



Core Skills Educational Factsheet 2: Orchard Management

Agriculture Education Program

People in Need Czech Republic

2014



Core Skills Educational Factsheet 2: Orchard Management

Contents:

- 1) Welcome to the Factsheet
- 2) Orchard Management Overview
- 3) Irrigation of Orchards
- 4) Fertilization of Fruit Trees
- 5) Pruning & Training of Fruit Trees
- 6) Thinning Fruit Trees

1) Welcome to the Factsheet

Orchard management starts before the trees are planted. Orchard owners need to determine what their goals for the orchard will be. The soil must be tested for nutrients, and there needs to be a specific plan for what will be planted where. This involves knowing what grows well in the area, and what fruits and nuts there a demand is for. The tree saplings are then planted according to the plan, in a way that will encourage pollination and maximum growth. A lot of these steps were described in the first Factsheet presented by PIN devoted to Orchard Establishment.

In this second Core Skills Educational Factsheet focused on Orchard Management we are going to cover the periods of tree training, shaping and the main production period. The most important topics to discuss are irrigation, fertilization, pruning and thinning. Enjoy the factsheet and please provide us with feedback.

2) Orchard Management Overview

The second phase of orchard management after planting the trees is tree care. This includes fertilizing and treating the crop with insecticides. It also includes knowing how to handle a diseased tree, and having a plan in place for disasters, like fires, hail, or freezes. Checking each tree for problems, like rot, mildew, or bugs, can be time consuming, but it is a necessary step. The sooner potential problems are discovered, the better the chance of being able to rescue and repair the tree. Keeping track of the amount of fruit gathered, and then finding markets for the fruit are also part of orchard management. There are a lot of details to record and keep track of. The average size of the fruit, the age of the trees, and how much fruit each type of tree produces will need to be recorded, allowing the owner to use this information to improve next year's yield. The most important activities are described in the following table:



Time	Main Stage	Sub – Stage	Main activities
1st to 3rd year	Planting	Planting saplings	Sapling preparation
			Planting saplings
			Basin formation
			Staking
			Mulching
			Irrigation
	Orchard management	Training fruit tree	Head back
			1st-3rd year shaping cut
			Staking
			Propping vs. trellising
			Cloth pinning
			Basin formation
			Staking
			Mulching
			Irrigation
			Weeding
			Pest & disease management
			Plant nutrition
4th to 5th year		Shaping fruit trees	4th-5th year shaping cut
			Staking
			Propping vs. trellising
			Cloth pinning
			Basin formation
			Staking
	Mulching		
	Irrigation		
	Weeding		
	Pest & disease management		
5th to 12th year	Main production period	Plant nutrition	
		Pruning	
		Propping	
		Irrigation	
		Pest & disease management	
		Plant nutrition	
Harvesting			

Source: Ferenc Sandor, ROP, Afghanistan 2008

Weather Conditions and Climate

- Many deciduous fruit and nut trees are adapted to a Mediterranean climate of cool, wet winters and hot, dry summers.
- Frosts in spring can injure flowers and affect fruit set and shoot growth.
- Rain during spring and summer can increase the risk of fungal and bacterial diseases while hail and strong winds can cause physical damage to fruit and limbs.
- The bark of newly planted trees is very easily damaged by too much sun; when injured, the bark is easily infested by borer insects. Protect the bark of the tree from sunburn immediately after planting by painting with white interior latex paint diluted to half strength with water. Apply the paint mixture from the soil surface up the entire trunk, including the dormant buds.
- To avoid the risk of sunburn of fruit and limbs you can cover trees with shade cloth or use sunburn protection sprays or paint the tree limbs.



Protecting fruit trees from sunburn

To avoid risk of freeze damage on newly planted fruit trees cover them with hay:

- put a stick closer to your planted tree to keep the plant from falling down
- cover the plant with hay
- tie the hay around the plant with a narrow rope



Protecting newly planted pomegranate from freeze (Dehdadi Research Farm, Mazar-e-Sharif)

3) Irrigation of Orchard

Irrigation is essential for the production of fruit. In general, newly planted trees need frequent shallow irrigation. They should be watered about once every 7-10 days once they have developed new leaves.

Fruit trees have an effective root zone of about 60 – 70 cm deep from which they extract water and nutrients during the growing season. Most of the water and nutrients are extracted from the upper 30 – 50 cm. A typical irrigation requires that enough water be applied to penetrate the effective root zone. For mature trees the roots are wider than the width of the branches (drip line) in mid-summer. Water should be applied beyond the drip line be sure to have enough well-placed emitters to cover the entire root zone. Install the system to run long enough to



apply enough water to penetrate two feet. . This will encourage lateral root development for young and developing trees.

This is easily accomplished with basin and drip irrigation methods. The frequency of irrigation depends on the soil type to a large degree. **Sandy soils will need more frequent irrigation than silt or clay soils.** Do not allow water to have contact with the trunk or it can cause rotting and diseases. When using the basin method, water less frequently, but add enough water to penetrate deep into the root zone.

During the hot summer season make an effort to deep water about once a month to leach salts and ensure deeper roots have available moisture. Don't forget to water during the winter. Tree roots continue to be active in winter months and need to be kept moist to prevent drying and freezing.

If there is some doubt about the watering schedule check the soil for dryness by using a soil probe. Use a 6 mm metal rod and push it into soil after irrigation. When the rod hits dry soil it will stop. Hence you know how deep the water has penetrated the soil. Check the soil (both wet & dry) for moisture by rubbing it between your fingers. This indicates a moisture level that is needed for optimum tree growth.

Trees do not use large amounts of water until the leaves are fully developed. **Once leaves are fully developed in early to mid-summer with a crop of maturing fruit, water use will increase dramatically.** Once fruit is harvested, water use will decline but trees still need water for maintenance and acclimation into dormancy. Continue to irrigate after harvest but not as frequently. Beware of water-lodging. Good drainage is important.

Irrigation after Planting

All fruit trees must be irrigated immediately after planting. Irrigating the soil around the roots helps to collapse air spaces around the roots. After soil spaces have collapsed, roots can grow into these spaces and take water and nutrients.

The Orchard manager must determine when to irrigate with observations of the soil, not the tree. The ideal time for irrigation can be determined easily by using a shovel, a sample of the soil and your hands. Use the shovel to dig and remove a handful of soil at the depth of the roots close to a tree. Squeeze the soil tightly with your hand. Lightly bounce the soil in your hand. If the soil falls apart easily after bouncing, it is time to irrigate.

Different irrigation techniques: In Afghanistan, mostly furrow, basin, flood and drip irrigation is used.



Furrow irrigation



Basin irrigation



Drip irrigation



Flood irrigation



1) Flood irrigation

This irrigation method is the oldest method known, and is also the method most widely used in Afghanistan. In this method the whole orchard divided in to small plots of fruit trees in every irrigating time the plots are full up with water. It has advantages as well as disadvantages which are outlined below:

Advantages	Disadvantages
Running costs are low (if enough water is available). Easy to apply. Initial costs are low if the area is flat. No need of flatting the land and no usage of high technology tools.	Only possible to use in flat areas. Very demanding on amounts of water. Difficult to achieve a high efficiency rate. Labor intensive. Irrigates areas in between where no trees are planted and not well suited for sandy soils.

2) Furrow

In furrow irrigation water is delivered to the garden through a network of furrows. Furrow irrigation is conducted by creating small parallel channels along the field length. Water is applied to the top end of each furrow and flows down the field under the influence of gravity.

Advantages	Disadvantages
Running costs are low. Easy to apply. Initial costs are low if the area is fairly flat. Is suitable for areas where there is enough water available.	Labor intensive (considerable labor is needed to maintain the furrows). Interferes with mechanical operations (if used). Quite high demands for water.

3) Basin irrigation

Basin irrigation is a redesign of flood irrigation. It is commonly used for irrigating fruit trees. A small ridge of 15 to 30 cm is formed around the tree at a distance of about 30 to 60 cm. Another ridge is made around tree trunk so that water doesn't touch the trunk (it could cause rotting or diseases). Look at the design of basin at the picture above.

Advantages	Disadvantages
Varying supply of water for each tree according to needs - irrigation is targeted specifically for each tree. No water loss by run off. Rapid irrigation possible. No loss of fertilizers and organic manures.	If land is not levelled, initial cost may be high. Labor intensive as basins need to be formed and each tree needs to be irrigated separately.

4) Drip irrigation

This is the latest irrigation method designed for areas like Afghanistan where there is scarcity of water. In the areas with warm weather (especially lowlands in the south and east of Afghanistan) drip irrigation is often used and works very well because there is no need to worry about freezing of the drip tubes and emitters.



In cool areas drip irrigation is also used but there might be problems with freezing of the tubes and emitters. The orchard manager needs to check the emitters and water pipes on time and empty them before the freeze comes, otherwise they can be damaged.

Advantages	Disadvantages
Very efficient use of water. Once installed, running costs are low. Easy to schedule and manage. Applicable also on hillsides, not only flat land. Not much labor is needed for irrigation (from one tank many trees are irrigated).	Expensive (installation). Requires very clean water or exchanging filters. Sometimes difficult to determine if the correct amount of water has been applied by the system. Needs maintenance (filter cleaning). Can be damaged by frost.

4) Fertilization of fruit trees

Fertilizer is a material that is added to the soil to supply one or more elements required for plant growth and productiveness. The major three elements are nitrogen, potassium and phosphorus; the secondary elements are calcium, sulfur, magnesium, and some other elements. Fertilizers enhance the natural fertility of the soil or replace the chemical elements taken from the soil by harvesting, grazing, leaching or erosion. Organic fertilizers include properly managed animal manure, compost and green manure. Manure contains nitrogen and phosphate content.

Best way is to use compost, composted manure or green fertilizers. If these are not available, chemical fertilizers can be used. Nitrogen, phosphorus, potassium and magnesium may be added by ground application, which is the most efficient way to apply these nutrients. Foliar application is recommended for boron, zinc, copper and manganese.

- **Phosphorus:** 6-8 kg per jerib in the form of P_2O_5 in fertility age; 2-4 kg per jerib when young (4-7 years)
- **Potassium:** 10-14 kg per jerib in fertility age; 4-10 kg per jerib for young orchards (4-7 years)
- **Magnesium:** 8-14 kg per jerib as sulfate
- **Nitrogen:** The nitrogen application rate for young trees is around 20 – 30 kg per jerib until 3rd year of life. In the first year 10 kg, second year 20 kg and in the third year 30 kg. Too much nitrogen should not be applied and fertility of soil should be measured. Later, 6-10 kg per jerib in young orchards (4-7 years); in full bearing age (fertility age, since 7th year of age), 4-20 kg per jerib. Any type of nitrogen fertilizer can be applied but the use of urea, ammonium sulfate and ammonium nitrate should be avoided if the soil pH is fewer than 6.0. The fertilizer should be applied 4-6 weeks before bloom. Always be aware of the fact that most of this nitrogen will accumulate actually in the foliage, thus, increasing the reserve in the tree. This reserve will provide the necessary nitrogen for the fruit.

When and how to apply fertilizer to fruit trees

The timing of the application of fertilizer and its amount are crucial. **Fall (after the leaves have fallen off) or early spring** is the best time to fertilize fruit trees. Avoid fertilizing in summer as this may stimulate late summer or fall growth that is more susceptible to winter injury. Too much fertilizer produces excessive vegetative growth and inhibits fruiting. The most important nutrient is nitrogen but must be applied carefully as too much of it causes only excessive vegetative growth, doesn't lead to greater yields and makes trees vulnerable to diseases.

There are **two ways to apply fertilizer to your trees**. The easiest way is just to **spread the fertilizer on the ground**, rake it in, and then water. Don't apply fertilizer next to the trunk



Digging a series of small holes is another method of applying fertilizer. It is a bit more work, but it ensures the fertilizer is getting to the tree roots. Dig the holes 15 cm deep and 30 – 40 cm apart. Start drilling the holes a foot outward from the trunk and continue on to the drip line. **Once you have finished fertilizing, spread some compost over the top and water well.**



Red spots in a peach caused by nitrogen deficiency



whole - leaf chlorosis caused by nitrogen deficiency



Purple coloration on phosphorus deficient senescing nectarine leaves



Nectarine fruit cracking caused by phosphorus deficiency



Leaf rolling and pale color of potassium deficiency



potassium deficiency include scorching and curling of the leaf

5) Pruning & Training of Fruit Trees

Pruning is a practice of cutting away a portion of plant to improve the quality of the fruits or to heal or repair the injury. Pruning is an essential part of successful fruit growing. It helps to:

- Develop and maintain a balanced tree, of manageable size and even shape
- Rejuvenate the tree, stimulating growth and new fruit-bearing branches
- Let in light and air, encouraging a regular crop of healthy fruit
- Remove branches that are diseased, damaged, crossing and badly placed
- Find a balance between growth and productivity

These tools are useful for pruning:

- Bow saws for large branches
- Pruning saws for medium branches
- Loppers for smaller stems
- Secateurs or shears for twigs and shoots
- A pruning knife for young growth and tidying up larger cut



Bow saw



Pruning saw



Loppers



Pruning knife



Secateurs or Shears

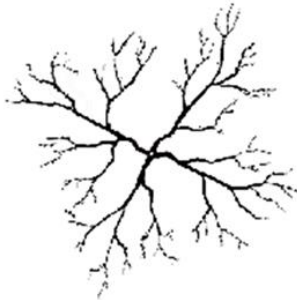
Why Prune a Fruit Tree?

- Prune your fruit trees to remove dead branches and parts of the plant that are no longer useful to help prevent insect and decay organisms from entering the tree.
- Prune to thin a dense canopy on a tree to increase air and sunlight, improve air circulation and allow light to reach inner and lower leaves, resulting in fewer disease problems.
- Remove suckers (Vegetative, adventitious growth coming from the root system of a tree) these are branches which are not producing fruit and consume more nutrient of the tree.
- Improve the plant's overall health - frequently removing older stems encourages a plant to put energy into new growth, thus keeping the plant young.
- Prune to increase the number and quality of fruit, for increasing yield.

Two main reasons of pruning your fruit trees are: 1) Control the Tree (Pruning for Training) 2) Control Fruit Production.

1) Control the tree (Pruning for training)

- Make the tree strong to hold fruit without breaking
- Make the tree small - make the tree easy to harvest and spray
- Prune to use all the light coming to the tree
- Prune to open tree for good light inside the tree
- Prune tree to continue producing close to the ground
- Prune tree so that it doesn't shade other trees



Pruning to Train or Control the Tree

2) Control Fruit Production

- Remove crossed and broken branches
- Remove disease or insect problems
- Prune to get as much fruit as possible all over the tree



- Prune to get quality fruit all over the tree



Get as much fruit as possible and quality fruit all over the tree.

However, getting the maximum fruit is not necessarily the best approach: sometimes even fruit-bearing branches have to be removed too. We need to find a balance between growth and productivity.



Bad Fruit Color Because of Low Light

What happens if there is not enough light inside the tree canopy?

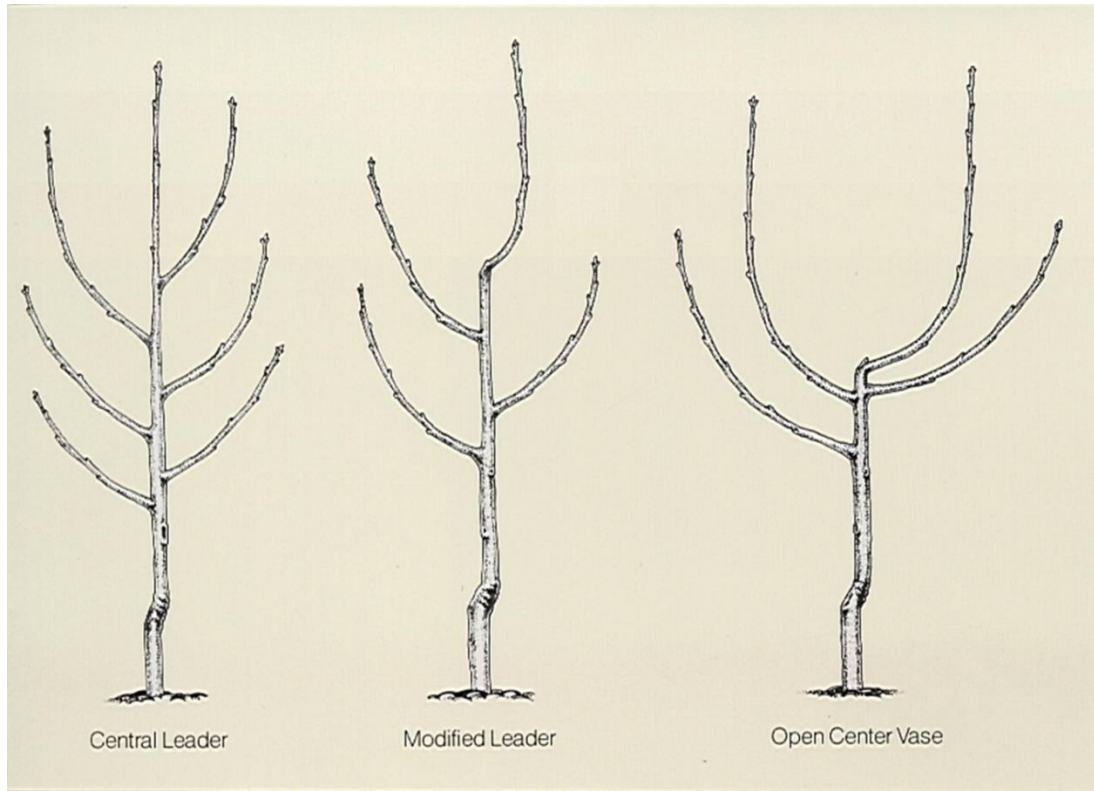
- Leaves drop or branches die inside where it is dark
- Fruit yield is lower because of low light
- Fruit color is not good where it is dark
- Many small fruit because of darkness
- Most fruit at the top or sides of the tree where there is light



Pruning Cuts Manage Light. More light = More fruit



Leaves Fall inside the Tree Because Of Low Light



Pruning to Train the tree – Central Leader

Prune to Train the Tree – Modified Central Leader

Pruning to Train the Tree – Open Center

Types of Pruning Cuts

There are two types of pruning cuts, thinning and heading. **Thinning is the removal of the entire branch or limb at its base.** Thinning cuts are employed to remove an entire limb or branch where crowding occurs. **Heading is cutting back a portion of a branch to just above a healthy bud or side branch.** Heading cuts are useful for shortening branches or to redirect their growth.



Heading Cut

We use heading cut in order to:

- Remove part of branch and increase the number of branches. One cut = three new branches because of one heading cut the branch is encouraging to produce new growths.
- Make a weak branch stronger (thicker)
- Force the tree to produce fruit closer to the trunk



Heading Cut

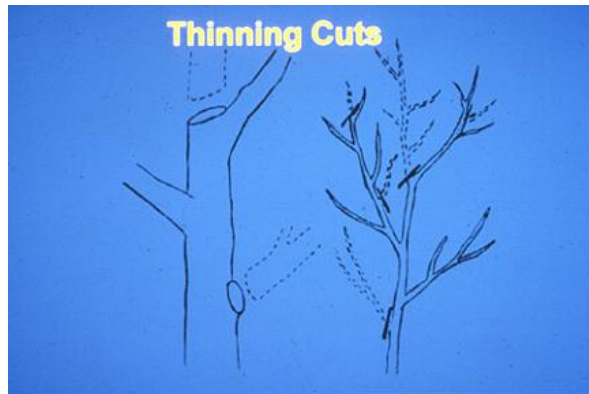


Heading Cut Removes Terminal Bud Releasing Control of Side Buds



Why Do Thinning Cut?

- Control the size of the tree
- Open tree for more light inside
- Remove branches without increasing new growth too much



Thinning Cut



Thinning Cuts Keep Terminal Buds to Control Side Buds



Best angle is 45 degrees



Use a spreader to make 45 degrees angle



When to Prune?

Pruning needs to be done at least once a year. Traditionally, a fruit tree is pruned during its dormant season, which is late winter to early spring – **winter pruning**. Pruning can also be done at the end of summer to remove new shoots or to cut back upright shoots on side branches – **summer pruning**. Light pruning for the removing of dead branches as well as “suckers” growing around the base of the fruit tree can be done anytime of the year.

Winter Pruning

Pruning during dormancy is a most common practice. It results in a vigorous burst of new growth in the spring. It is usually best to wait until the coldest part of winter has passed and then start to prune because the cool weather will be a cause of freezing on pruned branches.

- Prune much in the top of the tree using thinning cuts
- Remove branches too close together using thinning cuts
- Remove branches growing far from 45 degrees angle (going down and up) using thinning cuts
- Keep horizontal growth, use heading cuts if too long

Summer Pruning

Summer pruning is done on young shoots (with leaves) which grew in the same year. There can be two objectives – either remove all shoots to allow for light to reach fruit (this is usually done on older trees which already have a formed tree crown); or cutting the shoots short so that they branch out and help form the canopy/crown (this is usually done in juvenile trees when forming the crown).

- 6) Remove only new growth growing straight up for this purpose always use thinning cuts. These branches growing straight up their color is bright and the buds they produce are not prominent like the buds producing fruit.
- 7) Do with your hands by pulling if you do it early enough.

8) Thinning Fruit Trees

Thinning fruits is an important activity in order to have good quality of fruit. Sometimes the tree is overcrowded with fruits; a situation that is not in balance with the nutrient availability and with the capacity of the tree to mature them. Different types of trees vary in this aspect. Peach, plum and apple trees need more fruit thinning while citrus and pear trees need less. Thinning fruits should follow the following procedure:

- Fruit thinning should take place during the first 6 weeks of fruit set.
- Shaking the tree before thinning helps to dislodge unfertilized fruits.
- During the initial thinning, malformed, overcrowded and paired fruits should be pruned.
- Short stems in apple trees should be pruned drastically.
- A maximum of 1 fruit are allowed to be kept per cluster, in exceptional cases 2 fruits are also kept.



Recommendation for Fruit Thinning

Cherries, figs, persimmons, pomegranates, citrus, and nut trees do not usually require thinning. However, branches of persimmon trees can break from the weight of a heavy crop and may benefit from some fruit thinning or branch propping.

Fruit tree type	Fruit thinning
Apple	Leave 1-2 evenly spaced fruits per spur. Thin when fruits begin to turn downwards. Leave just one, two maximum, but definitely not three.
Peach	Thin fruits after they have stoned. Leave one fruit in every 20-25 cm.
Plum	Thin fruit after they have stoned. Leave one fruit every 5-8 cm.
Pear	Thin when fruit begins to turn downwards. Leave 1 or 2 fruits per cluster.
Apricot	Similar with plum. Leave one fruit every 5-8 cm.
Cherry	The fruit of sweet cherry and sour cherry are not typically thinned, but, if your trees are having issues with fruit drop due to stress, you might consider thinning some of the fruit. No more than 10 cherries should be on any given spur, so thin clusters that may be creating crowding issues or contributing to cherry drop.

Source: Ferenc Sandor, ROP, Afghanistan 2008

Too much fruit on a tree may weaken it and result in small-sized fruit of poor quality as well as smaller crop for the next season. . To avoid these problems thin the trees two or three weeks after bloom. Remove all but the largest fruit in each cluster. Remove small, insect- or disease-injured fruit first and follow recommended average spacing distances.

Thinning your fruit trees also gives you an opportunity to observe each tree closely, which helps to spot and treat early threats to the developing fruit. Tent caterpillars, for example, are easy to see when thinning fruit, and easier to eradicate when the invasion is found early.



In the picture above, there are 5 young apples in a cluster. If your tree is producing this much fruit, it needs to be thinned. Even with clusters of only 2 fruits, thinning is usually a benefit to the tree. With the fruit cluster above, 4 of these young fruit will be removed, leaving the largest single young fruit to develop.



If you have two similar sized fruit on a cluster and can't decide which to remove, take the one which has less sun exposure.



As you thin each cluster, keep your eye out for any flaws in the fruit, such as spots, bug damage or poor conformation. These are the first ones you should remove.



When you're done, there should be just a single apple per cluster and it will look like this



From the two fruits in the tree one of them needs to be thinned.



When you are finished, the branch will look like this.



Using your fist as a measure for minimum distance between fruit