten it neatly.**



*Use a board.*

**4. Protect seeds.**



*Make shade.  
Keep away pests.*

**5. Mix seeds with fine soil or sand.**



*Keep the packets.*

**6. Draw lines.**



*A few cm deep,  
about 15 cm apart*

**7. Sprinkle seeds.**



*Label the rows.*

**8. Cover lightly.**



*Press down gently.*

**9. Water well.**



*Don't flood!*

**10. Mulch.**



*Keep cool and damp.*



### **2.2.5 Enriching soil quality**

Growing plants take nutrients out of the soil. When we harvest crops, we take away what the soil produces to eat or to use it. In doing this, we take the richness out of the soil and it must be put back in some way (FAO, 2005). If we do not put back what we take from the soil, the soil becomes exhausted and cannot produce good crops. Chemical fertilisers put nutrients back into the soil, but they are harmful to worms, good soil fungi and expensive. Organic gardeners protect and maintain soil in the following ways: *compost, manure, mulching, crop rotation and permanent raised beds*.

Use **manure** from plant-eating animals. Keep in mind that fresh animal manure can hurt roots – either leave it for six months or add it to compost. Animal manure contains all the food (nutrients) plants need, namely nitrogen, phosphorus, potassium and most trace elements. Animals that eat lucerne, good quality hay, silage and concentrates will produce better manure than animals that graze in the veld only. Poultry manure is the best, then sheep, horse, cattle and lastly, pig manure. As poultry manure contains much nitrogen, it must be used carefully. Apply sparsely (150–200 g/square metre) and dig in well before planting the crop. Do not use poultry manure when you are planting a root crop. Do not plant carrots in manure or compost-rich soil. If manure is not handled correctly, it may lose its value. Rain on unprotected manure washes out many of the nutrients and it should be covered or worked into the soil as soon as possible.

**Mulching** means putting dry organic material (grass, straw, leaves) about 6cm deep around the base of the plants. The mulch keeps moisture in the soil, keeps the soil surface cool and soft, prevent weeds and gradually change into compost to enrich the soil. Mulching is very useful where the soil is poor or there is little water or in hot climates or seasons. The best mulching material is light-coloured and reflects the light.

**Composting** is the most practical and convenient way to handle school waste. It is an easy, cheap and environmentally friendly way to improve soil and the plants growing in it. By using compost you will be returning organic matter to the soil in a usable form. Organic matter in the soil helps to break up clay soil and improves the structure. It adds water and nutrient-holding capacity to sandy soil and adds essential nutrients to any other soil. Using compost is important because it returns nutrients to the soil, helps the soil to hold water and air, binds the soil and prevents erosion, and produces healthy crops with few diseases (Cornell University, Department of Crop and Soil Sciences, 2005; Directorate Agricultural Information Services, Department of Agriculture in cooperation with ARC-Roodeplaat, 2006; Faber, Laurie & Venter, 2006).

## **Making compost**

About half of the refuse we throw away each day can be turned into compost. Most healthy materials of plant or animal origin (organic material) that rot easily can be used. The following material can be used to make compost:

### **☼ Garden material**

Grass cuttings, soft garden trimmings, leaves, flowers, and vegetable remains. Chop up the stalks of sweetcorn, cabbage, broccoli and Brussels sprouts so that they will decompose faster. Weeds are especially suitable. Their long roots absorb many nutrients from the soil and these nutrients will be released in the compost. The weeds should be pulled up before they develop any seeds.

### **☼ Kitchen waste**

Vegetable peelings and leaves, fruit peelings and cores, cooked table scraps, tea leaves and bags, egg shells, stale bread.

### **☼ General**

Paper and cardboard, sawdust (only small quantities) and woodshavings, animal manure, woodfire ash, seaweed.

### **☼ Materials that should not be added to a compost heap**

Kikuyu grass, woody garden clippings, pine needles, rose cuttings and other cuttings with thorns, seeds, bulbs, garden wastes sprayed with pesticides, toilet waste or septic tank sludge, diseased animal carcasses and diseased plants, anything that does not decompose, such as metals, glass, plastic.

## **Where to make a compost heap?**

Make the compost heap under a leafy tree or next to a tall hedge. This will prevent the sun and wind from drying out the outer layer of the heap. Do not make the heap in a hollow where rainwater could gather for a number of days. Composting is nature's way of recycling organic material back into the soil to allow the cycle of life to continue. If you want to start your own compost heap at home, here are the different layers, together with the appropriate material you need to keep in mind: A good size for the compost heap is usually 2 m x 2 m. The heap should be about twice as big at the bottom as at the top. It is a good idea to start by levelling the spot. After that you can mix all the material. Remember that all big pieces should be chopped up. Do not add layers of only one material. Remember to moisten each layer as you build along.

⚙ **Base**

As the micro-organisms in the heap need air to work, the base is built to improve aeration. Use coarse material such as twigs, mealie cobs, bricks, autumn leaves, sawdust, wood shavings, etc. for the base. This layer must be about 20 cm deep.

⚙ **First layer**

Spread a layer of plant material about 20cm deep on the rough basis.

⚙ **Second layer**

If you have kraal or chicken manure or mature compost, spread a layer about 10 cm deep on top of the first layer. The manure and/or compost speeds up decomposition.

⚙ **Third layer**

Next add a thin layer of soil and ash (3 cm deep). The organisms in the soil, earthworms in particular, will help the rotting process, mix the material and increase air flow. Repeat the first three layers until the heap is as high as you want it.

⚙ **Last layer**

Stop with a layer of soil, dry grass, leaves or sawdust. This will keep smells in and will not attract flies.

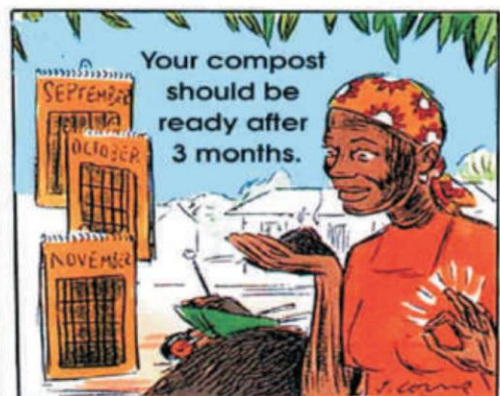
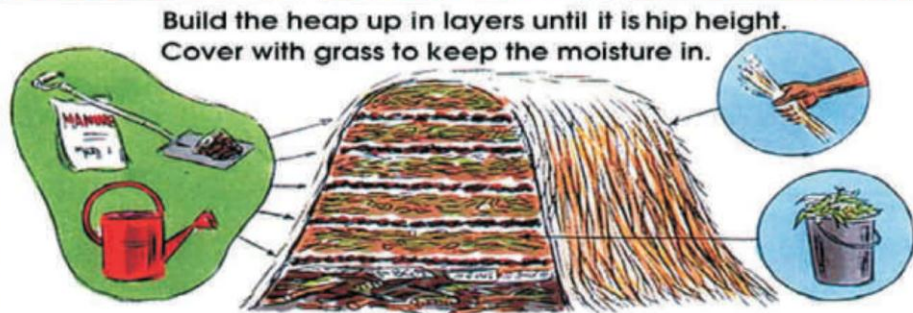
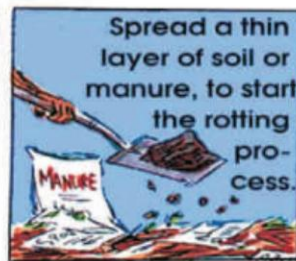
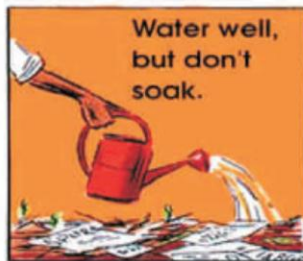
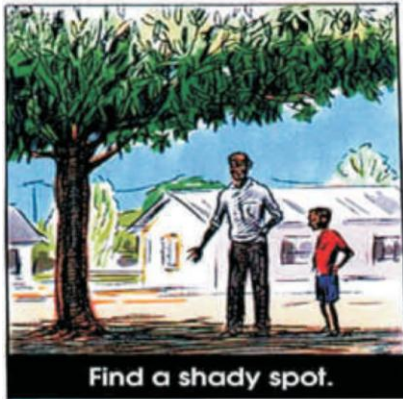
⚙ **Sticks**

Take 2 or 3 sticks of about 2 m long and push them into the heap. The sticks can be taken out later to test the heat and moisture of the compost. They also help to aerate the compost. Take the wooden sticks out on a regular basis to test if the heap is moist enough on the inside. If necessary, water can be added. Do not allow the heap to dry out or become too wet.

⚙ **Cover**

Cover the heap with straw, soil or plastic. This keeps in moisture and heat. Heat helps decompose plant and animal material and destroys weeds.

Turning the heap inside-out speeds up decomposition. The best will be to turn the heap after 3 weeks and again after another 3 weeks. If any of the material is dry, moisten it. The compost should be ready for use in about 10-12 weeks.



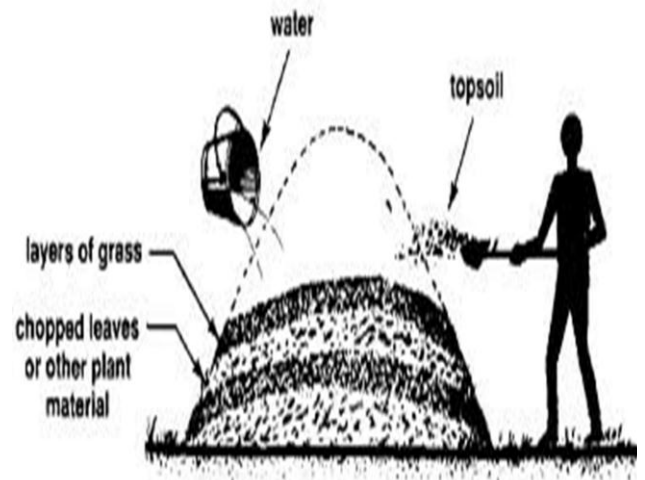
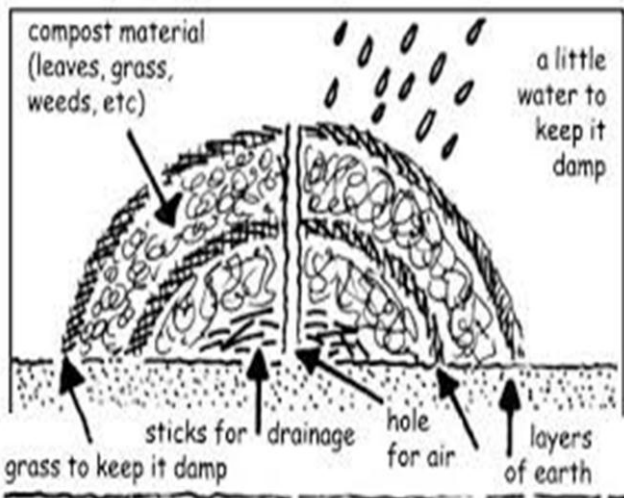
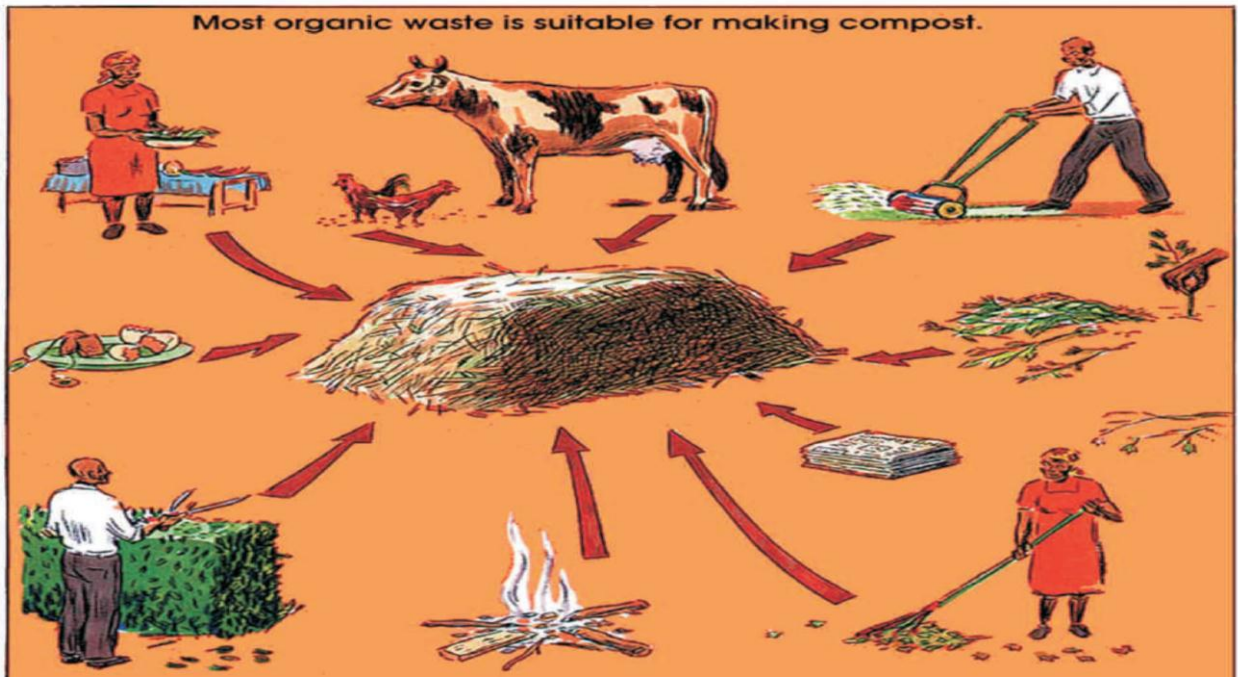
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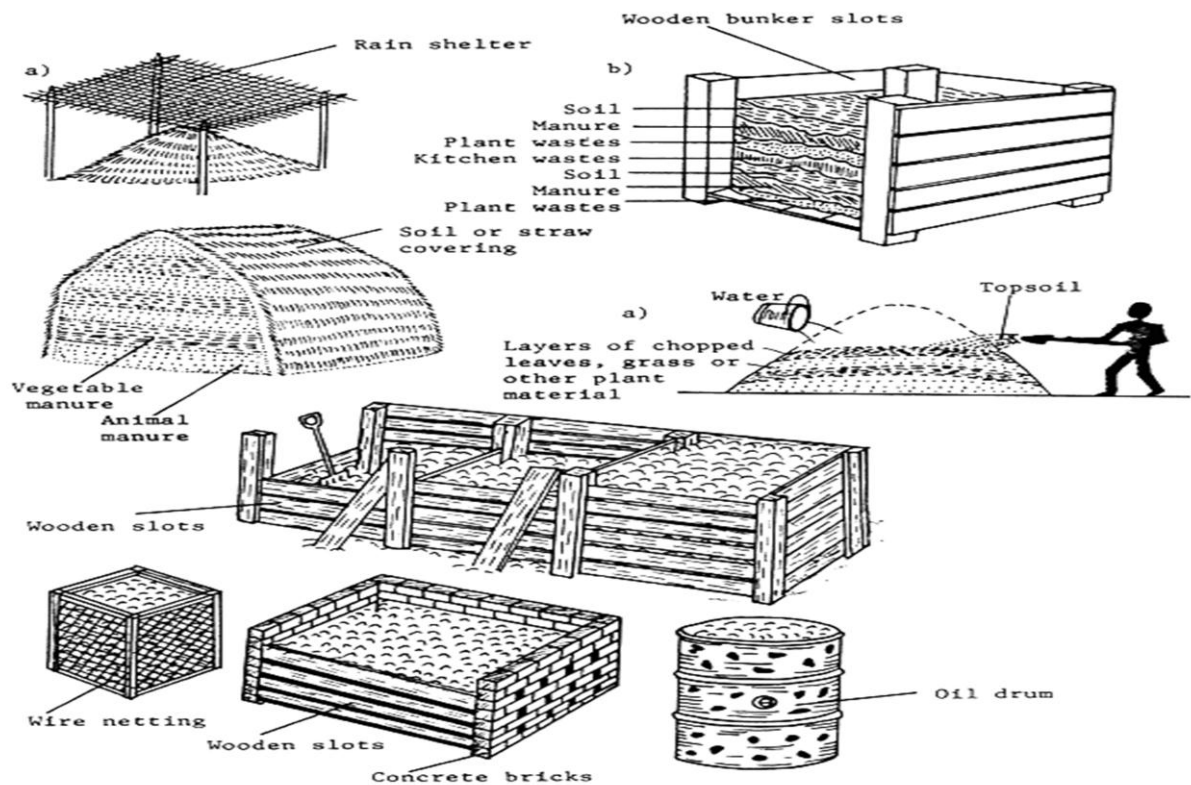


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## 2.3 Accessing pathways to knowledge

### ⚙️ *Indigenous knowledge*

Multiple social benefits of school-based vegetable gardens include the preservation of indigenous knowledge and culture (Galhena, Freed & Maredia, 2013). Rich indigenous and communal knowledge can be expressed through school-based and home vegetable gardening by the selection of plants and agricultural practices used by the local community (Kumar & Nair, 2004). Both school-based and home vegetable gardens “serve as a valuable repository for preserving and transferring

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*indigenous vegetables, production knowledge and skills from one generation to another” (Galhena et al., 2013:7).*

### ✿ **Expert volunteers (community volunteers and expert volunteers)**

Specialist NGOs may be able to help with funds, supplies, advice, information or even education and training. Local church groups reach wide audiences and are usually willing to give voluntary help or donations, talks on school gardens and can spread the reputation of the school.

### ✿ **Internet resources: International**

<p>American Horticultural Society 7931 East Boulevard Drive Alexandria, VA22308 Tel: 703-768-5700 Toll free: 800-777-7931 Fax: 703-768-8700 Web site: <a href="http://www.ahs.org">www.ahs.org</a></p>	<p>Center for Ecoliteracy Zenobia Barlow Executive Director 2522 San Pablo Ave. Berkeley, CA 94702 Tel: 510-845-4595 E-mail: <a href="mailto:zenobia@ecoliteracy.org">zenobia@ecoliteracy.org</a> Web site: <a href="http://www.ecoliteracy.org">www.ecoliteracy.org</a></p>	<p>Evergreen – Canada 355 Adelaide St. West, 5th Floor Toronto, ON M5V 1S2 Tel: 416-596-1495 Web site: <a href="http://www.evergreen.ca">www.evergreen.ca</a></p>
<p>Food and Fiber Systems Literacy Project Department of Agricultural Education 448 Agricultural Hall Oklahoma State University Stillwater, OK 74078-0484 Tel: 405-744-8036 Web site: <a href="http://www.food-fiber.okstate.edu">www.food-fiber.okstate.edu</a></p>	<p>Food, Land and People Presidio of San Francisco P.O. Box 29474 Tel: 415-561-4445 Web site: <a href="http://www.foodlandandpeople.org">www.foodlandandpeople.org</a></p>	<p>Junior Master Gardener Program Susan Gloeckler 669 County Square Drive, Suite 100 Tel: 805-662-6943 Fax: 805-645-1474 E-mail: <a href="mailto:sygloeckler@ucdavis.edu">sygloeckler@ucdavis.edu</a> Web site: <a href="http://www.jmgkids.com">www.jmgkids.com</a></p>
<p>Junior Master Gardener Program JMG Kids 1515 Emerald Plaza College Station, Texas 77845 Tel: 800-JMG-KIDS Web site: <a href="http://www.jmgkids.com">www.jmgkids.com</a></p>	<p>Life Lab Science Program 1156 High Street Santa Cruz, CA 95064 Tel: 831-459-2001 Fax: 831-459-3483 E-mail: <a href="mailto:lifelab@zzyx.ucsc.edu">lifelab@zzyx.ucsc.edu</a> Web site: <a href="http://www.lifelab.org">www.lifelab.org</a></p>	<p>National Gardening Association 1100 Dorset Street Burlington, VT 05403 Tel: 800-863-5251 Web site: <a href="http://www.kidsgardening.com">www.kidsgardening.com</a></p>

### ✿ **International websites**

Botanical Society of America  
[www.botany.org](http://www.botany.org)

California Foundation for Agriculture in the Classroom  
[www.cfaitc.org](http://www.cfaitc.org)

Children’s Gardening  
[www.hort.vt.edu/human/Children’G.html](http://www.hort.vt.edu/human/Children’G.html)

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Corn World

[www.ohiocorn.org](http://www.ohiocorn.org)

Easy Garden

[www.easy-garden.com](http://www.easy-garden.com)

Garden in Every School Project

[www.cde.ca.gov/nsd/nets/g\\_index.html](http://www.cde.ca.gov/nsd/nets/g_index.html)

Gardens for Growing People

[www.svn.net/growpepl](http://www.svn.net/growpepl)

The Great Plant Escape

[www.urbanext.uiuc.edu/gpe](http://www.urbanext.uiuc.edu/gpe)

Growing Seasons

[www.growingseasons.com](http://www.growingseasons.com)

Insect Lore

[www.insectlore.com](http://www.insectlore.com)

Junior Master Gardener Program

[www.jmgkids.com](http://www.jmgkids.com)

Kids CORNer

[www.ohiocorn.org/kids](http://www.ohiocorn.org/kids)

KIDSGARDEN

[www.kidsgardening.com](http://www.kidsgardening.com)

Let's Get Growing!

[www.letsgetgrowing.com](http://www.letsgetgrowing.com)

Life Lab Science Program

[www.lifelab.org](http://www.lifelab.org)

National Arbor Day Foundation

[www.arborday.org](http://www.arborday.org)

National Gardening Association

[www.garden.org](http://www.garden.org)

Pumpkin Circle

[www.pumpkincircle.com](http://www.pumpkincircle.com)

### **⚙ *Local organisations and government departments***

The Agricultural Research Council (ARC) provides the following types of services:



### **Training in agricultural production**

The objective of the ARC Training Services is to address the information gap between research and development (R&D) and the end user of the research output. ARC researchers have developed more than 120 short courses to address various skills needed for a thriving agribusiness, incorporating those specific to a commodity and generic business skills. Courses are customised to meet the needs of the different clients in the sector. Popular courses are: Beef Cattle Management; Cheese and Yoghurt making; Hydroponics Vegetable Production; Beekeeping, Mushroom Production and Integrated Pest and Disease Management. The ARC is an accredited Agricultural Education and Training provider.

### **Soil analysis**

The ARC provides comprehensive soil analysis to determine the composition, nutrient content and measure of fertility. Recommendations to remedy deficiencies and improve soil fertility are provided to add value to the service and provide the customer with practical advice on steps to be taken.

### **Disease diagnostics**

The ARC helps provide professional diagnostic services to help detect and diagnose pests and pathogens before they can cause major harm to farming enterprises. These services include disease monitoring surveillance, identification of disease-causing pathogens and advice on preventative programmes.

Department of Agriculture, Forestry and Fisheries, tel. (012) 319 6000

Department of Land Affairs, tel. (012) 312 8911

ARC-Roodeplaat Vegetable and Ornamental Plant Institute, tel. (012) 841 9611

Resource Centre, Department of Agriculture, tel. (012) 319 7141/7085

### **⚙️ Workshops and government departments**

Local agricultural extension consultants can give technical information and advice, and possibly training courses on specific subjects. Health services can give information on nutritional needs and guidelines. The municipality or water authorities may help with information on rainwater harvesting or irrigation systems etc. The Agricultural Research Council (ARC) provides comprehensive skills programme in crop production. The Cedara College of Agriculture provides training in vegetable production, crop production and soil fertility. The Elsenberg College of Agriculture provides courses in agricultural marketing, soil preparation and plant nutrition.

# SECTION 3: SUSTAINING A SCHOOL-BASED VEGETABLE GARDEN



## **REFLECTION ACTIVITY:**

**What do think are some requirements to sustain a school-based vegetable garden?**

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### **3.1 Secrets of success**

Some of the secrets of success in terms of sustainability include the following:

- ✿ Start small and expand later
- ✿ Establish and maintain a good water supply and fencing
- ✿ Use organic approaches to improve and conserve soil
- ✿ Choose crops which will adapt to local conditions, match local traditions and food habits, have high nutritional value, contribute to household food security and are easy to cultivate
- ✿ Involve trained and experienced teachers and helpers to share their knowledge and skills.

Ideas to motivate everyone involved:

- ✿ Have a school-based vegetable garden opening ceremony
- ✿ Celebrate 'main vegetable gardening events' (planting and harvesting), have visits and open days
- ✿ Learners can create posters about crops, insects, compost etc. and present the posters to their own classes, other classes and visitors
- ✿ What about a Sweet potato day or Cabbage day or Spinach day when the crops are at their peak?
- ✿ Celebrate World Water Day, World Health Day, World Environment Day, World Health Day etc.

### **3.2 Mobilising systemic networks**

In sustaining a school-based vegetable garden teachers can rely on several resources that are available. You can, for example, utilise systemic networks through:

#### **✿ Continued commitment by key internal role players**

Please refer to section 1. If team members remain motivated and committed, you are halfway there.

#### **✿ Government departments**

The Departments of Basic Education, Agriculture, Forestry and Fisheries, Health, Rural Development, Water and Environmental Affairs, as well as local municipalities can assist schools in the training of teachers and community members on garden management, provide training material and support schools in the provision and upgrading of vegetable garden infrastructure.

#### **✿ Non-government stakeholders (NGOs and NPOs)**

Several NGOs and NPOs assist schools in initiating and sustaining vegetable gardens. Schools can identify and contact potential NGOs and NPOs, in order to request such assistance.

### **3.3 Relying on scientific sources**

A vast amount of literature is available on school-based vegetable gardens, which can be accessed and applied. Besides the aspects covered in Section 2, knowledge on permaculture; and high nutrition, low maintenance plants; can assist teachers to sustain an established garden.

#### **✿ Permaculture in a nutshell**

*Permaculture* comes from the words *PERMANent* and *agriCULTURE*. The focus is on agriculture (food production) that lasts, or culture (ways of doing things) that lasts. Permaculture can furthermore be defined as a system of natural farming in which the farmer co-operates with nature and is about looking at our resources (at school, in the surrounding community and even outside of that) and ‘designing’ better environments. Designing means joining the different resources and elements (water, soil, plants and animals) of the environment together like a puzzle so that they can work better for us and produce a food rich environment. Once you start to understand the natural functions of soil development, you will begin to realize the importance of using techniques like composting and mulching.

If you have water that is running across your property, try to use the soil to redirect it so that it spreads out over the land. To do this you can use a “swale”, which is a type of permanent ridge. Dig a channel along the contour of the land to stop the water and then plant perennial crops on the top of the ridge to make it strong and permanent. These swales will help to stop and spread your water, thus allowing time for it to sink into your soil. The plants that you establish on the top of the swale will also act as shade to help hold the moisture once it has gone into your soil.

Secondly, the use of mulch is essential for helping to harvest your water throughout the year, but especially during the rains. Mulch is generally any type of organic matter such as leaves, grass, maize stalks etc. that is used to cover your soil and protect it from being damaged by the sun, wind and rains. As the mulch breaks down, it becomes compost to feed your soil. This organic matter will also act as a sponge in your soil, absorbing large amounts of water, allowing the water to filter into the soil, and shading it so that it stays there for a longer period of time.

Thirdly, water harvesting tanks may be designed to harvest rain water off of roofs and other structures. Basically this simply entails guiding the water through some sort of channel (such as

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split bamboo, plastic bottles that have been cut in half, gutters made out of tin, purchased rain gutter, or whatever else you can think of. This water is then directed off the roof and into some sort of container (such as an old oil drum, a cement tank, clay pots, etc.). This water can then be used to wash clothes, mop floors, etc. and finally poured onto your vegetable garden when it is finished.

Lastly, plant trees! Trees absorb and store massive amounts of water in their trunks, roots, and leaves. During the dry season, this moisture is slowly returned to the soil and the air, causing boreholes to remain full, rivers to continue running, and rain clouds to be formed.

A permaculture guild is another important aspect to take note of in permaculture. A permaculture guild is a group of plants that are all working together to help each other grow strong and healthy. A good guild should contain the following seven aspects:

**Food**—One of the first things that we use a guild for is to provide us with food. Remember that diversity is the key to good health. Try to include all of the food groups when you are planting a guild. This would include: staples, vegetables, fruits, legumes and nuts, and lastly fats.

**Things that Feed the Soil**—Legumes are vegetables which are able to take nitrogen from the air and change it in the soil into a form that other plants can use. This is called “fixing nitrogen”. Legumes generally produce their seeds in pods, so even if you don’t know if something is a legume or not, you may be able to guess just by looking at the type of seeds it has. Examples of legumes include: all beans, peanuts, peas etc. Other things that feed the soil include compost, compost tea, mulch and manure.

**Groundcover**—Groundcover is just what it says...something that covers the ground. Groundcover is important for protecting the soil from the damaging rays of the sun as well as helping to shade the ground and hold moisture for longer periods of time. It can also help to inhibit “weeds” (good plants in the wrong place), so that there is not as much root competition. There are many types of groundcovers available: sweet potatoes, pumpkins, cucumbers and anything else that will vine or spread across the soil. Mulch is also a form of groundcover.

**Miners and Diggers**— Deep rooted plants, such as trees, will reach deep into the earth’s soil and bring minerals up to the surface. This is why it’s important to eat the skins of foods (if they are edible), because that is where a great deal of the minerals are. It is also why it is important to

use the leaves of trees in compost piles so that those minerals are returned to the soil for other plants to use. Diggers are any plants that help to open up the soil and allow air and water to enter. Examples of diggers include: sweet potatoes and yams.

**Protectors**—Any plant that helps to protect your guild is a protector. If you want to protect your guild from insects then it's important to know that many insects find their food through the sense of smell. If you plant strong smelling plants such as garlic, basil or lemon grass the insects have a difficult time finding their food. Other plants such as marigolds will help to protect from things like root nematodes in the soil. There are also beneficial predators that will help to protect your guild, such as frogs, lizards, birds and ladybirds. Try attracting these to your guild with the use of shelter (i.e. a small pile of stones for them to hide in), water features (such as a bird bath that can be easily made out of a broken pot) and the addition of flowers, bird-berries, and hedges that will provide food and protection for all of your protectors. You can also protect your guilds from large animals like goats and people with the addition of things with thorns.

**Climbers**—Many people claim that they don't have enough land on which to farm. What many people are forgetting, however, is that they may have a lot of space. If we look at a forest system (which is what Permaculture is based on), we see that nature stacks plants in many layers. If we start to use this vertical space rather than just the horizontal we can greatly increase our food production on just a small plot of land. The use of climbers is one of the ways to do this. Climbers will grow upwards and provide us with a whole other level of food production. Example of a climber that you can include: beans.

**Supporters**—Climbers are only helpful when they actually have something on which to climb. Many things can act as a supporter. You may see beans climbing up maize plants. This is a good example of increasing food production while using a nitrogen-fixing climber/supporter combination. Trees can also be used to act as supporters as long as they are big enough to support the climber and that the climber doesn't take over. Other supporters include fences, walls, roof tops and other buildings.

### ⚙ **High nutrition, low maintenance plants**

For school-based vegetable gardens to have an impact, school-communities need to grow the right combination of vegetables in such a way that they are produced as regularly as possible throughout the year. Examples of high nutrition, low maintenance plants are: carrots, garlic, onions, squash, tomatoes, peppers. Many sources on this topic can be accessed on the Internet.

**3.4 Continuous planning**

Through continuous planning, goals can be set for your school vegetable garden project. In addition recycling, crop rotation, good gardening principles, seasonal planting, companion planting and sustainable methods can be implemented. We encourage you to read up on these topics in order to assist you to sustain a beautiful garden.

**What would you like to accomplish within this year in terms of the school vegetable garden project?**

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**What do you hope to have in place one year from now?**

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**What would you like to see happening with your school vegetable garden project five years from now?**

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**A school vegetable garden will be good for our school because...**

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**In our school vegetable garden learners will learn about.....**

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**In our school vegetable garden learners will experience.....**

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**Develop a shared vision for your school vegetable garden project. Describe what that includes.**

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### 3.5 Monitoring and evaluation

#### **Why monitoring?**

'Monitoring' can be used as a strategy to ensure that you are doing what you intended to do in the school-based vegetable garden or to keep track of progress. Many developments can be monitored, for example: plant growth, weather, rainfall, condition of the compost, garden infrastructure (equipment, irrigation system, paths etc.), work done and the time spent, number of and types of weeds, presence of beneficial and harmful insects, as well as their effects and lastly money spent and received. A garden book or diary can be kept with weekly entries (FAO, 2005).

#### **Why evaluate?**

Evaluation assists with future planning and looks back at the original practical and educational objectives of the school-based vegetable garden. Furthermore, evaluation also has psychological and educational value, where lessons learned, things that worked well, failures and challenges are regarded as instrumental ingredients for success. Evaluation also forms part of the process of experiential learning and reflection (FAO, 2005). One might ask *What did we want to do? Did we do it? What did we hope to learn? Did we learn it? What was enjoyable? What was less enjoyable?*

Children, teachers and volunteers can 'inspect' their school-based vegetable garden everyday – on the way to class, during break or on their way home. Learners can for example be organised into a pest patrol group (insects, worms etc.), plant health patrol group (growth and quality), as well as a plant protection patrol group (soil moisture, weeds, mulching and fencing). Example of a week's report:

Week beginning: .....
Jobs done: .....
Progress: .....
Challenges: .....
Other observations: .....
Signed: .....

**Who are responsible for monitoring and evaluation?**

Evaluation and monitoring is regarded as a shared responsibility, thus everyone who is involved should contribute (learners, teachers, parents, volunteers etc.). Evaluation can be done by class discussions, focus groups, through a comments box and informal discussions. Record keeping and note taking of what is said forms an essential part of evaluation.

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A photograph of a vibrant vegetable garden. In the foreground, there are several rows of green leafy plants, including what appears to be a tall stalk of leafy greens on the left and various other leafy vegetables. The garden is bordered by reddish-brown stones. In the background, a house with a green corrugated metal roof and yellow walls is visible. A clothesline with various items of laundry, including a red cloth and a blue and white striped shirt, hangs across the front of the house. The overall scene is bright and sunny.

**ADDITIONAL READING MATERIAL**