



Horticultural Greenhouses in Tajikistan

Overview of existing greenhouses



Greenhouses case study
Tajikistan
2013

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FOREWORD

During the Soviet time in Tajikistan, the most common greenhouse design was a glasshouse heated with coal or gas or geothermia.

With the end of the Soviet Union, maintenance of these greenhouses could not be ensured. As a consequence, farmers had to adapt and turn towards other types.

This study is based on the statement that many different types of greenhouses are now in use to produce vegetables and fruits in Tajikistan, but that a comprehensive study on their diversity is not available to the farmers.

Information on protected agriculture is also hard to access for farmers in the field as private agricultural extension services are just starting to replace the former strong state support. Inputs of good quality are difficult to access for farmers far from the main urban centers.

This document aims at providing an overview of the different existing types of greenhouses for farmers and agricultural technicians.

Data on the different greenhouses available in the country was gathered during a study tour in spring 2013 in the different regions of Tajikistan (Dushanbe, Region of Republican Subordination, GBAO, Khatlon), and thanks to a partnership with Sugdagroserv Consulting for Sughd region.

43 greenhouses representing 10 different types were visited, but this survey is not exhaustive and some models are not described.

The survey involved private farmers, NGOs (Cesvi, Mercy Corps, MSDSP, Nuri Khatlon), the Horticultural Institute of Dushanbe, Sugdagroserv Consulting services in Khujand. No private companies selling greenhouses were interviewed as they are still very seldom.

The existing greenhouses models in Tajikistan are presented and their characteristics are detailed.

Several factors should be considered before building a greenhouse:

- the climate of the region: the date of first sowing and of the last harvesting in the open field, the minimal temperature in winter,
- the type of crop that will be grown and its temperature requirements,
- the possible financial investment by the farmer and profitability of the activity.

The growing period in the open field changes according to the location: the Northern plain of Sughd is colder than Khatlon area and the elevation plays an important part in decreasing the growing period.

Location	average elevation	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
plain Khatlon	0-400 m												
plain Sughd	400 m												
low mountain	400-1500 m												
high mountain	1500-2500 m												
growing period													

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In the greenhouse of the state fruit and vegetable farm of Dushanbe





GREENHOUSE FACTSHEET EXPLANATION

Technical description and specificities

This table presents in a table and with some narrative, a description of the design: materials, size, specific features and cost according to the area.

Level of technology

The technology implemented is graded from 0 to 2:

0: fast to build and easily implemented by one person,

1: basic construction skills are needed,

2: skilled masters are needed.

Thermal performance

A greenhouse is a construction that aims at providing the adequate microclimate for the plant growth, especially in cold climates: stable humidity rate, wind protection and sufficient temperatures.

Insulation of the greenhouse allows to retain the heat inside while the thermal mass provides inertia against temperature fluctuations, it is the ability of the mass of a building to store heat.

As an indicator, thermal performance is divided into 3 categories for the greenhouses:

Low: low thermal performance means that the greenhouse has no insulation, it loses heat quickly and has no thermal mass.

Medium: medium thermal performance means that the greenhouse has minimum insulation and thermal mass.

High: high thermal performance means that the greenhouse has insulation and thermal mass.

Agricultural calendar and performance

The calendar gives indications on the dates of sowing, transplanting and harvesting in the greenhouse depending on the vegetables.

S => for sowing time

T => for transplantation time

H => for harvest time

The maximum income (without subtracting the costs of running the greenhouse) is provided.

Dissemination level

The level of dissemination gives some indication on the extent of spreading of the model in Tajikistan:

o **Low dissemination:** <10 greenhouses,

o **Medium dissemination:** 10-100 greenhouses,

o **High dissemination:** 100- 1000 greenhouses.

Target

It details which climate and productions can be targeted with this greenhouse model and which kind of farmers are using it.

1 PASSIVE SOLAR GREENHOUSES: CHINESE STYLE

Technical description and specificities

dimensions	
length	60 to 100 m
width	10 m
height	4.2 m
depth	1.2 m
growing area	600 m ² to 1000 m ²
cost	63,000 to 81,000 somonis



materials used	
walls	soil
insulation	thickness of the north wall
roof	polyethylene
greenhouse cover	Same as roof cover

The Chinese model of greenhouse is orientated towards the south, the north wall is made of the dirt excavated for the construction and it is covered with polyethylene.

Level of technology

2. It is necessary to have skills in construction and special equipment for digging is needed.

Thermal performance: high

The insulation is good, the orientation and slope angle of the polyethylene allows to capture well sun radiation. The soil at the back of the greenhouse releases heat during the night. The greenhouse can be heated during the coldest winter months.

Agricultural calendar and performance

		Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
In Khatlon (without heating)	tomatoes		T		H	H	H					S	
	cucumbers	H						S			T		H

With two crops a year (tomato and cucumber), the total income can go up to 70 000 TJS/year.

Dissemination

Medium. Investment is high and limits the dissemination. Mostly found In Khatlon and Sughd.

Advantages	Drawbacks
Good thermal performance allows easy off-season production	Investment is important Ventilation management is a challenge

Target

This model is used by commercial farmers who produce off-season tomatoes and cucumbers.

2

PASSIVE SOLAR GREENHOUSES: SMALLER DESIGN

Technical description and specificities

dimensions	
length	10 to 20 m
width	5 to 6 m
height	2 m
depth	0.5 to 1.2 m
growing area	40 m ² to 100 m ²
cost	10,000 somonis for 10 m length



materials used	
walls	dirt bricks
insulation	double walls with insulation
roof	reeds, apricot branches, metal sheet
greenhouse cover	polyethylene

Level of technology

2. It is necessary to have skills in construction.

Thermal performance: high

This model has both insulation and thermal mass, that allow to gain 5 months of production in mountainous areas.

Agricultural calendar and performance

		Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
At 1500m elevation	early tomatoes		T		H	H						S	
	aromatics	H							S		H	S	H

With two crops a year (aromatics and early tomatoes), the total income can go up to 2000 TJS/year.

Dissemination

Medium. It was implemented by NGOs in Sughd, Kathlon, GBAO, Hissar.

Advantages	Drawbacks
Good thermal performance allows easy off-season production in mountainous areas and production even at very high altitude (3700m).	Investment is important.
Building materials are available locally.	Good farming skills are necessary to ensure good income.

Target

This model is used by smallholder farmers who can produce in mountainous areas all year long vegetables for their family and for sale. Early tomatoes and cucumbers are possible to grow, whereas, during the winter time, only frost-resistant plants will grow (aromatics, beets, ...).

3 MULTI HIGH-TUNNEL GREENHOUSES

Technical description and specificities

dimensions	
length	42 m
width	6 m
height	2.2 m
depth	1.2 m
growing area	1 ha
cost	Not communicated

materials used	
walls	polyethylene
insulation	no insulation
roof	polyethylene
greenhouse cover	polyethylene

This greenhouse is constituted of several connected high tunnels that are heated in the winter time.

Level of technology

2. The installation of the frame needs skilled farmers

Thermal performance: low.

Agricultural calendar and performance

		Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
In Dushanbe area	tomatoes			H	H							T	
	cucumbers					T		H	H				

Income reaches 300,000 somonis/year for 1ha greenhouse, but costs of heating, manpower are **significant**.

Dissemination

Low. It is implemented by entrepreneurs.

Advantages	Drawbacks
Produces significant volumes of vegetables, the structure can be removed and used on another piece of land.	Big investment, lot of land needed

Target

Commercial farmers in Dushanbe area produce off-season tomatoes and cucumbers in these multi high tunnels by heating them with coal.



4

HIGH TUNNELS: MIDDLE WALLS GREENHOUSES

Technical description and specificities

dimensions	
length	10 to 20 m
width	3 to 5 m
height	2 m
depth	0,6 m
growing area	30 to 100 m ²
cost	8600 somonis

materials used	
walls	dirt bricks
insulation	double walls with insulation
roof	-
greenhouse cover	polyethylene or polycarbonate



This greenhouse is a mix between a passive solar greenhouse and a high tunnel. On the north face, the wall is of middle height, on the south face, the wall is very low.

Level of technology

2. The installation of the frame needs skilled farmers.

Thermal performance: medium

The middle height walls have insulation and thermal mass. Nevertheless since they are of middle height, their action remains limited.

Agricultural calendar and performance

		Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
At 1000m elevation	aromatics	H									S		H
	tomatoes	S		T		H	H						

Dissemination

Low. It was implemented by NGOs in GBAO.

Advantages	Drawbacks
The cost is affordable	The minimal insulation and thermal mass limit its use to low elevations.

Target

Smallholder farmers use this design in Darvoz area at an elevation of 1000m both for home consumption and sale. It allows them to produce aromatics in winter and early tomatoes and cucumbers in spring. It is also used as a community greenhouse for seedlings production.

5 SEMI-HIGH TUNNELS

Technical description and specificities

dimensions	
length	4 m to 26 m
width	2 to 6 m
height	1.5 to 2m
depth	0.5 for hotbed to 0 m without hotbed
growing area	8 m ² to 156 m ²
cost	300 to 4250 somonis



materials used	
walls	no walls
insulation	no insulation
roof	no roof
greenhouse cover	polyethylene



Level of technology

1. It does not necessitate complex construction skills.

Thermal performance: low.

As the greenhouse is only made of polyethylene, it quickly loses its heat. To heat it up, farmers do hotbeds (Rasht region) or install coal stoves (Khatlon region).

Agricultural calendar and performance

		Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
In Khatlon	early tomatoes	T		H	H								S
	cabbage, corn					S				H			
	aromatics									S		H	

With three crops a year, the total income can go up to 4000 TJS/year

Dissemination

High. It was implemented by NGOs in Kathlon and Rasht.

Advantages	Drawbacks
Easy to build	It has to be combined with a hotbed in mountainous areas to prevent cold temperatures at night from damaging the crops
Provides significant improvement in the growing period	

Target

Smallholder farmers in mountainous areas use it to produce seedlings and early vegetables in spring, commercial farmers grow in it the early tomatoes and cucumbers in Khatlon.

6

LOW TUNNELS

Technical description and specificities

dimensions	
length	5 to 40 m
width	1.20 m
height	0.3 to 1 m
depth	0
growing area	30 m ² to 60 m ²
cost	500 somonis



materials used	
walls	no walls
insulation	no insulation
roof	no roof
greenhouse cover	polyethylene

Level of technology

It is easy to implement.

Thermal performance: low.

As the greenhouse is only made of polyethylene, it loses quickly its heat.

Agricultural calendar and performance

		Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
In Khatlon	Winter aromatics	H										S	
	seedlings		S	H									

Dissemination

High. Many households implement this directly on their household plot.

Advantages	Drawbacks
<p>Easy to implement</p> <p>Allows to grow aromatics in winter time in the plains,</p> <p>It protects the crop from harsh external conditions</p>	<p>Only provides a limited temperature gain.</p>

Target

Smallholder farmers can improve their production in winter time by growing aromatics in plains, or by growing seedlings in early spring.

7 “ENVELOPE” GREENHOUSES / CALLED TASHKENT STYLE / TWO FOLD

Technical description and specificities

dimensions	
length	50 m
width	12 m
height	3.2 m
depth	0
growing area	600 m ²
cost	50 000 somonis



materials used	
walls	bricks
insulation	-
roof	polyethylene
greenhouse cover	



Level of technology

3. It is necessary to have skills in construction.

Thermal performance: medium

The walls can act as thermal mass but without insulation, the building has limited capacity to keep heat at night.

Agricultural calendar and performance

		Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
In Khatlon	Winter aromatics	H									S		
	seedlings		S	H									
	Early vegetables			T									
	Vegetables												

Dissemination

Medium. Investment is high and limits the dissemination.

Old soviet greenhouses are being covered with polyethylene instead of glass and put back into use.

Advantages	Drawbacks
Often the walls already exist	Needs to be heated in winter time
	High investment

Target

Envelope greenhouse are mostly used by commercial farmers, private individuals who are using the old buildings left from kholkozes.

8

LEMONARIUM

Technical description and specificities

dimensions	above the ground	under the ground
length	25 to 100 m	35 to 40 m
width	7 to 10 m	7 m
height	3.5 m	1.5 m from soil of the greenhouse
depth	0 m	2 m
growing area	50 m ² to 120 m ²	245 m ²
cost	40 000 TJS	60 000 somonis



materials used	above the ground	under the ground
walls	dirt bricks	cement
insulation	no insulation	no insulation
roof	polyethylene	polyethylene
greenhouse cover	This is the roof	polyethylene

Level of technology

3. It is necessary to have skills in construction.

Thermal performance: medium

The soil around the dig-in design provides thermal mass; the walls for the above the ground design can ensure a minimum of insulation depending on their thickness. The greenhouse might be heated during the coldest winter months.



Agricultural calendar and performance

Lemon trees are perennial and produce fruits every beginning of winter. For 250 trees, the income for the farmer can go up to 40 000 somonis/year.

Dissemination

Medium. Investment is high and limits the dissemination. In Khatlon, the design above the ground has been spreading out, and the one underground in Sughd.

Advantages	Drawbacks
The structure lasts a long time	Investment is significant
The production of lemon is very profitable	Time before receiving fruits (3 years).

Target

Commercial farmers use the lemonarium, they often have business agreements to export them out of Tajikistan.

SUMMARY OF THE GREENHOUSE SPECIFICITIES

Model of greenhouse	Needed area	Maximum height	Ventilation	Thermal mass	Construction complexity
1 Chinese greenhouse	>600 m ²	4m	little	yes	2
2 Solar greenhouse	>50 m ²	2,2m	yes	yes	2
3 Multi high tunnel greenhouse	>0,5 ha	2,2m	yes	no	2
4 High tunnel with middle walls	>30 m ²	2m	no	yes	2
5 Semi-high tunnel	>8 m ²	1,5m	no	no	1
6 mini tunnel	>2 m ²	0,3m	no	no	0
7 Envelope greenhouse	>100 m ²	3,2m	yes	no	2
8 Lemonarium	>50m ²	3m	little	yes	2

Possible crop growing in winter time and early spring					
Model of greenhouse	Low plain (Khatlon)	Low plain (Sughd)	Mountain (<1500 m)	Mountain (>1500 m)	
Solar greenhouses (Chinese style and small model)	cold sensitive crops and cold resistant crops without heating	cold sensitive crops with heating cold resistant crops without heating	cold resistant crops all winter early cold sensitive crops possible	cold resistant crops all winter	cold resistant crops all winter
Multi high tunnels, Envelope greenhouses	cold sensitive crops with heating cold resistant crops without heating	cold sensitive crops with heating cold resistant crops without heating	cold sensitive crops with heating	No experience	No experience
High tunnel with middle walls	No experience	No experience	Frost sensitive crops all winter Early cold sensitive crops possible	No experience	No experience
Semi-high tunnel	Early cold sensitive crops and cold resistant crops without heating	No experience	early cold sensitive crops possible with hotbed	No experience	No experience
mini tunnel	cold resistant crops without heating	cold resistant crops without heating	No experience	No experience	No experience
Lemonarium	Lemon		No experience	No experience	



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