Unit 6 The Organic Food Movement
Lesson 2: To Spray or Not to Spray

A man’s nature runs either to herbs, or to weeks; therefore let him seasonably water the one, and destroy the other.
Francis Bacon (1561-1626) English philosopher

Introduction

This second lesson introduces you to both organic and conventional methods and practices used by farmers in food production. The issue of pesticides; hazards, regulation and monitoring of herbicide and pesticide use in farming, identification of and soil and pest management are discussed.

Organic Versus Conventional Farming

Alternative methods of farming have become a mainstay of US agricultural food production.
“Farmers who want to avoid the use of synthetic fertilizers, herbicides, insecticides, fungicides, preservatives and other chemical ingredients produce and market organically grown crops” (Whitney and Rolfes, 2002, page 661, ¶2).

The Encarta Encyclopedia describes organic farming as a food production method that “...combines a variety of methods to maintain the health of soil, prevent soil erosion, and control pests with minimal or no use of synthetic pesticides. Conventional farmers also use some of these methods, but to a lesser degree.

(USDA, 2008)

Organic Consumers discuss the emergence of organic farming as a major alternative method of food production.

Organic farming is now the fastest growing component of world agriculture, with farmers in 110 nations now cultivating certified organic crops. In the US, more than a million acres of certified organic cropland and pasture were added over the last four years, bringing the total to more than 2.3 million acres, according to USDA data cited, although this is less than 0.3% of total U.S. farmland. The growth has been triggered by multiple factors. Many family farmers are discovering organic farming provides more economic stability than conventional farming. Consumers are buying more organic products as they are witnessing an increasing number of scientific studies revealing the dangers (to human health and the environment) of pesticides and genetically engineered crops. Consumers also support organic farming, because it’s more likely to support family farmers (although in increasingly fewer cases). (2008).

Organic farming uses different methods and practices when growing food for human consumption. According to the USDA,

The word "organic" refers to the way farmers grow and process agricultural products, such as fruits, vegetables, grains, dairy products and meat. Organic farming practices are designed to encourage soil and water conservation and reduce pollution. Farmers who grow organic produce and meat don't use conventional methods to fertilize, control weeds or prevent livestock disease. For example, rather than using chemical weedkillers, organic farmers conduct sophisticated crop rotations and spread mulch or manure to keep weeds at bay. (2008)

However for a better understanding of how organic farming differs from traditional 'conventional farming' the Mayo Clinic provides us with the following table showing additional differences between the type types of food production.

**Conventional vs. Organic farming**

Table 1: Other differences between conventional farming and organic farming

<table>
<thead>
<tr>
<th>Conventional farmers</th>
<th>Organic farmers</th>
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<tbody>
<tr>
<td>Apply chemical fertilizers to promote plant growth.</td>
<td>Apply natural fertilizers, such as manure or compost, to feed soil and plants.</td>
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<tr>
<td>Spray insecticides to reduce pests and disease.</td>
<td>Use beneficial insects and birds, mating</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th><strong>Disruption or traps to reduce pests and disease.</strong></th>
<th><strong>Use chemical herbicides to manage weeds.</strong></th>
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<tbody>
<tr>
<td>Rotate crops, till, hand weed or mulch to manage weeds.</td>
<td></td>
</tr>
<tr>
<td><strong>Give animals antibiotics, growth hormones and medications to prevent disease and spur growth.</strong></td>
<td><strong>Give animals organic feed and allow them access to the outdoors. Use preventive measures — such as rotational grazing, a balanced diet and clean housing — to help minimize disease.</strong></td>
</tr>
</tbody>
</table>

The definition of organic farming according to Encarta:

Organic farmers instead rely on ecosystem management, including the use of pesticides and fertilizers derived from plants, animal wastes, and minerals. They incorporate biological methods, such as the use of one organism to suppress another, to help control pests. The methods used in organic farming seek to increase soil fertility, balance insect populations, and reduce air, soil, and water pollution.

In the United States, organic farming is a rapidly growing sector of agriculture. In 2006 organic food sales reached $16.7 billion, up from $7 billion in 2001. Exports of organic food products are also growing, particularly to Japan and Europe. (2008).

Controversy between Organic and Conventional Farming Methods

Eric Moon, in 2002, provided extensive material on the controversy between both methods of farming.

The controversy between organic and conventional methods of farming and livestock production is one of the hottest topics now days. Traditional methods of farming are often attacked by supporters of organic methods. Stating [sic] detrimental impacts on humans and the environment do to the principles that are used, many organic supporters call the products of conventional practices unsafe and unhealthy. The same can be said for organic, in that the lack of management practices implemented often result in infestations of insects, significantly lower yields due to weedy crop fields, and an overall lower quality end result.

Those supporting organic argue it is more healthy to humans because there are no chemical inputs such as pesticides or herbicides. They point out that chemicals used in conventional crop production can kill weeds that are used in other habitats for certain wildlife and insects. They also claim the organic method of raising livestock to be less stressful on the animal due to a more “natural” environment. Critics of organic point out that it is in efficient and over priced in the long run when the quality of product is evaluated against a comparable conventional crop. Most opposing the use of will be quick to point out the claims that are made by the supporters of organic are vague and at times misguided.

Organic supporters argue their all natural products are more healthy. Since all certified organic food has strict restrictions about the prohibited use of pesticides and herbicides placed on it, organic farmers are forced to use alternate methods of pest and weed

control. Therefore, consumers can rest assured there are no chemicals being passed on to them in their food.

Organic activists claim this fact to be a reason not to buy conventionally grown comparable products. In all actuality the FDA would not allow the farmers of the United States to produce and market crops that were not safe for human consumption, considering they and their families consume the very products they approve. Realistically there is actually a higher chance of crop born pathogens without use of chemicals. As far as food quality goes, conventional crops are higher yielding and more uniform across an entire field than organic crops. (Eric Moon, 2002).

A Model of Organic Farming
The Texas Department of Agriculture\(^8\) developed an organic food production certification program. Program highlights focus on “…the major limitations of pests, diseases and nutritional disorders of fruits and nuts” as well as a rating of the relative potential for organic production of each fruit and nut.

Public concerns about food safety and the environment have stimulated interest in producing fruits and nuts organically. Organic production is widely embraced as a means to better health and environmental quality because of total avoidance of synthetic fertilizers and pesticides in food production. This is not to imply that organic pesticide or fertilizer sources are completely safe and thus do not require precautions governing their use in food production. All pesticides and fertilizers should be used with caution and only in accordance with applicable label directions and/or sound production and safety practices.

Adherence to sound horticultural principles and practices is essential to the growth, development and fruiting of healthy, vigorous orchard trees which can best resist or overcome pest or disease problems—from planting through the life of the orchard. Proper site selection, plant selection, spacing, pruning, irrigation, fertilization, weed control and other practices will reduce or eliminate the plant stresses which can often catalyze increased pest or disease problems. (Texas Department of Agriculture, n.d.\(^9\))

Soil Preservation in Organic Farming

Fertilizers are used to provide the minerals lacking in some soils, and to replace the minerals removed from the soil by crops as they grow. Many conventional farmers rely on concentrated chemical fertilizers that are rapidly absorbed by plants. These fertilizers produce quick growth but may kill important soil organisms, such as earthworms and beneficial bacteria. Organic farmers use manure, compost (a mixture of decaying organic matter that is rich in beneficial soil microorganisms), and other natural materials to nourish

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soil organisms, which in turn make minerals available to plants. (Texas Department of Agriculture, n.d.)¹⁰

**Fertilizer**, natural or synthetic chemical substance or mixture used to enrich soil so as to promote plant growth. Plants do not require complex chemical compounds analogous to the vitamins and amino acids required for human nutrition, because plants are able to synthesize whatever compounds they need. They do require more than a dozen different chemical elements and these elements must be present in such forms as to allow an adequate availability for plant use. Within this restriction, nitrogen, for example, can be supplied with equal effectiveness in the form of urea, nitrates, ammonium compounds, or pure ammonia. (Texas Department of Agriculture, n.d.)¹¹

Virgin soil usually contains adequate amounts of all the elements required for proper plant nutrition. When a particular crop is grown on the same parcel of land year after year, however, the land may become exhausted of one or more specific nutrients. If such exhaustion occurs, nutrients in the form of fertilizers must be added to the soil. Plants can also be made to grow more lushly with suitable fertilizers.

Of the required nutrients, hydrogen, oxygen, and carbon are supplied in inexhaustible form by air and water. Sulfur, calcium, and iron are necessary nutrients that usually are present in soil in ample quantities. Lime (calcium) is often added to soil, but its function is primarily to reduce acidity and not, in the strict sense, to act as a fertilizer. Nitrogen is present in enormous quantities in the atmosphere, but plants are not able to use nitrogen in this form; bacteria provide nitrogen from the air to plants of the legume family through a process called nitrogen fixation. The three elements that most commonly must be supplied in fertilizers are nitrogen, phosphorus, and potassium. Certain other elements, such as boron, copper, and manganese, sometimes need to be included in small quantities. (Texas Department of Agriculture, n.d.)¹²

**Crop Rotation**

Crop rotation is a system of farming in which a piece of land is planted with different crops in succession, in order to improve soil fertility and control crop pests and diseases. For example, a field planted with corn may be harvested, plowed under and a different type of crop planted.

Clover is often used in crop rotation, a method of restoring soil nutrients in which different crops are planted periodically in the same field. Clover harbors root bacteria that incorporate nitrogen into the soil, reducing the need for commercially produced petroleum-based fertilizers.

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Soil Fertility Management

Soil amendments must contribute to overall soil improvement as well as improve growth and production. Manures, tillage of residues, compost, green manure crops and nitrogen-fixing intercrops are most adapted to orchard systems. Soil improvement is very gradual over time, usually requiring many seasons of intensive management to improve and maintain soil fertility.

Organic fertilizers are not normally well-balanced in major nutrient content, most being disproportionately high in one nutrient. Consequently, a variety of organic materials may be required to meet the nutritional needs of fruit crops. Because fruit trees are perennial and most Texas soils are relatively fertile, the extensive root system can extract nutrients from the soil as they become available. Nitrogen may be the most commonly limiting fertilizer element.

It is essential to ascertain the nutrient content of the fertilizer being used so as to guide relative application rates. In addition, soil test samples should be collected and analyzed each summer to determine the status of essential elements in the soil. Because the soil test measures total nutrient content without determining the availability of those nutrients, tissue analysis should also be performed each summer to determine the actual nutrient status of the trees. Thus, the nutrient content of the fertilizer(s), soil and tree will provide an accurate nutritional program for the orchard to assure optimum growth and production.

**Nitrogen:** Nitrogen is readily leached from the root zone and is the most likely nutrient to be limiting to growth. Common sources of supplemental nitrogen include various animal manures, green manures, cover crops, nitrogen-fixing intercrops and microbes and compost. Vegetable meals, animal hides, fish emulsions, blood meal or meals made of other animal by-products are not considered to be organic by Texas Department of Agriculture (TDA) standards, so they may only be used temporarily with TDA approval.

**Phosphorous:** Phosphorous is rarely limiting in Texas soils, particularly in perennial orchard crops, as most established trees can obtain adequate phosphorous as it becomes available through soil reactions. Hard-rock, soft-rock and colloidal phosphate, bonemeal and bat guano are common organic sources of phosphorous. Neither food-grade orthophosphoric acid, fish emulsions, soap phosphates nor basic slag are considered organic by TDA standards, so approval must be obtained for temporary use.

Source: Iowa State Education. [http://www.public.iastate.edu/~ecmoon/org_con.html](http://www.public.iastate.edu/~ecmoon/org_con.html)
2008. Compiled by K. Cavanaugh
Potassium: Potassium is not often limiting in most Texas soils, although acid soils and deep sands may be deficient. Organic potassium sources include wood ashes, dusts of granite, feldspar and greensand, sulfate of potash magnesium (langbeinite), natural potassium sulfate, kainite and recycled potassium-rich organic matter.

Calcium: There are very few documented cases of calcium deficiency in Texas fruit and nut production. Agricultural limestone (dolomite) should not be used on alkaline soils. Gypsum, kiln dust, calcified seaweed, corn calcium and calcium oxide are calcium sources useful on acidic or alkaline soils. Neither calcium chloride nor ground oyster shells can be used without TDA approval.

Magnesium: Magnesium is rarely deficient in most tree crops in Texas, but supplemental magnesium is available in dolomite (not for use in alkaline soils), kieserite and sulfate of potash magnesium (langbeinite). Epsom salts can be used temporarily only with TDA approval.

Sulfur: It is unlikely that sulfur deficiencies would be observed in orchards, but elemental (mined) sulfur is often applied to the soil in a limited attempt to lower soil pH.

Micronutrients: Micronutrient deficiencies are common in some tree crops in Texas, including zinc in pecans and peaches and iron in peaches and other stone fruits, pome fruits and blackberries growing in alkaline soils. Seaweed extract, kelp meal and natural rock powders are limited sources of some micronutrients. TDA may approve the temporary use of fritted and chelated micronutrients, fish emulsions and/or acid-treated elements of zinc, boron, cooper, iron, manganese and molybdenum.

(Texas Department of Agriculture, n.d.)

Weed Control

Weed control is essential to young tree establishment and good tree growth. Weeds can be controlled mechanically or by manual cultivation, but control is usually delayed until after unfavorable weed competition has occurred. Tillage incorporates crop residues and other organic wastes into topsoil. However, deep tillage is deleterious to plant roots and soil moisture relations and should be avoided except in serious cases of soil compaction. Frequently, very shallow tillage is recommended to control weeds without damaging tree roots and without causing undue soil drying. This shallow tillage permits good water penetration without exposing additional weed seeds from deeper levels of the soil, thereby reducing weed pressure over time.

Mowing of sod middles, with shallow tillage along the tree rows and/or mulches beneath the tree, reduces soil compaction and erosion and fosters soil microbes and macrobes. However, sod middles compete for available water and nutrients. Electrical or flame weeding equipment can also be used, but may not be practical or safe under orchard conditions. Careless or uncontrolled fire can kill fruit and nut trees rapidly. (Texas Department of Agriculture, n.d.)

Cultural Practices for Preventative Pest Management

In most cases, wider spacings than normally recommended between trees and rows for conventional production can lessen pest and disease pressure significantly by improving air circulation and reducing the duration of leaf wetness. Some trees can be pruned to more open canopies and with higher skirts to lessen disease pressure by virtue of increased air circulation beneath and through the tree. Raised skirts limit some pests by eliminating easy access via limbs near the ground.

Planting depth should be equal to or higher than that of the tree in the nursery to protect the scion from soil borne diseases. This is particularly critical in citrus, as citrus trees planted too deeply or in a low area will contract foot rot, root rot or both--and die within a couple of years.

Crop rotation and altered planting or harvest dates are routinely applied in the production of annual crops, including strawberries, but are not practical for perennial fruit and nut trees, shrubs or vines. Altered harvest dates provides little or no practical pest or disease relief in most fruit crops. Harvest at any time other than the peak of maturity is usually detrimental to fruit quality, taste and appearance. However, varieties which mature earlier in the season are usually subject to less pest and disease pressure.

Companion plantings and trap crops are widely touted as deterrents to some pests, although there is little proven substance to many of the claims. Either would be difficult to establish and maintain under standing trees because of shading and competition, irrespective of mulches. Establishment in row middles may be easier, although not assured, but such practices could restrict necessary tillage operations or other cultural practices within the orchard, to the detriment of tree health. Moreover, companion plants that may be favored hosts of serious pests (such as spider mites) should be avoided.

Mulching with organic materials is highly beneficial in many orchard crops. It precludes weed growth, lowers soil temperature in the root zone, conserves water, reduces soil erosion and increases microbial and macrobial activity within the mulch and soil, increasing humus, organic matter, water percolation and soil nutrition. Mulches may increase disease pressure by maintaining increased humidity within a tree microclimate, e.g., mulches increase the incidence and severity of foot rot of citrus trees.

(Texas Department of Agriculture, n.d.)

The Texas Model describes various methods of management pests in order to reduce environmental contamination and increase food production.

Prevention of pest or disease problems is the primary consideration in the production of fruits and nuts. Use sound horticultural principles to maintain vigorous, healthy plants free of stress that leads to pest or disease problems. Some fruits will never be free of pests or diseases; others will be affected sooner or later by various problems which limit production,

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quality or both, and may require control measures. (Texas Department of Agriculture, n.d.)

The methods of pest management include in the Texas Model include:

**Biological Control** Biological pest control is the use of natural parasites, predators and pathogens to reduce pest populations below damaging levels. Hundreds of biological control agents exist, but most are quite small and thus rarely observed. Many are host specific, attacking only a limited number of species of pests. Biological control has many successes, particularly in citrus, but complete eradication of a pest is extremely rare--there must be a pest population present in order to sustain a population of biological control agents. Thus, some damage to orchards and fruits or nuts is to be anticipated.

Green lacewings, praying mantids, vedalia beetles and lady beetles are well-known predators that feed voraciously on aphids, mites, leafhoppers, thrips, mealybugs and others. *Bacillus thuringiensis* (Bt), a popular bacterium, effectively controls the larvae of several moths and butterflies. A large variety of birds consume hundreds of worms and other insects (including many of the beneficials). Tiny *Trichogramma* wasps attack the eggs of butterflies and moths, while other parasitic wasps attack other pests, including scales, whiteflies and blackflies. *Hirsutella* is a fungus that attacks some mites; *Aschersonia* is another fungus that attacks pupae of whitefly.

Many beneficials occur naturally in the orchard. Others can be purchased from rearing facilities and introduced into the orchard. Fungal and bacterial beneficials may require certain climatic conditions (such as humid humidity) to survive. It should be reiterated that a pest population must exist and be maintained, or introduced beneficials will die or leave the orchard.

**Mechanical Pest Control:** Mechanical pest control devices are useful to deny pest access to parts of the tree or its fruits. Metal collars and sticky barrier strips (such as Tanglefoot) around tree trunks prevent rodents and crawling insects from reaching the foliage or fruits. Low hanging branches, particularly when laden with fruit, should be pruned up to deny ready access from the ground. Bird netting over smaller trees, vines and shrubs will preclude bird predation on fruit and could exclude numerous flying insects, depending upon mesh size.

Soapy water sprayed vigorously onto aphids and whiteflies will wash them from the plant. Whiteflies may return, but the aphids rarely go back up the tree. Tent caterpillars and webworms can be treated with fire, particularly early or late when the insects are back inside the protective tent. Pruning to remove the tent is also effective. Sanitary removal of diseased plant parts is also an effective mechanical control method, particularly useful for anthracnose in blackberries.

Insect traps, vacuuming, sound devices and shooting may be useful, the latter two being mainly for birds and rodents. Rubber snakes, fake owls and other visual deterrents will often repel birds from maturing fruits such as figs, berries and pecans. Electric ultraviolet light traps which attract and kill various flying insects are effective against some fruit and nut pests, but would be limited to small orchards. Diatomaceous earth and various rock powders may be partly effective against some pests.

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Pheromones and other semiochemicals can be used in traps in the orchard to manipulate pests, particularly as attractants, repellents or disruptors of normal life cycles. For example, sex pheromones readily lure the opposite sex of a species to its death, effectively reducing that part of the breeding population. (Texas Department of Agriculture, n.d.)

**Major Nutritional, Pest and Disease Problems**

According to the Texas Model, food production involves effectively managing pest and disease problems which affect organic food production. In order to help farms improve food productivity, the Department evaluates the production potential for fruits and nuts and lists them in the following table:

**Table 1: Major Problems and Production Potential**

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Description</th>
<th>Organic production potential</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agarita</strong></td>
<td>Agarita has no chronically serious pest or disease problems. Black stem rust of wheat can cause crop loss but its incidence can be reduced by elimination of small grains and winter grasses near the production area. Spring frosts can reduce production. Bird predation on the maturing berries can be significant.</td>
<td>Very high</td>
</tr>
<tr>
<td><strong>Almond</strong></td>
<td>Almond has fewer insect problems than peaches, but brown rot is a major fruit problem. Major nutritional deficiencies of iron and zinc occur on alkaline soils, but own-rooted almonds tolerate alkaline soils well. Early bloom consistently results in poor fruit set. Almonds are not well-adapted in Texas. Refer to PEACH for further information.</td>
<td>Low to moderate</td>
</tr>
<tr>
<td><strong>Apple</strong></td>
<td>Fire blight is a major disease affecting apple tree health, and cotton root rot losses can be quite severe. Codling moth is a major pest in North Texas. Black rot and bitter rot can cause serious crop damage, especially in more humid areas.</td>
<td>Moderate</td>
</tr>
<tr>
<td><strong>Apricot</strong></td>
<td>Brown rot and bacterial spot are major fruit diseases; other diseases, insect pests and nutritional problems are the same as PEACH. Cropping consistency is poor in more humid areas, being a little more consistent in West Texas. Seedling trees are better adapted and more consistent than budded trees.</td>
<td>Low to moderate</td>
</tr>
<tr>
<td><strong>Avocado</strong></td>
<td>No major insect pests are known in Texas. Spider mite damage to foliage may occur in some seasons. Anthracnose and scab severely affect fruit of thin-skinned Mexican-race avocados, but pose no problems for 'Lula'. Salt-induced chlorosis and necrosis of foliage common to Mexican-race avocados is mostly avoided by using 'Lula' or other West Indian seedlings as rootstocks.</td>
<td>Very high</td>
</tr>
</tbody>
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**Banana**

No major insect or disease problems are common in Texas.

*Organic production potential: Very high.*

**Blackberry**

Thrips, stink bugs and strawberry weevil can become serious on flowers or fruit; leaves are often affected with spider mites. Rosette (double blossom), anthracnose, septoria and cercospora leaf spots can be moderate to severe in humid areas, less so in drier climates. Proper pruning after harvest, elimination of all weed growth and selective removal of diseased (double blossom) canes will minimize problems. Erect varieties have better disease resistance. Iron chlorosis in alkaline soils can become limiting.

*Organic production potential: Moderate to high.*

**Blueberry**

Blueberry bud mite, blueberry maggot, cranberry fruitworm and other pests can cause minor to severe damage in some seasons. Prompt removal of old canes, plus many naturally occurring predators and parasites keep most pests from having significant impact in most seasons. Alternaria leafspot, anthracnose, Botrytis, rust and other leaf spots have affected growth, flowering and fruiting. Good sanitation, complete weed control and proper irrigation and drainage are essential to minimize losses. Salt, particularly sodium, is detrimental. Nutritional problems are minimal if soil pH is maintained at 4.5 to 5.2.

*Organic production potential: Moderate to high.*

**Chestnut**

Chestnut blight is still a major threat to all but resistant varieties. The chestnut gall wasp is a frequent problem. Little is currently known of other potential problems, as only a few varieties of blight-resistant chestnuts have begun to be planted. Micronutrient deficiencies can be expected on alkaline soils.

*Organic production potential: Moderate to high.*

**Cherry**

Sweet cherries are not known to be adapted in Texas. Sour cherries have been grown at elevations above 3,000 feet. The bush or thicket cherries will produce in North Texas.

*Organic production potential: Moderate to high.*

**Citrus**

Sucking insects and mites, including scales, aphids and blackfly, can limit production because of adverse effects on growth and development of twigs, leaves and fruit. Most are under partial biological control. Melanose deforms leaves and causes partial defoliation of grapefruit; greasy spot causes extensive defoliation. Foot rot kills trees, but is easily precluded by high budding and proper planting in well-drained sites. Virus diseases are excluded from Texas by quarantines against citrus plant materials from other areas.

*Organic production potential: High.*

**Date**

There are no major pests or nutritional problems. Lethal yellowing (lethal decline) is killing all date palms in the Valley, but clean stock isolated in more arid areas of non-coastal South Texas could escape this disease. Date palms rarely produce quality dates because of inadequate pollination and high humidity.

*Organic production potential: Very high.*
Feijoa
Fruit is virtually free of major pests, diseases and nutritional problems. However, high humidity induces fruit splitting and/or failure to ripen properly. Organic production potential: Very high.

Fig
The dried fruit beetle enters the eye of maturing fruit and causes souring, but closed-eye varieties and earlier harvest reduce losses significantly. Bird predation of maturing fruit can be extensive. Fig leaf rust causes extensive defoliation in late summer, particularly in humid areas. Organic production potential: High to very high.

Filbert
Pest and disease problems of filbert have not been reported in Texas. However, production has not occurred in Texas because of poor adaptability to spring and summer temperatures. Organic production potential: Very high.

Grape, Muscadine
Muscadine grapes prefer acidic soils. There are few pests or diseases that are limiting, although black rot can cause crop damage. Organic production potential: High to very high.

Grape, Mustang
There are no major limiting problems to the production of this Texas native wild grape. Grape leaffolder can cause extensive defoliation in some seasons, but is rarely debilitating to the vine. Organic production potential: Very high.

Grape, Varietal
American types are fairly resistant to serious diseases; grape leaffolder can be damaging in some seasons. Organic production potential: High

French-American hybrids have some tolerance to Pierce's disease, but black rot is a limiting factor and mildew can be serious. Grape leaffolder and grape berry moth can be serious pests in some seasons. Organic production potential: Low to moderate.

Vinifera grapes are seriously affected by black rot, Pierce's disease, mildew, and grape berry moth. Organic production potential: Very low.

Guava
There are no limiting problems in adapted climates of South Texas. Organic production potential: Very high.

Jujube
There are no limiting pest or disease problems of jujube in Texas. Rootsprouts are extensive. Organic production potential: Very high.

Kiwifruit
Kiwifruit is seriously limited by cotton root rot and hot temperatures during spring and summer. To date, most attempts to grow kiwifruit have ended with vine death within a few months of planting, so kiwifruit has not been reported to fruit under natural conditions in Texas. Organic production potential: Low.
Loquat  The only limiting factors are susceptibility to fire blight and occasional crop failure following very cold winters, i.e. temperatures below 24° to 25°.  
*Organic production potential:* High to very high.

Mango  There are no major pests, although scales and whiteflies can affect growth and production. Anthracnose affects all stages of fruit production, particularly during humid seasons.  
*Organic production potential:* High.

Mayhaw  Mayhaw is subject to many of the same pests that attack other pome fruits, but none are considered seriously limiting to production. Both quince rust and hawthorne rust can be severe, but removal of alternate, evergreen hosts should reduce the problem.  
*Organic production potential:* High to very high.

Mulberry  Bird predation of mature fruit and Cercospora leaf spot are the only serious problems affecting mulberry.  
*Organic production potential:* Very high.

Nectarine  Nectarines are seriously affected by the same pests and diseases as PEACH.  
*Organic production potential:* Very low to low.

Olive  There are no limiting pests or diseases, but olive has rarely fruited in Texas.  
*Organic production potential:* High to very high.

Papaya  Cotton root rot and virus diseases can limit papaya life and productivity. No significant pests occur. Postharvest fruit rots can be alleviated by more careful handling. Anthracnose can be serious in wet, humid seasons.  
*Organic production potential:* High to very high.

Peach  Catfacing and scale insects are serious pests of peach. Limiting diseases include brown rot, leaf rust, cotton root rot, bacterial spot and others. Both zinc and iron deficiencies exist in alkaline soils.  
*Organic production potential:* Very low.

Pear  Fire blight is a major limitation to susceptible varieties. Codling moth can be serious in North Texas, as can various scale insects, in some seasons.  
*Organic production potential:* High.

Pecan, Improved  Improved pecans have major pest and disease problems except in arid Far West Texas. Pecan scab is the major disease, but downy spot, stem end blight and several other diseases can be limiting. Major insect pests include pecan nut casebearer, hickory shuckworm, pecan weevil and aphids. Less serious pests include stinkbugs, mites, phylloxera, webworm and walnut caterpillar. Zinc deficiency is a major nutritional problem throughout the pecan belt.  
*Organic production potential:* Low.
Pecan, Native

The same problems that affect improved pecan also affect native pecan, although native pecan has generally better scab resistance and can obtain some zinc nutrition from the soil. Pecan weevil is probably most damaging, but its cycle generally corresponds well with alternate bearing tendencies of native pecan trees.

*Organic production potential*: Moderate to high.

Persimmon

Both native and Japanese persimmons are virtually free of pest and disease problems. Scale insects may pose occasional problems.

*Organic production potential*: Very high.

Pistachio

Pests and diseases are not a serious problem, but several are considered of minor significance, including thrips, stinkbugs, scales, aphids, mites, verticillium wilt and cotton root rot. Pistachio is best adapted to the more arid regions of the state.

*Organic production potential*: High.

Plum

Both native and varietal plums are subject to most of the same pests and diseases as PEACH, although wild plums often exhibit greater resistance or tolerance.

*Organic production potential*: Low to moderate.

Pomegranate

There are essentially no limiting pests or diseases, although fruit spots can be serious in humid areas. Fruit splitting near maturity occurs because of poor water relations. Plants tolerate alkaline and somewhat saline soils quite well.

*Organic production potential*: Very high.

Quince

Quince is subject to the same pests and diseases as PEAR, but only fire blight is considered serious.

*Organic production potential*: High.

Raspberry

The same pest and disease problems that affect BLACKBERRY affect raspberry, although rosette (double blossom) has not been reported in Texas. The red varieties have more resistance and are better adapted to Texas.

*Organic production potential*: Moderate to high.

Strawberry

A number of foliar diseases affect strawberry plants, but do not normally achieve great significance. Root diseases are avoided by the use of resistant varieties. Fruit rot, particularly gray mold, can be serious, but incidence is reduced by sanitation and wider plant spacing. Various insects can become damaging in some seasons, particularly strawberry weevil, but most are of only minor significance.

*Organic production potential*: Moderate to high.

Walnut, Black

Anthracnose is the most serious disease of black walnuts, particularly during humid, rainy weather; but some seedlings and varieties are somewhat resistant. There are no significant pests.

*Organic production potential*: Very high.
**Walnut**

**English**

Anthracnose and bacterial blight are major problems on non-resistant varieties. Insect pests include webworm, walnut caterpillar, codling moth, husk maggot (walnut husk fly) and others, but serious infestations have not generally occurred.  

*Organic production potential:* High.

**Pesticides and Environmental Contamination**

According to Whitney and Rolfes, using pesticides in food production is a topic fraught with controversy. While the use of pesticides, or chemicals to control threats to food production such use can cause environmental contamination. According to the Texas Department of Agriculture, methods to deal with environmental contamination use the following methods

**Sanitation and Crop Residue Removal** can be particularly important in some fruit crops. Diseased plant parts and pest-infested residues should be removed promptly and destroyed to reduce further damage during the current season and to eliminate overwintering sites for pest or disease carryover to the following season. Prune infected tissues carefully to preclude unintentional spread of the disease organism. Heat sterilization of pruning equipment should be practiced, particularly in the case of virus diseases, to prevent infection of other plants.

Residues may be composted for subsequent use, although many composting operations may not be adequate to kill overwintering pests or disease organisms. To be safe, it may be preferable to shred larger materials and subject all crop residues to solarization prior to composting. Solarization is commonly used to control weeds and pests in the soil prior to planting and can be readily adapted to treat crop residues before composting. Exposing well-moistened crop residues--layered and sealed between two sheets of clear plastic--to several days of Texas sunshine will effectively destroy pests and disease organisms. (Texas Department of Agriculture, n.d.)

The Texas Department of Agriculture recommends the use of organic pesticides and fertilizers rather than synthetic. A scientific study of organic fruits and vegetables shows that “...they contain a third as many pesticide residues as conventionally grown foods” (Texas Agricultural Extension Service, n.d).

**Natural Pesticides:** Inevitably, some pests on some fruits in some seasons simply experience rapid population increases, thus requiring quick and effective control measures to avoid substantial plant or crop damage. There are, however, few materials that can be used, including herbal or plant-derived controls such as pureed pepper or pureed garlic, pureed arthropods and insecticidal soaps. Expect only limited control of pests.

Dormant oil spray is considered organic, which would certainly help reduce overwintering populations of some pests in deciduous fruits. It is assumed that summer oils used in citrus would also qualify as organic, thereby providing an excellent control for scales, mites and greasy spot disease in citrus orchards.

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20 Ibid.
All botanical pesticides, including rotenone, sabadilla, pyrethrum, quassia and ryania can only be used in a certified organic orchard by written approval of TDA. The same is true of copper-based and sulfur based fungicides, including elemental sulfur. Use of diluted chlorine bleach as a disinfectant and micronutrients such as zinc are also subject to TDA approval.

(Texas Department of Agriculture, n.d.)\(^{21}\)

**Hazards of Pesticides**

Whitney and Rolfes discuss how “pesticides may linger on the foods to which they were applied in the field” with health risks from such residues greatest among “…children, the elderly, and people with weakened immune systems.” With these populations, “…pesticide poisoning…” may occur (2002, page 657-658).\(^{22}\) In order to protect vulnerable groups from exposure to plant residues, “…government agencies set a tolerance level for each pesticide…” (Whitney & Rolfes, 2008, pp. 658, ¶)\(^{23}\) through use of an identification system of foods children eat the most and then evaluating the effects of pesticide exposure.

**Pesticide Regulation**

The US Environmental Agency (EPA) and the US Food and Drug Administration (FDA) share responsibilities for monitoring and evaluating risks of pesticide use. The EPA is charged with approving pesticides for use in food production and to do so, tolerance levels for how much residue can be left in food products for each pesticide is established. The set of tolerance levels are then codified into regulations with responsibility for enforcement and monitoring carried out by the FDA. (Whitney & Rolfes, 2008, pp. 658, ¶).\(^{24}\)

However, there is a major flaw in the pesticide regulation system. ”A loophole in federal regulations allows US companies to manufacture and sell, to other countries, pesticides that are banned in this country” (Whitney & Rolfes, 2008, pp. 658, ¶2-3).\(^{25}\) Because “70% of the fruits and vegetables consumed in the United States are imported from other countries…the banned pesticides then return to the United States…” (Whitney & Rolfes, 2008, pp. 658, ¶2-3)\(^{26}\) in the imported foods. As of 2002, efforts were underway to address this flaw by having “federal inspectors sample imported foods and refuse entry if they are found to contain illegal pesticide residues” (Whitney & Rolfes, 2008, pp. 658, ¶2-3).\(^{27}\)

**Minimizing Risks**

Consumers can take steps in food handling and preparation to minimize pesticide residues. According to Whitney and Rolfes, “To remove or reduce any pesticide residues from foods…”


• Trim fat from meat
• Remove skin from poultry and fish
• Discard fats and oils in broth and pan drippings
• Wash fresh produce in warm water
• Use a scrub brush and rinse fresh produce thoroughly
• Use a knife to peel an orange or grapefruit
• Do not bite into the peel of an orange or grapefruit
• Discard the outer leaves of leafy vegetables such as cabbage and lettuce
• Peel waxed fruits and vegetables
• Peel vegetables such as carrots and fruits
• Eat a variety of foods to minimize exposure to any one pesticide

(Whitney & Rolfes, 2008, pp. 660, ¶1).

Summary
Alternative farming methods may allow farmers to grow crops with few or no pesticides. Farmers employing conventional farming methods using pesticides can safely improve crop yields when pesticides are used according to regulations and consumers can minimize their ingestion of pesticide residues on foods. (Whitney & Rolfes, 2008, pp. 660, ¶3).

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