Edible Landscaping

The number of US households planning to grow or growing their own fruits and vegetables is increasing daily! Join us for Edible Landscaping and receive science-based curricula in edible landscape plants and practices using a train the trainer model. The program is designed for Master Gardeners and Industry Professionals who serve as trainers for the public. Each participating Master Gardener county will be asked to complete a training both for their fellow Master Gardeners and the public.

Register for a two-day training in your area at http://camastergardeners.ucdavis.edu.

The registration fee is $35 for Master Gardeners and $65 for industry professionals.

Photo: Rosalind Creasy ©1994

Day 1

Time	Topic	Speaker(s)
9:30–9:40 AM	Welcome & Introductions	Pam Geisel
9:40–10:20 AM	Goals of the Project & Teaching Expectations	Amanda Crump, Pam Geisel
10:20–10:30 AM	Stretch Break	
10:30–11 AM	Introduction to Edible Landscaping	Missy Gable, Claire Napawan
11 AM – 12 PM	Design & Planning	Claire Napawan
12–12:15 PM	Introduce Group Project	Missy Gable, Claire Napawan
12:15–1 PM	Lunch & Group Project	
1–3:30 PM	Planting & Maintenance	Mary Bianchi, Janet Hartin, Chuck Ingels, Scott Oneto, Dennis Pittenger
3:30–4 PM	Transportation to Garden Site	
4–5 PM	Garden Orientation/ Tour/Observations	
Total	**7.5 Hours**	
Group Project	Attendees will work collaboratively on a landscape scenario. Each group must propose an edible landscape that fits both with the site and its proposed use.	

Day 2

Time	Topic	Speaker(s)
8–9 AM	Breakfast, Group Project	
9–10 AM	Policy	Mary Bianchi, Loren Oki
10–11 AM	Harvest & Storage	Pam Geisel
11–11:15 AM	Stretch Break	
11:15–12:15 PM	Food Safety	Linda Harris
12:15–1 PM	Lunch & Group Project	
1–2:15 PM	Group Project Presentations	Everyone
2:15–2:30	Stretch Break	
2:30–3:30 PM	Teaching & Evaluation	Amanda Crump
3:30 PM	Trainer pin distribution	Everyone
Total	**7.5 Hours**	

Master Gardener — University of California Cooperative Extension

CCUH — California Center for Urban Horticulture — UC Davis — College of Agricultural & Environmental Sciences

Edible Landscaping

Photo: Rosalind Creasy ©1994

Master Gardener — University of California Cooperative Extension

CCUH — California Center for Urban Horticulture — UC Davis — College of Agricultural & Environmental Sciences

Dear Edible Landscape Trainees,

Thank you for attending the Edible Landscape "Train the Trainer" program. A major goal of the program is to provide objective research-based based curricula on edible landscaping to University of California Cooperative Extension (UCCE) Master Gardeners who, in turn, will provide the information to the gardening public via workshops and other methods.

The UCCE Master Gardener Program and the California Center for Urban Horticulture extend appreciation to the ANR Competitive Grants 2011 for providing funding to develop and deliver this program.

Determining the effectiveness of this training is very important. To this end, we are implementing a year-long survey of those receiving the training. This will provide crucial information that will assist us in developing and delivering future training programs to both Master Gardeners and the gardening public.

We hope that this training will allow you to better address the needs of the gardening public in the area of edible landscaping and we appreciate your attendance and your commitment to the 'Train the Trainer' model.

Happy Gardening!

The Edible Landscaping Team

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Special Thanks

We offer gratitude to the following people for working diligently to coordinate workshop logistics:

- Aubrey Bray, Program Representative, University of California Statewide, Master Gardener Program, UC Davis
- Sally Mohr, Event Coordinator, CA Center for Urban Horticulture, UC Davis

Design

Stephanie Chu, Senior Designer, Reprographics

Will Suckow, Senior Artist, ANR Communication Services

TABLE OF CONTENTS

Please complete the following table with Master Gardeners from your county to help you prepare for teaching edible landscaping.

Topic	Audience and Type of Training[1]	Important Content to Teach[2]	Teaching Strategy[3]
Introduction to Edible Landscaping			
Design & Planning			
Planting – Crop Rotation			
Planting – Companion Planting			
Maintenance – Water			
Maintenance – Soil & Mulch			
Maintenance – IPM			
Maintenance – Fertilizers			
Fruit Trees			
Berries			
Vegetables			
Policy			
Harvest & Storage			
Food Safety			

[1] Describe the audience you anticipate with regard to number of attendees, experience of attendees, age, etc. Describe the type of training. Will you hold a one hour training? A series of trainings? A one day training?

[2] Please pull out the content that you think is important for your audience and type of training.

[3] Describe how you will teach. Will you use PowerPoint? Will you do hands-on activities? A combination? How will you address different learning styles?

SECTION 1

INTRODUCTION

Overview

Edible landscaping is an exciting and vibrant way to combine both function and aesthetics within a landscape. It incorporates the use of food plants as design features, elevating the status of carrots from simply food products to lacy leafy rosettes that have presence and value in a designed landscape. Beyond leaf shape and color, edibles can also contribute to affecting space, enhancing function, and creating memorable places. In a conventional landscape, these design features are typically relegated to traditional ornamental plants, however, integrating edible plants can increase the benefits of many conventionally designed landscapes.

Edible landscapes encompass a variety of landscape garden types and sizes but do not include food items produced for sale. Examples of edible landscapes can include, but are not limited to: edible schoolyards and corporate campuses, community gardens, rooftop gardens, public parks, private residential landscapes, parking lots, streetscapes, and more.

Terms commonly associated with edible landscaping include urban agriculture, urban farming, foodscaping, permaculture, organic gardening, and homesteading. While some of the terms define landscapes and gardens that produce food, they may or may not share similarities to edible landscapes. Important distinctions should be made between these labels.

Urban agriculture is a broader term that includes edible landscapes as just one of its many types; it describes food growing, animal husbandry, and related activities on private or public landscapes in urban, peri-urban, or suburban locations for personal consumption, educational or demonstration purposes, or for commercial sale. Urban farming, market farming, kitchen gardens, and demonstration farms are just a few other subsets of urban agriculture, each describing different locations and functions of edible plant-growing outside of conventional rural, agricultural settings. Permaculture, organic gardening, and bio-dynamic farming refer to specific practices associated with gardening ornamental or edible plants, and homesteading describes a set of related activities for producing and preparing food and other consumables utilizing materials from one's own land. This particular training focuses specifically on edible landscapes, which does not include food grown for commercial sale, and may integrate edible food growing with other traditional landscape functions.

Introduction Learning Objectives:

- Know that edible landscaping is the use of food plants as design features in a landscape. These plants are used for both aesthetic value as well as consumption.
- Realize that edible landscaping is not a new concept, as evidenced by precedents from around the world.

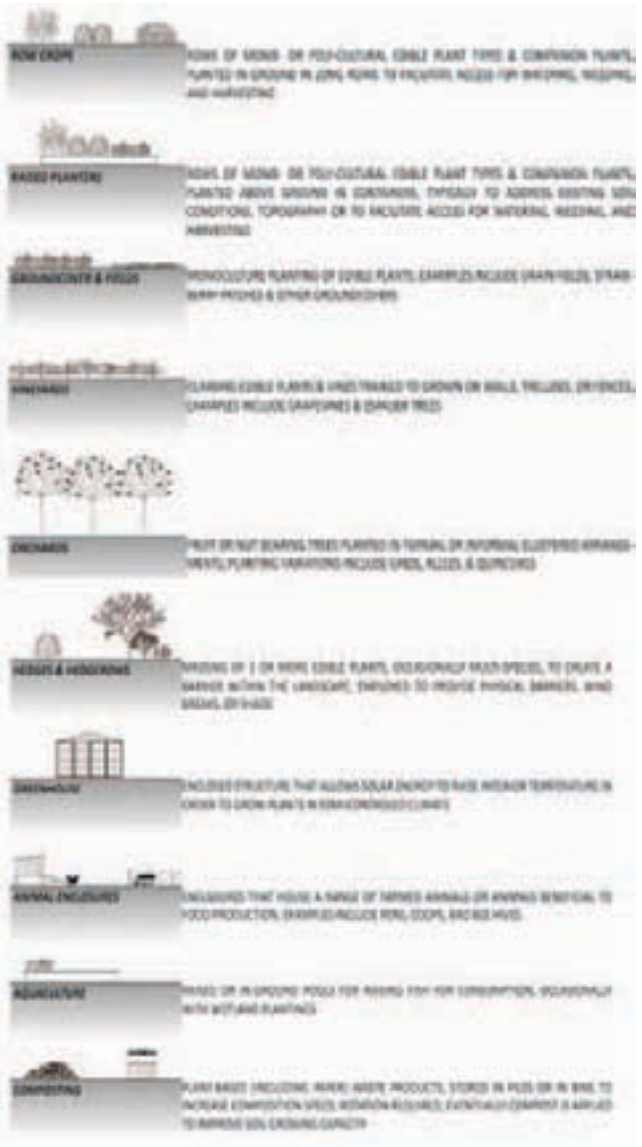

Table 1.1 Edible Landscaping Related Terms. Source: Claire Napawan

Edible Landscape vs. Traditional Landscape

A traditional landscape might utilize both hardscape (stone paving, concrete, gravel, etc.) and softscape (planting material) to define spaces for different functions. For example, a landscape that utilizes asphalt paving and large canopy trees for shade might be described as a traditional parking lot. Alternatively, a landscape that includes a privately owned home surrounded by shrubs, ornamental trees, and mown lawn might be described as a traditional residential landscape. Edible landscapes seek to retain (or enhance) the existing function of a landscape, be it commercial, residential, private, or public, while integrating edible plants into the design and maintenance. In the case of a residential landscape, canopy shade trees might be designed to include fruit or nut trees and a lawn might be replaced with ornamental herbs to achieve similar design intents. Incorporating edibles transforms traditional landscapes into edible landscapes.

Top Traditional Landscape. Credit: Carmia Feldman
bottom Edible Landscape. Credit: Rosalind Creasy

Pros and Cons

The creation and maintenance of an edible landscape is an undertaking that must be matched to an individual's gardening preferences. Benefits of edible landscaping include food security, reduced reliance on fossil fuel supported calories, decreased food miles, increased variety of foods, an improved lifestyle and healthy food choices. In general, edible landscaping promotes sustainable gardening practices such as mulching and utilizing green waste on site, saving energy, maximizing water use efficiency, improved plant diversity, support for pollinating insects, and a decreased reliance on chemical applications of herbicides and insecticides.

Considerations before embarking on edible landscaping projects include increased maintenance requirements, increased water needs (over a low-water Mediterranean landscape plant palate), a greater need for garden planning and seasonal planting plans, and overall compatibility with the existing or intended landscape use. Edible landscapes and the food produced in them may also be subject to different regulations. This topic is discussed in Section 6: *Public and Private Policies*.

The challenge in creating an edible landscape planting plan lies in choosing plants that adapt best to the given site while achieving the desired function of the landscape. Addressing site considerations, landscape function and users, as well as aesthetic value of edible plants is addressed in Section 2: *Planning and Design*. Other important considerations include installation and maintenance practices associated with edible plants; this is covered in Section 3: *Planting and Maintenance*.

History of Edible Landscaping

Edible landscaping is not a new concept. Food-growing integrated with existing landscapes was most notably employed during the Victory Gardening movements of both World Wars, and community gardens have come in and out of popularity in US cities throughout the last 60 years. But even before that, there are examples of the lasting effect that food-growing or productive landscapes have had on predominant landscape styles employed in the United States.

Within the United States and Western Europe, three of the most influential landscape design styles include: the Italian Renaissance, French Baroque and English Picturesque. These landscapes, as we might think of them today, appear to be predominantly ornamental landscapes, but in reality their design forms can all be traced backed to an origin related to food-production. For example, the French Baroque parterre (a formal means of planting ornamental annuals or perennials within a pattern encircled by clipped hedges) evolved directly from the predominant planting patterns utilized in French kitchen gardens. These kitchen gardens were an early historic form of companion planting, organized and encircled by a clipped hedge, and only through time did they evolve to incorporate solely ornamental plants. Other ornamental planting forms, such as pollarding and espalier, are a result of early agricultural maintenance practices from Italian kitchen gardening, and evolved into ornamental practices such as topiary in Italian Renaissance gardens. In the past, the practice of pollarding of trees provided dense firewood and espaliered fruit trees provided increased fruit production and ease of harvesting.

The English Picturesque draws its origin from landscape patterns associated with livestock grazing. The closely cropped lawn and high-limbed canopy trees of this landscape form were the result of grazing from cows, sheep, horses, and goats on estate land. This landscape form has had a lasting influence on American urban park design. The most iconic American public park form, as typified by New York City's Central Park, shares its roots in the English Picturesque and pastoral landscapes. While human maintenance now must tend to the mowing and pruning, originally these parks were maintained by livestock. In fact, the Boston Commons, one of our country's oldest public parks, was originally a commonly-owned grazing land for city-dwellers who owned livestock.

The strongest example of integration of food-growing for both aesthetic and production purposes includes the style of ferme ornee, or the ornamental farm, which originated in the 18th century and was popularly used throughout

Top Boston Commons. *Credit: Claire Napawan*
bottom Parterre at Kew Botanical Gardens, London. *Credit: Claire Napawanasy*

Michelle Obama at the White House Garden. *Credit: AP Images*

England and France. Stephen Switzer, the estate gardener who coined the term described it as such: "By mixing the useful and profitable parts of Gard'ning with the Pleasurable… My Designs are thereby vastly enlarg'd and both Profit and Pleasure may be agreeably mix'd together." Switzer's description of the integrated garden for both pleasure and production serves as a lasting reminder for some of the many benefits of edible landscaping.

Growing Food Movement

It is undeniable that the United States is experiencing a growing food movement. From the highest levels of our government, icons like Michelle Obama have become advocates for gardening, healthy eating and exposing our youth to agriculture. Michael Pollan (researcher/writer) and Alice Waters (chef/writer) are just two of the many promoters for increased awareness of food and its relationship to sustainability. Unsung heroes include landscape architects, community leaders, public schools, and homeowners who are taking initiative in promoting edible landscapes. Although this topic seems to have recently appeared, edible landscaping pioneer Rosalind Creasy began promoting the topic and writing some of the first texts in 1970. She continues to be a strong presence in the food movement as well.

The concept of returning to an understanding of global food production systems couldn't come at a better time. In the United States, less than 2% of the population is farming and many would argue that an even smaller percentage of our nation's youth could accurately describe how the components of their pizza are grown and processed.

According to the Food and Agriculture Organization of the United Nations, there are growing concerns about the high market volatility of agricultural commodities. There is competition for the uses of ag-based products such as corn for biofuel production. When there are crop failures due to drought, competition for resources leads to marked instability with very high prices and limited availability. When the world entered into a global economic recession in 2007, food prices soared and the number of hungry and undernourished increased from their already unacceptable levels. Introducing edibles into home landscapes contributes to decentralizing the current food system and increasing our personal and community food security.

In response to these concerns, and volleyed by the mounting evidence of urban food growing achieving multiple economic, social, and environmental benefits,

many cities across the nation are adopting programs, policies, and initiatives to support the growth of urban agricultural projects like edible landscapes. This includes the promotion of food growing on public land in cities like San Francisco, Portland, New York City, and Vancouver, to name a few. It also includes policy changes in cities such as San Francisco and Oakland which promote small-scale food growing on privately owned land.

As edible landscapes emerge in urban settings, the mysterious veil covering the production of fruits and vegetables is being lifted. Individuals otherwise not exposed to growing food are getting glimpses of corn, eggs and tomatoes outside of their sterile packaging at the grocery store. In addition, communities are taking greater strides towards food security and resilience, more sustainable planting and eating practices, and a greater sense of community through their involvement in food growing. The hope of this publication is to increase the popularity of edible landscaping and the ease of which it can be done. These materials were compiled from science-based research and information in an effort to assist practitioners in making healthy, safe choices in their landscapes.

EXERCISES

1. *Catalogue where you see edibles in landscapes. What function are they serving? How do they contribute to the aesthetics and functionality of the landscape?*

2. *Take an inventory from participants about why they are interested in learning about edibles. Refer back to this list at the end of the workshop to make sure you have answered all of their potential questions.*

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SECTION 2

PLANNING & DESIGN

Table 2.1 Private vs. Public Edible Landscapes. *Source: Claire Napawan*

Overview

When designing an edible landscape, one must take into account both the aesthetic and productive potential of a space. An effective edible landscape balances site, use, and edible plants; it serves the purpose of being a beautiful, functional space as well as a "fruitful" one. These landscapes can take place in many settings, from public to private and rooftop to blacktop.

Since there are multiple approaches to the design and development of every landscape, it's important to evaluate the advantages and disadvantages of each approach and ultimately invest in one that suits the space and its user(s). Before determining how best to incorporate edibles into a landscape, one must complete a site assessment and a client/user assessment.

Planning & Design learning objectives:

- Understand that planning and design of any landscape is a process of synthesis that requires a thorough analysis of the intended use, client/user(s), and program/functional use of the site.
- Know that aesthetics should be an important functional consideration of an edible landscape.

Site Assessment

Site assessment is one of the most critical steps in designing for any landscape, edible or not. It includes the collection and analysis of detailed data about the physical characteristics of a landscape, and can consist of intangible as well as tangible characteristics. Collecting information regarding a site's location, growing area, availability of critical resources, microclimate, and more are all a part of the site assessment.

Typically, site assessment is carried out in a sequence of scales, looking first at the regional conditions of a site and then moving down to consideration of specific microclimatic conditions. At the regional scale, physical conditions that should be considered include, but are not limited to: planting zone, growing season, and average rainfalls. At the site scale, access, sun-shade patterns, soil type, resource availability, and site adjacencies are important considerations.

Depending on the size of the landscape under assessment, more detailed analysis of microclimates within the site might be necessary as well. A microclimate is an atmospheric zone that has different climatic characteristics than the surrounding area; this can impact plant

productivity. Microclimates that exist in a home landscape are often associated with moderate to dense shade under tree canopies or proximity to the north and east faces of buildings as well as intense sun and heat on plantings adjacent to south-facing walls. The area and intensity of a microclimate's effect may change with the seasons.

Some landscape designers also find it helpful to conduct an assessment of the intangible conditions of a site. This might include addressing cultural practices of site users, the natural or cultural history of a landscape, or the ephemeral qualities or mood of a site. The more thorough the site assessment, the more likely one is to produce a successful edible landscape and also prevent costly replacement and labor expenses.

The final assessment would be to understand the time availability issues for the caretakers of the landscape. How much time can be devoted to the production of food? It takes a significant amount of time to grow, manage and process the produce/fruit grown in a garden. If the time is not devoted to proper and timely harvest or timely pest control, the productivity of the garden is severely handicapped.

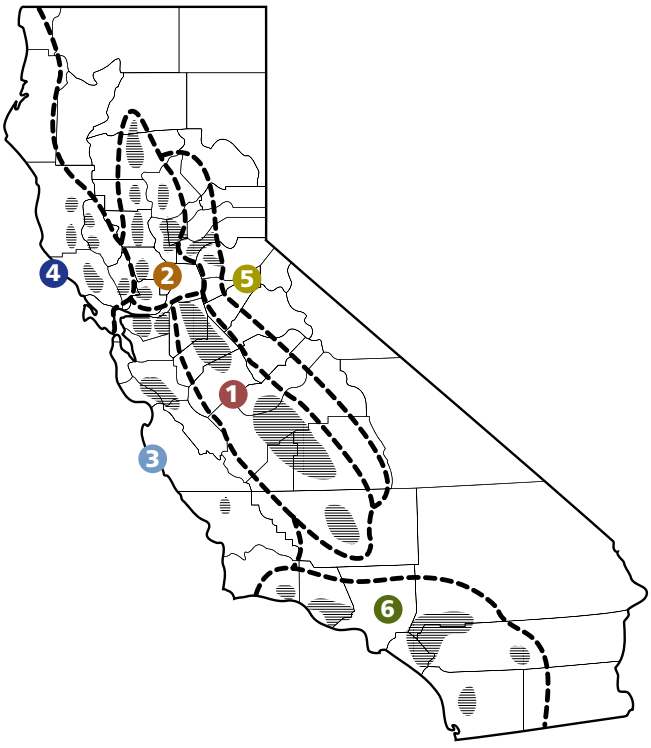

Figure 2.1 Regions for growing temperate-zone fruits and vegetables in California. *Source: Adapted from Vossen 2002.*

Growing Areas (Adapted from *The Home Orchard*, Climate and Soils pgs. 1-2)

For the purposes of this workbook, California has been divided into six regional growing areas (**Figure 2.1**). These zones are approximations: each contains microclimates in which the climate can vary considerably from other areas in the zone. To get an idea of local microclimate, consult a University of California (UC) Master Gardener, local UC Cooperative Extension farm/horticulture advisor, or a certified nursery professional. Publications and online resources such as the *Sunset Western Garden Book* (Brenzel 2012) and the USDA Climate Zones also contain useful climate maps. Distinct microclimates can also be found within an individual landscape; for example, along the southern side of a house or in the shade of a building or trees.

What follows is a general description of the growing zones shown in **Figure 2.1** and the types of produce that are grown successfully in each. For specifics on vegetable crops see the vegetable growing chart in **Table 3.5**, How to Plant and Store Vegetables.

Regions 1 and 2: *San Joaquin and Sacramento Valleys*

The San Joaquin Valley consists of the southern portion of the Central Valley, south of Sacramento. Its cities include Bakersfield, Fresno, Merced, Modesto, and Stockton. The Sacramento Valley consists of the northern portion of the Central Valley along the Sacramento River. Its cities include Sacramento, Yuba City, Marysville, and Redding. Certain basic seasonal weather conditions apply throughout the Central Valley: the summer is hot and dry and the winter is cool and damp. Very little rain falls from May through September and dense fog can form in December and January. Strong, dry winds are common in spring and fall. Virtually all cool and warm season vegetables, deciduous fruits and nuts grow well in the Central Valley.

Region 3: *Central Coast*

The Central Coast region extends from the Golden Gate Bridge south to Point Conception and reaches inland to include the southern portion of the Coast Range. Its cities include San Francisco, Oakland, San Jose, Concord, Santa Cruz, Monterey, San Luis Obispo, and Santa Maria. Right on the coast, the summer is cool and foggy and the winter is mild and damp. Strong sea breezes are common; frost, though rare, can occur. In the interior portions of the region, the summer is warmer and less foggy and the winter is cooler than on the coast, but the summer and winter extremes are generally less severe than in the neighboring San Joaquin Valley. Exceptions might be the King City,

Paso Robles, and Cuyama areas, where in some years the temperature extremes may exceed those of the San Joaquin Valley. Like Regions 1 and 2, almost any vegetable can be grown successfully here. Deciduous fruits and nuts that grow well, particularly in the interior areas, include almond, apple, apricot, cherry, fig, nectarine, peach, pear, plum, pomegranate, prune, and walnut.

Region 4: *North Coast*

The North Coast region extends from the Golden Gate Bridge to the Oregon border and reaches inland to encompass the northern portion of the Coast Range. Its cities include Novato, Santa Rosa, Ukiah, Mendocino, and Eureka. The northern end of this zone is the wettest part of California. Both summer and winter are cooler than on the Central Coast, and the area also receives more rainfall. Strong sea breezes are common on the coast, and frost can occur. The inland, higher-elevation areas of the zone are similar to those of Region 5, but wetter. Home gardens in this area can support almost any vegetable. Deciduous fruits and nuts that grow well in the warmer areas include apple, apricot, cherry, pear, plum, prune, and walnut.

Region 5: *Sierra Nevada Foothills*

The Sierra Nevada Foothills region corresponds roughly to what is known as the Gold Country, the lower elevations of the western slope of the Sierra. Its cities include Sonora, Jackson, Placerville, Camino, Auburn, and Grass Valley. The summer is warm with occasional rain, and the winter is cold and wet. Frost is common in winter and spring, especially at the higher elevations. Deciduous fruits and nuts that grow well here include apple, cherry, olive, peach, pear, persimmon, pistachio, plum, prune, quince, and walnuts. Growing vegetables in this region is fair game but gardeners need to be cautious of frost.

Region 6: *Southern California*

Southern California includes the coastal and inland areas from Point Conception south to the Mexican border. Its cities include Santa Barbara, Los Angeles, Riverside, San Bernardino, and San Diego. On the coast, summer is mild with some fog, and winter is mild with some rain. Strong, dry southwest winds known as Santa Anas are common in spring and fall; frost can occur, especially in the desert and higher elevations. The climate in this region's higher-elevation areas is similar to that of the Sierra Nevada Foothills. The climate in the inland desert areas is similar to that of the southern San Joaquin Valley, but with a hotter, drier summer and a warmer winter. Deciduous fruits and nuts that grow well in this zone include apple, fig, nectarine, peach, persimmon, plum, and walnut. In general, most vegetables can be grown in Southern California. The exception may be the inland dessert areas where heat prevents some vegetables like rhubarb, leeks, lima beans and celery from thriving.

Maintenance Regime

It is important to realize that maintenance requirements (time, money, etc.) often increase when edibles are added to a conventional ornamental landscape. Adding edibles increases the complexity of irrigation scheduling and can alter microclimates considerably, requiring more time and maintenance. Additional practices that may require a greater time investment include pruning, pest prevention and pest management. For an undeveloped site, a maintenance assessment is a necessary tool to ensure that available resources are adequate to maintain the project. Once a gardener is aware of the required maintenance level of the site under various scenarios, he/she can identify the best mix of edibles and ornamental plantings from season to season and from year to year. In some cases, smaller changes made over several seasons or years are more realistic than a complete overhaul at one time.

Resource availability

Identify the availability of existing resources including soil, water, soil energy, compost, labor, and equipment prior to investing in the development of a new landscape. The old adage of 'measure twice, cut once' is an important concept in the landscape as well. Before endeavoring to create an edible landscape, a gardener must know that the soil is safe, water is safe and there is space for necessary composting and equipment storage. The Home Garden and Landscape Site Assessment Checklist in **Table 2.2** is an easy tool for compiling important information.

Client/User Assessment

Completing a client or user assessment of a landscape is an important facet to understanding the role a landscape plays (or will play) in a person's life. It is of value to know how many people use a landscape site and what activities take place in it. When it comes to incorporating edibles, it is critical to understand the landscape user's special needs or restrictions, their personal design preference, the incorporation of animals or pets into the site and the level of maintenance desired. Balancing edible plants with existing landscape function is what distinguishes an edible landscape from the typical singularly-driven productive kitchen garden.

Home Garden and Landscape Site Assessment Checklist

Date of review_____ Site location_____

Size of site_____ Site orientation_____

Limitations to space: ☐ utilities marked and noted on sketch

☐ overhead wires (height:_____)

Sunlight levels: ☐ full sun (6 hrs +) ☐ partial sun/filtered light ☐ shade

Sunset Zone:

Microclimatic description:

Wind: ☐ overall windy site ☐ windy in isolated sections ☐ relatively calm

Soil Factors

Compaction: ☐ severely compacted ☐ moderately compacted

☐ somewhat compacted ☐ not compacted

Drainage: ☐ wet ☐ well-drained ☐ low lying spots

Drainage test results (in/hr): ☐ poorly drained (less than 4" per hour)

☐ moderately drained (4-8" per hour)

☐ excessively drained (more than 8" per hour)

Texture: ☐ clay ☐ loam sand

Range of pH levels:

Irrigation system description:

Observations: ☐ recent construction ☐ excessive salt ☐ topsoil removed

☐ slopes to consider ☐ erosion ☐ soil contamination

Existing plants: total number of trees_____

total number of shrubs_____

☐ presence of noxious weeds

Table 2.2 Home Garden and Landscape Site Assessment Checklist. *Source: Site Assessment for Gardeners, © Cornell University 2007.*

It is also important to assess a clients' or users' ability to spend the time and/or money required to maintain an edible landscape, being careful to match the design of an edible landscape with the interest and 'know-how' of the clients or users.

Programmatic Use

The program of a landscape refers to the functional purpose of the landscape, and in many cases that functional purpose might incorporate more than one use. For example, a parking lot serves the programmatic function of providing vehicular parking, but might also be balanced with other uses, such as pedestrian walkways, storm-water management, or edible plantings. An edible landscape, by its definition, is a landscape with two or more programmatic uses, one of which includes the growing of edible plants. Balancing the programmatic use of an existing or proposed landscape with an edible landscape is critical to an edible landscape's success. Therefore, before making any modifications to a landscape, one must clearly identify the current and intended use of the space. The questions to ask is, will the addition of edibles interfere with the way people interact with the environment or will it enhance it? For example, the introduction of edible plants in a schoolyard setting that seeks to integrate food growing with curriculum would be a logical symbiosis of programs. However, a schoolyard that requires predominantly open recreational sports fields would have fewer opportunities for integrating edible planting program.

Aside from the existing or proposed programmatic uses of site, consider necessary landscape plants, elements, and maintenance associated with a site's program, and whether their presence will interfere with edible plantings. For example, the need for shade trees in a parking lot or frequent mowing in a recreational field might interfere with the ability of a landscape to support edible plants. Other considerations include: excess shade and root invasion from ornamental trees, presence of toxic or hazardous materials in the soil or from pesticide sprays, excessive traffic, or concerns about litter, pets, pests or pilfering.

Landscape User

While the client of a landscape design project might fully embrace the integration of edible plants into their landscape, the actual users of the site might not be well represented by the client. For example, public streetscapes, while owned and maintained by the city are utilized by the general public. For that reason, users of the site in consideration should be considered if they differ from the client.

Educational Role

When working with existing site users and land-owners, educating clients regarding the significance of an edible landscape might be necessary. Discussing the associated benefits of edible landscapes including multiple health, economic, environmental, and social benefits might help bring greater awareness to clients. Design of edible landscapes can also help bring greater awareness to site users, and occasionally influence changes in habit, including healthier eating, improved waste recycling, and sustainable water use. Current industrial food production in the United States utilizes nearly 10 calories of fossil fuels for every 1 calorie of food produced, as such; encouragement of local and sustainable food production and consumption practices is an important benefit of any edible landscapes.

Scales of Design Intervention

Limited Design Interventions

Based on site and client/user assessments, some sites have limited opportunities for edible plant integration. Reasons for this may include:

- Small-scale sites, poor soils, or paved surfaces. In this case, consider container plantings.
- Limited maintenance or user interest. In this case, consider replacement of 1-2 existing landscape plants with an edible alternative that has similar plant form; i.e.: replacing existing groundcovers with strawberries, or utilizing fruit or nut trees as ornamental trees.

Moderate Design Intervention

Much like sites with limited design interventions, there are many reasons for the number of edibles that can be incorporated into a landscape. Sites with a moderate level of opportunities for edible plant integration may include:

- Landscapes with microclimates that serve as 'zones' that are appropriate for introduction of edibles .
- Sites with opportunities for replacement of existing landscape zones with symbiotic edible plants; i.e.: an existing woodland landscape character that can integrate fruit & nut bearing canopy trees and edible groundcover; or areas for raised planter beds integrated with existing landscape use.
- Edible product output is commensurate with maintenance availability and user interest.

Good Life Garden,
UC Davis.
Credit: Claire Napawan

Intensive Design Intervention

Sites with the greatest opportunity for edible plant integration can support intensive design intervention.

- Consider opportunities to maximize productivity of edibles integrated into existing landscape.
- Consider opportunities to reorganize the landscape and plan to meet resource efficiencies.
- Confirm that edible product output is commensurate with maintenance availability and user interest.

Developing a Planting Plan

The completed site assessment will be the foundation used to narrow down a list of appropriate edible plants for a landscape. The growing region will identify an initial palate of plants with which to work from. From there, this list can be altered based on findings from both the site assessment and the client/user assessment.

Edible plants can also serve important design and aesthetic functions in a landscape. See **Table 2.3**, Edible Plants for Aesthetics and Productivity, in the back of the workbook for edible substitutes of common landscape plants, the design features of those edibles and recommended varieties. You'll also find USDA and Sunset zones as well as water needs listed for each crop.

EXERCISES:

1. *Have participants perform an assessment with each other.*
2. *Have participants draw images of high, medium, and low maintenance/output edible landscapes and then work in groups to design a list of questions that would help guide planting and maintaining each type of landscape.*

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SECTION 3

PLANTING & MAINTENANCE

Overview

Planting and maintaining edible landscapes presents gardeners with several challenges and opportunities compared to traditional landscapes, vegetable gardens, and home orchards. Edible landscapes are plant systems that integrate food production, aesthetic value, and environmental modification functions. Knowledge of crop production and landscape maintenance needs to be understood and applied to these integrated, multi-functional productive systems.

A benefit of edible landscapes is that they provide opportunities for more diverse and complex plantings than do individual vegetable, fruit, or ornamental gardens. This eliminates crop monocultures more prone to pest outbreaks and can increase habitats for desirable organisms such as beneficial insects. Beneficial insects are a gardener's true ally, whether they are pollinating flowers for produce or predating on harmful insects impacting ornamental and edible plants. Edible landscapes also offer the possibility of having an attractive landscape while producing food.

A challenge for edible landscapers is to select food-producing plants that also possess ornamental value. Detailed attention to seasonal and annual production schedules and how they interface with ornamental plantings is also necessary. Soil management practices for edibles can be very different than those for landscape ornamentals. Furthermore, pollination requirements are critical for some food crops, such as sweet corn, apples, and certain other tree fruits. Meeting these requirements can be challenging. For example, sweet corn needs to be planted in a block, while some tree fruit varieties, such as Gravenstein apple, require more than one variety to assure pollination.

Fava beans have attracted a healthy population of lady beetles. *Credit: Kathy Keatley Garvey.*

In essence, an edible landscape offers the opportunity to enjoy home-grown produce while simultaneously providing an attractive, functional landscape. The challenge is to apply crop management knowledge to maximize production in what are often less than ideal crop production conditions.

Planting & Maintenance learning objectives:

- Understand what special considerations are needed for the horticultural practices required in planting and maintaining edible crops in landscapes.

Planting

Learning objectives, Planting

- Know about companion planting and why edible landscapes can be a diverse habitat.
- Understand the seasonal nature of edible plants and how planting frequency is affected.

Sun and Shade Effects

Crop plants generally perform and yield best with at least six to eight hours of full sun per day. This can be a challenge in many sites. Gardeners should avoid planting food crops where current or future shade from other landscape plants or structures will prevent optimal growth and productivity. Gardeners should also plan for changes in shade patterns within the landscape as the sun angle changes seasonally. If a landscape does not have an area in full sun, leafy vegetables that enjoy shade such as spinach and lettuce may be appropriate. Landscapes in hot interior valleys and desert climates can be challenged by the sun and often benefit from cool-season crops such as peas planted in partial shade.

Crop Rotation

Crop rotation is the practice of growing different types of crops in the same area in sequential seasons. Since many

Table 3.1 Vegetable Families.

Vegetable Families	
Beet Family	beet, Swiss chard, spinach
Carrot Family	carrot, celery, celeriac, parsley
Cole Crop Family	cabbage, cauliflower, broccoli, Brussels sprouts, bok choy, collards, kale, kohlrabi, mustard, radish, rutabaga, turnip
Cucurbit Family	cucumber, watermelon, cantaloupe, pumpkin, squash, gourds
Legume Family	bean, pea, cowpea, peanut
Lettuce Family	lettuce, chicory, endive
Onion Family	onion, shallot, leek, chive, garlic
Tomato Family	tomato, potato, pepper, eggplant
Green Manure Crop Family	hybrid sudangrass, buckwheat, soybean, cowpea, mung bean, garden pea, fava bean, ryegrass, rye grain, barley, oats, vetch, Austrian winter pea

pests and diseases have a very narrow host range, gardeners can use crop rotation as a pest management tool to prevent the buildup of a variety of pests and diseases. By not planting members of the same plant family (see **Table 3.1** above) in the same location during consecutive seasons, many pest and disease issues are avoided. For example, do not follow melons with cucumbers or squash. Waiting two years to plant the same family of vegetable in the same location is the most effective rotation practice; however, yearly rotations can also be beneficial. Rotating annual flower plantings is also a good practice.

Intercropping or 'Companion Planting'

The concept behind companion planting is that some plants can benefit other plants when grown in near proximity. In many cases the benefit is cultural, where you have modified the immediate environment so that a plant can flourish. The benefits to be gained include improved pest control, lower disease pressure, improved yields and better quality. There is no significant data to prove the value of companion planting or intercropping, but it is thought that certain plants may produce substances which confuse insects, altering their impact as a pest. In addition, some evidence also shows that planting flowers among vegetables attracts beneficial insects seeking the flowers' nectar and those insects can either lay their eggs in the larva of certain pest or prey on plant pests. Integrated Pest Management is discussed further under *Maintenance*. While little data from scientific studies exist to prove the value of companion planting, there tends to be an overall agreement today on the validity of several mechanisms that create beneficial plant associations:

- *Trap cropping.* Sometimes, a neighboring crop may be selected because it is more attractive to pests and serves to distract them from the main crop.
- *Symbiotic nitrogen fixation.* Legumes such as peas, beans, and clover—have the ability to fix atmospheric nitrogen for their own use and for the benefit of neighboring plants via symbiotic relationship with Rhizobium bacteria. Forage legumes, for example, are commonly seeded with grasses to reduce the need for nitrogen fertilizer. Likewise, beans are sometimes inter-planted with corn.
- *Biochemical pest suppression.* Some plants exude chemicals from roots or aerial parts that suppress or repel pests and protect neighboring plants. Marigolds are a popular cover crop for suppressing nematodes; however, only certain varieties of the French dwarf (*Tagetes patula*), the African (*T. erecta*) and South American (*T. minuta*) marigolds reduce numbers of root lesion and root-knot nematodes
- *Physical spatial interactions.* For example, tall-growing, sun-loving plants may share space with lower-growing, shade-tolerant species, resulting in higher total yields from the land. Spatial interaction can also yield pest control benefits. The diverse canopy resulting when corn is companion-planted with squash or pumpkins is believed to disorient the adult squash vine borer and protect the vining crop from this damaging pest. In turn, the presence of the prickly vines is said to discourage raccoons from ravaging the sweet corn.

Table 3.2 Companion Planting Chart for Home & Market Gardening.

Source: ATTRA (Appropriate Technology Transfer for Rural Areas) Companion Planting: Basic Concepts & Resources.

Companion Planting Chart for Home & Market Gardening		
Crop	**Compatible Companions**	**Incompatible**
Asparagus	tomato, parsley, basil	
Beans	most vegetables & herbs	onion, garlic, gladiolus
Beans, Bush	Irish potato, cucumber, corn, strawberry, celery, summer savory	onion family
Beans, Pole	corn, summer savory, radish	onion, beets, kohlrabi, sunflower
Beets	cabbage & onion families, lettuce	pole beans
Cabbage Family	aromatic herbs, celery, beets, onion family, chamomile, spinach, chard	dill, strawberry, pole beans, tomato
Carrots	English pea, lettuce, rosemary, onion family, sage, tomato	dill
Celery	onion & cabbage families, tomato, bush beans, nasturtium	
Corn	Irish potato, beans, English pea, pumpkin, cucumber, squash	tomato
Cucumber	beans, corn, English pea, sunflowers, radish	Irish potato, aromatic herbs
Eggplant	beans, marigold	
Lettuce	carrot, radish, strawberry, cucumber	
Onion Family	beets, carrot, lettuce, cabbage family, summer savory	beans, English pea
Parsley	tomato, asparagus	
Pea, English	carrots, radish, turnip, cucumber, corn, beans	onion family, gladiolus, Irish potato
Potato, Irish	beans, corn, cabbage family, marigolds, horseradish	pumpkin, squash, tomato, cucumber, sunflower
Pumpkins	corn, marigold	Irish potato
Radish	English pea, nasturtium, lettuce, cucumber	hyssop
Spinach	strawberry, fava bean	
Squash	nasturtium, corn, marigold	Irish potato
Tomato	basil, onion family, nasturtium, marigold, asparagus, carrot, parsley, cucumber	corn, Irish potato, fennel, cabbage family
Turnip	English pea	Irish potato

- *Beneficial habitats.* Beneficial habitats— sometimes called refugia—are another type of companion plant interaction that has drawn considerable attention in recent years. The benefit is derived when companion plants provide a desirable environment for beneficial insects and other arthropods—especially those predatory and parasitic species which help to keep pest populations in check. Predators include ladybird beetles, lacewings, hover flies, mantids, robber flies, and non-insects such as spiders and predatory mites. Parasites include a wide range of fly and wasp species including tachinid flies, and Trichogramma and Ichneumonid wasps.

- *Security through diversity.* A more general mixing of various crops and varieties provides a degree of security to the grower. If pests or adverse conditions reduce or destroy a single crop or cultivar, others remain to produce some level of yield.

The companion planting partners listed in **Table 3.2** are thought to have compatible growth habits. They share space well, and in many instances are believed to be allies by enhancing each other's growth and by warding off insects. "Antagonist" plants in the last column are believed to inhibit growth of the target plants.

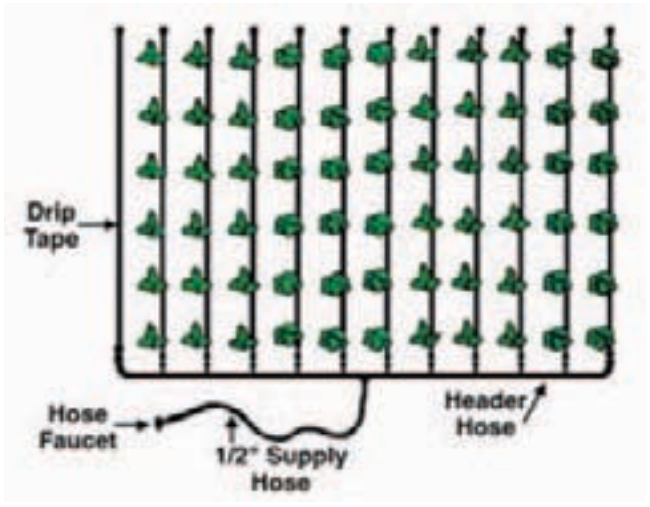

Figure 3.1 Typical drip system layout.
Source: Texas A&M Cooperative Extension

Maintenance

Learning objectives, Maintenance

- Understand what MAWA is and how adding edibles to a landscape helps homeowners stay within the new statewide water budget.
- Present challenges of inter-planting edible crops into existing landscape areas.
- Be able to list the advantages and disadvantages of chemical vs. organic fertilizers
- Know how to use key tests to ensure that compost is thoroughly decomposed before application.
- Understand how Integrated Pest Management (IPM) can be used in an edible landscape.

Irrigation

Traditional vegetable gardens are laid out in rows. The linear nature of traditional gardens makes them easy to irrigate effectively due to their straight lines and uniformity.

Edible landscapes are artistic creations that may not share a linear nature with traditional row crops and are more challenging to irrigate due to their wide variety of plant species and forms, high planting density, and potential for drastic changes in microclimates (e.g., shade, lack of air circulation) as plants are harvested and/or mature.

Water Management

Factors that influence water use in a landscape include plant species, planting density, microclimate, and a gardener's expectations of plants' performance. Choosing plants that are adapted to the climate and the microclimate is crucial to the success of an edible landscape. The key is to select plants well adapted to the existing environment and to any planned changes. Plants grown for their production of edible fruits and vegetables should be well watered to assure meaningful yields of high quality crops. In general, edibles should not be viewed as water conserving plants because they may not meet performance expectations if water is limited.

To conserve water in an edible landscape, gardeners may consider hydrozoning, harvesting rainwater, re-using graywater, and using drip irrigation. As edible plants are added to the landscape, it is important to understand that their water needs may differ from traditional landscape plants.

Hydrozoning is an important practice to adopt; it saves water and improves plant growth and productivity. Hydrozoning involves placing plants with similar water needs together, making hand watering or watering with an automated system more efficient. Each hydrozone should be separately valved to enable separate irrigation schedules (i.e.: days of the week, length of time) matching the needs of each zone to be developed. For example, a lawn bordered on one side by water-efficient plants and the other side by a row of stone fruit trees would optimally have three separate schedules representative of the needs of each hydrozone. One would water the turfgrass at a level appropriate to that crop using the Lawn Watering Guide for California (publication # 8044: http://anrcatalog.ucdavis.edu), another would irrigate the water-efficient area which would require less water than the turfgrass, and a third valve would control water to the fruit trees. Each of these plantings requires a very different irrigation schedule. In addition, each hydrozone may employ different water application devices to maximize irrigation efficiency. For example, a fruit tree hydrozone might use drip irrigation while a lawn hydrozone would use a pop-up overhead spray system.

Rainwater harvesting for irrigation purposes is regaining popularity in California and other areas of the United States due to water shortages and heightened interests in recycling natural resources. Rainwater capturing involves collecting rainwater from a catchment surface such as rooftops, gutters and driveways. The water then travels through or down a conduit (typically a gutter or downspout) and to a purification site or filter. The filter unit may use charcoal, sand or other means to remove water impurities. Finally, the water enters a storage tank for future use.

It is important to ensure that collection vessels are covered to prevent mosquito breeding and entry by animals and children. Also, gardeners considering rain harvesting should contact their local water agency regarding local ordinances restricting or limiting collection and reuse of rainwater.

The use of **graywater** (also spelled greywater, gray water, and grey water) to irrigate non-edible landscape plants is becoming popular throughout California and other arid states. In California, graywater is defined as untreated wastewater that has not been contaminated by any toilet discharge, has not been affected by infectious, contaminated, or unhealthy bodily wastes, and does not present a threat from contamination by unhealthful processing, manufacturing, or operating wastes. Graywater includes, but is not limited to, wastewater from bathtubs, showers, bathroom washbasins, clothes washing machines, and laundry tubs, but does not include wastewater from kitchen sinks or dishwashers.

Graywater should not be applied directly to edible plant parts or root crops. To be safe, it should only be applied to non-edible ornamental plants. In a landscape using both graywater and potable water, it is also important to avoid splashing graywater on neighboring edible plants. When irrigating ornamental plants with graywater, salt and boron free liquid laundry detergents should be used; chlorine bleach should be avoided.

As of August 2009, a permit is no longer required for the installation of single or two family residential graywater irrigation systems in California if other conditions under section 1603A1.1 of the Department of Housing and Community Development (HCD) are met. The conditions include:

- A simple clothes washing graywater system may be installed as long as it does not require cutting of the original plumbing piping.
- A single fixture system that collects graywater for one plumbing fixture may be installed. All other systems require a construction permit prior to erection, retrofitting, construction and installation.

The full text of these standards can be viewed at http://www.hcd.ca.gov/codes/shl/Preface_ET_Emergency_Graywater.pdf. Because these regulations may change at any time, always check with the HCD and local enforcement agencies before developing plans for or installing a graywater system.

Drip irrigation (also referred to as micro, low-flow irrigation, or trickle irrigation) was originally developed for agricultural use in Israel and is now commonly found in residential as well as commercial landscapes throughout California. The advantage of drip irrigation is that water is applied directly into the root zone of plants, reducing water waste between

Outlet drip system used to retrofit sprinklers.
Credit: Micro & Drip Irrigation.

Outlet drip system used to retrofit sprinklers.
Credit: Micro & Drip Irrigation.

plants otherwise irrigated by a traditional sprinkler system. (Drip irrigation can also prevent weed seeds from germinating between plants since the soil remains dry.) It can also reduce the chance that water contaminated with food-borne diseases will contact edible plant parts.

Drip systems are not difficult to install but typically need regular maintenance. Many 'do it yourself' stores and irrigation supply companies offer free guidelines detailing their installation and upkeep. If you don't have the time or desire to install the system yourself, there are many reasonably-priced landscapers/irrigation specialists who provide this service.

When changing sprinkler systems into drip systems, 1/2" risers or existing sprinkler heads can be retrofitted to 1, 4, 6, or 12- outlet drip systems without creating flow problems down the line. The retrofitted system can be controlled automatically or manually. Retrofitting a current system is advantageous for irrigating hydrozones or container plants. This can be particularly important in an edible landscape where water needs of food producing plants may be different from established ornamentals and low-water herbs.

Soil amendments can aid in conserving soil moisture, thereby also reducing landscape water use. Adding composted greenwaste to your garden as a soil amendment is a great way to improve soil water holding capacity, drainage, structure, and population of soil microbes. Furthermore, it diverts organic products from overflowing landfills and recycles into a high-quality soil amendment. Compost should be mixed into soil to a depth of at least six inches, adding no more than 30% by volume to the finished amended soil. The only time the use of compost is not recommended is in planting holes for trees. The presence of compost in a tree planting hole will often lead that tree's roots to stay 'pot-bound' within the hole, enjoying the high quality of the compost to the detriment of the long term structure and survivability of the tree. When planting trees, compost is not added to the hole in an effort to encourage tree roots to penetrate the native soil and form a strong structure.

Mulch is another easy addition to the landscape that can assist in water conservation. Mulch is any product (wood chips, shredded bark, decorative rocks, landscape fabric) that is placed on top of soil rather than mixed into it. When using mulch, natural and biodegradable materials are recommended over the use of more permanent soil dressings such as rocks or fabric. Choosing medium textured organic mulch can decrease soil evaporation, control weeds, buffer soil temperatures, and provide aesthetic appeal to landscapes and gardens. Mulch can be applied around trees and shrubs but should be kept several inches away from trunks to prevent crown rot.

Soil Management *(Adapted from The Home Orchard, 2007)*

Managing soil to be optimum for annual crops that are planted among perennial ornamentals can be difficult. The soil must be able to support not only the growth and development of the plant but it must also contain the necessary nutrients for the plant to thrive and produce an abundance of food. Completing a simple soil test can give important information as to what plants can easily grow in the landscape without nutrient supplements. It can also identify macro- and micronutrients required for addition to the soil. When examining soil, four important components should be checked. They are: soil texture (sand, silt, clay), pH, organic matter and nutrient availability.

Soil Texture

The relative proportions of sand, silt, and clay in a soil determine the soil's texture. Soil scientists have defined twelve soil textures and have grouped them into three categories:

- coarse: sand and loamy sand
- medium: sandy loam, loam, silt loam, silt, clay loam, sandy clay loam, and silt clay loam

Table 3.3 Organic Mulches. *Source: Pests of Landscape Trees and Shrubs, 2004.*

Organic Mulches	
Material	**Comments**
bark chips	Attractive, slowly improves soil as it gradually decomposes. Medium- to coarse-textured products are long-lasting and resistant to wind movement, fine-textured are conducive to weed seeds germinating in them. Can be placed over plastics or landscape fabric as a decorative material, but these synthetic materials can be difficult to remove once they begin to deteriorate. Relatively expensive.
compost[1]	Excellent source of organic matter, readily available or can be made. Because of its smaller particle size, applying and maintaining a 2-inch layer can be very effective. May harbor weed seeds, especially if not properly composted. May promote crown disease if applied to contact trunk. Ties up significant amount of water from overhead irrigation or precipitation.
grass clippings and leaves	Readily available, can be applied often. May contain weed propagules, e.g., seeds or bermudagrass stems. Mats and reduces water penetration, especially if not dried first. Better if composted before use.
greenwaste	Un-composted yard and tree trimmings. A variable mixture including bark, grass, ground wood, and leaves. Relatively inexpensive.
hay and straw	Allows good water penetration. Looks good. Usually contains grain seed, which may germinate.
leaf mold	Can add needed acidity to alkaline soils and is attractive. Requires careful attention and substantial effort to prepare, or can be collected.
newspapers (shredded)	Readily available, inexpensive, no weed seeds. Can interfere with water penetration if not shredded. Not stable in windy conditions. Certain inks may be toxic, do not use around edible plants. Unattractive.
peat moss	Ties up significant amount of water from overhead irrigation or precipitation. Increases water-holding capacity if mixed into the soil. Adds acidity to alkaline soils. Contains few or no weeds. Blows away, especially if used alone. Resists wetting when dry. Expensive.
pine needles	Adds acidity, readily available. Slow to break down. Most suitable for plant species adapted to acidic soil.
pressed heavy fibrous paper for mulching (e.g., Hortopaper)	Good water and air penetration, easy application. Must be purchased. Tends to break or tear after transplanting or if walked on.
rice hulls	Increases soil aeration and drainage if incorporated, slow to degrade. May contain weed seeds unless composted or rolled to crush seeds.
sawdust	Will mat and inhibit water penetration. Blows away and decomposes rapidly. May contain allelochemicals; leach well with water before using around small or young landscape plants. Use only untreated wood. Inexpensive or free.
wood chips	Medium- to coarse-textured products are long-lasting and resistant to wind movement. Sometimes inexpensive. May contain weed seeds. May not stay in place on slopes.

1. Commonly composed of greenwaste properly composted for 30 days or more.

- fine: clay, sandy clay, and silt clay

Coarse-textured soils are often called *light* soils, and fine soils are often called *heavy* soils: these terms refer to how easy or difficult it is to work the soil. A practical way to identify soil texture, as well as moisture, is by the "feel test". Both the texture and the moisture level of the surface soil can be completely different from those of the soil a few feet deeper.

Loam, sandy loam, and silt loam are good all-around soils for gardening, and they are also good soils for growing fruit and nut trees. Fine-textured clay soils retain water and mineral nutrients well, but they do not allow water and air to move easily. This makes them prone to waterlogging, so irrigation must be carefully scheduled. Coarse-textured sandy soils drain well and warm quickly in spring, but they do not retain minerals or water well, and food-producing plants in such soils can be prone to water stress or nutrient deficiencies.

Soil Chemical Problems & pH

A soil can have any of a number of chemical problems, including high or low pH, total salt levels that are too high, or excess levels of toxic elements such as sodium, boron, and chloride. Soil analysis can be a useful tool for diagnosing these problems. Nutrient levels in the soil, however, are not a reliable indicator of the nutrient status of the trees and shrubs planted there. UC Cooperative Extension county offices do not offer soil analysis services, but gardeners can inquire with local UC Master Gardener programs, UC Cooperative Extension county offices, or certified nursery professionals for the names of commercial laboratories that perform soil analysis.

Soil reaction, expressed as *pH* on a scale of 0 (acidic) to 14 (basic or alkaline), refers to the acidity or alkalinity of soil. Most plants grow best at a pH of 5.5 to 7.5. Gardeners can improve overly acidic soil (pH<5.5) by adding lime (calcium carbonate) to the soil; alkaline soils (pH>7.5) can be improved through the addition of soil sulfur or an acidifying nitrogen source such as ammonium sulfate. If soil has excess levels of toxic elements or salts, the situation cannot be remedied with soil chemical amendments, although gypsum (calcium sulfate) can help displace excess sodium in the soil and thereby improve soil structure. Regardless, it is imperative that the soil's drainage is improved so that the offending chemicals can leach out of the root zone. Fortunately, this type of toxicity is rare in garden soils.

Soil Management Considerations in Edible Landscaping

Frequently, annual edible crops are replanted on a seasonal basis in edible landscapes. It is better to devote bed areas to these crops where the soil can be amended with organic matter and perlite to optimize soil structure so that frequent planting, establishment, and removal of crop plants can be easily done. Inter-planting edible crops into established landscape plantings can be frustrating.. Roots of existing plants can make it difficult to dig planting holes and disruption of these root can cause injury to the existing plants. If soil physical or chemical properties do not readily meet the need of edible crops being planted, it may be impossible or infeasible to amend the soil in established landscape areas to meet the edible crops' needs. Edibles often have a need for larger amounts of fertilizer and more frequent fertilization, particularly nitrogen. For edibles and ornamentals, consider using slow-release forms of nitrogen fertilizer to reduce potential environmental impact. In situations where soil conditions are severely limiting to edible crops, container growing edibles is an excellent alternative. Quality potting media composed of bark, forest products, and coconut coir are ideally suited for growing edible crops. When using an unknown potting media, fill the container with the mix and thoroughly water it to leach excess salts that might be present. Be certain containers have good drainage and do not place a layer of gravel or other coarse material in the bottom of the container. This practice is typically intended to improve drainage, but in fact it creates a textural layer in the media that actually impedes water movement through the media and out of the container.

Composting/Greenwaste Management

Compost is an organic soil conditioner created by decomposing organic matter under controlled conditions until it is stable enough to improve soils without harming plants or transmitting disease. Organic materials such as grass clippings, food and kitchen scraps, leaves and brush can all be composted and re-used as soil additive in the landscape. Compost is not a fertilizer but it generally contains important plant nutrients such as nitrogen, phosphorus and many micronutrients. These macro and micro nutrients are slowly released from compost for use by plants. Compost also improves soil structure due to its high content of bacteria and fungi responsible for binding soil particles. One teaspoon of high quality compost contains about 100 million bacteria and 800 feet of fungal threads.

For edible landscapers, maintaining a compost pile can be an important way of diverting plant waste from the landfill, especially since edible plants may increase the amount of green waste generated in a landscape. Composting is a simple process of speeding up the natural decay process. When maintaining a compost

pile, manage air flow, water, temperature and organic material to increase the rate of composting and compost quality. In California, yard wastes are the largest component of municipal waste (CalRecycle). Although the tonnage of diverted (composted/recycled) waste is steadily increasing, it is estimated that nearly 50 percent of organic wastes continue to clog landfills. For more information on composting, download http://www.calrecycle.ca.gov/publications/organics/44207002.pdf.

Pest Management

Integrated Pest Management is the recommended approach for resolving pest problems in an edible landscape. The IPM steps are similar for edible and ornamental plants. Correct pest identification, use of cultural controls, mechanical controls, and conservation of biological controls are encouraged before use of pesticides as a last resort. Setting realistic expectations for both the ornamental and edible portions of the landscape is important. Learning to tolerate some aesthetic damage to individual fruits and vegetables is important.

Key cultural controls in the edible landscape include the following:

Selecting low-pest species or varieties. California's many climate zones and microclimates can make pest problems a challenge. It is a good practice for Master Gardener groups to develop lists of species and varieties best suited to their particular area. Swiss chard is a favorite, not only because of its beautiful selection of varieties, but because of low pest pressure.

Timing is an important cultural tool. Waiting to plant until after major pest pressures occur or until plants have best growing conditions for rapid growth can help reduce pest pressure. For instance, wait to plant eggplant until the soil warms. Rapid growth helps the eggplant resist pressure from flea beetles.

Although more planning is needed in a multi-functional landscape, *crop rotation* is a valuable tool to combat pests. The general rule of thumb is to consider rotating plant families' locations, with 3 years between planting in the same location.

Sanitation - Consider removing the entire plant when pest pressure becomes very high, then replanting later in the year.

Intercropping or 'Companion Planting'

The concept of companion planting was mentioned earlier in this section. There are some specific examples of IPM techniques that provide good discussions for edible landscapes:

- *Trap cropping.* The use of Shasta daisies to protect strawberries from lygus bug provides a good example of trap crops for an IPM program. Additional information and references can be found in *Pests of the Garden and Small Farms ANR Publication 3332 Page 92, and in the following article from California Agriculture: http://californiaagriculture.ucanr.org/landingpage.cfm?article=ca.v061n04p152&fulltext=yes.*
- *Biochemical pest suppression*. Marigolds are a popular cover crop for suppressing nematodes; however, only certain varieties of the French dwarf (*Tagetes patula*), the African (*T. erecta*) and South American (*T. minuta*) marigolds reduce numbers of root lesion and root-knot nematodes. This suppression is only effective if marigolds are planted as a cover crop prior to planting edibles. Inter-planting with marigolds has not been effective, even when marigold is planted in close proximity (*http://edis.ifas.ufl.edu/ng045*).
- *Beneficial habitats.* Although little information is available in multi-functional landscapes, information is available from hedgerow plantings adjacent to agriculture fields that provides information regarding species and abundance on select California natives. The greatest beneficial insect abundance on each shrub species coincides with the bloom period of that species, when nectar and/or pollen were available. An excellent reference for information on hedgerows is available at: *http://californiaagriculture.ucanr.org/landingpage.cfm?article=ca.v065n04p197&fulltext=yes.*

Master Gardeners will be challenged to provide information on companion planting which also meets the requirement to extend science-based information. For example, borage is said to control worms in tomato. UC IPM notes six species of worms that are active pests of tomato, but research is not available as to which of those 6 worms borage might suppress. Anecdotally, borage is said to confuse the sphinx moth so that she doesn't lay her eggs on the tomato. However, it is unknown how many borage plants might be needed to have this effect.

Pesticide Applications

Pesticide use in edible landscapes requires close observation of the label recommendations. Most pesticide labels for edibles plants include information regarding the number of applications allowed per year, intervals between treatments, and pre-harvest intervals between application and harvest. These may not appear on pesticide labels for ornamental plants. Pesticide runoff and drift is also important to consider in these multifunctional landscapes. For more information on how to read pesticide labels, visit *http://www.epa.gov/pesticides/regulating/labels/pdf/garden.pdf.*

Chemical vs Organic Fertilizers

Edible landscapes versus traditional ornamental landscapes serve to be both aesthetic and productive. This two-fold landscape purpose can also equate to a greater need for fertilizers than would be typical for a traditional landscape. In general, landscape plants do not need more than a spring application of fertilizer and some trees and shrubs can go longer than that between feedings. Edibles require more fertilizer at precise times due to nutrient demands during fruit set and nutrient removal from harvesting crops.

When planning garden maintenance activities, gardeners can choose between chemical and organic fertilizers; each has its own set of pros and cons to weigh, but an increasing number of people are choosing organic gardening. Chemical fertilizers are man-made and most require the use of ammonia, which is made from natural gas (methane). These fertilizers can be formulated to have a high quantity of nitrogen (N), phosphorous (P) and/or potassium (K). Organic fertilizers, on the other hand, usually have a lower percentage of N, P, and K. Therefore, it can require larger amounts of an organic fertilizer product versus a chemical fertilizer to deliver the desired amount of nutrients to a planting. Whatever choice a gardener makes, it is important to remember that both chemical and organic fertilizers can provide essential plant nutrients, pollute ground and surface water, and harm plants if overused or misapplied.

Chemical fertilizers are economical and simple to use, and they provide accurate amounts of nutrients. However, the downside to these products is that they are energy intensive to produce due to the high heat required, and they can be easily over applied, leading to increased insect and disease pest problems. Also, chemical fertilizers lack carbon, so they provide little food for soil microbes and do nothing to promote soil structure. In essence, chemical fertilizers feed the plant but not the soil, although increased plant growth does result in more organic matter, and microbes will use the N from fertilizers. As most of these products are quick-release (soluble), they are an immediate nutrient meal for the plant. However, since they aren't tied up in organic matter, some chemical fertilizers, particularly nitrate forms of nitrogen, are subject to leaching out of the soil if applied too heavily or if large amounts of water are applied after the fertilizer.

In contrast to chemical fertilizers and depending on the formulation, organic fertilizers can improve soil structure (also known as soil tilth) and feed soil microbes by providing a carbon food source. However, by themselves organic fertilizers provide a limited carbon source compared to compost, so including both may be the best approach. Compost is generally not considered a fertilizer because of its low nutrient analysis and slow nutrient release rate.

A downside of organic fertilizers is that the price per pound of actual N is often far higher than chemical fertilizers. It is also common that the percentage of nutrients is lower and those nutrients can be bound up with carbon so they are not released quickly or when needed. Organic fertilizers tend to be bulkier, requiring more fossil fuels than chemical fertilizers for transport. Another drawback is that some organic fertilizers, such as bloodmeal and feather meal rely on animal slaughter to produce, which is of concern to a growing number of people. Fertilizers such as cottonseed meal and manure do not rely on animal slaughter.

Some on-farm research has shown that the judicious use of both compost and N fertilizer (chemical or organic) results in the best crop production. The compost provides a carbon source, increasing microbial populations and improving soil tilth, and the N fertilizer provides N for use by both plants and microbes. The choice to use strictly organic fertilization is sometimes a philosophical decision, as well as a statement about the use of natural vs. synthetic products.

Apple and pear harvest. *Credit: Rosalind Creasy.*

Fruit Tree Practices

Learning objectives, Fruit Trees

- Learn the factors to consider in using fruit trees including species selection, pest issues, and site selection.
- Understand fruit tree planting and post-planting care.
- Learn some specific training methods for fruit trees.

Planning

When the time is right to purchase a fruit tree, it is important to choose trees that are ½ to 5/8 inches in caliper. A tree's caliper is defined by the diameter of the tree trunk 12" up from the potting soil. Trees can be purchased either as bare root or potted. Bare root trees are typically less expensive and have smaller but (often) better root structure than potted trees. With any potted plant, it is very important to choose one that does not have kinked or circling roots. Kinked or circling roots are a preventable structural defect in the formation of the root system. When trees are kept in containers too long, their roots often circle around the container, creating the defect. When these trees are planted in the landscape and the roots continue to enlarge, they can cause trunk constriction and tree instability. These situations often lead to fallen trees.

Site Selection

Once a variety has been selected, an appropriate planting site within the landscape needs to be found. The site must have 6-8 hours of full sun, shelter from high winds and soil at least 2-3 feet deep. The planting site should preferably not be in the middle of a lawn. In cooler climates, trees may benefit from a warm south wall that radiates heat and protects from cold damage. Another facet of site selection is finding a location that is convenient. The tree must be easily accessible for harvest and should not be planted where fruit could fall on walks or driveways. This situation creates a messy and frustrating experience for the gardener, although sometimes there is little choice.

Planting

There are simple guidelines to follow when getting a fruit tree into the ground. First, dig a hole that is the same depth as the tree root ball and three times as wide. The

Circling roots on a container plant. *Credit: Brian Kempf.*

Table 3.4 Common Fruit Tree Terms

Fruit Tree Terms	
Term	**Definition**
Rootstock/Stock	Tree below the graft union.
Scion	Tree above the graft union. Either a bud or a shoot can be grafted.
Crown	Trunk just below the soil level, before the roots.
Standard	These trees typically grow to 20-25 feet tall.
Semi-dwarf	These trees have a dwarfing rootstock and are typically 12-20 feet tall.
Genetic dwarf	These trees have a standard rootstock and are typically 8-12 feet tall.

Special Considerations for Citrus

Citrus trees are a great option for the home landscape but they have different needs than other fruit trees. With shallow roots (1-2 feet), good drainage is essential and heavy clay soils should be avoided. Raised beds or containers are a great way to get around this.

planting hole should only be deeper if the soil at the site is compacted, even when the soil is moist. The base of the hole should be uncultivated to prevent settling. Planting high reduces the chances of crown and root rot problems. Before putting a tree in the ground, inspect the roots and remove any that are dead or damaged.

Non-composted soil amendments such as fresh manure can be rototilled at the site months before planting. This activity is done well in advance to allow the amendments time to break down and begin improving soil structure, nutrients and water retaining capacity. At the time of planting, no amendments should be put in the planting hole. In addition to compost, mulch can also be added to the soil surface in order to add nutrients and protect the soil temperature and moisture.

When the planting hole and the tree are prepared, the tree should be placed with the previous soil line at or above the new soil level. This allows for the soil to settle. In hot areas, paint the trunk of the fruit tree with a 50:50 mix of white interior latex paint and water. This prevents both sunburn and bark borers.

Additional post-planting care can involve some major pruning. Bare root trees should be cut back to 18-36 inches in total height from the soil level. Well-placed laterals should also be cut back to 3-8 inches and all other laterals should be removed. These pruning practices can look severe but they promote strong tree structure and development for long term enjoyment of the selected tree(s).

Irrigation

The best irrigation for fruit trees is drip and microsprinkler irrigation. Furrow, doughnut ring and sprinkler irrigation are also possible but typically less common in home landscapes. No matter the type of irrigation used, water must penetrate the soil at least 2 feet. A 2 year old tree can use about 2 gallons of water each day whereas a large, mature tree can use over 50 gallons daily.

Fertilization

It is important not to over-fertilize fruit trees. Use no more than 1 pound of actual nitrogen per year on mature trees, and no more than a half pound on young trees and fruit bushes. Too much Nitrogen equates to excessive growth and shading of lower wood.

Pruning

Summer pruning of young fruit trees is done to promote the development of scaffold branches. Unwanted shoots should be headed to 4-6 inches. These shoots are retained on the tree to shade the trunk and promote strong trunk taper. Wanted shoots are called scaffold branches and should be pinched when they are 2 feet long to promote side branching. Summer pruning expedites tree training and shortens time to the first fruit production.

Specific fruit and nut tree training methods include the following:

- Open Center

In this method, which produces a large tree, the center of the tree is kept open during summer. Training starts by selecting scaffold branches during the first 2 growing seasons as well as in winter, although cherries and apricots should not be pruned in winter due to branch diseases brought on by winter pruning. This method is typically used for stone fruits and almonds.

- Central Leader

Maintaining a central leader is common for landscape trees and can also be used for several fruit and nut trees. An upright central leader is maintained with lateral branches reaching outward. This practice is commonly used for

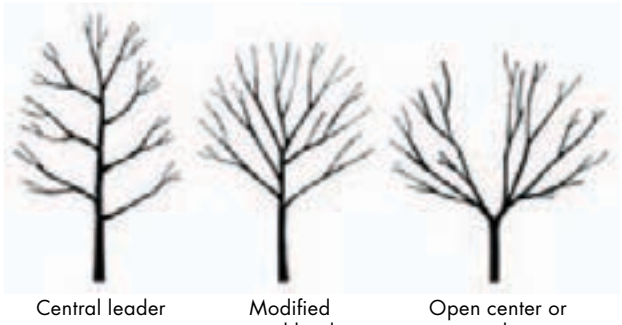

Figure 3.2 Common Pruning Techniques. From L to R: Central leader, modified central leader, open center. *Credit: www.Gardenality.com.*

apples, pears and Asian pears, pecans and is best for persimmons.

- Modified Central Leader

This method is an option for walnuts, persimmons, pistachios and pomegranates. After the central leader is formed and five to seven lateral branches are developed with about 6-12 inches of vertical spacing from each other, the leader is headed back or simply allowed do develop a number of competing (co-dominant) leaders. However, the lower canopy should still remain wider than the upper canopy to allow light to reach the lower branches.

- Fruit Bush

This pruning technique involves maintaining a tree at a desired height, typically no more than 6-7 feet. To create a fruit bush, after planting and heading the tree, shoot length is reduced by half when they reach about 2-3 feet. When the subsequent shoots reach the same length, they too are similarly shortened. Usually two such prunings are sufficient in the first year (in about mid-spring and mid-summer), but more vigorous trees may require such pruning three times. Since heading cuts cause several new shoots to grow, some should be thinned to prevent crowding. The process is continued in year two, or until the permanent tree height is reached – usually 5-7 feet. Pruning mature trees consists of cutting off new shoots above that height two to three times during each growing season and thinning branches and shoots to allow sunlight penetration. Touch-up pruning is useful in the winter, when branch structure is more visible. It may be beneficial to keep the center of the tree open to increase light in the lower canopy. The advantages of fruit trees include tree maintenance without a ladder and trees for small spaces. Disadvantages of a reduced tree canopy are less fruit and damage to fruiting branches that can be caused by missing a key pruning time during the growing season.

Fruit bushes are kept short for ease of harvest. *Credit: Chuck Ingels.*

- Espalier

Training trees on a sturdy trellis can provide a fruiting wall in a narrow space, either free standing with space on both sides (preferable) or against a fence or house. Apples, pears, and Asian pears are especially well adapted to espalier training, but other species may work with informed effort. There are many ways to train the branches, including fan shapes, but typically three to four horizontal wires are spaced about 1½- 2 feet apart vertically, and the lateral shoots are tied (trained) along the wire running in either direction. For best results, shoots can be initially trained upward at about a 45° angle on a bamboo stake to keep them growing vigorously. Once they reach the desired length, shoots can be lowered to the wire. Vigorous shoots should be cut back during the growing season to encourage spur growth. Lateral growth from the branches should be kept short to prevent shading of lower branches. If shoot growth is excessive, provide more space by extending the trellis outward or upward.

Fruit Thinning

Thinning fruit is a common practice to improve the size and color or produce. It also has the advantage of reducing disease (especially brown rot) as well as limb breakage from heavy fruit loads. Thin fruit when it is ¾ to 1 inch in diameter, typically around late April to early May. The amount of thinning depends on the vigor of the tree but the end goal is that fruit should not touch at the time of harvest. Peaches should typically be spaced 5-6 inches apart and apricots 4-5 inches apart. Apples should be thinned to 1 fruit per cluster or 6 inches and pears should be thinned to 1 fruit per cluster.

Berries

Learning objectives, Berries

- Know general training systems for blackberries and raspberries.
- Know general growing needs for blueberries and site factors that would encourage containers vs. in-ground.

The berries most often planted in California gardens include blueberries, blackberries and their hybrids, raspberries, and strawberries.

Blueberries

Blueberries are an excellent, low-maintenance crop that fit well into edible landscapes. The most commonly planted species are highbush blueberries. They are separated into northern varieties, which are best for cooler areas with high winter chill, and southern varieties, which are better in hot climates with low winter chill. These varieties are self-pollinating but fruit set will increase and berries will be larger if another variety is also planted. Most varieties are deciduous to semi-deciduous shrubs that grow to 4 to 6 feet tall. Depending on location and variety, blueberry harvest typically takes place May through June or July. Gardeners wishing to extend their harvest can plant a selection of varieties that ripen at different times.

Blueberries will grow on most soil types, provided that the soil is porous and well drained. They benefit from the incorporation of organic matter into the soil. Products such as peat moss, pine sawdust, and finished compost, along with enough nitrogen fertilizer to offset any tie-up of nitrogen by amendments, should be applied. A key factor is that blueberries require an acidic soil with a pH of 4.5 to 5.5. Blueberries are in the same family as azaleas and rhododendrons; they need similar growing conditions.

To acidify soil for blueberries, incorporate soil sulfur in the top 8 inches at a rate of about 3 to 7 pounds per 100 square feet. The amount to use depends on soil texture (use higher rate in clay soils, lower rate in sandy soils), calcium carbonate (lime) content (use higher rate where soil analysis shows high levels), and existing pH. Rototill the sulfur and compost in a strip about 3 or 4 feet wide in the row in the top 6 inches of soil. Preferably, this should be done six months to one year prior to planting because sulfur is slow to break down. Test the soil at planting and every year thereafter with a kit available at local nurseries to be sure it remains acidic. If additional sulfur is needed in later years, side dress or lightly incorporate additional sulfur into the soil.

Blueberries are often planted in the spring when they are most available at nurseries. After planting, irrigate and cover the soil with 4 to 6 inches of mulch. Blueberries should be spaced 3 feet apart for a hedge, or 4 to 5 feet apart for shrubs.

Blueberries do not require large amounts of fertilizer and are sensitive to over-fertilizing, so observe first whether plants are growing and fruiting well. If fertilizer is needed, rake back mulch, spread fertilizer over the soil without incorporating it in, then replace mulch and water in well. Fertilize blueberries with an acidic fertilizer, such as a 10-10-10 formula for azaleas. Organic fertilizers such as blood meal, cottonseed meal, fish meal, and alfalfa meal can also be used. Ammonium sulfate,

Top Red and golden raspberries. *Credit: Kathy Keatley Garvey.*
bottom Strawberries. *Credit: Kathy Keatley Garvey.*

a common acidic nitrogen source, may be used if caution is exercised to carefully follow application rates on its label.

Dormant pruning of mature plants involves removing unproductive wood and generating replacement wood with the goal of having a balance of branches that are one to five years old. Follow these steps: (1) cut out dead, damaged, and diseased wood, (2) remove small sucker shoots and weak twiggy growth at the base, (3) remove low spreading branches that will be shaded and touching the ground with fruit, (4) remove one or two of the oldest canes each year, cutting back to the ground or to a strong new side shoot, (5) if more than two new canes grew from the crown the prior year, remove all but the two healthiest canes at crown level, (6) remove weak twiggy wood from the top and outside branches, (7) prune out crossing branches, (8) if plants overbear, cut back some of the branch tips where most of the flower buds are located, (9) extremely vigorous new shoots should be tipped or headed back to encourage branching and fruiting.

Top **Figure 3.3** Pruning blueberries. *Source: University of California Agriculture & Natural Resources.*
Bottom Developing blueberries. *Credit: Rosalind Creasy.*

Blueberries can be grown successfully in containers outdoors and are attractive patio plants. Blueberries need at least six hours of sun, and would benefit from late afternoon shade in the Sacramento area, so the location of the containers should accommodate that. If the containers are located on a concrete patio slab, they should be grouped together to minimize the reflected heat. Keep the soil moist but not wet. Take into account that soil in a container dries out faster than soil in the ground. Apply a 4 to 6 inch layer of mulch to conserve water and help moderate soil temperature. Replace soil with fresh potting mix, and root prune the plant every three to four years.

Cane Berries

Cane berries are usually planted in the dormant season as bare root plants. In-row spacing for blackberries is 3½ to 4 ft., and raspberries can be planted 2½ to 3 ft. Rows should be 8 to 10 ft. apart. They should be planted on a small berm if the soil is poorly drained. After planting, irrigate and cover the soil with plenty of mulch, such as wood chips.

Blackberries, boysenberries, and red raspberries require a trellis on which to tie or wrap the canes. End posts should be strong (4 to 6 in.), and the posts in between (if necessary) can be 2-in. by 2-in. grape stakes, spaced 20 ft. apart. Strong galvanized wire (No. 10 or 12) should be used for durability. **Blackberries and boysenberries** are commonly grown on a three-wire trellis, with the lowest wire about 2 ft. above ground, the second wire at about 4 ft., and the top wire at about 6 ft. **Raspberries** can be trellised in several ways. The most common support method is a three-wire trellis, in which a single top wire is placed 4½ ft. above ground, and two detachable wires are placed 2½ ft. above ground. The detachable wires are used to bring the newly grown canes into the row; they are placed on a hook or bent nail attached to either side of each post when the new canes have grown to a height of 3 to 4 ft. (about early May). Alternatively, the wires could be placed on short cross-arms and the new canes tucked in between them.

After the summer harvest, old blackberry canes that fruited are cut back to the ground. About 5 to 8 new canes are allowed to grow and all other new canes are cut back to the ground. In the winter the new canes are cut back to 5 to 6 ft. long. They can then be either spread out in a fan shape and tied to the trellis wires, wrapped to the top wire, or brought over the top wire and tied to the middle wire. The side branches (laterals) are cut back to 12 inches.

Raspberries are best grown in cooler climates but they can be grown in hot areas as long as they have afternoon shade. Raspberries can be challenging in the home landscape. They have invasive roots and will spread unless contained by borders. Persistent gardeners can be successful containing the plants by removing unwanted shoots in the spring.

Summer bearing cane berry varieties produce new canes from the ground at the same time that they bear fruit (May-June) on last year's canes. Ever-bearing (also known as fall-bearing) varieties produce flowers and then fruit on the mature tips of current season's growth, starting in late summer and continuing through the fall. If not pruned, the same canes would then over-winter and produce a smaller second crop on the canes the following May.

If cane berry roots are not contained within a bordered area, use a hoe in early spring to cut canes that grow outside the vine row. After late spring harvest, remove the old fruiting canes, select and tie the strongest well-spaced new canes (8 to 12 per plant) to the trellis wires, and cut the remaining canes off at the ground.

Ever-bearing varieties bear mostly on current season's growth in the fall (from September thru November), so they are usually completely cut back to the ground each winter. If a small June crop is desired, the canes are instead cut below the autumn fruiting region rather than cutting the entire cane back to the ground.

Summer-bearing varieties bear fruit in June on over-wintered canes while new vegetative shoots grow from the ground to become the next year's fruiting canes. No canes are removed in winter (except for weak, broken, or damaged canes), instead, the canes can be shortened to 6 ft. All fruiting canes are cut back to the ground after harvest allowing new canes to grow.

Vegetables

Learning objectives, Vegetables

- Learn the site selection factors that must be considered when selecting the optimal plant stock for an edible garden.
- Learn how companion planting can compliment your gardening and landscaping goals.
- Examine the variety of edible plant groups and how they can be used in the landscape.
- Discover the different landscape uses that edibles can be utilized for.

Planning

Whether starting from scratch or incorporating vegetables into an existing landscape, the first step is to make a list of edibles that suit personal taste preferences, garden climate restrictions (minimum 6-8 hours of sun per day), and ideally have an ornamental feature. Cultural needs like sun versus shade, soil pH, irrigation requirements, and nutrient requirements define where in a landscape the selected edibles should be grown. For overall design of an edible landscape, knowing a plant's size, shape, color, flowers and fruits help to appropriately blend them with other landscape plants. It is also critical to consider scheduling planting in the season(s) in which a vegetable grows best and produces the best quality crops.

Once a list of suitable plants has been identified, there is value in researching varieties/cultivars that may be better suited to different landscape or maintenance challenges. As plant breeders are becoming more aware of edible landscaping, new varieties are being created that may make growing them easier or more attractive. Characteristics such as drought tolerance, salt tolerance, disease resistance, pest resistance and striking or more profound colors may be available.

Site Selection

Vegetable crops can be used and placed as edible ornamental annual plantings among or adjacent to perennial ornamental landscape plantings that perform well when well irrigated and receive at least 6-8 hours of sun per day. Specific sites and crops will be further dictated by the aesthetic functions and type of vegetables desired. Vegetable crops can serve as annual low border bedding plants, visual screens, trellis vines, and hanging basket or container plants.

Planting

Seasonal temperatures are very important in determining when to plant a crop. Seed of cool-season crops germinate better when soil temperatures are cool then do seed of warm season crops. Average monthly temperatures for cool-season crops are 60 to 65 degrees Fahrenheit during the growing period; for warm-season crops 65 to 80 degrees Fahrenheit. Be certain to plant crops within the recommended range of dates for your area (see Table 14.2 in California Master Gardener Handbook).

Vegetables can be planted by direct seeding, planting transplants, or self-seeding. Direct seeding is often recommended for large seeded plants such as corn, melons, squash, beans and peas. Direct seeding is also recommended for many of the root crops including, carrots, radish, beets,

turnips, and parsnips. However, before direct seeding make sure the soil has dried out sufficiently and that the soil temperature is warm enough for the seeds you want to plant. Pea seeds for example, germinate in soil as cool as 40 degrees Fahrenheit, and you can plant them as soon as you can work the soil in spring. Squash, melons, tomatoes and other warm season crops need warmth, and will not germinate until the soil temperature reaches 65 degrees Fahrenheit.

Using transplants will often lead to producing crops earlier, but care must still be taken to ensure that the soil is properly prepared and the plants have been hardened off. To harden-off seedlings, leave the plants in their containers and put them in a shaded area with some indirect light for a few days. A north-facing, covered porch is ideal. Whenever a freeze is predicted, bring the plants inside overnight. If these are shade plants, you can leave them in this protected site for a few more days and then put them in the garden. For sunny-spot plants, give them a few days in the shaded area and then place the plants in a sunny location for an hour. Give them a couple of hours of sun the next day, and so on, increasing their exposure incrementally. At the end of a week, the plants are thoroughly accustomed to the outdoor elements and are ready to go into their new home.

One of the characteristics of a sustainable edible landscape is that it produces at least some of its own seed. This is most often done when gardeners select, harvest and store seeds until the following year. But some self-seeding crops produce seeds so readily that as long as you give them time to flower and mature, and set seed, you will always have free plants growing in your garden. Simply let the seeds fall where they are, or toss pieces of the seed heads into the corners of your edible landscape, or whichever area you want them in — no harvesting, storing or replanting required. With most self-seeding vegetables, herbs and annual flowers, you'll just need to learn to recognize the seedlings so you don't hoe them down. Some of the early self-seeding flowers, herbs and vegetables include arugula, calendula, chamomile, cilantro, dill, beans and carrots. Later in the spring, warm season plants will emerge including nasturtiums, spinach, basil, zinnias, tomato and squash.

Working with reseeding or self-sowing crops saves time and money, but a few special techniques and precautions are in order. Some plants can self-sow too freely and can become weedy. Plants such as garlic chives and horseradish can quickly become a problem if you let them reseed. Make sure to find out which annuals self-seed in your climate. Encouraging the annuals you desire will save you time and money. Common self-seeding vegetables and herbs include:

Beans Self-sown beans can be left to germinate in Spring, particularly if you grow climbing beans on a trellis so that the beans are kept away from the soil and split open when the pods are dry the following spring.

Carrots Several different varieties of carrots can be grown, with self-seeded carrots germinating in autumn and spring.

Chinese Cabbage Chinese cabbage cross pollinates, so you may end up with some unusual results, but they are edible and delicious.

Chives As per Garlic and Spring Onions.

Garlic Leave a bulb in the ground at harvest time and more garlic will grow.

Japanese Turnip Once Japanese turnips are set, the next generation springs up quickly and easily.

Leeks When leeks self-sow, a clump of very small, but very tender leeks form. These can be eaten from top to bottom.

Lettuce Some varieties of lettuce will thrive all year round, such as red and green mignonette, oak leaf and Romaine. Once you have let two or three crops of mignonette go to seed, you should start having them all year round.

Parsley (Italian) Parsley allowed to self-sow forms a thicket of re-sprouting, fresh Parsley.

Parsnip Allow Parsnips to self-seed and self-sow and you'll never run out.

Peas Peas can germinate in much the same way as beans.

Potatoes Potatoes don't need to be dug. Simply burrow under the earth/mulch, and take what you need. Leave the rest to regrow so that you have year round potatoes.

Pumpkin A pumpkin left in the garden will rot slowly, and the seeds will germinate in spring.

Radish Radish self-sows extremely easily; almost to the point that it becomes a weed in the vegetable garden. The older the radish, the hotter they taste.

Spring Onion Spring Onions never need to be pulled up, as the tops can be picked and the clumps go on expanding, becoming year round greens.

Tomatoes Tomatoes reseed and re-sow themselves prolifically, and when grown amongst other crops, will bear fruit throughout the winter months. They can also be put into a pot and taken indoors.

Zucchini A very ripe zucchini will rot and the seeds will germinate when left in the garden.

Irrigation

Vegetable crops need to kept well watered and not experience water stress in order to perform well and produce good crops. In general, vegetables will need about 1.0 to 1.5 inches of water per week in mid-summer, depending on the area of the state. During cooler seasons, most vegetables will need about 0.5 to 0.8 inches of water per week, again depending on location. Coastal and higher elevation locations will need near the lower amount while interior valleys and desert locations will need near the higher amount. Summer irrigation amounts should be divided into 2-3 irrigations per week. If significant rainfall occurs, irrigation can be reduced or eliminated. It is important that other landscape plants irrigated in the same hydrozone as the vegetables share the same irrigation demands as the vegetables. Likewise, it is important that the vegetables are effectively watered by the irrigation system in place for the hydrozone.

Fertilization

Most vegetables perform best with some fertilizer applied at planting and again during the crop's growth period, which may not match the fertilizer needs of shrubs or other ornamental landscape perennial plants. Nitrogen is most important and can be applied just around the vegetable plants where a mixed landscape is being grown.

Training and Support

Some vegetable crops, such as tomatoes, cucumbers, and pole beans perform best with some training and support. These crops are well-suited to tying on stakes or training on a trellis or fence. Otherwise, most vegetable crops do not usually require detailed pruning and training in order to provide good crops and aesthetic value.

EXERCISES:

1. *Do as many activities as you can to illustrate the content in this section. For example, you can practice fruit thinning, have participants test their soil and water, practice pruning and espalier, and practice reading pesticide and fertilizer labels.*

2. *Develop a list of edibles that you enjoy. Using the planning and design elements from Section 2, and the guidelines from Section 3, make a drawing of your landscape with current planting beds and the placement of new edible plants.*

3. *For each edible make a list of major pest/diseases and address any control strategies you may utilize to reduce damage or loss.*

4. *Compile pest and beneficial insect identification materials for the common garden pests in your location for use in your workshops.*

5. *Use existing pesticide labels to demonstrate the differences between application instructions for ornamental plants versus edible plants.*

RESOURCES

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UC Integrated Pest Management web resources
UC IPM website: http://www.ipm.ucdavis.edu

UC IPM for Retailers Portal:
http://www.ipm.ucdavis.edu/RETAIL/

Newsletter:
http://www.ipm.ucdavis.edu/RETAIL/retail-newsletter.html

Table 3.5 How to Plant and Store Vegetables. *Source: California Master Gardener Handbook.*

VEGETABLE GARDENING AT A GLANCE: HOW TO PLANT AND STORE

	Recommended planting dates[a]				General planting requirements				Storage conditions		
Vegetable	North and North Coast	South Coast	Interior Valleys	Desert Valleys	Crop type[b]	Amount to plant (4 persons)	Distance in inches[c] between plants in rows (cm)	Distance in inches[c] between rows (no beds) (m)	Best temp °F (°C)	Time length (weeks)	How to preserve[d]
artichoke[e]	Aug–Dec	May–Jul	Jul	Sep	C	3–4 plants	48 (122)	60 (1.5)	32 (0)	1–2	freeze whole, can, dry, or freeze hearts
asparagus[e]	Jan–Mar	Jan–Feb	Jan–Feb	Feb–Apr	C	30–40 plants	12 (31)	60 (1.5)	32 (0)	3–4	can, dry, or freeze
beans, lima[f]	May–Jun	May–Jun	May–Jun	—	W	15–25-ft row	6 (15) bush; (4.5–7.5-m row)	30 (0.8) 24 (61) pole	40 (4)	1–3	can, dry, or freeze
beans, snap[f,g]	Jul; May–Jun	Mar–Aug	Apr–May; Jul–Aug	Jan–Mar; Aug	W	15–25-ft row (4.5–7.5-m row)	3 (7.5) bush; 24 (61) pole	30[h] (0.8)	45–55 (7–13)	1–2	can, dry, or freeze
beets[f,g]	Feb–Aug	Jan–Sep	Feb–Apr; Aug	Sep–Jan	C	10–15-ft row (3–4.5-m row)	2 (5)	18[h] (0.5)	32 (0)	3–10	can, dry, or freeze
broccoli[e, f,g]	Feb–Apr; Aug–Sep	Jun–Jul; Jan–Feb	Dec–Feb; Jul	Sep	C	6–10-ft row (2–3-m row)	12–18 (30–45)	36 (0.9)	32 (0)	1–2	dry or freeze
brussels sprouts[e]	Feb–May	Jun–Jul	—	—	C	15–20-ft row (4.5–6-m row)	24 (61)	36 (0.9)	32 (0)	3–4	dry or freeze
cabbage[e,f]	Jan–Apr; Jul–Sep	Aug–Feb	Jul; Feb	Sep–Nov	C	10–15 plants	24 (61)	36 (0.9)	32 (0)	12–16	dry or freeze
cabbage, Chinese[f]	Jul–Sep	Aug–Oct	Aug	Aug–Nov	C	10–15-ft row (3–4.5-m row)	6 (15)	30[h] (0.8)	32 (0)	2–3	dry or freeze
cantaloupes and other melons	May	Apr–May	Apr–Jun	Jan–Apr; Jul	W	5–10 hills	12 (30)	72 (1.8)	40–45 (4–7)	2–4	freeze
carrots[f,g]	Jan–May; Jul–Aug	Jan–Sep	Aug–Sep; Feb–Apr	Sep–Dec	C	10–25-ft row (3–7.5-m row)	2 (5)	24[h] (0.6)	32 (0)	16–20	can, dry, or freeze
cauliflower[e]	Jun–Jul;	Jul–Oct; Feb Jan–Feb	Jul–Aug	Aug–Sep	C	10–15 plants	24 (61)	36 (0.9)	32 (0)	2–3	pickle, dry, or freeze
celeriac	Mar–Jun	Mar–Aug	Jun–Aug	—	C	10–15-ft row	4 (10)	24[h] (0.6)	32 (0)	8–16	can, dry, or freeze
celery[e,f] freeze	Mar–Jun	Apr-Aug	Jun–Aug	—	C	20–30-ft row (6–9-m row)	5 (13)	24[h] (0.6)	32 (0)	8–16	can, dry, or
chard[f]	Feb–May; Aug	Feb–May	Feb; Aug	Sep–Oct	C	3–4 plants	12 (30)	30 (0.8)	32 (0)	1–2	freeze
chayote	—	Apr–May	May–Jun	—	W	1–2 plants	72 (183)	use trellis	—	—	use fresh
chives[f]	Apr	Feb–Apr	Feb–Mar	Sep–Feb	C	1 clump	—	—	—	—	use fresh
corn, sweet[g]	May–Jul	Mar–Jul	Mar–Jul; Aug	Feb–Mar	W	20–30-ft (6-9 m) in 4 rows	12 (30)	36 (0.9)	32 (0)	½–1	can, dry, or freeze
cucumbers	Apr–Jun	Apr–Jun	Apr–Jul	Feb–May; Aug	W	6 plants	24 (61)	48 (1.2)	45–55 (7–13)	1–2	freeze, pickle, or puree
eggplant[e,f]	May	Apr–May	Apr–May	Feb–Apr	W	4–6 plants	18 (46)	36 (0.9)	50–60 (10–16)	1–2	dry or freeze
endive[f]	Mar–Jul	Dec–Aug	Jan; Apr; Aug	Sep–Dec	C	10–15-ft row (3–4.5-m row)	10 (25)	24[h] (0.6)	32 (0)	2–3	use fresh
Florence fennel	Mar–Jul	Feb–Jul	Aug	Sep–Nov	C (3–4.5-m row)	10–15-ft row	4 (10)	30[h] (0.8)	32 (0)	2–3	can, dry, or freeze
garlic[f]	Oct–Dec	Oct–Dec	Oct–Dec	Sep–Nov	C	10–20-ft row (3–6-m row)	3 (7.5)	18[h] (0.5)	65–70 (18–21)	24–32	use fresh
kale	Feb–April	Aug–Oct	Aug–Sept	Sept–Nov	C	10 -ft row (3-m row)	18–24 (46–61)	24–30 (0.6–0.8)	32 (0)	2	use fresh
kohlrabi[f]	Jul–Aug	Jan; Aug–Sep	Aug	Oct–Nov	C	10–15-ft row (3–4.5-m row)	3 (7.5)	24 (0.6)	32 (0)	2–4	use fresh
leeks	Feb–Apr	Jan–Apr	Jan–Apr	—	C	10-ft row	2 (5)	24 (0.6)	32 (0)	4–12	use fresh
lettuce[f,g]	Feb–Aug	Aug–Apr	Aug; Nov–Mar	Sep–Dec	C	10–15-ft row or 5 ft (1.5m) each month	12 (30) head; (3–4.5-m row)	24 (0.6) 6 (0.15) leaf	32 (0)	2–3	use fresh

Table 3.5 How to Plant and Store Vegetables. (cont.) *Source: California Master Gardener Handbook.*

	Recommended planting dates[a]				General planting requirements				Storage conditions		
Vegetable	North and North Coast	South Coast	Interior Valleys	Desert Valleys	Crop type[b]	Amount to plant (4 persons)	Distance in inches[c] between plants in rows (cm)	Distance in inches[c] between rows (no beds) (m)	Best temp °F (°C)	Time length (weeks)	How to preserve[d]
mustard	Apr; Jul–Aug	Aug–Feb	Aug; Apr	Oct–Dec	C	10-ft row (3-m row)	8 (20)	24[h] (0.6)	32 (0)	1–2	use fresh
okra	May	Apr–May	May	Mar	W	10–20-ft row	18 (46)	36 (0.9)	50–60 (10–16)	—	use fresh
onions, bulb[f]	Jan–Mar	Feb–Mar	Nov–Mar	Oct–Nov	C	30–40-ft row	3 (7.5) (9–12-m row)	18[h] (0.5)	32–36	12–32 (0–2)	can, dry, or freeze
onions, green[e,f,g]	Apr–Jul	All year	Aug–Dec	Sep–Jan	C				85–90 (30–32)		use fresh
parsley[f]	Dec–May	Dec–May	Dec–May	Sep–Oct	C	1–2 plants	8 (20)	24 (0.6)	32 (0)	1–2	dry or freeze
parsnips	May–Jun	Mar–Jul	May–Jul	Sep–Oct	C	10–15-ft row (3–4.5-m row)	3 (7.5)	24[h] (0.6)	32 (0)	8–16	freeze
peas[f,g]	Jan–Apr; Sep–Oct	Aug; Dec–Mar	Sep–Jan; Jan–Feb	Sep–Oct	C	30–40-ft row (9–12-m row)	2 (5)	36 (0.9) bush; 48 (1.2) vine	32 (0)	1–2	can, dry, or freeze
peppers[e,f]	May	Apr–May	May	Mar	W	5–10 plants	24 (61)	36 (0.9)	45–55 (7–13)	4–6	can, dry, or freeze
potatoes, sweet[e]	May	Apr–May	Apr–Jun	Feb–Jun	W	50–100-ft row 1 (15–30-m row)	2 (30)	36 (0.9)	55–60 (13–16)	8–24	can, dry, or freeze
potatoes, white	Early: Feb Late: Apr–May	Feb–May Jun–Aug	Feb–Mar; Aug	Dec–Feb	C	50–100-ft row (15–30-m row)	12 (30)	30 (0.8)	40–45 (4–7)	12–20	can, dry, or freeze
pumpkins	May	May–Jun	Apr–Jun	Mar–Jul	W	1–3 plants	48 (122)	72 (1.8)	55 (13)	8–24	can, dry, or freeze
radish[f,g]	All year	All year	Sep–Apr	Oct–Mar	C	4-ft row (1.2-m row)	1 (2.5)	6[h] (0.2)	32 (0)	—	use fresh
rhubarb[e]	Dec–Mar	Dec–Jan	Dec–Feb	—	C	2–3 plants	36 (91)	48 (1.2)	32 (0)	2–3	can or freeze
rutabaga	Jul; Mar–Apr	Jul–Sep; Aug–Mar	Aug	Oct–Dec	C	10–15-ft row (3–4.5-m row)	3 (7.5)	6[h] (0.2)	32 (0)	8–16	freeze
spinach[f]	Aug–Feb	Aug–Mar	Sep–Jan	Sep–Nov	C	10–20-ft row (3–6-m row)	3 (7.5)	18[h] (0.5)	32 (0)	1–2	dry or freeze
squash, summer[f]	May–Jul	Apr–Jun	Apr–Jul Aug–Sep	Feb–Mar;	W	2–4 plants	24 (61)	48(1.2) (10–13)	50–55	2–3	can, dry, or freeze
squash, winter[f]	May	Apr–Jun	Apr–Jun	Feb–Mar; Aug	W	2–4 plants	24–48 (61–122)	72 (1.8)	55 (13)	8–24	can, dry, or freeze
tomatoes[e,f]	May	Apr–Jul 15	Apr–May	Dec–Mar	W	6-10 plants	18–36 (46–91)	36–60 (0.9–1.5)	55–65 (13–18)	1–2	can, dry, or freeze
turnips[f]	Jan, Aug	Jan Aug–Oct	Feb; Aug	Oct–Feb	C	10–15-ft row (3–4.5-m row)	2 (2.5)	18[h] (0.5)	32 (0)	8–12	can
watermelons	May–Jun	Apr–Jun	Apr–Jun	Jan–Mar	W	6 plants	60 (152)	72 (1.8)	40 (4)	2–3	freeze

Notes:

[a] North and North Coast = Monterey County north; South Coast = San Luis Obispo County south; Interior Valleys = Sacramento, San Joaquin, and similar valleys; Desert Valleys = Imperial and Coachella Valleys. Because the areas shown here are large, planting dates are only approximate, as the climate may vary even in small sections of the state. Contact experienced gardeners in your community and experiment on your own to find more precise dates.

[b] C = cool season, W = warm season.

[c] Planting distances listed here are standards. Many crops can be spaced more closely for intensive production.

[d] Adapted from *Vegetable Gardening Illustrated* 1994.

[e] Transplants, shoots, or roots are used for field planting.

[f] This crop is suitable for a small garden if compact varieties are grown.

[g] In a suitable climate, these crops can be planted more than once per year for a continuous harvest.

[h] If grown in beds, plant two rows per bed. Space the beds about 32 to 40 inches (80 to 100 cm) apart and make the tops of the beds 18 inches (45 cm) wide.

SECTION 4

HARVEST & STORAGE

Purple cauliflower. *Credit: Rosalind Creasy.*

Overview

A great deal of effort goes into growing produce so that it can harvest crops of the best possible quality. Gardeners prune, thin the fruit, water, fertilize, and manage pests, yet the most critical and timely task of harvest is often ignored, sometimes until it is too late to salvage a quality crop. In addition to having a timely harvest, it is important to provide the optimum storage conditions to maintain produce quality for as long as possible or until the fruit or vegetable can be either eaten or processed for longer-term storage.

Harvest & Storage learning objectives:

- Understand the various stages of fruit/vegetable maturity.
- Know what optimal harvest periods and methods are for a variety of crops.
- Know what the key storage requirements are for a variety of crops.

General Rules of Harvest

This section was adapted from *Harvesting Fruit and Nuts, The Home Orchard* (pg. 129-130).

Each crop has an optimum period and method for harvest, but the harvest period can vary, depending on the individual tastes of the gardener, physiological characteristics of the produce, and planned use for the produce. Vegetables, fruit and nuts ripen by degrees, and they can be harvested over a range of maturity and ripeness.

Some species are harvested when fully ripe and ready to eat; others when simply physiologically "mature," meaning that they will continue to ripen after harvest. For those that do not ripen further after harvest, the sugar they have at harvest is all they ever will have; it will not increase after harvest. These species may seem to get sweeter as their acidity decreases, but sugar content itself does not increase. They may also soften after harvest, but this is more a manifestation of decay and breakdown than of ripening. Fruit in this category include blackberries, cherries, grapes,

citrus, raspberries, and strawberries.

Other species of mature-harvested fruit may further change in color, texture, and juiciness, but will not improve in sweetness or flavor. These fruit include apricot, blueberry, fig, nectarine, peach, and plum. Some fruit, such as apples, European pears, cherimoyas, kiwifruit, mangoes, and papayas, do increase in sugar and sweetness after harvest. These fruit contain starch that can be converted to sugars whether the fruit are on or off the tree.

Nut crops such as almond, walnut, and pecan can be harvested late without significant loss of quality to the nut itself. All the same, a timely harvest when the hulls begin to split will prevent other creatures, such as squirrels, ants, and navel orange worms, from getting to the crop before it can be harvested.

The same criterion for harvest of fruit often applies to vegetables as well. Exceptions to this include leafy vegetables and cole crops. Cole crops refer to plants belonging to the Cruciferae or mustard family. This includes popular members such as broccoli, turnips, cabbage, Brussels sprouts, mustard, kale and cauliflower. Leafy vegetables and cole crops must be harvested when the head is fully developed but still firm and before the plant has flowered. Size, generally and bud maturity is the best indicator of whether or not these particular veggies are ready for harvest.

In all cases, waiting too long to harvest will render produce overripe, perhaps overly tough and very susceptible to birds, dried fruit beetles, or rot. Overripe produce does not store well and fruit that is harvested mature-green does not taste the best. The flavor of fully ripe fruits and vegetables cannot be beat.

The harvest stage a gardener choses for produce also depends on how he/she plans to use it. For immediate fresh eating, fully ripe is ideal. For canning, the fruits or vegetables should be more firm than soft; for drying, fully ripe fruit will yield a full-flavored dried fruit. That is the advantage of growing one's own food—it gets harvested when it is at the peak stage for personal preference. Calendar notations that indicate the ripening period for individual crops will help remind gardeners to prepare for the harvest. The exact date of harvest will vary from year to year, however, depending upon factors such as weather and water stress.

It is also important to note that most species are harvested over a period of time, since ripening usually occurs over one or more weeks. Gardeners may have to harvest every 3 to 5 days in order to get all of the fruit right when it is ready. While frequent harvesting is more time-consuming than one-time harvesting, an extended harvest period allows for processing and storing a smaller and more manageable quantity of produce at any given time. The ripening period also varies with the growing region. Produce of the same variety tend to have a later harvest period in cooler climates.

Finally, the stage that is considered "optimum ripeness" will vary with individual preferences. Some people prefer a bit more tang or acidity to their fruit, so they harvest their fruit less ripe. Others prefer a bit more sugar, and therefore harvest fruit when it is riper. Commercial growers follow maturity standards that are based on indices such as the amount of sugar or acid in the fruit, firmness of the fruit, or splitting or browning of nut tissue. In the home garden, however, that determination is up to the individual.

When harvesting fruit by hand, it must be treated it gently. Most produce can be harvested by gently twisting and pulling upwards. If the fruit resists separating from the spur, it is not ready to harvest. Avoid throwing or dropping the fruit into bags and boxes. Rather, place it gently where it won't get bruised. Also, avoid stacking the produce too deep in containers as the weight on top can contribute to bruising the items on bottom.

In the unique situation of an edible landscape, the aesthetic value of a crop can be retained over a long period of time through careful harvest. Leafy crops such as lettuce and shard can be harvested all at once (the entire plant) or slowly over time by only removing the outer leaves. When the harvest of leafy crops is sustained in this way, the produce can be enjoyed over a longer period of time and the aesthetic value of the plant in the landscape is retained.

Certain produce such as persimmon, pomegranate, quince, grapes, peppers and eggplant must be clipped when harvesting. This helps to avoid damaging the plant so that successive harvests can occur. It is important to clip using clear kitchen shears or sanitized clippers. Clippers can be sanitized with products such as bleach (25% solution), pine oil cleaner (25% solution) rubbing alcohol (50% solution)

Tomato harvest. *Credit: Kathy Keatley Garvey.*

and Lysol (full strength). After clippers are sanitized, they also require lubrication to avoid corrosion.

It is also a good idea to wear clean cotton gloves in order to reduce bruising and cutting of the produce. Any opening or wound reduces shelf life. Pay attention to the methods of harvest described for each fruit and vegetable. With some species and varieties of fruit trees, improper harvesting can cause damage to the fruiting spurs and destroy the crop in following years.

Storage

A single large tree may produce several hundred pounds of fruit and adding one too many zucchini mounds to a landscape equates to surplus. For a small family, these situations may result in more produce than the family can use. In this type of situation, excess fruit can be given to neighbors or to a local food bank instead of dumping it in the trash. Planning for the harvest and storage is just as important as planning which variety to plant. Is there access to a large enough freezer to store the fruit or sufficient time to can or dry it? If not, consider quantity of produce that a family can consume or try growing "fruit bushes" or small genetic dwarf trees that produce a smaller quantity of fruit and are easier to manage.

Even if a gardener doesn't plan on freezing, drying, or canning, he/she will still need to be able to provide some cold storage for harvested produce. The capacity to get produce cold and keep it that way is the next most important quality control tool, right after timely harvest. The focus on keeping it cool begins when you choose to harvest in the morning when it is cool and continues when you get the freshly harvested commodities into a refrigerator as soon after harvest as possible. Most kitchen refrigerators cannot handle the large amount of fruit and vegetables that may come from a single harvest in addition to normal household food storage needs. Having a spare "Produce fridge" can be a good idea, but try to get a newer, energy-efficient model and only use it during harvest. Look for one that has wide doors for ease of loading and unloading and has uniform distribution of cold air. Make sure its temperature controls are functioning accurately.

When it comes to tree fruit, temperature is the most crucial factor that determines how fast fruit will degrade in storage. For every 18°F (-7.8 C) above the fruit's optimum temperature, its rate of deterioration increases two to three times (Thompson 2002). Deciduous fruit are not as sensitive to chilling injury as the tropical type fruit. For example, most deciduous tree fruit such as apricot, cherry, fig, nectarine, peach, and plum are not chilling sensitive and are best stored at just above freezing, from 32°F up to 35°F (0 to 1.7 C). For optimum ripening, however, temperatures between 68° and 77°F (20 and 25 C) are best. The more tropical-type fruit such as olive, citrus, cherimoya, mango, papaya, avocado, and feijoa tend to be much more sensitive to chilling injury and are best stored between 50° and 59°F (10 and 15 C), with optimum ripening temperatures between 68° and 77°F (20 and 25 C).

It is difficult to maintain lower temperatures in a home-type refrigeration unit. Test produce refrigerators with a thermometer at the different settings and on the various shelves to determine what setting is best for a particular harvest. Most can be maintained around 45°F (7.2 C) or somewhat lower. If dedicating one refrigerator to fruit storage, it would be better to set its temperature at 35°F (1.7 C) for all temperate fruits.

When loading produce into the refrigerator, try to stack it in a way that allows adequate air circulation around each item. Keep fruits and vegetables away from the walls and avoid rot by not putting wet produce into the refrigerator. Layer the produce in clean newspaper to reduce the amount of fruit-to-fruit infection from decay fungi. Cut fruits and vegetables should always be consumed immediately or refrigerated within 2 hours (1 hour if >90°F).

Refrigerated fruits and vegetables are best kept in perforated plastic bags. These can be purchased or you can make them yourself by making small holes with a sharp pin, (put 20 holes in a medium size bag). Try to separate fruit from vegetables if possible, since many fruits will produce ethylene which can impact the storage life of your vegetables. In most cases, fruits and vegetables under refrigeration should be used or further processed within a few days since longer storage will result in loss of freshness and flavor.

Some produce requires only dry storage such as onions, garlic, potatoes, tomatoes, squash (like acorn, butternut and spaghetti), avocado and peppers. A cool, dry, dark and well-ventilated place is optimum for this kind of storage. Onions, garlic, potatoes and winter squash can be stored for 6-8 months although onions and potatoes should be stored separately and at temperatures between 32°-41°F (0 to 5 C). If stored at 65°-70°F (18.3 to 21.1 C), they may only last about a month. Tomatoes, avocados and peppers have a shorter shelf-life; keep them out of the refrigerator but be prepared to incorporate them in to weekly meals during harvest time.

Fruits and vegetables ripened or stored on the countertop should be placed away from direct sunlight to prevent produce from becoming too warm. You can reduce moisture loss from the produce by storing in vented plastic bowl or

perforated plastic bags. Do not put produce in sealed bags because this will slow the ripening process and increase the likelihood of decay due to accumulations of carbon dioxide and depletion of oxygen inside the bag.

For more information on storage, refer to **Table 3.5 and Table 4.1**

References

Cantwell, M.I. and R.F. Kasmire. 2002. Postharvest Handling Systems: Underground Vegetables (Roots, Tubers, and Bulbs) p. 435-443. In: A.A. Kader (ed.) Postharvest technology of horticultural crops, University of California . ANR Publication 3311.

EXERCISES:

1. *Print and hand out the table developed by UC Davis Postharvest Technology Center on storing fruits and vegetables for better taste: http://ucce.ucdavis.edu/files/datastore/234-1920.pdf. Ask participants if there were any surprises on the table and allow them to talk through and hypothesize why the science-based solutions were different than they had thought.*

2. *Acquire tomatoes before the presentation. Place some tomatoes in the refrigerator and some at room temperature. Have a taste test.*

Table 4.1 Storing Fresh Fruits and Vegetables for Better Taste. *Source: UC Davis Postharvest Technology.*

Storing Fresh Fruits and Vegetables for Better Taste			
Storage Location	**Fruits and Melons**	**Vegetables**	
Store in refrigerator	apples (>7 days) apricots blackberries blueberries cherries cut fruit figs grapes nashi (Asian pears) raspberries strawberries	artichokes asparagus green beans lima beans beets Belgian endive broccoli Brussels sprouts cabbage carrot cauliflower celery cut vegetables	green onions herbs (not basil) leafy vegetables leeks lettuce mushrooms peas radishes spinach sprouts summer squashes sweet corn
Ripen on the counter first, then store in the refrigerator	avocados kiwifruit nectarines peaches pears plums plumcots		
Store only at room temperature	apples (<7 days) bananas grapefruit lemons limes mandarins mangoes muskmelons oranges papayas persimmons pineapple plantain pomegranates watermelons	basil (in water) cucumbers^ dry onions* eggplant^ garlic* ginger jicama peppers^ potatoes* pumpkins winter squashes sweet potatoes* tomatoes	

* Store garlic, onions, potatoes, and sweet potatoes in a well-ventilated area in the pantry. Protect potatoes from light to avoid greening.

^ Cucumbers, eggplant, and peppers can be kept in the refrigerator for 1 to 3 days if they are used soon after removal from the refrigerator.

SECTION 5

FOOD SAFETY & PRESERVATION

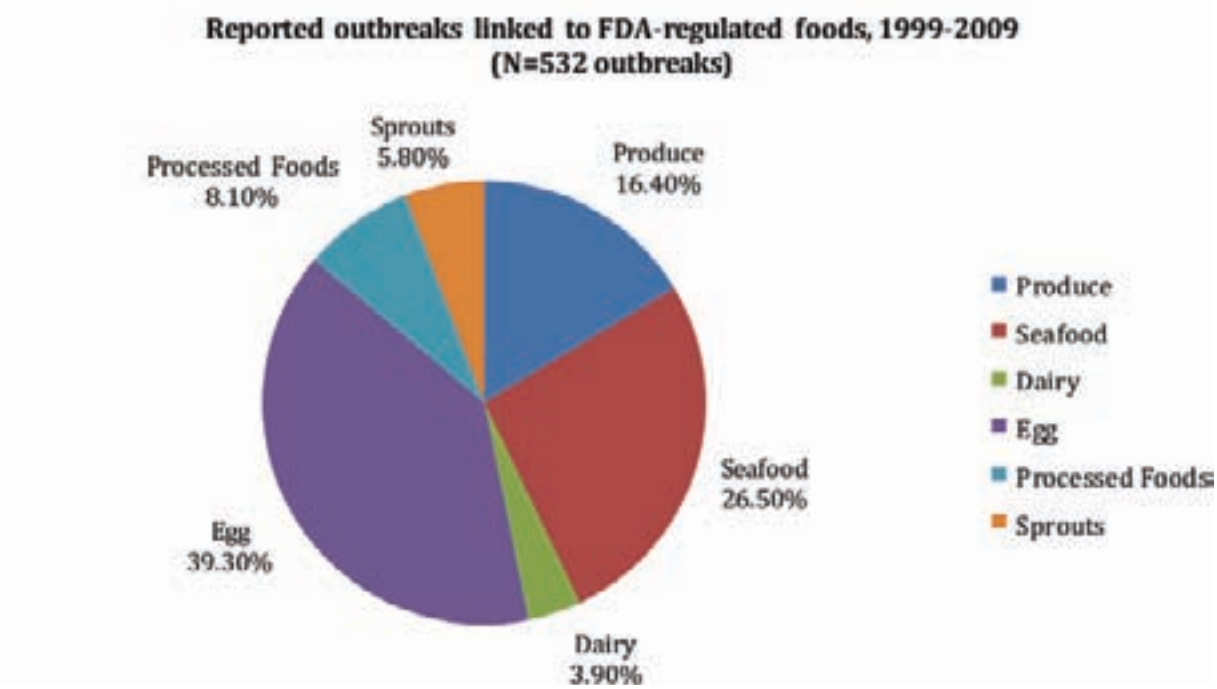

Figure 5.1 Reported outbreaks linked to FDA-regulated foods by vehicle, 1999-2009 (N-532 outbreaks). *Source: FDA CFSAN, 2011.*

Overview

Food safety is arguably the most important facet of the edible landscaping discussion. Because the purpose of an edible landscape is to produce healthy food for self, family, friends and neighbors, food safety guidelines must be considered before planting takes place. Expectations for home-grown food are the same as food purchased at a farmer's market or grocery store. Food items should be fresh, safe, grown in a wholesome environment, harvested hygienically and stored under sanitary conditions.

Introduction of foodborne pathogens (organisms that cause human illness) onto produce can occur at any point from the time the seed is planted through the time the product is consumed at the dinner table. Very small numbers of these pathogens can cause illness in susceptible individuals. Contamination of fruits or vegetables with microbial pathogens may result from contact with one or a combination of the following: contaminated water, animals carrying the pathogens, uncomposted or inadequately composted soil amendments and people (because people can shed pathogens or move them from place to place on hands or clothing). Preventing contamination of fruits and vegetables is key as it is generally accepted that once produce is contaminated, pathogens are exceptionally difficult to eliminate if the items are consumed fresh (not cooked - proper cooking will eliminate the pathogens in most cases). Food safety in the edible landscape should be an integral part of the planning stages from before the plants are planted through harvest and storage of the food. Because contamination can occur over a broad range of activities the general approach is to evaluate the potential risks and work to minimize those risks.

Food Safety learning objectives:

- Fruits and vegetables are a very important part of a healthy diet.
- Fruits and vegetables can be a source of foodborne illness.

- Common sources of foodborne pathogens (microorganisms that cause illness) in produce include:
  - » Water
  - » Animals: wild and domestic
  - » Soil amendments (especially animal-based)
  - » People
- Preventing contamination is key because removal of contaminants is difficult.
- Evaluate and mitigate risks from pre-plant to harvest of the edible landscape.

Ensuring Microbiological Safety

For the purpose of this document, food safety in the edible landscape will be discussed for garden planning, plant growth, produce harvest and post-harvest handling.

Planning

Site Selection

When choosing a site for any type of edible landscape, it is important to know the history of the land. This is particularly important for community gardens but may also be an issue in the home garden. Was there prior land use that could have left chemical, physical, or microbiological hazards lingering on the site? If the previous use included a septic system, heavy use of chemicals or animal farming operations, it would be prudent to be cautious, as residual microbial or chemical hazards may be present. Examine the site for visible hazards. In some cases, soil testing for heavy metals may be appropriate.

In addition to knowing the history of a site, gardeners should be aware of how neighboring landowners are making use of their properties. It is important to determine whether the neighboring property could be a source of contamination caused by unintentional runoff from their property into the garden. Inquire about the surrounding properties to determine what, if any, contaminants might cause issues after the garden is planted. Valuable questions include, how is the neighboring land used? Will something be built next to the property line in the near future? What is the zoning for the adjacent property?

It is also important to know about existing structures in the proximity of your edible landscape. Is there a septic tank? Plumbing lines? Will you have access to safe water and a restroom facility? These considerations are particularly important when choosing an area for planting a community garden, away from the conveniences of a gardener's personal residence.

Some other questions to consider during the planning phase

Community Garden. *Credit: Rick Bradley, photo used under Creative Commons Attribution License.*

Table 5.1 Water Types and Sources.

Source	Definition	Notes
Municipal Water	Water that originated as ground or surface water and has been treated for public use.	Should be considered drinkable (potable) and therefore safe to irrigate produce.
Well Water	Underground water that has been in contact with soil and pervious rocks.	Should be tested on a regular basis; should examine the integrity of the well to avoid surface run off or soil infiltration.
Surface Water	Overflow from rivers, lakes and streams.	This fluctuates throughout the season and should not be a regular source of irrigation for produce.
Rainwater	Water that has fallen as rain and contains little dissolved minerals.	When collected and stored correctly, should be considered safe to irrigate the edible landscape.
Graywater	Wastewater from laundry, bathroom sinks and showers.	Graywater is a potential source of human pathogens and should not be used to irrigate the edible landscape.

of your edible landscape project include:

- Who will maintain the edible landscape?
- Who and what have access to the garden?
- Who will harvest the produce? How?
- What process will be used for harvesting and storing the produce safely?
- How and where is the food being handled after harvest?

Considering these questions during the planning phase of the edible landscape can pave the way to a healthy and enjoyable gardening experience.

Water Source

Water can quickly and efficiently transfer contaminants to produce so it is critical to know that your water source is clean. Water quality will be discussed several times in this section as safe water is important for irrigating plants, hand washing as well as post-harvest produce washing. There are a number of potential water sources for garden irrigation. See **Table 5.1** for additional information.

A gardener should note that even clean water could become contaminated if the water delivery system is not sound. Check that all hoses, pipes, and containers in contact with irrigation or wash water are clean and in good condition.

Cattle. *Credit: Stuart Heath, photo used under Creative Commons Attribution License.*

SEM image of E. coli. *Credit: National Institute for Health.*

Pre-Harvest Food Safety

Water

Gardeners have two general methods for delivering water to their plants: foliar application (spray) and soil application (drip). In a foliar application, water can come into contact with the edible parts of a plant and, therefore, the water used should be from a safe, potable, source. This is particularly critical when the water is applied close to harvest. This also applies to plants that yield produce with peels that may not be consumed such as melon or citrus because contamination from the rind can be easily transferred to the edible flesh. If the only available water is of less than potable quality, drip irrigation is a safer option. Water applied by drip is less likely to come into direct contact with the edible portions of the product, especially if the crop is grown in close proximity to the ground. However, the drip system must be adequately maintained to avoid leaks and pooling of water.

Soil Amendments and Supplements

For information on soil amendments and fertilizers, refer to Section 3, *Planting & Maintenance*. With regard to food safety and its relationship to soil management, what you use to enhance your soil nutrient status could have a negative impact on the safety of your harvested produce by introducing foodborne pathogens to the garden environment. See the list below for typical soil amendments and how they can be safely used in the landscape.

- Compost
  Compost is organic matter that has decomposed and can be recycled into the landscape as soil amendment. In general, there are two types of compost, material from animal sources and material from plant sources.

  » **Animal Sources (manure)**

  Composted/Heat Treated: The use of properly composted manures is recommended over the use of raw manures. Properly composted or heat treated manure fertilizers are unlikely to be a source of pathogens. Guidelines to optimize pathogen reduction in compost can be found in other sections of this document. Manure from many types of animals can be safely composted, however, manure from pigs, dogs and cats should not be used, as parasites may remain viable and infectious to humans even after proper composing. Maximize the time between the application of composted animal manure to garden areas and harvest.

  Fresh: Raw material can be a potential source of pathogens and should not be used on or around edible plants. Be careful not to contaminate edible crops when applying uncomposted manure to other landscape areas or plants. If fresh manure is going to be used it should applied at least 60 days before planting (preferably longer) and should be incorporated into the soil, not left on the soil surface. Pathogens survive longer in manure left on the surface and are more likely to come into contact with people. The opportunity for runoff contamination is greater as well. Do not apply manure after seeding or transplanting edible plants.

  Manure Slurries or Manure Teas: The potential for direct or indirect contamination of produce should be evaluated and reduced when using these products.

Chickens in an edible landscape. *Credit: Hardworking Hippy, photo used under Creative Commons Attribution License.*

» Vegetative Sources

These typically consist of grass clippings and plant waste from the kitchen or garden.

- **Green Manures**
  Green manures are cover crops grown to add nutrients and organic matter to soil. When these cover crops are chopped and incorporated into the soil, they become green manure.

- Manure/Compost Tea
  Manure or compost teas are made using finished compost (either animal or vegetative) and water. Finished compose is placed in an over-sized tea bag and allowed to brew in water with the aid of the sun. The liquid is then strained (if needed) and used as fertilizer-enhanced water. Manure or compost teas should be used with extreme caution (ANR publication 8101). The use of fresh or unfinished manure in slurries or teas is not recommended.

Chemical Pesticides & Fertilizers

When mixing, spraying and cleaning up chemical applications in the landscape, it is critical to follow all label instructions. The pesticide label contains important information about the pesticide application method and rate, required personal protective equipment and disposal of extra material. The label will also list the time between application and safe re-entry as well as the time before the food can be safely harvested (pre-harvest interval). Detailed information about the permitted use of the pesticide can be found in the label as well. Gardeners must make sure the product being applied is registered for both the crop and the targeted pest. Always read and understand the pesticide label before using a pesticide in the edible landscape.

Animal Access

As discussed previously, fresh un-composted animal manure should not be used near edible plants. Therefore, it follows that the presence of domestic and wild animals in the garden must be addressed. Wildlife, pets, and of course farm animals (even those that appear healthy) can be carriers of a variety of pathogens including those that cause foodborne illness. If it is impossible to exclude domestic animals near the garden, efforts should be made to minimize or restrict their access to edible plants. Pet owners should consider designating an area outside of the edible landscape for their family pets. Because runoff from fecal deposits could spread disease in edible landscapes, a system for managing and containing animal waste should be in place.

Although wildlife is not as easily controlled, efforts should be made to also exclude roaming deer, birds, rabbits, rodents, and wildlife from edible landscape areas. Implementation of an integrated pest management plan can reduce the presence of unwanted animals. Unwanted animals are more likely to be attracted to the area and persist if shelter and food are available to them in the landscape. Minimizing or eliminating harborage for animals, keeping vegetation at the edges of edible plots to a minimum, eliminating animal food sources by harvesting ripe produce, discarding overripe produce, and prematurely dropped product and keeping a clean workspace can reduce the appeal of the garden to wildlife.

Harvest

Hygiene

Proper hygiene is a valuable component of keeping a food supply safe for human consumption. Conveniently located and well-maintained washrooms and toilets make it easy for people to practice good hygiene. If the edible landscape site happens to be in a public space that does not have a permanent facility, consider the addition of a portable restroom and hand washing station that will be maintained. Every site must also have an up-to-date first aid kit with bandages. When a gardener suffers a scrape or cut, wounds should be covered before resuming work in the garden. Along those lines, if a gardener is ill and symptomatic (sneezing, diarrhea or vomiting), he/she should stay away from edible plants; preferably out of the garden.

In addition to personal hygiene guidelines, it is important to note that hygiene extends to equipment and personal

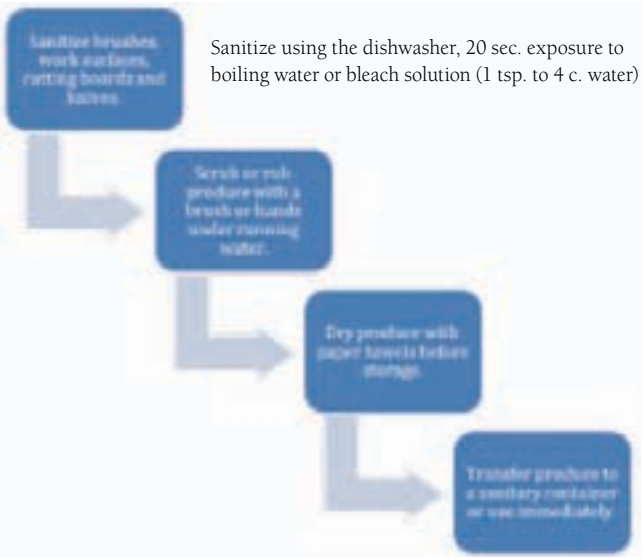

Figure 5.2 Washing Fresh Produce After Harvest.

protective items. All personal protective and gardening equipment should be kept clean and in good condition. Gardening equipment such as shovels and buckets used for activities such as maintaining compost piles or removing dead animals should not be used around edible plants unless thoroughly cleaned with warm or soapy water to remove soil, microorganisms, pesticides, and grease and then sanitized to eliminate any pathogens that might be present. Tools used to prune or harvest produce such as clippers and knives should also be cleaned and sanitized before they are used (**Table 5.2**). Likewise, when handling unsanitary materials, a separate set of gloves (such as disposable latex or nitrile gloves) should be used and kept away from garden gloves that come in contact with produce.

For other antimicrobials or sanitizers always follow the label directions. The sanitizer should be appropriate for use on food contact surfaces or utensils. Note that some treatments may be corrosive to typical garden tools that have not traditionally been designed with food safety in mind. Tools should be dried with a clean towel and lubricated prior to storage to prevent rusting.

Post-Harvest Handling

Water

Water quality is also important after harvest when fruits and vegetables are washed. Here again, it is important to only use potable water when washing produce items, even if they have a rind or skin that you do not intend to consume. Once produce is contaminated, it is difficult

Table 5.2 Options for cleaning and sanitizing tools and containers that come into contact with food

Clean (remove soil, microorganisms, pesticides and grease)				
Method	**Material**	**Process**	**Temperature**	**Time**
Wash by hand	Soap and water	Wash well and rinse with clean water	Warm	As needed
Dishwasher	Dishwasher detergent	Sanitize cycle or regular	Auto	Auto
Sanitize (eliminate pathogens that might be present)				
Method	**Material**	**Process**	**Temperature**	**Time**
Household bleach	1 Tbsp/gallon	Submerge	25°C (77° F)	1 minute minimum
Hydrogen peroxide	3% hydrogen peroxide	Submerge	55°C (131°F)	1 minute minimum
White vinegar	5% vinegar	Submerge	55°C (131°F)	1 minute minimum
Alcohol wipes	Sani Wipes or other brand	Thoroughly wipe surface and air dry	N/A	N/A
Dishwasher	Regular detergent	Sanitize cycle	Auto	Auto
Dishwasher	Chlorine based detergent	Regular cycle	Auto	Auto
Only for use on tools that DO NOT come into direct contact with food				
Lysol	Lysol Concentrate Disinfectant	Use as directed	N/A	N/A

Top Safely preserved dried fruit. *Credit: Melissa Gable.*
Bottom Safely processed jam. *Credit: Melissa Gable.*

to eliminate pathogens. Washing serves to remove visible contaminants but is not as effective at removing microscopic organisms such as bacteria.

Washing Fruits and Vegetables

Fruits and vegetables should always be washed (**Figure 5.2**), even those that come from the consumer's own garden or a farmer's market. Generally speaking, the quality and safety of fruits and vegetables is best preserved if washing occurs just before cooking or eating. Washing introduces water to the produce, which can facilitate the growth of spoilage organisms. Of course if harvested products (such as carrots) are very dirty you may prefer to wash them before storing them in the refrigerator. Items washed in advance may last longer if dried with a clean towel prior to refrigeration.

Washing under running water is preferred over washing in a sink full of water. Washing in batches can result in one contaminated item spreading microorganisms to other items in the batch. When washing produce, dish soaps and detergents are not recommended because they are not designed for this use and chemical residues may remain on the fruits and vegetables. The safety of these residues has not been evaluated. Produce-specific cleaning products are widely marketed; however, the ability of these solutions to reduce microbial populations has not been standardized so it can only be assumed that they help remove soil particles.

Specific washing methods vary depending on the type of produce item. Always begin with a sanitary work area (e.g., sink, countertop) and tools (e.g., brushes, cutting boards, knives). The work area and tools should be cleaned with warm soapy water and sanitized with a substance approved for food contact surfaces (see **Table 5.2**). Generally, fruit or vegetables such as (apples, potatoes or cucumbers) should be scrubbed with a brush or hands under running water and dried with paper towels or clean cloth towel before storage in a sanitary container.

Special handling is required for certain produce items such as those that are leafy or intrinsically more difficult to clean (e.g., raspberries or blackberries). When washing leafy greens, removal and disposal of the outer green leaves (likely the most contaminated) is recommended before washing. Hulls or stems from items like tomatoes, strawberries and peppers are best removed after washing. Cantaloupe can be difficult to clean due to the netted rind. Scrub the rind of the cantaloupe with a clean brush under running water. Dry the melon with paper towels and cut off and discard the stem end (about ¾ to 1 inch). Peel the rind from the melon using a knife and slice the fruit from blossom to stem end before consuming. Leftover melon should be stored in the refrigerator without its peel. Additional information on preparing and storing fruits and vegetables can be found at the UC Davis Food Safety website listed below.

Storage & Preservation

Cut produce should be consumed immediately or refrigerated within 2 hours at typical ambient temperatures and within 1 hour if the temperature is over 90°F. If washed, whole produce will generally spoil faster that unwashed produce because of the addition of moisture. Leaving the fruit or vegetable unwashed until just before consumption is usually recommended. However, there are circumstances where washing prior to storage may be appropriate, especially for produce items with longer shelf life (e.g., winter squash, carrots) or those that have a significant amount of soil. Thorough drying after washing is critical to prevent spoilage. While some fruits and vegetables are best stored at cooler temperatures to preserve quality, others are best stored at

room temperature. Refer to **Table 4.1** for proper storage practices of a variety of fruits, melons and vegetables.

Long-term storage of produce can be achieved through freezing, drying, fermenting, pickling and canning. Refer to the UC Davis food safety website under home preservation for brochures and links to information describing long-term storage options for a variety of fruits and vegetables.

References:

Table 5.2

Teviotdale, B.L., M.F. Wiley and D.H. Harper. 1991. How disinfectants compare in preventing transmission of fire blight. Calif. Agric. 45:21-23.

Yang, H., P.A. Kendall, L. Mederios, and J.N. Sofos. 2009. Inactivation of Listeria monocytogenes, Escherichia coli O157:H7, and Salmonella Typhimurium with compounds available in households. J. Food Prot. 72(6): 1201-1208.

EXERCISES:

1. *Invite a UC Master Food Preserver to your workshop to give a demonstration of preservation.*

2. *Have participants make a list of possible contamination places in their own landscapes or homes with a list of how to prevent contamination from occurring.*

RESOURCES:

http://ucfoodsafety.ucdavis.edu/UC_Publications/UC_Home_Preservation_and_Storage_Publications/)

http://www.fda.gov/Food/ResourcesForYou/Consumers/ucm114299.htm

http://www.fightbac.org/storage/documents/flyers/producebrochure.pdf

SECTION 6

PUBLIC & PRIVATE POLICIES

Overview

Policies that affect edible landscaping can involve many things including land use, food safety, and water use. They can be either public or private, put in place by federal, state, city or even community (e.g., Home Owners Associations) governing bodies. For example, public policies regulate air emissions and therefore the tools we use to maintain edible landscapes. Public policies may regulate quantity and quality of our water supply and therefore the amount and type of fertilizers and pesticides that can be applied to our gardens. Both public and private policies affect the food we eat by regulating how it is harvested, distributed and sold. These regulations are put in place to keep people safe and ensure we have high quality air to breathe, safe water to drink and nourishing food to consume.

Public & Private Policy learning objectives:

- Know local public and private land use policies that might affect edible gardens on private property.
- Know local public policies from the County Department of Environmental Health regarding donations of food from non=commercial sources.
- Understand local public policies regarding water use for an edible landscape, including water budget, pricing, water capture, and graywater.

Categories of Policies

Land Use

Public and private policies may be triggered based on how much of a landscape is edible and how much is ornamental. Please refer to Section 2, *Design,* for guidelines as to what constitutes an edible landscape.

Public Policies/Restrictions

The focus of most public policy is on community gardens rather than residential landscapes. As a reminder, a community garden is defined in Section 2 as any piece of land gardened by a group of people rather than a single family or individual. It is important to check with city and county planning departments for local policies affecting residential landscapes. These policies may relate to setbacks (distance from the street), the height of vegetation in front and back yards, and maintenance.

In addition, public policies may require specific plant materials such as trees for new landscape development. In some cases, public policies may place limits on the type of restrictions that may be included in restrictive covenants.

Private Policies/Restrictions

Covenants, Conditions, and Restrictions (CC&Rs) are limitations and rules placed on a group of homes. These confines are typically adopted by neighborhood associations and homeowner associations but can also be put in place by a builder or a developer. CC&Rs can regulate anything from house color to the presence of basketball hoops over a garage. When it comes to landscapes, it is important to be aware of CC&Rs that include an approved plant list or regulations regarding the placement of fruit trees and or vegetable gardens. Residents who disobey CC&Rs can be fined and required to retrofit their landscapes. All condos and townhomes adopt CC&Rs, and so do most planned unit developments and neighborhoods.

Food Safety

It's not unusual for a gardener to produce fruits and vegetables in over-abundance. In fact, many gardeners plan for this and preserve food for later months or share it with their neighbors. In some cases, gardeners may have the option to donate or sell their produce. However, they must be aware of policy regulating these activities and recognize that in some cases, donating or selling produce may not be a feasible option for a prolific harvest.

Donating Produce

Before donating produce, a gardener should check on government policy through the local county Department of Environmental Health. Foodborne illness can be a life-threatening situation and there are numerous examples of illness associated with consumption of fresh produce. This is especially true for the elderly, children, and immune-compromised individuals. Individual organizations may have food safety policies that restrict acceptance of some types of foods.

Sometimes, policies in place to prevent the spread of plant pests may also prevent donations. For example, Light Brown Apple Moth is an invasive pest causing major damage to certain crops. In order to restrict the pest

range, the California Department of Food and Agriculture can define quarantine zones. Within a quarantine zone, host plants and host plant material cannot be donated or sold without an authorized certificate. If a home gardener lives within a quarantine zone for Light Brown Apple Moth, they would be prohibited from distributing their crop outside of that zone.

Prior to offering donated produce, gardeners should also check with their target organization regarding institutional policy. A standard guiding principle is that produce must be received defect free, must have a minimum 3-day shelf life, and must arrive in a clean container.

Selling Produce

Most gardeners with edible landscapes do not sell their produce. An individual that intends to raise fruits and vegetables for sale would typically fall under the classification of small, residential, or lifestyle farm. This document will not cover the sale of fruits and vegetables in depth. For county regulations, contact the appropriate County Department of Environmental Health or Agricultural Commissioner's office.

Water Use and Conservation

Budget

In many urban areas the local water purveyor (water district, municipal utility, etc.) institutes commercial and residential water budgets that quantify the amount of water needed for indoor (drinking, cooking, laundry, toilet flushing, etc.) and outdoor (irrigation, washing cars, etc.) uses. Typically the indoor and outdoor portions are combined to formulate an overall water budget for each billing period. Water budgets are intended to encourage water conservation by establishing just the amount of water a commercial enterprise or residence should need to meet its normal indoor and outdoor demands.

Landscape water budgeting

Landscape water budgeting is the estimation of the annual water needs for irrigating a landscape. This requires doing some math and having knowledge of the details of the landscape. These details include:

- The annual historical reference evapotranspiration (ET_0) of the area in which the site is located. This information can be found at the web site for the California Irrigation Management Information System (CIMIS) at wwwcimis.water.ca.gov (ET_0 Zones Map - http://wwwcimis.water.ca.gov/cimis/pdf/CimisRefEvapZones.pdf).
- Within each hydrozone, the area serviced by a single irrigation valve, the following additional information:
  - » size of the landscaped area, including the sizes of lawns, beds, swimming pools and spas, water features, vegetable gardens
  - » types and quantities of plants, with associated Plant Factors (from WUCOLS, http://www.water.ca.gov/wateruseefficiency/docs/wucols00.pdf)
  - » irrigation type

Using this information, an estimate of the Maximum Applied Water Allowance (MAWA) for irrigation is calculated for the year. The Statewide ordinance that regulates this is the Model Water Efficient Landscape Ordinance (MWELO) which is discussed later in this section. This regulation is enforced by the agencies that issue building permits. However other agencies, such as water purveyors, may use the regulation to encourage landscape water conservation practices.

The Ordinance allows 70% of ET_0 (0.7 ET_0) for the entire landscape area (LA). Recognizing the higher water needs of edible landscapes, the ordinance classifies edible portions of landscapes as Special Landscape Areas (SLA) and allows 100% of ET_0 (1.0 ET_0) to be budgeted for those areas. In other words, an additional 0.3 ET_0 can be budgeted for the edible landscape areas in addition to the 0.7 ET_0 already allowed.

For example, let's create an annual water budget for a home with a landscape at of 10,000 square feet that includes a vegetable garden of 1,000 square feet. Of the entire landscape, 9,000 square feet can receive no more than 0.7 ET_0. The 1,000 square foot vegetable garden is considered to be an SLA, so an additional 0.3 ET_0 can be applied to this area for a total of 1.0 ET_0.

The annual budget for this landscape would be:
ET_0 * (0.62 conversion factor) * [(0.7*LA of 10000 sq ft)+(0.3*SLA of 1000 sq ft)].

For a city like San Luis Obispo, where annual ET_0 is 43.80 inches, the maximum applied water allowance is 198, 300 gallons. That becomes the water budget for the year. For more details, see the references on MWELO *http://www.water.ca.gov/wateruseefficiency/docs/MWELO09-10-09.pdf.*

See **Table 6.1** for additional calculations of MAWA water budget using both edible and traditional landscapes.

Watering Restrictions

Comparisons Of Statewide MAWA Water Budget When Edibles Are Added To A Traditional Landscape

CIMIS Zone 18: Coachella Valley Low Elevation Desert (annual historical ETo = 71.0 in)

Hypothetical Landscape Area = 5,000 sq ft

MAWA = (Eto) (0.7)* (LA) (0.62)**

MAWA = (71.0) (0.7) (5,000 sq ft) (0.62)

MAWA = 154,000 gallons per year

*ET Adjustment Factor

** Conversion factor from inches to gallons

Same landscape above but with 25% edibles and 75% ornamentals:

MAWA = (71.0) (.7 x .75 + 1.0 x .25) (5,000) (0.62)

MAWA = 170,578 gallons per year

CIMIS Zone 1: Coastal Plains: 33.0 inches

Hypothetical Landscape Area = 5,000 sq ft

MAWA = (Eto) (0.7)* (LA) (0.62)**

MAWA = (33.0) (0.7) (5,000 sq ft) (0.62)

MAWA = 71,610 gallons per year

*ET Adjustment Factor

** Conversion factor from inches to gallons

Same landscape above but with 25% edibles and 75% ornamentals:

MAWA = (33.0) (.7 x .75 = 1.0 x .25) (5,000) (0.62)

MAWA = 79,283 gallons per year

CIMIS Zone 6: Los Angeles Basin: 49.7 inches

Hypothetical Landscape Area = 5,000 sq ft

MAWA = (Eto) (0.7)* (LA) (0.62)**

MAWA = (49.7) (0.7) (5,000 sq ft) (0.62)

MAWA = 107,849 gallons per year

*ET Adjustment Factor

** Conversion factor from inches to gallons

Same landscape above but with 25% edibles and 75% ornamentals:

MAWA = (49.7) (.7 x .75 + 1.0 x .25) (5,000) (0.62)

MAWA = 119,404 gallons per year

Some purveyors' encourage water conservation by simply restricting the days of the week, hours within a day that irrigation is allowed, and/or specific outdoor water uses (i.e. fountains, hosing down driveways, washing cars may be prohibited). In these situations, there is normally no restriction on the amount of water used and there is no variation in price based on the amount used.

Allocation and Pricing

Water budgets are usually tailored to each residence based on the number of people living in the household and the irrigable area (square footage) available for growing gardens and landscapes. Indoor water requirements are assessed from historical water use data collected by the water industry, while outdoor water requirements are calculated from estimated or actual measurement of landscaped area in combination with historic or current weather data correlated to plant water demand. Thus, the indoor budget portion remains for all billing periods, and the outdoor budget portion varies depending on local weather conditions that occur in each billing period, peaking in summer months. Water budgets are commonly combined with tiered water rates to reward customers that stay within their water budgets and discourage water waste. In tiered rates, water used within the budgeted amount is priced the cheapest and water used in excess of the budgeted amount is priced significantly and progressively higher (i.e., double or triple the cost of the lowest tier) as usage exceeds set percentages of the budgeted amount.

Water Capture and Conservation

As discussed in Section 3, *Planting & Maintenance*, there are many innovative means to capture and reuse water. Two water reuse practices, rainwater harvesting and graywater irrigation, have been discussed. As water reuse gains popularity in the United States, science will help to inform the guidelines from which policy and regulation related to water capture and conservation will evolve.

Before undertaking a rainwater harvesting project for irrigation use, it is important to check state and local regulations and codes. The Environmental Protection Agency has policy concerning how to protect human health when rainwater is intended for drinking or bodily contact uses. However, when rainwater is stored for irrigation use, these EPA regulations do not apply. Every state has regulations, or codes, related to building, electric, plumbing, zoning and stormwater. Any of these codes can discourage or forbid rainwater harvest. If codes do not prohibit

rainwater harvest, an interested individual should also check their local municipal codes or community Covenants, Conditions & Restrictions (CC&Rs) related to the aesthetics of a harvest system. Storage tanks are often regulated as to their size and placement.

Graywater use is also gaining reputation as a productive re-use of water from laundry, bathroom sinks and bathing. Graywater does not include waste water from kitchen sinks or dishwashers (from California Graywater Standards). As previously discussed, when graywater is intended for landscape use, household products used and incorporated into that water should be all-natural and biodegradable so as not to negatively affect soil fertility. However, the long-term effects of graywater on soil, plant, and ecosystem wellness have not been scientifically evaluated.

Government regulation governing graywater use for landscape irrigation is still developing. As the practice gains wider support, science is assessing the risks and benefits of the practice in order to inform regulation and ensure both human and environmental safety. In some states where graywater is considered to be sewage, the use and disposal of this water is strictly regulated. In these places, greywater is not allowed for use in irrigation. In the State of California, subsurface drip irrigation with graywater is an allowable and acceptable practice. This is a part of the State Plumbing Code. The Environmental Protection Agency has helpful rules and design guidelines for graywater re-use systems available online (http://www.epa.gov/). As these regulations are for landscape irrigation, the use of this water for edible plants may require additional considerations. Graywater should only be used on ornamental plants and should not provide water for edible plants.

Model Water Efficient Landscape Ordinance (MWELO)

The Model Water Efficient Landscape Ordinance (MWELO) became law in January 2010 and was developed in response to Assembly Bill 1881, the Water Conservation in Landscaping Act of 2006 (Laird). The ordinance mandated local jurisdictions to adopt the water conservation provisions included in MWELO or enact their own equally effective landscape water conservation ordinance. MWELO sets the maximum amount of water that can be applied to landscaped area (water budget). Depending on whether or not a jurisdiction adopted the MWELO or developed its own ordinance, a given local landscape water budget may vary from MWELO or specific landscape water budgets may not be assigned.

In addition, MWELO requires a permit for new or rehabilitated landscapes larger than 5,000 square feet for homeowner-installed projects and 2,500 square feet for developer-installed projects. The permit requires calculating the estimated irrigation water needs of landscape plantings. Again, local ordinances may or may not include these provisions depending on whether or not the MWELO was adopted or an equally effective ordinance was enacted.

For more information on MWELO, resources include the Department of Water Resources, local water providers, county Cooperative Extension Offices and the CA Center for Urban Horticulture.

EXERCISES:

1. *Invite someone from the county's agricultural commissioner's office or environmental health department to speak at your workshop about policies that are specific to your region that address land use, food donations and/or water use.*

2. *Use the UC Survey Tool available on your ANR Portal to survey your Master Gardeners regarding the prevalence of potential restrictions from private Homeowner's Associations or Covenants, Codes and Restrictions within your Master Gardener group as a way to understand what's happening in your area.*

3. *Check out the Turning Point audience participation software from the Master Gardener Program Statewide office at http://ucanr.org/sites/mgcoordinator/Training_/Turning_Point_Devices/ or, if available, your county program and use these in your edible landscape workshops.*

SECTION 7

TEACHING ADULTS, ASSESSING LEARNING STRATEGIES,EVALUATING AND MAKING IMPACT

Objectives for Section:

1. Understand and articulate adult learning expectations
2. Understand and are able to create suitable teaching strategies for teaching adults
3. Learn how to write learning objectives/impact statements
4. Develop one impact statement for county workshop

> ***"Education, in order to accomplish its ends both for the individual learner and for society must be based upon experience – which is always the actual life-experience of some individual."***
>
> **– John Dewey, 1938**

Teaching Adults

Adult learners are motivated to change their perceptions by many things. Adult learners may only change their previously learned behavior after they have had time to reflect on how the new information they have learned works within their own schema (Mezirow, 1997). Adults base their decisions, in part, on their current values and beliefs – their frame of reference (Mezirow 1997). To change or influence adult perceptions, educators must allow adults to reflect on their old experiences before incorporating new ideas. The presentation of new ideas may not be enough for adults to form new behaviors but presentations of new ideas combined with hands-on activities and reflection through continued interaction may affect change (Mezirow 1997, Taylor 1997) particularly in areas of sustainability (Kerton and Sinclair 2010).

Learning Strategies

There have been many models of learning that incorporate experience and reflection; two components of learning that are important for adult learners. One model, developed by Jones and Pfeiffer (1973) contains five steps. Participants (1) experience an activity and then educators facilitate an open-ended reflection where participants (2)share, (3)process, (4)generalize, and then (5) apply what they've learned to a new situation (either through group discussion or a new experience). Educators should plan enough time after the activity: "the next four steps of the experiential learning cycle are even more important than the experiencing phase" (Pfeiffer, 1985, p. 5).

Jones & Pfeiffer (1973) Experiential Learning Cycle

LEARNING STYLES ASSESSMENT

1. **When I try to learn something that I want to remember, I like to**
   a. Explain the information to someone else
   b. Use a highlighter to emphasize points
   c. Use a chanting rhythm to memorize

2. **I like to learn things**
   a. In a group so I can listen to others
   b. Alone in a quiet place
   c. With one other person using role playing games

3. **I remember things best if I**
   a. Record the information and listen
   b. Make lists and write them over and over
   c. Write things down and read them back

4. **I like to learn using**
   a. Rhymes and chants that I make up
   b. Photographs and diagrams
   c. Labs and demonstrations

5. **Sometimes when nobody is around I will**
   a. Create songs about my hobbies
   b. Draw a picture showing a process I need to understand
   c. Act out information

6. **I remember things most when I**
   a. Hear them
   b. Read them
   c. Say them

7. **I have trouble remembering information if I**
   a. Can't discuss it with others
   b. Can't take notes
   c. Read it but don't talk about it aloud

8. **I remember**
   a. Names
   b. Faces
   c. Names and faces if I can shake hands

Number of "a" answers: _____

Number of "b" answers: _____

Number of "c" answers: _____

WHAT THE ASSESSMENT MEANS

A. Visual and Auditory Learner

- Use combination of sight and sound
- Understand by listening and reading
- Class demonstrations, Diagrams and other Visual Aids (videos, etc.)
- Take notes and read them out loud
- Study groups
- Use rhymes
- Enjoy speaking in class

B. Visual Learners

- Demonstrations, Diagrams, Slides, Charts, etc.
- Take great notes
- Benefit from color codes
- Like to create pictures of processes or events
- Write down explanations and instructions
- Use flash cards
- Need time alone to practice and process

C. Tactile and Auditory Learner

- Enjoy music
- Good on a debate team
- Enjoy handheld games and gadgets
- Use a combination of sound and activity
- Class participation and discussion and activities

It's a Tie?

- Some people don't have one specific dominant learning style
- Learn by reading, hearing, and experiencing new things
- Get bored if the teacher uses only one method in the classroom.
- Interests are broad

Other Strategies

There are a variety of learners and learning strategies that require a varied teaching approach. Some learners understand by doing something active while others prefer to work alone. Class time should be allocated for both of these types of learners. Likewise, some learners enjoy facts while others don't enjoy memorizing the details. Combining these learners in a classroom can be challenging but allowing them to work together will often solve the problem. Finally, some learners require visual diagrams while others learn by listening. Some learners are able to understand something only after watching it occur step-by-step. Global learners tend to understand complex concepts quickly. It is important to remember that everyone learns differently and many people learn differently than the educator.

Type of Learner	Types of Teaching/Outreach for Learner
Visual and Auditory	
Visual	
Tactile and Auditory	
Active	
Reflective	
Sensing	
Intuitive	
Visual	
Verbal	
Sequential	
Global	

Evaluating Classes Mid-Class or Post-Class

It is important to continually monitor a class and be flexible to adjust teaching to different learners. Depending on the size, location, and composition of a class, a quick evaluation may consist of asking the audience to gauge how class is going and what can be improved, using classmates to help instruct struggling students, polling learners, or gauging the general tone of the class.

Creating Impact and Impact Statements

A good impact statement summarizes the difference your efforts have made. It states your accomplishments and creates support for your work. Good statements (1) outline the issue, (2) describe what you did, (3) show the benefits, and (4) give credit to those who did the work.

Examples from eFARS at Virginia Tech (http://www.efars.cals.vt.edu/eFARS/documents/WritingImpactStatements.html):

Because of Virginia Cooperative Extension's Pesticide Safety Education program, 15,000 commercial and private pesticide applicators were trained and certified according to state and federal requirements. The program allowed 15,000 agricultural producers and commercial pesticide applicators to purchase and use both restricted and general use pesticides in Virginia. Because of the program, the risks to public health and the environment were minimized while maintaining crop protection and effective pest control efforts.

The economically devastating plant disease, Asian soybean rust is expected to reach Virginia. With yield losses up to 80% the risk to Virginia's $100 million dollar soybean crop is significant. Extension's first responder educational programs trained 300 agricultural professionals, including extension agents in best management and crop protection strategies. 7 fungicides received emergency registration for use because of Extension's efforts. Because of the Soybean Rust Program, Virginia is prepared to quickly identify soybean rust and will be able to respond to minimize yield losses and economic impacts to growers.

Practice Together
My Impact Statement:

References:

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Table 2.3 Edible Plants for Aesthetics and Productivity

Landscape Function	Types of Ornamental Plant *Many others not listed	Edible Substitute		Suggested Varieties	Design Elements	USDA Hardiness Zones	Sunset Zone	Water Need*	
		Common Name	Latin Name					O	E
Annual - cool season	Agapanthus, Armeria, Eriogonum	Garlic, Onion	*Allium spp.*	Garlic: Burgundy, California Early, California Late, Georgia Crystal, Inchelium Red, Rosewood, Susanville; Onion: Early Yellow Globe, fiesta, Granex, Grano, Southport White Globe, Stockton Red, White Sweet Spanish, Yellow Sweet Spanish; Green Bunching: Southport White Globe, White Lisbon, White Sweet Spanish	Grass-like foliage, with spectacular blooms atop long naked bare stems; use in flower beds, rock gardens, herb gardens, as edging or in containers	3-8	all zones	H	H
Annual - cool season	Ornamental Kale; coleus, annual color beds	Beet	*Beta vulgaris* spp. *vulgaris*	Albina Vereduna, Chioggia, Cylindra, Golden	Attractive foliage with red, purple and gold veins; perfect as an understory planting intermixed with ornamental flowers	2-10	all zones	H	VH
Annual - cool season	Ornamental Kale; coleus, annual color beds	Chard	*Beta vulgaris* ssp. *vulgaris*	Argentata, Barese, Bright Lights, Bright Yellow, Fordhook Giant, French Swiss, French White, Golden Sunrise, Rainbow, Rhubarb, Ruby	Grows upright and straight; strong supportive midribs range in color from white, red, golden, yellow, orange and pink; deep green leaves are often slightly ruffled; ideal as a border, in flower beds or containers	5-10	all zones	H	VH

Table 2.3 Edible Plants for Aesthetics and Productivity (cont.)

Landscape Function	Types of Ornamental Plant *Many others not listed	Edible Substitute		Suggested Varieties	Design Elements	USDA Hardiness Zones	Sunset Zone	Water Need*	
		Common Name	Latin Name					O	E
Annual - cool season	Ornamental Kale; coleus, annual color beds	Cauliflower	*Brassica oleracea* var. *botrytis*	Cheddar, Early Snowball, Graffiti, Panther, Romanesco, Snow Crown	Use in a decorative setting, showcasing the attractive large, blue-green foliage	3-11	A1-A3, 1-24, H1, H2	H	VH
Annual - cool season	Ornamental Kale; coleus, annual color beds	Cabbage	*Brassica oleracea* var. *capitata*	Copenhagen Market, Earliana, Early Jersey Wakefield, Golden Acre, Ruby Ball Hybrid	Leaves are ornamental, curled, ruffled, green, blue-green, red, purple or blue; use in herbaceous borders, flower bed or container	all zones	all zones	H	VH
Annual - cool season	Snapdragons, annual color beds (in the back)	Brussels Sprouts	*Brassica oleracea* var. *gemmifera*	Jade Cross	Compact plants have large attractive green foliage with tall flowering stems adorned with small, round sprouts; use in herbaceous borders, flower bed or container	7-11	A1-A3, 1-24, H1, H2	H	VH
Annual - cool season	Ornamental Kale; coleus, annual color beds	Turnips	*Brassica rapa* var. *rapifera*	Amber Glove, De Milan, Scarlet Queen, White Lady	Attractive foliage with green, red, purple accents; roots vary in size and color; use as an understory planting intermixed with ornamental flowers, bulbs or ground covers	6-11	A1-A3, 1-24, H1, H2	H	VH
Annual - cool season	Ornamental Kale; coleus, annual color beds, middle height	Broccoli	*Brassica spp.*	Calabrese, Di Cicco, Green Comet, Green Goliath, Minaret, Packman, Premium Crop, Romanesco, Waltham 29	Use in a decorative setting, showcasing the attractive large, blue-green foliage	3-10	A1-A3, 1-24, H1, H2	H	VH

Landscape Function	Types of Ornamental Plant *Many others not listed	Edible Substitute		Suggested Varieties	Design Elements	USDA Hardi-ness Zones	Sunset Zone	Water Need*	
		Common Name	Latin Name					O	E
Annual - cool season	asparagus fern, or lacy filler	Carrots	*Daucus carota spp. sativus*	Chantenay, Danvers, Paris Market, Minicor, Nantes, Thumbelina	Lacy, fern-like foliage adds texture intermixed amongst other low growing flowers; grows well in deep well drained beds or containers	4-10	A2-A3, 1-24	H	H
Annual - cool season	various types	Lettuce	*Lactuca sativa*	Butterhead (Bibb): Buttercrunch, Deer Tongue, Marvel, Tom Thumb, Winter Marvel; Crisphead (Iceberg): Great Lakes, Red Iceburg, Reine de Glace; Looseleaf (Cutting): Australian Yellow, Black Seeded Simpson, Lollo Rosso, Slowbold; Romaine (Cos): Crisp Mint, Forellenschuss, Parris Island	Widely adaptable; leaves range in color from bright green to dark green to reds and chartreuse; varying shapes and textures; great for borders, mixed flower beds containers, can be combined with bulbs or ground covers	4-9	all zones	M-H	VH
Annual - cool season	various types	Peas	*Pisum sativum*	Shelling: Little Marvel, Maestro, Tall Telephone; Sugar Snap: Super Sugar Snap; Snow Pea: Mammoth Meltin, Oregon Sugar Pod II	Range from climbing vines to small bushes; bluish-green leaves and white pea-shaped flowers; use in herbaceous border, raised bed or large container; vining types on trellises or over retaining walls	not available	A1-A3, 1-24, H1, H2	M-H	VH
Annual - cool season	various types	Spinach	*Spinacia oleracea*	America, Bloomsdale Longstanding, Giant Nobel, oriental Giant, Tyee F1, Viroflay, New Zealand (summer substitute)	Widely adaptable; leaves range in color from bright green to dark green; varying sizes and textures; great for borders, mixed flower beds containers, can be combined with bulbs or ground covers	6-9	22-24	M-H	VH

Table 2.3 Edible Plants for Aesthetics and Productivity (cont.)

Landscape Function	Types of Ornamental Plant *Many others not listed	Edible Substitute		Suggested Varieties	Design Elements	USDA Hardiness Zones	Sunset Zone	Water Need*	
		Common Name	Latin Name					O	E
Annual-warm season	various types	Kale	*Brassica oleracea* var. *viridis*	Dwarf Blue Curled, Lacinato, Nagoya White, Redbor, Red Russian, Red Ursa, Winterbor	Leaves are widely varied from frilly and crinkled to smooth and velvety; leaves come in a variety of shades of green, red, chartreuse, grey-green and bicolored; use along a border, or intermixed with other annuals; also works well in containers	7-11	all zones	M-H	VH
Annual-warm season	Delosperma litorale, Gazania	Melons	*Cucumis melo, Citrullus lanatus* var. *lanatus*	Cantaloupe/Muskmelon: Ambrosia, Jeny Lind, Minnesota Midget; Honeydew/Crenshaw: Crane, Super dew; Watermelon: Moon and Stars, New Orchid, Sugar Baby, Yellow Doll	Tailing vines or bush type, with small yellow flowers; melons can range in size (3 in. to 2 ft.); varying colors make melons a wonderful addition to any landscape; great interplanted with ornamental shrubs, or grown along a border or large containers	4-11	2-24	L-H	H
Annual-warm season	various types	Cucumber	*Cucumis sativus*	Armenian, Burpee Hybrid, Chinese Cucumber, Early Triumph, Holland, Kidma, Lemon, Sweet Slice	Most have fairly rough, ivy like leaves; flowers are yellow, small and cup shaped; fruits are green and often hide under foliage; plants can be vine-like and trellised along poles, fences, arbors, or arches; or bush-type and planted in ornamental beds amongst flowers, or in large containers on porches, patios or balconies	4-11	all zones	M	H

Landscape Function	Types of Ornamental Plant *Many others not listed	Edible Substitute		Suggested Varieties	Design Elements	USDA Hardi-ness Zones	Sunset Zone	Water Need*	
		Common Name	Latin Name					O	E
Annual-warm season	various types	Squash	*Cucurbita spp.*	Summer: Aristocrat, Clairmore, Early Yellow Crookneck, Golden Dawn, Goldrush, Horn of Plenty, Raven, Ronde De Nice, Sunburst, Sunny Delight, Tromboncino; Winter: Burpee's Butterbush, Buttercup, Cornell's Bush Delicata, Sunshine, Waltham Butternut	Large, rough, ivy-shaped leaves; use bush types in herbaceous borders, raised beds, or containers; vining types on fences and trellises	not available	A1-A3, 1-24, H1, H2	M	H
Annual-warm season	various types	Mint	*Mentha spp.*	Curly mint, Ginger, Orange bergamont, Peppermint, Spearmint, Vietnamese Mint	Delightful smell with various leaf types and colors; confining to containers can help prevent it from becoming weedy	3-11	3-24	M-H	H
Annual-warm season	various types	Basil	*Ocimum spp.*	Anise, Aussie Sweetie, Bush basil, Cinnamon, Green Pepper, Indian Basil, Lettuce leaved, Lime, Magical Michael, Mrs. Burns Lemon, Nufar, Pesto Perpetuo, Purple Bush, Purple Ruffles, Red Rubin, Siam Queen, Sweet basil, Sweet Dani, Thai	Splendid colors, and multitude of leaf shapes and sizes; use as a border accent; in flower beds, herb garden, flower or foliage border, pots and containers	4-10	all zones	M-H	H
Annual-warm season	various types	Parsley	*Petroselinum spp.*	Curly Parsley: Favorit, Forest Green, Moss Curled; Hambug Parsley: Arat; Italian Parsley: Giant Italian, Single, Survivor	Curly parsley has a tight, formal appearance and is great at lining a border, flower bed, or herb garden; Italian and Hambug varieties have flat leaves and compliment most flowering borders herb gardens and containers	3-9	A3, 1-24	M-H	H

Table 2.3 Edible Plants for Aesthetics and Productivity (cont.)

Landscape Function	Types of Ornamental Plant *Many others not listed	Edible Substitute		Suggested Varieties	Design Elements	USDA Hardiness Zones	Sunset Zone	Water Need*	
		Common Name	Latin Name					O	E
Annual-warm season	various types	Bean	*Phaseolus spp.*	Bush: Blue Lake Bush, Beurre De Roquencort, Dragon's Tongue, Greencrop, Landreth Bush, Nickel, Purple Queen, Rocdor, Roma II, Royal Burgundy, Slankette, Strike, Tenderpod; Lima: Christmas, King of the Garden; Runner: Aztec Dwarf Runner, Dwarf Bees, Hestia, Painted Lady, Scarlet Runner, Sunset Runner, White Dutch Runner; Pole: Blue Lake, Dutch White Runner, Emerite, Fortex, Kentucky Wonder, Kwintus, Marvel of Venice, Purple Tepee, Ramdor	Range from climbing vines to small bushes; plants have attractive leaves and pods varying in color from green, yellow, or purple; use in herbaceous border, raised bed or large container; vining types on trellises or over retaining walls	3-10	all zones	M	H
Annual-warm season	Pelargonium, salvia	Tomato	*Solanum lycopersicum*	Classic: Black from Tula, Carmello, Dona, Early Girl, Gold Medal, Lime Green, Orange Strawberry, Santa Clara Canner, Stupice; Beefsteak: Aunt Ginny's Purple, Aunt Ruby's Green, Big Rainbow, Brandywine from Croatia, Cuostralee, Ed's Millenium, Ernie's Plump, Ernie's Round, Green Giant, Hillbilly, Russian 117, Sump of the World; Cherry: Black Cherry, Chadwick, Galinas, Sungold, Sugary, Sun Sugar, Sweet 100, Sweet Chelsea; Cherry: Amish Gold, Amish Paste, Jersey Devil, Opalka, Principe Borghese	Bright green lobed leaves and attractive colorful fruit are highly ornamental characteristics; use in flower border, hanging basket, container or train on trellis, fence or arbor	all zones	all zones	L-M	H-VH

Landscape Function	Types of Ornamental Plant *Many others not listed	Edible Substitute		Suggested Varieties	Design Elements	USDA Hardiness Zones	Sunset Zone	Water Need*	
		Common Name	Latin Name					O	E
Annual-warm season	Erigeron, Penstemon heterophyllus	Eggplant	*Solanum melongena*	Black Beauty, Casper, Ichiban, Neon, Violette di Firenze	Purple flowers, colorful fruits and large downy leaves make it a spectacular specimen; used in a border or ornamental container	9-11	1-24, H1, H2	M	VH
Annual-warm season	various types	Nasturtium	*Tropaeloum spp.*	Alaska, Empress of India, Glorious Gleam, Jewel of Africa, Strawberries and Cream	Beautiful accent to any landscape; large, round leaves provide a backdrop for the brilliant display of flowers ranging in color from yellow, orange, red and cream; reseeds well in warmer climates; use in flower beds, herb gardens, containers, or use a trailing variety in hanging baskets or over retaining walls	9-11		M-H	M-H
Annual-warm season	morning glory, flowering beans, climbing zinnia	Bean, fava	*Vicia faba*	Negreta, Windsor	Attractive leaves with small, white or lavender flowers and brilliant long green, yellow, or purple pods; use bush type to set off showy flowers (sunflowers, salvias, or petunias); use pole types to create arched pathways, cover tepees, privacy screen on chain link fence	7-11		M-H	VH
Annual-warm season	Canna	Corn	*Zea mays*	Early Sunglow, Golden Bantam, Haney and Cream, Kandy Korn, Jubilee, Platinum Lady, Silver Queen	Tall annual, good for architectural diversity in ornamental beds; great as a border, along a fence or screen	4-8	1B, 2B-24, H1, H2	H	VH

Table 2.3 Edible Plants for Aesthetics and Productivity (cont.)

Landscape Function	Types of Ornamental Plant *Many others not listed	Edible Substitute		Suggested Varieties	Design Elements	USDA Hardiness Zones	Sunset Zone	Water Need*	
		Common Name	Latin Name					O	E
Ground cover	various types	Alpine strawberries	*Fragaria vesca*	Alexandria, Improved Rugen, Variegata, Yellow Fruited	Mounds of greenery, showy white flowers; tolerate partial shade; doesn't produce runners; plants fruit all summer; fruit white, yellow and red	3-10	A1-A3, 1-9, 14-24, H1, H2	M	H
Ground cover	various types- azaleas, rhododendrons	Blueberry - lowbush	*Vaccinium angustifolium*	Brunswick, Burgundy, Top Hat	Beautiful pinkish, white clusters of flowers in early spring, before foliage appears; great fall color; ideal as a ground cover in woodland settings, wild garden, or lining a woodland walk	3-7	2A, 2B, 3A, 3B, 4-9, 14-17	M	H-VH
Ground cover	ground covers	Cranberry	*Vaccinium macrocarpon*	Ben Lear, Hamilton, Pilgrim, Stevens, Thunderlake	Compact vines make an attractive ground cover especially under other acid loving plants like blueberries, azalea, and rhododendrons; small, bright green leaves, and clusters of pink, bell shaped flowers; bright red berries; great along pathways; dwarf varieties can be used between stepping stones; most grow well in containers	3-7	1-6, 17	L-M	H-VH
Ground cover	various types	Lingonberry	*Vaccinium vitis-idaea*	Red Pearl, Sanna, Sussi	Compact vines make an attractive ground cover especially under other acid loving plants like blueberries, azalea, and rhododendrons; small, bright green leaves, and clusters of pink, bell shaped flowers; bright red berries; great along pathway or in containers	2-7	2-7, 14-17	L-M	M-H

Landscape Function	Types of Ornamental Plant *Many others not listed	Edible Substitute		Suggested Varieties	Design Elements	USDA Hardiness Zones	Sunset Zone	Water Need*	
		Common Name	Latin Name					O	E
Perennial	asparagus fern, equisetum or tall ornamental grasses	Asparagus	*Asparagus officinalis*	Jersey Giant, Jersey King, Jersey Knight, Purple Passion, UC 157, Viking	Long lived herbaceous perennial; great architectural form; ferny foliage 3 to 5 ft tall; good for walkways, lining a fence; or as a backdrop	2-9	1-24, 29-45	M-H	M-H
Perennial	Butterfly bush (Buddleja sp.),Indigo bush (Dalea sp.), Jerusalem sage (Phlomis sp.)	Artichoke and Cardoon	*Cynara spp.*	Artichoke: Green Globe, Imperial Star (from seed in spring), Violetto. Cardoon: Gigante, Bobbo di Nizzia, Tenderheart	Long lived herbaceous perennial; can also be grown as an annual; large, silvery gray foliage, deeply lobed; use as accent plants along walk or driveway, as a specimen in a planting bed; great architectural form	6-11	8-9, 14-24	M	VH
Perennial	small scale ground covers	Oregano	*Origanum vulgare*	Greek, Sicilian, Verona	Small gray-green leaves with white or lavender blooms; use in herb garden, drought tolerant border, hanging basket, container, or sprawl over a wall;	5-9	4-24	L-M	M
Perennial	acanthus, philodendron, fatsia	Rhubarb	*Rheum rhabarbarum*	Chipman's Canada Red, Cherry Red, Crimson Red, Strawberry, Victoria	Crinkly, rich green leaves with red veins atop rosy red stalks; use in a border, flower bed, as an accent in a container or as a foundation plant	2-8	1-11, 14-24, 26-45	M-H	H
Perennial	canna	Ginger	*Zingiber officinale*		Narrow bright green foliage gives these plants an airier appearance than the strictly ornamental gingers; plants sucker from tuberous rhizome, maintain by planting in containers	7-11	9, 14-14, H1, H2	M	M

Table 2.3 Edible Plants for Aesthetics and Productivity (cont.)

Landscape Function	Types of Ornamental Plant *Many others not listed	Edible Substitute		Suggested Varieties	Design Elements	USDA Hardiness Zones	Sunset Zone	Water Need*	
		Common Name	Latin Name					O	E
Perennial / Annual-warm season	Gaillardia, Galvezia, Salvia	Pepper, sweet	*Capsicum spp.*	Sweet: Apple, Corno di Toro (red and yellow), Karma, Italia, Lipstick, Marconi (red and yellow), Nardello, Orange Sun, Topepo Rosso; Hot: Aji Cristal, Aji Amarillo, Habanero (orange, chocolate), Pimiento de Padron, Piment d'Espelette, Rocoto, Suave Orange	Dark green, glossy foliage and attractive, colorful fruit; use in flower beds, raised beds, herb garden or container	10-11	all zones	L-M	VH
Perennial / Vine	taller hedges such as privet, or photinia, euonyomus	Blackberry	*Rubus* spp.	Apache, Black Diamond, Black Pearl, Black Satin, Boysen, Chester, Thornless Boysenberry, Hull, Kiowa, Logan Thornless, Marion, Navaho, Olallie, Prime-Jan, Triple Crown	Beautiful green foliage, white flowers and purple fruits; great as a hedge or along fence line; must keep properly pruned and trained	5-9	4-9, 14-24	L-M	H
Perennial / Vine	taller hedges such as privet, or photinia, euonyomus	Raspberry	*Rubus* spp.	Bristol, Jewel, Anne, Autumn, Bababerry, Boyne, Canby, Caroline, Fall Gold, Heritage, Kiwi Gold, Royalty, Tulameen	Beautiful green foliage, white flowers and multitude of colored fruits from black, red, purple and yellow; great as a hedge or along fence line; must keep properly pruned and trained	5-9	3-6, 15-17, 36-40, 42	L-M	H
Shrub	dogwood, forsythia	Nanking cherry	*Prunus tomentosa*	also called Manchu cherry, downy cherry, and Chinese bush cherry	Bushes burst with color in early spring with sprays of blossoms that start as pink buds and open to white blooms; fruits are small, but prolific; flavor is tart and sweet; berries range in color from white to dark red; during winter, bark is lustrous and orange -brown, become even more engaging with age	3-6	A1-A3, 1-3, 10	M	H

Landscape Function	Types of Ornamental Plant *Many others not listed	Edible Substitute		Suggested Varieties	Design Elements	USDA Hardiness Zones	Sunset Zone	Water Need*	
		Common Name	Latin Name					O	E
Shrub	various types	Currant - clove	*Ribes odoratum*	Crandall	Produces an abundance of yellow, tubular flowers in the spring that dangle from the branches; flowers smell of clove and vanilla; fruits are blue-black and large; leaves are bluish green and turn plum-purple in autumn; use as a specimen shrub, in ornamental bed, or in container	4-8	A2, A3, 1-10, 14-17	M	M-H
Shrub	various types	Currant - red, white, or pink	*Ribes petraeum, R. rubrum, and R. sativum*	Albatross, Blanka, Champagne, Jonkheer van tets, Primus, Red Lake, White Versailles, Wilder	Beautiful flowers dangle in long clusters from the stems; fruits range in color from white/yellow to pink/red; fruits cascade from stems like fine jewelry; leaves maple like; plants can be trained as small shrubs to espalier	3-7	A1-A3, 1-6, 15-17	M	M-H
Shrub	various types	Rosemary	*Rosmarinus officinalis*	Arp, Golden Rain, Irene, Lockwood de Forest, Majorca Pink, Prostratus, Tuscan Blue	Evergreen shrub that comes in upright and trailing forms; aromatic needlelike leaves are deep green with gray underside; blooms in spring with blue-pink flowers; use as bank cover, ground cover, topiary, herb garden, raised bed, flower bed, border or container	6-10	4-24	L-M	L
Shrub	weigela, lilac	Elderberry	*Sambucus spp.*	American elderberry (*S. canadensis*): Adams, Johns, Nova, York; Blue elderberry (*S. mexicana*): no named varieties; European elderberry (*S. nigra*): Allesso, Black Beauty, Guincho purple, Sutherland Gold, Thunderclound	American and European varieties are less vigorous than native *S. mexicana* and easier to maintain; magnificent clusters of white or pink flowers; foliage green to purple; berries blue-black; excellent hedge, screen or shrub, or trained as a small tree	3-9	2A, 2B, 3A, 3B, 4-7, 14-17	M	M-H

Table 2.3 Edible Plants for Aesthetics and Productivity (cont.)

Landscape Function	Types of Ornamental Plant *Many others not listed	Edible Substitute		Suggested Varieties	Design Elements	USDA Hardiness Zones	Sunset Zone	Water Need*	
		Common Name	Latin Name					O	E
Shrub	various types- azaleas, rhododendrons	Blueberry - Northern highbush	*Vaccinium corymbosum*	Berkeley, Bluecrop, Bluejay, Blueray, Chandler, Duke, Earliblue, Northland, Patriot	Beautiful pinkish, white clusters of flowers in early spring, before foliage appears; great fall color; used in a mixed shrub border, as a hedge, or as a boundary planting; excellent in containers	4-7	2-17	M	H-VH
Shrub	various types- azaleas, rhododendrons	Blueberry - Southern highbush	*Vaccinium spp.*	Georgia Gem, Jubilee, Misty, O'Neal, Reveille, Sharpblue, Southmoon, Sunshine Blue	Beautiful pinkish, white clusters of flowers in early spring, before foliage appears; great fall color; used in a mixed shrub border, as a hedge, or as a boundary planting; excellent in containers	7-10	2-9, 14-17	M	H-VH
Shrub	various types- azaleas, rhododendrons	Blueberry - rabbiteye	*Vaccinium virgatum*	Aliceblue, Beckyblue, Climax, Premier, Southland, Tifblue, Woodard	Beautiful pinkish, white clusters of flowers in early spring, before foliage appears; great fall color; grows to 18 ft tall, makes excellent hedge and screen	7-9	8-9, 14-24	M	H-VH
Shrub - Tree	large shrubs such as English Laurel, gardenia, euonymous, photinia etc.	Citrus	*Citrus* spp.	Grapefruit: Marsh, Oroblanco, Ruby Red; Kumquat: Meiwa, Nagami; Lemon: Eureka, Improved Meyer, Lisbon, Variegated Pink Eureka (Pink Lemondade); Lime: Bearss, Key Lime; Mandarin Orange: Clemenules, Esbal, Fina, Marisol, Dancy, Owari; Pomelo: Chandler; Sour Orange: Bouquet des Fleurs, Seville; Sweet Orange: Hamlin, Moro, Pineapple, Valencia, Washington Navel; Tangelo: Fairchild, Minneola, Orlando, Temple	Great addition to any landscape with many varieties; bright green, evergreen foliage; fragrant white flowers can be a sweet addition to the landscape; orange and yellow fruits decorate the plant in the winter when few other plants have color	8-11	8, 9, 12-24, H1, H2	M	

Landscape Function	Types of Ornamental Plant *Many others not listed	Edible Substitute		Suggested Varieties	Design Elements	USDA Hardi-ness Zones	Sunset Zone	Water Need*	
		Common Name	Latin Name					O	E
Tree	various types	Maple - sugar	*Acer saccharum*	Bonfire, Commemoration, Fall Fiesta, Green Mountain	Spectacular shade tree with blazing red, orange and yellow leaves in the fall; use as a screen or for shade; can be tapped for syrup in late winter/early spring	4-8	A2-A3, 1-9, 12, 14-24	M	
Tree	various types	Pawpaw	*Asimina triloba*	Davis, Mitchell, NC-1, Overleese, Pennsylvania Golden, Rappahannock, Shenandoah, Sunflower, Taylor, Taytoo, Wells, Zimmerman	Tropical appearance, large green leaves droop throughout the season providing visual interest in the landscape; use as a shrub, screen, hedge, or as a specimen tree	5-8	2-21	M	
Tree	redbud, ornamental peach, flowering plum, fruitless pear	Pecan, Hickory	*Carya spp.*	Pecan: Cheyenne, Western-Schley; Hickory: Abundance, fayette, Keystone, Lindauer, Nook, Silvis, Weschcke, Wurth	Large specimen used as shade tree, street tree, or screen; hickory has shaggy bark that is visually appealing and both provide fall color	5-9	8-10, 12-14, 18-20	M	H
Tree	Chinese elm, European elm, fruitless mulberry, valley oak	Chestnut	*Castanea* spp.	Basalta #3, Colossal, Crane, Eaton River, Nevada, Qing, Sleeping Giant	Magnificent spreading tree with sweeping branches; spectacular display of flowers in spring and delicious nuts in fall; grows well in lawns	5-9	2-9, 14-17	M	H
Tree	dogwood, tart cherry, forsythia	Cornelian cherry	*Cornus mas*	Black Plum, Elegant, Flava, Golden Glory, Macrocaarpa, Nana, Pioneer, Red Star, Siretski, Vavilov, Yellow	Produces a profusion of yellow flowers in early spring; followed by satin green leaves that turn mahogany red in the autumn; fruits are abundant and range from red to yellow; fruits start tart but mellow with ripeness	4-8	1-6	M	H

Table 2.3 Edible Plants for Aesthetics and Productivity (cont.)

Landscape Function	Types of Ornamental Plant *Many others not listed	Edible Substitute		Suggested Varieties	Design Elements	USDA Hardiness Zones	Sunset Zone	Water Need*	
		Common Name	Latin Name					O	E
Tree	various types	Filbert (hazelnut)	*Corylus spp.*	American filbert (*Coylus americana*); Chinese filbert (*C. chinensis*); European filbert (*C. avellana*): Barcelona, Clark, Epsilon, Lewis, Halls Giant, Santiam	Large, decorative leaves; nuts are covered with a frilly green covering that can turn pink or burgundy giving the nuts an attractive appearance; grow as a decorative screen or hedge; can be grown as an accent plant but many varieties sucker profusely	4-9	2-9, 14-20	M	H
Tree	redbud, ornamental peach, flowering plum, fruitless pear	Persimmon	*Diospyros spp.*	American Persimmon: Early golden, John rick, Meader, Ruby, Szukis; Asian: Fuyu, Gailey, Hachiya, Jiro, Saijo, Sheng	Leaves are heart-shaped, glossy ; chartreuse in spring, dark green in summer, and red-orange in autumn; attractive, orange fruit dangle in fall; use as specimen tree, shade tree, large shrub, screen, espalier, or as a patio tree	4-10	6-24, H1	M	H
Tree	crepe myrtle, flowering magnolia	Apple	*Malus spp.*	Beverly Hills, Calville Blanc d'Hiver, Cornish Gilliflower, Cox's Orange Pippin, Ein Sheimer, Enterprise, Esopus Spitzenburg, Fuji, Gala, Golden Delicious, Golden Sentinel, Granny Smith, Gravenstein, Honeycrisp, Hudson's Golden Gem, Jonagold, Liberty, McIntosh, Mutsu, Newtown Pippin, Northern Spy, Pink Pearl, Scarlet Sentinel, Winter Banana	Fragrant, showy white to pink flowers; edible fruit; standard or semi dwarf trees are good as shade trees or focal points; genetic dwarfs can be planted into shrub borders, planted in small orchard groups, or grown in containers	3-9	1-11, 14-21	M	H

Landscape Function	Types of Ornamental Plant *Many others not listed	Edible Substitute		Suggested Varieties	Design Elements	USDA Hardiness Zones	Sunset Zone	Water Need*	
		Common Name	Latin Name					O	E
Tree	crepe myrtle, flowering magnolia, flowering crab apple	Apple - crabapple	*Malus spp.*	Centennial Crab, Chestnut Crab, dolgo, Geneva, Whitney	Fragrant, showy white to pink flowers; edible fruit; blossoms and fruit are more showy then apples; make excellent shade tree	3-9	1-11, 14-21	M	M
Tree	fruitless mulberry	Mulberry	*Morus spp.*	King James, Geraldi Dwarf, Beautiful Day, Pakistan, Pendula, Illinois Everbearing	Tropical appearance; many cultivars are especially showy and make ideal accent plants; perfect for lining a walkway, roadway; or as a background for a shrub border	4-11	4-24, H1, H2	M	M
Tree	bird of paradise, windmill or phoenix palms, canna	Banana	*Musa spp.*	Apple, Dwarf Cavendish, Goldfinger, Ice Cream, Lacatan, Lady Finger, Rajapuri, Red Jamica	Tall, narrow tree 6-25 ft tall; leaves can reach 9 ft long and 2 ft wide; bold accent as a specimen planting either in a courtyard, atrium or near a pool; dwarf varieties can be grown in containers	10-11	8-9, 14-24, H1, H2	H	VH
Tree	Evergreen magnolia, bay laurel, English laurel	Avocado	*Persea americana*	*P.a. var. drymifolia*: Bacon, Don Gillogly, Mexicola; *P.a. var. nubigena*: Gwen, Haas, Whitsell; Hybrid: Choquette, Fuerte, Murasige	Large, evergreen tree, provides excellent shade; lush green foliage; flowers not showy; dwarf varieties can be grown in containers, or as a screen	9-11	8-9, 14-24	M	H
Tree	redbud, ornamental peach, flowering plum, fruitless pear, crepe myrtle, Japanese maple	Apricot	*Prunus armeniaca var. armeniaca*	Alfred. Autumn glow, Blenheim, Earlicot, Flora Gold, Goldcot, Gold Kist, Harcot, Harglow, Hargrand, Harlayne, Moorpark, Puget Gold, Scout, Tilton	Showy white flowers; contrast with black bark; leaves nearly heart shaped, bronzy-green in spring and brilliant yellow in fall; fruit range in colors from golden-yellow to purplish-red; make excellent shade tree, focal point, or specimen planting	4-9	2-12, 14-22	M	H

Table 2.3 Edible Plants for Aesthetics and Productivity (cont.)

Landscape Function	Types of Ornamental Plant *Many others not listed	Edible Substitute		Suggested Varieties	Design Elements	USDA Hardiness Zones	Sunset Zone	Water Need*	
		Common Name	Latin Name					O	E
Tree	flowering cherry, flowering plum, fruitless pear	Sweet cherry	*Prunus avium*	Bing, Black Tartarian, Compact Stella, Emperor Francis, Hedelfingen, Kristin, Sodus, Stella, Sweet Ann	Trees have white blossoms in spring; followed by large sweet fruits that range in color from yellow to burgundy; use as a specimen tree, espaliers, or screen	5-9	4-6, 12, 15-17	M	H
Tree	flowering cherry, flowering plum, fruitless pear	Tart cherry	*Prunus cerasus*	English Morello, Meteor, Montmorency, North Star	Trees are more spreading than sweet cherry; white blossoms appear on one year old stems; fruit are bright red to dark burgundy; use as a specimen tree, espaliers, or screen	4-8	A2-A3, 1-17	M	H
Tree	flowering cherry, flowering plum, fruitless pear, flowering tulip magnolia	Almond	*Prunus dulcis*	All-in-One , Garden Prince, Hall's Hardy, Mission, Ne Plus Ultra, Nonpareil	Showy white to pink flowers; edible nut; provides shade for other drought tolerant plants; use as a specimen tree, shad tree; dwarf varieties good in large containers	5-9	2-3, 8-10, 12-16, 19-21	M	H
Tree	various types	Beach plum	*Prunus maritima*	Cotuit, Eastham, Hancock, Jersey, Safford, Snow	Medium sized shrub or small tree to 6 ft; profusion of white flowers in spring followed by small deep blue fruits; use as a low hedge/thicket, shrub border, or trained to be a small tree	3-8	not classified	M	M-H

Landscape Function	Types of Ornamental Plant *Many others not listed	Edible Substitute		Suggested Varieties	Design Elements	USDA Hardiness Zones	Sunset Zone	Water Need*	
		Common Name	Latin Name					O	E
Tree	redbud, ornamental peach, flowering plum, fruitless pear	Peach and Nectarine	*Prunus persica*	Peach: Arctic Supreme, Babcock, Belle of Georgia, Frost, Harbelle, Indian Free, J.H. Hale, La Feliciana, Loring, Madison, Monroe, O'Henry, Red Baron, Redhaven, Reliance, Saturn, Suncrest; Nectarine: Artic Glo, Cavalier, Fantasia, Goldmine, Harko, Honey Kist, Mericrest, Red Chief, Panamint, Redgold, Snow Queen, Southern Belle, Zee Glow	Beautiful blooms in the spring, followed by attractive fruit in the summer; use as a specimen tree, espaliers, screen, shrub, or container plant	5-9	1-16, 18-24, H1	M	H
Tree	redbud, ornamental peach, flowering plum, fruitless pear	Pear	*Pyrus spp.*	European Pear: Bartlett, Beurre Bosc, Blake's Pride, Comic, Flesh Beauty, Harrow Delight, Magness, Moonglow, Seckel, Warren; Asian Pear: Chojuro, Hossui, Korean Giant, Kosui, Seuri, Shinko, Shinseiki, Tsu Li, Ya Li	Beautiful blooms in the spring, followed by attractive fruit in the fall can be used as a specimen tree, espaliers, screen, shrub, or container plant	4-9	2-11, 14-24, H1	M	H
Tree	various types	Jujube	*Ziziphus jujuba*	Lang, Li, Ming Tsao, Mu Shing Hong Tsao, Sherwood, Silverhill, So, Twen Ku Lu Tsao	Trees have glossy green foliage; flowers sporadically all summer; fruits are smooth and mahogany colored; tree spreads by suckers; can be contained by growing in a large container	6-9	7-16, 18-24	M	M

Table 2.3 Edible Plants for Aesthetics and Productivity (cont.)

Landscape Function	Types of Ornamental Plant *Many others not listed	Edible Substitute		Suggested Varieties	Design Elements	USDA Hardiness Zones	Sunset Zone	Water Need*	
		Common Name	Latin Name					O	E
Tree/Shrub	photinia, euonymous, privet, osmanthus,	Pineapple guava	*Acca sellowiana*	Coolidge, One Green World, Pineapple Gem, Nikita	Leaves are dark green to silver; showy spring flowers make this plant an attractive show piece; use as a multi-stemmed tree/ shrub near a patio, privacy screen, windbreak, or as an accent in an ornamental bed	8-11	7-9, 12-24, H1, H2	L-M	M
Tree/Shrub	redbud, ornamental peach, flowering plum, fruitless pear	Quince	*Cydonia oblonga*	Aromatnaya, Champion, Kaunching, Orange, Pineapple, Smyrna	Grows as a small, spreading tree, often multi-stemmed; trunk becomes gnarly with age; delicate rose flowers appear in early spring; use as specimen tree/shrub, hedgerow, or in a container	3-9	2-23	M	H
Tree/Shrub	various types	Olive	*Olea europea*	Arbequina, Leccino, Manzanillo, Maurino, Mission	Can be pruned to be small shrub or large tree; light blue-green, evergreen foliage is a great contrast against many plantings; use as a multi stemmed tree, specimen plant, screen, or large shrub	9-11	8-9, 11-24, H1, H2	M	M
Tree/Shrub	redbud, ornamental peach, flowering plum, fruitless pear	Plum and Pluot	*Prunus spp.*	European Plum: Bluefire, Damson, French Improved Prune, Green Gage, Italian Prune, Mirabelle, Mount Royal, Stanley; Japanese Plum: Au Roadside, Burgundy, Delight, Emerald Beauty, Hollywood, Ozark Premier, Santa Rosa, Satsuma, Shiro, Sprite, Weeping Santa Rosa, Dapple Dandy, Flavor Grenade, Flavorosa, Geo Pride	Attractive display of white blooms in early spring, followed by leaves that range from dark green to red; many varieties have some fall color; use as specimen tree, shade tree, large shrub, screen, espalier, or as a patio tree	4-9	2-12, 14-24, H1	M	H

Landscape Function	Types of Ornamental Plant *Many others not listed	Edible Substitute		Suggested Varieties	Design Elements	USDA Hardiness Zones	Sunset Zone	Water Need*	
		Common Name	Latin Name					O	E
Tree/Shrub	redbud, ornamental peach, flowering plum, fruitless pear	Pomegranate	*Punica granatum*	Eversweet, Granada, Nana, Spanish Ruby, Utah Sweet, Wonderful	Forms a fountain shaped large shrub or small tree; leaves are bronzy-green in early spring and turn yellow in fall; red-orange flowers are showy, fluted and occur in small clusters; use as a multi-stemmed tree, patio tree, large shrub, screen, specimen plant, hedge, espalier, or container plant	7-10	5-24, H1, H2	M	M
Vine	Mandevilla, Cup of Gold Vine	Kiwi	*Actinidia spp.*	Artic Beauty Kiwi (*Actinidia kolomikta*): Frost, Male Kolomikta, September Sun; Fuzzy Kiwi (*A. deliciosa*): Elmwood, Hayward, Matua, Saanichton, Tomuri Male, Vincent; Hardy Kiwi (*A. arguta*): Ananasnaja, Dumbarton Oaks, Issai, Ken's Red, Make Meyer's Cordifolia	Fast growing vine that needs study support; can be trellised on an arbor, pergola, arch, or strong fence; leaves are nearly round, dark green above and fuzzy below; clusters of brown fruit are easy to pick; male pollinizer required	3-9	A1-A3, 1-10, 12, 14-24	M	H
Vine	wisteria, trumpet vine,	Paypop (purple passionflower)	*Passiflora incarnata*	Alba, Incense (sterile pollen, requires another variety to produce fruit)	Tropical appearance, with intricate flowers and glossy green leaves; herbaceous vine can be trained to a fence, arbor, trellis or wall	5-10	15-17, 21-24, H1, H2	M	M

Table 2.3 Edible Plants for Aesthetics and Productivity (cont.)

Landscape Function	Types of Ornamental Plant *Many others not listed	Edible Substitute		Suggested Varieties	Design Elements	USDA Hardiness Zones	Sunset Zone	Water Need*	
		Common Name	Latin Name					O	E
Vine	wisteria, trumpet vine,	Grape	*Vitis spp.*	American grape (*Vitis labrusca*): Beta, Concord, Fredonia, Himrod, New York Muscat, Niagara; European grape (*V. vinifera*): Black Monukka, Cabernet Sauvignon, White Riesling, Zinfandel; Muscadine grape (*V. rotundifolia*): Carlos, Fry, Scuppernong, Southland	Climbing vines with peeling bark; can be trellised on an arbor, pergola, arch, lattice, along a fence or to wire; leaves are dark green to medium blue-green, with varying shapes; some turn yellow or red in fall; fruit hang in clusters from the long arching canes	4-10	zones vary by species	M	M-H

*Water Need Keys:

O = ornamental plant; **E** = edible substitute plant.

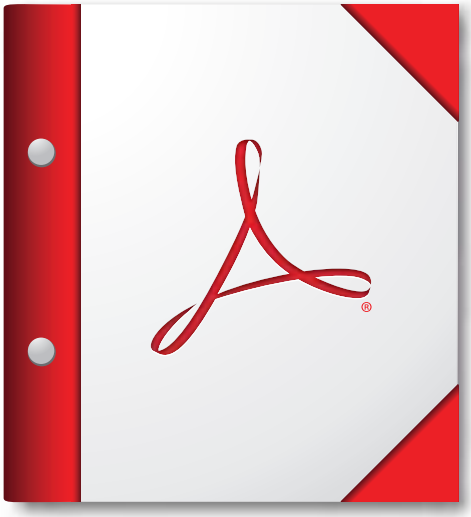
VH = very high, 90-115%; **H** = high, 75-90%; **M** = medium, 50-70%; **L** = low, 25-40%

(percentage of reference evapotranspiration[ETo]).

Values for edibles are averages for the growing season and are intended to support high quality yields.

Ornamental plant water need estimates based on adaptation of field research findings.

Edible crop water needs adapted for home garden application from: *R.G. Allen, J.L. Wright, W.O. Pruitt, L.S. Pereira, and M.E. Jensen. 2007. Chapter 8 – Water Requirements, In: G.J. Hoffman, R.G. Evans, M.E. Jensen, D.L. Martin, R.L. Elliott (eds.). Design and operation of farm irrigation Systems, 2nd ed. St. Joseph, MI: Am. Soc. Agricultural and Biological Engineers.*



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