



Rug material



Rug material

Dedication

To My Friend Dr. Mark R. Jones

You were the man that helped me to realize my dreams. Without you, none of this would be possible. Your interest and inquiring mind about oriental rugs inspired this project. You are the most imaginative and perceptive person I have ever met. Very few people have these gifts. You have faithfully believed in my vision and understood the importance of this project.

You came in as a curious investor, and have become my most loyal and trusting friend. You were the Godsend that made this all possible.

To My Father Mozafar Khazai

I dedicate this work to my late father – the man who initially cultivated the passion I have for thinking ambitiously and having big dreams. Acting as a living example, he nurtured the virtues of discipline and hard work within me, which have led to my life's achievements and overall success. His unending generosity, courage, friendship, networking, and ability to live life large will always leave me in awe.





WOOL

Wool is primary and raw material for every rugs. Even in rural rugs they just use wool for weft, warp and knots. Therefore in these kinds of rugs dye and wool are the only primary material. In other words without use of high-grade wool there would be no excellent rugs. The finest qualities of wool are obtained from sheep reared primarily for this fibre.





Wool can be divided into three broad categories.

Fine

The finest diameter wool comes from Merino sheep. It is used for high quality, soft handling fabrics and knitting yarns and is highly valued by the world's leading fashion houses.

Medium

A wide range of wools between fine and coarse is produced by crossing one breed of sheep with another. Many of these crosses have become established breeds – such as Corriedale – and are bred in large numbers. Medium wools are used in a variety of woven apparel cloths, knitting yarns and furnishings.

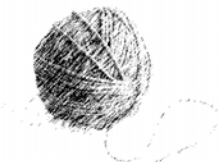
Coarse

Many different sheep breeds produce coarser wools and often they are dual purpose breeds farmed with equal emphasis on meat and wool. Romney produces long, medium-lustre wool which is particularly useful for rugs because of its strength and durability.



Wools are sheared by scissors from alive sheep, or by a knife from a dead one and in a tannery. It is important to know that the high-grade wool which is used in Iranian rugs is the wool that is sheared by scissors from an alive animal, because the shortness of tannery wool makes it improper to be used in rugs production.

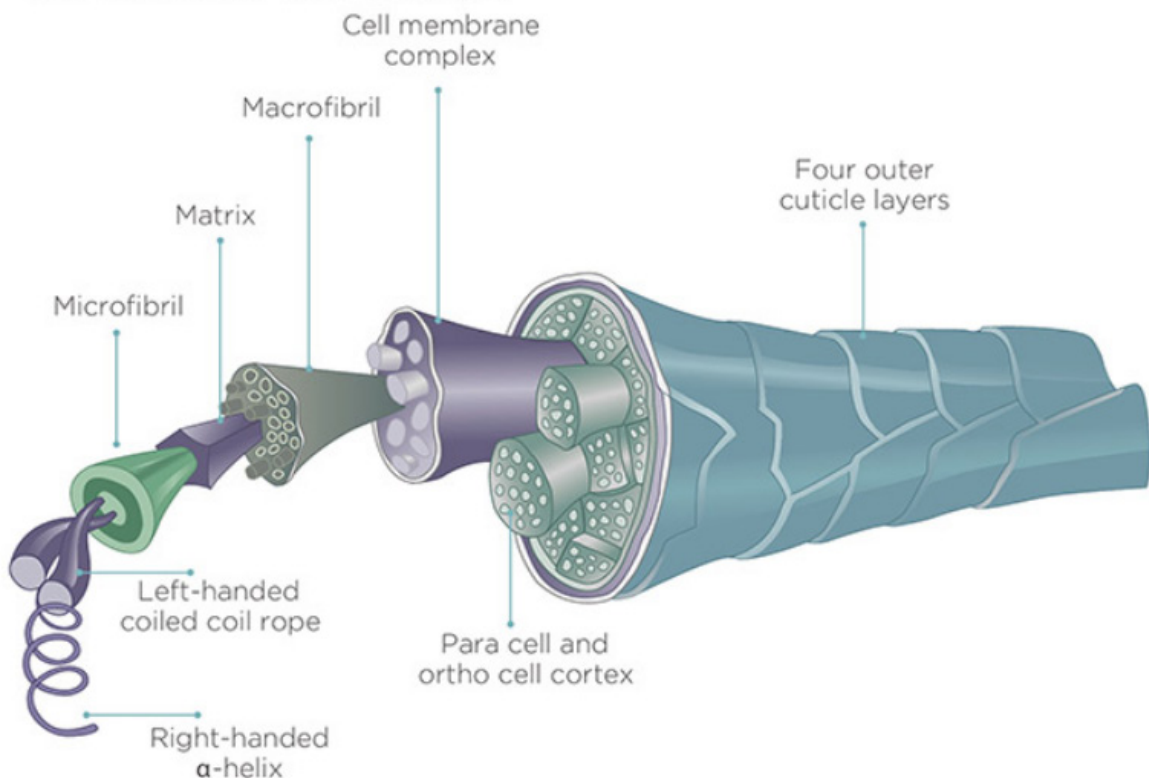
Excellency of the wool is depended to delicacy and thickness, length, strength, smoothness, its natural color, quality of adaptation in dyeing process and tension bearing of each string. Not all the wools of a sheep's body are similar in these characteristics. Wool of shoulders are the best, after that comes the wool of chest and at last wool of legs and under belly.





For more explanation on these characteristics, it is also mentionable that; the more thin strings would be, the wool will have a better quality and becomes high-grade. For instance, nowadays general standards of strings' thickness are as follows: the best quality should have less than 30 microns thickness of each string. The thickness of Second grade is between 30 to 35 microns. And the Third grade has around 35 to 40 microns thickness. And the wool with more than 40 micron thickness is considered as the worst, and at the Fourth grade.

The structure of wool fibre



It is better that strings of wool be as long as possible. The average of strings' length should be not less than 7.5 cm for the First grade wool.

The strength of wool's string is depended to nourishment of the sheep. If sheep does not have a good nourishment then its wool will be dry and fragile. The curly wools are not good for rugs. Smoother wools are so much better. For smoothing the curly wools some chemical progresses are needed which are expensive and would harm excellence and durability of products.

Naturally wools are in white, yellow, gray, brown and black. The white wools are the best and most expensive one because they can be easily converted to any other colors with no requirement to extra chemical progresses.



Dye-taking ability of wools is related to different factors. One of them is primary color of the wool itself as I mentioned it before. The other one is the wool's dose of greasiness which should be decreased by persistent washing. And again, the thickness of each string since the more thin it would be, the more stability and dyeing ability it might have.

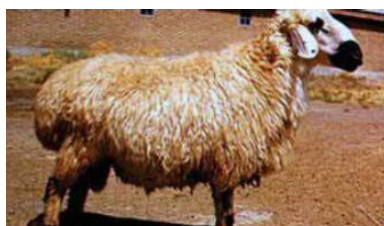
According to these factors the best quality wool is the wool which is white (%25 pollution at maximum), and with average of 30 microns thickness and not less than 7.5 cm length of each string.



Obviously the quality of products at the end is completely depended to quality of their raw materials at the beginning. And that is why all big weaving companies, always have their representatives and purchase agents to provide the best raw materials even in the most remote villages of Iran.



Sheep husbandry is common all around Iran. Kurdish, Sarakhsi, Baluchi which are common in every part of Khorasan have the best quality wool. The wool output of these breeds is around 65 to %70. And around 65 to %70 of their wool is in white tonality.



Kurdish breed



Baluchi breed

In province of Azerbaijan some other breeds are common, like Maku, Hergi and Moqan. Maku is the best among them. The wool output of these Azerbaijani breeds is around 35 to %55. And around 35 to %55 of their wool is in white tonality.



Moqan breed



Maku breed









In Markazi province sheep breeds are: Arab, Mahabad, Bakhtiari, Kaku and Farahan. Mahabad is the best of them. Their output is around %70 to %75 and they have 30 to %40 white tonality.



Bakhtiari breed



Farahani breed

Sheep of Kurdistan and Kermanshah are Lori breed. Output of their wools is around 45 to %55 and also around 70 to %85 of their wools are in white tonality.



Lori breed

In Khuzestan, Fars and Kerman sheep have Arab-Lori and Qashqai breeds. Their wool output is around 50 to %55 and 65 to %70 of their wools have white tonality.



Kerman breed

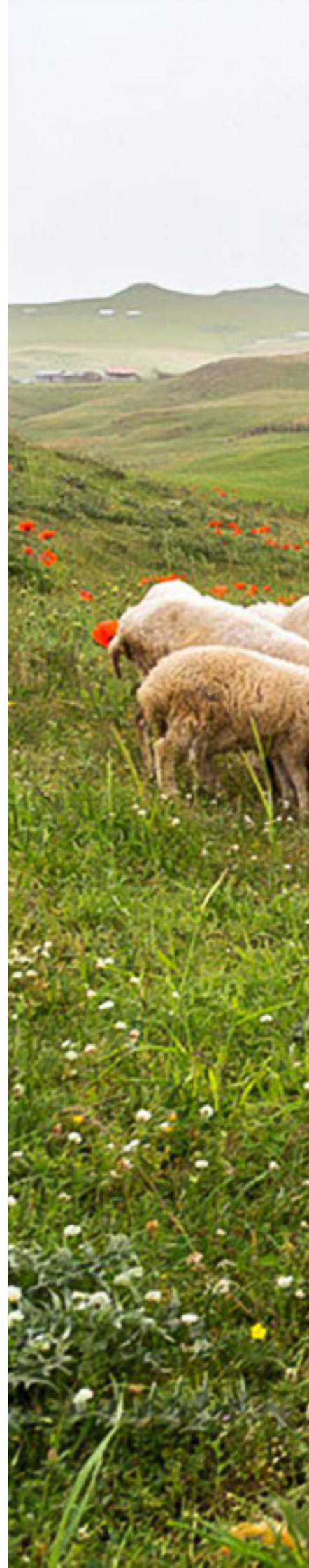


Kbodeh Shiraz breed

In Mazandaran and Gilan provinces sheep of Zol breed are more common. The output of wool of these sheep race is around 50 to %55 and only 20 to %30 of their wool are in white tonality. Generally the wools of Mazandaran and Gilan are among most inferior wools considering the required quality. But in spite of this some of Mazandarani rugs are very well-known like rugs of Kelardasht which is so unique and is famous worldwide.



Zol breed





Breeding of sheep, from their prehistoric forebears to the pure and domestic breeds, have been related to improvement of weaving techniques and methods and the demand for wool between human societies. The wool of early sheep was too rough and difficult to shear. After centuries of artificial selection, domestic sheep have longer wool than their ancestors, which could be easily spun.

Wool's characteristics are very different from hair, cotton or silks. There are small crimps on wool fibers which in spinning intertwine with each other making the woolen more elastic than the other textiles.

The domestic sheep is the result of mating between Urial and Mouflon. These two breeds have a double layer wool. The inner layer is tight and curly and the outer layer is soft and long. Mouflon is a wild breed with long and curved horns, mostly living in Asian mountains. Both male and female have small bulks.

Mouflon can be domesticated, but Qashqais in Zagros Mountain, Afghans in Hindu Kush and Balouchs in Palangan hunt it as a valuable prey.



Mouflon



Urial

Urial's main habitat is Alborz Mountain, in the southern part of Caspian Sea. Both male and female Urials are horned. The males have large horns, curling outwards from the top of the head turning in to end somewhere behind the head; since females have shorter, compressed horns. The horns of the males may be up to 100 cm long.

Differences in breeding between shepherds depend on their needs and also environmental conditions; and in searching for the highest result, they examine several breeds mating. People of each tribe and region choose the breed, which has the best adaptability to the natural conditions of the region, to be mated with their native breeds. In Iran for example, they import Merino from Australia and New Zealand to be mated with predominant breeds like Kermani, Balouchi, Kurdi and Raxshani.

There is considerable diversity in the wool's color of the different breeds; including ivory, light brown, dark brown, grey, black, cream and even red. On the subject of wool, some of the best breeds which have been mixed with Merino, live in the west of Turkey, near Bursa

The Daglıç breed, who has long wool with ordinary quality, live in central and eastern Anatolia; a very thick and tight yarn is made from its wool. Kivircik is another breed from this region which a short curly yarn is made from its wool.



Most of Iranian domestic sheep have short fat tails. Fat-tailed sheep could be found in all over central Asia and North Africa. For many years, the Caucasian ground cloth have been made of fat-tailed sheep's wool. This breed is hardy adaptable, but is able to withstand the tough challenges of peripatetic life;

Because of these characteristics fat-tailed sheep is the favorite breed between nomads, like Qashqai.



The most well-known breeds in Iran are Qaragul, Makui, Mehraban, Qezel, Sanjabi, Kurdi, Bakhtiari, Sangsari, Balouchi, Golkuhi and Naeini. The wool of these breeds is tough and lasting. Wool of those which live on the mountains has better quality than the ones which live on the low and humid lands. Qaragul has a double layer wool. Both layers grow simultaneously. The inner layer, also known as Iranian lamb's wool, has small crimps and is used for coat and hat. The outer layer is long and tough and in the north of Afghanistan people use it for making rug and kilim.



Mehraban breed



Qaragul breed



Qezel breed



Sanjabi breed



Golkuhibreed



Bahmani breed



Afshari breed



Zandi breed



Dalaq breed



Shal breed

The quality of wool depends on environmental conditions and richness of pasturelands. For example, the wool of Khorasan is famous for its elegance and the best ability of dye-taking; and it gets these characteristics because of the temperate climate and fertile land, and of course, the long background in sheep husbandry in the region.



Wool's quality, also, depends on the time of shearing. The wool which have been shorn at spring, known as "Bahar-Chin" is better than the wool which have been shorn at autumn. The yellowish white wool is the most expensive and high-grade, due to its cheesy color.



Shearing

Each adult sheep is shorn once or maybe twice each year; mostly, when the cold season has been finished, in April and May. But the time of annual shearing, also depends on the climate of the region and the culture of nomads; for example between Qashqais and Bakhtiaris it most often occurs after their summer migration. About 3-1 Kg. wool can be obtained from each adult sheep. As wool grows in the follicle it is covered with natural grease and suint which have to be removed by scouring before any further processing can be carried out. The natural grease can be recovered to produce lanolin and thus used in many cosmetics and soaps. There are two common way for wool washing. Before shearing and after it; for the first one, shepherds make the herd pass across a pool or a river.





The best wool is the one which had been washed for many times, until its natural greasiness comes to the required level. The most favorable water for wool washing is a river stream. If the wool is washed gently, it will be more adoptable with dyeing process, and it shines more after dyeing.



In the next step is combing; fibers should be neat and well separated. The most common tool for combing is a stick with metal teeth that is set in the ground. The wool must be crossed several times through the teeth, until the laying direction of fibers become similar and short and long fibers divide totally.





Spinning

Spinning is a hard and apparently an interminable work that is done by every member of a spinner family. It is just between Qashqais a womanish job.

Nowadays the spinning machines are becoming widespread, but the traditional methods have still the best result, because the machines make the wool thin and fragile and reduce its elasticity.

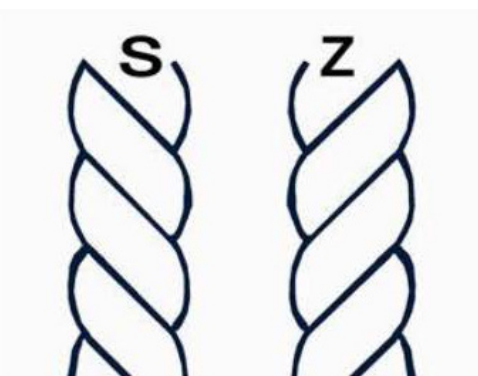
The most common way is using a spindle. The spindle has a disk of wood or clay and a cone-shaped shaft of wood or metal which is set in the middle of the disk. Circling the disk, make the shaft spinning and it twist the wool into yarn.

Each thread of yarn has a twist which is accordant with the direction of disk circling; clockwise, that make the twist in the form of "Z" or counterclockwise, that make it in the form of "S".

If the spinner is right-handed, the normal circling will be clockwise and the most of yarns have "Z" formed twist. But the spinning machines do it counter clockwise, and machine spun yarns have mostly "S" formed twist.

If a thread have been twisted just one time, it might have not enough strength, so usually the two or more threads are twisted again with each other to make a tight and lasting yarn. Mostly in the second phase, the twisting is done in the opposite direction.

Yarns are graded according to the twist direction, the number of threads and also the twist direction of the secondary phase. For example "Z3S" says that threads with "Z" formed twist, and are retwisted three times in the "S" form or counter clockwise direction.





How to recognize tannery wool in rugs.

Tranny wool can be recognized easily due to their lack of quality. There is two methods to test the quality of wools:

First method:

Press your thumb over rug's surface. If after lifting of the thumb up, wool immediately returns to its previous condition and has a good reactionary ability, then you can be sure of wool's quality. And if it takes too long for wool to return or it cannot return at all, then you must be sure that it does not have a good quality.

Second Method:

Rub your thumb over rug's surface, in the way that you are wiping something out of it, remember that you should move it against regular lay direction of the wool. If by this rubbing lint of wool divide and stick on your thumb then the wool does not have a good quality. A good quality wool should has strength and remains stable.







Silk Road



SILK



The tale of silk begins with a little cocoon, that near 4700 years ago, dropped accidentally into a tea cup which belonged to a Chinese empress. Her name was Leizu and she was Huangdi's wife; the Yellow Emperor of the great China. Wishing to remove the little cocoon from her tea, Leizu began to unroll the thread of the cocoon. That was amazing and she wondered if the brilliant thread could be woven or not.

So she asked her husband to send his men for more worms with different types of cocoons. And also asked him a garden full of mulberry trees. She herself began to breed silk worms in the garden and soon she achieved her ambition to weave wonderful clothes of the treads, and also she taught her courtiers how it was, to maintain the art in the Chinese court. Thence Leizu became well-known as the goddess of silk.



Such, at least, was the story that Chinese people have told their children for thousands of years. Certain it was that the first silk cloth had been woven in ancient China, and silk weaving had remained in the Chinese court as a secret art for ages.

The luxury of silken garments became the characteristic of Chinese higher social classes during several dynasties. But they used silk not just for clothing. It also have been used for painting and writing. Silk is the ancestor of paper. The kings of the other lands (Japan, Korea, India and Persia) had a great interest in silken costumes, and, although the Chinese keep selling them silken clothes, there was a severe banning on exporting silk worms to these lands, and also, the Chinese had succeeded to guard the secrets of skill for centuries.



Chinese Silken Garment



Silk Making

Now, the tale continues with another Chinese princess. She was very fond of silken garments and she was promised to the prince of Khotan. But the princess, refused to go to her husband without the fabric that she loved. Finally, she broke the imperial ban on silk worm exportation. After that the Chinese lost their secret to the neighbors, the Koreans and the Japanese. At last the Indians, too, discovered how making silk, and, from India it was, that the silk-weaving found its way to the Persia, where, it seems, the very first silken rugs had been woven. Actually, no one could say decisively where and when the silk had been used in rugs, for the simple reason that it is the most perishable of the weaving materials (The oldest surviving silk rugs are from the 16th century, during the Safavid dynasty in Persia). But there are some reasonable proofs for the claim: the silken rugs have been mentioned in the Persian literature, like in Shahnameh (The Book of the Kings) of Firdowsi, that shows the Persians had acquaintance with the silken rugs from the ancient times, and, historians, too, speak about the Bahrestan rug (the Spring-Land rug) which was made for the main audience hall of the Sasanian dynastic imperial Palace at Ctesiphon, and it was woven of silk, gold, silver and rare stones.



Silk Rug from Safavid Iran



Silk Textiles from Safavid Iran



Silk Textiles from Safavid Iran



Silk Textiles from Ilkhanid Iran



*Murder of Darius and Alexander at the side of the dying king
depicted in a 15th-century manuscript*

From old eras the Persian Shahs, like the other kings of Asia, were the main purchasers of the Chinese silk. It is famous that when Alexander covered the corpse of Darius III with his cloak, the body was in a silken garment. But it was during the Han dynasty in China (206 BC – 220 AD) and Parthian dynasty in Persia (247 BC – 224 AD) that the silk trade developed well between China and Persia, and continued by the following dynasties on both sides. This profitable trade was done through the routes which in the 19th century have been named "Silk Road" by the German geographer Ferdinand von Richthofen.

Lots of other goods have been trading in these routes, but Richthofen was right; for thousands of years silk was the main merchandise and it caused lots of troubles for caravans and also lots of wars between the countries on the road.



The silk road was the longest trading way of the old world that connect China to Europe. Of course the mainland between the far east and the west was Persia, and the road brought many benefits to the Persians. Sasanian kings kept their overall control on the trade. Custom duties on silk was one of the most important incomes for them.

But it was not just money that made silk trading important for Sasanians. There was long struggles between Persia and Byzantium, and for the Romans silk was like a strong currency. So by increasing the silk value, Sasanians could succeed to empty the Roman treasuries of gold and silver. That made Byzantium's army weak.



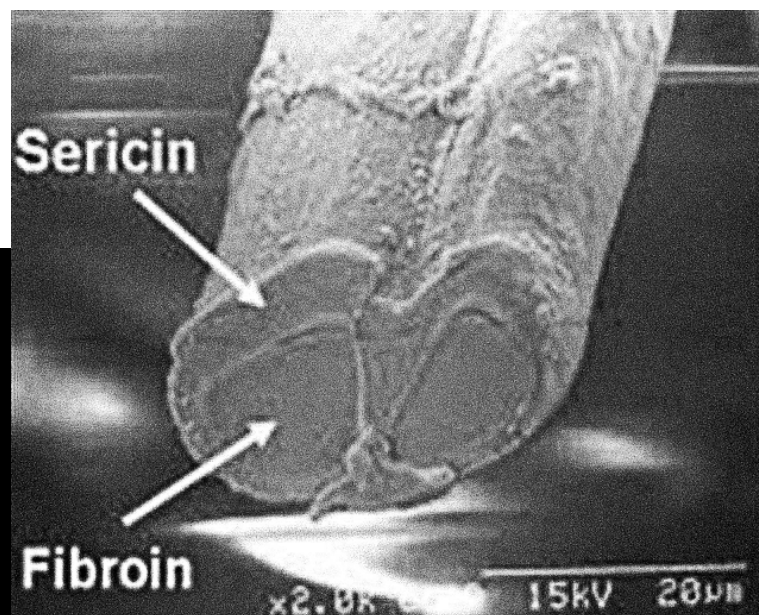


Rock-face relief at Naqsh-e Rostam of Shapur, the Sasanian king (on horseback) with Philip the Arab and Valerian, the emperor of Byzantium



Well, let's put the fairy tales and history aside, and take a close look at the silk itself.

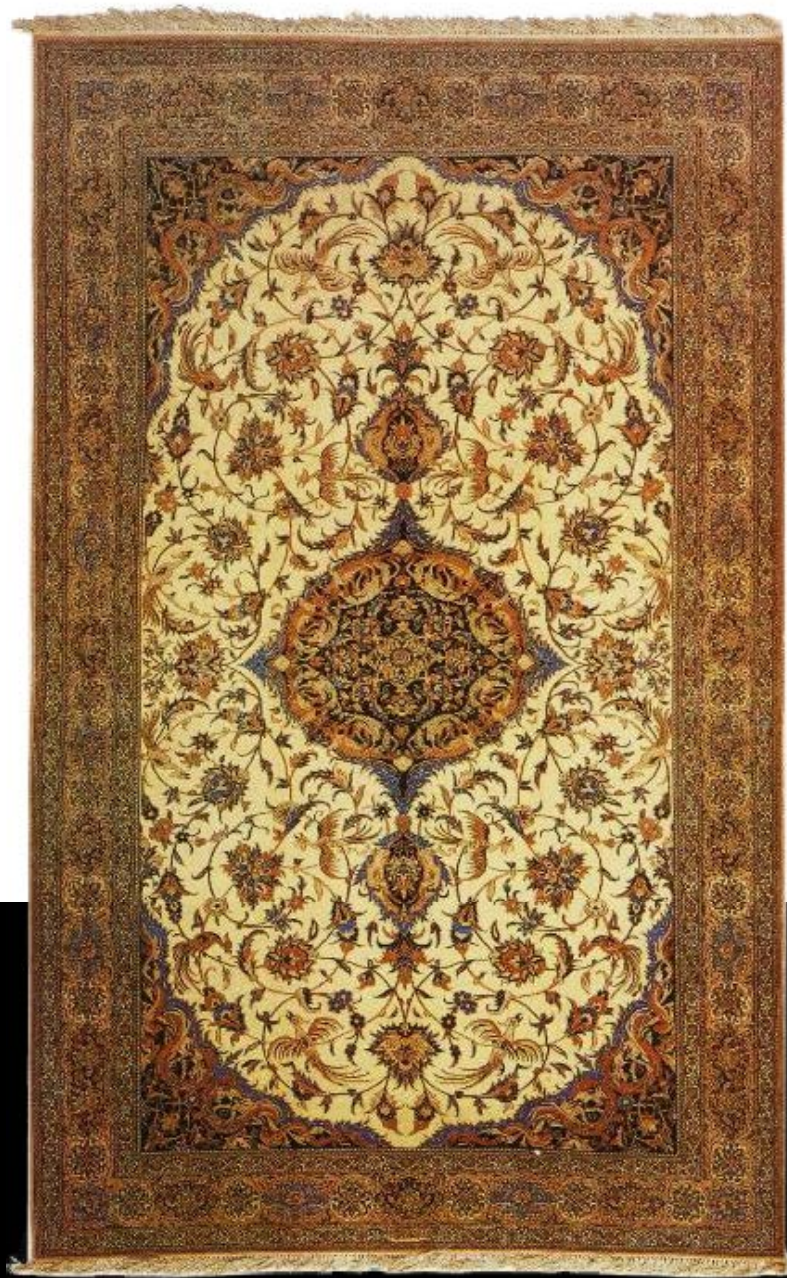
Silk is a protein fiber, that its surface has a triangular structure. This structure refracts the light and makes the silken cloth shimmering. Silk fiber is resistant, though it is also tender. Each silk fiber can reach over 1000 meters in length. The raw silk fiber actually consists of two filaments called fibroin bound by a soluble silk gum called sericin. Boiling the cocoons makes the sericin separated. Silk is conductive, and unlike wool, doesn't keep the air. So it matches itself with the ambient temperature.



Cross-sectional view of silk fibre.

Silk as a material in the Iranian rugs

In the past, silk had been used in warps and naps of the rugs. Nowadays In the central parts of Iran, especially in Kashan, Nain and Qom the full-silken rugs are woven. There are some exquisite rugs which have silken knobby patterns, namely, the patterns in these kind are woven with silken naps. Most of The silken knobby rugs are made in Kashan.



A Nain Rug, Silk & Wool & Cotton



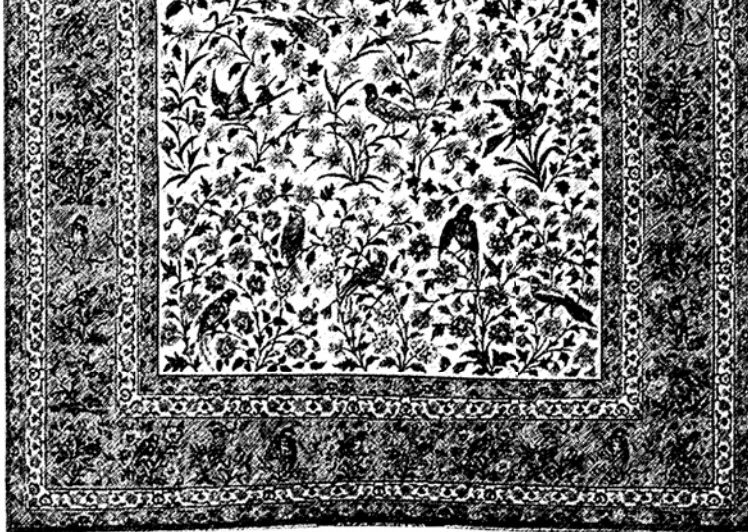
A Qum Rug, Silk



In rug-weaving, the silk varies in fineness. There are three degrees of fineness: the first one, called "Daneh" is the finest and used as nap; the second one, called "Hashti" is used as warp in elegant rugs; the third one, called "Poodi", which is the roughest, and is used as weft. There is also a type of silken threads, named "Golabetun", which used in luxurious rugs. Golabetun is the combination of silk and gold or silver threads. Nowadays golabetun-weaving happens very rarely, but it is still common in kilim-weaving in the city of Khoy in the West Azerbaijan province.



An Isfahan Rug, Silk & Wool



Silk deterioration

Chemical factors

The alkalis, which are used in dyeing, could dissolve the silk; the strong ones quickly, and the weak ones slowly. The very watery alkalis make the silk surface rough, opaque and bulged.

Over time

Silk could be oxidated over time, especially in a humid environment.

The sun's rays

In a dry climate, the rays may cause opacity and decay to the fibers, and in humid climates the sunlight speeds up the oxidation

Heat

Silk could withstand heat up to 140 degrees Celsius. In 150 degrees Celsius, it discolors to brown and after that it will be burned and totally perished.





Cotton





Cotton lint is cultivated in most parts of Iran and is one of the most important raw material of rugs. Production of white cotton string is more regular for the business purposes and because of its non-elasticity ability it can maintain its shape better and therefore it can be used as warp for delicate rugs and sometimes is used in Lur, Bakhtiari and Turkmen's kilims.

Till the 1950's handmade cotton strings have been used for low-priced rugs. These kind of strings were sold as skeins and usually wavers wind and warp them up like yarn's balls.

The plant is a shrub with thin branch and broad leaf. Cultivation of this plant has a long history and cotton even have been mentioned in religious plasms of 1500 B.C. but the origin of this plant is not exactly found and based on the evidences cotton supposed to be an international plant.

Boll or Pot are the fruit of cotton. Boll contains cotton yarns and seeds. Separation of cotton yarns from seeds take place in cotton-cleansing factories which are mostly located in Gorgan and Gonbad-e-Kawus region in north-east of Iran.





Linter which is an inferior quality cotton will be separated from the seeds after the primary cotton yarns.

Cotton yarns have many uses, for instance they are used in spinning factories for production of strings and then they may be used for production of textiles, rugs and etc.

Cotton which is cultivated in most parts of Iran, especially in Gorgan, Gonbad-e-Kawus, Dasht-e Turkmen, Isfahan, Yazd and Khorasan is a very precious commodity with high economic significance which named as White Gold.

This commodity is one of the Iran's main exports and after wheat and barley has the third place in vastness of cultivation field in Iran. Cotton has many types and its variety depends on its environment and climate of growing field.

Cotton's yarns seem curly under the magnifier. Cotton's fibers are almost pure cellulose, they occur in white, yellow, brown and grey colors and their length are variable.

Cotton yarns can be bleached to white by use of chemical materials. Cotton is main material of warp yarn which is used in rug waving.

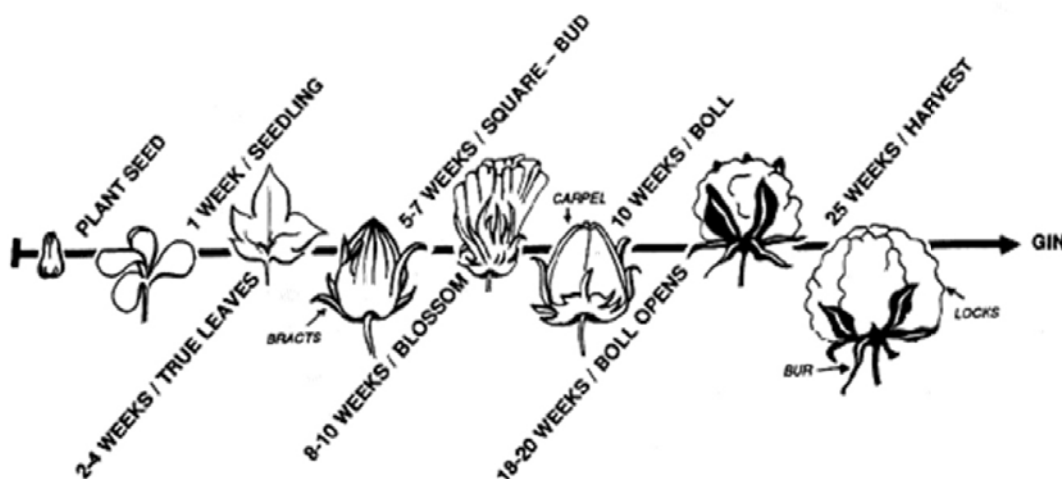
These type of yarns are used in rug-waving based on their thickness and strength, and the plan of the rugs.

Types of Cotton

Cotton of Iran has various types which each of them has special physical and natural characteristics.

Generally Iran's high quality cotton should have below characteristics:

1. Its yarns must be long. (with average 20 to 40 mm)
2. Yarn's diameter should be between 7 to 12
3. Dead and unripe yarns be as less as possible.



Seeds of Cotton

Cotton seeds are conceived in pollination process and shapes more than %60 of cotton pot.

Each year around %5 of cotton seeds are kept for the cultivation of next year. And other %95 are used for oil production. Waste of cotton seeds which remain after oil extraction process are named as Press-Cake or Oil-Cake which is a good foodstuff for cows and sheep and other grass-fed animals.



In addition, these Press Cake even can be used after their possible spoilage as fertilizer for agricultural purposes.

A ton of cotton seeds are usually consist of below materials:

1. %70 cotton linters
2. 145 kg edible oil
3. 20 kg soap oil
4. 420 kg press cake
5. 270 kg cotton seed chaff
6. 75 kg water, humidity and waste materials.

Clearly all these products excluding the sixth one have special economic and industrial value.

Cotton yarns

These days, around %70 of warp and %65 of wefts strings are cotton and this is for the tensile strength of cotton yarns.

On the other hand, less fray resistance of cotton yarns and their dirt extraction are the reasons that they are not used as main material of rug production.



The quality of cotton yarns is estimated based on their length, strength, percentage of short yarns, delicacy and whiteness. Effective length of cotton yarn in Iran is between 18 to 32 mm, their delicacy is around 3.4 to 3.8 microgram per inch, and their strength is around 20 to 27 grams per tex, with %13 to %15 of impurity. Although these characteristics do not suffice to be used for high level quality of cotton products, but they are quite suitable for production of warp and weft strings and for production of handmade rugs. Chemical materials, heat, sunlight and time which categorized as environmental factors, also have significant effects on the quality of cotton made products. These environmental factors are categorized in next pages:



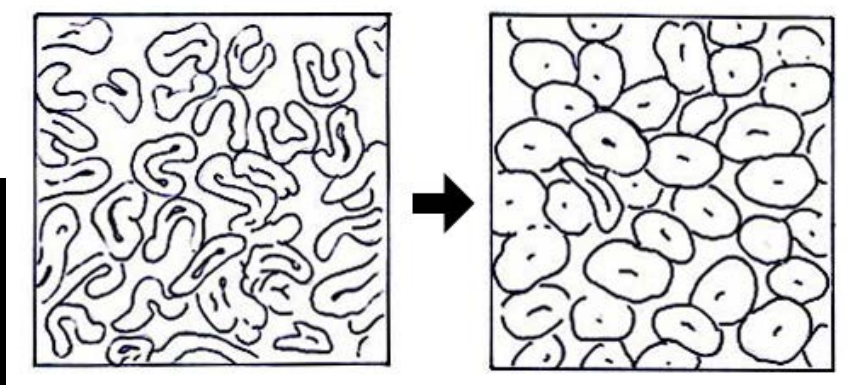
Effects of chemical materials on cotton yarns:

In ordinary usages, cotton yarn shows a good resistance quality. But warm and thin, and cold and thick acids have devastating effect on them and cause the decomposition of cotton yarns. While cotton shows more resistance against thin and cold acid in short period of time.

It is also mentionable that cotton yarns absorb acid gases as NO_2 , SO_3 and SO_2 . Thin acids which merged from combination of these gases and air humidity would be absorbed in cotton yarns and gradually cause the deformation of some characteristics. At first cotton's color may become yellower, then cotton loses its flexibility and looks like an old paper. Worse than that cotton may lose its mechanical characteristics. These types of changes are more visible especially in warps' strings which left for a long time suspended on waving frame or "Daar".

Soft acid does not harm cotton products. But continuous usage of oxidants as Hydrogen Peroxide and Sodium Hypochlorite damage the cotton strength. This is mentionable that alkali also has some effects on cotton. For the first time English scientist John Mercer discovers these effects. And for this reason the reaction of cotton with alkali is named after him as Mercerisation.

Mercerisation has 9 effects on cotton as well as increase of strength and shininess and increase of responsiveness of cotton yarns.

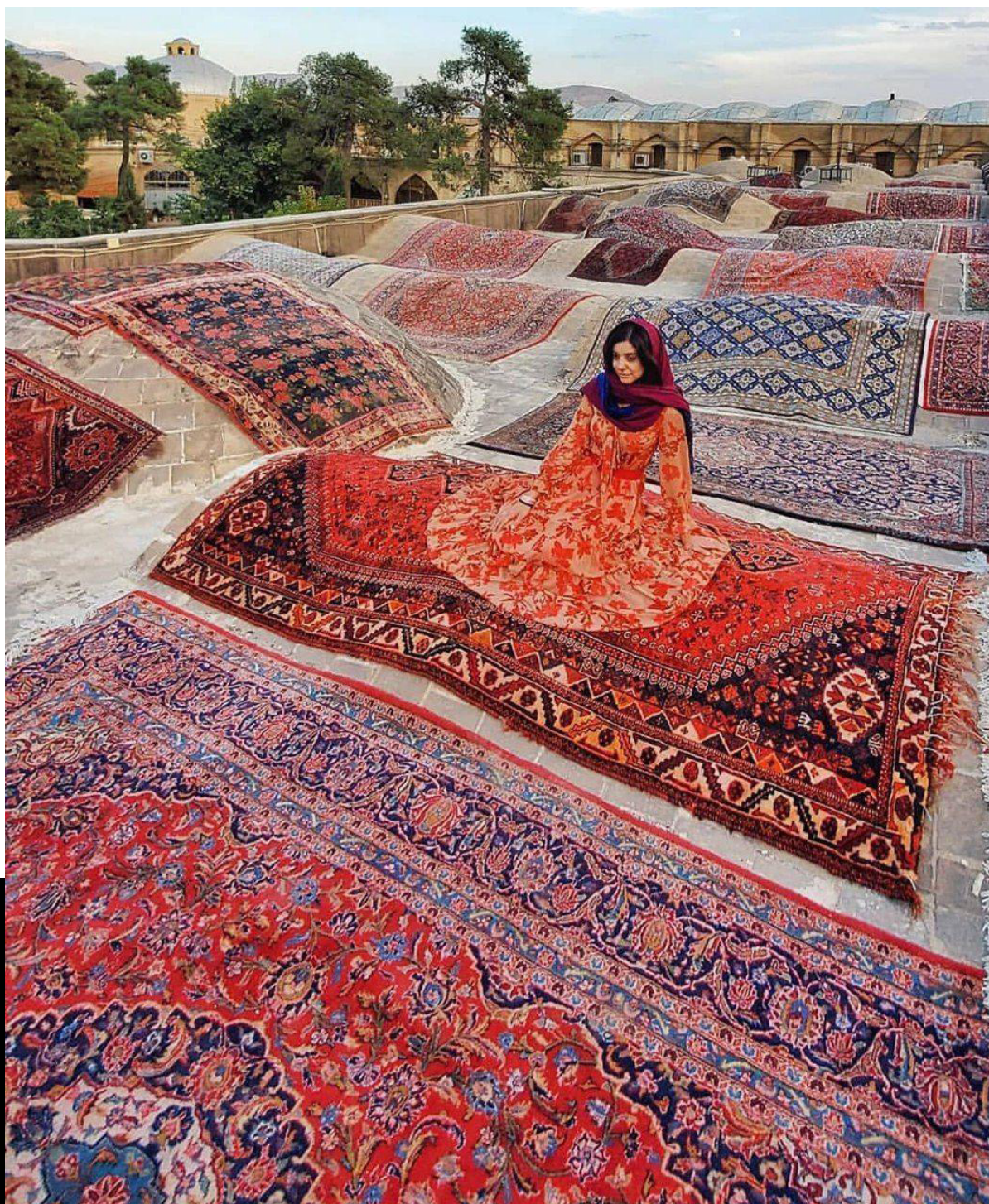


Before Mercerisation

After Mercerisation

Effects of heat on cotton yarns

Cotton yarn has high resistance against heat. When cotton for several hours be kept in 120 c heat it starts to become yellow. In 120 c it becomes considerably oxidized and falls apart, and at last at 140 c in just a few moments becomes severely damaged, and burns with similar smell of paper burning.





Effects of sunlight on cotton yarns

If cotton remains in sunlight for a long time it becomes yellow and its strength decreases. Most of these changes caused by UV or ultra violet radiation of sunlight. This harmful effect increases in warm and humid climate. Usage of some colors may increase cotton's resistance against the sunlight.

Effects of Time on cotton yarns

Cotton may has good resistance against effects of time passing. But the important point is if cotton is kept in proper environment or has a good warehousing or not. Cotton has a good resistance against micro-organisms, but high humidity, high temperature and improper ventilation may cause spoilage, decay, color change and decrease of strength in cotton yarns.

Role of cotton in rugs production in Iran

Averagely %30 of Iran rugs' weight is cotton. Cotton strings are used in many parts of an Iranian rug:

A) In warp: most of the Iranian rugs, as well as kilims, Zilu etc. are made by cotton strings. Although wool string has more strength and other considerable advantages, but considering all characteristics of cotton yarns, weavers usually prefer to use cotton strings for warps. And even many of rugs which are made by silk or wool lint have cotton string as their warps.

B) In weft: weft strings of many rugs may be cotton as well. These types of strings are chosen based on rug's acquired characteristics as thickness of strings etc.

C) In lint: but cotton should not be used as lint in rugs due to their lack of strength and durability next to open air. Since Cotton does not have enough fat, flexibility and humidity to maintain its qualities as lint -in compare of silk and wool- the usage of cotton strings as main material of rugs can even harm the worldwide reputation of Iranian rugs.





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