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Edible Landscaping in the Philippines: Maximizing the Use of Small Spaces for Aesthetics and Crop Production

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Edible landscaping (EL) in the Philippines is an innovative concept of combining various principles of landscape design with existing technologies for small-scale crop production. EL utilizes vegetables, herbs, and fruit crops as major softscape materials to substitute for the ornamental plants commonly used in conventional landscaping. It considers the aesthetics and functionality of space in relation to the production of safe and readily available crop products for the family and community.

EL involves various components such as softscape, hardscape, design, and crop production. The design part of EL is very flexible and can vary from one cropping period to another, depending on the planting scheme chosen. Edible crops can assume several landscape functions to create different attractions in each cropping season. The production side of EL follows recommended techniques for seedling establishment up to harvesting while some practices are modified to fit the chosen design. EL also promotes the use of organic pest management and recycling of available on-site resources—particularly those derived from plant residues—to enhance and maintain soil productivity.

Even though EL is focused on food availability at household level, it is also intended to increase interest in the utilization of endemic edible plants and greening of urban spaces to alleviate environmental problems. Moreover, surplus crop products can be marketed to generate additional income. Currently, EL is being intensively promoted in the Philippines and is open for further development to cater for a wider scope of crop production.

Key words: Crop production, Edible crops, Landscaping, Subsistence farming

Introduction

Sustained availability of safe food on the table for every Filipino seems a never-ending concern for the government and has been the focus of most agricultural projects in the Philippines. This concern is aggravated by the increasing population growth rate and decreasing availability of land for food production. Sources of food, and production centers, are relatively far from target populations. This causes additional concern with regard to product quality and increasing health hazards because of the need to add chemicals to prolong the postharvest life of produce.

Depressed communities in urban areas are the most vulnerable to problems of food availability. Within these zones, no tillable land is readily available and food commonly comes from external sources. These increasing concerns about food availability provide good reason for the government and the public to search for the solutions needed to produce safe and readily available food.

One possible solution is the use of technologies developed for food production under adverse conditions and applicable to household level crop production. If most householders were to utilize the open space within their properties, they could benefit by having their own sources of food even at the smallest scale possible. Such production systems and technologies can be adopted and practiced with increased enthusiasm when the basic tenets of landscape design

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become the guiding principles. According to Naranja (2011), science and creativity were blended together in this type of integrated food production technology, which is now called edible landscaping (EL).

Edible Landscaping

EL is an innovative concept of space management that uses vegetables, herbs and fruit trees as major softscape materials to substitute for the ornamental plants commonly used in conventional landscaping. However, EL is not just about crop production. It is a complex activity of planning, design, implementation, and maintenance, as similarly done in conventional landscaping. The art of landscaping, or the act of purposely changing the natural features that exist, with the intention of making the environment more attractive similarly holds true in EL (Naranja, 2011).

EL may find similarities in vegetable gardening, backyard gardening or orchard growing, but with an added design component and usually situated in strategic location. With traditional crop production methods, plots are usually made simply by following either a square or a rectangular shape, but in EL plots can be of any form required by the design specification. Fruit trees can also be intercropped with other edible crops and can be planted at various spacings in accordance with the design.

EL Combined with Bio-intensive Gardening for Small-scale Crop Production

EL can be combined with bio-intensive gardening (BIG), which is commonly used in small spaces to increase productivity. BIG is a crop production method designed to maximize the use of space and utilize the resources present in the surrounding environment. The original concept of BIG starts with the creation of plots mixed with organic matter. Plots can either be raised or double-dug, depending on the conditions at the site. Each plot is then sub-divided into four parts allotted to the planting of four groups of crops, namely legumes, root crops, leafy vegetables, and fruit vegetables. Every cropping season, representatives of each crop groups are planted in designated parts of the plots to recycle nutrients, control pests, and increase biodiversity.

With the addition of the EL concept, BIG is modified to suit various designs but most of the original concept is retained. Plot shapes are diversified and follow various principles of design. If the area is not suitable for field production, then the crops can be grown in containers but is guided by the concept of BIG. The aim is to produce safe and readily available nutritious food for the family and the community while creating an attractive and functional edible landscape and maximizing the use of all resources present in the site.

EL Components for Small-scale Crop Production

Softscape Component

Technically, the plants used in edible landscaping are called the "softscape". These include fruit trees, vegetables, cereals, herbs, and medicinal plants, all of which serve as screens, accents, hedges, and ground covers in the landscape. Plants can be judged superior or inferior only within the role requirements set out in the chosen design. In conventional landscaping, ornamental plants are selected for certain roles in the landscape on the basis of architectural, engineering, and aesthetic considerations (Ingels, 2000). Edible crops also assume specific functions in the landscape; these are similar to the landscape functions of ornamental crops but must be limited to minimize limitations on crop yield.

The key to successful cropping is the selection of desirable species, varieties, or cultivars. Desirable crops should possess characteristics such as high yield potential, resistance to pests and diseases, and high adaptability to a wide range of soil and climatic conditions. In addition, yield should be high, or at least acceptable (Namuco and Protacio, 2010). Some recommended crops and their functions in EL are listed in Table 1. These crops should be selected carefully on the basis of their adaptability to the site and their suitability for the chosen design or crop production technique.

Because of the annual nature of the growth cycles of most vegetables and frequent crop rotation, a year-round planting calendar must be planned early enough to give continuous production. It is also beneficial to include perennial crops such as medium-sized fruit trees, tree vegetables, and medicinal plants whenever possible. These perennial crops give a sense of permanence to the landscape after the annual crops have been harvested.

Annual crops that serve as ground covers can be interchanged every cropping season, whereas hedges and shrubs can stay longer, depending on the growth phase and the objective of the design. Apart from the re-

Table 1. Recommended crops and their potential landscape uses in small-scale edible landscaping.

Common name	Scientific name	Special features	Function in the landscape
Leafy vegetables			
Lettuce	*Lactuca sativa*	Various leaf colors and arrangements	Ground cover
Onion	*Allium cepa*	Insect repellent / blue-green leaves	Edging
Bok choy	*Brassica chinensis*	Wide plant form	Ground cover
Swamp cabbage	*Ipomoea aquatica*	Light green leaves	Edging, ground cover
Fruit vegetables			
Bitter melon	*Momordica charantia*	Serrated leaves and yellow flower	Screen*
Bottle gourd	*Lagenaria siceraria*	Fancy fruit shape	Shade
Cucumber	*Cucumis sativus*	Yellow flowers	Screen*
Eggplant	*Solanum melongena*	Attractive fruits	Hedge
Hot pepper	*Capsicum annuum*	Colorful fruits	Specimen
Sponge gourd	*Luffa cylindrica*	Yellow flowers and long fruits	Screen*
Squash	*Cucurbita maxima*	Large yellow flowers	Ground cover
Tomato	*Lycopersicon lycopersicum*	Colorful fruits	Specimen, edging
Root crops			
Cassava	*Manihot esculenta*	Attractive leaves	Screen/barrier
Taro	*Colocasia esculenta*	Large leaves	Specimen, foundation plant
Ginger	*Zingiber officinale*	Attractive leaves	Barrier
Sweet potato	*Ipomoea batatas*	Colorful leaves	Ground cover
Legumes			
Bush sitao	*Vigna* spp.	Violet flowers	Edging
Cowpea	*Vigna unguiculata* subsp. *unguiculata*	Violet flowers	Edging
Peanut	*Arachis hypogaea*	Yellow flowers	Ground cover
Pole sitao	*Vigna unguiculata* subsp. *sesquipedalis*	Violet flowers	Screen*

*When vines are supported by a trellis

quirements of BIG, there are several criteria that should be considered in selecting an appropriate crop for EL. First, the crop should suit the householder or grower's personal preference and be consumed by them at high rates. Second, it should possess attractive features (e.g. the color, texture, and shape of the leaves and fruits) to add aesthetic value and interest to the garden. The third consideration is the climatic requirement of the crop: to maximize the benefits from the edible landscape garden it should thrive in the given environment. Lastly, choose a crop that is indigenous to the area. This will ensure good adaptability and fewer problems in maintenance operations in the future.

EL also encourages the use of insect-repellent plants that can ward off harmful insects. This practice lessens the maintenance operations required in the garden, as it reduces the incidence of insect-related dam-

Table 2. Other crops utilized in various edible landscape projects in the Philippines.

Common name	Scientific name	Edible part/useful part Special features	Function in the landscape
Malabar spinach	*Basella rubra*	Leaves/red stem	Specimen
Basil	*Ocimum basilicum*	Leaves	Edging
Calamansi	*Citrus microcarpa*	Fruits	Screen/hedge/barrier
Garlic	*Allium sativum*	Bulb/insect repellent	Edging
Gynura	*Gynura crepioides*	Leaves/light green leaves	Ground cover
Guava	*Psidium guajava*	Leaves and fruits/ interesting stem characteristics	Specimen
Hummingbird tree	*Sesbania grandiflora*	Flowers/attractive flowers; round canopy	Specimen
Lemongrass	*Cymbopogon citratus*	Leaves/aromatic , insect repellent	Edging
Drumstick tree	*Moringa oleifera*	Leaves and fruits/fine leaves	Screen
Mint	*Mentha* spp.	Leaves/textured leaves	Ground cover
Oregano	*Origanum vulgare*	Leaves/aromatic, insect repellent	Edging, ground cover
Pandan	*Pandanus amaryllifolius*	Leaves/Upright leaf orientation	Ground cover
Pineapple	*Ananas comosus*	Fruit/rosette leaf formation	Specimen
Rosemary	*Rosmarinus officinalis*	Leaves/grayish colored leaves	Edging
Stevia	*Stevia rebaudiana*	Leaves/fine sweet leaves	Edging, ground cover
Tarragon	*Artemisia dracunculus*	Leaves/aromatic and attractive yellow flowers	Edging
Wild tea	*Carmona retusa*	Fine leaves; tolerate heavy pruning	Hedge/topiary/screen

age (Naranja, 2011). Some examples of insect-repellant plants are given in Table 2, which also includes examples of the edible crops used in projects in the Philippines.

Hardscape Component

The hardscape is the non-living component; it can be moving or stationary and helps to achieve the function of the space. It strongly enhances the edible landscape garden and enables the space to be aesthetically attractive even when crops are absent. Structures bring permanence to the landscape by providing a general outline and solid edging. The presence of paths, divisions, and other features and focal points also enhances the space. It helps to think of the structures as the "skeleton" of the edible landscape, which will be fleshed out and given body, form, and features by the edible plants (Houdret, 1991).

Hardscapes are designed to fit the goal of the landscape while providing support for better growth of the crops. Table 3 shows different hardscapes that can be used in EL and their corresponding functions in terms of crop production. In deciding what materials to use for the hardscape, the cardinal rule is to use local materials wherever possible (Pfeiffer, 1994). Use of recycled materials is also encouraged to decrease waste generation. Used materials can be transformed into other forms to fit the design. These materials can be salvaged and painted to look new and attractive. The key for better recycling of on-site materials is creativity and resourcefulness.

Table 3. Hardscapes for edible landscaping, and their functions.

Hardscape	Function	
	Landscaping	Crop production
Containers (pot, planter box, basket)	Enhance the beauty of plants. Used for easy rearrangement of plants in the landscape.	Solution to limited availability of open fields and holds growing medium.
Mulch	Covers bare spaces	Decreases water evaporation and weed growth.
Pavers	Directs foot traffic and provides comfort for feet.	Enables crops to be reached more easily during maintenance operations.
Plant shelves	Maximize the vertical space of a small garden or space.	Maximize sunlight exposure for photosynthesis.
Trellis	Gives interest to the landscape and provides a message of direction in welcoming guests. Can also serves to delineate zones in an area.	Supports plants for better growth and development.
Water feature	Adds interest to the landscape. Soothing sound for relaxation.	Cools the environment. Regulates micro-climate.

Landscape Component

As a major part of EL, the landscape component is critical for the success of the whole project. The focus is not only on the aesthetic value of each element in the landscape but also on how to maximize the area to meet the optimum crop requirement for improved yield. This component follows the concept of the traditional landscaping process but with a strong emphasis on the productivity of edible crops. The functionality of the space focuses on two major concerns: the needs for the end-user to have an area for recreation or relaxation, and the function of the area as an environment for crop production. The success of the landscaping component lies in the proper planning and management of the site before, during, and after each production period. This process is governed by the principles of landscaping and crop production. The whole process is subdivided into three phases, namely design, implementation, and maintenance.

The design phase revolves around preparation of the plan for the whole area for the entire production period. Every component of the plan is designed to meet the requirements for optimum crop production. Moreover, it is governed by the elements and principles of design to meet the aesthetic requirements. The detailed steps of the design phase are as follows:

1. Site analysis – evaluation of the particular space for EL in terms of problem areas, views, access, assets, and suitability for crop production. The prevailing micro-climate, sources of water, wind, and light should be included in the analysis.
2. Design conceptualization – creation of the EL design on the basis of the site analysis and in accordance with the principles of landscape design and BIG. This includes selecting, planning, and scheduling of activities for the whole crop production period. The cropping scheme should be planned properly to identify future needs and the activities required at the site.
3. Production of working drawings – optional but important for assessing the envisaged design before it is implemented. It is better to make mistakes on paper than in the field. Proper working drawings should be made to avoid confusion during implementation and to direct the flow of activities and positioning of materials at the site.

The implementation phase involves the construction of hardscapes, production of planting materials, and modification of the environment to fit the cropping system. Work in the implementation phase is full of conflict, and an awareness of the activities that must be

done is essential to minimize mistakes during construction (Sauter, 1999). The steps in the implementation phase are site clearing, laying out, hardscape construction, and planting.

For small-scale EL, hardscape construction is considered minimal. Most of the structures built for small spaces are in the form of planter boxes, trellises, pavements, and accents. Production of planting materials depends on plant selection. Some crops can be propagated from seed, whereas others can be propagated by using asexual methods such as separation or division or taking cuttings. Preparation of planting materials is a continuous and well-planned set of activities aimed at replanting or relay-planting of crops to avoid bare spaces. In the maintenance phase, all of the practices involved in landscaping and crop production are applied to preserve a pleasing landscape. A good landscape is one that fulfills its function with efficiency, enhances the welfare and pleasing appearance of the environment in the short and long term, and can be maintained in a viable condition (Weddle, 1979).

The difference between edible landscapes and conventional crop production systems in terms of maintenance is that in the former, the edible crops are maintained as ornamentals to provide aesthetic appeal during the whole production period. Some of the practices employed during maintenance are watering, nutrient and pest management, fruit bagging, staking, pruning, ratooning, training, harvesting, propagation, media preparation, and sanitation. The hardscape is also maintained throughout the cropping season to preserve its aesthetic value and function. General cleaning of the hardscape should be done to display its detail and maintain its form in the garden. Moreover, sanitation helps to prevent the structures from harboring pests.

Crop Production Component

Yield is a major priority in EL. To improve the yield, a good crop production system is needed. In selecting the crop production technique to use, consider the objective of the project and the characteristics of the chosen space. Your decision can be crop-based or site-based and will depend on either the ability of the selected crops to thrive at the site or the intensity of the site modification required to fit the needs of the preferred crops. If the site is the most limiting factor, then both the landscape component and the crop production should be carefully designed to maximize the positive characteristics of the site and incorporate various production techniques.

Various crop production techniques (e.g. container and vertical gardening) are available for problematic spaces. All of these techniques can be used to meet the needs of the plants and the limitations of the space. The use of container gardening has been expanding in recent years in the Philippines because of the limited space available in most populated areas. The concept involves the use of a recommended growing medium and containers to support the crop throughout its life cycle. Recycled materials can be used as containers to support plant growth and at the same time help recycle non-biodegradable waste (Mabesa *et al*., 2005).

Another proposed technique to maximize area is to use containers modified for what is popularly known as vertical gardening. This technique involves the use of vertical planters to increase planting space for better sunlight absorption and air circulation (Mabesa *et al*., 2005). There are already containers available on the market that can be easily arranged in place and can be used every cropping season.

Almost all recommended crop production practices (e.g. irrigation, fertilization, and pest management) are used in EL. Calculations of the water requirements of vegetables should consider all forms of water loss, including evapotranspiration, percolation, and run-off during irrigation (Malixi, *no date*). Watering is the most repetitive and time-consuming task in crop production. The growing medium should never be allowed to dry out completely, and plants should never be allowed to wilt (Manaker, 1997). Watering containerized plants requires more attention than watering plants in the field. Plants in containers dry out faster because of the limited amount of growing medium, especially when the containers are located on solid paving surfaces in direct sunlight. Containerized crops should be watered when the top 4 to 6 cm of the growing medium is dry (Mabesa *et al*., 2005).

EL promotes the use organic methods of nutrient and pest management. However, there are a number of different concepts of organic crop production. Some strictly avoid the use of chemical inputs, whereas others allow synthetic inputs but only when they cannot be replaced with natural inputs (Dung, 2005). Nonetheless, all concepts agree that maintenance of soil fertility, pest control, and weeding are the three main concerns and foci of operations in any type of large- or small-scale organic crop production (Fuji-

moto, 2005). This also holds true for EL and is programmed by using a combination of various activities recommended for organic gardening. Always follow organic crop production techniques that promote the use of natural organic sources as inputs in food production; synthetic chemical agents should be used only in minimal amounts and only when they cannot be replaced by organic agents (Dung, 2005).

Soil fertility is enhanced by adding compost produced from garden and kitchen wastes. Compost can be produced through different methods such as vermicomposting. Compost tea can be applied as a drench or sprayed on the leaves of crops (Mabesa *et al*., 2005). Legumes are used in intercropping or crop rotation to increase soil nutrient levels.

For pest management, the use of chemicals can be avoided through the close monitoring of crops. Manual weeding and removal of infected plants of infected plants can be used to help control disease, and insects can be removed by hand. Fruit can be bagged to protect fruit vegetables such as ampalaya (bitter melon *Momordica charantia*); the use of colored paper for bagging can add a color accent to the landscape. Companion planting can also be a pest management practice. Repellent plants such as onion, garlic, and marigold (*Tagetes* spp.) are commonly used in companion planting to repel insect pests. Traps such as small pieces of yellow board smeared with grease can be placed among the plants to attract and catch insects in the garden.

Special practices are also used in EL. Vine crops require trellising for better growth, whereas some herbaceous crops need staking. Crops such as eggplant (*Solanum melongena*) and swamp cabbage (*Ipomoea aquatica*) can be ratooned to decrease the time that would otherwise be required for sowing and site preparation. Ratooning is a method of crop rejuvenation that allows old plants to produce young shoots.

The cropping scheme is critical in the crop production part of EL. The landscape area should not be left open after harvesting, and there should be an organized plan for this period in every crop cycle. From the perspective of BIG, the location of each of the four groups of crops should be planned such that one group is not planted in the same area in the next cropping season. Before the harvest of the current crop, the next season's seedlings or planting materials should be prepared and planted; this scheme is called "relay cropping".

Lastly, harvesting can be staggered to meet the needs of the household and the growth of the crops. Some fruits should be allowed to mature on the mother plant and be harvested as a source of seeds for the next cropping season.

Benefits of Edible Landscaping

Introduction of the landscaping concept to crop production ignites the interest of household members in a seemingly unfamiliar method of gardening given a new twist through EL. EL is more suited to small spaces than traditional crop production practices and makes these more aesthetically appealing. It is applicable even in urban areas, where there is a high demand for safe and nutritious food.

EL has a number of benefits:

・It provides safe and readily available crop products at a household level.

According to Holmer (2010), about 20% of Filipinos regularly suffer from hunger and about one-third of all children in the Philippines are underweight, with iron deficiency anemia and low vitamin A levels. This can be attributed to the low rates of consumption of vegetables in this country (Mabutas, 2011). If every household were to practice small-scale EL, then hunger could be reduced, because vegetables and fruits would be readily available on the table. Also, the involvement of children in EL may increase their interest in, and thus their consumption of, vegetables and fruits. Because EL promotes organic crop production and targets households, most of which have only small spaces available for cropping, pesticide application can be avoided. This should result in the production of fresh and safe food for the family.

・It promotes the use of endemic plants and increases biodiversity.

EL promotes the use of endemic plants in the landscape in various ways for everyday food preparation. If the community learns to utilize endemic plants, then these plants will be conserved through cultivation. According to Coronel (2011), this method of conservation has been used widely ever since humans learned to domesticate useful plant species. Adaption of EL can increase the biodiversity of ecosystem components because of the introduction of a variety of crops to an area. To meet its objectives, EL requires more species of crops than in small-scale monoculture crop production.

・It helps to reduce environmental problems through the greening of open spaces.

In places where EL is practiced, the environment can become safer and more wholesome because of the presence of more green vegetation. These green spaces not only mask concrete surfaces, softening hard views, but they also cool areas down. The development of more green spaces also helps to reduce water run-off and soil erosion (Naranja, 2011). Green plants photosynthesize and in the process absorb carbon dioxide. Photosynthesis helps to freshen the air with oxygen (Naranja, 2011).

・It can be an additional source of income.

EL can reduce expenditure on fruit and vegetables by Filipino families; such expenditure accounts for 10% of 88% of spending on all foods consumed at home (NSCB, 2006). The family can also make additional money by selling the surplus to the community.

Promotion of Edible Landscaping in the Philippines

EL is being intensively promoted in the Philippines. It is promoted through the training of teachers, students, organized groups of women, soldiers, government officials, businessmen, and hobbyists. Interviews have also been conducted on national television and local radio stations for faster dissemination of information. EL has already been presented at various exhibitions and conferences, and a number of demogardens have been constructed in strategic locations so that the public can experience and enjoy them. The concept has also been incorporated in various agricultural courses at the University of the Philippines Los Baños (UPLB), such as Horticulture 119 (Urban Horticulture) and basic crop science courses. Moreover, the concept is being discussed in other courses under different UPLB curriculums. The production of brochures and a manual funded by the Department of Agriculture—Bureau of Agricultural Research (DA-BAR) of the Philippines is in the pipeline to further promote this promising technology.

Conclusion

In the Philippines, food availability is one of the major challenges brought about by rapid population growth and urbanization. One possible means of addressing this challenge is through the adaptation of EL. EL is an innovative concept of incorporating various principles of landscape design with existing technologies for small-scale crop production. EL utilizes vegetables, herbs, and fruit crops as major softscape materials to substitute for the ornamental plants commonly used in conventional landscaping. It considers the aesthetic and functionality of space in relation to the production of safe and readily available crop products for the family and community. Promotion of the EL concept in the Philippines aims to increase the awareness and interest of people in gardening or farming. EL is promoting the more creative use of most crop production technologies. The other goal of EL is to engage more Filipinos in growing their own vegetables and thus to increase vegetable consumption. EL is very flexible and open to any possible modifications brought about by new developments in landscaping and crop production. It may evolve, but the aim of feeding every Filipino will remain.

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