

## RISĀLA DAR FALĀHAT

[PERSIAN MANUSCRIPT ON AGRICULTURE AND HORTICULTURE]

M. MAJUMDAR

(Senior Research Fellow, Indian National Science Academy)

75/18 S. N. Roy Road, Calcutta-700038

(Received 19 May 1984)

### INTRODUCTION

There are, in the collection of Asiatic Society, Calcutta several manuscripts in Persian, which deal with agriculture and horticulture. These are concerned mostly with gardening but information on field cultivation is also given in the texts of some works. The titles of these works are *Risāla dar Zarā'at*, *Risāla dar Falāhat* and *Irshādu'z-Zarā'at* in the Society collection (Nos. 1612, 1613 and 1614) and *Irshādu'z-Zarā, at, Nakhbandiyya* and *Risāla dar Falāhat* in Curzon collection (Nos. 628, 629 and 630). The date of transcription is generally the eighteenth century but the original text was evidently composed much earlier. Of all these manuscripts, the *Risāla dar Falāhat* of Curzon collection is the most exhaustive.

### SYNOPSIS

There is no indication of the date of the original manuscript, but the copy was written in the nineteenth century. Nevertheless, the original text seems to have been prepared much earlier as there is no indication of any contact with European science or even with modern European nations and the fruits, vegetables and spices introduced by them from the American continent in the sixteenth or seventeenth centuries. The only exception is the mention in the text of *amrut*, which is taken to refer to guava. Guava is believed to have been introduced by the Portuguese from America. According to Prof. Irfan Habib, however, *amrūd* in the literature of the time signified a pear, not guava.\* Similarly an Indian background is ruled out except for a brief mention of *pan* or *tambol*. But betel leaf has been such an important item of daily use in this country from the remote past that it is not unlikely that the Arab merchants of the early middle ages were well acquainted with it and its use and the knowledge about this herb might have reached the countries of West Asia or Iran at the time when such works on cultivation or gardening came to be written. The writer probably knew about cultivation of *pan* even without visiting this country.

\* (Vide Foot note at page 50 of *Agrarian System of Mughal India* by Irfan Habib).

That the background of this work was perhaps not India is indicated by the absence of any reference to rice—the principal foodgrain of a very large area of this country. There is also no mention of mango among the fruits in this manuscripts (while in some other Persian manuscripts even the grafting of mango is mentioned in detail). While the methods of watering are described in detail, there is no mention of the system of irrigation.

The text mentions in quite great detail about the classification of soil and the method of soil testing. The technique of ascertaining the salinity of soil described in this work reveals a scientific approach. The treatment of seeds before planting, the actual agricultural operations of sowing, planting, re-planting, and watering described here indicate the importance assigned to these operations in the medieval period. According to the text if the root of the grass growing on the soil is solid and has a strong base, the soil is good. If the grass blades are straight and slender, the soil is to be considered medium. Weak grass roots and bending grass blades indicate that the soil is not so good and not suitable for cultivation. Another significant observation made in the text is that if Egyptian onion is sown in one year, the next year anything will grow well on that land.

There is a reference to the physique and health of the cultivators. As is to be expected there is marked repetition of astrological observations in all spheres, particularly in determining the proper time for cultivation discussed in the first chapter.

The treatment of seeds before sowing prescribed in the text includes soaking in water and mixing with birds' droppings which served as fertilizers. Among manures mention has been made of droppings of all birds except the stool of ducks, animal stools and cow dung and buffalo dung. It is mentioned that pigeon stool is the best among birds' droppings and the stool of donkeys is the best among animal stools. While buffalo dung has been placed above cow dung, pig stool is described as very bad. The use of ash as manure is also mentioned.

The third chapter deals mainly with the protection of seeds and plants and trees, from various dangers. The fourth chapter deals with harvesting and storing of grains. It is mentioned that it is better to cut the stalk with the grain when the grain is still a little green because at that stage the grains are better and are tastier to eat. The methods of preservation of seeds and grains have been prescribed. The fifth chapter is concerned with planting and replanting of trees. It is very interesting that the use of iron is not encouraged and in many places it is clearly mentioned that iron should not touch the roots or branches.

There is detailed discussion on the methods to avoid insect infestation or attacks of pests and rodents. The text says: "human urine mixed with the urine of animals, if sprayed on leaves, the tree is protected from insects and pests. Seeds of trees, if immersed in cow dung before being planted or sown, will keep the tree free from

insects and pests." To protect fruits from insects and pests it has been suggested that a scorpion (presumably live) should be put on the plant. Various other methods including charms and occult methods have also been suggested.

The sixth chapter is devoted primarily to the cultivation of grapes and the seventh chapter to the plantation of trees. It has been shown how with some treatment of seeds, the seeds, trees and fruits will all be protected from insects. Among the trees special mention has been made of fig, peach, orange and *amrut*.

The eighth chapter is devoted to grafting. The most remarkable feature of the manuscript is the description, in great details, of the methods of grafting. This evidently Persian technique was presumably introduced into India during the Mughal period. According to some authorities grafting was practised by the Portuguese even earlier in Goa, which resulted in the evolution of improved varieties of mangoes. In North India, however, the practice of grafting spread from the sixteenth-seventeenth centuries presumably adopting the technique described in this and other Persian manuscripts. Methods have been suggested for producing different kinds of grapes in one plant, changing or improving the colours of fruits and enhancing their sweetness, and increasing productivity. Among fruits, there is a detailed discussion of cultivation of temperate zone fruits (apple, peach, apricot, melon, pomegranate, mulberry, fig, olive, almond, pistachio, grape), that is, fruits which are called *Turani* fruits in the *Ain-i-Akbari*. There is no mention of coconut, jackfruit, black berry and other typically Indian produce.

The ninth chapter is devoted to the subject of picking of fruits and of fruit preserves and other fruit preparations. The tenth chapter deals with the preservation of some fruits and vegetables. Mention has been made of gourd, cucumber, turnip and onion.

The eleventh chapter is concerned with locusts and other harmful living beings and the ways of saving plantations from them. The use of magnet to drive away ants is worth notice. Ways have been suggested to get rid of rats and bees. Perhaps the rôle of ants and bees as agents of pollination was not known to the author.

Cultivation of wheat, barley, and pulses like *mash*, *masoor*, *moong* and gram occupies important space in the text. Perhaps the agricultural practices mentioned in the text were mainly relevant to northern India in the medieval period.

#### A GIST OF RISĀLA DAR FALĀHAT

This treatise is incomplete at the beginning, so that the passages which may have contained the exact title, the name of the author, etc. are lost. The colophon does not give information on these points. The work consists of 12 *babs* (chapters)

and a *khatima*, dealing with various technical details of cultivation and horticulture. The date given in the Catalogue is the 27th *Dhī Qa'da* 1255/1st February, 1840.

*Bab 1.*—The introduction and the beginning are lost.

The beginning portion of the existing copy deals with seasons, such as the following:

When there are circles of red and yellow in the sky, a strong winter is anticipated. When flies, honey bees, grazing goats run away, the sky is full of inky clouds and small birds come and peck at water, winter and rains are expected. In such season *philphil* (pepper) yields good harvest. When hare scratches at land and looks at the west, a prolonged winter is expected.

If the rains fall before a meteor is sighted, that year the grains will be plentiful. On the other hand, if rains fall after the meteor, the grains will be delayed.

*Second Section:* Then follow some astrological hypotheses, such as the position of planets (*Seri Yamini*) and their effects on the seasons and on cultivation. There are also astrological forecasts with regard to rains, earthquakes, famines, plagues and other pestilences, the visit of locusts etc. Astrological sayings include the possibility of cheap grains and cultivation of grapes.

As the planets have effect on economic condition, one is asked to keep watch on planets.

*Third Section:* This portion deals with cultivation in connection with time and date. The months have Iranian names such as *Farvardin*, *Ordee Behist* etc. (*Farvardin* is the first month of Persian solar year. It has 31 days. *Ordee Behist* is the second month of Persian solar year. It has 31 days). *Mirdao* is another month close to *Ordee Behist*. This month is suitable for cultivation of grapes. Watering is to be done at the time of flowering, and again at the time of harvesting. This way higher yields can be expected. Land is to be ploughed in this month and where there is no yield of grapes, grafting is to be done. All plants are to be watered. No cutting of branches is to be done when there is water. Soil should be thoroughly ploughed so that the rays of the sun penetrate the soil during this month. Again it is prescribed that *paibandh* (grafting) is to be done in this month. Water should be sprayed on the plants in the evening so that the heat of the day is removed.

Some techniques of grafting are prescribed—such as, in order to prevent the effect of cold or heat on the grafting, these should be greased by oil or fat. And *khad* or ash is to be applied and also dry matting is to be applied.

Almond and fig should be planted in the month of *Mehr-man*. (*Mehr-man* is the seventh month of Persian solar year, of 30 days). Fertilizers are to be applied

to these fruit plants during this month. Picking of grapes may commence in this month and continue up to the beginning of the next month. One has to keep watch regarding rains as different plants grow well during this month. This is the proper month for planting even those trees which yield only wood. The cultivator has to take care to remove all loose leaves and other dirt. The base of the plants should be cleaned. This month is suitable for extraction of wood and timber.

Removal and replanting of plants should be done either at the beginning of the day or at the end of the day, so that the timber may eventually become strong and worms do not affect it. One method of avoiding worm is to dry the root moisture.

Almond, *shaftalu* and *zardalu* (peach and apricot) should be planted in this month but care should be taken to ensure that no north wind or cyclone blows when the cleaning operation is undertaken. Transplanting should be done with only 2-year old or 3-year old plants. One year old plants should not be transplanted as the root is very soft.

Removal of the bark of trees may be done during this month. Cutting and removal of branches should be done by hand and *zaitun* oil or olive oil is to be applied in this month. Transplanting of figs or *anjir* may be done during this month.

## *Bab 2* (Second Chapter)

This chapter is devoted to matters connected with the plantation of seeds. The first point concerns the condition of soil and the manner of sowing seeds. The first operation prescribed is to find out whether the land is near or far away from water. One method suggested is to dig up the land and then to put bundles of silk thread into a hole. One end of the silk thread should be immersed in oil and then put into the dug up earth and covered by earth. The other end of the silk should be waxed and kept in a *degchi*. The *degchi* should be put upside down after some time. If the end of the silk thread outside the soil becomes wet after some time, that would indicate the presence of subsoil water.

The second point is about the suitability of the soil for cultivation. If the soil does not crack after rain—it is good soil. If the root of the grass growing on the soil is solid and has a strong base, the soil is good. If the grass blades are straight and slender, the soil is to be considered medium. Weak grass roots and bending grass blades indicate that the soil is not so good and not suitable for cultivation.

Another test prescribed is that dry soil is to be collected, powdered, and then mixed with rain water and then allowed to settle. If the soil shows clearly in the settled condition, it is good soil. If, however, deposits of salt are found on the settled clay, one should not consider the soil as good. Salty soil is not suitable for any cultivation, except for dates. Soil emitting bad smell is also not suitable.

Another test mentioned is that a portion of the soil should be dug out and put inside a hole in the land. If the dug out portion of the soil becomes swollen, the soil is good. If the portion remains as it is the soil is of middle class. Drying up the portion of the soil and its being reduced in quantity would indicate bad soil.

Still another test is to throw seeds on the wet land and dry land. If the seed becomes green after some time, that is, if green sprout emerges and the seed germinates, the land is good. The same operation is prescribed for the high land and low land to find out whether the seed becomes green or not. After this test selection may be made of the low land and high land for particular seeds and crops.

Wheat, onion and *mash* (pulse), if planted in a very dry land, do not become very strong, as the seeds are eaten away by worms. In a good soil, if Egyptian onion is sown in one year, the next year anything will grow well there.

The third point or *marfat* (i.e. knowledge) is about cultivators—as to their fitness. They should be strong and well bodied young men. Those who look after the cattle should have strong voice also.

The fourth *marfat* is about the timing of sowing and other cultivation operations. There are astrological indications such as when the sun is at the end of the circle of *Sambūlā*, the land is wet. The best time of cultivation is when the sun is in the *Mizan* circle. When the wind blows northward, seeds should not be sown. In all cases the seeds should be sown thrice, so that even if the first and second sowings get damaged, the third one may be successful. Sowing is better when it is done at the beginning of the month.

The fifth *marfat* is about seeds. The grains of wheat which are yellowish or reddish, should be selected for sowing. Yellowish hard and big grains are better to eat. Fine grains are not suitable for sowing purpose. Barley should be white, big and hard. Wheat should not be washed before sowing because when the wheat becomes wet, the juice comes out of the grains. All big and hard grains should be selected for the purpose of seed. The best seeds are those which are one-year old. Two-year old seeds are of medium variety. Seeds which are three years old are considered bad while four-year old seeds are useless.

*Mash* and *masoor* seeds, if these are soaked in the droppings of birds before being sown, will yield green leaves early.

Onion seeds should be soaked in water for one day and one night. If they are sown after being kept in water for one day and night, a harvest of big onions can be expected. Onions should be sown in summer.

Grains, if kept in tepid water for one day and one night before being sown, will yield big grains.

*Tarmuz* or melon seeds should be soaked in water for three days, and then sown. The plants that will germinate from such seeds will yield sweet fruits which will have no bitterness.

The cultivators say that seeds collected from deserty places should be sown in hilly places. They also say that for seeds collected from a hilly place, the preference will be hilly places for sowing. Hen and pigeon droppings can be mixed with seeds—these will act like fertilizers (the Persian text uses the word *lahi*). One should make the soil well and soft when one uses seeds mixed with birds' droppings. The soil should be wet but there should be no accumulation of water. Too much of water will spoil the seeds.

It is also suggested that sieves should be made of wolf skins. At the time of sowing the seeds may be dropped through such sieves.

The manner of broadcasting of seeds—*Sair* is a measure of land. Five to seven grains of wheat are to be sown in one *sair* of land. For barley, the number is restricted to seven to nine grains; but in the land which is wet more grains may be sown. One should be careful not to throw the seeds over the horns of cattle. If the seeds are thrown over the horns of cattle, the wheat produced will not be good.

Manure—Droppings of all birds are good for cultivation and for trees, except the stool of ducks. It is, however, mentioned that pigeon stool is the best.

Among the animals, the stool of donkeys is the best as fertilizer, then the stool of horse and then of camel.

Among the cattle, the best is buffalo dung and then cow-dung.

Pig stool is very bad; it should be separated from other manures because it dries up the other manures. But pig stool is good for almonds. Mixed dung is good for cultivation. Mixed stool of animals and birds is a good manure for olives.

### *Bab 3* (Third Chapter)

This chapter deals with things which are harmful for cultivation and for trees, that is, the method of removal of the harmful things, and the manner of saving the seeds. This chapter is concerned with general observations on these topics.

*Protection of seeds:* Leaf of *sarb* (a plant) and leaf of *beet* should be mixed with the seed. This will save the seed until it is used for cultivation.

The seed can also be saved if it is mixed with the powder of elephant bone. Another method is to boil the elephant bone in water and to spray the water on the seeds. The seeds should also be removed from the sun, and kept inside the house.

Another method suggested is to soak *dhania* (coriander) in water for a day and a night and then spray that water on the seeds. The seeds should then be covered with a cloth which will help the seeds to absorb the water. If these seeds are then sown, no harm will ever befall on the seeds.

It has also been suggested to get hold of live *zafda* (probably an insect) and put it on a tray. The tray, with the *zafda* on it, may be buried under earth for some time. Afterwards, the tray is to be brought out and kept near the seeds. The smell of the tray will protect the seeds from any harm. If *masoor* is treated in a similar manner, it will benefit the seeds and the cultivation of *masoor* will become free from danger.

Knowledge of the removal of grass called *Roman Deva Neos*—this type of grass dries up the cultivation. A handful of the seed of bamboo *Harzohra*, if thrown on all sides, will help the grass to die out. A big crying cock may be killed and its blood sprayed on the land—this will prevent this grass from growing.

This *marfat* then deals with the driving out of harmful clouds. Some occult methods of charms and some magical practices are prescribed.

The next *marfat* relates to protection from cold. Heaps of all sorts of dung should be made near the cultivation field. On the night of severe cold, these heaps should be put on fire. Three or four such heaps should be put on fire in such a way that the smoke may spread all over the cultivation field. This smoke will protect the plantation from cold.

Small pieces of bamboo roots and flowers may be broadcast throughout the plantation. This will protect the land from cold. Dry ash may be mixed with seed and kept in a plate. The plate may be buried in the soil and the top covered with a thin fine cloth. This will protect the seed.

#### *Bab 4* (Fourth Chapter)

This chapter discusses how to harvest the grains and how to store them, that is, time of harvest, where to store and how to preserve the grains.

*Harvesting:* Wheat and other grains, when they seem white from a distance, that is the proper time for harvesting. Although the grain should appear white from a distance, the plant should not be allowed to be very dry because when the plant becomes very dry the grain starts falling and the stalk becomes weak. It is better to cut the stalk with the grain when the grain is still a little green because at that stage the grains are better and are tastier to eat. The husk and stalk of plants when still a little green will make better fodder, but not when the grains become very dry.

The threshing floor (*khirman*) should be constructed at an elevated place where threshing and other operations will be done. This threshing floor should be away from the garden as well as from the home because the dust of the threshing floor is harmful for the trees.

To make the threshing floor, the soil should first be broken to pieces and then water should be sprayed on the soil. The soft mud that will come out should be mixed with ash and the mixture should be used to plaster the floor. This plaster will save the grains from being damaged by white ants and insects.

While keeping the bundles of cut stalks on the threshing floor, the heads should be kept on northwardly direction, so that the north wind may dry it up quickly. Another suggestion is that the heads of the bundles may be kept inside the earth and the ends upwards, so that the grains may be safe from birds.

The grains after being separated from the stalks should be kept (in the threshing room) for ten days. On the eleventh day, the grains should be removed to the store-house before sunrise so that the heat of the sun is avoided.

*Location of the grain storehouse or warehouse*—The grain store-house should be away from the stable, leather works, kitchen, bathroom and fire works factory. The mud with which the storehouse is to be made should be very clean. The mud may be mixed with olive leaves to make it strong and free from insects and worms. The store-house should have windows on all sides except south. South wind is generally injurious for grains.

*Saving the grains*—The leaves of *kahu* (a tree), pomegranate and *bulut* should be mixed with wheat—in the ratio one *man* to 100 *mans*. By the use of the leaves the grains can be preserved even if not separated from the stalks and these are in bundles. Another method of preserving wheat is to dig a big hole in the earth like a well—leaves should be kept on the sides of the well and in between layers of wheat. The grains of wheat can be preserved in this way for a long time. For keeping the grains at home these should not be kept on the earth but on bamboo or reed matting.

*Method of saving barley*—Ashes of all kinds and wood ash should be mixed with barley for preservation. In the centre may be kept *sirka* or vinegar.

*Preservation of masoor, mash and onion*: These should be kept in a big pot the borders of which should be smeared with oil. The oil should be applied inside the pot also. Then ash should be applied on all sides—the seeds thus preserved should be safe from all kinds of pests and diseases.

There is another view that the grains should be kept for some time spread on

the ground so that dew may touch them. Then the grains may be stored. This may be beneficial to the grains.

The remaining portion of this chapter is devoted to preservation of flour and the making of *roti*.

### *Bab 5* (Fifth Chapter)

This chapter is concerned with the planting of trees and matters related to that.

*Planting of trees:* The best time for the planting of trees is the start of *kharif* season when there is not too much of water in the soil. The water could gradually and slowly percolate to the roots.

The auspicious time for planting has also been mentioned giving the suitable planetary positions. These are mostly astrological indications and sayings.

The writer recommended the start of the *kharif* season for planting but he has also observed that some authorities were of the view that autumn was a better season because the roots became stronger, if planted in autumn.

In selecting trees for planting only the small plants should be chosen and not the big ones. It is better to plant when there is moon light, that is during the brighter half of the month.

Transplantation is very necessary for almond, pistachio, peach, apricot. Replantation should be done when green sprouts come out of the seed. While replanting, the plant should be tied so that it may not fall. Replantation is recommended for apple, almond, guava or pear (*amrut*), peach, pomegranate, mulberry, orange and all trees which yield juicy fruits. Apart from replanting, cutting of a branch and keeping it on another (that is grafting) is also done with these trees.

Then the text describes how the small plants should be looked after. Those that have been planted in autumn—the soil near the root should be hoed every twenty days. This should be done at least four times. The tree must be watered in summer. The tree should be watered whenever the land becomes dry. The benefit of hoeing is that the soil is kept light and grass and weeds are removed. It should be remembered that for ten years no iron should be used on the tree and the cutting of branch or removal of grass should be done by hand. If the tree tends to fall, a support should be provided. Manure should be applied on the root.

*About replantation:* Fruit plants should be taken out and kept in shade till they are dry, and then planted at the selected spot. The plant should then be watered.

Replantation should not be done till the tree is two years old; the tree should be green when it is replanted. All fruit bearing trees should be replanted except *zaitun* (olive).

*Plantation of big trees:* In planting big trees, the earth should be dug up three cubits in length, breadth and depth. Care should be taken not to break any of the roots. No iron implement should be used because iron should not touch the roots. While the tree is taken out, the roots should not get entangled. The roots should spread out on all sides—also at the time of planting. The soil which comes out with the tree should be kept in the hole for replantation. Support should be provided from the three sides so that the tree should not bend. A big vessel full of water with a small hole at the bottom should be kept so that water slowly oozes out and drops on the root. It should continue like this for two months.

If one wants to dry up any tree, he should put *masoor* on the roots and cut the branches with the teeth. The tree will dry up. If holes are made on the branches and hot iron is put inside the holes, the tree will dry up. Also, the roots can be cut to dry up the tree. Horns of goat can be burnt and put on the roots to dry up the tree.

*Protection of trees:* Human urine mixed with the urine of animals, if sprayed on the leaves, the tree is protected from insects and pests. The seeds of trees, if immersed in cow dung before being planted or sown, will keep the tree free from insects and pests.

A grown up tree can be saved from insects by digging up the soil at the root and putting the stool of pigeons on the roots. Another method suggested in the text is to put a scorpion in water till it dies. That water should be kept in the sun for some time and then sprayed on the leaves; the leaves will be protected from pests. This process should be repeated for eight days. This ought to be done at least once a year. Similar result will be obtained if the stool of dogs mixed with animal urine is sprayed on the trees.

The text has warned against the unintended adulteration of wheat. It enjoins that where wheat is grown, grass should be separated from the wheat plant or else the black seed of the grass will get mixed up with wheat and the flour that will be produced from the wheat will be bitter.

To protect the fruits from insects and pests it has been suggested that a scorpion (presumably live) should be put on the plant. It has been suggested that animals might be moved around the trees or tied near the tree. The stools of such animals will fall on the land and insects that will generate from this tools will help destroy other insects.

Then the text suggests methods to prevent the fruits from falling from the branches. One method is to plant seeds near the trees and when the seeds germinate, to take them out and bury in the earth and allow it to dry up. Then the dry mud should be thrown on the trees and the fruits will not fall from the branches. Another method

is to put onion plants in water and to spray that water on the tree. This will prevent the fruit from falling from the branches.

*Slow watering on the roots:* Earthen pots with water should be kept near the roots. The pot should have very small holes on the sides. The soil should be regularly dug up. The water will come out slowly and go into the roots. This will make the roots strong and the tree will not fall easily.

The text then suggests several indigenous charms and occult methods such as the keeping of a paper with a *mantra* written on it, hanging of a piece of stone and the like, to save the tree and the fruits.

#### *Bab 6* (Sixth Chapter)

*Matters connected with grapes:* For planting grape, the earth should be dug up to a depth of one yard. The soil should be taken out and put on the top. To moisten this soil, rain water would be the best. Small leaves, weeds and useless plants, wood and broken twigs should be burnt and the ash obtained thereby should be mixed with the soil. The wet soil should be put on the tongue. If the taste appears good, the land should be considered proper for planting. If bad smell is emitted by the soil, particularly the smell of cats, the land would not be considered as suitable.

Autumn is the best season for planting and replanting. The first half of the lunar month is the most suitable time although there are three views on the subject. According to one view the most suitable time is from the beginning to the middle of the lunar month; another view is that the most suitable time is the first four days of the lunar month while the third view assigns the last four days of the month as the proper time. While replanting, care should be taken to keep the branches loose. They should not be tied.

The plants should be neither too young nor too old. Middle size plants are best for replanting. Replanting should not be done on too wet a land. After replanting, moist soil should be put on the roots before watering the plant. Replantation should be done before the roots get dried up (after being taken out of the soil). The soil should be deep.

Cow-dung should be smeared all over at the time of replanting to protect the plant from insects. Leaves of *balut* or chestnut may be mixed with cow dung so that the grape plant bears good fruit. Some people also mix *masoor* (lentil) leaf, gram leaf, *mash* leaf or onion leaf with dung. Roots should be kept straight to protect the plant from cold. Some people put human urine and some people make a paste of fried onion and put the same on the root.

After replantation the colour of the grapes changes—the black grapes become white and the white grapes become black.

A small piece of stone, of the size of a fist, may be kept below the root so that the stone may absorb all the bad water or moisture from the soil. Some people put drops of oil which protects the plant from germs.

Two plants should be planted together—one big or stout and the other one small or less stout—because, even if both do not survive at least one will survive. But if both survive, then one of the two—the weaker one—should be plucked out and uprooted because the land cannot sustain both the plants.

*Shifting of grape plant:* Replantation increases the productivity of the plant. Replantation should be done within three hours of the plant being taken out of the soil as otherwise the root will dry up. No iron should touch the plant. Only a proper quantity of water should be put on the soil—not too much nor too little. No digging should be done at the site of replantation.

Grafting, if required, should not be undertaken within one year of replantation. After one year, grafting may be done in the first month.

*Techniques of increasing the production of grapes:* The stem above the soil should be cut a little, the marrow should be brought out and cow dung should be put inside; two pieces of chips of wood should be tied on the stem to cover the stem.

Three kinds of grapes can be grown from one plant. The stems of three plants should be cut and the marrow taken out. Cow-dung should be put inside and then the three plants should be put together and planted. In planting, one yard should be put inside the soil and one yard above the soil. The plant should be watered every day. It will yield three kinds of grapes. To produce fruits with different smells from the same plant, the same method of grafting different plants together should be adopted.

*Grapes with different qualities:* *Tiryag* (Persian word denoting a type of poison) acts as antiseptic. The stem of the plant should be cut and *tiryag* put inside; the stem should then be planted. After eight days, *tiryag*, diluted with water should be put on the soil. The grapes so produced will possess antiseptic qualities. If musk is put in the cut portion on the stem, the grapes will have pleasant smell. The wooden pieces on the stem should be removed after some time and the *tiryag* taken out—the grapes will have medicinal qualities. Grapes on one side of the plant may have a good smell and the grapes on the other side may have bad smell.

Wheat husk, after being fried may be mixed with water. The water may be sprayed on the plant and some water may be put on the roots. The production of the plant will be good.

*Cutting of leaves:* The leaves should be plucked by hand and no iron should be used. The slender and weak branches should be removed and the strong ones kept.

The best time for cutting is when the leaves fall. The plant will become strong if the leaves are cut at this time. Some people say that spring is the best season for the cutting of leaves and some recommend the autumn season. In winter, grass from the roots on the soil should be removed.

The text then discusses matters pertaining to the growing of *zaitun* (olive)—how to recognise the seeds of olive, which soil is suitable, how the growth of the olive tree can be increased, etc.

### *Bab 7* (Seventh Chapter)

*Knowledge of the plantation of trees:* Apples and peaches are also planted in spring and *kharif* season. The land suitable for plantation of these trees is the one which becomes very dry in winter. If the seeds are soaked in onion juice (before sowing), that will protect them from insects. If the seeds are kept in a mixture of pig stool and human urine for one day, the seeds will be protected. The seeds will then be watered and dried alternatively for seven days, and as a result of these treatments, the seeds, the trees and the fruits will all be protected from insects.

After plantation, cow-dung is to be spread all around the bottom of the plant in order to save it from pests. For four years human urine is to be poured at the base, four times a year, as a result of which the fruits will be red. The branches will be laden with fruits which will not drop easily but the tree will bend due to the weight of the fruits: in such a case, stakes should be provided to support the tree. The stakes should face southwards because the south breeze bends the tree. During summer, a small pot of water should be kept near the tree to absorb the heat of the sun's rays.

### About figs

The season of plantation is spring and autumn. Sun's rays should fall on the soil. River side is quite suitable. The land may be wet or moist but there should not be too much of water. Cow-dung and ash should be used in plantation. Replantation is to be done when the tree is a yard high and very green. Three or four branches are ideal for the tree but if the tree is found to be branching too much, the branches should be tied together as too much branching out makes the tree weak. Spraying of ash is recommended.

Two plants may be tied and planted together—such as *pista* and *badam* (almond). They should be tied with a silk thread. This will increase production. Both the trees will produce fruits in good quantity as each will draw nourishment from the other.

*Peach:* For peach wet land is preferable or where water can reach easily. If the land receives rain, the fruits will be big. For replanting, the beginning of the spring season is suitable. If roses are put below the roots, the fruits produced will be red.

If there are too many fruits, some should be plucked out, so that the remaining fruits grow large.

*Oranges:* Oranges may be planted in autumn, and may grow in the spring season. The plant should be protected from insects. As north wind is harmful, an enclosure should be put up around the plant to protect it from the north wind. To protect it from the severity of winter, the plant may be wrapped with the leaves of *kadu* (gourd).

*Amrūt:* *Amrūt* should be planted after cutting the stem and taking out the marrow. Cow-dung mixed with white flower, should be put in place of the marrow and then the stem should be tied up with chips of wood. Then the tree may be planted. The soil should not be dry. The soil should be regularly watered to keep it moist until the plant grows.

The text then provides similar information on date trees, flower plants like rose, the *sarb* tree, the *sauzon* (lily) plants.

#### *Bab 8* (Eighth Chapter)

*Paibandi* or Grafting—the technique of uniting two plants or trees.

If the skin of the tree is thick like that of *anzir*, a small incision should be made on the skin with a sharp wooden object (not iron). The incision should be made in such a way that the marrow is not touched. Then the two branches should be united by a string and fresh soil should be put on the joining; it should be smeared with soil. Then a pot of water should be kept over the joint with a small hole at the bottom of the pot so that little drops of water fall on the joint all the time. This should be done till the two branches fully unite and become one.

For trees with thin skin the same formula should be applied but the incision should pierce the marrow and while tying up, the marrow of the two branches should combine.

In the case of medium skin trees, that is where the skin is not too thick nor too thin, an incision should be made on both sides but the marrow should not be touched.

Instead of making incision, scraping of the skin is also possible. The soil should be white and clean. Red soil dries up the graft. White soil is to be smeared on the graft.

The tree should be at least two years old before the branches are used for grafting. If the grafting is done with branches of a tree less than two years old, the yield of fruits will be less.

When the south wind blows, the time is suitable for grafting, and not when the north wind blows. Grafting should not be done during the full moon. Grafting may be done during the rainy season. Autumn is the best season as the temperature during the day and the night is the same.

Then the text gives some planetary positions to indicate the auspicious time.

*About knowledge of the tree for grafting*

Fig on mulberry, apple on *amrūt* (pear). They have affinity. They will easily combine. The grafting is to be done lengthwise of the stem, not breadthwise.

If *amrūt* is combined with mulberry, then the fruit will not be red—the fruit will be white. If apple is grafted on *amrūt*, the apple will be of big size, and it will be sweet. Apple on peach will result in big size apples.

Peach, apricot, pear, apple and pomegranate go well for grafting.

Orange can be grafted with apple and apple with orange.

If orange is combined with mulberry, the orange that the grafted tree will produce, will be red.

Some people say that pomegranate has affinity with orange. Olive can be grafted with grape and grape with olive.

*Paibandi (grafting) of grapes:* The general formula is to be applied—strong branch to be combined with strong branch of another grape plant, the skin is to be scraped and the two branches united, and the joint is to be smeared with soil. Another method is to dig-up up to half a yard at the bottom of the plant and then to apply the grafting with another grape plant. The dug up hole should then be covered with soil. Of the two methods—scraping of the skin and making incision in the skin—the incision method is the better one. The two plants should be situated close to one another. If grafting is done with branches on the upper portion then the distance between the two plants should be one yard only. If the grafting is done at the bottom, then the distance between the two plants should be two yards. The plants should be more than one year old at the time of grafting.

In the case of grafting by the process of scraping of the skin, the branches should not be united immediately after scraping. After scraping of the skin, the branch should be smeared in cow dung, and kept immersed in a vessel putting soft moist soil on the branch and then the grafting should be done after a week or ten days. The grafting on the upper portion of the plant may, however, be done quickly. The marrow of

the branch should unite with the marrow of another branch. Some ash should be spread on the joint and the two branches should be tied with silk.

The text then describes the method of grafting on *Zaitun* (olive).

In regard to *shaftalu* (peach) it is mentioned that the branch can be grafted with almond and apple tree. The incision should be made on the branch and the grafting process should be adopted in the same manner as described in the previous section. Peach can be grafted with *baid*—the fruits produced in such combination will be without seed. The method briefly is: one *baid* plant should first be planted, and then the peach seed should be sown nearby and when the green peach tree comes out, one branch of the *baid* should be put down and split a little. Then the branch of the peach should be united with the branch of *baid*. Clean and clear mud is to be smeared on joint and drops of water should fall on that throughout winter. With the advent of spring, the outer branches are to be cut so that the main stem draws sustenance from the *baid* tree, and the fruits grown will be without stones.

Apple can be combined with *amrūt* and orange, with the branches of the three fruit trees grafted together. The apple tree will produce fruits twice a year.

*Amrūt* (Pear) can be grafted on apple or pomegranate. The process of grafting is the same as described in the previous section.

Fig can be grafted on *chinar* and on mulberry. The tree will bear fruit in every season.

Pomegranate can be grafted on willow. While pomegranate can be grafted on other trees, other plants cannot be grafted on pomegranate. However, according to the opinion of some authorities, orange can be grafted on pomegranate.

Almond—grafting to be done in autumn. Grafting may be done on the middle branch of any tree.

### *Bab 9* (Ninth Chapter)

This chapter is devoted to the subject of picking of the *mewa* (fruits) and the preparation of fruit preserves and fruit products.

For instance, the method of preparing *manacca* has been described. The grapes are to be treated with hot iron. The fruits should then be spread on the dry floor and covered with grape leaves.

Similarly the making of vinegar (*sirca*) has been described. The vinegar of grapes is the best of all vinegars.

Then the text gives the method of picking olive and the making of oil from olive.

The other subjects dealt with are preserves of apples and oranges. Mulberry should be kept in glass vessels which should be full up to the brim.

#### *Bab 10* (Tenth Chapter)

Preservation of fig, cucumber and gourd has been described.

Cucumber is to be soaked in saline water. Then cucumbers should be hung together, binding the upper end on a piece of wood. The hanging cucumbers are to be lowered into a big jar of wine in such a way that the cucumbers do not touch the wine. The mouth of the jar is to be closed and sealed. The cucumber will remain fresh.

For gourd, the process suggested is to cut the gourd into small pieces, pour hot water on them and then to soak them in saline water. The gourd pieces will stay fresh for a long time.

Onion is to be mixed with salt and then spread on grass and kept for drying up. Each of the pieces is to be kept separate. It will last long.

Preservation of almond has also been described.

Melons (or musk-melons)—It has been suggested that powdered rose flower should be mixed with the seeds of melon. The plants will bear rose-scented melons. The seeds can be soaked in milk and honey for two or three days and then sown. The fruits will be sweet.

To keep the melon plant free from insects it has been suggested that the roots of the lily (*sauzon*) are to be boiled in water and the melon seeds are to be soaked in that water before being sown.

The text also suggests a method of producing gourd and cucumber which are seedless. When the creeper is one yard long, holes are to be dug in the soil and some side branches are to be put into the soil. When the creeper is another yard long, the same process is to be repeated, and then once more. When the branches put out roots, the branches should be cut. The process should be repeated till the last branch puts out roots. This last plant should be allowed to grow and it will give seedless fruits.

Mechanical aid may be provided to stimulate the rapid growth of gourd plant. Holes are to be made in an earthen pot through which the branch of the creeper should be passed, and kept for two or three days. The sides may be changed after that and the plant will thereafter grow quickly. Ash may be spread on the ground and holes may be dug near the plant which should be filled up with ash. Cucumber and gourd grow in the same pattern.

In the case of beet, the soil on the edge is to be removed and cow dung is to be spread there. Cow dung is to be smeared on the plant also. The beet will grow big even in saline soil. The saline soil will protect it from insects.

The turnip (*salgam*) is to be grown on white soil. The seeds may be soaked in honey and milk and kept like that for four hours and then sown. The turnip will be tasty.

### *Bab 11* (Eleventh Chapter)

This chapter is concerned with harmful living beings and the ways of saving plantations from them.

Locusts (*malakh*)—The left horn of a cow should be burnt with cow dung—the smoke will drive away the locusts. If some locusts can be caught these may also be burnt—the smoke emitted by the burnt body of the locusts will drive away the other locusts. A tree by the name *habbul fir* grows in the Roman (European) countries. It attracts locusts—if a branch of this tree is thrown on the ground, the locusts will go and sit on it. With the help of this tree, the locusts may be enticed to leave the cultivated land.

*Narmas* (a fruit so called by the Egyptians) and *hanjal* (*datura*) may be soaked in water and that water may be sprayed on land—the locusts will not sit on that land. Then water may be sprayed on sitting locusts—the locusts will drop down. A living mouse may be tied to a tree—the locusts will avoid that tree. Locusts sit on a land if they see people from above: when locusts are noticed, the villagers should try to hide inside the huts. Not seeing the people, the locusts are likely to fly over that land which may thus escape their attack. The locusts do not cross water—and so when the locusts come and sit on a field, trenches should be dug quickly around and filled with water. The locusts will not cross into the neighbouring field.

*General protective measures in regard to insects and animals:* *Datura* fruit should be boiled in water and that water may be sprayed on seedlings just when they are coming out and vinegar may also be sprayed at different places around; this will save the plant from insects and animals. Crabs may be kept in a pot of water for a week, till they are dead. When bad smell comes out of that pot, that water may be sprayed around and no insect or animals will attack the plants. Sulphur may be burnt—the smoke will drive away and kill all insects. The smoke will go inside the holes in the trees and kill all ants. The smoke should go inside the holes.

*Ants:* The text then suggests a mechanical device; according to this work if a magnet stone is kept near the tree full of ants—the ants will come out. If grape seeds are soaked in *til* oil and then sown, the ants will not sit on that grape plant. Another method to save plants from ants is to burn silk and to mix the ash with

honey; if the seeds are soaked in honey before being sown, the plant that will germinate from these seeds will not attract ants. Opium may be soaked in vinegar and that vinegar may be lightly smeared on the plant and also spread a little on the ground—it is stated that the ants will never attack that place. Lastly, five *datura* seeds may be burnt and the smoke coming out of these seeds will drive away ants.

To avoid ants and insects in the *khalian* (store-house for grains), it has been suggested that mud and ash should be mixed and spread around the *khalian*.

*Rodent*—The text suggests a rodent killer, viz. a mixture of *datura* fruit and *murdar sani* (a medicine) to be powdered and mixed with *roti*. The pieces of *roti* to be thrown to be eaten by rats. The rats, on eating the *roti*, will die. Some other trees and plants are mentioned in this context. They grow chiefly in West Asia. *Roti* may be mixed with the leaves of *sauson* (lily) to be given to rats. Some Unani medicines are also mentioned as rat-killers.

*Bees*: Sometimes it may be necessary to drive away the bees. One method is to smear olive oil on grape plant—the honey bees will not throng there. If olive oil is burnt in a lamp (*chirag*), the smoke will drive away those pests. Bees may be caught and burnt—other bees will keep away from the smoke.

Some antidotes have been suggested in regard to scorpions, snakes, mosquitoes, flies and white ants.

Mention has also been made of pests which attack chickens and some antidotes have been suggested.

### *Bab 12* (Twelfth Chapter)

This chapter deals with herbs and leafy plants such as *pan*. *Kahu* is another useful herb for cure of coughs and indigestion. *Kahu* is useful in the treatment of various other ailments. The juice will bring relief from sleeplessness. It is also a cure for jaundice. It has been suggested that the leaf should be kept on the person while travelling and it may be kept in the bed also.

Mention has been made of *kashni* leaf, *sudab*, *tambol* and beet.

The manuscript ends with a word about pigeons—their varieties, the feed of the pigeons, how to keep them and protect them, and similar topics.

### ACKNOWLEDGEMENT

Shri Shibdas Chaudhury, Librarian, Asiatic Society and Shri Mumtaj Ahmed of the Asiatic Society Library, Calcutta deserve thanks for their willing assistance.