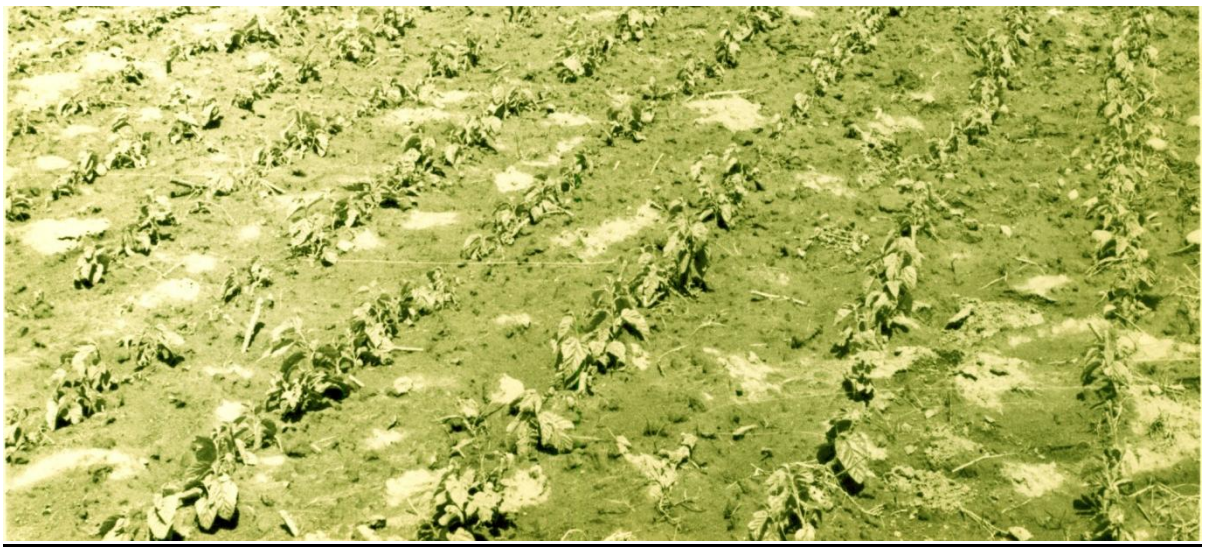
საქართველოს სოფლის მეურნეობის მეცნიერებათა აკადემია

ACADEMY OF AGRICULTURAL SCIENCES OF GEORGIA

RECOMMENDATION

ROOTING OF MULBERRY CUTTINGS OF RESISTANT VARIETIES IN THERMAL WATER HEATED SUBSTRATE AND THE ECONOMIC EFFICIENCY



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In 1998 fabric made of silk of mulberry silkworm of Georgian breeds (Mziuri 1 and Mziuri 2) received the highest quality award of Europe – "Platinum Star".

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Introduction

Sericulture is one of the oldest branches of agriculture in Georgia, It was always considered as the source of strengthening of economics of the country, rational application of labor resources and monetary incomes and the object of permanent care. High quality Georgian silk enjoyed great authority at the world market. Silk cocoon, egg, fabric and other products were exported. Big Silk Road transected territory of Georgia.

In 1850, in Turin and in 1862 at the International Exposition of London Georgian silk was awarded the medals. At current stage, in spite of the difficult situation the quality of the product still meets the newly signed agreement with the EU requirements and will be highly beneficial for the population. In 1998 fabric made of silk of mulberry silkworm of Georgian breeds (Mziuri 1 and Mziuri 2) received the highest quality award of Europe –"Platinum star".

At present, sericulture and Sericulture Scientific-Research Institute is destroyed. Few enthusiast scientists take care so far. Sericulture needs more attention from state, which enables silk sector prosperity and takes worthy place in the country's economy.

In the 60-ies of the twentieth century Georgia produced 4,0 thousand tones of live cocoon, 4,5-5,0 tons of silk eggs, 4,0-4,4 thousand ton raw silk thread and 4,5-5,0 million linear meter natural silk fabric. Powerful intellectual resources and solid capital investments were concentrated in this branch of economy. Unfortunately it was namely at this stage that mulberry micoplasma disease – "leaf curl" was spread in Georgia and destructed more than 15 million mulberry trees, which together with other reasons, resulted in final fall of the branch;

As a result of the implementation of emergency measures in Georgia in 1990 it was identified 20.0 million plants, which was 25% higher comparing to 1964 figures.

Unfortunately, the success achieved in the years 1964-1990, capital investments and all efforts was in vain and everything had to start from the beginning.

In this situation, the primary objective was to consider all of the method of food database recovery and growing planting material of specific conditions.

In this recommendation we discuss about one method of disease-resistant varieties vegetative propagation. Issue of stock rooting on the base of naturally heated water.

Thermal springs in the world belong to the energy resources. They are used for heating buildings, while in Iceland and Japan they are also involved in electricity generation. Georgia is very rich in such resources. 1/3 of the territory coms to thermal waters. It is known Codori, Colchis, Kartli, Tbilisi, Alazani thermal water pools (in many places, this issue is still not studied). There are 220-250 million cubic meters of thermal waters in Georgia, which temperature reaches to 100°-110°C. Its rational using can save 1,3-1,5 million tons of fuel.

Thermal waters are used in Georgia for balneological purposes, therapeutic use of thermal baths.

Table 1. contains information about the reserves of thermal waters in Georgia. Especially in Samegrelo there is high temperature water group that is not used fo far and may be very important for future electro energy generation.

Thermal Waters in Georgia

Table 1.1.

Spring waters	Region	Temperature ^{0}C	debit m^3/day
Juma-Caishi	Samegrelo - Svaneti	103	14 300
Chkhorotsku	Samegrelo - Svaneti	90	12 960
Jinota	Samegrelo - Svaneti	60	4 320
Qvalori	Samegrelo - Svaneti	109	4 320
Zugdidi	Samegrelo - Svaneti	105	2 600
Khobi	Samegrelo - Svaneti	102	4 250
Menji	Samegrelo - Svaneti	55	3 456
Nokalakevi	Samegrelo - Svaneti	81	8 640
Samtredia	Imereti	50	2 765
Lisi	Tbilisi	64	3 991

Note: There is not given in the table small thermal water deposits, which are in abundance in almost all regions

1. Rooting of Wintered Mulberry Cuttings, Its Importance and Short History

Among vegetative propagation methods of wintered dormant mulberry cuttings is very useful for restoration of fodder base in sericulture.

There are many studies made concerning mulberry propagation with above mentioned method – rooting of wintered cuttings. From 1965 Georgian researchers Georgi Zviadadze and Besik Sakandelidze were working about the problems facing wintered mulberry cuttings rooting and they have decided many problematic issues positively. For the purpose of rooting disease resistant mulberry cuttings in 20 th century, 70 ties there were conducted studies in Kutaisi Zonal Experimental Station.

There was created in 1972,Vani district the thermal area on 36 m2 for better heating regulation. For soil heating they used warm bath waters. When the soil of greenhouse reached the temperature 25-28^{0}C, on 14-16 March different cuttings of 25 varieties were placed in the soil.

According to the final results, rooting of mulberry cuttings varieties such as "nezumigaesi" equaled to 92%, "Oshima" - 91%, conventionally called "Kutaisi 1" - 91% and "Kutaisi 2" - 89%, "Iveria" - 83%, "Kutatui" - 79%, "Russian" - 70%, while rates were lower for others, but none have been less than 55%. Rooted plants were well developed and have all reached the standard.

The "oshima" and "nezumigaesi" had better results in cuttings rooting and it is more interesting because their grafting buds do not give the desired result.

In November of the same year rooted nursery stocks were planted on 1.2 ha territory of Vani region, village Amagleba. There conducted intensive scientific observation and received

favorable results. Sericulture specialists convinced that the food base recovery is essential and it has great prospects.

Georgian Ministry of Agriculture and local government of Vani region expressed their interests in rooting of winter passed mulbery cuttings in greenhouses based on natural warm water. In March 1973, was created open greenhouses in 3 sections on 400 m2 area. For greenhouse arrangement they removed 35 sm thick soil surface, then was placed 50 mm metal pipes. The distance between the pipes was 50 cm, and the length - 18-20 m. Join the longitudinal pipe couplings was by using electric welding. Pipe sections are connected to one another so that the warm water pipe from moving in a circular tube and only after going through all the miles passed drainage canal. Suction and discharge pipes are placed at the ends of the regulated water flow variability and taps needed to establish the desired temperature. Unlike it was in 1972, the pipes were not conected by welding but were bended with gradual heating. Thus improved the quality of the work and reduced labor costs as well as losses associated with pipe weld and cutting.

Pipe sections covered with 30-35 cm thick river silt. Tubes filled with warm water coming out of the bath, the temperature was 36^0-38^0C. 24 hours after the release of the water in the pipes the soil temperature was 27^0-28^0 C where water was entering, while the place were water was leaving was almost 10^0-12^0 C.

After establishing the desired temperature in the greenhouse on 25cm soil depth, in March 28-31, 1973 it was planted 8000 stocks of different mulberry varieties for rooting in greenhouse. Stock materials were taken from the first decade of February, which is then stored in the refrigerator. Cuttings were taken from the refrigerator before the day of planting and were cut 18-20 sm each. On each cutting there was 5 or 6 buds. They should be placed in the soil leaving 2 buds on the surface, parallel to the pipes. The distance between the stock cuttings was 10-12 cm, and 50 cm between the rows. Watering the soil, fertilizers and weed-cleaning activities was carried out as needed. Mineral fertilizers were used (for a particular purpose) at a reduced dose. Although cuttings were planted 15-20 days later, rooting of various varieties implemented by 60-65%. In the autumn of 1973 they recieved 3700 standard mulbery stocks and was arranged plantation on 400 m2 area.

2. Soil Selection and Open Thermal Area Arrangement.

2.1. Sections installation and thermal area soil preparation

a) For arranging thermal area (preferably close to the thermal spring) should be selected humus-rich, fertile soils;
b) From selected area 35 cm thick soil layer should be cut by the bulldozer and the top surface be graded.
c) On the thermal area plastic pipes (diameter 50 mm) to be placed in parallel sections (Fig. 2.1.); The distance between the pipes should be 50-60 cm, and the length 18-20 m; Couplings of plastic pipes will be using special iron.

Taps will be placed in the inflow and outflow ends of pipes. They will regulate the needed amount of water and the speed by which it is possible to establish the desired temperature.

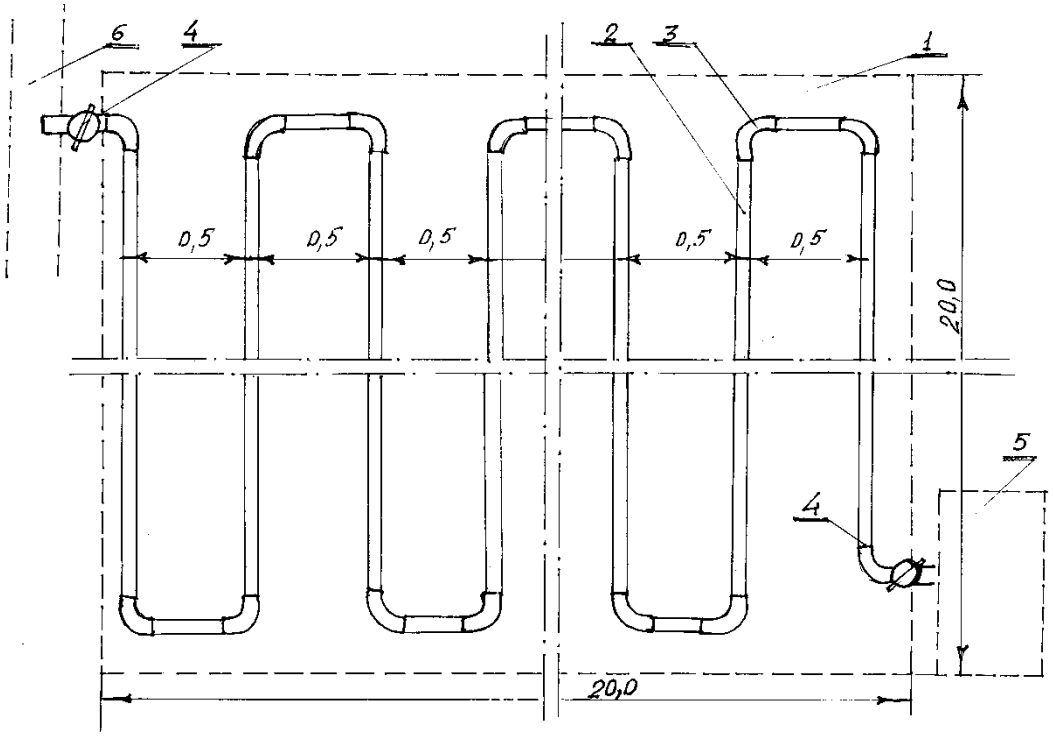

Fig 2.1 Scheme of plastic pipes arrangement on the thermal area

1 – thermal area 20 X 20 m (F = 400 m^2); 2 – plastic pipe (Φ=50 mm); 3 – joint angle (Φ=50 mm); 4 – tap; 5 – hot water source; 6 – drainage channel.

Sections should be covered with 30-35 cm thick humus-rich manure or the river silt fertile soil. For this purpose it can be used above mentioned removed soil surface layer.

2.2. Soil temperature regulation, control check, preparation of cuttings for planting

A) The temperature of water inflow in plastic pipes must be regulated within 36-380^0 C limits, while the temperature of the soil will be 27 - 28^0 C in place of inflow section, and outflow section temperature – 10-12^0 C

B) If it may be proved the soil temperature 27-28^0 C in 25 cm deep in the soil , then you can start planting.

Cuttings should be prepared in advance , one day earlier to start planting.

C) Cuttings should be 18-20 cm in length leaving 5 or 6 buds on it. Lower cut should be on 1-1,5 cm distance from bud.

D) For the placement cuttings in the soil it should be arranged dibbles parallel to the pipes 50-55 cm distance and between the plants 10-12 cm distance. Cuttings should be placed in the soil leaving 2 buds on the surface. They must be irrigated immediately after planting.

During vegetation period irrigation, intake of fertilizers, green operations should be done according to agro technical norms and rates.

E) Planting dates are variable according to specific natural and climatic conditions;

The optimal period for cuttings placement in the soil is the first half of March in the Imereti region.

2.3. Terms of preparation and storage of cuttings

a) Cuttings should be prepared from nursery plants, if such does not exist, then you need to select other recommended plants.

based on Natural warm water for rooting of mulberry cuttings they must be prepared in February ("Oshima" , "nezumigaesi", "Kutaisuri 1", "Kutaisuri 2"), before buds raise.

b) In case of grafting, they cut one-year branches.
   The branches should be cut 25-30 cm long cuttings (about 10 buds) well with a sharp knife, so that the skin will not be damaged. Cut on the bottom should be correct and buds 1-1.5 cm away;
   Cuttings should be packed and labelled.
c) Until the end of February, small bands of cuttings may be stored in plastic bags, undergrounds. Before planting, it may be placed in a cool area in wet send. It is very simple to place cuttings in plastic bags. In each bag may be placed 150-200 cuttings, which ends should be covered with send or sawdust.
d) It is strongly forbidden to bring cuttings from "curly leaf" decease zone into healthy zone.

3. Arrangement of open thermal area on the base of natural warm water and its economic efficiency

Acceleration of the production of mulberry planting material and the lowering its price is in full compliance with the purposeful utilization of the thermal waters, one of the natural riches of Georgia. This condition will be considered by The Ministry of Agriculture, the farmers involved in sericulture, and the specialists of the field. As it known, the quality of Georgian silk production fully corresponds with European Union demands.

According to our calculations, the costs of mulberry planting materials considering market prices (the wholesale price is even lower) are presented in the Table 3.1; For arrangement of the greenhouse the modern materials are used, which are characterized with a long term utilization, is economically satisfactory, and we think it will be rather interesting for the farmers involved in sericulture.

Costs of mulberry seedling and expenditures for Arrangement of open thermal area on the base of natural warm water (on 400 m 2).

Table 3.1.

№	Expenditures	Unit	number	Price GEL	
				Unit	Total
1	2	3	4	5	6
1.	Number of mulberry cuttings	,000	8,0	160	1280

2. 3.	Produced seedlings Income from realization of seedling	,000 ,000	4500 4500	- 2,50	- 11250
4.	Capital costs for thermal area arrangement		-	-	5460
	Including:				
	50 mm plastic pipe	m	800	4,0	3200
	100 mm plastic pipe	m	55	5,0	275
	Tap 50 mm	Pieces	2	21.0	42
	Pipe tubes 50 mm (plastic)	Pieces	120	0,55	66
	Pipe threads (plastic)	Pieces	80	0.70	56
	Pipe transportation costs	GEL	-	-	400
	Water Hydraulic Pump	Pieces	1	32	32
	Fencing poles and wires	GEL	-	-	765
	Cutting of 35 cm thick soil surface on 400 m2 area and its disposal.	GEL	-	-	280
	Remove silt by excavator, loading vehicles and deliver to the greenhouses	GEL	-	-	250
	Costs for welding of plastic pipes by using of hand iron and arrangement of sections.	GEL	-	-	100
5.	Operating Costs	GEL	-	-	2542
	Number of cuttings for rooting	‘000 Pieces	8,0	160	1280
	Manure - Compost	Tone	2,0	10	20
	Mineral fertilizer – nitroamophos N16P16K16	kg	10	1.20	12
	Chemicals, preparats containing propins	kg	0,5	20.0	10
	Fuel - lubricants	kg	100	2.0	200
	Other expenses	GEL	-	-	80
	align the silt on the greenhouse area	Man/day	5,0	20	100
	Preparing of cuttings and placement into soil	Man/day	4,0	20	80
	Work activities for rooted plants (plowing, input of fertilizers, irrigation, fertilizers, green operations)	Man/day	4,0	20	80
	Remove seedlings by hand (150 stocks)	Man/day	30	20	600
	Various works	Man/day	4,0	20	80
6.	Permanent fixed costs:	GEL	-	-	990
	The land tax	GEL	-	-	3,0
	Property Tax	GEL	-	-	-

	Income Tax	GEL	-	-	-
	Additional cost	GEL	-	-	-
	Depreciation 15%	GEL	-	-	819
	Unforeseen expenses	GEL	-	-	168
7.	Total direct costs (5 + 6)	GEL			3532
8.	Overhead costs	GEL	-	-	350
9.	Total costs (7 + 8)	GEL	-	-	3882
10.	Profit margin (3-7)	GEL	-	-	7718
11.	Profit (3-9)	GEL	-	-	7368
12.	The full cost of production (without capital expenditure) (5 + 6): [2]	GEL/stock	-	-	0,78
13.	Product profitability (11: 7) X100	%			200

Note: Under the current legislation, the farmer (in our case, the entrepreneurs) do not pay taxes, if the entrepreneur's full income is less than GEL 100,000.

Take into consideration the fact that the technical conditions of the greenhouse should not serve farmers in five-seven years, but also for longer periods, and then the cost of the seedlings will be even less.

Since Greenhouse invested capital facilities (plastic pipes, pipe connection details, water hydraulic pump, wiring, etc.) corresponds to the project services in line with not a single season, but at least 7 years and one of the saplings in the cost would be around 0.78 GEL, this should also be considered that if the cuttings in the optimal time (first half of March) will be placed in the soil, rooting will reach to 80% and the cost of seedlings will be reduced, and the efficiency will be increased according to the level of intensification.

According to the previous analyses it is proved that in Georgia it was very low percentage 15-20% of growing grafted seedlings in nurseries. In this situation, the actual cost of each seedlings was 2,5-3,0 times higher than the costs of seedlings received from thermal areas.

It should be noted that a large part of the work in the greenhouse is performed in the winter and early spring, when the labor force is relatively free.

Conclusion

So, providing healthy planting material using rooted wintered mulberry cuttings on the basis of naturally warm watered are is very positive, environmentally friendly and economically feasible.