

MICHAEL SUCCOW FOUNDATION
for the Protection of Nature

Feasibility study for the establishment of pistachio growing centers in Tashkent province in Ugam Chatkal National Park / Uzbekistan



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The content of this publication lies within the responsibility of the authors.



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in the buffer zone of Ugam-Chatkal National Park / Uzbekistan

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Chimgan Mountains – triangle of fruit tree plantations, natural tree sites and highly degraded pasture / wheat growing sites

Abbreviations and explanation of terms

AHK	Delegation of German economy in Central Asia
BMUB	Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
Hokim	Head of executive authority at city, district or province level
Hokimiyat	Executive authority at city, district or province level
GEF	Global Environment Facility
GIZ	Gesellschaft für Internationale Zusammenarbeit
MAWR	Ministry of Agriculture and Water Resources
MDF	Main Department of Forestry under the MAWR
SGP	Small Grants Programme
SFM	Sustainable Forest Management
SLM	Sustainable Land Management
UNDP	United Nations Development Programme
UZS	Uzbekistan Soum (national currency). Exchange rate as due July 2014 - 1:3149

CONTENT

1. INTRODUCTION	1
1.1. Ecologic and climatic resilient land management shift to pistachio cultivation	1
1.2. Experiences in Uzbekistan with the establishment of pistachio plantations	3
2. LEGAL FRAMEWORK FOR THE PISTACHIO GROWING CENTER APPROACH	6
3. STAKEHOLDERS	6
3.1. Methods of farmers' selection	6
3.2. A short description of the studied farms	7
3.3. Description of collaboration with selected farmers	9
4. PROJECT IMPLEMENTATION PLAN	10
4.1. Site No. 5 Komiljon Sidikov, Bostanlyk District, near village of Saylik	11
4.1.1. Description of plots in site No. 5	11
4.1.2. Drafted implementation costs for site No. 5	13
4.2. Site No. 4 Chatkal section of Chatkal mountain land management research station	15
4.2.1. Description of plots in site No. 4	15
4.2.2. Drafted implementation costs for site No. 4	17
5. BUSINESS PLAN OR COST-BENEFIT ANALYSIS	21
6. SUSTAINABILITY OF THE PROJECT	25
6.1. Financial sustainability	25
6.2. Ecologic sustainability	26
6.3. Aspects of carbon sequestration	26
6.4. Aspects in terms of labour benefits	27
6.5. Aspects on gender equity	27
6.6. Legal aspects	27
7. ANNEXES	1
7.1. Annex I	1
7.2. Annex II	1

TABLES

Table 1 <i>Pistacia vera</i> distribution and age classes in hectare in Uzbekistan (dated 1.1.2013)	2
Table 2 Leading countries of the world in pistachio production 2008 (FAO, 2008)	3
Table 3 Prices of several fruits in 2014	21

MAPS

Map 1 Potential distribution of <i>Pistacia vera</i> in western Tien Shan and Hissar mountain ranges.....	1
Map 2 Boundary of National Park Ugam-Chatkal in the region of investigation of the feasibility study	5
Map 3 Location of the farmers plots as indicated in the text identified for further cooperation.....	9
Map 4 Location of the plots belonging to farmer Komiljon Sidikov (farmer No. 5)	12
Map 5 Location of the plots in the Chatkal plot of the Chatkal mountain land management research station (farmer No.4).....	16

CHARTS

Chart 1 Expenses, revenue and cost-benefit balance of pistachio plantations at plots of 6m x 6m.....	22
Chart 2 Expenses, revenue and cost-benefit balance of pistachio plantations at plots of 10m x 10m.....	23
Chart 3 Expenses, revenue and cost-benefit balance of pistachio plantations and intercrops at plots of 6m x 6m	24
Chart 4 Expenses, revenue and cost-benefit balance of pistachio plantations and intercrops at plots of 10m x 10m	24

1. INTRODUCTION

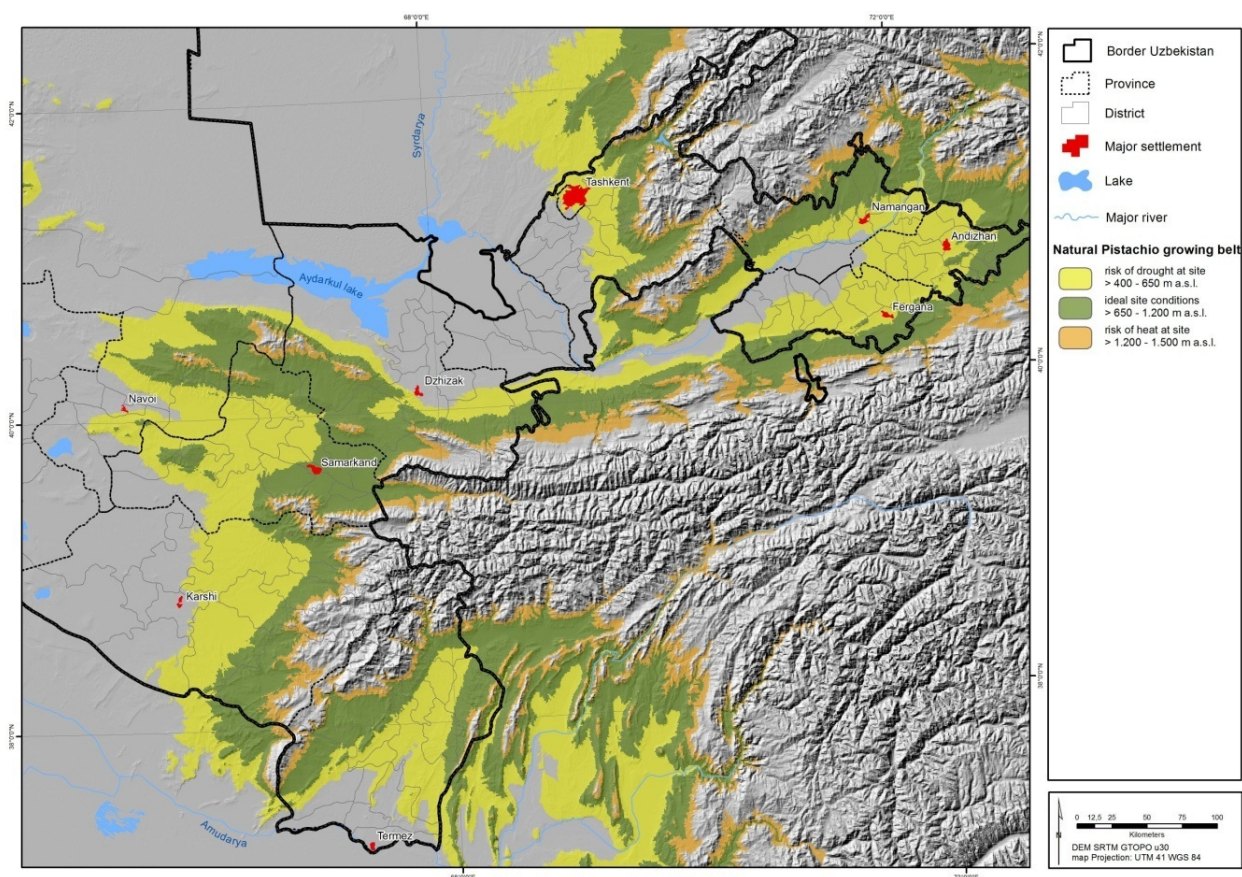
1.1. Ecologic and climatic resilient land management shift to pistachio cultivation

Pistachio is a small tree that grows up to 6-8 m with wide and branchy friable crown, 8-12 meters in diameter and has a form of a big shrub.

The natural habitat of pistachio *Pistacia vera* L. covers vast territories of Central Asia and Middle East occupying certain niches with corresponding soil and climate conditions. Natural pistachio sites are situated on the foothills and hills at elevations of 400 to 1,500 m above sea-level. The climatic condition of these areas is continental, arid.

Soil conditions of the pistachio belt in Central Asia are mainly gray desert soils, so called *sierozems*, partly on chestnut and carbonate-brown grounds with moderate humus concentration of 1 to 4 %.

Natural pistachios are an integral part of a wood and shrub community, so called *xerophilous hard-leaved light forest*. It consists also of other dominating species such as Bukhara almond (*Amygdalus bucharica*), Pontic and Turkestan hawthorn (*Crataegus pontica*, *C.turkestanica*), Griffitt Cercidiphyllum (*Cercis griffithii*), Regel pears (*Pyrus regelii*), downy maple (*Acer pubescens*). Below 500 m a.s.l. pistachio trees begin to get shifted to semi-steppes and at elevations higher than 1,500 m a.s.l. shift for juniper stands of Zeravshan juniper (*Juniperus zeravschanica*). Distribution of pistachio is usually limited according to hypsometric borders. At elevations of 500-700 m a.s.l. there is too low precipitation, whereas in areas of elevations higher than 1,500 m a.s.l. the annual average temperature is too low (compare map 1).



Map 1 Potential distribution of *Pistacia vera* in western Tien Shan and Hissar mountain ranges

There is evidence that even until recent times vast areas were occupied by pistachio forests. Many names of locations, like *Pistali Say*, or miraculously preserved centuries-old pistachio trees in cemeteries, are remaining witnesses. These lands remain natural habitat for *Pistacia vera*.

Nowadays pistachios` natural habitat is fragmented to a large extent. The diminishing areas of natural pistachios and their ecologic condition are subject of concern. According to official information, in 1934 pistachios occupied more than 64,000 ha on Babatag mountain range (main pistachio area in Uzbekistan). The current state is that they remained at some higher elevations and occupying less than 23,000 ha at the whole territory of Uzbekistan.

	Total forest-cover	age groups					
		Sapling		Middleage	Ripening	Ripe	Overripe
		I	II				
<i>Pistacia vera</i>	22,908	548	1,000	0	4,371	12,892	4,097

Table 1 *Pistacia vera* distribution and age classes in hectare in Uzbekistan (dated 1.1.2013)

It is apparent from table 1 that age representation of saplings and middle-age sites is dramatically disturbed in favor of ripe and overripe ones. Besides the overall distribution, the unbalanced age classes serve as another alarming indicator of pistachio forest degradation.

The main reason for these indicators is a continuously increasing anthropogenic impact. Pistachio light forests were logged and replaced by pastures or dry farming agriculture. Livestock breeding and crop cultivation was for some time the most suitable way for people to survive under these harsh climatic conditions and the economic breakdown. The population in Uzbekistan in its present boundaries was 4.33 million people in the end of 1913. In 2012 population took the breakthrough of 30 million people. Obviously the 7 times increase of population within a century, from which the majority is living in the countryside, has increased pressure to the forests tremendously.

At present time arable lands are used mainly for dry-land crops of grains (wheat) and oil-yielding crops (safflower) cultures. Grain crops` harvest on these territories primarily depends on humidity level in a certain year but it seldom reaches 0.8-1 t/ha and such a harvest takes place once in 3-5 years. In other years harvests cover for expenses of seed grain only, or there is not any harvest at all.

Livestock breeding sometimes remains the main source of income for the increasing local population. It is a rare survival strategy in a country with low trust in institutions, increasing inflation, poor governance and uncertain future perspectives for a young generation. Overgrazing and missing sustainable pasture management practices are the regular situation, not the exception. Vegetation cover is gone, including below ground biomass, at large areas of the mountain foothills. It initiates serious soil erosion processes. Soils suffer from induration, surface layer and soil structure destruction, wind erosion, surface flow increase and interflow decrease. Mudslides, reduction of river discharge, soil fertility loss are the serious consequence.

More and more evident climate change indicators in Uzbekistan can only aggravate the situation: as climatologists forecast, air temperature at the country`s territory is going to increase, whereas the amount of precipitation changes insignificantly, so humidity decreases. Consequently the probability of acceptable grain crop harvest on dry-farming land and feeding biomass on pastures is decreasing and will decrease even more in the future as a result of territory`s increasing aridization. In other words: The risk not to maintain current livestock numbers and gain agriculture yields on dry lands will increase with the time. Therefore there is actually no other option but to consider sustainable land and forest management approaches (SLM and SFM), the sooner the wiser.

However there are not many alternatives for such severe conditions of growing areas and they should correspond to at least, two criteria. First, alternatives need to be adapted to the natural conditions of the specific areas, in particular under climate change. Second, they must deploy enough economic benefit for local population, at least not less than existing land use.

As it was described above, pistachio is the native plant for the foothills and hills of Central Asia and Uzbekistan in particular. Pistachio is cultivated in many countries of the world as profitable resource. For example, in 2008 Iran gathered more than 192,000 t pistachio and earned 635 million USD with it at the international market. Pistachio has its natural distribution in Iran as well. But pistachio is also cultivated in USA (2008, 126.000 t were harvested and sold for 417 million USD). To compare (table 2), Uzbekistan harvested in 2008, 200 t of pistachios (sold for 700.000 USD).

No	Origin	Income in thousand US dollar	Harvest in t
1	Iran	635,477	192,269
2	USA	416,779	126,100
3	Turkey	396,991	120,113
4	Syria	173,850	52,600
5	China	132,206	40,000
6	Greece	26,771	8,100
7	Afghanistan	8,262	2,500
8	Tunisia	8,262	2,500
9	Italy	6,610	2,000
10	Kyrgyzstan	2,644	800
11	Pakistan	2,544	773
12	Madagascar	760	230
13	Uzbekistan	661	200

Table 2 leading countries of the world in pistachio production 2008 (FAO, 2008)

Though both in Iran and USA pistachio is cultivated on irrigated lands in large territories of industrial plantations with the use of high productive varieties with big and open nuts.

However all the necessary conditions for pistachio production exist in Uzbekistan, and it may be done on dry-farming lands without extra watering under natural conditions:

- as it was mentioned the foothills of Central Asia, including Uzbekistan are natural habitat of *Pistacia vera*. The center of pistachio variety diversity is situated there. It allows local scientists to select different varieties.
- about 7.8 million hectares are in general suitable and out of them about 3 million hectares of optimal suitability in terms of the altitudinal limits in Uzbekistan as drafted in map 1. According to the State Committee on Land Resources a minimum of 700,000 hectares of dry-farming land exists in Uzbekistan that are suitable for pistachio growing because of its optimal land use rights (which will get explained below);
- all the techniques and know-how for the establishment of afforestation sites, their inoculation and maintenance are available. Moreover techniques for the optimization of already existing pistachio sites are available;
- there is a collection of pistachio's varieties (about 20) with big and open nuts on the pilot site Gallyaaraal of Jizzak forestry enterprise (Dzhizzak Province). GEF Small Grants Program in Uzbekistan (SGP), established a mother plantation (explanation below) there that holds 12 varieties that are the source for tree stocks inoculation for higher ecologic variability and resistance to diseases and other risks;
- economic analysis shows, as will be outlined in chapter 5 that pistachio cultivation is more profitable than dryland-farming or livestock breeding;
- the establishment of pistachio growing sites contributes to a much better land management and re-establishment of its natural ecosystem services. Thus it is an efficient tool for mitigation and adaptation to climate change and to combat desertification.

1.2. Experiences in Uzbekistan with the establishment of pistachio plantations

In times of Soviet Union there were several pistachio plantations established in Uzbekistan, most to function as wind belt and erosion prevention on lands of the State Forest Fund and along the roads in mountain foothills. Taking into account planting density and the fact of wild origin of planting they were never considered as a source of pistachio nut production, with one exception. At the riverside of Saraykurgan water reservoir in Samarkand province several thousand hectares of natural pistachio variety exist and were harvested. But usually farmers thinned the natural pistachio sites and replaced them by productive pistachio varieties.

Beginning in 2009 the GEF SGP started the implementation of pistachio projects on lands leased by farmers within Jizzak, Kashkadarya, Surkhandarya and Andijan provinces. Some of the participants at the project sites have shown

serious interest on pistachio cultivation. There were actually not enough resources by the Scientific-production center of decorative gardening and forestry to cover the whole need for advisory service and planting material.

The GEF SGP together with national experts then elaborated a strategy to provide consulting services, planting and inoculation material for farmers. The core idea of that strategy was the establishment of so called *points of growth*, where farmers could receive advice, planting and inoculation material. Dry-farming is distributed in the eastern part of the country (see map 1). The provinces are actually too remote from each other thus it became necessary to create at least one *point of growth* in each of the provinces. In line with the strategy each *point of growth* is run by a farmer at its land under tenure. The farmer must be ready to take over the economic responsibility over the *point of growth* and to provide consultancy / advisory service for interested farmers in the region or even the province. A *point of growth* has to provide:

- Collection of pistachio varieties. A variety of pistachios aims to hold and protect the existing selected gene pool at different places and to be able to provide planting material on certain demands. It reduces the risk of loss from fire, minimizes the risk of pests and diseases within a population. The farmer moreover is able to expand its collection by doing own selections;
- Mother plantation. Mother plantations aim to function as the source of inoculation material (cutting with buds) of a particular pistachio variety. A mother plantation has only to provide varieties which are most suitable for specific local conditions in the province;
- Pilot site of plantations. They need to provide best practice demonstration plots with different soil preparation techniques and additional plantation utilization, depending on specifics of land (dense or strip plowing, arable or bulldozer terraces, grounds, watering infrastructure, -management and -know-how), steepness and slope exposition, layout charts a.s.o.;
- Advisory center. Provision and maintenance of a building that meets minimum requirements to deliver advisory services to farmers on specific demands.

The *point of growth* thus provides opportunity to combine the theory of pistachio growing with practical demonstration and support.

At the moment such a *point of growth* as intended exists in Gallyaaral in Dzhizzak province. The training takes place outdoors since a building is not in place, yet. It holds a mother plantation of 12 varieties and one universal pollinator at an area of 10 ha. Another point of growth is being established in Andijan province. In Kashkadarya and Surkhandarya provinces, the establishment of points of growth under GEF SGP is still under development, so far.

No action took place in Tashkent province until the BMUB got engaged in funding that project which paved ground for the study. In Tashkent province there are considerable land areas available for pistachio cultivation and at the same time a very close market, the largest in the country. We will show later in that study that there are several farmers in Tashkent province who are potentially able and willing to establish *points of growth*. Some of them are situated in Ugam-Chatkal National Park or its surroundings. The national parks buffer zone where land use opportunity exists has a size of 68,866 ha (see map 2). The expansion of pistachio growing facilities to a pilot national park in Uzbekistan can, if successfully implemented, function as a model for ecosystem based adaptation approaches in certain types of protected areas in comparable ecosystems of Central Asia. Like only very few other land use change approaches pistachio growing can show effect to mitigate climate change, even more provide measures for adaptation to climate change, combat desertification and revive habitat for biodiversity conservation. Up-scaling opportunities exist for Zaamin National Park in Uzbekistan. It can also function as a model for SLM and SFM for management planning of new national parks (as there started considerations in Baysun district (Surkhandarya province)) and in the buffer zone around Surkhan Zapovednik or Biosphere Reserves like in Nuratau mountains (where planning for Biosphere Reserve establishment took place many years ago and where ICARDA is currently implementing community based pistachio plantings, but another approach as proposed in this project). The Master Plan for a Protected Area System of Uzbekistan is now under discussion with relevant governmental agencies and the current approach can be used later for buffer zones of new or expanded protected areas in the rain-fed mountain belt zone of Uzbekistan.

Near Ugam-Chatkal National Park there are two possible land categories in question for being suitable for project implementation; namely those areas under the administration of district hokimiyats and areas under State Forest

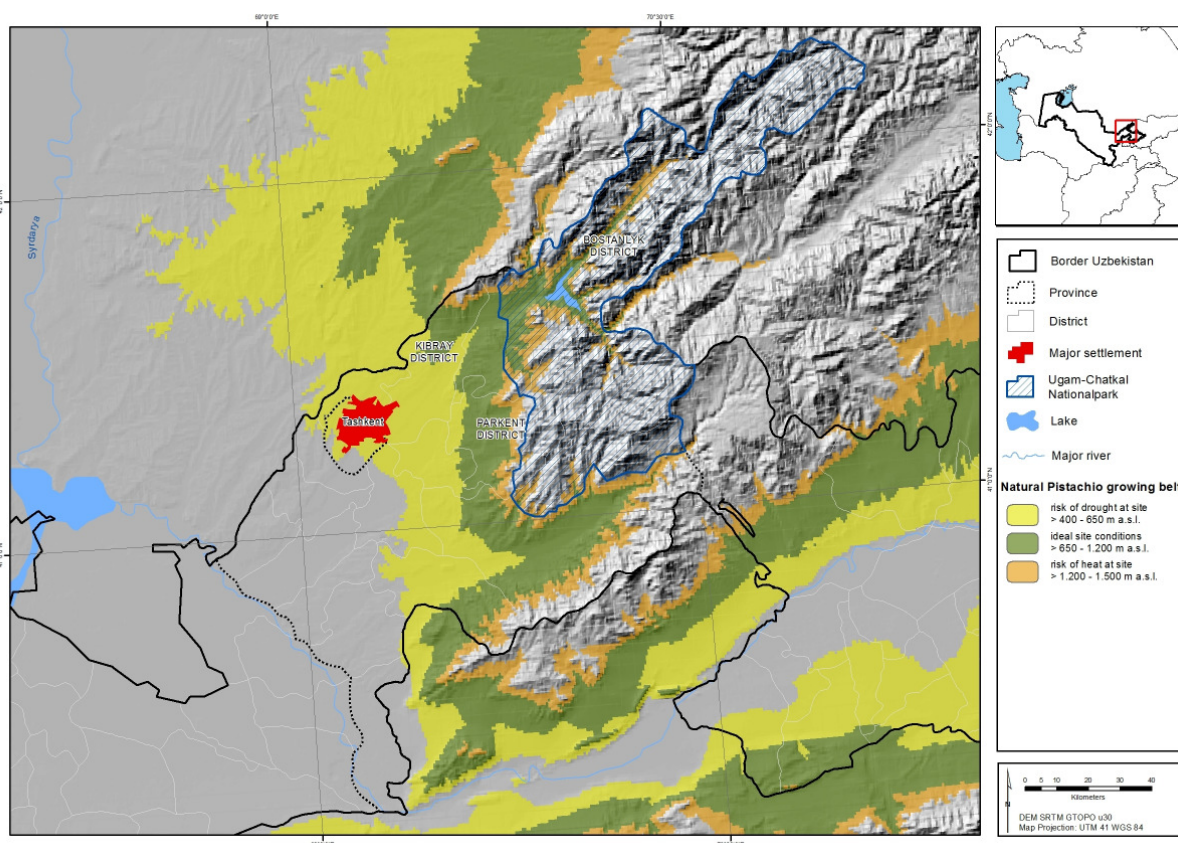
Fund. For both the kinds of economic activity differ but even more important the land lease terms vary considerably. Both options will get addressed individually below.

For several reasons it is preferred to establish *points of growth* at land under district hokimiyat ownership. At the same time we propose to establish several *points of growth* at sites with different specifics in terms of soil condition, territory slope and aspect for a better replication of land use change approaches at land with different site demands as for instant in Parkent and Bostanlyk districts. Rain-fed land under district hokimiyat ownership provides much more flexibility in agriculture compared to land under State Forestry Fund, for instance. Joint financing of pistachio *points of growth* with different natural conditions for farmers is considered (with an approximate in-kind co-funding of 50 % of total budget). Usually farmers have farm machinery or at least budget to rent it. Since the farmer will become the major beneficial of a successful project implementation real ownership is given and project sustainability is likely.

For land under State Forest Fund, the growing conditions of pistachio plantations are considerably different. Land under State Forest Fund is limited to operational expenses of governmental financing. An individual interest in successful project implementation is not given since benefits do not receive the person who works at the land. Employees at land under State Forestry Fund need to receive know-how by capacity building measures as well as seedling materials for graded pistachio plantations. Therefore it is still suggested to keep land under State Forest Fund in the focus for pistachio growing, especially since much of its land is adjacent or within Protected Areas as some of the Ugam-Chatkal National Park.

As will be described in chapter 4 in detail some project activities will be implemented at land under State Forest Fund in Parkent district of Chatkal Mountain land management research station of the Scientific-production center of decorative gardening and forestry. Some of their employees are member of the research team on pistachio growing of the center. The advantage of involving that entity is that there is an experienced team able to supervise variations, queen cell a.s.o.. Thus scientific research will be an additional benefit of project implementation.

So *points of growth* promote ecosystem-based adaptation activities almost without governmental financial assistance, by a market-based approach.



Map 2 Boundary of National Park Ugam-Chatkal in the region of investigation of the feasibility study

2. LEGAL FRAMEWORK FOR THE PISTACHIO GROWING CENTER APPROACH

The law on land of the Republic of Uzbekistan considers the following land administration categories:

1. Agricultural land
2. Settlements
3. Land of industry, transportation, communication, military defense and other purposes
4. Nature conservation land and recreational land
5. Forest State Fund
6. Historical and cultural heritage
7. Water State Fund
8. State Reserve Land (Uzgeozemkadastr)

Agricultural land, as the title implies, is used for farming economy. It is divided into irrigated, dry farming land, arable land as well as hay mowing, pasture, perennial, fruit and vineyard land. The major harvests in Uzbekistan are produced by farm enterprises on agricultural land.

The legal basis for the use of land by citizens and companies in Uzbekistan is the leasehold. The leasehold is regulated by a fixed date for leasing term and use of a parcel on a contractual basis. The parcel being subject of a leasehold contract is granted to citizens or companies by the mayor (hokim) of a district or settlement. The leaseholder has the preferential right to renew the contract of the leasehold after the expiration date where other conditions remain equal. The conditions and terms of the leasehold are defined by the contract. Land dedicated as agricultural land can be leased for forty nine years and not less than for thirty years.

Four of five of the farms chosen for a potential project implementation phase (phase II) are located at agricultural land, under agreement of the relevant hokimiyat. All of them are regularly certified. On demand the certificates can get submitted. At the same time the right to do gardening is given in the lease contract. The fifth plot which is the Chatkal Mountain land management research station is located on lands of State Forest Fund. This kind of land gives leasehold of up to ten years.

Moreover in the last years governmental bodies such as hokimiyats offer to farmers to make gardens on their dry farming land. In turn they offer to abrogate the obligatory state quota for wheat and safflower production. This is a major asset and precondition to shift from state quota production to other land use opportunities which can be more profitable and better adapted to ecosystems at the same time.

3. STAKEHOLDERS

3.1. *Methods of farmers' selection*

As a first stage, the selection of farmers for a partnership in a potential future pistachio project began with an introduction seminar for the farmers of Tashkent province. The seminar was held on 24th of February 2014, at the Farmers' Council of the Republic of Uzbekistan in Tashkent. The seminar was attended by eighty farmers and representatives of mass media.

A questionnaire in Russian and Uzbek (Annex I) was prepared for the seminar in order to estimate the farmer's interest, motivation and actual readiness, the location and area of his lands, the legal conditions for using the land and creating pistachio plantations in the territory, available equipment and other facts. At the end of the introduction seminar the questionnaires were collected and used to prioritize farmers for future partnership in a joint project aimed at creating a *point of growth* for the development of cultivation of pistachio in Tashkent Province.

In a second stage the filled questionnaires were analyzed. In total 30 questionnaires were submitted.

Criteria used to divide farmers into certain partnership categories have been the following:

- degree of readiness for implementation of the project, that is willingness to be engaged in cultivation of *Pistacia vera* and pistachio varieties;
- long-term renting agreement of land in the foothill area;
- legal agreement to use the land for pistachio plantations;
- proximity to Ugam-Chatkal National Park;
- existence of a fence;
- proximity to transportation infrastructure (as the site must be easy accessible for interested farmers);
- investment ability;
- ability to co-finance at a minimum ratio of 50 %,
- possession of farming equipment;
- soft-skills (sociability) and willingness to become a trainer.

Out of the 30 submitted questionnaires ten were fitting best the criteria given before. Those ten were chosen for further interviews and investigation of their farms. Among the chosen farmers we have selected four being originated in Parkent district, five in Bostanlyk district and one in Kibray district, all of them within Tashkent Province (compare map 2). As Kibray district is situated in an irrigated area, far from the Ugam-Chatkal National Park, it was decided to exclude this farmer from the list.

3.2. A short description of the studied farms

On March, 27 2014 an evaluation team composed of representatives of SGP GEF, the Michael Succow Foundation and the Scientific-production center of decorative gardening and forestry went to Parkent district. The properties of land of three farmers, who intended interest in project participation, plus a representative of the Chatkal Mountain land management research station under Scientific-production center of decorative gardening and forestry have been investigated. Individual interviews were conducted. A short description of the results is given below:

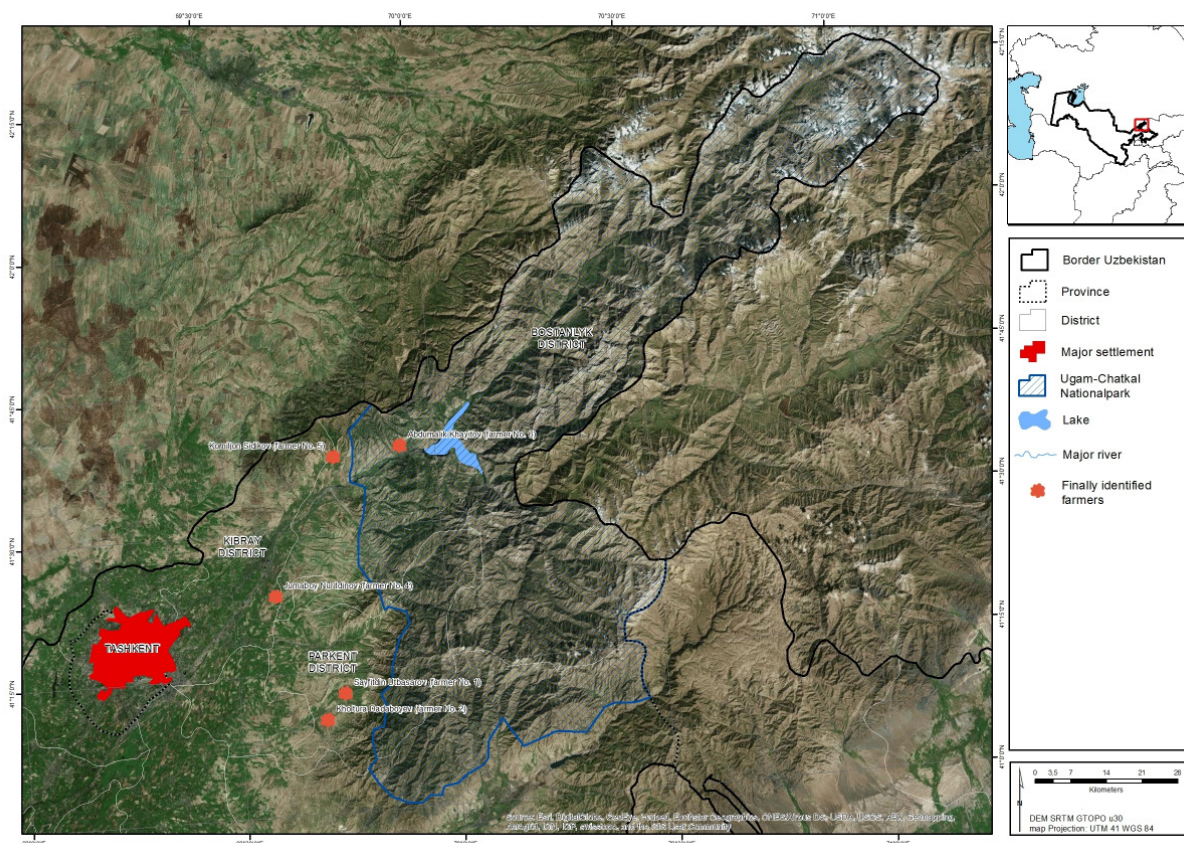
1. Sayfitdin Utbasarov, runs a farm on agricultural land leased on a long-term basis of 49 years. The territory is situated near the village of Shampan, 21.5 ha, 800 m a.s.l.. Currently, a share of 5 ha of the land is used for growing wheat and other crops. However, within the next two years farmers are entitled to shift agricultural crops and to begin with gardening agriculture. In this certain case, it is planned to grow cereals, eventually. The farmer has already established a garden on a share of his territory. He owes a tractor and other relevant farming equipment. The farmer is interested to establish a pistachio garden on 4 ha of his territory. Moreover he showed interest to establish a *point of growth* to disseminate knowledge and saplings to other farmers.
2. Kholtura Dadaboyev, runs a farm on agricultural land leased on a long-term basis of 49 years. The farm is situated on hills near the village of Namdanak, behind a bridge across the Boshkzylsay, at an elevation of 820 m a.s.l., The area has 156 ha of which 72 ha are occupied by wheat and another 60 ha are fallow land). He has relevant farming equipment and is willing to assign 5 ha of his lands for pistachio plantations and is ready to disseminate knowhow as a trainer.
3. Yuldash Niyazov, runs a farm on agricultural land leased on a long-term basis of 49 years. The farm is situated near the village of Nevich. The farmer is engaged in breeding goats for milk currently.
4. Jumaboy Nuritdinov, is the director of Chatkal Mountain land management research station, which is a state organisation financed by the government and is running land under the State Forest Fund. The station possesses a site near Chatkal village, situated about 20 km from the main area of the station near Sukok village. The site is 16 ha in size, of which 7 ha are irrigated at an elevation of about 650 m a.s.l.. The site includes two areas one with 1,2 ha and another one with 2,5 ha that have been planted with pistachio trees in 2012 and 2013. There are 5 employees involved on fulltime permanent basis.

On April, 3 2014 the evaluation team went to Bostanlyk district. The properties of land of the remaining five farmers, who intended interest in project participation, have been investigated. Individual interviews were conducted. A short description of the results is given below:

5. Komiljon Sidikov, runs a farm on agricultural land leased on a long-term basis of 49 years. The farm is situated above the village of Saylyk, 975 m a.s.l. and occupies an area of 25 ha. A relevant difference of his farm to the farms of others is that he has already established non-irrigated gardens and a vineyard on most of the territory of his farm. The area between the rows of trees and bushes is planted with alfalfa, onion, potatoes, maize, pumpkins and beans. The whole farm is fenced and guarded permanently. The territory includes about 5 ha of fallow land, which the farmer wants to turn into pistachio plantations. A part of this land is covered with thin natural forest, with the hawthorn forming dominant species. Pistachio may be grown there on open pattern among the forest, thus increasing the area under crown cover. The farmer possesses farming equipment. He is willing to create the *point of growth* at his farm and to train other farmers interested in cultivating pistachio. He also plans to build a farmhouse, where he will receive other farmers and give them consultations.
6. Abdumalik Khayitov, runs a farm on agricultural land leased on a long-term basis of 49 years. The farm is situated near Khojkent within Ugam-Chatkal National Park. It consists of 11 plots and has an area of 80 ha. The farmer uses the land for crops requiring no irrigation. However, there are irrigated areas. The elevation is from 915 m to 1,100 m a.s.l.. The farmer possesses farming equipment. He is willing to assign a considerable area of his land for pistachio plantations and is going to plant 5,8 ha with pistachio trees at his own expenses.
7. Juraboy Odinayev, runs a farm on agricultural land leased on a long-term basis of 49 years. The farm adjoins the border of Yakka-tut village in Ugam-Chatkal National Park and is situated at an elevation of 1,000 m a.s.l.. The territory of his farm includes 15 ha of declining almond forests 60 years old. It also includes 1 ha of fallow land in a much degraded state requiring urgent land management shift measures to regulate erosion and ravine formation. The current condition doesn't allow pistachio plantation establishment.
8. Yodgor Mirzajanov, runs a farm on agricultural land leased on a long-term basis of 49 years. The farm is situated in the neighbourhood of Saylik village, on the debris cone of one of the river valleys, that's why the whole area is covered by alluvial pebbles. The elevation is 830 m a.s.l.. The farmer possesses farming equipment and is willing to create a pistachio plantation on a territory of 5 ha.
9. Tohirjon Rustamboyev runs a farm on agricultural land leased on a long-term basis of 49 years. The farm lands are situated 10 km from Saylik village at an elevation of 830 to 1,100 m a.s.l.. The farmer is willing to create a pistachio plantation at 10 ha of his land. He possesses farming equipment and a farmhouse at the side of a road.

Based on that field trips the team excluded from the list Juraboy Odinayev (farmer No. 7), because current conditions do not fit for pistachio growing. During the elaboration of a detailed implementation plan, the expert group visited all of the farmers. Unfortunately, farmers Yuldash Niyazov (farmer No. 3), Yodgor Mirzajanov (farmer No. 8) and Tohirjon Rustamboyev (farmer No. 9) couldn't manage to meet with the expert, which was assessed as too little interest in further cooperation. Nevertheless, we agreed to keep these farmers informed as future target groups for dissemination.

Farmers that have been remaining after personal consultations are Sayfitdin Utbasarov (farmer No. 1), Kholtura Dadaboyev (farmer No. 2), Jumaboy Nuritdinov (farmer No. 4), Komiljon Sidikov (farmer No. 5) and Abdumalik Khayitov (farmer No. 6).



Map 3 Location of the farmers plots as indicated in the text identified for further cooperation

3.3. Description of collaboration with selected farmers

The strategy to increase land under pistachio communities is planned to be implemented by the establishment of so called *points of growth* in the rain-fed foothills of Tashkent province. The term *points of growth* intends to deliver the following services and functions:

1. a collection plot;
2. a mother plantation;
3. samples of commercial plantations;
4. a training centre.

It is planned to involve all selected farmers as described in section 3.2. into a joint project of Michael Succow Foundation, GEF SGP and the scientific-production center of decorative gardening and forestry of Uzbekistan. However, the amount of implementation efforts and the degree of involvement of farmers will vary. One of the farmers will be the main partner, three others will be secondary partners. The farmer No. 4 is the only one with land under State Forest Fund and therefore considered additionally. The remaining farmers listed in section 3.2 (five) are not involved in a project implementation phase but will be future target groups for roll-out and dissemination since they expressed their general interest already. All the sites are situated close to the territory of Ugam-Chatkal National Park (compare map 3).

The most suitable candidate is the farmer Komiljon Sidikov (farmer No.5), who meets the criteria mentioned above best. Apart from the criteria, he has already participated in international projects. And in addition to the sites investigated, he has some more land in mountainous regions, which will enable him to expand pistachio plantations. On his land, it is planned to create a collection of pistachio varieties, a mother plantation and commercial plantations in the form of small areas on the site of open spaces in a natural hawthorn forest on a mountain slope, at a total area of 5 ha. In future, the farmer plans to build a house with rooms to conduct trainings there.

At the following farmers' land the below given implementation activities are planned:

- At the land of Abdumalik Khayitov (farmer No.6) the creation of a collection and a mother plantation and to plant pistachio on undulating slopes and aspects is planned;
- At the land of Sayfitdin Utbasarov (farmer No.1) the creation of a collection and a mother plantation and to plant pistachio in an area with a severe relief is planned;
- At the land of Kholtura Dadaboyev (farmer No.2) the creation of a collection and a mother plantation and to plant pistachio and almond on undulating slopes and aspects is planned.

As Chatkal Mountain land management research station (farmer No.4) belonging to scientific-production center of decorative gardening and forestry, the scientists will continue research for further selection and adaption of new pistachio varieties on the collection plot.

The interest of the remaining farmers involved in the project will be stimulated in various ways: for instance, providing a certain amount of pistachio seedlings for planting, they will get provided with support for fencing their territories and with advisory.

The land of all the farmers (except farmer No.4) involved in the project is located in areas used for agricultural purposes. It is leased for a long term (up to 49 years) with a right for prolongation. Currently, farmers owing non-irrigated lands are encouraged to use them for creating gardens and vineyards, including pistachio plantations. A hokimiyat can cancel the state quota for wheat and safflower production from land, which is to be converted to pistachio plantation.

However, about 20 % of the rain-fed lands are located at territories of the State Forest Fund. Such land is used by state forestry enterprises and may get leased for a maximum period of 10 years. Therefore, even though there are considerable territories favorable for the development of pistachio plantations, they may only be used by state forestry enterprises, and not by individuals / private farmers. Therefore, to include as many different interested parties as possible, it is planned to involve both, farmers and a state organization (farmer No. 4), which is the Chatkal Mountain land management research station.

In the Chatkal Mountain land management research station it is planned to create a collection of pistachio varieties, a mother plantation so that state forestry enterprises can obtain high-grade pistachio material for the inoculation of wild pistachio trees (*Pistacia vera*). The main office of the station has everything to organize trainings and advisory services.

4. PROJECT IMPLEMENTATION PLAN

In the frame of the feasibility study it turned out that we do not manage to finalise a detailed implementation plan for all 5 farmers planned to be involved in a project phase II. Thus, as example we managed to finalise a detailed planning for one of the farmers (major partner), having land under hokimiyat, as well as for the only entity under State Forest Fund. A detailed budget for all farmers going to be involved will be drafted finally in the project within the implementation (phase II) proposal. The below given item and figures form the basis for the project implementation proposal (phase II) and will be given in tabular format for a more clear picture of tasks and costs. The more comprehensively drafted activities in this study are aiming at giving the reader a better understanding on how costs are calculated for certain activities and their relevance for project implementation. Unfortunately this is made at costs of less readability.

4.1. Site No. 5 Komiljon Sidikov, Bostanlyk District, near village of Saylik

4.1.1. Description of plots in site No. 5

Plot No. 1 – a pistachio plantation, 1,005 m a.s.l.

The western slope is covered with wild fruit shrubs and trees (cherry plum, hawthorn and *Rosa canina*), with a crown coverage of 0.2, and a thick layer of grass of various kinds.

The average length of the plot is 370 m; we suggest that the vegetation of the plot be thickened through planting 4 rows of pistachio trees, with a 6 x 6 m disposition pattern, for which purpose 4 small parallel slightly sloping irrigation canals will be dug along the local horizontals. The pistachio trees will be planted at least 3 m from the trees and shrubs that are already growing. Thus, one row may consist of $370 / 6 = 62$ plants, with a total of $62 \times 4 = 248$ plants in all four rows.

Plot No. 2 – a pistachio plantation

The western slope is covered with wild fruit shrubs and trees (cherry plum, hawthorn and *Rosa canina*), with a crown coverage of 0.2, and a thick layer of grass of various kinds. It is a continuation of plot No. 1, separated from it by an earth road.

The average length of the plot is 230 m; we suggest that the vegetation of the plot be thickened through planting 4 rows of pistachio trees, with a 6 x 6 m disposition pattern, for which purpose the 4 small parallel slightly sloping irrigation canals dug on plot No. 1 will be continued along the local horizontals. The pistachio trees will be planted at least 3 m from the trees and shrubs that are already growing. Thus, one row may consist of $230 / 6 = 38$ plants, with a total of $38 \times 4 = 152$ plants in all four rows.

Plot No. 3 a collection of pistachio varieties

The plot is located in the southern, lowest part of this farm. From the top it is limited by grapevines, from the bottom by a fence. There we also plan to organize several small canals along the local horizontals, which will roughly repeat the contours of the fence. We plan to create 9 parallel canals, beginning the construction of the canals from the bottom of the plot. The average length of the canals is 180 m. Thus, $180 / 6 = 30$ plants may be placed along each canal, with a total of $30 \times 9 = 270$ plants along all 9 canals. In addition, it is possible to plant 2 rows of pistachio trees in the western part of this plot, between the grapevines and the potato field. The length of each of these rows will be 175 m, which means that $175 : 6 = 29$ trees can be planted in each row and $29 \times 2 = 58$ plants in the two rows. In total $270 + 58 = 328$ plants will be added to the collection plot.

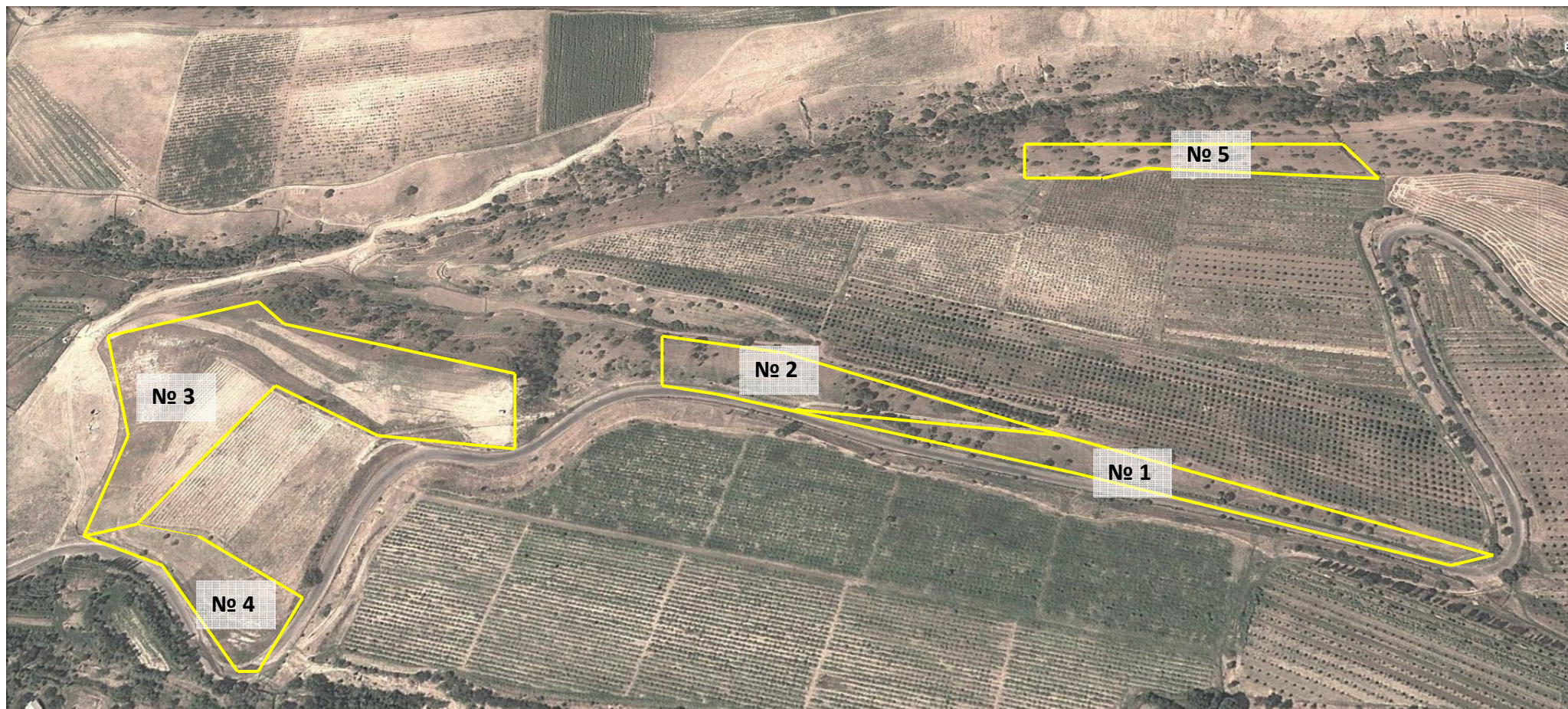
Plot No. 4 – a pistachio plantation

The plot is situated in the lower, eastern part of the farm, between the grapevines from above and the fence along a highway from below. We plan to create there 7 rows of pistachio trees parallel to the contour of the road. The average length of such contour is 165 m, which means that it will be possible to plant $165 / 6 = 27$ trees in each row, with a total of $27 \times 7 = 189$ plants in 7 rows. Trees will be located on the grounds along water channels with the length $165 \times 7 = 1,155$ m.

Plot No. 5 – a mother plantation

The plot is situated in the western part of the farm, next to its border, and has the form of a steep slope covered with wild fruit trees. The average crown coverage of the vegetation is 0.2 - 0.3, with large open areas. We plan to increase the thickness of the vegetation by planting there some additional pistachio trees. The plot is roughly 240 m in length and 75 m in width. We plan to plant an average of 7 rows of pistachio trees, with a 6 x 6 disposition pattern, for which purpose 7 small parallel slightly sloping irrigation canals will be dug along the local horizontals. The pistachio trees will be planted at least 3 m from the trees and shrubs that are already growing. Thus, one row may have a maximum of $240 / 6 = 40$ plants, with a total of $40 \times 7 = 280$ plants in all seven rows.

We plan to create 5 rows of pistachio trees with the scheme 6x6 m. For that purpose we will dig 5 parallel irrigation channels horizontally with slight gradient with a total length $240 \times 7 = 1,680$ m. Pistachio trees will be planted at least 3 m from current trees and shrubs. Therefore, each row will be maximum $240 / 6 = 40$ plants and all 7 rows content $40 \times 7 = 280$ plants.



Map 4 Location of the plots belonging to farmer Komiljon Sidikov (farmer No. 5)

4.1.2. Drafted implementation costs for site No. 5

Estimation of costs for the creation of pistachio plantations

The plot is fenced all along the perimeter; in daytime in warm seasons there always are workers at the farm.

We plan to create canals with a total length of 7,205 m, running roughly along the local horizontals and having a slight inclination. Along these canals, in every six meters, we plan to create special grounds, 1 x 1 m in area, for planting pistachio seedlings. This means that $7205 / 6 = 1,200$ grounds will be created.

Marking of the plots

Before starting any work concerning the planting of pistachio trees it is necessary to mark the planting places. All the planting places in the territory of the farm will be made in the form of grounds, 1 x 1 m in area, situated on the slopes. We plan to plant pistachio seedlings in a permanent place, that is, on the prepared grounds. To make sure the seedlings with containers will survive it is necessary to water them 3-4 times a day at least during the first year. To make the watering easier we plan to create little canals (30 cm deep and 30 cm wide in the upper part), which will have a slight inclination and run along the slopes, roughly along the local horizontals. The planting grounds will be made along these canals, at a distance of 6 m from each other, while the distance between the canals will also be equal to 6 m. To create such a network of canals is a complex and difficult task. A special group of competent people (mirabs) will be involved in this operation. It is important to make these canals sloping in order to provide the flow of water; however, their inclination must be but slight, as even an insignificantly excessive inclination may lead to erosion and the breakdown of the irrigation system. To mark the routes of the canals and the planting grounds, landmarks 1 m high will be used. The landmarks will be placed 6 m from each other. As we plan to create 1,200 planting grounds in the whole farm, it is necessary to make 1,200 landmarks. The landmarks will be produced of material we shall have at hand. The making of the landmarks, their transportation to the site and distribution throughout the farm will cost 600 UZS for each landmark. Thus, 1,200 landmarks will cost $1,200 \times 600 = 720,000$ UZS.

The installation of 1 landmark and the digging of 6 m of canal will cost 1,000 sum, which means that the whole operation of digging the canals and installing the landmarks will cost $1,200 \times 1,000 = 1,200,000$ UZS.

Preparation of the planting grounds

It is necessary to prepare a total of 1,200 planting grounds 1 x 1 m in size each. The two upper corners of the grounds will have the so called 'antennas' – little diagonal canals used to take the water from the main canal and direct it to the planting ground. Afterwards this will ensure a better collection and concentration of moisture on the planting ground, which is necessary for a pistachio tree. One worker can create 20-25 grounds for one working day. One working day costs 25,000 UZS. To make all the planting grounds we need $1,200 / 20 = 60$ man-days or $60 \times 25,000 = 1,500,000$ UZS.

Fertilization with manure

The soil where the pistachio trees will be planted will be fertilized by pouring 3-5 kg of manure onto the ground. The place will be dug over. Thus, one worker will bring manure for 25 grounds, taking into account the operation of distributing the manure to the grounds. The whole operation requires $1,200 / 25 = 48$ man-days or $48 \times 25,000 = 1,200,000$ UZS.

We shall have to buy two lorryfuls of manure, each equal to 2.5 m^3 and each costing 150,000 UZS. The total sum spent on the manure will be $150,000 \times 2 = 300,000$ UZS.

Planting of the seedlings in spring

The whole procedure consists of the following operations: bringing the seedlings to the planting place, digging a hole, 20 cm deep for planting, opening the container on the pistachio tree, putting the tree into the planting hole, filling the hole with soil, tamping the soil and bringing the plant into the right position. The norm is to plant 50 trees per day. The whole procedure requires $1,200 / 50 = 24$ man-days or $24 \times 25,000 = 600,000$ UZS.

We shall have to buy 1,200 seedlings of a pistachio with underground root system – $1,200 \times \$1 = \$ 1,200$.

The costs for their transportation will be 60,000 UZS (Tashkent-Soylik; 120 km).

Fertilisation with mineral fertilizers

To prepare quickly the pistachio plants for inoculation we plan to use mineral fertilizers, 50 g of ammophos, 50 g of carbamide and 25 g potassium for each plant. The total amount of ammophos and carbamide will be equal to $50 \times 1,200 = 60,000$ g or 60 kg and potassium will be $25 \times 1,200 = 30,000$ g or 30 kg. A 50-kg bag of ammophos costs 60,000 UZS; so 60 kg will cost $(60 \times 60,000) / 50 = 72,000$ UZS. A 50-kg bag of carbamide costs 80,000 UZS; so 60 kg will cost $(60 \times 80,000) / 50 = 96,000$ UZS. A 25-kg bag of potassium costs 30,000 sum; so 30 kg will cost $(30 \times 30,000) / 25 = 36,000$ UZS.

All fertilizers will cost $72,000 + 96,000 + 36,000 = 204,000$ UZS. The cost of their transportation will be equal to 10,000 UZS.

The process includes careful mixture of fertilizers, bringing of a necessary amount to the planting place, digging of a hole, 10-15 cm deep for the fertilizers at a distance of 5-8 cm from the stem of the plant, putting of a necessary amount of fertilizer into the hole and filling of the hole with soil. The norm is 200 holes per day. The whole procedure requires $1,200 / 200 = 6$ man-days or $6 \times 25,000 = 150,000$ UZS.

Post-planting watering

Right after planting the pistachio trees must be watered. The total length of the irrigation canals is 7,205 m, while 1 ha of the land, with a 6 x 6 disposition pattern, contains $100 / 6 = 16.66$ rows 100 m long each or $16.66 \times 100 = 1,666$ m of canals. The first watering will be the most difficult, as the soil will not yet have absorbed water and it will be necessary to watch carefully how the water flows along the whole length of the canal. This will require much time: 1,667 m (1 ha) of canals require 8 man-days, that is, 208 m or 0.13 ha per day per person. In total, $7,205 / 208 = 34.6$ man-days or $34.6 \times 25,000 = 865,000$ UZS are necessary to perform this operation.

Second and third watering (late May, June): to do it we need 6 man-days per 1,667 m (1 ha) of canals, that is, 278 m or 0.17 ha per person per day. In total, we shall need $7,205 / 278 = 25.9$ man-days or $25.9 \times 25,000 = 647,500$ UZS for this operation.

Two waterings will require $647,500 \times 2 = 1,295,000$ UZS.

Possibly, we shall need two more waterings, in July and August.

After every watering (at least 4 times per season), tillage will be made with elimination of weed around every tree with the area 1 m². Average work for 1 man-day is 100 m².

Night guard

From April to November, that is 7 months, with a salary of 300,000 UZS per month, with a total of $300,000 \times 7 = 2,100,000$ UZS.

Motor cultivator

Niguan – 9 million UZS.

4.2. Site No. 4 Chatkal section of Chatkal mountain land management research station

The Chatkal section of Chatkal station is situated 15 km from the main territory of the station. It occupies 15 ha of land, 7 ha of which are irrigated. The irrigated part is occupied by the nursery. At the same time, the station, whose irrigable lands are all used, needs more area. Therefore, the station plans to spread its activity onto this section. However, the Chatkal section is not provided with agricultural equipment, that is, with a tractor, rigging, trailers and means of transport. Therefore, to make the work more effective the section must be provided with a tractor, plough, chisel, mowing machine, trailer, petrol saw and sprayer. The section consists of two plots.

4.2.1. Description of plots in site No. 4

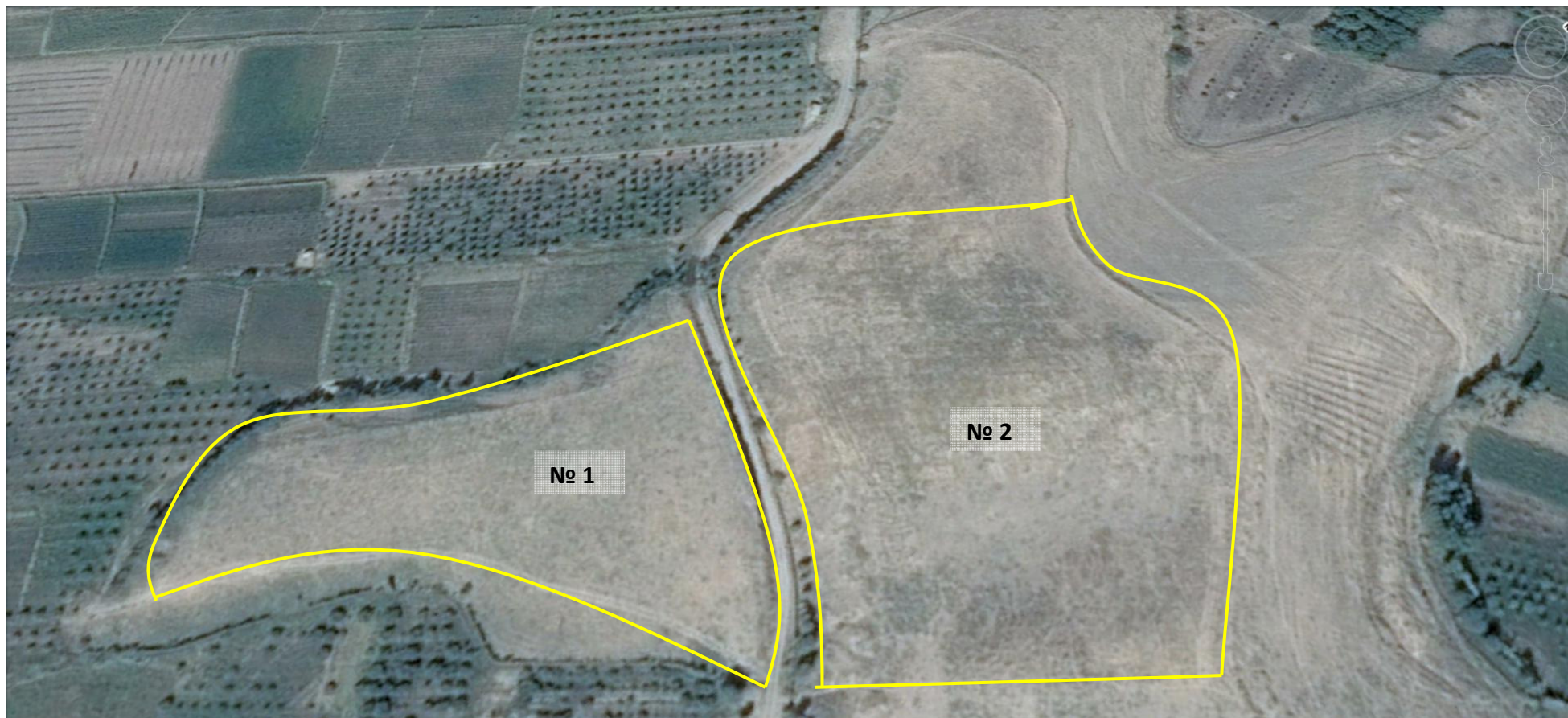
Plot No. 1

Area – 1.2 ha. Size – 161 x 74 m. Gentle undulating slope at an elevation of 650 m above sea level. The whole area is covered with grass of different types. The soil type is typical sierozem (grey desert soil). Fencing of the plots: Plot No. 1 is situated near an irrigated nursery and is protected from cattle by a guard. We suppose that plot No. 1 will also be included in the protected territory and, therefore, do not plan any fencing for this plot.

Plot No. 2

is situated on the top of a hill and is protected from the southwest by a precipice; so this side of plot No. 2 needs no fencing either. The length of the fence and the method of fencing for the other parts of the plots will be discussed later.

Because of different conditions, cost estimation will be done separately. Moreover, establishing pistachio plantation is almost done on Plot No.1. This work will be counted as co-financing for the project proposal.



Map 5 Location of the plots in the Chatkal plot of the Chatkal mountain land management research station (farmer No.4)

4.2.2. Drafted implementation costs for site No. 4

Plot No.1 - 1st year of vegetation, 2012

The plot contains 344 places for trees with a scheme 6 x 6 m. Therefore, we need 344 landmarks for marking each seedling. The landmarks will be produced of material we shall have at hand and cost approximately 300 UZS each. Total amount will be $344 \times 300 = 103,200$ UZS.

Marking of the plots

We need in average 3 man-days per 1 ha. For 1.2 ha we need $1.2 \times 3 = 3,6$ man-days with the current costs 1 man-day is 25,000 UZS. Total cost is $3.6 \times 25,000 = 90,000$ UZS.

Preparation of the planting grounds for moisture accumulation

One worker can create 20-25 grounds for one working day. One working day costs 25,000 UZS. To make all the planting grounds we need $344 / 25 = 14$ man-days and $14 \times 25,000 = 350,000$ UZS.

Fertilization with manure

We need to buy manure and mineral fertilizers for speeding growth of the seedling. Needs in manure for 280 trees are $- 0.003 \text{ m}^3 \times 280 = 0.84$; or in terms of budget $60,000 \times 0.84 = 50,400$ UZS per 1 ha or $0.84 \times 1.2 = 1 \text{ m}^3$ or $60,000 \times 1 = 60,000$ UZS.

Depends on relief one worker can distribute manure to 150 holes per 1 day. For 280 trees it will be $280 / 150 = 1.9$ man-day or $25,000 \times 1.9 = 47,500$ UZS/ha or for the whole plot $344 / 150 = 2.3$ man-days or $2.3 \times 25,000 = 57,500$ UZS.

One worker can dig the manure over in 90-100 holes (30x30 cm) per 1 day. For 280 holes $280 / 95 = 2.9$ man-days or $2.9 \times 25,000 = 72,500$ UZS/ha or for the whole plot $344 / 95 = 3.6$ man-days or $3.6 \times 25,000 = 90,000$ UZS.

Purchasing of seedlings

280 pistachio plants for 1 ha cost $280 \times 3,000 = 840,000$ UZS. For the whole plot it will be $344 \times 3,000 = 1,032,000$ UZS.

Fertilization with mineral fertilizers

We count 50 g of ammophos, 50 g of carbamide and 25 g potassium for each plant. The total amount of ammophos and carbamide will be equal to $50 \times 280 = 14,000$ g or 14 kg and potassium will be $25 \times 280 = 7,000$ g or 7 kg. A 14 kg of ammophos cost $14 \times 1,200 = 16,800$ UZS. A 14 kg of carbamide cost $14 \times 1,600 = 22,400$ UZS. A 7 kg of potassium cost $7 \times 800 = 5,600$ UZS. For the whole plot we need 17.2 kg of ammophos, the same amount of carbamide and 8.6 kg of potassium. All fertilizers together cost 55,040 UZS.

Planting of 280 seedlings together with putting mineral fertilizers will be 3.5 man-days or $3.5 \times 25,000 = 87,500$ UZS. For all area $344 / 80 = 4.3$ man-days or $4.3 \times 25,000 = 107,500$ UZS.

Watering plants

Watering of plants was made manually by 2 people and pack animal with 2 water cans 40 liters each. 160 plants can be watered for 1 man-day. For 280 seedlings we have to spend $280 / 160 = 1.8$ man-days or $1.8 \times 25,000 = 45,000$ UZS. For the whole plot it will be $344 / 160 = 2.2$ man-days or $2.2 \times 25,000 = 110,000$ UZS. For 4-times watering we need $2.2 \times 4 = 8.8$ man-days or $25,000 \times 8.8 = 220,000$ UZS.

Soil tillage

After every watering (at least 4 times per season), tillage was made with elimination of weed around every tree with the area 1 m^2 . Average work for 1 man-day is 100 m^2 . For 280 trees: $280 / 100 = 2.8$ man-days or $2.8 \times 25,000 = 70,000$ UZS. For the whole plot $344 / 100 = 3.4$ man-days, and for 4-times tillage is $3.4 \times 4 \times 25,000 = 340,000$ UZS.

Plot No.1 – 2nd year of vegetation, 2013

Additional planting instead of lost plants (with survival rate 80%).

Purchase seedling

Purchase of seedlings for 280 trees are $280 \times 0.2 = 56$ plants; $56 \times 3,000 = 168,000$ UZS. For 1.2 ha is $344 \times 0.2 = 69$ seedlings or $69 \times 3,000 = 207,000$ UZS.

Planting pistachio seedlings

$69 / 80 = 0.8$ man-day or $0.8 \times 25,000 = 20,000$ UZS.

Watering plants

Watering plants was made manually by 2 people and pack animal with 2 water cans 40 liters each. 160 plants can be watered for 1 man-day. For 280 seedlings we have to spend $280 / 160 = 1.8$ man-days or $1.8 \times 25,000 = 45,000$ UZS. For the whole plot it will be $344 / 160 = 2.2$ man-days or $2.2 \times 25,000 = 110,000$ UZS. For 4-times watering we need $2.2 \times 4 = 8.8$ man-days or $25,000 \times 8.8 = 220,000$ UZS.

Soil tillage

After every watering (at least 4 times per season), tillage was made with elimination of weed around every tree with the area 1 m^2 . Average work for 1 man-day is 100 m^2 . For 280 trees: $280 / 100 = 2.8$ man-days or $2.8 \times 25,000 = 70,000$ UZS. For whole plot $344 / 100 = 3.4$ man-days, and for 4-times tillage is $3.4 \times 4 \times 25,000 = 340,000$ UZS.

Plot No.1 - 3rd year of vegetation, 2014

Soil tillage

Tillage was made 3 times per season with elimination of weed around every tree with the area 1 m^2 . Average work for 1 man-day is 100 m^2 . For 280 trees: $280 / 100 = 2.8$ man-days or $2.8 \times 25,000 = 70,000$ UZS. For whole plot $344 / 100 = 3.4$ man-days, and for 3-times tillage is $3.4 \times 3 \times 25,000 = 255,000$ UZS.

Purchasing of grafts for inoculation

Each graft has at least 5 suitable for inoculation buds. Approximate price for each graft is 1,500 UZS. Each tree got at least two inoculations. Taking into account survival rate (80%) we need $(344 \times 0.8 \times 2) / 5 = 110$ grafts or $110 \times 1,500 = 165,000$ UZS. Transportation cost is 60,000 UZS.

Inoculation

The cost of one inoculation is 200 UZS. For the whole plot $344 \times 0.8 \times 2 = 550$ inoculations or $550 \times 200 = 110,000$ UZS.

Crown caring

including revision of inoculation we need to do 3 times per season. The cost is 3 man-days or $3 \times 25,000 = 75,000$ UZS.

Plot No.1 - 4th year of vegetation, November 2014 – November 2015

Soil tillage

Tillage will be made 3 times per season with elimination of weed around every tree with the area 1 m^2 . Average work for 1 man-day is 100 m^2 . For 280 trees: $280 / 100 = 2.8$ man-days or $2.8 \times 25,000 = 70,000$ UZS. For whole plot $344 / 100 = 3.4$ man-days, and for 3-times tillage is $3.4 \times 3 \times 25,000 = 255,000$ UZS.

Inoculation of the rest of 20%. Purchasing of grafts for inoculation

Each graft has at least 5 suitable for inoculation buds. Approximate price for each graft is 1,500 UZS. Each tree got at least two inoculations. We need $(344 \times 0.2 \times 2) / 5 = 28$ grafts or $28 \times 1,500 = 42,000$ UZS. Transportation cost is 60,000 UZS.

Inoculation

The cost of one inoculation is 200 UZS. For the whole plot $69 \times 2 \times 200 = 27,600$ UZS.

Crown caring

including revision of inoculation we need to do 3 times per season. The cost is 3 man-days or $3 \times 25,000 = 75,000$ UZS.

Plot No. 2. Planning project: November 2014 – November 2015

Area – about 2.5 ha (240 x 100). Slightly undulating top of a hill sloping northwestwards, elevation – 660 m above sea level. The whole area is covered with cereals. Soil type is typical sierozem (grey desert soil).

Although the operation of planting pistachio trees has already begun on plot No. 2, it is necessary to mark the planting places throughout the whole area of the plot again. This must be done to determine the direction of the rows, to specify the distance between them and to calculate the number of required plants. All the planting places in the territory of this section will have the form of grounds, 1 x 1 in size, situated on the slope. We plan to plant seedlings of pistachio in a permanent place, namely, on specially prepared grounds with a 6 x 6 m disposition pattern. Estimated area of the plot is 2.5 ha and based on this number we will calculate our expenses for establishing mother plantation.

Stripe preparation of the soil

with a 6 x 6 m disposition pattern on the slopes with 8-12°.

With the width of stripe 105 cm (4 size of plough) are of ploughing per 1 ha will be $1.05 \times 100 \times 17 = 1,800$ or 0.18 ha. The costs will be as follows:

Rent of a tractor – $100,000 \times 0.18 = 18,000$ UZS

$30 \times 0.18 = 6$ l of diesel = $3,500 = 21,000$ UZS

Sub-total: 39,000 UZS

Chiseling and harrowing (at the same time) ploughed soil

Rent of tractor $50,000 \times 0.18 = 9,000$ UZS

15 l of diesel $\times 0.18 = 3$ l = $3,500$ UZS/l / 10,500 UZS

Sub-total: 19,500 UZS

Total: 58,500 UZS

Fencing

The plot is located on upper part of the hill and from south-west is protected by steep cliff and that's why we don't need fence from that side. The fence will be made from material at hand – wooden sticks with the height 1.5 m put every 2 m. 2-meters sections made from twigs and branches are attached to the wooden sticks and tied with whips. For 450 m of fence we need 200 sticks and 225 2-meters sections. The norm is 1 man-day = 10 m of fence including collecting of material at hand.

$450 / 10 = 45$ man-days or $45 \times 25,000 = 1,125,000$ UZS.

Marking plots with landmarks

Every landmark costs 400 UZS, for 700 seedlings we need $700 \times 400 = 280,000$ UZS. Man labor costs $2.5 \times 3 = 7.5$ man-days or $7.5 \times 25,000 = 187,500$ UZS.

Overall $280,000 + 187,500 = 467,500$ UZS.

Fertilization with manure

We need to buy manure and mineral fertilizers for speeding growth of the seedling. Needs in manure for 280 trees are – $0.003 \text{ m}^3 \times 280 = 0.84$; or in terms of budget $60,000 \times 0.84 = 50,400$ UZS per 1 ha. For the whole plot we need $0.003 \text{ m}^3 \times 700 = 2.1 \text{ m}^3$; $60,000 \times 2.1 = 126,000$ UZS.

Distribution of manure for the plot will be $700 / 150 = 4.7$ man-days or $4.7 \times 25,000 = 117,500$ UZS.

One worker can dig the manure over in 90-100 holes (30x30 cm) per 1 day. For 280 holes $280 / 95 = 2.9$ man-days or $2.9 \times 25,000 = 72,500$ UZS/ha or for the whole plot $700 / 95 = 7.4$ man-days or $7.4 \times 25,000 = 185,000$ UZS.

Purchase of seedlings

280 pistachio plants cost $280 \times 3,000 = 840,000$ UZS. For the plot $700 \times 3,000 = 2,100,000$ UZS.

Fertilization with mineral fertilizers

We count 50 g of ammophos, 50 g of carbamide and 25 g potassium for each plant. The amount for 1 ha of ammophos and carbamide will be equal to $50 \times 280 = 14,000$ g or 14 kg and potassium will be $25 \times 280 = 7,000$ g or 7 kg. A 14 kg of ammophos cost $14 \times 1,200 = 16,800$ UZS. A 14 kg of carbamide cost $14 \times 1,600 = 22,400$ UZS. A 7 kg of potassium cost $7 \times 800 = 5,600$ UZS. For whole plot we need 35 kg of ammophos, the same amount of carbamide and 17.5 kg of potassium. All fertilizers cost 112,000 UZS.

Planting of 280 seedlings together with putting mineral fertilizers will be 3.5 man-days or $3.5 \times 25,000 = 87,500$ UZS. For all area $700 / 80 = 8.8$ man-days or $8.8 \times 25,000 = 220,000$ UZS.

Watering plants was made manually by 2 people and pack animal with 2 water cans 40 liters each. 160 plants can be watered for 1 man-day. For 280 seedlings we have to spend $280 / 160 = 1.8$ man-days or $1.8 \times 25,000 = 45,000$ UZS. For the whole plot it will be $344 / 160 = 2.2$ man-days or $2.2 \times 25,000 = 110,000$ UZS. For 4-times watering we need $4.4 \times 4 = 17.6$ man-days or $25,000 \times 17.6 = 440,000$ UZS.

Soil tillage

After every watering (at least 4 times per season), tillage was made with elimination of weed around every tree with the area 1 m². Average work for 1 man-day is 100 m². For 280 trees: $280 / 100 = 2.8$ man-days or $2.8 \times 25,000 = 70,000$ UZS. For the whole plot $344 / 100 = 3.4$ man-days, and for 4-times tillage is $3.4 \times 4 \times 25,000 = 340,000$ UZS.

Fire protection corridor

It is necessary to make a fire protection corridor twice a season around the plot. The perimeter $450 + 250 = 700$ m. The fire line is made by plough with the width 1.4 m. Overall area is $1.4 \times 700 = 980$ m² or 0.1 ha.

Rent of tractor

$100,000 \times 0.1 = 10,000$ UZS

$30 \times 0.1 = 3$ l of diesel = $3,500 = 10,500$ UZS

Sub-total: 20,500 UZS

Total $20,500 \times 2 = 41,000$ UZS

Purchase of agriculture machines

Tractor "Belarus" 80.1 - \$18,000

Plough 4- 35 - \$1,000

Chisel - \$1,000

Mowing machine-2.1 - \$1,000

Tractor trailer 2PTS - 4 - \$4,000

Chainsaw HITACHI CS 33 EB \$200

Moto sprayer SOLO 423 Port - \$300

Transportation - \$6,000

Total \$26,500

5. BUSINESS PLAN OR COST-BENEFIT ANALYSIS

For the cost-benefit analysis the approximate figures of costs for the implementation of pistachio plantations as given in chapter 4 were used as a basis. This includes costs for renting of equipment (like tractors), petrol to run machinery, purchase of seedlings, labour (man-days), purchase of fertilizers, inoculation costs and others. Major costs occur in the first four years to prepare the plots and marinating seedlings. The consecutive years are neglectable in terms of running costs since infrastructure is settled, watering is not necessary anymore, plot protection is almost not necessary anymore, fences are built a.s.o.. The calculation unit is one hectare. Calculations were done for planting pattern of 6m x 6m as well as for 10m x 10m. Moreover the beneficity of intercrops for safflower, chick-peas, melon, alfalfa and rose-hip were calculated as well to draft side-income.

Certain assumptions were made that form the basis for the calculations. The inflation rate of Uzbek Soum reaches approx. 20% annually which doesn't reflect the official statistics but empirical observations. This results in almost astronomic economic prospects when calculating any future harvest. It is hard to imagine from a today's perspective how the future income will mirror the real purchasing power. In other words 20% of inflation rate does massively distort the calculations if not normalized by any mean.

Therefore we decided to recalculate all the figures to Euro (exchange rate July 2014) and assume an annual inflation rate of 0.4% (July 2014) that reflects the market developments much better. The purchasing power if calculated in Euro remains almost proportionally over the years. Thus it is more appropriate to apply Euro as the currency for the cost-benefit analysis.

Other assumptions are that from all of the pistachio trees 90% are fruiting the other 10 % are male trees. There are in average 280 trees per hectare for a planting pattern of 6m x 6m and 100 trees per hectare for a planting pattern of 10m x 10m. This is an average value. It must be noted that the calculations were made on a harvest of kg per tree. It might be the case that harvest from trees planted at 10m x 10m is considerably higher than from 6m x 6m plots. But to find an easy measure to apply formula we assume the figures as given here. Prices for fruits in the calculation are as follows:

fruit	Unit	Values UZS	Values € (Exchange rate July 2014)
Pistachio	UZS/kg	20,000 UZS	6,35 €
Safflower	UZS/kg	1,500 UZS	0,48 €
Chick-peas	UZS/kg	4,000 UZS	1,27 €
Melon	UZS/kg	500 UZS	0,16 €
Alfalfa	UZS/kg	250 UZS	0,08 €
Rose-hip	UZS/kg	2,000 UZS	0,64 €

Table 3 Prices of several fruits in 2014

The bazaar price for pistachios in Tashkent is 40.000 UZS, we halved the value in order to have a realistic figure on what the farmer can expect as real earnings.

The amount when first harvests start and its volume for all the fruits but the pistachio in particular are experience-driven. For pistachio fruits it starts with 200g per tree in the seventh year after planting and increases annually with 400g (eight year), 700g (ninth year), 1,200g (tenth year) and so on (details in the calculations in Annex II).

The inflation rate is applied to calculate the income but in equal terms to the costs for labour force, resources, and rentals as well. So the relation between both axes remains.

Usually a reference to investments into the banking sector for the same period should be calculated in order to give a relation to the overall economic developments of the country. Since there is not a functioning banking and finance sector for medium-sized business in Uzbekistan it is worthless to use it as a proxy. More appropriate would it be to apply realistic investment mechanisms as they are common for farmers in Uzbekistan like income from livestock breeding or wheat production.

The profitability of wheat harvests in the rain-fed mountain belt zone is 35,4%, of livestock 80,3 % in regard to the investments calculated over 18 years as a proxy to the calculations of pistachio (calculations based on Rudenko, I. and Nurmetov, K. (2011)).

Chart 1 shows the development of investments (annual expenses) and income (annual income) from pistachio growing for the first 18 years for the planting pattern of 6m x 6m. The annual expenses graph starts with remarkable investments in the first four years and remains almost stable at a very low level for the following 14 years. The annual income graph remains at zero until the first harvest starts in the seventh year and then begins to increase year by year. Regularly there are bad harvests every several years as a natural process. This was considered in the calculations and is reflected in the regular collapse of the graphs, in chart 1 and chart 2 in the years 13 and 16, but the years are arbitrary. In fact such bad harvest years would get averaged over the years but for a better explanation we kept them visual. Analogue to the income and expenses graphs we plotted the annual cost-benefit balance which starts to increase in the seventh year after planting with the first harvest. A better plot is the accumulated costs-benefit graph which drafts a full reimbursement of all investments after the tenth year with beginning increase of incomes from seventh year on. The years one to six show the accumulating investments without any income generation. With the break-even point in the tenth year the accumulated costs-benefit increases almost exponentially until the 18th year since the investments remain at a very low level and the trees are fruiting with an increasing tendency.

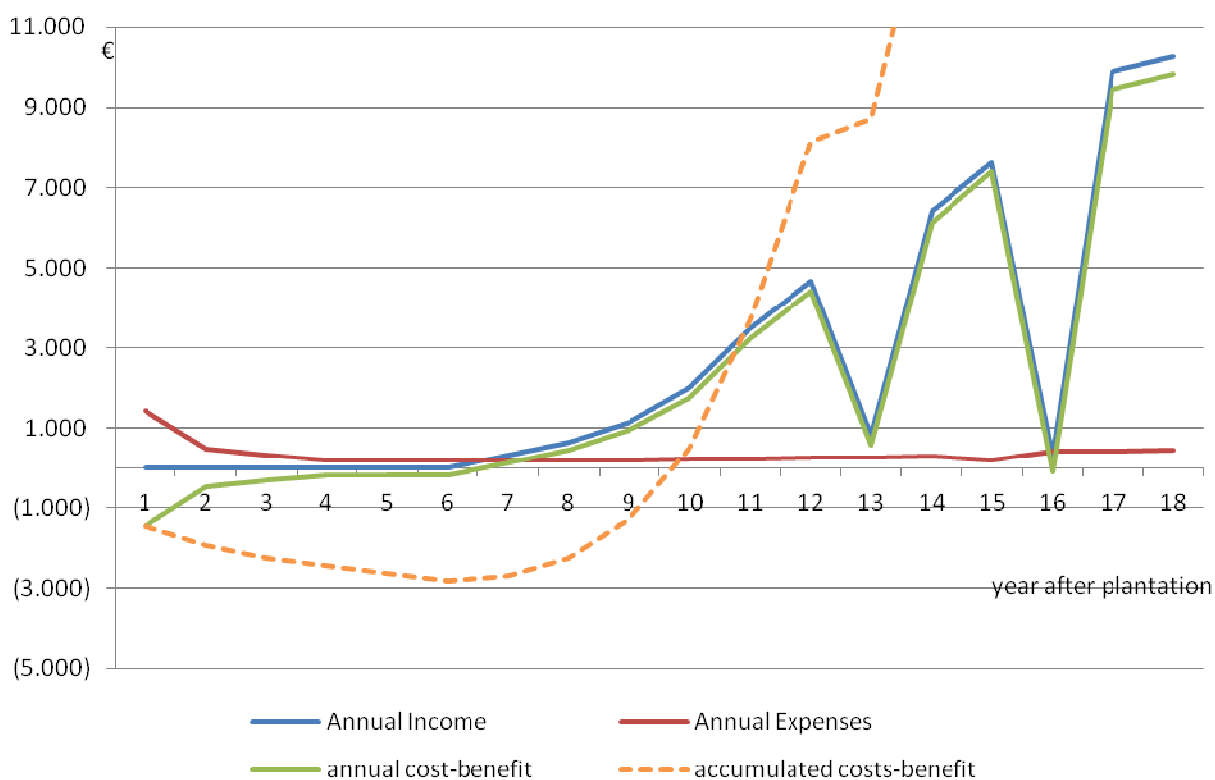


Chart 1 Expenses, revenue and cost-benefit balance of pistachio plantations at plots of 6m x 6m

The picture is pretty similar with plots planted at 10m x 10m but with different cost-benefit balances (see chart 2). The first time when the income from harvests top the expenses for investments is the eighth year after planting. With the eleventh year the initial investments have got reimbursed as the accumulated cost-benefit graph shows. So the break-even point is just one year later if the pistachio trees are planted in a 10m x 10m raster.

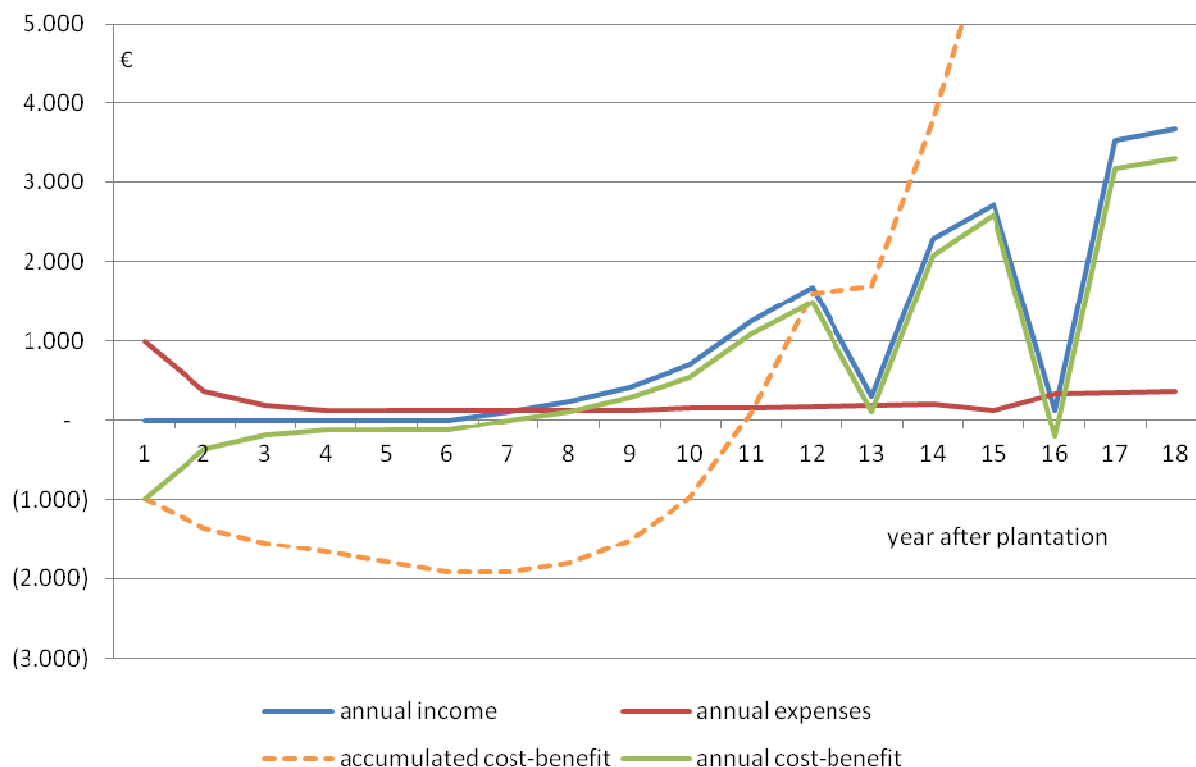


Chart 2 Expenses, revenue and cost-benefit balance of pistachio plantations at plots of 10m x 10m

In order to decrease the period between first investments and full reimbursement of investments several scenarios with different intercrops were calculated. The scenarios for pistachio planting pattern of 6m x 6m include calculations with:

- Pistachio 6m x 6m with rose hip
- Pistachio 6m x 6m with rose hip and safflower
- Pistachio 6m x 6m with rose hip and water melon
- Pistachio 6m x 6m with rose hip and chick-peas
- Pistachio 6m x 6m with rose hip and alfalfa

Rose hip is considered as a fence not as an intercrop. That's why it is possible to include it as additional fruit into the calculation. Each of the other four crops is calculated to cover 75 % of the territory (one hectare). The most beneficial cropping pattern as depicted in chart 3 is the combination of pistachio planting pattern of 6m x 6m with water melon and rose hip. Applying that scheme would result in a break-even point shifted from tenth year (as in the ordinary calculation) to the sixth year. As of planting pattern of pistachio of 10m x 10m like depicted in chart 4 the break-even point is shifted from the eleventh year to the fifth year.

In the end a combination of several crops will ensure a more stable income as the focus on one crop carries the risk of bad harvest years. Therefore our recommendation is always to combine different crops, but there is no doubt that intercrops decrease the period of a reimbursement of investments and therefore minimizes the risks for the farmer.

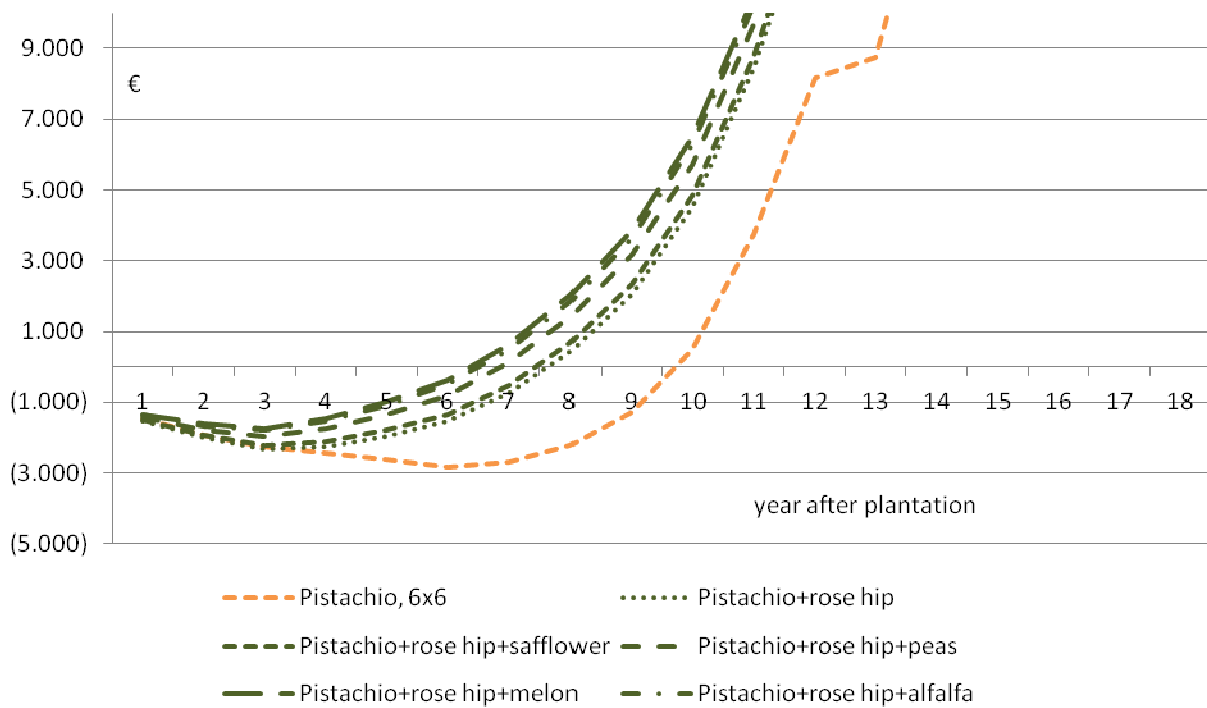


Chart 3 Expenses, revenue and cost-benefit balance of pistachio plantations and intercrops at plots of 6m x 6m

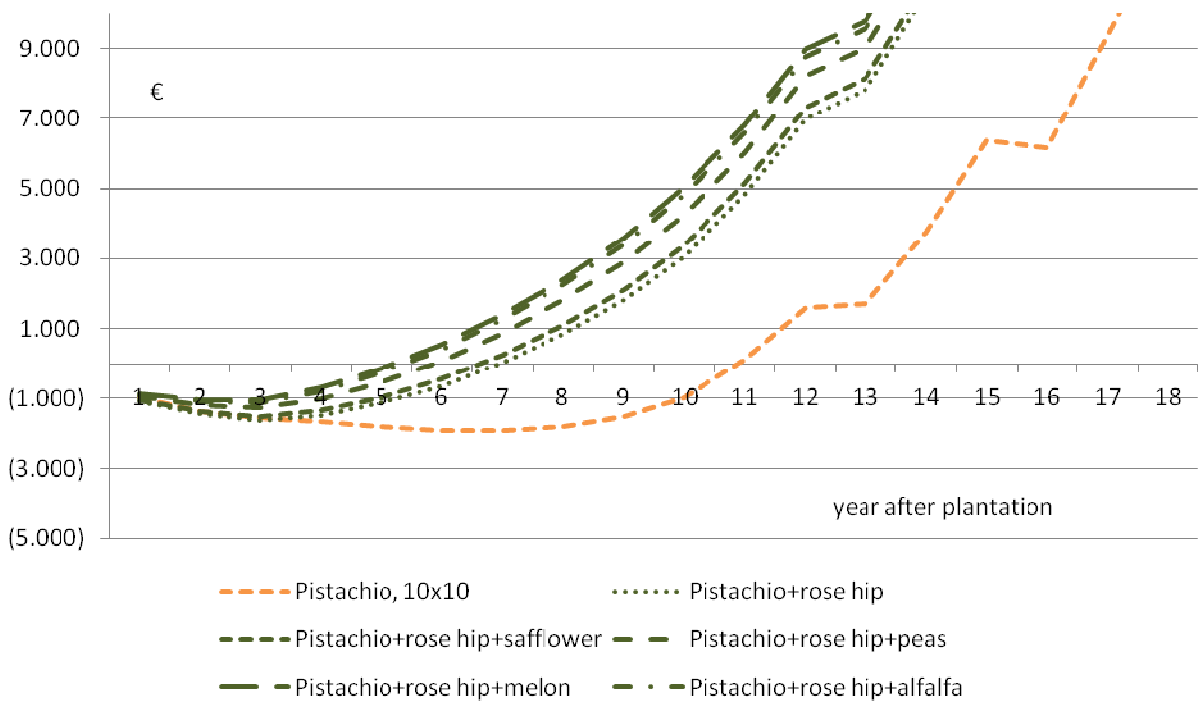


Chart 4 Expenses, revenue and cost-benefit balance of pistachio plantations and intercrops at plots of 10m x 10m

6. SUSTAINABILITY OF THE PROJECT

6.1. Financial sustainability

The cost-benefit analysis for pistachio growing in Tashkent province is showing that first earnings from pistachio growing will be gained in the seventh year (6m x 6m) or eight year (10m x 10m) after planting and full revenue of farmers' investments will be received after the tenth year (6m x 6m) or eleventh year (10m x 10m). A full reimbursement is reached much earlier if combined with intercrops. However, this does not apply for the overall investments of the project for equipment supply, workshops, national and international staffing as well as consulting services. These costs must be calculated as external investments that were not included into revenue calculations.

The sustainability of the financial prospects of a farmer investing in the frame of a project is envisaged to function by support of several pillars. First it is an external funding scheme provided by a donor as for instance currently planned a BMUB funded project phase II co-funded by SGP. Second it is an agreement with SGP national coordinator to support the initiative another two years after the BMUB funding came to an end (so three years all in all). Third it is an intrinsic interest of farmers to bridge the remaining years until first harvests start to gain profit from pistachio growing. In other words it would not make sense for a farmer to invest labour, money and time into pistachio growing if he or she would stop all activities after the project is ended. Fourth, and the most relevant pillar, is the diversification (agrobiodiversity) of crops and fruit tree species. The approach doesn't aim at a re-vegetation of pistachio only but also on growing other beneficial and native agricultural products, first in line as given in the cost-benefit analysis safflower, chick-peas, melon, alfalfa and rose-hip. But besides also trees and shrubs as vineyard, apricot, apple, almond, caper, poplar and agro fruits as maize, beans, pumpkins, potatoes or income from haymaking in a very patchy and small-scaled manner can be combined as well; even it was not considered in the cost-benefit analysis. While pistachio trees need to grow, other income from fruits and natural products is received at annual, bi-annual and longer-term harvests.

The calculations show, that for farmers who start to invest into pistachio growing the break-even point is settled with the seventh year (6m x 6m). Every single farmer who decides to invest into pistachio growing at his site under long-term lease conditions carries the full responsibility to bridge the years until first harvest. The approach that provides best mechanism to do so is diversification of crops that gain income in the years before first harvests. Besides each farmer receives information, know-how, planting material and support through:

1. Agricultural advisory services that the *points of growth* provide and which are to be established in the frame of project phase II;
2. The website (www.pistachio.uz) giving first insights for interested farmers and nearest contact persons in Russian und Uzbek language;
3. The detailed guidelines to be received either via the website or through the *points of growth* free of charge and in Russian and Uzbek language;
4. Ready calculations and business plans for different site conditions, published at the website and at the *points of growth* in Russian and Uzbek language;
5. Proper planting material provided by the *points of growth*;

In terms of further market chains there is a) an international market for pistachios as well as b) a national market that can easily absorb more pistachio fruits and thus decrease the need to import pistachios from Iran or Turkey which is currently in place. As a consequence Uzbekistan has the chance to become more independent from imports and safes resources.

To follow an export strategy it is necessary to develop market chains for international market supply with pistachio from Uzbekistan. A first approach is to get in contact with the representative of the delegation of German economy in Central Asia (www.zentralasien.ahk.de/) (AHK). In the frame of the project (phase I) interests in pistachio products from sustainable production were shown by a German company who market premium fair trade products as coffee, cocoa, chocolate and tea. A German-Uzbek PPP facilitated by GIZ Tashkent could be a

financial leverage to get such an approach started. The AHK could function as advisor on how to place a German company in the economy of Uzbekistan. Besides there is one national company on Fair-trade products in Uzbekistan (Pearls of Samarkand), producing high quality dried-fruits for international markets.

6.2. Ecologic sustainability

As already described in the project outline the negative impact of current land use practices of wheat production and livestock breeding in the rain-fed mountain belt of Uzbekistan on ecology, biodiversity, desertification and climate change are manifold and highly destructive. Current land use practices neglect any ability of natural processes to compensate human impact. Moreover the harvests and gains from current land use practices will become more and more uncertain and less profitable the longer they will be applied. Climate change is a fact taking place and prospects show increasing temperatures by remaining precipitation. The resilience of the rain-fed mountain belt ecosystem decreases undoubtedly if no change in land use takes place soon.

Pistachio and fruit tree growing as well as gardening provide a vegetation cover that combats desertification processes, as gully erosion, wind erosion, deflation and other erosive processes. In the arid climate conditions an all-season vegetation cover increases humidity, soil moisture and water retention in the soil surface layer. It has positive impact on ground water retention and at certain sites it prevents soil salinization (where it would occur). Pistachio is a drought-resilient tree and can grow in arid climate with 300 mm annual precipitation. It does not need additional watering except for the first two years. The diversification of agricultural crops through small-scale inter-row crops will lead to a much higher resilience. Agrobiodiversity will gain much more constant harvests. Suggested intercrops such as safflower, chick-peas, alfalfa don't need water either. Unpredictable external effects as uncertain weather events over the seasons may get compensated by different crops differently. A deficit of one crops harvest might get compensated by another crop that got not harmed for instance.

Stepping back from monoculture agriculture and getting into agrobiodiversity is also an initiative to diversify habitat conditions for insects, reptiles, birds and mammals. There are many species of high specialisation that will benefit from more diverse habitats, flowers, plants, pollen and general environmental conditions.

6.3. Aspects of carbon sequestration

The carbon sequestration potential of pistachio growing sites has been calculated in detail in the frame of the project (full documentation in supplement to the feasibility study). We know the area to become planted in a potential project phase II. Consequently we are able to calculate the carbon sequestration that is going to be initiated through project implementation. Since the project approach is not just to establish pistachio growing sites but to establish pistachio distribution centres in order to roll-out the ecosystem based land use change to all the naturally suitable habitats of Uzbekistan and abroad the carbon sequestration potential is much higher.

In this case we limit the calculation of the carbon sequestration rate to the (five) implementation sites (see chapter 4), only because this is what we can be certain about. Uncertain at the moment is how large the roll-out will become within the next years and decades. So a calculation for other areas would be done under uncertain assumptions.

The overall area going to be planted with pistachio by the five farmers investigated sums up to 23,5 ha. Considering a planting scheme based on natural pistachio growing conditions each hectare sequesters in its most active growing period of the first 40 years about 144 tC/ha.

Therefore the overall and direct carbon sequestration of a project phase II is 3,384 tC for the first 40 years. It is an equivalent of 2,093 flights of one person from Berlin to Tashkent via Istanbul and back in economy class (reference www.atmosfair.de). The same source offers the payment of 285.667 Euro to compensate an offsetting of that amount of carbon.

6.4. Aspects in terms of labour benefits

In the pilot site of Gallyaral in Dzhizzak province farmers calculate with two employees per hectare of land under pistachio to a) guard the area, b) water the first years the plants, c) construct fences, channels and other infrastructure and d) maintain the pistachio plantation.

At field visits to Tashkent province evidence was given that one family is responsible for the maintenance of between 0.5 ha – 1.5 ha of land under fruit trees and gardening plots.

In average we assume that conservatively one family can gain a constant annual income per ha under pistachio plantations. For project implementation phase II at the 23,5 ha involved this would result in income and employment generation for approx. 24 families which are long-termed as long as the plantations are cultivated.

6.5. Aspects on gender equity

For many rural areas of Uzbekistan an astronomic unemployment rate as well as a high rate of subsistence economy is common. It is a well-established mechanism for those families that men leave for seasonal work abroad, most of all to Russia and Kazakhstan. This implies for women that they carry the responsibility to care for the family, daily duties, food-, firewood- and water supply. Another side effect of seasonal migration is a destruction of ties among family members and long-lasting strains for the family, first in row for women.

As drafted in the prior paragraphs literally families are involved in pistachio site maintenance, thus men and women. The discussed approach provides incentives for families to remain in their home settlements near the pistachio growing sites and to care jointly for its maintenance. Trainings on pistachio growing are provided to man and woman, equally. The creation of jobs in the nearest surroundings of rural settlements strengthens family ties instead of threaten them and releases women from too many duties. A regular annual family income provides planning reliability and supports family planning as well. According to accepted research findings functioning family planning opportunities and facilities decrease fertility rates (which are currently very high in rural Uzbekistan) and a much better women's health, reflected in life expectancy as well as social and physical well being.

6.6. Legal aspects

The land code for agricultural land administered at hokimiyat level allows a land lease agreement of 49 years with option of extension and the practice of gardening. Therefore this is the optimal legal framework to be applied for a maximum of planning reliability for the farmer.

7. ANNEXES

7.1. *Annex I*

Questionnaire (uzbek)

**«Навли пистазорлар плантацияси қандай яратилади – Тошкент вилоятининг лалмикор ерларидан унумли фойдаланиш бўйича янги иқтисодий фойдали ечим» мавзuidaги семинар-тренинг учун сўров варақаси
Тошкент, 2014 йил 24 февраль**

1. Исмингиз, фамилиянингиз, отангизнинг исми
2. Ёшингиз
3. Фаолиятингиз тури
4. Контактлар (тел., e-mail):
5. Тоғ олди ҳудудида ер майдонингиз борми?
6. Хўжалигингиз жойлашган манзил
7. Ерингиз бўлса, неча гектар?
8. Ердан фойдаланишнинг ҳуқуқий асоси (томорқа хўжалиги, ижара, ўрмон хўжалиги ва ҳ.з.)
9. Ҳозирги пайтда бу ердан қандай фойдаланаяпсиз (деҳқончилик, чорвачилик ва б.)?
10. Сизни ердан фойдаланиш усули ва бундан олинадиган даромад қаноатлантирадими?
11. Ердан фойдаланиш усуллари ўзгартириш ниятингиз борми, қай тарзда ва бу нима учун керак?
12. Мазкур семинарда иштирок этгандан сўнг ерингизда пистазор плантациясини яратиш нияти пайдо бўлди?

Жавобларингиз учун катта раҳмат!

Сизда ерингизда пистазор плантациясини яратиш нияти пайдо бўлган бўлса, яна бир неча саволимизга жавоб беришингизни сўраймиз.

- 1.1. Ерингиз денгиз сатҳидан қандай баландликда жойлашганини биласизми?
- 1.2. Ерингизда ёки яқин атрофда табиий равишда ўсаётган писта дарахтлари борми?
- 1.3. Атрофингизда жойларнинг номида «пистали» деб аталадиганлари учрайдими?
- 1.4. Нима учун сизда пистазорлар плантациясини яратиш нияти пайдо бўлди?
- 1.5. Ерингизда деҳқончилик қилиш усулини ўзгартириш ҳуқуқига эгамисиз? Бундай ҳуқуқингиз бўлмас а, пистазорлар плантациясини яратишга рухсат олиш имкониятини борми?

Ерингизда деҳқончилик қилиш усулини ўзгартириш ҳуқуқингиз бўлмаса, пистазорлар плантациясини яратишга рухсат олиш имкониятингиз бўлмаса,

Жавобларингиз учун катта раҳмат!

Ерингизда деҳқончилик қилиш усулини ўзгартириш ҳуқуқингиз бўлса, яна бир неча саволимизга жавоб беришингизни сўраймиз:

1.6. Пистазорлар плантацияларига неча гектар ер ажратмоқчисиз?

1.7. Қишлоқ хўжалиги техникасига (трактор, плуг ва б.) эгамисиз ?

1.8. Пистазорлар плантацияларини яратишга ўз маблағларингизни сарфлашга тайёрмисиз?

1.9. Пистазорлар плантациялари пайҳон қилинмаслиги учун атрофида тўсиқ ўрнатишга тайёрмисиз?

1.10. Пистазорлар плантациялари даромад келтиргунча 8-10 йил кутишга тайёрмисиз?

1.11. Пистазорлар плантациялари яратилаётган ерлардан моддий даромад олишни тезлаштириш бўйича фикрларингиз борми?

1.12. Пистазорлар плантацияларини яратиш бўйича ишлар юзасидан қандай ёрдам олишни истайсиз?

1.13. Фикрингизча, пистачиликни ривожлантиришга давлат томонидан қандай ёрдам кўрсатилиши мумкин?

1.12. Ерларингизда навли саноат пистазорларини етиштиришдан ташқари навли писта дарахтлари тўпламини, айрим нав/шакллар бўйича пайвандлаш материалларини олиш учун оналик плантациясини яратишга тайёрмисиз?

1.13. Агарда тайёр бўлсангиз, хўжалигингиз асосида пистачилик бўйича тренинг и консалтинг марказини яратишга тайёрмисиз?

1.14. Сиз ва ходимларингиз келгусида пистазорлар плантацияларини яратиш бўйича тренер-маслаҳатчи бўлишга тайёрмисизлар?

Бирон бир савол тушунарли бўлмаса, муурожаат этинг.

Мулоқот учун:

Манзарали боғдорчилик ва ўрмон хўжалиги республика илмий-ишлаб чиқариш маркази

Евгений Константинович Ботман – лойиҳа раҳбари,
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7.2. Annex II

Tables of the cost-benefit analysis

Feasibility study for the establishment of pistachio growing centers in Tashkent province

	Number of planting seats	280		Scheme	6x6		
Time	Actions for establishing pistachio plantation	Unit	Amount	Price per unit, UZS	Total costs, UZS/ha	Total costs, Euro/ha (exchange rate July 2014)	Comments
1st year					4.807.727	1.526,75 €	
1	Solid tillage on the slopes 3-5°				307.500	97,65 €	
1,1	Ploughing	times	1		205.000	65,10 €	
	Rent of tractor	times	1	100000	100.000	31,76 €	
	Diesel	L	30	3500	105.000	33,34 €	30 L/ha
1,2	Chiseling and harrowing (at the same time) ploughed soil	times	1		102.500	32,55 €	
	Rent of tractor	times	1	50000	50.000	15,88 €	
	Diesel	L	15	3500	52.500	16,67 €	15 L/ha
2	Stripe preparation of the soil on the slopes with 8-12°.				55.350	17,58 €	
2,1	Area of tillage	ha	0,18		36.900	11,72 €	With the width of stripe 105 cm (3 size of plough) area of ploughing per 1 ha will be 1,05x100x17=1800 or 0,18 ha
	Rent of tractor	times	1	100000	18.000	5,72 €	
	Diesel	L	5,4	3500	18.900	6,00 €	30 L/ha
2,2	Chiseling and harrowing (at the same time) ploughed soil	times	1		18.450	5,86 €	
	Area of tillage	ha	0,18			0,00 €	
	Rent of tractor	times	1	50000	9.000	2,86 €	
	Diesel	L	2,7	3500	9.450	3,00 €	15 L/ha
3	Terraced on the site with slopes up to 8-15°	times	1		271.800	86,31 €	Done by tractor with 4-times ploughing in one direction with earthboard downhill
3,1	Area of tillage	ha	0,24		247.200	78,50 €	With the width of stripe 140 cm (4 size of plough) area of ploughing per 1 ha will be 1,4x100x17=2400 or 0,24 ha

Feasibility study for the establishment of pistachio growing centers in Tashkent province

	Rent of tractor	times	4	24000	96.000	30,49 €	
	Diesel	L	43,2	3500	151.200	48,02 €	30 L/ha. 17 times of idling to the beginning of terrace increase fuel consumption by 1,5 times
3,2	Chiseling and harrowing (at the same time) ploughed soil	times	1		24.600	7,81 €	
	Area of tillage	ha	0,24		24.600	7,81 €	
	Rent of tractor	times	1	50000	12.000	3,81 €	
	Diesel	L	3,6	3500	12.600	4,00 €	15 L/ha
4	Preplanting activity				1.415.000	449,35 €	
4,1	Preparation of the soil for planting/sowing	times	1		280.000	88,92 €	Size of planting grounds 1x1 m with reverse slope (for slopes more then 20°)
	Planting grounds	pcs	280			0,00 €	
	Labour	m-days	11,2	25000	280.000	88,92 €	For 8-hour working day 1 worker can make 25 planting grounds
4,2	Fencing from material at hand				500.000	158,78 €	
	Length of fence	metre	400			0,00 €	The fence will be made from material at hand – wooden sticks with the height 1.5 m put every 2 m. 2-meters sections made from twigs and branches are attached to the wooden sticks and tied with whips. For 1 ha we need 400 m of fence or 200 wooden sticks and 200 sections 2 m each.
	Labour	m-days	20	25000	500.000	158,78 €	Average norm 1 m-d=20 m of fence
4,3	Marking the plot and installing landmarks				215.000	68,28 €	
	Labour	m-days	3	25000	75.000	23,82 €	Average norm 3 m-d for 1 ha
	Landmarks	pcs	280	500	140.000	44,46 €	Depends on the scheme we need from 100 to 280 landmarks per 1 ha. Price is average.
4,4	Dog rose				245.000	77,80 €	
	Purchase of dog rose seedlings	pcs	400	300	120.000	38,11 €	For creation of natural thorny fence
	Labour	m-days	5	25000	125.000	39,70 €	80 seedlings = 1 m-d
4,5	Creating of irrigation channels				175.000	55,57 €	For better survival rate it is recommended to water during first year.

Feasibility study for the establishment of pistachio growing centers in Tashkent province

	Labour	m-days	7	25000	175.000	55,57 €	Manual digging of irrigation channels needs 5-8 m-d/ha and depends on the landscape
5	Fertilization				215.551	68,45 €	Preparation of planting ground consists for planting/sowing of following steps: purchasing manure, distribution to the planting grounds, digging it over, purchasing mineral fertilizers and its application.
5,1	Manure				170.751	54,22 €	
	Purchase of manure	cub.m	0,84	60000	50.400	16,01 €	Needs in manure for 280 trees are – 0,003m3x280=0,84 м3
	Fertilization	m-days	1,9	25000	46.667	14,82 €	Depends on the landscape for 1 working day a worker can distribute manure to about 150 planting grounds.
	Digging manure over	m-days	3	25000	73.684	23,40 €	One worker can dig the manure over in 90-100 holes (30x30 cm) per 1 day.
5,2	Mineral fertilizer				44.800	14,23 €	
	ammophos	kg	14	1200	16.800	5,34 €	50 g per 1 planting ground
	carbamide	kg	14	1600	22.400	7,11 €	50 g per 1 planting ground
	potassium	kg	7	800	5.600	1,78 €	25 g per 1 planting ground
6	Seedlings				927.500	294,54 €	Establishing pistachio plantation via planting seedlings in containers.
	Purchase of seedlings	pcs	280	3000	840.000	266,75 €	1 seedling for 1 planting ground
	Labour	m-days	3,5	25000	87.500	27,79 €	Planting pistachio seedlings with mineral fertilizers distribution - 80 seedlings = 1m-d
7	Afterplanting activity				1.177.960	374,07 €	
7,1	Watering via irrigation channels	times	5		875.000	277,87 €	Afterplanting water and at least 4 vegetation water.
	Labour	m-days	7	25000	175.000	55,57 €	about 7 m-d per 1 ha
7,2	Molder of soil	times	4		280.000	88,92 €	After every watering (at least 4 per season) we need to do tillage with removal of pests on the planting ground with the size 1 m2
	Labour	m-days	2,8	25000	70.000	22,23 €	1 m-d per 100 m2
7,3	Fire line	times	2		22.960	7,29 €	It is necessary to make fire line twice a season around the plot.
	Area of tillage	ha	0,056			0,00 €	The fire line is made by plough with the width 1,4 m. The perimeter is 400 m.
	Rent of tractor	times	1	100000	5.600	1,78 €	

Feasibility study for the establishment of pistachio growing centers in Tashkent province

	Diesel	L	1,68	3500	5.880	1,87 €	30 L/ha
8	Other expenses	UZS	1	437066	437.066	138,80 €	10 % of all costs
						0,00 €	
2nd year					1.499.806	476,28 €	
1	Seedlings				185.500	58,91 €	Additional planting instead of lost plants (with survival rate 80%).
	Purchase of seedlings (instead of lost)	pcs	56	3000	168.000	53,35 €	
	Labour	m-days	0,7	25000	17.500	5,56 €	80 seedlings = 1 m-d
2	Watering via irrigation channels	times	5		875.000	277,87 €	
	Labour	m-days	7	25000	175.000	55,57 €	
3	Molder of soil	times	4		280.000	88,92 €	
	Labour	m-days	2,8	25000	70.000	22,23 €	
4	Fire line	times	2		22.960	7,29 €	
	Area of tillage	ha	0,056			0,00 €	
	Rent of tractor	times	1	100000	5.600	1,78 €	
	Diesel	L	1,68	3500	5.880	1,87 €	30 L/ha
5	Other expenses	UZS	1	136346	136.346	43,30 €	10 % of all costs
						0,00 €	
3th year					973.500	309,15 €	
1	Molder of soil	times	4		280.000	88,92 €	
	Labour	m-days	2,8	25000	70.000	22,23 €	
2	Inoculation	times	2		380.000	120,67 €	Each tree has to get 2 inoculations.
	Purchase of grafts for inoculation	pcs	56	1500	84.000	26,68 €	Each graft has at least 5 suitable buds for inoculation. The price is approximate.
	Inoculation	times	280	200		17,78 €	The cost for one inoculation

Feasibility study for the establishment of pistachio growing centers in Tashkent province

					56.000		
	Transportation	times	1	50000	50.000	15,88 €	Depends on distance from mother plantation. The cost is approximate.
3	<i>Crown caring</i>	times	3		225.000	71,45 €	Including revision of inoculation
	Labour	m-days	3	25000	75.000	23,82 €	3 m-d per 1 ha
4	Other expenses	UZS	1	88500	88.500	28,10 €	10 % of all costs
						0,00 €	
4th year					580.756	184,43 €	And further years
1	<i>Molder of soil</i>	times	4		280.000	88,92 €	
	Labour	m-days	2,8	25000	70.000	22,23 €	
2	<i>Fire line</i>	times	2		22.960	7,29 €	
	Area of tillage	ha	0,056			0,00 €	
	Rent of tractor	times	1	100000	5.600	1,78 €	
	Diesel	L	1,68	3500	5.880	1,87 €	30 L/ha
3	<i>Crown caring</i>	times	3		225.000	71,45 €	
	Labour	m-days	3	25000	75.000	23,82 €	
4	Other expenses	UZS	1	52796	52.796	16,77 €	10 % of all costs

Table 1 Expenses for 6m x 6m plots

Feasibility study for the establishment of pistachio growing centers in Tashkent province

	Number of planting seats	100		Scheme	10x10		
Time	Actions for establishing pistachio plantation	Unit	Amount	Price per unit, UZS	Total costs, UZS/ha	Total costs, Euro/ha (exchange rate July 2014)	Примечания
1st year					3.356.174	1.065,79 €	
1	Solid tillage on the slopes 3-5°				307.500	97,65 €	
1,1	Ploughing	times	1		205.000	65,10 €	
	Rent of tractor	times	1	100000	100.000	31,76 €	
	Diesel	L	30	3500	105.000	33,34 €	30 L/ha
1,2	Chiseling and harrowing (at the same time) ploughed soil	times	1		102.500	32,55 €	
	Rent of tractor	times	1	50000	50.000	15,88 €	
	Diesel	L	15	3500	52.500	16,67 €	15 L/ha
2	Stripe preparation of the soil on the slopes with 8-12o.				33.825	10,74 €	
2,1	Area of tillage	ha	0,11		22.550	7,16 €	With the width of stripe 105 cm (3 size of plough) area of ploughing per 1 ha will be 1,05x100x17=1800 or 0,18 ha
	Rent of tractor	times	1	100000	11.000	3,49 €	
	Diesel	L	3,3	3500	11.550	3,67 €	30 L/ha
2,2	Chiseling and harrowing (at the same time) ploughed soil	times	1		11.275	3,58 €	
	Area of tillage	ha	0,11			0,00 €	
	Rent of tractor	times	1	50000	5.500	1,75 €	
	Diesel	L	1,65	3500	5.775	1,83 €	15 L/ha
3	Terraced on the site with slopes up to 8-15°	times	1		158.550	50,35 €	Done by tractor with 4-times ploughing in one direction with earthboard downhill
3,1	Area of tillage	ha	0,14		144.200	45,79 €	With the width of stripe 140 cm (4 size of plough) area of ploughing per 1 ha will be 1,4x100x17=2400 or 0,24 ha
	Rent of tractor	times	4	14000		17,78 €	

Feasibility study for the establishment of pistachio growing centers in Tashkent province

					56.000		
	Diesel	L	25,2	3500	88.200	28,01 €	30 L/ha. 17 times of idling to the beginning of terrace increase fuel consumption by 1.5 times
3,2	Chiseling and harrowing (at the same time) ploughed soil	times	1		14.350	4,56 €	
	Area of tillage	ha	0,14		14.350	4,56 €	
	Rent of tractor	times	1	50000	7.000	2,22 €	
	Diesel	L	2,1	3500	7.350	2,33 €	15 L/ha
4	Preplanting activity				1.145.000	363,61 €	
4,1	Preparation of the soil for planting/sowing	times	1		100.000	31,76 €	Size of planting grounds 1x1 m with reverse slope (for slopes more then 20°)
	Planting grounds	pcs	100			0,00 €	
	Labour	m-days	4	25000	100.000	31,76 €	For 8-hour working day 1 worker can make 25 planting grounds
4,2	Fencing from material at hand				500.000	158,78 €	
	Length of fence	metre	400			0,00 €	The fence will be made from material at hand – wooden sticks with the height 1.5 m put every 2 m. 2-meters sections made from twigs and branches are attached to the wooden sticks and tied with whips. For 1 ha we need 400 m of fence or 200 wooden sticks and 200 sections 2 m each.
	Labour	m-days	20	25000	500.000	158,78 €	Average norm 1 m-d=20 m of fence
4,3	Marking the plot and installing landmarks				125.000	39,70 €	
	Labour	m-days	3	25000	75.000	23,82 €	Average norm 3 m-d for 1 ha
	Landmarks	pcs	100	500	50.000	15,88 €	Depends on the scheme we need from 100 to 280 landmarks per 1 ha. Price is average.
4,4	Dog rose				245.000	77,80 €	
	Purchase of dog rose seedlings	pcs	400	300	120.000	38,11 €	For creation of natural thorny fence
	Labour	m-days	5	25000	125.000	39,70 €	80 seedlings = 1 m-d
4,5	Creating of irrigation channels				175.000	55,57 €	For better survival rate it is recommended to water during first year.
	Labour	m-days	7	25000	175.000	55,57 €	Manual digging irrigation channels we ned 5-8 m-d/ha depends on the landscape
5	Fertilization				76.982	24,45 €	Preparation of planting ground consists for planting/sowing of following steps: purchasing manure, distribution to the planting grounds, digging it over, purchasing mineral fertilizers and its application.

Feasibility study for the establishment of pistachio growing centers in Tashkent province

5,1	Manure				60.982	19,37 €	
	Purchase of manure	cub.m	0,3	60000	18.000	5,72 €	Needs in manure for 100 trees are – 0,003m3x100=0,3 м3
	Fertilization	m-days	0,7	25000	16.667	5,29 €	Depends on the landscape for 1 working day a worker can distribute manure to about 150 planting grounds.
	Manure preparation	m-days	1	25000	26.316	8,36 €	One worker can dig the manure over in 90-100 holes (30x30 cm) per 1 day.
5,2	Mineral fertilizer				16.000	5,08 €	
	ammophos	kg	5	1200	6.000	1,91 €	50 g per 1 planting ground
	carbamide	kg	5	1600	8.000	2,54 €	50 g per 1 planting ground
	potassium	kg	2,5	800	2.000	0,64 €	25 g per 1 planting ground
6	Seedlings				331.250	105,19 €	Establishing pistachio plantation via planting seedlings in containers.
	Purchase of seedlings	pcs	100	3000	300.000	95,27 €	1 seedling for 1 planting ground
	Labour	m-days	1,25	25000	31.250	9,92 €	Planting pistachio seedlings with mineral fertilizers distribution - 80 seedlings = 1m-d
7	Afterplanting activity				997.960	316,91 €	
7,1	Watering via irrigation channels	times	5		875.000	277,87 €	Afterplanting water and at least 4 vegetation water.
	Labour	m-days	7	25000	175.000	55,57 €	about 7 m-d per 1 ha
7,2	Molder of soil	times	4		100.000	31,76 €	After every watering (at least 4 per season) we need to do tillage with removal of pests on the planting ground with the size 1 m2
	Labour	m-days	1	25000	25.000	7,94 €	1 m-d per 100 m2
7,3	Fire line	times	2		22.960	7,29 €	It is necessary to make fire line twice a season around the plot.
	Area of tillage	ha	0,056			0,00 €	The fire line is made by plough with the width 1,4 m. The perimeter is 400 m.
	Rent of tractor	times	1	100000	5.600	1,78 €	
	Diesel	L	1,68	3500	5.880	1,87 €	30 L/ha
8	Other expenses	UZS	1	305107	305.107	96,89 €	10 % of all costs
						0,00 €	
2nd year					1.170.631	371,75 €	

Feasibility study for the establishment of pistachio growing centers in Tashkent province

1	Seedlings				66.250	21,04 €	Additional planting instead of lost plants (with survival rate 80%).
	Purchase of seedlings (instead of dead)	pcs	20	3000	60.000	19,05 €	
	Labour	m-days	0,25	25000	6.250	1,98 €	80 seedlings = 1 m-d
2	Watering via irrigation channels	times	5		875.000	277,87 €	
	Labour	m-days	7	25000	175.000	55,57 €	
3	Molder of soil	times	4		100.000	31,76 €	
	Labour	m-days	1	25000	25.000	7,94 €	
4	Fire line	times	2		22.960	7,29 €	
	Area of tillage	ha	0,056			0,00 €	
	Rent of tractor	times	1	100000	5.600	1,78 €	
	Diesel	L	1,68	3500	5.880	1,87 €	30 L/ha
5	Other expenses	UZS	1	106421	106.421	33,80 €	10 % of all costs
						0,00 €	
3th year					577.500	183,39 €	
1	Molder of soil	times	4		100.000	31,76 €	
	Labour	m-days	1	25000	25.000	7,94 €	
2	Inoculation	times	2		200.000	63,51 €	Each tree has to get 2 inoculations.
	Purchase of grafts for inoculation	pcs	20	1500	30.000	9,53 €	Each graft has at least 5 suitable buds for inoculation. The price is approximate.
	Inoculation	times	100	200	20.000	6,35 €	The cost for one inoculation
	Transportatio	times	1	50000	50.000	15,88 €	Depends on distance from mother plantation. The cost is approximate.
3	Crown caring	times	3		225.000	71,45 €	Including revision of inoculation
	Labour	m-days	3	25000	75.000	23,82 €	3 m-d per 1 ha
4	Other expenses	UZS	1	52500	52.500	16,67 €	10 % of all costs

Feasibility study for the establishment of pistachio growing centers in Tashkent province

						0,00 €	
4th year					382.756	121,55 €	And further years
1	Molder of soil	times	4		100.000	31,76 €	
	Labour	m-days	1	25000	25.000	7,94 €	
2	Fire line	times	2		22.960	7,29 €	
	Area of tillage	ha	0,056			0,00 €	
	Rent of tractor	times	1	100000	5.600	1,78 €	
	Diesel	L	1,68	3500	5.880	1,87 €	30 L/ha
3	Crown caring	times	3		225.000	71,45 €	
	Labour	m-days	3	25000	75.000	23,82 €	
4	Other expenses	UZS	1	34796	34.796	11,05 €	10 % of all costs

Table 2 Expenses for 10m x 10m plots

Feasibility study for the establishment of pistachio growing centers in Tashkent province

6	Planting seedlings (labour)	27,79 €																	
6	Purchase of seedlings (instead of lost)		53,35 €																
6	Planting seedlings (labour)		5,56 €																
7	Afterplanting activity	374,07 €	374,07 €	88,92 €	96,21 €	96,21 €	96,21 €	96,21 €	96,21 €	96,21 €	96,21 €	96,21 €	96,21 €	96,21 €	96,21 €	96,21 €	96,21 €	96,21 €	96,21 €
7	Watering via irrigation channels	277,87 €	277,87 €																
7	Molder of soil	88,92 €	88,92 €	88,92 €	88,92 €	88,92 €	88,92 €	88,92 €	88,92 €	88,92 €	88,92 €	88,92 €	88,92 €	88,92 €	88,92 €	88,92 €	88,92 €	88,92 €	88,92 €
7	Fire line	7,29 €	7,29 €		7,29 €	7,29 €	7,29 €	7,29 €	7,29 €	7,29 €	7,29 €	7,29 €	7,29 €	7,29 €	7,29 €	7,29 €	7,29 €	7,29 €	7,29 €
8	Inoculation			120,67 €															
9	Crown caring			71,45 €	71,45 €	71,45 €	71,45 €	71,45 €	71,45 €	71,45 €	71,45 €	71,45 €	71,45 €	71,45 €	71,45 €	71,45 €	71,45 €	71,45 €	71,45 €
10	Other expenses	138,80 €	43,30 €	28,10 €	16,77 €	16,77 €	16,77 €	16,77 €	16,77 €	16,77 €	16,77 €	16,77 €	16,77 €	16,77 €	16,77 €	16,77 €	16,77 €	16,77 €	16,77 €
11	Harvesting																		
	Total cost	1.449,94 €	478,28 €	312,15 €	188,43 €	189,43 €	190,43 €	191,43 €	192,43 €	193,43 €	232,53 €	233,53 €	247,24 €	260,94 €	274,64 €	199,43 €	390,96 €	404,66 €	418,37 €
	Note: Costs for planting dog rose are not included into total cost of pistachio and shown separately. It was done in case dog-rose will not be planted.																		

Table 3 summary 6x6

Feasibility study for the establishment of pistachio growing centers in Tashkent province

7,2	Molder of soil	31,76 €	31,76 €	31,76 €	31,76 €	31,76 €	31,76 €	31,76 €	31,76 €	31,76 €	31,76 €	31,76 €	31,76 €	31,76 €	31,76 €	31,76 €	31,76 €	32	32	32
7,3	Fire line	7,29 €	7,29 €		7,29 €	7,29 €	7,29 €	7,29 €	7,29 €	7,29 €	7,29 €	7,29 €	7,29 €	7,29 €	7,29 €	7,29 €	7,29 €	7	7	7
8	Inoculation			63,51 €																
9	Crown caring			71,45 €	71,45 €	71,45 €	71,45 €	71,45 €	71,45 €	71,45 €	71,45 €	71,45 €	71,45 €	71,45 €	71,45 €	71,45 €	71,45 €	71	71	71
10	Other expenses	96,89 €	33,80 €	16,67 €	11,05 €	11,05 €	11,05 €	11,05 €	11,05 €	11,05 €	11,05 €	11,05 €	11,05 €	11,05 €	11,05 €	11,05 €	11,05 €	11	11	11
11	Harvesting										38,11 €	38,11 €	50,81 €	63,51 €	76,21 €			191	203	216
	Total cost	987,99 €	371,75 €	183,39 €	121,55 €	121,55 €	121,55 €	121,55 €	121,55 €	121,55 €	159,66 €	159,66 €	172,36 €	185,06 €	197,76 €	121,55 €		312	325	337

Note: Costs for planting dog rose are not included into total cost of pistachio and show separately. It was done in case dog-rose will not be planted.

Table 4 summary 10m x 10m

Feasibility study for the establishment of pistachio growing centers in Tashkent province

Costs for intercrops before full fruiting of pistachio trees

2010 year

Name	Used area from 1 ha	Seeds		Sowing	Min. fertilizers	Caring, weeding	Harvesting	Cleaning the field from vegetation remains	Total costs	
		kg/ha	€/kg							€/ha
Safflower	75%	10	0,25 €	1,91 €	4,76 €	29,77 €	7,94 €	6,35 €	4,76 €	55,49 €
Chick-peas	75%	50	0,79 €	29,77 €	4,76 €	29,77 €	7,94 €	6,35 €	4,76 €	83,36 €
(Water) melon	75%	4	1,59 €	4,76 €	9,53 €	25,72 €	15,88 €	15,88 €	9,53 €	81,30 €
Alfalfa	75%	20	0,48 €	7,15 €	6,67 €	35,73 €	0,00 €	12,70 €	0,00 €	62,24 €

Average rate of price growth from 2010 to 2014

2

2014 year

Name	Used area from 1 ha	Seeds		Sowing	Min. fertilizers	Caring, weeding	Harvesting	Cleaning the field from vegetation remains	Total costs	
		kg/ha	€/kg							€/ha
Safflower	75%	10	0,51 €	3,81 €	9,53 €	59,54 €	15,88 €	12,70 €	9,53 €	110,99 €
Chick-peas	75%	50	1,59 €	59,54 €	9,53 €	59,54 €	15,88 €	12,70 €	9,53 €	166,72 €
(Water) melon	75%	4	3,18 €	9,53 €	19,05 €	51,44 €	31,76 €	31,76 €	19,05 €	162,59 €
Alfalfa	75%	20	0,95 €	14,29 €	13,34 €	71,45 €	0,00 €	25,40 €	0,00 €	124,48 €
Rose hip					77,80 €			95,27 €		77,80 €

Table 5 calculation of intercrops

Feasibility study for the establishment of pistachio growing centers in Tashkent province

		988	373	185	123	124	124	124	125	125	165	166	180	194	208	129	331	346	361
	Safflower	111	111	112	112	113	113	114	114	115	115								
	Chick-peas	167	167	168	169	169	170	171	171	172	173								
	(Water) melon	163	163	164	165	165	166	167	167	168	169								
	Alfalfa	124	125	125	126	126	127	128	128	129	129								
	Dog rose	78			39	68	87	98	98	98	99	99	100	100	100	101	101	102	102
6x6	Pistachio+rose hip	1.528	480	315	229	260	282	294	296	298	340	342	358	374	390	312	516	533	550
	Pistachio+rose hip+safflower	1.639	592	427	342	373	395	407	410	413	455	342	358	374	390	312	516	533	550
	Pistachio+rose hip+peas	1.694	648	483	398	430	452	464	467	470	513	342	358	374	390	312	516	533	550
	Pistachio+rose hip+melon	1.690	643	479	394	425	448	460	463	466	508	342	358	374	390	312	516	533	550
	Pistachio+rose hip+alfalfa	1.652	605	440	355	387	409	421	424	427	469	342	358	374	390	312	516	533	550
10x10	Pistachio+rose hip	1.066	373	185	162	191	211	222	223	224	264	265	280	294	309	229	432	448	463
	Pistachio+rose hip+safflower	1.177	485	297	274	304	325	336	337	338	379	265	280	294	309	229	432	448	463
	Pistachio+rose hip+peas	1.233	541	353	330	361	382	393	394	396	437	265	280	294	309	229	432	448	463
	Pistachio+rose hip+melon	1.228	536	349	326	356	377	389	390	392	433	265	280	294	309	229	432	448	463
	Pistachio+rose hip+alfalfa	1.190	498	310	288	318	338	350	351	352	393	265	280	294	309	229	432	448	463
	accumulated profit Euro	Period																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	Pistachio, 6x6	(1.450)	(1.930)	(2.245)	(2.435)	(2.628)	(2.822)	(2.690)	(2.230)	(1.273)	477	3.732	8.156	8.722	14.838	22.244	22.169	31.632	41.462

Feasibility study for the establishment of pistachio growing centers in Tashkent province

	Pistachio, 10x10	(988)	(1.361)	(1.546)	(1.669)	(1.793)	(1.917)	(1.924)	(1.814)	(1.526)	(981)	102	1.595	1.700	3.780	6.371	6.161	9.349	12.659
6x6	Pistachio+rose hip	(1.528)	(2.008)	(2.323)	(2.243)	(1.961)	(1.543)	(729)	418	2.063	4.504	8.453	13.574	14.840	21.659	29.769	30.402	40.577	51.120
	Pistachio+rose hip+safflower	(1.496)	(1.944)	(2.226)	(2.115)	(1.801)	(1.350)	(502)	677	2.355	4.829	8.778	13.899	15.165	21.984	30.094	30.727	40.902	51.445
	Pistachio+rose hip+peas	(1.409)	(1.769)	(1.964)	(1.764)	(1.361)	(822)	115	1.384	3.152	5.717	9.666	14.787	16.052	22.871	30.982	31.615	41.789	52.333
	Pistachio+rose hip+melon	(1.333)	(1.618)	(1.736)	(1.460)	(980)	(364)	651	1.997	3.843	6.486	10.435	15.556	16.822	23.641	31.751	32.384	42.559	53.102
	Pistachio+rose hip+alfalfa	(1.355)	(1.661)	(1.801)	(1.546)	(1.088)	(494)	499	1.823	3.647	6.268	10.217	15.338	16.604	23.423	31.533	32.166	42.341	52.884
10x10	Pistachio+rose hip	(1.066)	(1.439)	(1.624)	(1.477)	(1.126)	(638)	38	834	1.810	3.047	4.824	7.013	7.818	10.600	13.897	14.395	18.294	22.317
	Pistachio+rose hip+safflower	(1.034)	(1.375)	(1.528)	(1.349)	(965)	(444)	264	1.093	2.102	3.372	5.149	7.338	8.143	10.925	14.222	14.720	18.619	22.642
	Pistachio+rose hip+peas	(947)	(1.200)	(1.265)	(998)	(526)	84	881	1.800	2.899	4.259	6.036	8.225	9.031	11.813	15.109	15.607	19.506	23.529
	Pistachio+rose hip+melon	(871)	(1.049)	(1.038)	(694)	(145)	542	1.417	2.413	3.590	5.029	6.806	8.995	9.800	12.582	15.879	16.377	20.276	24.299
	Pistachio+rose hip+alfalfa	(893)	(1.092)	(1.102)	(780)	(253)	412	1.265	2.239	3.394	4.810	6.588	8.777	9.582	12.364	15.661	16.159	20.057	24.080
	Profit, Euro	Period																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	Pistachio, 6x6	(1.450)	(480)	(315)	(191)	(192)	(194)	132	460	957	1.750	3.255	4.424	566	6.117	7.405	(75)	9.464	9.830
	Pistachio, 10x10	(988)	(373)	(185)	(123)	(124)	(124)	(7)	110	288	546	1.083	1.492	106	2.080	2.592	(210)	3.188	3.309
	Safflower	32	32	32	32	32	33	33	33	33	33								
	Chick-peas	119	120	120	121	121	121	122	122	123	123								
	(Water) melon	195	195	196	197	198	199	199	200	201	202								
	Alfalfa	173	174	175	175	176	177	177	178	179	180								
	Dog rose	(78)	-	-	270	474	612	683	686	689	691	694	697	700	702	705	708	711	714
6x6	Pistachio+rose hip	(1.528)	(480)	(315)	79	282	418	815	1.146	1.646	2.441	3.949	5.121	1.265	6.819	8.111	633	10.175	10.543
	Pistachio+rose hip+safflower	(1.496)	(448)	(282)	112	314	451	848	1.179	1.678	2.474	3.949	5.121	1.265	6.819	8.111	633	10.175	10.543

Feasibility study for the establishment of pistachio growing centers in Tashkent province

	Pistachio+rose hip+peas	(1.409)	(361)	(195)	200	403	540	937	1.269	1.768	2.565	3.949	5.121	1.265	6.819	8.111	633	10.175	10.543
	Pistachio+rose hip+melon	(1.333)	(285)	(118)	276	480	617	1.014	1.346	1.847	2.643	3.949	5.121	1.265	6.819	8.111	633	10.175	10.543
	Pistachio+rose hip+alfalfa	(1.355)	(306)	(140)	255	458	595	992	1.324	1.824	2.621	3.949	5.121	1.265	6.819	8.111	633	10.175	10.543
10x10	Pistachio+rose hip	(1.066)	(373)	(185)	147	351	488	676	796	976	1.237	1.777	2.189	805	2.782	3.297	498	3.899	4.023
	Pistachio+rose hip+safflower	(1.034)	(341)	(153)	179	383	521	708	829	1.009	1.270	1.777	2.189	805	2.782	3.297	498	3.899	4.023
	Pistachio+rose hip+peas	(947)	(254)	(65)	267	472	610	798	918	1.099	1.360	1.777	2.189	805	2.782	3.297	498	3.899	4.023
	Pistachio+rose hip+melon	(871)	(178)	11	344	549	687	875	996	1.177	1.439	1.777	2.189	805	2.782	3.297	498	3.899	4.023
	Pistachio+rose hip+alfalfa	(893)	(199)	(10)	322	527	665	853	974	1.155	1.416	1.777	2.189	805	2.782	3.297	498	3.899	4.023
	Profitability %	Period																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	Pistachio, 6x6	-100%	-100%	-100%	-100%	-100%	-100%	67%	233%	479%	726%	1339%	1713%	207%	2115%	3512%	-18%	2194%	2195%
	Pistachio, 10x10	-100%	-100%	-100%	-100%	-100%	-100%	-6%	88%	229%	330%	652%	829%	54%	998%	2016%	-63%	921%	916%
	Safflower	29%	29%	29%	29%	29%	29%	29%	29%	29%	29%								
	Chick-peas	71%	71%	71%	71%	71%	71%	71%	71%	71%	71%								
	(Water) melon	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%								
	Alfalfa	139%	139%	139%	139%	139%	139%	139%	139%	139%	139%								
	Dog rose	-100%			700%	700%	700%	700%	700%	700%	700%	700%	700%	700%	700%	700%	700%	700%	700%
6x6	Pistachio+rose hip	-100%	-100%	-100%	35%	108%	148%	277%	387%	552%	718%	1154%	1431%	339%	1750%	2603%	123%	1909%	1918%
	Pistachio+rose hip+safflower	-91%	-76%	-66%	33%	84%	114%	208%	288%	407%	544%	1154%	1431%	339%	1750%	2603%	123%	1909%	1918%
	Pistachio+rose hip+peas	-83%	-56%	-40%	50%	94%	119%	202%	272%	376%	500%	1154%	1431%	339%	1750%	2603%	123%	1909%	1918%
	Pistachio+rose hip+melon	-79%	-44%	-25%	70%	113%	138%	220%	291%	396%	520%	1154%	1431%	339%	1750%	2603%	123%	1909%	1918%
	Pistachio+rose hip+alfalfa	-82%	-51%	-32%	72%	118%	146%	236%	312%	428%	559%	1154%	1431%	339%	1750%	2603%	123%	1909%	1918%

Feasibility study for the establishment of pistachio growing centers in Tashkent province

10x10	Pistachio+rose hip	-100%	-100%	-100%	91%	183%	231%	304%	357%	436%	468%	670%	783%	274%	901%	1438%	115%	871%	869%
	Pistachio+rose hip+safflower	-88%	-70%	-51%	65%	126%	160%	211%	246%	298%	335%	670%	783%	274%	901%	1438%	115%	871%	869%
	Pistachio+rose hip+peas	-77%	-47%	-18%	81%	131%	160%	203%	233%	278%	311%	670%	783%	274%	901%	1438%	115%	871%	869%
	Pistachio+rose hip+melon	-71%	-33%	3%	105%	154%	182%	225%	255%	301%	332%	670%	783%	274%	901%	1438%	115%	871%	869%
	Pistachio+rose hip+alfalfa	-75%	-40%	-3%	112%	166%	196%	244%	278%	328%	360%	670%	783%	274%	901%	1438%	115%	871%	869%