MERCY CORPS INTERNATIONAL

HORTICULTURAL HANDBOOK

Apricots

Grapes

Pomegranates

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Compiled by:

William A. Welch

with assistance from:

Samir Ahmad
Karimullah Qureshi
Tahira Baloch

For the people of Afghanistan
In the hope that with Peace, Knowledge, and much hard Work
We can make her fields green with fruit again

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With thanks to the hard working
men and women of MCI
without whom this book
would have been impossible

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APRICOTS

(*P. armeniaca*)

Commercial Origin

Although the botanical name of the common apricot Prunus armeniaca indicates that it originated in Armenia, it is more likely to have originated in central and western China. The cultivated apricot, seem to have originated in northeast China between the town of Kan-Tcheou and the Russian border. The Chinese used a character believed to represent the apricot in writings earlier than 2000 BC. It spread to southwest Asia before the time of Alexander the Great and he is credited with taking the apricot to Greece in the 4th century BC. That zone later extended to include central Asia, northwest China, Uzbekistan, and the town of Tashkent corresponding to tian-Chan. Apricots are found to altitudes of 600-1000 m. Pliny writes that it reached Italy about 100 BC. It seems that a population of seedlings was also imported from Iran through North Africa and Spain by Arabs in the seventh century A.D. The fruit soon became established in other parts of Europe where the weather was not too cold. The English brought the apricot to Virginia and Captain John Smith reported in 1629 that the trees were thriving. The spaniards introduced the apricot into Mexico where it grew well in the less humid parts of the country. Then as the Spanish missions were established in California in the 18th century, seedling trees were planted. Named cultivars were brought from Europe prior to 1850.

It must be noted that great majority of trees were of seedling origin, even though the Romans knew how to graft. The use for seedlings still remains in several areas such as the upper valley of the Indus (Ladakh), northern Iran (Tabriz), oases of the mountains of Tunisia (Sbeitla), and Algeria (M'sila), as well as the valleys in the southern Atlas in Morocco (Draa). Even in Europe the extensive apricot plantations around Mount Vesuvius, near Naples, are often not grafted trees.

The use in plantations of systematically grafted trees is quite recent, and this explains the number of old varieties still existing in European countries. Inspite of this variability, a characteristic of the apricot is the very strict adaptation of the old cultivated sorts to their specific local environment. The introduction of varieties from other countries has most often failed for this reason; thus world production is based on a small number of grafted cultivars.

Propagation and Management

The apricot tree blooms very early and must be grown where early spring frosts are not a hazard. However, it requires cool winter weather to break dormancy and sunny, dry warm weather in spring and summer. Fruits that have relatively short growing seasons, as apricots, are more affected by ambient temperatures during the growing season than are long-season crops. Accordingly days from bloom to harvest is not alone a dependable index of harvest maturity.

Botanically, the apricot, like the peach, cherry, and plum, is a drupe fruit.

In nursery stock and young trees, apricot root is easily identified by the beet-red or blood-red color. In older trees, however, more detailed features are essential to distinguish between apricot and peach roots.

Quick overview of Management

Fruit trees may be layed out on square system having 7.32 meters (24 feet) distance from row to row and plant to plant. Nitrogenous fertilizers may be applied in two doses, one dose (Urea 1.5 kg, Potassium sulphate one kg and supter phosphate one kg) per tree at the time of sprouting and the second dose of one kg. Urea is applied about fifteen days after fruit set. The fertilizers are applied about 2 feet away from the trunk of the trees thoroughly mixed with soil. Three irrigations are given to these fruit trees. First irrigation after the application of first dose of fertilizer, second irrigation after fruit set and third before picking of the fruits. Hoeing may be done in April for the eradication of weeds and acration.

Propagation

Apricot cultivars are propagated commercially by T-budding on various seedling rootstocks in the genus *Prunus*. Fall budding is the usual practice, but spring and June budding may be used.

Rootstocks for Apricot

Three stocks are commercially suitable apricot seedlings, peach seedlings, and in some cases, myrobalan plum seedlings. Seeds of all these species require low-temperature (41° F; 5° C) stratification before planting in the spring-three to four weeks for the apricot and about three months for the peach and myrobalan plum. On good, well-drained soils, apricot seedlings are the recommended rootstock for apricot cultivars.

Apricot seeds can be obtained from drying yards and canneries.

Seeds of 'Royal' or 'Blenheim' produce excellent rootstock seedlings in California. Since the apricot root is almost immune to the root-knot nematode (*Meloidogyne* sp.), it should be used where this pest is present. In addition, it is somewhat resistant to the root-lesion nematode. It is susceptible to crown rot (*Phytophthora sp.*), and is not tolerant of poor soil-drainae conditions. Apricot roots are not as susceptible to crown gall (*Agrobacterium tumefaciens*) as are peach and plum roots. Apricot seedlings are susceptible to oak root fungus and highly susceptible to verticillium wilt.

Peach (*P. persica*)

In some areas peach seedlings are satisfactory as a rootstock for apricot cultivars but sometimes the union is enlarged or rough. Although the peach itself is short-lived, apricot trees 85 years old growing satisfactorily on peach have been know. In unirrigated orchards or where drought conditions prevail, apricots on peach seedling roots make better growth than those on apricot roots. Peach roots are not tolerant of wet soils, growing better on light or well-drained soils. For trees to be planted in a location formerly occupied by peach roots, some stock other than peach should be used, because peach roots often grow poorly on soils formerly occupied by them. In some regions apricot cultivars show definite incompatibility on peach seedlings, so it cannot be assumed that all cultivars will do well on peach roots.

Myrobalan plum (*P. cerasifera*)

Although there are successful high-yielding apricot orchards grown on this rootstock, it cannot be unqualifiedly recommended. In a few instances the trees have broken off at the graft union in heavy winds, and die-back condition have been noted. Nurserymen often have trouble getting apricots started on myrobalan roots, some of the trees failing to grow rapidly and upright or else having weak or rough unions. After these weaker trees are culled out, the remaining ones seem to grow satisfactorily. In older trees of this combination, the myrobalan root usually grows much larger than the apricot trunk, giving a "churn bottom" tree.

This stock is useful for apricot when the trees are to be planted in heavy soils or under excessive soil moisture conditions, which the myrobalan root will tolerate. An alternative to myrobalan plum seedlings is the related vegetatively propagated 'Marianna 2624' plum on which apricot seem to do well. In apricot rootstock trials in Australia trees on Myrobalan seedlings, 'Myro 29C, and Marianna plum far outfielded those on peach or apricot roots over an eight-year period.

Western sand cherry (*P. besseyi*)

Although it is not used commercially, this rootstock will produce a semi-dwarf tree.

Rootstock relationships

Interstems have been used in apricot culture for two reasons: to overcome problems of root--scion incompatibility and to prepare trees with a high trunk. In the first instance, the interstem must be compatible with both rootstock and though there is some delay in coming into production, when compared to Myrobalan. These stocks produce fruit with more color ad earlier maturity. Myrobalan, peach, and Marianna rootstocks all seem to give larger fruit. Generally speaking, a slight incompatibility will usually result in larger, sweeter, and more colorful fruit. Pollizo plum rootstock seems to give more cracking. Myrobalan rootstocks produces trees with fewer leaves which drop later in autumn than do apricot seedlings as rootstocks.

Age of Bearing, Tree Life, and Yield

The trees often bear a few fruits at 3-4 years of age, but more usually bear the first light crops at 4-6 years. Commercially, the life of a good orchard is 15-20 years. Yields average 3.08-3.52 kl per ha (350-400 bu per acre) of marketable fruit, and may be higher in the most suitable areas and lower in less favorable ones.

Location[1]

Because of its early bloom a northern slope may have some advantage. Poorly drained sites, for either soil or air, are not good for apricot orchards.

Planting distance[2]

The row to row and plant to plant distance depends on several factors such as planting system, variety, rootstock,soil type, and fertility. In case of commonly adopted square system of

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1 For more general information on fruit tree planting see the "Fruit Tree Planting" section at the end.

2 "Planning, planting and management of stone fruit orchards in N.W.F.P" Habibuah Khan, Saffar Ali, Mohammad Anwar Department of Agriculture, Agricultural Research Institute, Tarnab (Peshawar), N.W.F.P.,Pakistan 1983

planting,the following distance is generally satisfactory under our present orchard management system.

Fruit	Distance	Plants/acre
Peach	20	109
Plum	18-20	140-109
Almond	20	109
Nectarine	20	109
Apricot	20-25	109-69

The trees are commonly space 6.1-7.6 m (20-25 ft) each direction, i.e., 3-44 trees per ha (70-109 trees per acre), in leading apricot areas. Spacing may be halved the first several years for increased fruit production and then selective removal to the optimal spacing.

Planting time

Peach, plum, apricot, almond, and nectarine are planted while in complete dormant state (December to February) in plains, and up to March at higher elevations. Generally speaking plantation of these fruit plants must be completed before buds begin to grow, the earlier the better. Plantation after bud sprouting will result in greater mortality and poor growth.

Digging pits

After proper layout, the pits should be dug shortly before plantation and should be only large enough to accommodate the roots of the plants in natural form on most soils. But if there is any hard layer below subsoil, then digging should be deeper to break it.

In case of light and very poor soils it is better to dig bigger pits and to fill them with equal amount of top soil and well rotted organic manure, followed by two three irrigations so that the soil is settled and the manure decomposes fully. This has to be done at east two months ahead of planting time.

Depth of planting

Plant should be set in the soil as deep as it was in the nursery or with the bud union at least 5 to 6 inches above soil, otherwise the ability of the rootstock to resist soil borne disease will not be utilized. In case of deep plantation when the scion portion of the plant comes in contact with the soil, it is likely to be attacked by soil borne organisms causing food rot collar rot disease. Many plants of apricot,and other stone fruit varieties are lost annually because of this disease mainly due to deep plantation.

Pruning[3]

Pruning is one of the important and essential operations in fruit production. Young plants are pruned with an object to develop a well balanced tree with a strong skeleton. This pruning is called training. The object of pruning bearing trees is to maintain tree vigor production and fruit quality, for example, pruning generally improves the size of the fruit.[4]

Unfortunately many of our fruit growers are not well aware of the importance of proper training and pruning in fruit production. In young stone fruit orchard pruning is carried out for a couple of years but pruning during this period is not according to the principles of training. Trees are pruned severely with no attention to develop a tree with well balanced skeleton. The tree is forced to grow upward with the object to have more and more land for intercroping. When the trees come into bearing, pruning is stopped all together specially in case of apricot and plum. Some people prune their trees after a period of three years. As a result of irregular or no pruning, trees grow very tall which creates problems in fruit picking and application of plant protection measures. The result is decrease in quality and production and early orchard decline.

Training of young trees

There are several training system such as : Open center, central leader and modified leader. Under our climatic conditions modified leader system is the most desirable one for stone fruit varieties specially in Peshawar Valley. In this system during first to three years, efforts are made to select three to five scaffold branches spaced 15 to 30 cms apart around the trunk. The lowest branch should be 45 to 60 cms from the ground.

Stone fruits like other deciduous plants require proper training in the first three to four years. During this period efforts are made to develop the tree with a well balanced and strong frame work. There are several training systems but again under our climatic conditions modified leader system is to be preferred over others. Under this system four to five primary branches 6

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3 "Pruning and its importance in stone fruit production" by Habibullah Khan, saffar ali, mohammad anwar department of agriculture, agricultural research institute, Tarnab (Peshawar), N.W.F.P.,Pakistan 1983

4 "Effect of pruning on size, quantity and quality of apricot fruit", Saifur-rahman, Sharafit Khan and Mohammad Ishtiaq, Sarhad Journal of Agriculture, Vol. 2, No. 1, 1986

to 10 inches apart, well distributed around the trunk are selected during the first tree years. The lowest branch has to be kept 18 to 20 inches from the ground. During the second and third years, three to four branches are selected on each primary limb, with the lowest branches 15 to 20 inches from the trunk. In the forth or fifth year the leader is cut back about ten feet from the ground to develop a tree with low top.

During subsequent years four to five secondary branches are selected on each primary limb. These branches should also be well spaced with the lowest branch not closer than 40 to 45 cms to the trunk. The central leader has to be cut to a side branch at about two and half to three meters from the ground straight up.

Because of its growth habit and need for light, the apricot is not suitable for high-density plantings. Some attempts have been made in Italy to utilize the Baldassari palmette system. The advantage of this system, compared to the usual modified leader system for production, are not a subject for this chapter. As for rootstocks, there is presently no information available on their direct effect on production in these systems.

Pruning bearing trees

The object of pruning bearing trees is to maintain tree vigor, fruit quality, productivity and also to keep the tree within reach. Therefore, annual pruning must be carried out regularly in stone fruit orchards.
The important benefits of annual pruning are given below:

1. Pruning keeps fruiting wood young and vigorous
2. Pruning increased fruit size
3. Pruning increased fruit color
4. Pruning assists in controlling insects and diseases.
5. Pruning facilitates fruit picking because the trees are kept low.
6. Pruning increase marketable yield.

Time of pruning

Deciduous fruit trees are generally pruned during dormant season. It has several advantages : the pruner can easily and quickly decide in selecting the wood to be removed as the tree is without leaves, secondly pruning can be done most efficiently during cold weather because the job requires much exercise and thirdly there is better healing specially if performed during late winter.

In addition to normal dormant pruning, deciduous fruit trees are also summer pruned with the main object to keep the trees short but well spread. This trend has to be developed in case of increased plant density system. Summer pruning is carried our several times during active growth period in case of young, non-bearing trees but just after harvest in case of bearing trees. This system has been found to be very useful in obtaining increased profitable production specially in case of early and mid season varieties of stone fruits.

Steps in pruning bearing trees

This recent trend in pruning is to develop and maintain trees with low tops, because low trees are much easier and less expansive to spray, prune, thin and pick. The following points should be noted for pruning bearing trees.

1. Start at the top of the tree and work down, removing the crowding branches and thin wood. Similarly short at the of the tips limbs and prune back to the base leaving the vigorous fruiting wood well spaced along the length of the limbs.

2. Remove dead, broken and diseased wood. If diseased wood is left on the trees it will result in further spread of the of the disease.

3. Remove any limbs which are crowding other limbs, growing parallel with them or resting upon them.

4. Use judgement in making large cuts so that direct after noon sunlight during hot days in summer will not sunscald remaining exposed branches.

5. Remove all water sprouts except an occasional one which may be required to fill a vacant space in the tree.

6. There is less risk of winter injury when pruning is done in late winter or early spring.

Rejuvenation of neglected orchards

Neglected orchards trees which have matted growth with lot of dried diseased and sick branches, often grow tall and are difficult to manage. Such orchards can be brought back into production by sever pruning and proper fertilization as under:

1. Cut back top limbs to strong laterals.
2. Thin out dead and matted limbs to open remaining buds and spurs to light and spray.
3. Apply one to one and a half kilo gram of nitrogen/plant in late winter preferably three to four weeks ahead of flowering.

Do not prune such a tree excessively at any one time to bring about the desired condition. Spread the pruning over two to three years.

Treatment of pruning wounds

Smaller cuts do not require dressing but cuts bigger than 5 cms in diameter would require proper dressing. A satisfactory inexpensive antiseptic paint can be prepared by mixing bordeaux mixture with raw linseed oil to the consistency of paint and applying it while fresh to the exposed cuts.

Soil Management and Fertilizer

The apricot is shallow rooted and suffers more than apples from lack of moisture when in competition with grass. Since apricots are so similar in growth and fruiting to the peach and Japanese plum, they generally respond to similar fertilizer treatments.

Application of manure or artificial fertilizer at planting time is not advisable because a slight over dose of artificial fertilizer is likely to damage the root system of the plant. Similarly as a result of application of organic manure which is not fully decomposed can also damage the plant because during decomposition heat is liberated which can burn the root system resulting in plant death.

When the shoot growth of the plants has reached 8-10 inches, plants should be supplied with two ozs of actual nitrogen (four ozs of urea) per plant. This fertilizer will be sufficient for the first growth season. During second winter plant should be supplied with farm yard manure at the rate of at least six inches away from the trunk and thoroughly mixed up with the soil. In case of poor growth, plants should be supplied with four ozs nitrogen (eight ozs of urea) per plant in early summer. During subsequent years the quantity of manure should be increased accordingly with the age. Annual application of nitrogen at the rate of one to two pounds trees is usually sufficient for bearing trees.

Generally, there is no need for application of phosphatic and potash fertilizers on many soils especially during non fruiting stage. However,whenever there is any doubt about deficiency of these elements it should be verified through leaf analysis and fertilizer application made accordingly for correction of deficiencies.

Maximum yields were obtained with the application of NPK at the rate of 2 kg each per tree respectively.[5]

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[5] Effect of nitrogen, phosphorus and potash fertilizers on the vigor and marketable yield of apricot; Syed Fazal Ahad, Mukamil Shah, Nawab Ali, and Jamshid Khan, Sarhad Journal of Agriculture, Vol. 1, No. 2, 1985

Apricots respond to K fertilizer with improved vigor, better bloom, and increased yields, but they fail to respond to P fertilizer except for newly transplanted trees. The P requirements of apricots are low but the trees seem able to absorb P from the soil over a long period of the year and to store it in the tissues.

Apricot trees are susceptible to Zn deficiencies, and the typical symptoms of "little leaf" or "rosette" are common in irrigated orchards.

Iron malnutrition of apricot trees is associated with carbonate in the soil and, as with peaches, is commonly referred to as lime-induced chlorosis. The disorder, as indicated by yellowing of the foliage, is not the result of a simple Fe deficiency but seems to be associated with a Ca, K, and fe interrelationship.

Saline toxicity in apricots may occur in soils containing sodium chloride in excess of 0.30%

The chief Mn deficiency symptom of apricot is an interveinal chlorotic pattern on the foliage. The disorder has been corrected by Mn sprays, injection, and soil treatment.

Boron deficiency symptoms in apricots, especially on the fruit, have been reported frequently. Internal browning and corky tissue developing in the stone area, cracking of fruit, and shriveling, surface browning and construction of fruit have been corrected by field applications of 227 g (0.5 lb) of borax per tree.

Soil Lime

The apricot is adapted to soils with a high lime content, although there is variability among seedlings for this characteristic.

The Effect of Fertilizer on Apricots[6]

Number of fruit set
Number of fruit set was significantly affected by different doses of fertilizer Maximum number of fruit set (25.95 average of four twigs) was obtained with 3 kg NPK/tree. While minimum number of fruits set (16.56 average of four twigs) was recorded with no fertilizer.

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6 "Effect of different levels of npk (10:20:20) on growth, pre-harvestfruit drop, yield and quality of apricot (frunus armeniaca) cv: trevatt." Sarhad J. of Agriculture, Vol. 6, No. 6, 1990

Effect of NPK (10-20-20) on tree vigour

Different doses of fertilizer significantly affected tree vigour. Maximum increase in tree girth and annual shoot growth was obtained with the application of 6 kg. NPK/tree.

Effect of NPK fertilizer on the number of flowers and fruit set

Number of flowers data revealed significant difference. Maximum number of flowers (38.59 average of four twigs) were obtained with 3 kg NPK/tree while minimum number of flowers (23.12 average of four twigs) were obtained with 6 kg NPK/tree. Minimum fruit drop of 26.5 and 32.00 was recorded with 3 kg NPK/tree and 4 kg. NPK/tree.

Effect on the total number of fruits/tree

Maximum number of fruits (1317.20 in average of 3 trees) were obtained with the application of 3 kg NPK per tree, while minimum number of fruits 856.10 were obtained 6 kg NPK/tree.

Effect of NPK fertilizer on the yield of apricot

Maximum yield of 71.07 kg per tree was obtained in 3 kg NPK per tree while minimum yield of 41.05 kg/tree was recorded using 6 kg/tree.

Effect on fruit size

Fruit size is not significantly affected by different treatments.

Effect on % Acidity

Percent acidity is not significantly affected by different doses of fertilizer.

Effect on Total Sugars:

Maximum value of 11.51% for total sugars was recorded with no fertilizer, while minimum value of 9.16% for total sugars was recorded 6 kg NPK/tree.

Irrigation

During the first growing season irrigation has to be done very carefully. The plants must receive adequate moisture especially during early summer and until the on set of monsoon. Slackness in irrigation during this period can result in loss of many plants. Weekly irrigation on mo t soils would be sufficient. In case of sandy and light soil or s ortage of irrigation water, use of some short of mulch would help in moisture conservation and keeping the soil cooler. The application of mulch has additional advantages such as suppression of weeds and improvement of soil fertility. White ants and mice can cause damage in mulched systems.

The irrigation interval during monsoon season and later will depend on the condition of soil moisture and plant appearance. Over irrigation during this period and later could be dangerous. Therefore, irrigation should be done in such a way so as to keep the soil moist, but not wet for longer periods. Under continuous wet soil conditions there are chances of root suffocation resulting in poor health or even death of plants.

Apricots are generally grown under irrigation. Prolonged periods of dry soil conditions during July, August, and September resulted in reduction in number of flower buds diffentiate, and a slower rate of development of buds. Also, an unusually cool March prolonged the bloom period of the late-developing, later differentiated buds, so that full bloom on trees which received no irrigation after harvest the previous year occurred about one month later than on trees receiving postharvest irrigations. Fruits set by the late-developing flowers from later-differentiated buds were characterized by long stems to which a small leaf frequently was attached. The stones of such fruit were smaller than normal. The fruits, which remained small, matured 1-3 weeks later than normal fruit.

Waterlogging

One of the most drastic difficulties encountered by rootstocks is waterlogging. This can occur in a wide range of soils as a result of too much rain and/or poor soil drainage. Roots are more susceptible during their growth period than when dormant. In the *Prunus* species, roots deprived of oxygen will begin to ferment and produce damaging substances. Root suffocation is characterized by leaf wilting and an alcoholic smell (sour sap) emanating from the dead roots, which are brown. The appearance of symptoms varies quantitatively and qualitatively among the different *Prunus* rootstocks. When such symptoms are present for a sufficient period, they cause not only partial or total destruction of existing roots but prevention of root regeneration. A partial destruction of the roots, if it does not induce scion death, will lessen production and fruit quality.

Rootstocks[b]	Resistance to Waterlogging: In Winter	In Summer
Almond (S)	70	
Apricot	70	5-7
(Peach X almond)FG 557 (C)	75	
Peach (S)	80-85	8-10
(Peach X almond)GF 667 (C)	85	
Brompton plum (C)	120	20-25
G.F. 31 (Myrobalan X Salicina) (C)	125	20-25
Myrobalan B (S)	130	20-30
Damas Plum (C)	140	40-50
Saint Julien (C)	140	
Mariana G.F. 8-1 (C)	145	50-60

[a]according to Duquesne and Bernhard.
[b]Seedlings; C = Cuttings.

Weeding and hoeing

For better plant growth, soil around the plant should be kept clean from weeds by repeated weeding and hoeing because young plants can not compete with weeds and if the perennial weeds are allowed to grow once, then it becomes very difficult to eradicate them completely later. For more information see the section on weeding.

Pollination

Like the peach, commercial cultivars of apricots are self-fruitful, but benefit from bee activity

Cold Resistance

Apricots bloom earlier than peaches, and thus stand a greater risk of damage from spring frosts. Closed buds are highly subject to damage from low temperature and, after injury, may drop to the ground in northern regions.

About 850 hr below 7.2° (45°F) seem necessary to break the rest period of Royal buds completely. Some of the Mediterranean types, from low altitudes, seem to have very low chilling requirements.

The scion budding must be high, at 8-100 cm, so as to protect the cultivar trunk from very low temperatures occurring near the soil. As a rule apricot seedlings are not particularly winter hardy. Similarly peaches are not especially cold tolerant and some seem to be particullary sensitive.

Heat

High summer soil temperatures are not harmful to apricot seedlings in dry conditions, but can depress growth with some plum rootstocks ('Damas,' 'brompton, 'Saint Julien') under the same conditions.

Increase in resistance of Royal fruits to low temperature injury was obtained by spraying 2,4,5-T about 15 hr before a frost of 0°C (32°F) for 3 hr or -0.6°C (31°F) for 1 hr that occurred 40 days after full bloom. Also, the sprayed trees dropped 84% less fruit that was injured by frost that did the unsprayed.

Fruiting Habit

Apricots tend to produce excessive crops in 1 year and, by reason of this overbearing, to develop few fruit buds for the following year. The alternate bearing habit, once established, has many disadvantages over the annual bearing condition. The tree fruits on 1-year-old shoots and on short spurs. These spurs have a life of 2 or, at most, 3 seasons.

Fruit buds are usually formed at all nodes from base to tip of the shoot. At the base of the shoot 2-3 buds form at each node and the number per node decreases toward the tip of the shoot where frequently only 1 bud is formed; 2 or more fruit buds per node are commonly found on short spurs. On biennial bearing trees in their heavy cropping year bud formation is largely confined to the shoots. Apricots usually produce more fruit on spurs than do peaches.

Thinning the Fruit

In British Columbia, the time during which blossom-bud induction in apricots could be influenced was not entirely constant from year to year, and variedd from 38 to 55 days from full bloom. The most effective period for influencing fruitbud formation, however up to 38-41 days from full bloom. These data emphasize the importance of early thinning f biennial cultivbars such as Blenheim and Tilton in order to maintain as far as possible the annual bearing condition.

Fruit Quality Criteria

The apricot contains nine times as much Vitamin A as the average of 18 other common fruits and twice as much as its nearest competitor--the nectarine. It exceeds the average of these 18 fruits in proteins, carbohydrates, phosphates, and niacin. It is slightly lower in fats and calcium.

More specifically dried apricot generally contain 18.6% Moisture, 2.8% Protein, 1.5% Fat, 3.5% Ash and 80.06% carbohydrates with an energy value of 347 calories per 100 g.[7] It has been also reported that apricot contains 0.35 mg of ascorgic acid, 0.022 mg of riboflavin and 0.94 mg of calcium pantothenate per 100 g. The ripe apricot has about 100 times higher vitamin A content than other fruits.

The average values for the chemical composition of the dried apricots indicated that these contain about 14.53% moisture, 5.02% protein, 0.92% fat, 2.64% fiber, and 3.15% ash. Total carbohydrate were determined by difference which was 73.94%. The averate energy value was calculated as 322.32 calories per 100 g of apricots. The concentration of moisture, protein and fat was 16.0, 5.2 and 0.7 percent in dry apricots.

An apricot must be tree-ripe to attain the pleasing flavor characteristic of this fruit. Fruit for drying is harvested full-ripe and that for canning less mature, when still firm enough to be pitted and processed. Fruit for freezing should be harvested riper than for canning, for it does not have to be firm enough to undergo heat-processing. Unfortunately, fruit for shipment in the fresh state is harvested before it reaches full flavor and color, when it is firm enough to withstand packing, handling and the long trip to market.

When purchasing apricots, do not select fruits with greenish color that are firm to hard. They are likely to be sour and have little apricot flavor. Purchase fruits with full apricot color, that are firm ripe to ripe, but not mushy and overripe. Sometimes the soft specimens are decayed. Look for soft spots that indicate the beginning of decay.

Selective harvest means that external characteristics such as size, color, and suture rounding must be used as indexes of harvest maturity. The definition of "mature" in the "United States Standards" for apricots is as follows: "Mature means having reached the stage of maturity which will insure a proper completion of the ripening process." The definition of "mature" used in California require the fruit to be $^{3}/_{4}$ yellow-green and the flesh to be at least $^{1}/_{2}$ yellow, as defined by a standard color chart. This is a reasonable basis for enforcement of harvest maturity regulations even though in the final analysis the picker is the sole judge, so it is essential that all pickers be instructed on fruit selection. The picking foreman can use other indexes, such as flesh color, loosening of the pit, and even percent soluble solids, but he must relate these

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7 "Effect of storage environments on the keeping quality of dried apricots" Sarhad J. of Agric., Vol. 4, No. 1, 1988

characteristics to external appearance for communication with the pickers.

The number of days from full bloom and the accumulated heat units above 7°C (45°F) are used as guides for growers in setting harvest dates. The first 6 weeks after full bloom appear to be the most critical in respect to temperature effects. High temperatures 39° to 39.5°C (102° to 103°F) during 2 or 3 days late in the growing season causes softening of the flesh near the pit and subsequent browning. The injury was not considered to be caused by O_2 deficiency or excess of CO_2 in the fruit.

Harvest maturity is not uniform among fruits on the tree, and even varies from tree to tree in one orchard. Because of this several pickings are required to obtain fruit of uniform quality--neither too hard and green to ripen with good quality nor too soft and ripe to reach the market in sound condition.

As the fruit is left on the tree longer, the soluble solids content increases, acids decrease, firmness decreases and consumer acceptance is improves as would be expected. Tilton apricots harvested mature but not ripe contained 11.3% soluble solids, and had 3.9 kg (8.5 lb) average pressure test or firmness as measured with the Magness-Taylor pressure tester with 8 mm ($^5/_{16}$ in.) diam. plunger. Most of the fruits, 85%, met consumer acceptance tests. Fruit picked at average commercial maturity for fresh shipment were only 56% acceptable, had 10% soluble solids and 5.1 Kg (11.3 lb) average firmness.

A consistent increase in total sugars and in the soluble solids-acids ratio in one cultivar of apricots, harvested from hard mature through firm mature to soft mature has been noticed. These differences were maintained through 8 days of postharvest holding at 21°C (70°F) and 85% rh. Spoilage after 8 days holding was a factor only in the fruit harvested as soft mature.

Canning

Apricots for canning are harvested at the optimum ripeness level. When harvested at the "canning-ripe" stage, the fruit is firm, of good color and of pleasing flavor. Yet, it will not have reached the maximum flavor at this stage of ripeness. As the fruit firmness decreases, the volatile reducing substances increase. Correlated fruit firmness and soluble solids at time of harvest with organoleptic acceptability of ripened apricots. The physiological and biochemical changes in maturing stone fruits include an increase in soluble solids, decrease in firmness, loss of chlorophyll, increase in specific pigments, and decrease in acidity. The average pressure test of Blenheim apricot at canning ripeness was at 2-5 lbs ($^7/_{16}$ -in. plunger).

Receiving

Most canners examine each delivery of apricots to determine roughly the percentage of the different grades, and payment is made to the grower on the basis of the test and whether the sample shows texture breakdown after canning on a trial run. If the sample shows texture break down right after canning, the lots are diverted for processing into nectars, baby foods, jams, and preserves.

Pitting

The apricots are washed, halved, and pitted but are usually not peeled. Some apricots are processed as whole fruit after lye peeling. The fruit may be cut by hand around the pit suture, and the pits removed; now, more commonly, the fruits is cut and pitted by a machine.

Grading

Screens with opening 40, 48, 56, 64 and 68 thirty seconds of an inch are used for apricots. The average diameters of fancy, Choice, and Standard grades are usually 56, 54 and 50 thirty-seconds of an inch respectively. The grades are based more upon color, texture, and absence of defects than upon size.

Filling and Syruping

The graded fruit is conveyed to mechanical or hand-pack devices for filling. The filled cans are fed to the vacuum syruping machines where syrups of the concentrations recommended by the California Canners' League, 55°, 40°, 25°, 10° Balling and plain water are used, according to whether the grade is Fancy, Choice, Standard, Second, or Pie.

Exhausting and Double Seaming

Apricots contain some imprisoned gas which will cause pin holing in the can unless the gas is driven out by exhaust. Can are exhausted up to 10 min at 180°F in the exhaust box and then closed in a steam-flow machine. A more common practice now is to prevacuumize the canned product and close it in an atmosphere of steam. This prevacuumizing gives less syrup loss, uses less floor space, and requires less steam than the exhaust box method.

Heat Sterilization

After exhausting and double seaming, the canned apricots are heat processed at 212°F sufficiently long for the center temperature of the product to reach 195°F.

Most canned apricots are heat processed in continuous rotary cookers at 212oF for 17-19 min for No. 2 $^{1}/_{2}$cans, and for 20-30 min for No. 10 cans, depending on the initial temperature and the texture of the fruit. Whole fruit requires longer processing than the halved. The heat-processed cans are water cooled to 105°F and then transferred to the warehouse for storage.

Yields

The yield of halved canned apricots per ton may vary from 52 to 55 cases of 24 No. 2 $^{1}/_{2}$cans. Loss in canning of the unpeeled halved fruit is about 10-15%. Where the fruit is peeled, the loss may exceed 30. Yields of canned whole apricots usually exceed 70 cases per ton.

Texture of Canned Apricots

Ripeness level of the fresh fruit and processing time were the important factors influencing texture of apricots. Canned apricot halves soften during storage with an increase in water-soluble pectin and viscosity in the syrup, and a decrease in protopectin. Riper apricots contained less protopectin and the syrup contained more water-soluble pectin.

Besides ripeness level and the processing conditio, the problem may also be related to intrinsic- and/or parasital-originated pectic and cellulytic enzymes. Perhaps control of mold contamination in the orchard, better sanitation, more rapid and careful postharvest handling, and more selective sorting on the grading table would help to alleviate the problem.

High acidity in the apricot is related to the softening problem. Acidity in the fruit is related to the variety, climatic conditions, and the level of nitrogen application.

Softening in high acid apricots with pH ranging from 3.3 to 3.5 may result from acid hydrolysis of cell wall constituents. Some canners have successfully eliminate the softening problem by eliminating certain lots with high acidity and those with possible mold contamination.

Apricot Purée and Apricot Beverages

Apricots for nectar manufacture should be so ripe that they are soft. Puree or nectar prepared from the firm fruit, such as is used for canning, will be of inferior flavor and color. Tree-ripened fruit possesses a better flavor than that permitted to ripen after picking. Since apricots ripen unevenly, it is necessary to harvest 3-4 times in order to obtain the best flavored fruit.

Apricot Puree

Washed and pitted apricot halves are steamed until soft; then they are passed through an expeller screw extractor with a 0.033-in. screen. One part of sugar is added to three of pulp. The product is filled into No. 1 plain cans, exhausted 8-10 min, sealed, processed at 212°F for 20-25 min, and cooled in water. The undiluted product prepared in this way requires dilution with water or sugar syrup before use as a beverage.

Apricot Nectar

The process for making apricot nectar may be briefly described as follows: The fruit is steamed in a continuous steam cooker for approximately 5 min. The hot fruit is then run through a brush finisher equipped with a 0.025-0.033-in. screen. The resulting puree is then passed through a steam heated tubular heat exchanger where it is brought to a temperature of 190°-200°F. The puree is sweetened with approximately 1.8 times its volume with 15° - 16° Brix sugar syrup, and citric acid is adjusted so as to maintain a constant total solids-acid ratio throughout the season. The resulting nectar is filled into plain cans, exhausted for approximately 6 min, and sealed. The No. 1 tall cans are processed for 15 min at 212°F; larger cans are given a longer processing.

Apricot Drying

Low Tech[8]

Direct sunshine during the summer is available for about 8 to 10 hr. to the fruit spread for drying when air temperature ranges between 28 and 34 C. About 3 days are required for drying under the direct sun.

The adequate range of sulphuring time for fumigation of fresh apricots was determined to be about 3 to 4 hours as shown by significant change in color of apricot and the filling of "cups" with juice.

Yields of various varieties of apricot fall within a range of 15 to 20% and their moisture contents run from 15% to 19%. These determinations seem to be within a satisfactory range for dried apricots.[9]

High Tech Sulfured fruits

In conventional practice, fresh apricots are halved, pitted, sulfured by contact with gaseous sulfur dioxide, then spread on trays and exposed to the sun until dry. The products have certain characteristics which are recognized and desired by consumers, including a rich orange color, a translucent appearance and a gummy texture. Although sun drying yields a product with these desirable characteristics, there are disadvantages to be reckoned with. Notable is the slowness of the process, requiring a least several days even when the fruit is exposed under ideal conditions to the bright sun in the California orchard areas. Another point is that the fruit is exposed to dust, insects, birds, rodents, etc, so that problems of sanitation are encountered. A further problem is the delay and danger of molding in the event of rain during the drying period.

However, if pitted fresh apricot halves are sulfured, then dried by exposing them to a draft of hot air, the products have these characteristics: in color they are pale-yellowish instead of rich orange; in appearance they are opaque instead of translucent; in texture they are pithy rather than gummy.

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8 The previous consultant's report (Mr. Tom Brown) outlines the low tech method in more detail. For further notes see the "Apricot Drying Training Report"

9 "Sun-drying of apricot in Baltistan", Fazal-ur-Rahman, PCSIR Laboratories, Peshawar (received October 14, 1985; revised July 3, 1986)

One process[10] produces apricots which have the desirable attributes of the sun-dried fruit. They are rich orange in color, translucent in appearance and gummy in texture. In addition, the products have an excellent characteristic flavor which is superior to that of sun-dried apricots. In shape, the fruit pieces have the proper curl of the edges toward the cut surface in contrast to the flat slabs often obtained in artificial drying methods. Also, the products reconstitute more rapidly and completely than the sun-dried product.

In applying the process, fresh apricots are first subjected to the conventional preliminary operations of washing, halving, pitting and placing on trays in the cups-up position. The whole fruit may be given a preliminary sulfuring, as by dipping in a solution of sulfur dioxide or alkali-metal sulfite or bisulfite, or by exposure to SO_2 gas, to prevent browning during these preliminary operations, particularly if there is any substantial delay between the successive steps of halving, pitting and traying.

The trayed fresh apricot halves are then sulfured. This may be effected by spraying the fruit with a solution of sulfur dioxide or an alkali-metal sulfite or bisulfite. In the alternative, the trays of fruit may be placed in a chamber where they are exposed to sulfur dioxide produced by burning sulfur or from commercial tanks of liquefied sulfur dioxide. In another alternative, the fresh apricot halves are dipped in a solution of sulfur dioxide or alkali-metal sulfite or bisulfite and then spread on the trays. In any event, the sulfuring should be sufficient that the fruit tissue contains 400 to 1,000 parts per million of SO_2, including that which is introduced by any previous sulfuring step of such is used. A greater proportion of SO_2 than 1,000 ppm may be employed if desired but is not necessary.

The sulfuring step is required to preserve the natural color of the fruit during subsequent processing steps. Also, the sulfuring causes a plasmolysis of the fruit tissue which contributes toward obtaining a final product of desired translucency.

The sulfured fruit is then subjected to partial dehydration. This is preferably effected in any of the usual typed of dehydration apparatus which provide a draft of heated air about the fruit pieces to cause rapid evaporation of moisture. Thus forced air dehydrators of the tunnel, tray or continuous belt type may be used. The temperature of the air should be as high

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10 U.S. Patent 2,979,412; April 11, 1961; assigned to the U.S. Secretary of Agriculture

as possible to obtain rapid evaporation of moisture yet not so high as to cause damage to color or flavor. Taking account of these factors, the preferred air temperature is 150° to 180°F., most preferably 180°F. The dehydration is continued until the fruit has lost about 50% of its weight.

After partial dehydration, the fruit is contacted with steam. This treatment provides several useful effects. One is that air within the fruit tissue is expelled. This is important to achieve a final product of bright orange color and translucent character; where air remains in the tissue, the final product is yellowish and opaque due to the presence of the minute air pockets in the tissue which by a reflectance phenomenon act like a white pigment.

Secondly, the steaming causes a shrinking and densification of the fruit tissue. This is desirable to obtain a final product with a gummy texture rather than a pithy texture as common to conventional artificially dehydrated apricots. Also the steam treatment brings out the characteristic flavor associated with sun-dried apricots. Another point is that the steam treatment inactivates the enzymes in the fruit tissue, thus ensuring that the flavor and color of the fruit will be preserved against enzymatic action during further processing and storage of the final product. The proper time for the steam treatment may be determined by observing the apricots from time to time and continuing the treatment until the apricots develop a translucent appearance. In general, to obtain deaeration and other desired results without overcooking, the fruit is contacted with steam for a period from 2 to 6 minutes, depending on the size and maturity of the fruit.

Following steam treatment, the apricots are subjected to a second dehydration. This operation may be conducted in any of the types of dryers and under the conditions previously mentioned. However, during this dehydration the maximum air temperature is controlled to avoid attaining a piece temperature above 160°F., thus to prevent darkening and flavor deterioration. The term "piece temperature" is used herein as referring to the temperature of the fruit tissue as opposed to temperature of the surrounding atmosphere. Generally, the second dehydration is continued until the moisture content of the apricots is 15 to 20%.

As evident from the foregoing description, this process is particularly adapted to the treatment of apricots. However, it may be applied to other fruit with similar benefits. Notable among these are pears, peaches and nectarines. It is obvious that in the treatment of these fruits some adjustments of the conditions and procedures may be necessitated by the different properties of these fruits.

Example:

Ripe apricots were washed, dipped in 2% aqueous solution of SO_2 for five minutes, then halved and pitted. The fruit was then dipped in 1% aqueous SO_2 solution for one minute, then spread in a single layer cups-up on trays at a loading of about 2 lbs./sq.ft. The SO_2 content of the fruit was 418 ppm. The fruit as placed on the trays was dehydrated to about 50% of initial fresh weight using cross-flow air heated to 180°F. which required about 2.25 hours. The partially dried fruit was then contacted with live steam (212°F.) for four minutes without disturbing the position of the fruit on the trays. The trays of partially dried, steamed fruit were returned to the dryer and dehydration was continued at an air temperature of 160°F. until the moisture content of the fruit was about 17%. This second dehydration required about 7 hours.

It was observed that the product had a rich orange color, translucent appearance, and a gummy texture. Also, the product had the characteristic shape with inturned edges typical of sun-dried apricots. In flavor, the products were superior to the best quality sun-dried apricots. Moreover, the products were more uniform in color and shape and rehydrated faster on contact with water.

Pretreatment to Shorten Sulfuring Time

The conventional dehydration of various kinds of fruit, e.g. of the genus Prunus, comprises two main operation; sulfuring the fresh fruit and drying the sulfured fruit. The sulfuring has the purpose, inter alia, of destroying microorganisms apt to cause fermentation or similar deterioration of the fruit, and in order that this aim can be achieved, the sulfuring agent should deeply penetrate into the fruit and should be retained there as much as possible during the subsequent drying operation. The sulfuring agent used almost exclusively is gaseous sulfur dioxide produced in situ by the combustion of sulfur.

Attempts have also been made to soak the fruit in aqueous SO^2 solutions, but it has been found that the penetration is too slow for practical purposes and gives rise to the loss of valuable flavor constituents. Even the sulfuring operation by means of gaseous SO_2 takes many hours, depending on the drying method used, since the fruit must retain a sufficient amount of sulfuring agent even after the dehydration: if the sulfured fruit is dried in the open air at temperatures below about 33°C., the fresh fruit should be exposed to the SO_2 gas for 8 to 9 hours. If forced-draft-drying is used, especially at somewhat elevated temperatures, the sulfuring still requires 5 to 6 hours. The long duration of the sulfuring operation is a waste not only of time, but also of working area. In the case of apricots, the drawbacks of conventional drying methods have prevented the development of the mainly small-scale, rural by-production of dried fruit, with its inherent lack of uniformity of quality of the product, into a large-scale industrial operation yielding products of standardized quality.

The described process avoids the time-consuming conventional sulfuring and includes the steps of (a) fissuring the skin by treating the fruit with a dilute alkaline aqueous liquid, preferably at elevated temperatures; (b) neutralizing the fruit with a dilute aqueous edible acid; (c) impregnating the fruit in vacuo with an aqueous sulfuring solution and (d) forcedraft-drying the fruit.

The step (a) is preferably effected by means of an alkali metal hydroxide solution, but other alkaline substances may be use, e.g., alkali metal carbonates or ammonia. With sodium hydrazide, for example, preferred concentrations of the solution are of the order of 1 to 5% by weight, and the temperature may be as high as 90°C. Thus, with a 2% solution at 90°C., the treatment achieves its purpose within as short a time as 30 to 60 seconds. The operation may be effected in batches in suitable vat, or continuously.

As an optional operation preferably interposed between steps (a) and (b), the fruit may be rinsed with water, e.g. a stream of water, for removing a large part of the alkaline matter before neutralizing the remainder thereof. The acid used in step (b) may be, for example, citric, tartaric, acetic or phosphoric acid, and indeed any edible acid the salt of which does not necessarily mean that the pH of the fruit has to be adjusted precisely to 7.0.

Step (c) is an essential feature in this method. The fact that the impregnation of the fruit is effected under subatmospheric pressure and by means of a liquid sulfuring agent makes for the removal of air from the fruit and the deep penetration of the sulfuring agent into the fruit and its satisfactory retention therein during the subsequent dehydration. The magnitude of the pressure, i.e. the degree of evacuation, can be chosen within wide limits. It will determine to some extent the duration of the impregnating operation; within limits the time may be shorter, the lower the pressure. With pressures of 50 to 70 mm.Hg the impregnating time may be reduced to a few minutes. Of course, there are also other determining factors, e.g. a satisfactory fissuring of the skin in step (a), and the concentration of the sulfuring solution which is an aqueous solution of SO_2 or of a water-soluble bisulfite or meta-bisulfite. For example, at a pressure of 35 to 85 mm. Hg, and with a 4% solution about 5 minutes.

The forced-draft-drying operation may be carried out in any suitable manner and by means of any suitable conventional equipment. The use of a tunnel oven is mostly preferred since it enable continuous operation. Suitable temperatures and drying periods will be selected empirically in accordance with the nature of the fruit to be dried, the relative humidity of the outer air, and other variable factors.

Apricots dehydrated by this method have a pleasant orange-to-deep-orange color and an attractive glossy appearance, and a sufficiently high SO_2 content for keeping for a more than adequate period of time. If the process is carried out in the same manner but the forced-draft-drying is replaced by open-air sun-drying, the fruit turns brown and is not glossy. The process is illustrated by the following examples.

Example 1:

Two kilograms of fresh apricots (of the Israel-grown Raanana variety) were dipped in a 2% by weight aqueous solution of NaOH at 90°C. for 30 seconds, rinsed with fresh water and a 3% solution of citric acid, pitted, halved, and immersed in a 4% by weight aqueous solution of sodium bisulfite in a vacuum vessel for ten minutes at a pressure of 60 mm. Hg. The fruit was dried in a forced-air tunnel oven for 12 hours at 70°C. whereafter it contained 4,960 ppm of SO_2 and 10% water.

Example 2:

Two kilograms of fresh peaches (of the Red Haven variety) were dipped into a 2% by weight aqueous solution of NaOH at 90°C. for 30 seconds, rinsed with fresh water and a 3% solution of citric acid, pitted, halved, and immersed in a 4% by weight aqueous solution of Sodium bisulfite in a vacuum vessel for ten minutes at a pressure of 60 mm. Hg. The fruit was dried in a forced-air tunnel oven for 12 hours at 70°C. whereafter it had a moisture content of 12% and contained 4,960 ppm of SO_2.

Injury and Disease

Fruit Diseases and Pests

Insect infestation starts appearing after 2 months of storage period. Infestation was 60.5, 67.8, 73.4 and 90.6 percent in the control treatments of apricots at 3,4,5,and 6 months storage. Tribolium castaneum was observed to attack the dry apricots under investigation. No infestation is observed in vacuum, nitrogen and their combination treatments.

Most of the insects and diseases which attack other drupe fruits also attack the apricot. In many cases, plum curculio is the chief insect pest of apricots. Apricots do not seem to be subject to leaf curl but are susceptible to rots.

Perhaps the greatest hazard in the shipment of apricots is decay. Brown rot and Rhizopus rot are market diseases of apricots. Brown rot develops in the orchard, and here is where control must be started with an orchard spray program and sanitation in removing sources of infection. Quick-cooling of apricots to temperatures of 5°C (40°F) or lower and holding them as near 0°C (32°F) as possible will help keep both Rhizopus and brown rots in check.

SO_2 injury can be avoided by realizing the dangers of storing or shipping stone fruits with grapes.

Diseases Caused by Microorganisms

Brown Rot, Monilinia fructicola and M. laxa (California).

This rot is the most important market disease of peaches, nectarines and apricots wherever they are grown.

The early symptoms of brown rot are small water-soaked spots on the fruit. Within 24 hr the affected flesh becomes brown or black and at 15.5°C (60°F) the spots enlarge quickly, the decay often extending to the pit of the fruit. The rot is covered with a leathery skin that remains intact. Tan-gray, powdery spore masses, often in concentric circles, grow on the surface of affected areas. The entire fruit may decay in 3 to 4 days at higher temperatures. The fruit eventually shrivels and becomes mummified. The fungi overwinters in the mummified fruit remaining in the orchard.

Brown rot spreads from fruit to fruit in shipping containers causing nests of rot at moderate temperatures. Infections usually start in the orchard. The fungus can penetrate unbroken skin of the fruit, but injuries of one kind or another increase infection. Fruits can also be infected from contaminated field boxes or bins, packing house equipment, and in the hydrocooler. Frequent changing of hydrocolling water or treatment with a fungicide is necessary to prevent infection from brown rot spores in the water. Spores of the fungus can germinate and grow at temperatures of 0° to 32°C (32° to 90°F) and commonly encountered orchard and packing-house temperatures of 16° to 27°C. (60° to 80°F) are ideal. The presence of free water is necessary for the germination of the spores.

Control of brown rot of stone fruits begins with sanitation practices in the orchard and packing house. Included in this program are insecticides to kill flies and gnats that spread the spores from infected fruit to sound fruit. An effective orchard spray program is necessary. Quick-cooling to temperatures below 4.4°C (40°F.) and transit and storage temperatures as near 0° (32°) as possible are helpful in retarding growth of the fungus. Brown rot develops as much in 1 day at 24°C (75°F) as in 7 days at 5°C (41°F) and 25 days at 0°C (32°F).

Dipping peaches in hot water of 52° to 53°C (125° to 128°F) for 2 to 2.5 min kills spores on the surface of the fruit and also prevents development of infections already established. The addition of 100 ppm of methyl (benomyl) to hot water increased the effectiveness of the treatment for control of brown rot of cherries. Good success in controlling both brown rot and Rhizopus rot of peaches by postharvest applications of another chemical 2,6,-dichloro-4-nitroaniline (Botran) has been reported. Recent work has shown that benomyl is very effective for brown rot control, but not against Rhizopu rot. However, Botran is effective and a combination of these two fungicides applied as a postharvest dip gave good control of these two rots of stone fruits. These fungicides are also used as preharvest sprays for Rhizopus and brown rots.

In Australia almost complete control of brown rot of peaches was accomplished by immersion in aqueous solutions of a mixture of benomyl and dichloran. It also reduced the incidence of Rhizopus rot to less than 10 infected fruits per 100 fruits.

Rhizopus Rot, Rhizopus stoloinifer.

This rot is second only to brown rot as a cause of heavy losses in the marketing of peaches, nectarines, apricots, cherries and plums. In some arid fruit district where little rain falls during the growing season and brown rot is not a problem, Rhizopus rot is the main cause of loss.
The fungus usually enters the fruit at an injury and as the fungus grows, a small circular tan-colored spot is formed on the skin. The skin will slip from the decayed tissue beneath with a slight pressure. As the infection becomes more advanced, a white mold growth appears first at the center of the affected area but eventually covers the entire surface. White, round spore bodies quickly develop and they soon turn black and the mold turns gray.

The fungus grows fast at summer temperatures and can involve an entire fruit in 48 hr. The mold spreads from fruit to fruit and can spoil all the fruits in the box in 2 to 3 days. The rot is soft and watery, causing the whole fruit to collapse, and a condition known as leak in plums.

Control of the rot is based on the fact that the fungus causing it will not grow at temperatures below 7°C (45°F) or below and holding fruit at these temperatures during shipment and storage are good control measures. Heat-treating peaches and nectarines in water at 52° to 53°C (125° to 128°F) for 2 to 3 min has been effective in killing spores of Rhizopus and incipient infections. The chemical Botran (DCNA), applied in a postharvest dip gave good control of Rhizopus rot as well as brown rot of peaches. Control of both Rhizopus and brown rots by a treatment using a combination of benomyl for brown rot and Botran for *R. stolonifer* was discussed earlier under brown rot.

Pests

See also the section on "Pesticides."

Peach Tree Borer

The peach tree borer (Aegeria opalescens) is confined mostly to the mountain and valleys near the coast of central California. The larvae of this moth burrow just beneath the bark at or below the soil line, although they sometimes work a considerable distance up the trunk. While the name implies that it chiefly attacks peach rootstocks, almond, myrobalan, and apricot stocks are also susceptible to attack. The graft union, particularly when it is rough, is often attacked. Heavy soil, which cracks more easily than light soil, provides an avenue for insect access to root bark. No rootstock is resistant to peach tree borer, although the apricot, which gives a smoother union with an apricot scion, has some advantage. Weaver (52) found some tolerant seedlings in populations of the peach cultivars 'Dixired,' 'Elberta,' 'Earlired,' etc.

Peach Capnodis (Capnodis tenebrionis L.)

This large beetle is familiar to growers in the Mediterranean countries. Its larvae burrow galleries in the upper roots and at the crown of almond, plum, peach, and apricot, killing the tree. Attacks are more common in years when trees suffer from drought. Thus it is a particular problem in dry-land farming areas of orth Africa, Italy, and Spain. No rootstock is resistant, although some growers think that the bitter almond stock has some resistance. The insect can be controlled by wetting or powdering the crown and adjacent soil during the growing season with Lindance.

Root Knot Nematodes.

Three species of Meloidogyne--M. arenaria, M. Incognita, and M. javanica, are particularly injurious. The first two are prevalent in soils of southern Europe and the Middle East, while the second and third are more common in North Africa. These three species affect most apricot orchards, worldwide, which are propagated on peach, almond, or plum rootstocks. Apricot seedlings seem to be uniformly resistant to root knot nematodes.

Wild peach seedlings are usually susceptible, but some selections have been selected for resistance; these include 'Nemaguard,' 'Rancho Resistant,' 'S-37,' 'Okinawa,' and 'Nemared' rootstocks. Almond seedlings, bitter or sweet, are also susceptible for the most part, but resistant selections (28) include 'Alnem 1, '88,' and '201.' These are susceptible to M. incognita, which is common in North Africa. In the plums, which are mostly susceptible, 'Myrobalan B' is tolerant and 'Marianna 2624' and 'GF 8-1' are resistant to root knot species. 'GF 31', which is a P. cerasifera (Myrobalan) X P. salicina hybird, is more or less tolerant, as are the french prune FG 43' and the 'Brompton' plum.

Root knot nematode resistance is mainly a hypersensitive reaction; cells around the puncture die and the nematode starves. With a high inoculum level in the soil, roots suffer numerous injuries that prove to be debilitating and production is decreased (45). Resistant rootstocks can suffer like susceptible ones if the nematode population level is increased by annual host crop growing such as tomato, lettuce, or wild hosts in volunteer vegetation.

Meadow or Lesion Nematode

Pratylenchus vulnus causes bark cankers, rather than beadlike knots on roots, and attacks all rootstocks. This nematode, common in Europe and California, has a major influence on tree vigor and production (32). Peach seedlings are very susceptible to P. vulnus; apricot, 'Myrobalan FG31,' and 'hybrid 2038' (Myrobalan X Besseyi) seem to be more tolerant; and P. tomentosa is quite tolerant.

Ring Nematodes

Ring nematodes Criconemella xenoplax and C. curvata, cause severe damage to several rootstocks, including apricots, on sandy soils. These two species are very common in European orchards and vineyards.

Nematodes as Virus Vectors. The most important species in this group for apricots is Xiphinema diversicaudatum, which is the main vector of strawberry latent ringspot virus (SLRV). This virus is widely spread in Europe and America. Damage caused by it is increased when in association with other viruses like necrotic ringspot virus (NRSV). In many countries nurseries are subject to nematode inspection in order to reduce the spread by nursery stocks. Nematodes in orchard or nursery soils can be reduce by preplant nematode treatments, for example, dichloropropene or dibromethane fumigation. In nurseries some nonphytotoxic compounds like aldicarb, oxmly, carbofuran are used in postplant applications for nematode control. In several countries, such as France, these nematocides cannot be used in bearing orchards.

Tree Diseases

Blackheart

Blackheart or verticilliosis seems to be present in different soil types throughout the world. Selection of resistant rootstocks difficult because artificial inoculation is unsatisfactory intests, and soils are irregularly contaminated. Irrigation, the culture of vegetables (tomato, melon, lucern, potato), and excess tree vigor all are disposing factors. Duquesne has shown in a trial of several rootstocks that the symptoms of blackheart decrease each year and disappear when trees are full grown. The influence of rootstock on scions is evident. Rootstocks that induce the greatest susceptibility are: 'Myrobalan GF31' and apricot seedlings. Peach seedlings, 'Marianna GF 1380' (Greengage'). Other observations indicate that the scion cultivar can also increase rootstock susceptibility to blackheart. Some years appear more favorable for the disease than others. Taylor found one apricot cultivar, 'Zaisky Altai,' obtained from a wild population of P. armeniaca, to be resistant and having potential as a rootstock in infected soil. Differences in tolerance levels probably also exist in plums.

Bacterial Gummosis or Bacterial Canker

Some bacteria, Pseudomonas syringae, P. morsprunorum, and P. viridiflava, can induce cankers and kill apricot trees. The bacteria induce cortical lesions, which develop in mild winters and in the spring. These lesions disturb the tree's spring growth. Young trees are susceptible and may be killed in a few weeks. The disease is often associated with the sour sap condition.

Rootstocks exhibit different levels of resistance. The following is a classification in order of increasing susceptibility: peach, apricot, plum 'Greengage' and 'St. Julien,'Myrobalan,' 'Marianna GF 8-1,' and '26-24'.

Day suggested that the rootstock influenced the bacterial canker susceptibility of apricot scions. This has been confirmed by Duquesne in several experiments,' with Marianna stocks having the worst influence. The rootstock and scion have a reciprocal influence and tree death can be a consequence of cankers on the scion or any part of the rootstock above ground. The rootstock itself is not killed completely and surviving roots send up suckers. High budding on a tolerant rootstock is a good precaution but its adaptation to the soil and growing conditions are important factors i resistance. an illustration of this is found in that plum rootstocks induce apricot scion susceptibility when grown n dry soils but less so when on rich land. An acid soil seems to increase susceptibility.

Crown Gall (Agrobacterium tumefaciens)

The bacteria causing crown gall are present in all soil types throughout the world. Trees may grow normally if the galls are only on the roots, but nursery trees are stunted and often die if attacked. Thus protection in the nursery is important and can be effectively achieved using the antagonist bacteria A. radiobacter K-48 strain.

Almond and apricot seedlings are very susceptible to crown gall, as are peach GF305. 'Nemaguard' and peach red-leaf seedlings of 'Rutgers Red Leaf' and the new French stock 'Rubira' have good resistance. 'Marianna GF 8-1,' 'Marianna 2624,' 'Myrobalan GF 31,' 'Reine Claude,' and 'GF 1380' are resistant.

Crown Rot or Phytophthora Canker

Day reported that bark canker, at or near the soil line or on roots caused by water molds of the Phytophthora species, often kills trees following protracted wet periods. The infection occurs mostly during the late winter or early spring when warm temperatures occur. A short period of the proper temperature plus wet conditions can result in an infection. The symptoms are similar to those induced by waterlogging, early wilting, or failure to leaf out. In waterlogging the lower roots are killed and turn dar,, whereas with crown rot (collar rot) the bark is killed in a band at or near the soil surface and roots below appear norma. The disease can attack rootstocks in the nurser or orchard and is particularly devastating to young trees. Its occurrence, being weather related, is periodic. Peach and almond rootstocks are susceptible, apricot seedlings less so, and 'Marianna 26-24' is moderately resistant (11,40). Crown rot is often called "helling-in-disease" because it attacks nursery trees after they are uprooted and temporarily "heeled in," particularly in wet soil or during protracted rain. As for bacterial gummosis, dried grass, weeds, leaves, or a high cover crop at the tree's crown furnish a good environment for fungal infection to occur.

Root Fungus (Armillaria mellea)

The roots of all stone fruits are subject to infection by this oak root fungus. Roselli necatrix has a similar effect, but is more common in France on pome fruits. It attacks all species throughout the southern Mediterranean area. Infection occurs when the fungus penetrates large or medium-size roots by means of special mycelium formations called rhizomorphs. The only method to prevent the onset of oak rot attack is to use resistant rootstocks. Trials by Thomas in 1948, Day in 1953, and, more recently, Duquesne in 1977, have found some resistance in Prunus species. Apricot and peach seedlings are very susceptible, with a 70% fatality rate after 7-8 years. Plums exhibit some degree of resistance. 'Reine Claude' (Greenage) GF 1380 is susceptible, 'Myrobalan GF 31' is slightly less so; 'Marianna GF 8-1' and 'Marianna 2624' show some resistance. Unfortunately, compatibility between these rootstocks and several apricot cultivars is unsatisfactory. Guillaumin thinks that cuttings of P. institia (domestica) such as 'Mirabelle,' 'Damas,' and 'Brompton' have a satisfactory tolerance level.

Resistance to oak root fungus appears to be incomplete. In the case of Myrobalan rootstocks, the rhizomorphs penetrate the root easily, but the development of the mycelium in the root if inhibited. This explains why the tolerance level in a rootstock can decrease if it is not growing under conditions of good culture and on good soil.

Percentage of Death by Oak Root Fungus of Apricots Grafted on Four Rootstocks[a]

	% of Death by Oak Root Fungus						
Rootstocks	1970	1971	1972	1973	1974	1975	1976
Seedlings of wild apricot (Mech Mech)	1,2	6,1	24	43	51	61	73
Seedling of Peach INRA 305-1	0	2,5	30	42	56	71	71
Reine Claude G. 1380		0	0	0	1,2	2,4	55
Marianna G.F. 8-1	0	0	0	0	0	2.4	2.4

[a]83-85 trees of each rootstocks distributed in 8 replications

Collar Rot[11]

To identify the cause of plant death in apricot orchards, a survey was carried out in various parts of Peshawar and Malakand divisions. The following observations were recorded.

1- Plant mortality was frequent in young orchards (up to eight years old trees)
2- The rate of mortality was greater in orchards which were intercropped with summer crops such as sugar cane, maize etc. and where there was frequent heavy irrigation.
3- Plant losses were more in low lying sports in the same orchard.
4- In certain orchards there was hundred percent mortality in case of plants propagated on apricot rootstock.

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11 Farmer's bulletin No. 3 "Plant mortality in young apricot orchards, its causes and suggestions for prevention" Habibullah Khan, Saffar Ali, Mohammad Rafiq, Department of agriculture, agricultural research Institute, TARNAB (PESHAWAR), N.W.F.P.,PAKISTAN, 1983

5- Similarly there were severe losses in case of deep plantation with the budunion below the soil surface.

Symptoms of the disease

1- Plant growth stop
2- Color of foliage changes from healthy green to yellow, plant gives unthrifty look.
3- Foliage drop, followed by plant death.

On close examination of trunk, close to soil surface the following symptoms are clearly visible.
1- Bark rot with gummosis
2- The wood below the bark is dark brown instead of normal whitish yellow color in case of healthy trees.

Disease Prevention Recommendations in brief

1- Apricots budded on apricot rootstock should not be planted in areas where phytophthora problem is suspected.
2- Deep planting should be avoided. While planting a tree care should be taken to set to the tree with bud union five to six inches above the soil.
3- While purchasing plants, select only those plants which have been budded at least six inches above the ground.
4- Irrigation should be done very carefully. Over irrigation is dangerous. The soil around the trunk should always be kept dry. Instead of furrow or flooding, side furrow irrigation should be used.
5- In young orchards intercropping if unavoidable may be done, but very carefully. There should be no crop or weeds close to the trees because dump conditions around the trunk will create favorable environment for the disease. In bearing trees clean cultivation will be advisable.
6- Trees should be kept healthy by proper fertilization and protection against insect pest and disease.

These instructions are also applicable to plum, peach, apple and almond which are also affected by this disease in case of severe soil infestation which the fungus.

Sour Sap

See discussions under waterlogging, crownrot, bacterial gummosis, and blackheart, as all these conditions are referred to by growers as sour sap.

GRAPES[12]

(Vitis sp.)

Acerage and Yield

Present vineyard size is generally smaller than it was in the past. Future sizes may become even smaller. This is due to the prevailing inheritance principle which leads to the division and fragmentation of holdings of father to his sons and daughters, after his death or even during his lifetime.

National averages for vineyard size and grape yield has been respectively estimated at 1000 vines (about 4 jiribs or 8 ha) and 4 kg per vine (about 5 MT per ha) inclusive of all ages and all types of grapes. Yields of 10-14 kg per vine have been obtained by a large percentage of farmers applying simple improved viticultural practices while under optimum improved conditions, very good yields of 21-28 kg per vine have been enjoyed by farmers, indicating a great potential for yield increases and a bright future for the development of grape production in the country.

Afghanistan-Average and Good Grape Yields

Area	No. Vines/ha	Yield (kg/vine	
		Average	Good
Kandahar	1380	10	20
Kohdaman	1500	7	14
Parwan	1500	7	14
Faryab	950	20	35

Sources: Ghajoor, Abdul "Prospects for the Development of Grape production and Marketing in Afghanistan."

The range of yields obtained indicate that high yields of grapes can be obtained in Afghanistan. Improving cultural methods, such as fertilizer use and plant protection programs should have good effects. In particular, more intensive trellis training systems should considerably improve yields and also quality by reducing the incidence of sunscold. Attenction should be given to developing the proportion of grapes sold fresh as this method of production is highly labor intensive and gives Afghan growers a distinct advantage in view of the low labor costs there.

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12 Portions of this were taken from the Agriculture-O/AID/PER Library "Prospects for the Development of Grape Production And Marketing in Afghanistan" by Abdul Gafoor Nov. 1974

In the grape producing areas of the country , no single crop can take the place of grapes and produce the same level of income with the given amount of investment, labor, and prevailing conditions. Thus, the best crop to be grown next to grapes in these areas is the one which will not compete with grapes for water and other inputs such as animal manures which are already scarce, but would enable the farmer to make the best use of his scarce resources. Wheat is a clear example of such a crop. Thus, wheat planting, in the grape growing areas, begins when grapes stop using irrigation water.

Varieties

There are about 45 different varieties, but 80-90 local types of grapes grown in Afghanistan. The ones that have commercial importance in raisin production and fresh consumption are common Kishmishi, Hussaini, Aita, Shindokhani, Black Kishmishi, Toran Kandahari, Gholadan, and Munoqa. The highest-quality grapes, as far as local preference is concerned, are Lal, Soyebi, Khalili, Fakhri, Red Kishmishi, Hussaini, Shundokhani, common Kishmishi, Aita, and some others depending on personal taste. Generally, the higher the quality of grapes, the lower its commercial value, thus limiting its coverage and production. The same kind of correlation exists between the quality and yield.

The trend of replacing vines of other varieties to the most commercially-important variety of Kishmishi and the further expansion of Shindokhani vineyards in Kanjdahar, Zabul, and even Parwan and Kohdaman areas, particularly for fresh export should be vigorously encouraged.

Grape Varieties of Afghanistan

1. Kishmishi, common white or Gerdak
2. Kishmishi, black
3. Kishmishi, red
4. Shindokhani, white
5. Shindokhani, red
6. Hussaini, common
7. Hussaini, Kilk-i-Aroos
8. Aita, white
9. Aita, red
10. Aita, balck
11. Black Kandahari, toran
12. Katta
13. Kohdaman Kandahari
14. Gholadam
15. Munoqa
16. Lal,
17. Lal white
18. Lal,red
19. Lal, seeded
20. Rancha, white
21. Rancha, red
22. Taifi, red
23. Taifi, white
24. Khalili, white
25. Khalili, red
26. Soyebi, white
27. Soyebi, red
28. Shonetak
29. Fakhri
30. Herati
31. Khalchini
32. Sheikhali
33. Sabooni
34. Kala Ghauchak
35. Qalami
36. Shakar Angor
37. Maska
38. Oquili, white
39. Oquili, black
40. Kala-i-zagh
41. Obak
42. Zaghak
43. Atumcha
44. Chall
45. Pestan-i-Buz
46. Shahabi
47. Turkmani
48 Alaman Toyeedi
49. Gurda-i-Gau
50. Objosh
51. Ala Bara
52. Garangani
53. Zanboorak
54. Lal (seeded)
55. Januz
56. Askari, white
57. Askari, red
58. Pushanki, white
59. Pushanki, red
60. Ayati, white
61. Loghi, black
62. Loghi, red
63. Sangenak, white
64. Mir Hamadi
65. Zerjumi
66. Serkagi
67. Qalamak
68. Muskagi
69. Kha-i-Kauk
70. Chashmi-i-Gau
71. Kesnadara, white
72. Kasnadara, red
73. Shabi, red
74. Shabi, white
75. Khair-i-Ghulaman
76. Kishmishi Siagak

Propagation

Grapevines are propagated by seeds, cuttings, layering, budding, or grafting. Seeds are used in breeding programs to produce new cultivars. Most commercial propagation is by dormant hardwood cuttings. For types difficult to root, such as the Muscadine (*Vitis rotundiolia*), layering or the use of leafy cuttings under mist is necessary. Budding or grafting on rootstocks is used occasionally to increase vine life, plant vigor, and yield. Where noxious soil organisms, such as phylloxera (*Dectylosphaera vitifoliae*), or root-knot nematodes (*Meloidogyne sp.*), are present, and cultivars of susceptible species such as *V. vinifera* are to be grown, it is necessary to graft or bud on a resistant rootstock.

Seeds

Grape seeds are not difficult to germinate. Best results with vinifera grape seeds are obtained after a moist stratification period at 33° to 40° F (0.5°to 4° C) for about 12 weeks before planting (63).

Dormant Cuttings

Most grape cultivars are traditionally propagated by dormant hardwood cutting, which root readily. Cutting material should be collected during the winter from healthy, vigorous, mature vines. Well-developed current season's canes should be used; they should be of medium size and have moderately short internodes. Cuttings $^1/_3$ to $^1/_2$ in. in diameter nd 12 to 16 in. long are generally used. One season's growth in the nursery should produce plants large enough to transplant to the vineyard.

Grapevines which are propagated from cuttings come into production from three to five years after planting. Planting density varies considerably. It can be as low as 600 vines/ha in some areas to over 2,000/ha in other areas.

Root-knot nematodes can be eradicated from grapevine rootings by dipping them in hot water (125° to 130° F; 51.5°to 54.5°C) for five to three min., respectively.

Leafy Cuttings
Leafy greenwood grape cuttings root with difficulty in Afghanistan.

Layers

Grape cultivars difficult to start by cuttings can be propagated by layering, using either simple, trench, or mound layering.

Grafting

Bench grafting is widely used; scions are grafted on either rooted or unrooted disbudded rootstock cuttings by the whip graft. The grafts are made in late winter or early spring from completely dormant scion and stock material. The stocks are cut to 12 to 14 in., with the lower cut just below a node and the top cut an inch or more above a node. All buds are removed from the stock to prevent subsequent suckering. Scion wood should be selected which has the same diameter at the stock.

After grafting, using a one-bud scion, the union is stapled together or wrapped with budding rubber. The grafts should be held for two to four weeks in well aerated, moist wood shavings or peat moss at about 80° F (26.5° C) for callusing. Plant the grafts in the nursery as soon as the unions have healed, before there is much shoot or root growth, but not before the ground has warmed.

The grafts are planted so that the unions are just above the soil level. Immediately after planting, the graft is covered with a wide ridge of soil so that the scions are covered to a depth of 2 or 3 in. After the grafts are growing vigorously and the shoots are 8 to 12 in. high, the bench grafts are uncovered for the first time. Each one should be examined carefully. Roots arising from the scion should be removed, although some scion roots are not undesirable for a time to help the graft get started. Removing the scion roots too late will retard root growth from the stock, suckers from the stock should also be removed. At this time, the tying material should be cut if it has not already deteriorated. The grafts must be covered back to the same depth.

Greenwood Grafting

Greenwood grafting is a simple and rapid procedure ror propagating vinifera grapes on resistant rootstocks. A one-budded greenwood scion is slice-grafted during the active growing season on new growth arising either from a one-year-old rooted cutting or from a cutting during midseason of the second year's growth.

Budding

A satisfactory method of establishing grape cultivars on resistant rootstocks is by field budding on rapidly growing, well-rooted cuttings which were planted in their permanent vineyard location the previous winter or spring. A form of chip budding is performed in late summer or early fall just as soon as fresh matuer buds from wood with light brown bark can be obtained and before the stock begins to go dormant. In areas where mature buds cannot be obtained early in the fall, growers may store under refrigeration budsticks collected in the winter and bud them late spring or early summer.

T-budding is not practiced with grapes, owing to the relatively large size of the buds or "eyes."

Rootstocks

For American Grapes

'Salt Creek' (Ramsay, *'Dog Ridge', 'Champanel', 'I..kfata' (V. champini)* These stocks have been very effective in the southern coastal region of the U.S. in increasing yields and prolonging vine life of the "bunch" type of grapes.

V. rupestris 'Constantia', 'Couderc 3309', 'V. cordifolia X V. riparia 125-1', 'Cynthiana', 'Wine King', 'Lenoir' These stocks have been useful in the inland states of the U.S. in increasing yields, plant vigor, and evenness of fruit ripening.

'Couderc 3309', 'SO-4 ('Oppenheim #4') and 'Teleki 5-A' are recommended in New York State for their resistance to root parasites, especially in replant situations.

Rootstocks for Vinifera Grapes

'St. George' (V rupestris) This vigorous, phylloxera-resistant stock, noted for its drought tolerance, is especially suitable for shallow, unirrigated soils; it is not resistant to root-knot nematodes. It is readily propagated by cuttings and easily grafted. It tends to sucker profusely, so disbudding before planting should be carefully done, and suckering continued for the first three or four years.

'Ganzin No. 1' ('A X R. # 1') This phylloxera-resistant rootstock is highly recommended for fertile, irrigated soils. Vines on this stock under such conditions are generally more productive than those on *'St. George.'* It is susceptible to root-knot nematodes and does not do well on dry, hillside soils. Cuttings root easily but it does not bench graft well, as it calluses poorly.

'Couderc 1613' This stock is the one most widely used in the interior valley grape growing region of california. It is resistant to root-knot nematodes. Although suitable for fertile, irrigated, sandy loam soils, it produces weak, unproductive vines in nonirrigated or sandy soils of low fertility. Cuttings are easily rooted.

'Harmony' This rootstock developed by the USDA is a cross between a *'Dog Ridge'* seedling and a '1613' seedling. It has

more vigor and more phylloxera and nematode resistance than '1613'.' Cuttings root readily and it buds and grafts easily. It is recommended as a replacement for '1613', and especially for table grape vineyards.

'Dog Ridge' and *'Salt Creek'* (*'Ramsay'*) (*V. champini*) These closely related stocks are moderately resistant to root-knot nematodes and are extremely vigorous. They should be used only in low-fertility soils. In fertile soils, the vines are often so vigorous that they are unproductive. Both are moderately resistant to phylloxera. Cuttings of these stocks are difficult to root, especially *'Salt Creek.'* On better soils, 'Salt Creek' is usually preferred to *'Dog Ridge'* because the latter's extreme vigor causes poor fruit set. These two stocks have performed best for raisin and wine grape vineyards.

Pruning

Except in the areas such as Peroze-Nakhcheer, where vines have to be covered early in the fall to be protected against winter damage and pruning is also done before the vines are covered (in Peroze-Nakhcheer it is done in October), in the rest of the country pruning takes place in early spring. Only experienced farmers are employed to do the pruning and maintain the shape of the vine. Nowhere in the country is thinning of grape bunches ever practiced.

There are no standardized methods of training and pruning, both rod and spur pruning being used. The method of pruning is largely influenced by the variety, vigor and growth habits of the vines.

In the Kohidaman Valley area of Kabul/parwan vines are planted at about a 2.5 by 2.5m spacing. They are trained in a goblet fashion to be self supporting. In Kandahar the vine space is about 5.0 by 2.0m. The vines are planted in trenches and are trained up earthen walls some 2m high.

In Here the growing method is somewhat similar to Kandahar except that some vine spacings are about 6.0 by 1.0m and the earthen wall much wider and higher. The walls are up to 5m wide at the base and up to 5m high from the trench bottom. The earthen walls provide the vines with support in the absence of trellis. They also protect the vines from damaging winds, particularly the hot summer winds. The walls also help to keep the fruit off the ground and provide shade from the intense heat of the summer sun.

In Juzjan the vines are trained horizontally along the ground. They are pruned early in autumn and then covered with soil to prevent frost damage during the very cold winter. Trellising is not usually found in Afghanistan except in one or two experimental situations, set up in the last 10 years. These growers claim big yield increases from the trellis, but there is no evidence that trellising will greatly expand in the near future.

For instance, experimental trellising in the Kohidaman Valley has been claimed to double or even triple the yield in limited cases. Even small improvements in management, water supply and pest and disease control are all likely to bring about significant increases in productivity. Better grower education is are likely to improve quality.

There is no definite source where certified cuttings (canes) of grapes are produced in the country. Farmers wishing to establish new vineyards do their own searching in getting the superior quality cuttings from other vineyards. When planted, it may take up to 4-5 years for the new vines to begin bearing grapes. During this period, the land is annually cultivated and is made use of in the production of annual crops.

Diseases and Injury

A well-planned scheme to reduce the damage annually caused by bees, birds, and rodents to the grape crops has no less or economic significance than controlling of diseases such as powdery mildew and anthracnose which is recommended to be actively followed on sustained basis in the affected areas.

Fertilization

Due to the importance of animal manure in commercial grape farming, it will be very profitable to encourage, finance, and support farmers in the grape growing areas to invest in developing small scale animal production activities as a source of additional income, better nutrition, seasonal employment, plus manure as a valuable by-product.

For many years it has been known that the application of manures to grapevines results in higher yields and good quality grapes. Dirt from old walls, fresh dirt from the ridge opposite the vine in the vineyards, barnyard manure, dried blood, green legume bushes, and though of recent origin, chemical fertilize--have all, in various quantities, been used to fertilize grapevines. As a matter of fact, grape farmers are the ones who first adopted the use of chemical fertilizers in Afghanistan.

Which and how much of the above-mentioned fertilizing material is used depends upon the secured supply of adequate irrigation water, availability of fertilizing materials, and in the case of chemical fertilizers, credit facilities.

Barnyard manure is a well-accepted material by almost all grape farmers, especially in Kandahar, Kohdaman/Parwan and other grape growing areas in the eastern grape zone. The largest quantity and the most widespread use of barnyard manure is in Kandahar. Even here vines are usually manured every other year. Kohdaman/Parwan not being as large and good a livestock raising area as Kandahar, is very much short of this important fertilizing and soil improving material. In the northern grape growing areas of the country, due to the shortage of water, barnyard manure is seldom used. Instead, a soil (dirt) changing operation by which the dirt around the collar of the vine is exchanged for fresh dirt from the ridge opposite the vine. Some farmers bury a bunch of some green leguminous bush at the bottom of the vine for fertility purposes.

The supply of barnyard manure which is so important in grape-farming and its profitability has already been accepted by the farmers generations ago, is deficient in most of the grape growing areas of the country particularly Kohdaman and Parwan areas. The use of this matter is of special importance in improving the water holding capacity of the soil and quality of grapes and raisins. The importance of phosphatic and potash fertilizers which are also important for the improvement of grape quality, production and soil structure, needs to be vigorously popularized.

The use of chemical fertilizers in grapevines is concentrated in Kohdaman/Parwan area. In Kandahar,chemical fertilizers are used only by a very few grape farmers. Some experienced farmers in Kandahar believe that Kishmishi grapes receiving chemical fertilizer do not keep as well in transport to the foreign markets. In addition farmers believe the use of chemical fertilizer makes the green raisin look blackish, which is not a desirable color. This attitude of farmers, whether a myth, a reality, or the result of wrongdoing, is the obvious reason why the use of chemical fertilizer has not received widespread adaptation in Kandahar vineyards.

Even in Kohdaman/Parwan very few farmers ever observe the proper ratio of fertilizer use, inclining more toward the use of nitrogenous fertilizer. On the other hand, fertilizer adoption has not progressed as was expected. The main reasons for the recent slow rate of adoption and popularization of a proper ratio of fertilizer us can be attributed to the uncertainty and/or shortage of irrigation water and the lack of an efficient extension program in the area. Rivers are the major source of irrigation. Water deficiency is more felt where karezes and springs are the sources of water, and this constitutes one of the serious problems of the areas concerned.

There has been a steady rise in the use of chemical fertilizers in the recent years, particularly since Afghanistan commenced manufacturing nitrogenous fertilizers. Unfortunately there has only been very limited grapevines in Afghanistan and it is by no means certain that farmers using chemicals fertilizers are doing so wisely. In fact there are suggestions that the over use of nitrogenous fertilizers is causing some quality problem in fresh fruit, particularly during transport to foreign markets.

Irrigation

Timing and number of irrigations also vary from region to region. While winter irrigation, locally called "chelaab" (meaning irrigation in the chill of winter) is considered an important practice in grape farming and ranges from at least one to five times, summer irrigations which take place at water stress periods, are the ones that determine the final yield. Depending upon the availability of water, the number of summer irrigations for vineyards ranges from 1-2 in most of the northern areas to 5 - 6 in Kohdaman/Parwan valley. During the years when precipitation is below normal, areas such as Kohdaman, Sangeharak, and others that take water from karezes and springs are harder hit, resulting in reduced grape production.

Irrigation is essential in all grape growing areas of Afghanistan. Water is mainly supplied by gravity via traditional and very efficient canals. In addition, small areas are irrigated from wells or karezes (man-made underground canals). There is very little water storage so that the amount of water available is controlled largely by the snowfalls of the previous winter and the rate of melting of the snow. Vine growth and production can be badly affected in drought years.

In many areas the vineyards are actually irrigated in winter in order to build up soil moisture during the period when rivers and streams are carrying adequate water.

Summer irrigations depend upon the needs of the vines and the availability of water. In the cooler northern areas one or two irrigations during summer are usually adequate. In the hotter, drier areas up to five or six irrigations spread throughout spring and summer are necessary to produce good crops of grapes.

Raisins

About 75 percent of the total annual grape production is processed into raisins, with an average grape-to-raisin conversion ratio of 4:1. 70-80 percent of the total crop is exported in both raisin and fresh forms.

Afghanistan produces many kinds, qualities, sizes, and colors of raisins. The bulk of the raisin production is of the seedless Kishmishi type which is the same as Sltarnia of Australia, Greece, Turkey, Iran, and Thompson's seedless of California.

The main types of raisins are:

a. Seedless Red Natural
b. Seedless Golden Green Natural
c. Seedless Long Golden Green
d. Seeded Large Golden Green
e. Seedless Black Natural
f. Seeded Long Red Natural
g. Seeded Large Red Natural

Afghanistan is capable of producing many of the raisin producing grapes in commercial quantity. It has long, hot, and rainless summer and fall seasons in its grape-growing areas. It possesses ample cheap labor. By making better use of the greatest yield potential and market opportunities, Afghanistan can become the raisin capital of the world.

The drying of red raisins off the bare ground must be introduced, encouraged, and rapidly popularized throughout the country. Measures such as the provision of mats, etc., on easy credit terms, buying the raisins dried off the ground at higher prices on contract basis, publicity other incentives, should be exercised.

The Ministry of Commerce has designed the following four size classes for Afghan Sultana raisins:

a. Large - Raisin size ranging from 8-12 mm, 90 percent of the weight of the raisins to pass through a 12 mm riddle, but not more than 5 percent of the weight to pass through an 8 mm riddle.
b. Mixed - Raisin size ranging from 3-12 mm (a mixture of large and small sizes)
c. Small (midget) - Raisin size ranging from 3-8 mm.
d. Extra Large - Raisin size is larger than 12 mm, only 5 percent of the weight to pass through a 12 mm riddle.

Likewise, there are three grades, each for red Sultana and green (or golden) Sultana. These grades are:

For red Sultana:
High quality or Afghan Red #1
Medium quality or Afghan Red #2
Standard quality or Afghan Red #3
For green Sultana:
High quality or Afghan green #4
Medium quality or Afghan green #5
Standard quality or Afghan green #6

The accepted (no deductible) moisture content for all grades is 13-13.9 percent.

POMEGRANATES

Commercial Origin

The pomegranate (*Punica granatum*) is native to the Middle East, and can now be found in the wild state in isolated sections of Iran and Pakistan. It has been grown in the Mediterranean countries of southern Europe and northern Africa for many centuries. It is now widely dispersed throughout the subtropical areas of the world, being adapted to essentially the same regions as citrus fruits.

Propagation

Pomegranates need warm dry summers and cool winters with winter temperatures not less than 9.50c. In some years, pomegranates in Tagau and Nangarhar are damaged by winter frost. Spring frosts can soetimes affect flower development and fruit set.

The pomegranate is easily propagated by hardwood cuttings. After one season's growth, the plants are usually large enough to be move to their permanent location. Softwood cuttings taken during the summer are also easily rooted if maintained under high-humidity conditions. The pomegranate forms suckers readily, and these may be dug up during the dormant season with a piece of root attached.

The spacing system varies from 3m x 3m to 7m x 7m. The cuttings are sometimes rooted in a nursery but are usually direct planted; 2 or 3 cuttings being pur into each planting hole. Wide spacing is requiredd to give large trees with good light extinction in order to protect fruit from sunscold. However, with these wide spacing, it means that, as it takes 8-10 years to reach full production yields, income is very low during the years the orchard is being established. But, as stock material is cheap, higher than required initial plant densities could substantially increase production in the early years of an orchar's development. Optimum plant density could be attained by thinning out as required.

Trees begin to bear fruit after 3-4 years. Maximum production is obtained after 8-10 years and an orchard lasts for 30-50 years. Yields vary for 5-10 tons/acre.

Farmyard manure and fertilizers are used alternate years. Crop protection systems are sometimes used but aphids can be a serious problem. Iron deficiency was endemic in many of the orchards visited yet no contol measures to correct iron deficiency had been used.

Better use of cropped area could be attained by producing plants from cuttings in a nursery area and as stated by using a higher than required initial plant density to increase early production. This problem is presently attacked by intercropping vegetables, alfalfa, and wheat with the pomegranates. The variety Bedana should be used in Kandahar and other areas too.

Crop protection programs should be encouraged and the use of iron chelate to correct chlorosis demonstrated to growers by the extension service. Fertilizer use should also be increased to ensure maximum protection.

Quality Criteria

The fruits are nearly round with a prominent attached calyx. Surface color varies in the few commercial cultivars from yellow with a crimson cheek, to solid brownish-red, to bright red. The edible portion is the bright-red pulp which surrounds the individual seeds. The juice, which has an attractive red color, is used in beverages and is the base for grenadine, used for flavor and color in drinks.

The fruits have a tendency to rind splitting which often leads to decay. The buyer should look for smooth, well colored fruits with unbroken rinds and a fresh appearance. Juice color and acidity are regulated for California pomegranates to be sold in the fresh market or for processing.

Culls due to cracking of fruit, can be serious and amount to 25% of production. Cull fruit sells at 50% of first quality fruit. The cracking problem is most serious in Kandahar and may be associated with a variety defect. The bedana variety grown mostly in Tagau is less liable to crack and is a sweet,juicy, soft seaded high quality variety. The Bedana variety is presently produced in Kpisa and Nangarhar but in view of its fruit quality, plantings of it should be made in Kandahar and other pomegranates areas as well.

Storage Conditions

Pomegranates are well adapted to storage. Control of the relative humidity is critical because the skins desiccate readily at low humidities and hard, darkened rinds are unattractive and reduce marketability.

Pomegranates keep well in storage at 5°C (41°F) and are subject to relatively few postharvest troubles. The fruit has a tough rind, which unless mechanically injured is resistant to invasion by microorganisms.

Injuries and Diseases

Internal Breakdown. Description

The pulp-bearing seeds (arils) do not develop the typical red color and are somewhat flattened rather than plump. Flavor of the arils is abnormal and many have a streaked appearance due to fine white lines radiating from the seed. There are no external symptoms.

Cause of the disorder is unknown. It originates during growth in some season, usually only in limited areas.

Sunburn

A leathery, tough area on the rind, usually at the stem end, is the principal symptom. The injury may show on only ne side or may extend completely around the fruit.

This injury occurs in the orchard. Aside from maintaining good foliage on the trees, little can be done to prevent it. Sunburn affects only the appearance of the fruit. It does not increase susceptibility to decay.

Splitting and Cracking

This injury occurs while the fruit is on the tree. The rind shows various degrees of cracking which often serve as entry points for decay organisms.

The exact cause of fruit splitting is not known, but is assumed to be due to fluctuations in moisture supply to the tree or moisture loss from the tree. Overmature fruit is particularly susceptible so the injury can be reduce by harvesting the fruit before it is fully ripe.

Gray Mold Rot (Botrytis cinerea)

Decay usually starts at the calyx. As it progresses the skin becomes light brown, tough and leathery. The pulp-bearing sees disintegrate into a dark mass in advanced infections. Under moist conditions the typical gray mycelium appears on the affected surface.

No specific control measures have been developed. Refrigeration will slow, but not stop infections, as Botrytis will develop slowly even at temperatures near the freezing point.

Heart Rot (*Aspergillus spp. and Alternaria spp*)

Affected fruits show a slightly abnormal skin color, but internally a mass of blackened arils. Usually there is a black line of decay extending from the calyx into the fruit interior.

This disease develops while the fruits on the tree. Affected fruits can usually be detected by sorters and eliminated from the commercial pack.

Penicillium Rot and other Penicillium spp.

The typical Penicillium decay symptoms are watery areas at the infection site followed by masses of blue or green spores.

Infections invariably occur at skin breaks caused by cracking, mechanical injuries or insect punctures. Other fungi may infect the same injured area and eventually overgrow the Penicillium.

Control of postharvest infection must be by removal of all cracked, split or mechanically injured fruits before the fruit is packed for market.

Pesticides[13]

General information

- Chemicals used to kill insects are called insecticides.
- Chemicals used to kill mites are called miticides or acaricides.
- Such chemicals if used properly can greatly increase the yield of marketable fruit.
- For an insecticide to be effective it must first of all be the right chemical selected against the insect being controlled. It must also be sprayed at the right time and in the right strength or concentration.

The Right Chemical

All too often the wrong chemical is used; e.g. Methasystox which is widely used for the control of aphids (green fly) is useless against the control of caterpillars of codling moth.

The Right Time

There is an optimum time to spray against each pest - this is usually the larval stage. Spraying at the egg stage is usually not effective as the eggs have a protective coating.

The Right Concentration

If too little chemical is added to the water, it will not be effective in killing the insect. If too much chemical is added to the water, spraying will be more costly and may cause damage to the leaves or kill beneficial insects. Also using the wrong concentration can cause resistance in the pest.

In the case of each pest mentioned in this bulletin the right chemicals, time of spraying and concentrations are given for their effective control. These recommendations should be strictly followed.

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13 Portions of this were taken from "Fruit development in Baluchistan insect pests of apples, pear and pomegranate," Department of Agriculture Research Sariab, Quetta
For more information
Contact Dr. Abdul Bajoi Entomologist
Fruit Development in Baluchistan
Agriculture Research Institute
Sariab Road, P.O. Box 234, Quetta Tel: # 78627

SPRAYING PROCEDURES

1. Read the instruction carefully. These are always present if the chemical is purchased in its original contained.

2. Ensure to weight or measure out the right quantity of chemical and mix it thoroughly in the right quantity of water.

3. If the spray is prepared in a large tank, ensure to mix each time before taking some of the spray out of the tank as the chemical may have settled in part to the bottom of the tank.

4. The spray should be applied as a fine mist to the leaves of the trees until the chemical starts to run-off the leaves.

5. All the leaves must be sprayed to the point of run-off.

6. Wear protective clothing and do not spray against the wind. Avoid spraying on windy days.

7. Should the chemical came in contact with the skin wash immediately in water.

8. Empty containers should be burned with their lids off and dug deep in the soil away from wells or water courses.

<u>How do insects develop (grow) and multiply (increase in numbers)?</u>

Butterflies or moths start their lives as eggs.

The eggs hatch into caterpillars or larvae. The larvae feed on parts of the plant such as leaves or fruits or flowers and cause serious crop losses.

When the larva is fully grown it changes into a pupa. This is a resting stage and many pests survive the cold winters as pupae.

As the weather becomes warmer in spring the pupa changes into a butterfly or moth.

The life cycle of an insect the different stages of development from eggs - jervae - pupae - butterflies.

When an insect has grown from an egg to the adult butterfly it has completed its life cycle resulting in a new generation. Some insects have many generations each year i.e. they grow from eggs to adults in a short time making it possible on them to repeat their life cycle more than once in the same year.

Beetles have a similar life cycle to butterflies and moths.

Codling moth

Damage Caused

Codling moth is the most serious pest of apples. The larva or caterpillar of the moth enters the fruit and destroys its core causing the inside of the apple to rot and sometimes fall prematurely. Due to this injurious pest farmers loose half of their crop annually. If timely sprays are carried out this loss can be avoided.

Alternate Hosts

In addition to apple the codling moth infests pear, quince, walnut and occasionally apricot fruits.

Life Cycle

There are two generations of this pest in Baluchistan. During each generation the pest passes through different stages of development. The adult moth lays eggs which hatch into larvae. the larvae change into pupae which in turn change into moths completing the life cycle.

The eggs are whitish and are hardly visible on the leaves and fruits. The larvae are whitish pink and are found inside the fruits. The larvae change into pupae after leaving the fruits. The pupae over winter under the loose bark of trees and finally come out as moths in April. Each moth lays 50 eggs on average. The larva enters the fruit at the 'eye' or calyx end or from the stalk end or the side. The first generation is active from April to June whereas the second generation is active from June to August.

Time of Spray

The first spray should be given when 9% often petals have fallen i.e. when the calyx cups are still open. If the calyx cups have closed it is too late to spray against codling moth.

This should be followed by 2-3 cover sprays at intervals of 2-3 weeks in order to achieve satisfactory control of the pest.

More recently Pheromone traps are used to determine the build up of moths by placing them on trees in the orchard in March and June. The moths are attracted to these traps and at the peak moth catch spraying can begin.

Pesticides Recommended

Gasathion - 24 oz./100 gals water

OR

Lorsban - 12 oz./100 gals water

OR

Perfekthion - 24 oz./100 gals water

Precautions

DDT and Sevin (Carbaryl) must not be sprayed as they increase mite infestation while Sevin will also cause some fruit drop.

Quetta borer

Damage Caused

This pest is common in the higher colder areas of Baluchistan such as Quetta and Ziarat. The larva drills holes about 1/2" in width in the trunk and older branches of fruit trees causing the trees or branches to die off after one year.

Alternate Hosts

Apple, apricot, almond and walnut trees and a few shade trees can be severely attacked.

Life Cycle

In the months of May and June, beetles about 1" long come out of tunnels (holes in the wood and start laying eggs. Approx 50 eggs are laid by each beetle on the branches of the tree under loose bark. Creamy white larvae hatch out and start drilling holes in the wood. The larvae continue to do this for one year before they change into pupae causing severe damage to the tree. The pupae also take a few months before they change into adults beetles. Hence the life cycle of this pest takes about two years to be completed.

Control Measures

a. <u>Preventive:</u> The trees must be nourished properly i.e. they should be given sufficient water and plant foods (fertilizers). Neglected orchards attract borers. Also infested branches and uprooted trees must be removed from the orchard and burnt. If tomatoes or peas are grown in between the rows of trees the farmer must not used infested branches for staking the plants. An aphid or other pest attack can also stress the trees. Therefore keep aphids and other pests under control.

b. <u>Chemical:</u> The trees should be examined in April. If tunnels are found in the wood, they must be cleared out with a piece of wire. A 5% solution of malathion or gusathion is made and the solution is pumped into each tunnel. Then the hole is blocked with a piece of cotton wool and sealed by pasting the hole with mud. In this way the larvae will be killed by the fumes of the chemical.

Tip Borer (the Cherry tip Borer)

Damage Caused

The borer is becoming a serious pest of fruit trees especially apples and apricots. The larvae bore tunnels inside the tips of branches i.e. the young shoots causing them to die.

Alternate Hosts

Apple and apricot are the main hosts, while almond, plum and walnut trees can also be attacked.

Life Cycle

There is one generation of the pest in a year. Each adult beetle lays about 50 quite large elongated eggs on the young shoots of fruit trees. The eggs are whitish in color and can easily be seen. The tiny larvae hatch out the bore holes into the shoot. This results in the shots drying out causing the larvae to move downwards to make tunnels in the hard wood. The larvae change into pupae inside the branch and finally come out as beetles.

Control Measures

a. <u>Preventive:</u> The adult beetles are attracted to light. Therefore if this is a serious pest the placement of light traps in the orchard can reduce the attack considerably.

b. <u>Chemical:</u> Insecticides have not proved successful for the control of this pest as almost all stages of its development take place inside the branches.

c. <u>Mechanical:</u> The pest can be controlled by clipping the infested branches and burning them. The infested branches can be seen very easily in the winter time as the leaves of such branches become dry but never fall.

SHOT HOLE BORER

Damage Caused

Shot hole borer attacks the branches of many fruit trees. The infested branches release gum threads from the shot hole wounds. The fruits fall prematurely. At the later stages of attack branched die and sometimes the whole tree can die.

Alternate Hosts

Apple, cherry, almond, apricot and plum trees can be attacked.

Life Cycle

There are four generations of this pest in one year. During each generation the pest passes through different stage of development. The eggs are laid in egg pockets made by brown beetles in the bark of branches. The eggs hatch into whitish tiny larvae which feed and make holes in the wood. After about one month the larvae change into pupae which later change into beetles. The generations are completed in April, June, August and October.

Control Measures

a. Preventive: The same as for Quetta Borer. There is one, the trees must not be stressed due to lack of water or fertilizer because trees in condition attract borers. Also care must be taken to remove and burn infested branches and trees. Again keep aphids and other pests under control.

b. Chemical: Chemical control can be successfully provided that spraying is done at the light time i.e. when the adult beetles appear. the beetle normally appear in April, June, August and October.

Pesticides Recommended

Gausthion	- 16 oz./100 gals Water	)Sprayed
		)on
	or	)branches
		)and
Lorsban	- 16 oz./100 gals water	)trunks

Pomegranate Moth

Damage Caused

Larvae of this moth attacks the young pomegranate fruits usually from the blossom end and feeds on the seeds. Infested fruits rot and fall prematurely. Later generations of the pest cannot penetrate through the tough skin of the fruit and enter the fruit instead through cracks that are often present. More than 30% of the fruits are lost in Loralai and Khuzdar areas due to this pest.

Alternate Hosts

The pests can also attack the fruits of apple, pear and quince if the fruits are already damaged by other pests.

Life Cycle

There are four generation of the pest in on year. The larvae over winter like codling moth worm under the loose bark of trees. In March and April the larvae turn into pupae and these change into adult moths at the time when young pomegranate fruits formed. The moths lay eggs on the leaves or fruit. The tiny larvae on hatching out enter the fruits a cause a yellowish fluid to ooze out from the wound. After feeding for a month, the larvae change into pupae inside the fruit. A week later young moth come out of the fruit and start laying eggs.

Control Measures

a. Mechanical: Removal of larvae from the loose bark of trees during winter reduces the infestation considerably.

b. Chemical: As small fruits form on the tree spray with Thiodan at the rate of 12-16 oz./100 gals water. This will control both the Pomegranate Moth and Aphids (greenfly) which are also like to attack the leaves of the plant at this time forty days afterwards a second spray should be applied to control later generations.

Pika

The Pika or Mountain Mouse is a small animal found in the higher attitude areas of Baluchistan such as Quetta and Ziarat. During winter the animal attacks the tree trunks and needs on the bark causing the trees to die.

Alternate Hosts

The hares will attack he bark of any fruit trees.

Life Cycle

This rodent (animal pest) is about twice the size of a rat and belongs to the Hare family. It does not have a tail. The neck is covered with whitish hairs. They do not live in burrows (nests in the ground) like other hares or rats. Instead they live under heaps of stones. Pour to six young are born in a litter and there are 3-4 litters per year.

Control Methods

a. Ostico is a sticky material. The material is pasted on the trunks of fruit trees just above ground level during the winter. The rodents will not touch the treated bark.

b. Zinc phosphate bait is also effective. The bait is prepared as follows:

- Equal amounts of crushed rice, wheat, pulses, corn and flour are mixed together. Then 2% zinc phosphate is added and mixed in thoroughly. Then 50 ml of oil is added and also mixed in thoroughly. Finally water is added and the mixture is pressed out on a flat surface and cut into small pieces. The material dries out and is then ready for use.

- Some pieces are placed around the base of a few trees. If they are eaten other pieces are put out. After eating the bait the hare dies in 2-3 hours.

SUMMARY

1. The most serious pests of apple, pear and pomegranate have been described in order to assist you to recognize which pests are attacking your fruit trees and causing serious crops losses.

   a. Some of these pests attack the leaves only e.g. spider mite, suck the sap from the leaves and hairy caterpillar eats the leaves.

   b. Others attack flower buds, leaves and fruit e.g. bud moth.

   c. Others feed on the fruit only e.g. codling moth and pomegranate moth.

   d. While other feed on the wood making holes in the branches e.g. Quetta Borer, Tip Borer and Shot Hole Borer.

   e. Still others eat the bark Pika Hare.

2. All of these pests whether they feed on the wood, the leaves or the fruits have the common effect of seriously reducing your yields and of shortening the life of your trees.

3. Specific control measures have been given for each pest. This may seem complicated to start with. However, if the following minimum recommendations are carried out you are likely to get greatly improved yields of marketable fruits.

a. Spray apples with Gusathion (24 oz./100 gals water) at 90% petal fall (late March early April) for the control of codling moth, bud moth, hairy caterpillar and shot hole borer. Repeat spray after 10 days.

b. A spider mite has been a problem in other years, spray with a mitacide such as plictra (16 oz/100 gals water). This can be added to the Gusathion mixture and prayed at the same time.

c. For pomegranate growers - spray with Thiodan when the fruits are forming for the control of pomegranate moth and aphids.

d. (I) For Quetta Borer, Tip Borer and shot hole Borer - remove and burn infested branches,

   (II) Nourish the trees with sufficient water and food to help prevent borer attack.

Weed Control

Weeds of orchards can be divided into:
1. Personnel weeds
2. Winter grasses
3. Summer grasses
4. Broadleaf winter weeds
5. Broadleaf summer weeds
6. Parasitic weeds

Weeds are considered harmful because:
1. Moisture and nutrient loss:
2. Weeds harbor pests:
3. Interfere with orchard operations:
4. Require frequent weed removal operations, tillage and moving:
5. Interfere with pollination:

Hand Hoeing

Hand weeding is the most common weed control methods in orchard & small tree gardens, but it is very difficult for -large scale commercial orchards. The pulling of grubbing of weeds is the simplest and most ancient form of weed control

Cultivation

Cultivation is effective and economical for weed control in fruits crops just as with other filled crops grower-know well the advantage of cultivation.

Mowing

Mowing is popular in border deciduous fruit crops especially where soil erosion is serious. These areas can be maintained as short turf effectively controlling erosion whele keeping plant weed competition to a minimum. Mowed turf give a clean and neat appearance.

Tillage

Deep tillage, repeated tillage usually done for the control of weed in orchard.

Inter-culture

Weeds can also be control by growing vegetables, fodder crop and cereal crop like wheat maize in row, of orchard like citrus, apple and other small tree fruit crops.

Fire has been used to control weeds in orchard.

Mulching

Mulching is another effective way to physical control wees in small areas. The spaces in and around cultivated plants are covered with wood chips, sawdust, straw, stalk, or similarly inactive material. If they are thick enough, such mulches shut out light from young weed seedlings, thus preventing their growth. Mulching is ineffective against perennial weed with heavy root system, that send strong growing shoots right up through the mulch.

Mechanical control

The traditional tools used for mechanical weed control were sharpened sticks or metal objects, culminating with common how. Even today in small garden, and flower bed, and in fields of such crops as sugar beets and lettuce the hoe is often the best means of eliminating weeds or they appear. In commercial crops planted in row, the horse drawn cultivators, is use to digout the weeds control in large expanses of soil entials tractor draw disks, harrows and other weeders.

Biological control

The utilization of the natural competition between weeds and other organisms is the basis of biological control. Crop competition is an important biological method of weed control. Similarly the use of geese to control of weeds has had limited success in some horticultural crops. Another example is of Bactr sp. which damage the tubers of Cyperus rotundus, in Pakistan. Pasturing animals such as sheep, goat, or gees in orchards can be used to control weed.

Allelopathy

Reduction in growth and yield of crops caused by weeds may be due to a factor other than competition. An allelopathic effect may also occur. Allelopathy is the deleterious effect of one plant on another through the production of toxic chemical compounds that enter the environment. Allopathic effects of weeds on crop plants and vice versa, are know to occur.

Common herbicides and application methods

Paraquat

The herbicide can be applied at the rate of 0.5 kg ai/ha. It will not provide a persistent control however repeated applications with intervals can keep the weed suppressed and ultimately may lead to permanent control. Application should be made carefully so that the chemical does not come in contract with the foliage of the fruit trees.

Glyphosate

The herbicide is applied at the rate of 1.0 kg ai/ha. It is a systemic herbicide and when applied on the foliage can translocate to the roots and other part of the plant body. This provides a persistent control of all types of weeds. Application should be made carefully and the herbicides should be applied in a way that it does not touch the foliage of the fruit plants.

Fusliade butyl:

It has been observed that grassy weeds are the major component of the weed flora in orchards. In such cases fusillade can be applied at the rate of 0.5 kg ai/ha. If some broad leaved weeds are present, they can be controlled with the application or paraquat.

Dalapan:

Dalapan can be applied at the rate of 4.5 kg ai/ha. This herbicide can proved persistent control if repeated applications are made.

Diuran

Diuran is a urea substituted herbicide and most effective against annual grasses as well as annual broad leaved weeds. Post-emergence applications at the rate of 1.90 kg ai/ha and pre-emergence application of 2.5 kg ai/ha gave substantial and persistent control of weeds.

Simazine:

Simazine is a selectie pre-emergence herbicide. It is highly effective against most of grasses and certain broad leaved weeds. Usually dose of simazine is 1.6 kg ai/ha but + 0.5 can be applied under certain non cropped area to extend the persistence and good control of weeds.

Vegetative Reproduction

TYPES OF CUTTINGS

Cuttings are made from the vegetative portions of the plant, such as stems, modified stems (rhizomes, tubers, corms, and bulbs), leaves, or roots. Cuttings can be classified according to the part of the plant from which they are obtained:

Stem cuttings
Hardwood
Deciduous
Narrow-leaved evergreen
Semi-hardwood
Softwood
Herbaceous
Leaf cuttings
Leaf-bud cuttings
Root cuttings

Many plants can be propagated by several of these different types of cuttings with satisfactory results. The type used would depend upon the individual circumstances, the least expensive and easiest usually being selected.

If the plant being propagated roots easily by hardwood stem cuttings in an outdoor nursery this method is ordinarily used, because of its simplicity and low cost. Root cuttings of some species are also satisfactory, but cutting material may be difficult to obtain in large quantities. For species more difficult to propagate, it is necessary to resort to the more expensive and elaborate facilities required for rooting the leafy types of cuttings. In selecting cutting material it is important to use stock plants that are free from diseases, moderately vigourous, and of known identity. Stock plants that are injured by frost or drought, that have been defoliated by insects. That have been stunted by excessive fruiting, or that have made rank, overly vigorous growth should be avoided.

A commendable practice for the propagator is the establishment of stock blocks as a source of propagating materials where uniform, true-to-type, pathogen-free mother plants can be maintained and held under the proper nutritive condition for the best rooting of cuttings taken from them.

Stem Cuttings

This is the most important type of cutting. They can be divided into four groups, according to the nature of the wood used in making the cuttings: *hardwood, semi-hardwood, softwood, and* *herbaceous*. In propagation by stem cuttins, segments of shoots containing lateral or terminal buds are obtained with the expectation that under the proper conditions adventitious roots will develop and thus produce independent plants.

The type of wood, the stage of growth used in making the cuttins, the time of years in which the cuttings are taken, and several other factors can be very important in securing satisfactory rooting of some plants.

Hardwood Cuttings (Deciduous Species)

This is one of the least expensive and easiest methods of vegetative propagation. Hardwood cuttings are easy to prepare, are not readily perishable, may be shipped safely over long distances if necessary, and require little or no special equipment during rooting.

The cuttings are prepared during the dormant season-late fall, winter, or early spring-from wood of the previous season's growth, although with a few species, such as the fig, olive, and certain plum varieties, two-year-old or older wood can be used. Wardwood cuttings are most often used in propagation of deciduous woody plants.

A few fruit species are propagated commercially by this method-for example, fig, quince,olive, mulberry, grape, currant, gooseberry, pomegranate, and some plums. Certaine trees such as the willow and poplar, are propagated by hardwood cuttings.

The propagating material for hardwood cuttings should be taken from healthy, moderately vigorous stock plants growing in full sunlight. The wood selected should not be from extremely rank growth with abnormally long internodes, or from small, weakly growing interior shoots. Wood of moderate size and vigor is the most esirable. The cuttings should have an ample supply of stored foods to nourish the developing roots ant shoots until the new plant becomes self-sustaining. Tip portions of a shoot are usually low in stored foods and are discarded. General and basal parts make the best cuttings. Gardwood cuttings vary considerably in length-from 4 to 30 in. Long cuttings, when they are to be used as rootstocks for fruit trees, permit the insertion of the varietal bud into the original cutting following rooting, rather than into a smaller new shoot arising from the original cutting.

At least two nodes are included in the cutting; the basal cut is usually just below a node and the top cut .5 to 1 in above a node. However, in preparing stem cuttings of plants with short internodes, little attention is ordinarily given to the position of the basal cut, especially when quantities of cuttings are prepared and cut to length, many at a time, as by a band saw.

The diameter of the cuttings may range from $1/4$ in. to 1 or even 2 in., depending upon the species. There different types of cuttings can be prepared, as shown in Figure 10-1: the "mallet,"the "heel," and the straight cutting. The mallet includes a short section of stem of the older wood, whereas the heel cutting includes cnly a small piece of the older wood. The straight cutting, not including any of the older wood, is most commonly used giving satisfactory results in most instances and is a very old method of hardwood cutting propagation.

Where it is difficult to distinguish between the top and base of the cuttings, it is advisable to make one of the cuts at a slant rather than at right angles. In large-scale operations, bundles of cutting material are cut to the desired lengths by hand saws or other types of mechanical cutters rather than individually by hand.

There are several methods commonly used for preparing and handling hardwood cuttings before planting:

(a) *Winter callusing* During the dormant season, make the cuttings of uniform length, tie them with heavy rubber bands into convenient-sized bundles,placing the tops all one way, and store them under cool, moist conditions until spring. The bundles of cuttings may be buried out-of-doors in sandy soil, sand, or sawdust n a well-drained location. They may be placed horizontally or buried in a vertical position, but upside down with the basal end of the cuttings several inches below the surface of the soil.

Steps in making and planting hardwood cuttings. Top left: preparing the cuttings from dormant and leafless one-year-old shoots. A common length is 6 to 8 in., and the basal cut is generally made just below a node. Top right treating the cuttings with a root-promoting substance. On the left a bundle of method is illustrated. The basal ends of the cuttings are being soaked for 24 hr in a dilute solution of the chemical. With easily rooted plants such treatments are unnecessary. Middle left: the cuttings may be planted immediately, but with some plants it is helpful to callus the cuttings for several weeks in a box of moist shavings or peat moss before planting. Mifflr right: planting the cuttings in the nursery row. a dibble (a heavy,pointed,flat-bladed knife) is a useful tool for inserting the cutting and at the same time firming the soil around the previously planted cutting. Bottom left: the cuttings should be planted 3 or 4 in. apart and deeply enough in that just one bud shows above ground. a loose, sandy loam is best for starting hardwood cuttings. Bottom right: several weeks after planting, the cuttings start to grow. They must be watered frequently if rains do not occur, and weeds must be controlled.

(a) **Direct spring planting** It is often sufficient with easily rooted species to gather the cutting material during the dormant season, wrap it in heavy paper or polyethylene with slightly damp peat moss, and store at 32° to 40° F (0° to 4.5° C) until spring. The cutting material should not be allowed to dry out or to become excessively wet during storage. At planting time, the cuttings are made into proper lengths and planted in the nursery.

Stored cutting material should be examined frequently. If signs of bud development appear, lower storage temperatures should used or the cuttings should be made and planted without delay. If the buds are far developed when the cuttings are planted, leaves will form before the roots appear, and the cuttings will die, owing to water loss from the leaves.

(b) Direct fall planting In regions with mild winters, cuttings can be made in the autumn and planted immediately in the nursery. Callusing, and perhaps rooting, may take place before the dormant season starts, or the formation of roots and shoots may occur simultaneously the following spring. Hardwood cuttings of peach and peach X almond hybrids have been successfully rooted in the nursery by this method provided they were treated prior to planting with indolebutyric acid and captan. Fall-planted cuttings could be injured by rodents and, unless herbicides are used, weed growth may be considerable.

(c) Warm Temperature callusing Take the cuttings in the fall while the bud are in or entering the "rest period" treat them with a root-promoting chemical then store under moist conditions at relatively warm temperatures-65° to 70° F (18° to 21° C)-for 3 to 5 weeks to stimulate root initiation. After this, plant the cuttings in the nursery (in mild climates) or hold in cold storage (35° to 40° F; 2° to 4.5° C) until spring. Experimentally, good rooting of hardwood pear cuttings occurred when the cuttings were allowed to callus (and initiate roots) while the buds were under the "rest" influence and did not start growth and compete for food reserves in the cuttings.

(d) Bottom heat callusing This method has been successful for difficult to root subjects such as some apple, pear, and plum rootstocks. Cuttings are collected in either the fall of late winter, the basal ends treated with root promoting chemicals (IBA at 2500 to 5000 ppm)_then placed upright for about 4 weeks in damp packing material over bottom heat at 65° to 70° F)(18° to 21°), but with the top portion of the cuttings left exposed to the cool outdoor temperatures. It is best to do this in a covered open shed for protection against excessive moisture from rains. The East Mailing Research Station in England has developed commercial procedures for propagating difficult subjects by this method cuttings must be transplanted before buds commence growth; this is usually done as roots begin to emerge. It is important to prevent decay in the cuttings by avoiding excessive application of water to the rooting compost. As long as the correct stimulation has been given it is not essential to await root emergence before transplanting.

This procedure is probably best suited for regions having relatively mild winters. When soil or weather conditions are not suitable for planting after roots become visible, it has been satisfactory to leave the cuttings undisturbed in the rooting bed, shut off the bottom heat, then plant them in the nursery when conditions do become suitable.

(e) Plastic bag storage The hardwood cuttings are taken during the dormant season, the bases dipped into a root-promoting material-for example IBA at 2000 ppm,for a few seconds-then sealed in a polyethylene bag which is placed in the dark at a temperature of about 50° F (10° C). Studies with this technique using peach hardwood cuttings showed 85 to 100 percent rooting after about 50 days. While high rooting can after be obtained by this method it is often difficult to obtain survival of the cuttings following translating.

Planting Fruit Trees[14]

Fruit tree planting is a long term investment and therefore careful consideration should be given in the selection and preparation of site; the choice of fruit tree varieties and their pollination requirements; and to see that the trees are cared for and planted properly using the correct spacing.

Site selection

- A free draining soil is the most desirable. Avoid very light (sandy) or very heavy (clay) soils.

- The soil depth should be at least 4 though 3 may be sufficient where trickle irrigation is used.

- Near electricity for power supply to pump water. Alternately a diesel pump can be used.

- The site should be accessible by road.

- The site should be relatively frost free.

SITE PREPARATION

- The land should be cultivated before planting to control weeds and make planting easier.

- Grading of the site will usually be necessary where flood or furrow irrigation is used but may not be necessary for trickle irrigation.

- The soil should be tested to determine what plant foods are present so that recommendations can be made as to what fertilizers should be applied.

FRUIT TREE SELECTION

- It is important to select varieties that are suited to your particular area.

- Because the fruit growing area in Baluchistan is between 3,500 and 8,000 above the sea level cold winters are experienced and this favours the production of many deciduous fruits.

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14 Portions of the following were taken from "Fruit Development In Baluchistan, Planting of Fruit Trees," Department of Agriculture Research, Sariab, Quetta

- The higher colder area (5,000-8,000) such as Quetta and Ziarat are very suited to apple, pear, cherry and European plum all of which flower late and escape Spring frosts. Of these varieties, the apple is by far the most important fruit. Shin Kulu and Tor Kulu are good commercial apple varieties which ripen late in the season (September/October), while Kashmiri and Mashadi are established varieties which have the advantage of fruiting early in the season (July/August).

- When planting almonds, apricots, peaches, nectarines and Japanese plums in these higher areas, it is better to avoid early flowering varieties as these are prone to frost damage.

- Figs, olives, almonds and early flowering apricots, peaches, nectarines and Japanese plums ar more suited to the warmer areas (3,500-4,000) such as Loralai and Khuzdar for example, the local almond varieties, Katha Mung Phali and Kaghzi all flower very early in the season (by mid-February) and are therefore vulnerable to spring frosts especially if grown in the higher altitude areas.

- Also in selecting varieties a spread in flowering and fruit development is desirable to make orchard management easier e.g. pruning, fruit thinning, spraying and especially harvesting. But always bear in mind that varieties which flower in early spring are prone to frost injury unless grown on protected sites.

POLLINATION REQUIREMENTS

In order for the trees to set fruit the flower must be pollinated.

Pollination - process whereby pollen grains are transferred from another (male part) to stigma (female part) of the flower. Pollination is normally done by bees.

Fertilization - When the pollen grain germinates (sprouts) and grows down into the ovary fertilization takes place.

Self-pollination - When the pollen is transferred from anther to stigma on the same flower or to stigma of another flower of the same variety. If fertilization takes place such a variety is said to be self-fruitful. Varieties of apricots, peaches, nectarines and some plums are self-pollinated or self-fruitful.

Cross-pollination - When pollen is transferred from an anther of one variety to the stigma of another variety. Most varieties of apples, pears, plums, cherries and almonds are self-unfruitful, i.e. they must be cross-pollinated before fertilization takes place. Therefore when planting any one of these varieties it is essential to plant close to each other two varieties that flower at the same time. For example, plant 2-4 rows of Tor Kulu. Similarly alternate Mashadi with Kashmiri.

Note: A well fertilized fruit is large in size and uniform in shape.

TIME OF PLANTING

Plant in early Spring (by end of February) ideally 3-4 weeks before the trees break dormancy i.e. before the leaves begin opening. Planting at this time promotes root development in getting the trees off to a vigorous start.

Planting trees that are already in leaf is very undesirable. Such trees may die or if not they will suffer a severe set back in growth and development.

TREE PLANTING

1. CARE OF TREES

The most common reason why many fruit trees fail to grow is because the roots, have been allowed to dry out at one stage or another either before, during or after planting.

- If you receive the plants from the nursery in good condition, heel them in immediately ensuring to sprinkle soil well amongst the roots and leaving no air pockets by pressing the soil well around the base of the trees. Water immediately afterwards.

- If the plants on arrival appear to have been subjected to some drying-out it is better to immerse the roots in water overnight before heeling-in.

- When planting the trees again every precaution must be taken to keep the roots moist either by covering some with a wet canvas bag or by keeping them immersed in water right up to planting.

- It is important to plant the fruit trees at the right spacing and to ensure that the trees are planted in straight lines. At present 12 x 15 is recommended for all fruit trees which give 242 trees per acre.

- Locate the position of first tree with a peg (A) placéd about 15′ in from both boundaries to allow a tractor to pass around the outside of the orchard.

- In order to achieve straight lines the corner at peg A must be squared. This can easily be done by marking out 12′ along one side of the field (AB). Then run the tape along the other side of the field from A to C and continue it through to B such that the tape measures 0 at A, 9′ at C and 24′ (9′ + 15′) at B. In this way the corner at A will be squared.

- From this corner the location of the first four trees can be pegged out 12′ x 15′.

- From this base all other trees can be measured off using pegs to mark their locations.

- Check to see that the pegs are in line by looking along one end of the row of pegs.

- The planting hole should be 2′ deep and 2′ in diameter.

- The top half of the soil from the hole should be mixed with an equal amount of well rotted farm yard manure. The sub-soil can be discarded.

- Center the tree with use of a planting board.

- Spread out roots in the bottom of planting hole, fitting the tree into the central notch of planting board. Add soil and lift tree upwards so that the soil will fall between the roots.

- Ensure the soil well around the tree leaving a slight depressing to catch water.

- Water immediately after planting giving each tree about 20 liter of water.

- Subsequently irrigate by flood method or with trickle system.

Nursery Work Plan

	1991			1992											
	O	N	D	J	F	M	A	M	J	JY	A	S	O	N	D
Seed purchase	+												+		
Seed sowing		+	+											+	+
Plant apple layers					+	+									
Plant apple rootstocks					+	+									
Bud rootstocks											+	+	+		
Sow Veg. seed						+	+								
Sow forest tree seed				+	+	+									
Plant poplar cutting					+	+									
Cutback budded stocks					+	+									
Lift rooted layers		+	+			+	+								+
Lift budded trees															
Weeding								+	+	+	+	+	+		
Pest control							+	+	+	+	+				
Fertilizer					+	+				+	+				

	1993											
	J	F	M	A	M	J	JY	A	S	O	N	D
Seed purchase												
Seed sowing												
Plant apple layers		+	+									
Plant apple rootstocks		+	+									
Bud rootstocks								+	+			
Sow Veg. seed			+	+								
Sow forest tree seed	+	+	+									
Plant poplar cutting		+	+									
Cutback budded stocks			+	+								
Lift rooted layers	+		+	+								
Lift budded trees											+	
Weeding				+	+	+	+	+	+	+		
Pest control			+	+	+	+						
Fertilizer		+	+				+	+				

Area of Agricultural and Horticultural Crop Production
(000's ha)

Province:	Area Of Fruit and Nuts	Area of Grapes
Urozgan	3.0	0.2
Kandahar	6.3	1.3
Helmand	5.3	2.0
Zabul	2.6	2.0
Grand Total	17.2	5.5

Source: Ministry of Agriculture, Afghanistan

Yield Data 1989						Grapes
District	No. Fmrs questioned	No. Fmrs growing crop	% who grew crop	Average area jeribs	Percentage of fmrs giving yield data	Average yield seer/jer
Helmand	270.00	30.00	11.00	3.00	2.00	149.00
Kandahar	292.00	137.00	47.00	4.00	8.00	70.00
Urzgan	129.00	2.00	2.00	2.00	0.00	0.00
Zabul	182.00	46.00	25.00	4.00	1.00	125.00
						Pomegranates
Helmand	270.00	26.00	10.00	3.00	0.00	0.00
Kandahar	292.00	52.00	18.00	6.00	7.00	202.00
Urzgan	129.00	7.00	5.00	1.00	0.00	0.00
Zabul	182.00	1.00	1.00	1.00	0.00	0.00
						Apricots
Helmand	270.00	3.00	1.00	2.00	0.00	60.00
Kandahar	292.00	9.00	3.00	6.00	2.00	118.00
Urzgan	129.00	59.00	46.00	4.00	16.00	15.00
Zabul	182.00	15.00	8.00	2.00	4.00	33.00
						Fruit
Helmand	270.00	45.00	11.00	1.00	0.00	
Kandahar	292.00	6.00	2.00	1.00	0.00	

Apricot Drying Training Report

Report of training about apricot drying in Quetta done by DAI and MCI from 2.6.91 to 12.6.91

Drying of apricots with sulphur by American Method before sulphuring we cut apricot with knife into two pieces and remove their seeds.

1. Size of place in which we put apricots for sulphuring L=2.70 W=1.42m H=1.70m V=6.5m(3)
2. Size of tray in which we put apricot: L=122 cm W=61cm
3. Number of trays used = 57
4. Amount of with seed used for one tray = 7 kgs
5. Amount of Apricot without seed in one tray for sulphuring=6.52 kgs
6. Amount of sees remained from apricots of one tray= 480 Grs
7. Percentage of seeds=6.85%
8. Total amount of apricots with seed= 395.5 kgs
9. Total amount of apricots in 57 trays put for sulphuring= 368.3 kgs
10. Total amount of sulphur used for burning 1.800 grms(3 times 800 grms+500 grms+500 grms) less than one kg consumed.
11. Total amount of dried apricots = 84.5 kgs

Note: Variety of apricots used for drying is Charmaghz from Quetta.

Date: 4.6.91

<u>Drying of apricots with sulphur by Turkey Methods:</u>

Sulphuring apricots before removing their seeds after 2-3 days remove their seeds with hands.

1. Size of place in which we put apricots for sulphuring L=2.70m W=1.42m H=1.70m V=6.51m(3)
2. Size of open carate to in which we put apricots for sulphuring L=44cm W=33cm
3. Amount of apricots with seed put in one Carate for sulphuring =4.3kgs
4. Number of Carats used=151
5. Total amount of apricots with seed put in 151 carats for sulphuring= 649.3 kgs
6. Percentage of seeds= 6.85%
7. Total amount of apricots without seed after sulphuring=604.82 kgs
8. Total amount of sulphur used for burning 2.700kgs(two times 1.700 kgs+1000kgs)less than one kg consumed.
9. Total amount of dried apricots=122 kgs

Note: Variety of apricots used for drying Charmaghz from Quetta.

Drying of apricots with sulphur by both American and Turkish Methods

I. At first place
a: 1. Number of carats used for Turkey method=64
   2. Number of trays used for American method=1
b: 1. Amount of apricots with seed put in 64 carats=275.? kgs
   2. Amount apricots without seed put on one tray=6.52 kgs (of seeds=6.85%
c: 1. Total amount of without seed apricots= 263 kgs
d: 1. Amount of sulphur used for burning=1 kg (less than 1 kg consumed)
II. In second place
a: 1. Number of carats used for Turkey method=63 ?
   2. Number of trays used for American method =2
b: 1. Amount of apricots with seed put in 63 carats=270?
   2. Amount of apricots without seed put on two trays=13.? kg
c: 1. Total amount apricots without seed=265.?kgs
d: 1. Amount of Sulphur used for burning=2 kgs
e: 1. Total amount of dried apricots in both places=106 kgs

Note: Variety of apricots used for drying was Charmaghz from Kandahar Province Afghanistan.

Date: 6.6.91

Drying with American method:

1. Number of trays in which we put apricots for sulphuring=5 (Large size trays made by MCI. L=1.30m W=1.0m)
2. Total amount of apricots without seed for sulphuring=50 grms
3. Percentage of seeds=12.5%
4. Amount of sulphur used for burning=1 kg (less than 1kg consumed)

Note: Variety of apricots used for drying were Capona Italim from Saryab Research Form Of Fruit Quetta.

Date: 8.6.91

Drying of apricots without using sulphur.

1. Number of trays on which we put apricots for drying=12
2. Total amount of apricots without seed put on 12 trays for drying=75 kgs. Apricots of 11 trays dried with sun.
3. Total amount of dried apricots=15.3 kgs
4. Percentage of seeds=6.85?

Note: Variety of apricots used for drying were Charmaghz from Quetta.

Note: To get a better result in the future from our project (drying of apricots by using of sulphur as famigation)

We sent two different sample on which we used different amount of sulphur to Karachi for analysis to show their sulphur amount and percentage of moisture.

Date: 9.6.91

Drying of apricot with sulphur with American Method

a. Place I sulphur was brought from plant protection of Quetta.
   1. Number of trays on which we put without seed apricots=7
   2. Amount of apricot without seed put on one tray for sulphuring =6.62 kgs
   3. Total amount of apricots used without seed=45.64 kgs
   4. Amount of sulphur used=1 kg (less than 1 kg consumed)
   5. Amount of dried apricot=8 kgs

b: Place II sulphur used was brought from Kandahar province Afghanistan.
   1. Number of trays on which we put apricots without seed=7
   2. Amount of apricots without seed put on one tray for sulphuring=6.52 kgs.
   3. Total amount of apricots used without seed=45.64 kgs.
   4. Amount of sulphur used=1 kg (less than 1 kg consumed)
   5. Amount of dried apricots=8 kgs.
   6. Percentage of seed in both places=6.85%

Note: Variety of apricots used for drying were Charmaghz from Quetta.

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