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Familiarity with Basic and principles of Jujube Training and Pruning

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Abstract

Jujube is one of the most important horticultural orchards in the world and Iran. The third rank of jujube cultivation in the world after China and Korea is in the possession of Iran with 3600 hectares area and production of 8000 tons of jujube products in 1399. Of this amount, about 96% of production is concentrated with about 7600 tons and the area under cultivation is about 3450 hectares in Southern Khorasan province. Jujube is not an unknown and new fruit for most Iranians but very little information Jujube pruning is available. In fact, in most people's minds, jujube is not pruned. This article provides an introduction to the basics of jujube training and pruning.

Keywords: jujube, pruning, principles, Iran,Southern Khorasan

1- Introduction :

Jujube is one of the most important horticultural orchards in the world and Iran. The third rank of jujube cultivation in the world after China and Korea is in the possession of Iran with 3600 hectares area and production of 8000 tons of jujube products in 1399. Of this amount, about 96% of production is concentrated with about 7600 tons and the area under cultivation is about 3450 hectares in Southern Khorasan province. There are gardens in them that are completely different from the advanced jujube cultivation that is the result of research by scientists and experts in the field of jujube in some cases, such as planting, holding and harvesting. These gardens are created based on the experience of farmers.Jujube is not an unknown and new fruit for most Iranians but very little information Jujube pruning is available. In fact, in most people's minds, jujube is not pruned. This article provides an introduction to the basics of jujube training and pruning.

2- what is Pruning :

Pruning is a horticultural and silvicultural practice involving the selective removal of certain parts of a plant, such as branches, buds, or roots .

3- Reasons to prune Jujube :

include deadwood removal, shaping (by controlling or redirecting growth), improving or sustaining health, reducing risk from falling branches, preparing nursery specimens for transplanting, and both harvesting and increasing the yield or quality of flowers and fruits.

4- Necessity to prune Jujube :

Jujube shoots are different from other fruit species. Vigorous new shoots of peach, apple, and grape can have branches in the same growing season, and the branches have structure similar to the primary shoot. Jujube has four types of shoots: primary (extension) shoot, secondary shoot (side branches), mother bearing shoot (fruiting spur), and fruitbearing shoot (branchlet) (Figure 1). There are three kinds of buds for jujubes: main buds, secondary buds, and dormant buds. There are two buds, one

main bud and one secondary bud, at each node of both primary and secondary shoots and at the apex of mother bearing shoots. The terminal main bud of the primary shoot will keep growing each season to expand the tree canopy, and the lateral main buds (at the base of each secondary shoot) normally do not sprout and instead become dormant except with strong stimulation (Yao,2019). The secondary buds on each node of primary and secondary shoots are early-maturing buds, which produce secondary shoots or fruitbearing shoots The jujube primary shoot is always accompanied by secondary shoots (side branches), or the secondary shoots are part of the primary shoot and later diverge in function. The primary shoot elongates every year to expand the tree canopy. The secondary shoot acts as a base for the fruiting structure, does not extend in length, and withers back after two or three years. At each node of the secondary shoot is a mother bearing shoot (fruiting spur), which is a compact spur that grows approximately 0.04 inch (1 mm) and produces 2 to 5 fruit-bearing shoots each year. The fruit-bearing shoot (branchlet) is thin, flexible, deciduous, and 4 to 8 inches (10-20 cm) long; it bears flowers and fruits at its axils. The primary shoot, secondary shoot, and branchlet are zigzagged and spiny. There were sprouts and buds on the main shoot that 30 percent of these shoots grow in the spring and the tree will not have the ability to feed all of them. so the tree gradually becomes weak and older and the product quality and its performance decrease . in order to prevent this situation , it is necessary to be pruned every year .

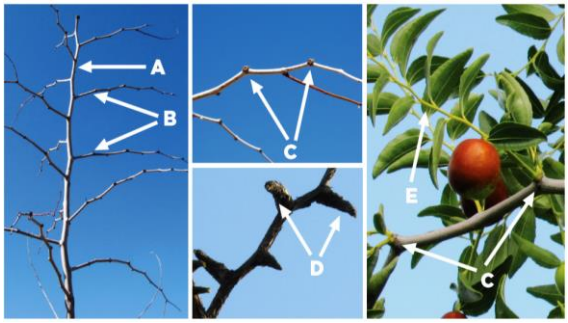

Figure 1. Jujube shoot structures: A. primary shoot, B. secondary shoot, C. mother bearing shoot (young fruiting spur), D. old fruiting spur, E. fruit-bearing shoot (branchlet). (Photos by Shengrui Yao).

5- One cut stop, two cuts sprout :

Jujube's special pruning responses are directly related to its shoot and bud structure. An easy way to remember pruning responses is the phrase "one cut stops, two cuts sprout" (Figure 2) (Yao,2019). With apples, peaches, or grapes, when a shoot is pruned short, 1–4 buds directly below the cut may grow out new shoots with a similar structure as the original shoot. But with jujubes, pruning a primary shoot will usually promote no new apical (end) growth, but will instead set fruit on the remaining secondary branches (Figures 2 and 3) (Ghouth., 2016) If the primary shoot is pruned and the first secondary shoot under the first cut is also pruned, the bud on the primary shoot near the base of the secondary shoot will grow out (Figures 4 and 5). If you want to stop canopy expansion, you can do a single cut to the primary leader shoot. If you want them to keep growing and expand the canopy, you can leave it as is (no pruning) and the terminal bud will continue to grow, or give them two cuts to continue the extension growth (Figures 4 to 6).

Figure 2 . Performing a final cut to stop the growth (Photos by Shengrui Yao).

Figure 3 . the bud at the base of the first secondary branch will remain dormant for at least one year. The appearance of the branch in the growing season without a new primary shoot after one cut(Photos by Shengrui Yao).

Figure 4 . Two cuts at The end of the main branch for to start sprouting(Photos by Shengrui Yao).

Figure 5. sporouting at prunned branch tip it has resulted in the production of a secondary branch during the growth season (yellow arrow -Top).the bud at the base of the first secondary branch will grow out during the growing season. The appearance of the old branch with a new primary shoot (white arrow -Down) in the growing season after two cuts during winter pruning (Photos by Shengrui Yao &
Edited by Ghouth kamal).

Figure 6. The intensive pruning in the jujube , It causes the growth of primary and secondary (top)branches from a node in the jujube , and eventually creating a generative branch(down)(Photos by Ghouth kamal).

6- Shorten secondary shoots to simulate branching :

Some cultivars, have plenty of scaffold branches, while others, have limited branches. For cultivars with sparse branches, we can intentionally shorten the secondary shoot to 1–2 nodes to stimulate new primary shoot growth (Figure 7). Unlike other tree fruit species, shortening the secondary branches does not guarantee new shoot emergence in jujubes. New shoots may come out the same year or the year following pruning. Occasionally, new shoots fail to come out at all. Growers can use this technique on newly planted trees (Figure 7) or 1- to 3-year-old young trees to stimulate new shoots at desired positions. Branches with wider branching angles originating from secondary branches (Figure 8) are preferred over branches with narrow angles directly from the trunk.

7- Thining cuts and shortening long branches :

If a jujube tree has too many primary shoots, weak and competing branches should be pruned out from their base. When a tree is short of branches, we can use these to increase the fruiting area, but when a tree is crowded with branches, we can thin them out or shorten them to 2- to 3-year-old secondary branches(Ghouth et al., 2019).

1-7- Year – by – Year pruning :

Planting year. If the trees are taller than your expected branching height, prune them to 35–40 inches in height and give the top two cuts to stimulate new growth on the central leader (Figure 7). If the trees have secondary branches, shorten 4–5 of them to 1–2 nodes to stimulate side branches (Figure 8). For those secondary branches below 2 feet, remove them completely. Some nurseries trim out all secondary branches for ease of shipping and handling. If the plants have no secondary branches, please also prune the whip down to your desired height, normally 35–40 inches or a little higher if desired. If the whips are strong enough, you may also end up with 2–4 branches. If growers have mechanical harvesting in mind, the branching height should be adjusted accordingly.

Figure 7. Shorten secondary branches to 1–2 nodes (black circles) for newly planted trees and two cuts on the trunk top of the central leade(Photos by Shengrui Yao)

Figure 8. to form new branches (yellow line and circles) from shortened secondary branches in young trees (Photos by Ghouth kamal).

2-7 - Second year :

Keep the central leader intact or cut it back with two cuts to balance it with other branches. If you have enough side branches, you can leave themas is for one year or give two cuts to stronger branches to balance them among side branches. Prune out competing branches (if any). If there are not enough side branches from year one, give the central leader just one cut to stop the apical growth, and cut more secondary branches at desired positions/directions to 1–2 nodes to stimulate branching. Also, to help increase fruit set and fruit volume and quality, you can include branch pruning, leaf removal, and thinning of fruits in your summer (Figure 10).

3-7 - Third year and later :

Control the tree height with one cut if the trees have already reached 9–10 feet. Prune out dead or damaged branches. Thin out or shorten the competing/crowded branches. You can also shorten the crowded branches to a 2- to 3-year-old secondary branch if space allows. If the tree has reached the desired height, prune the top to a side branch or secondary branch. For the extension branches/leaders of big branches, if there is still room to grow, you can leave them the way they are or use two cuts to stimulate new growth. If there is no room for further expansion, use one cut to stop the extension growth. Those early secondary branches on the central leader are useful for early fruiting, but they need to beremoved gradually as trees get older and become crowded in the middle of the canopy. For some cultivars, the one cut may hold the branch without new growth for more than one year. Then you will suddenly see an explosion of primary shoots when lots of the primary buds of the fruiting spurs on the secondary branches grow out as primary shoots (Figure 9). You can rip off most of them by hand in early summer when you notice them early enough and are sure they are primary shoots, or pinch them out and just keep the base 1–2 nodes if you notice them later. Or you can prune the overcrowded ones out during dormant pruning.

Figure 9. Most fruiting spurs on this secondary branch grow out as primary shoots(Photos by Shengrui Yao & Edited by Ghouth kamal).

Figure 10. The shoot tip and the main sporout (upper left) , the young stem tip after a 25 cm growth (upper right) and thinning of fruits (low) in order to help increase the fruit and quality of the fruit (Photos by Ghouth kamal).

8-Mature tree pruning :

Jujube trees live a long life. When trees are 15–20 years or older, they produce annually with stable structure and very few or no primary shoots. Pruning can be really simple or even unnecessary every year. If needed, you can prune out some old or dead branches, or shorten some old branches to renovate trees. We will have another publication on this topic when our trees at the Alcalde Center are getting older. In general, jujube tree pruning is simpler than most temperate tree species, but they do need some attention, especially young trees since most people prefer to keep their jujube trees at a manageable size. These are the basics of jujube pruning, and we do not have detailed studies about jujube pruning yet. As you tend your trees, note how your individual trees respond to different conditions and treatments and use these observations to guide your future pruning.

Figure 11 - Old branches (red box) and fruiting buds (yellow circles) in the jujube tree that are needed to create young branches and Produce suitable pruning load(Photos by Ghouth kamal).

9- Pruning rejuvenation of old trees is as follows (Figure 12):

1- Removal of one third of shoots in strong growing trees

2- Elimination of half of the shoots in medium growth trees

3- Elimination of two thirds of shoots in old and fruitless trees (Ghouth et al., 2019)

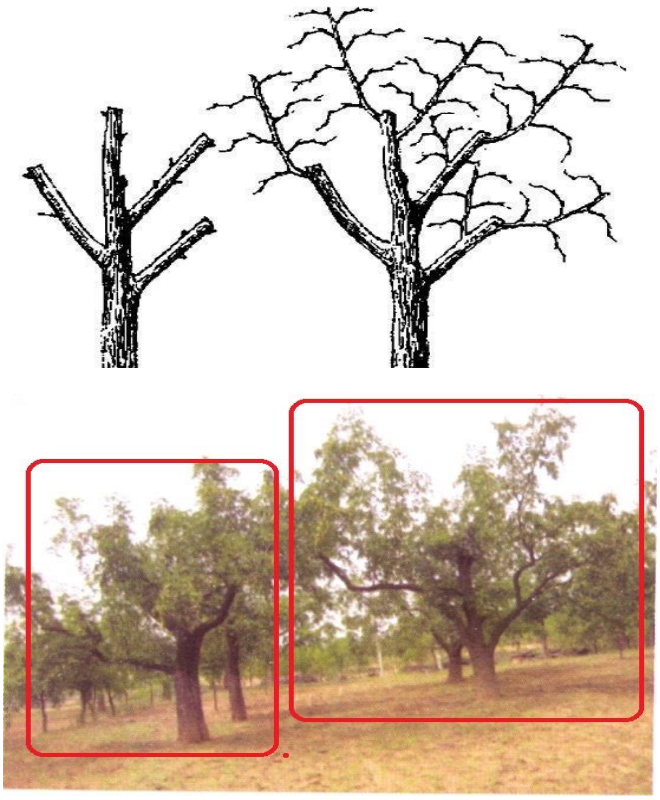

Figure 12 - Severe pruning of old trees that are not fruitful(Photos by Ghouth kamal).

10- Reaction of jujube sprouts to cutting points:

The reaction of jujube buds to the cutting site and from different nodes on the branch and how they grow are different from each other, which you can see in the pictures below (Figures 13 to 16)(Ghouth et al., 2019)

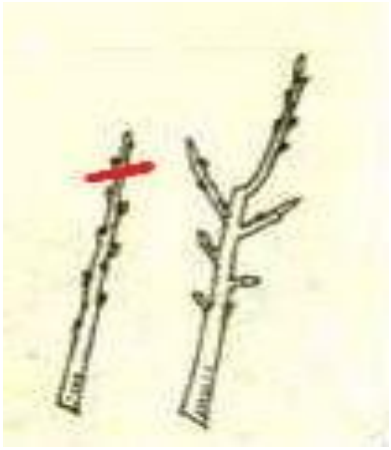

Figure 13 - The shape of the jujube branch when one to two terminal buds are removed (Photos by Ghouth kamal).

Figure 14 - The shape of the jujube branch when more than 3 primary buds are removed (Photos by Ghouth kamal).

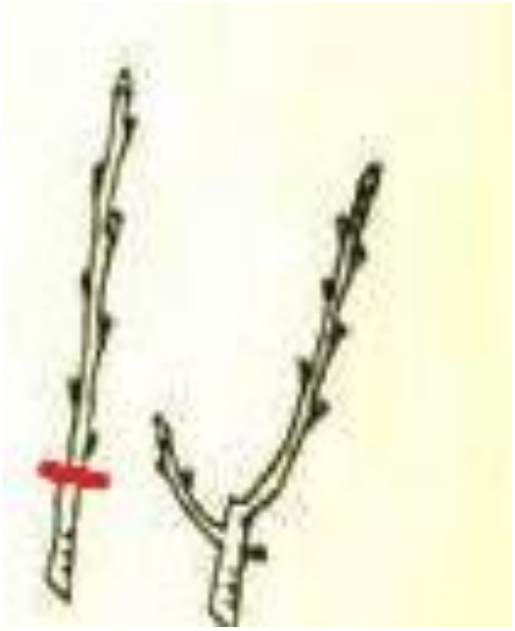

Figure 15 - Jujube branch shape when more than 2 primary buds are removed(Photos by Ghouth kamal).

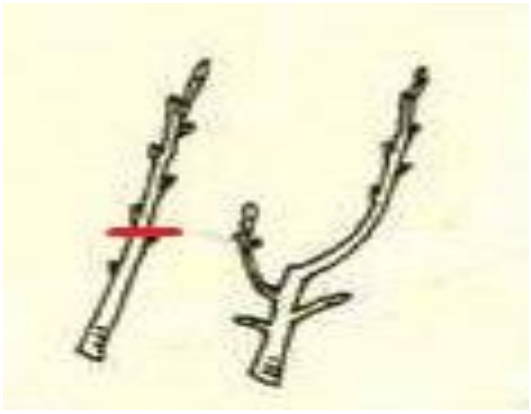

Figure 16 - The shape of the jujube branch whenremoved more than an initial bud (Photos by Ghouth kamal).

12- Pruning the branches in jujube in different modes:

Eliminate cross-branches, overlapping branches, dense branches, diseased and pest-prone branches, improperly placed long branches, and competing branches. These branches disrupt the shape of the tree, the effect of light, food consumption and the spread of diseases and pests of insects, which is very unfavorable for the growth of the jujube tree. Therefore, timely updating of 7 or 8 year old fruit groups is one of the important technologies to ensure the success of jujube trees (Ghouth, 2016) (Figures 17 to 20).

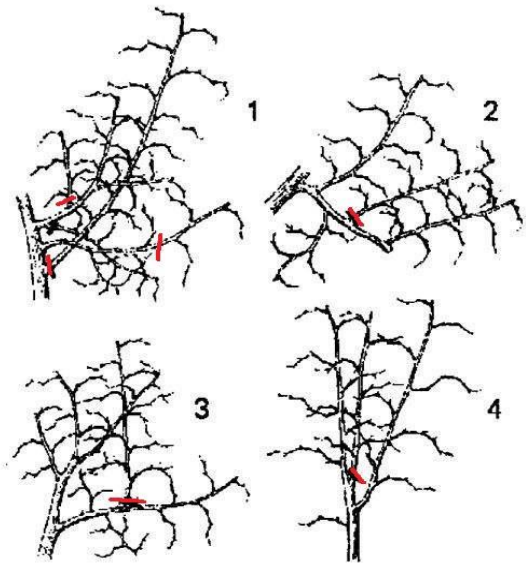

Figure 17: 1- Tangled branches 2- Overlapping branches 3- Long branches that are incorrectly located 4- Competing branches (Photos by Ghouth kamal).

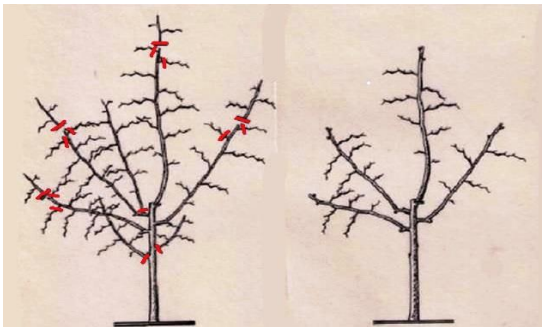

Figure 18 - Tree without pruning on the left and pruned on the right(Photos by Ghouth kamal).

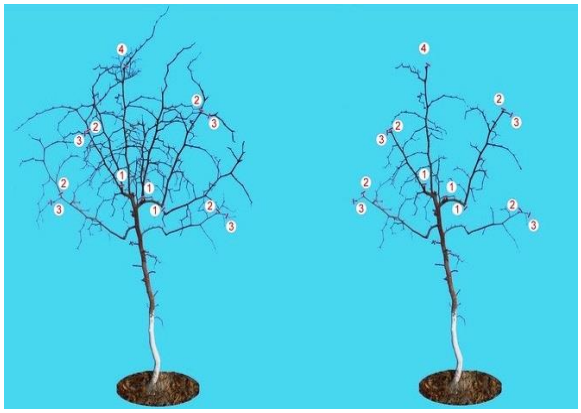

Figure 19 - Tree without pruning on the left and pruned on the right during planting (Photos by Ghouth kamal).

Figure 20 - Pruning tree on the left and pruned on the right when planting (Photos by Ghouth kamal).

13- Familiarity with some suitable forms of pruning in jujube tree:

Training is done during the first 2-5 years ofvthe growth.The traditional forms of jujube trees include centeral leader and open center or modified centeral leader systems.Today several new training systems such as cordon, dwarf pyramid pillar, espalier, spindle and hedge- row have been tested with success.In general about 6-8 primary branches are kept within a height of 3.5 m well spaced in all direction. After winter pruning in 20 to 30 year old trees, the number of buds on current shoots should be one eighth to one sixth of the total and the number of mother bearing branches should be about 120 per cubic meter. In the following some common forms of pruning is expressed :

1-13-Dwarf jujube pruning method in intensive cultivation or pyramidal tree cultivation:

In the first year after planting, we remove the seedlings from a distance of 50 to 60 cm from the ground and remove the first branch after the removal site from under the first node of the same branch and 3 branches after it from the first to the third node. Also remove the tips of the remaining branches and this is repeated every year until the branches meet in a row and they should be removed from nodes one to two to be replaced by new young branches. At the end of the fifth year, the tree has 15 horizontal fruiting branches (Figure 21) and basically in jujube pruning one should look for horizontal or dormant young branches, not tangled branches with very low angles (Johnson, 2017 and Ghouth ،2018).

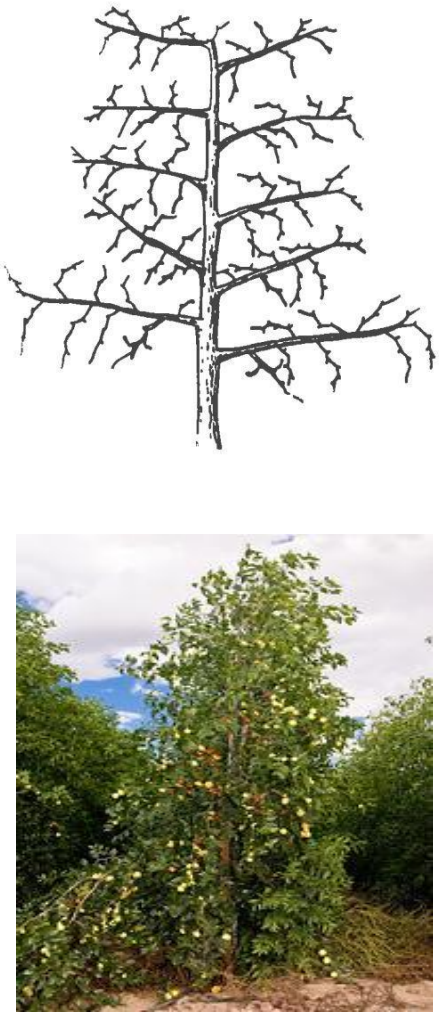

Figure 21 - The jujube tree trained by the dwarf pruning method in the sixth year and finally becomes a spindle or pyramid (Photos by Ghouth kamal).

2-13- Tree with open canopy and central axis:

The branches are open and scattered and the tree has a clear central trunk and the tree is about 3.5 meters high and 6-7 main branches, The tree is divided into several layers,3 side branches on the first floor of the branch to be preserved from the stem, The angle between the secondary branches is 120 degrees,The angle between the main branch and the central stem is 60-70 degrees,There are 2-3 lateral branches on each main branch in the first layer;2 main branches on the second layer,The distance of the first branch from the ground is 80 to 120 cm, There are 1-2 lateral branches in

each main branch; 1-2 branches in the third layer, All main layers and branches should be separated only from the main trunk. The distance between each layer of branches is 80 cm.This tree shape is used for large trees that have not been pruned (Figure 22).

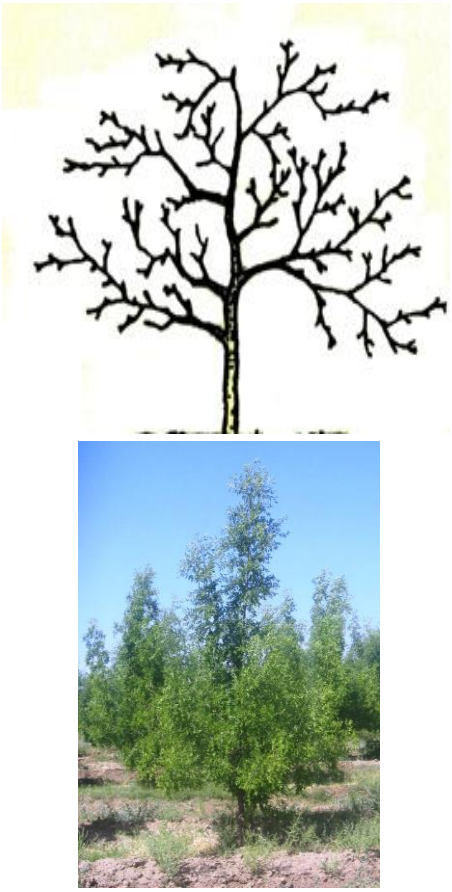

Figure 22 - Tree with open crown and central axis(Photos by Ghouth kamal).

3-13- Tree with wide crown and variable central axis:

In fact, it is the same tree with a central axis, with the difference that in no year does it have a fixed axial branch and regularly the central branch gives way to another branch every year (Ghouth, 2009) (Figure 23).

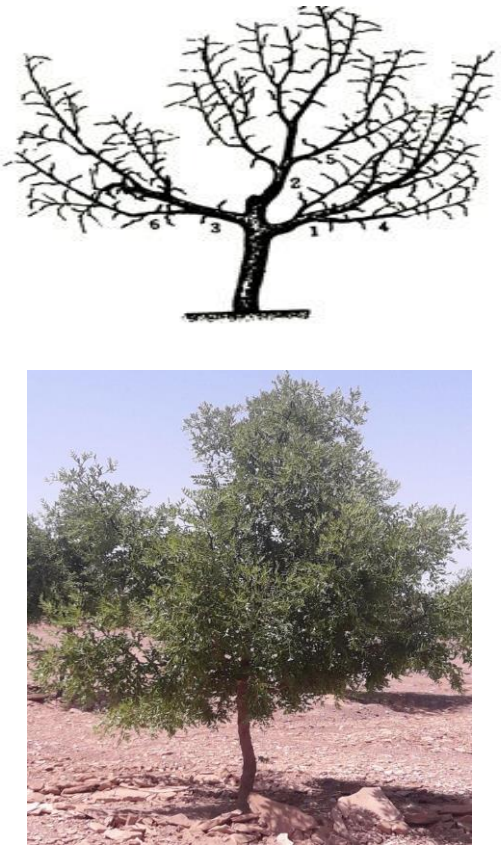

Figure 23 - Tree with variable central axis (numbers 1, 2 and 3 of the main branch and numbers 4, 5 and 6 of the side and secondary branches) (Photos by Ghouth kamal).

4-13- A tree with a broken and uneven crown :

Pruning young trees:

This period usually lasts from 1 to 10 years after planting or 1-5 years in dense gardens. At all ages the preservation of the main branch and the main sub-branches must be preserved.

In jujube trees less than 3 years old, when the tree reaches 1 meter, The main stem is pruned from a height of 60-70 cm above the ground. Cut a part of the secondary branch to a thickness of more than 1 cm. If the branches are thicker than 1 cm, pruning in winter is recommended. The secondary branch must be separated from the base, 3-4 branches of the end of jujube should be

pruned to accelerate the formation of the tree crown. Use by preserving the secondary branches for proper fruiting, after completing the canopy, control the overgrowth of the tree to increase the reproductive growth so that the fruiting is faster (Ghouth., 2016). The main measures for pruning are: summer pruning, breaking the head of the branch, winter pruning of thin and elongated branches (Figure 24).

Figure 24 - A tree with an uneven and messy crown(Photos by Ghouth kamal).

5-13- Cup-shaped tree:

in this form of training, no branch is allowed to take the lead. Pruning is done from a height of 75 to 100 cm and three to five main branches are kept at a distance of 10 to 15 cm from each other.The main branches, once they have grown and thickened, will fill in the gaps between them, and they will all appear to have branched off from the end of the trunk.The purpose of this training method is to have trees with wide crowns that have an open center.A short trunk about 50 cm high and 3 to 5 branches originating from the center of the tree , they form the overall shape of the trees. (Ghouth, 2009) (Figure 25).

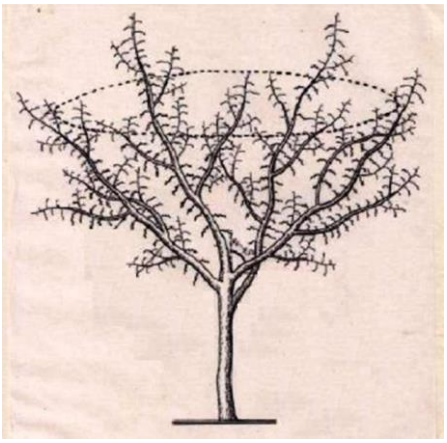

Figure 25 - Tree pruning in the form of a cup (Photos by Ghouth kamal).

14. Conclusion :

Addressing the issue of pruning in the development of jujube orchards in the country,including Southern Khorasan province, is very important due to reducing the discharge of wells, canals and water supply of jujube in conditions of drought stress and ultimately preventing quantitative and qualitative reduction of jujube Efforts should be made to promote

and develop it. Jujube tree pruning is one of the most important options that, while creating a standard structure for the tree, increases the possibility of managing nutrition by selecting the appropriate branches in the tree. This can significantly help the gardeners' economy. By pruning, the quality of the fruit is better and as a result, its marketability increases. For example, if each kilo of fresh quality jujube is traded for 1 dollars, this amount will be around 1/4 dollars for low-quality jujube. Equalizes. Although there is no reliable published information about the role of pruning in rejuvenation and increasing fertility in the field of jujube, but all experienced and reliable technicians and farmers have confirmed this issue and consider pruning in jujube as one of the most important steps in jujube cultivation.

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