Akaki Tsereteli State University

Agrarian Faculty

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Feijoa (Sellowiana Berg) Agroindustrial Grouping In agroecological environment of alluvial soils in Imereti Region

Major: 0101 agronomya

Author's abstract

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General description of the work

Actuality of the topic - Georgia belongs to the list of the countries having the small number of the ground. This fact makes us to be focused on intensive utilization of supply of land. In this respect determination of development and use of undeveloped alluvial soils is very important for producing highly profitable subtropical crops (Feijoa). These soils are widely spread in west Georgia, especially in Samegrelo and Imereti where the supply of land is approximately 30%.

Alluvial soils belong to hydromorphic soils zonal group. They are developed at the bank of rivers, in the ravines, also at the low terraces of the rivers which are periodically covered by water.

In agricultural industry involvement of soils according to regions, for growing highly profitable subtropical crops, is going on the basis of long research. Whilst intensive application of organic-mineral fertilizers alluviums don't expose those properties morphologically, which are typical for highly developed soils. It clearly displays that the quality of their development won't be only determined by index of some chemical elements.

Hitherto, complex studying of agronomic properties of alluvial soils hasn't been held that directs to actuality of the subject and they are applied under agricultural crops without selection of proper agrotechnology that finally makes negative impact on agroecological state of the soil as a natural resource.

Goal of research - we've studied Imereti alluvial soils as one of the reserve base of supply of land for highly profitable subtropical crops as is Feijoa and we made agro-industrial grouping of soils of the zone.

1. In Imereti region, according to physical and chemical properties of alluvial soils, we planted Feijoa plantation

on pilot lands and determined terms of agro-industrial zoning.

2. By using intermediate crops we've selected and established proper system of agriculture for pilot crops.
3. By effecting agroclimatic conditions and systematic observation on the pilot crop (Feijoa), we've displayed diseases and pests of plants and developed effective measures against them.
4. For expansion of agricultural area for highly profitable agricultural crop (feijoa), we've developed and recommended for highly efficient agroecological technology.

Research objective - For achieving the goals we've implemented the following objectives: At pilot lands of Akaki Tsereteli State University, in the village Tskaltubo, we have done soil section and studied physical and chemical properties of alluvial soils where Feijoa plantationis cultivated. The test was made in five versions: 1) without intermediate crops (control version); 2) corn sowing for grains in inter-row spacing; 3) Soybean sowing for grains in inter-row spacing; 4) Corn + soybean mix for grain; 5) Soybeanplough into the soil in florescence phase.

As a result of research there have been developed agricultural technology by using intermediate crops on research unit. We have made agro-industrial grouping of soil in the form of agro-ecological technology for improving fertility of alluvial soils.

Expected result - The level of subspecies has been separated out on alluvial soils and alluvial, carbonate, stony subspecies have been selected for regions of Imereti as are: Tskaltubo, Khoni, Vani, Samtredia, Bagdati and Terjola (Kharagauli-Kitskhi) and agro-

industrial zoning for cultivation of Feijoa. We have selected the best intermediate cropsfor alluvial soils.

Scientific innovation - it should be observed that in Imereti region for improving fertility of alluvial soils and complex research of cultivation of highly profitable subtropical crops- Feijoa has been held for the first time, as intensive application of organic-mineral fertilizers alluviums doesn't display their properties which are typical for highly cultivated soils. This displays that the quality of cultivation cannot be determined only by saturation of index of chemical elements. The new developed method by us gives proper terms for growing and development of the plant without violation of regulations of environmental safety. By using intermediate crops there is made cultivated land with agro-ecological landscape, which gives the basis of exact agriculture by soil mobile laboratory.

Object of research - object of research is the territory of educational- experimental economy of Ak. Tsereteli State University in Imereti Region (Geguti) and individual plantation of homestead lands, also laboratories of agricultural chemistry, soil science, agriculture and reclamation of the Department of agricultural science.

Practical meaning - Application of intermediate crops (corn, legumes) in inter-row spacing of feijoa plantations for improving agricultural properties and raising productivity of unused poor lands of subtropical zone (Imereti). Demonstration, introduction and extending of studied and approved agricultural technology as a result of implementation of research. As a result of research we've improved agricultural properties of soils of researching regions with intermediate crops.

Approbation – Reports of basic materials of dissertation have been madeat the International Scientific Conference: Students Republican Scientific and Practical Conference, GSUSA, Kutaisi,

2009; Students and Scientists 53rd Scientific-practical Conference, GSUSA, 2010; International Conference "problems of branches of subtropical zone and the ways of their solution", Kutaisi, 2010; Meeting of the Department of Agricultural Ecology of Georgian Agrarian University, 11.05.2011; International Scientific Conference dedicated to 100 anniversary since the day of foundation of Batumi Botanical Garden, Batumi, 2013;

Publication – 5 scientific works published around the subject of the dissertation

Volume and structure of the work- The dissertation covers 13pg, enclosed with the list of literatures and consists of 4 chapters and conclusion, X pictures, x- tables and x diagram.

Chapter 1. Literary review. In the chapter, on the basis of scientific analysis, there is presented general picture of theoretical research on the ground of which I tried to do a general review on creation, extending of alluvial soils and question of their fertilization which will be discussed in the following chapters. Also, I'll speak about growing, developing and extending of highly profitable crop such as Feijoa.

Pilot part

Chapter 2. Research objectiveand methods

The main point of the research is in studying agro-industrial zoning of Feijoa crops on low productive alluvial soils by using intermediate crops.

For implementation of the research, we have planned solution of the following problems:

1. Soil research on the researching land in Imereti region (Tskaltubo, Village Geguti); (morphological, mechanical, physical, chemical)
2. Cultivation of Feijoa on the research land
3. Studying of the impact of intermediate crops on fertilization of the soil,
4. Holding biometrical measurements according to variations for studying growing dynamics of Feijoa;
5. Displaying plants disease and pests and development of effective measures against them;
6. Economic efficiency of Feijoa production;
7. Demonstration, introduction and extending of the result of the research;

The research aims: application of intermediate crops (corn, legume) in inter-rowspacing of feijoa plantations for improving agricultural properties and raising productivity of unused poor lands of subtropical zone (Imereti)

For achieving the goals of the research, we have studied chemical and physical properties of soils in the experimental lands in Imereti region, and cultivated plantation of Feijoa crop (biennial plants).

We made observation on growing, development and productivity of Feijoa in the homestead land of different zones of Imereti, where we have selected 10-15 year plants of Feijoa. On the territory (Geguti, Bashi) we made a section of the soil on the area covered with grass and dewberry bushes. We selected genesis horizons, made morphological description, studied properties of the soil. We have treated taken samples using the cameral method and determined their mechanical properties.

On the basis of chemical properties we determined: humus, general and digestible nitrogen, general and digestible phosphorus,

potassium, carbonate, exchange acidity and soil reaction in P^{H} water extraction

In the period of the test we registered temperature indexes, average air temperature, maximum and minimal temperatures, sediment volume, their distribution according to months.

The soils are developed on old alluvial layers: they are characterized with profile of average and high thickness, they're stony, dump, carbonate. That's why our teaching method covers complex land-reclamation measures and the system of agro-biological research considers agroecological technology.

Methods reckon holding the research by field as well as laboratory methods.

In laboratory tests we determined mechanical, physical and chemical composition of the soil.

In samples prepared for analysis we determined:

P^{H}- with potentiometer

1. Exchange acidity – using Kapen method
2. Total absorbed bases (Ca+Mg)- using kapen method
3. Hydrolyzed nitrogen using Turin and Konovova method, by rule of overrun using Kjeldahl instrument;
4. Digesting phosphorus
5. Exchange potassium
6. Humus using Tiurin method by application of indicator dephenilamin

On the land in Geguti, we made experiment in the field for cultivation and raising productivity of the soil in Feijoa row-spacing according to diagram:

1. Without intermediate crops (control)
2. Corn sowing in inter-row spacing of Feijoa for grains;
3. Soya sowing in inter-row spacing for grains;

4. Corn and soya mixed sowing in inter-row spacing for grain;
5. Soya sowing in inter-row spacing for tilling down in the period of florescence

In tskaltubo district alluvial soils of meadow is widely spread on old and new terraces of the rivers Rioni and Tskhenistskali, in different territories of villages: Kvitiri, Maglaki, Mukhiani, Geguti, Patriketi and others.

Alluvial soils of Imereti region are developed on old alluvial layers, they are characterized with profile of average and great thickness, they are stony, dump and carbonate.

Reaction of the soil area is a weak alkali and in lower horizons it isn't changed. The sum of absorbed bases is high and it is increased in horizons. Mechanical composition has been established using organoleptic method. These soils are of average and heavy clay. These soils are characterized with the river sediments- accumulation of alluvium, weak differentiation of genesis horizons, monotonic profile, composition of stones, diversity of colors according to mechanical and chemical composition, which is provided by composition and properties of various materials brought by the river.

Imereti region is the important agricultural zone. It's distinguished with full of warm and sunshine. The climate of the region is humid subtropical, it's characterized with warm summer and long vegetation period. Winter is short and not very cold. Air average temperature fluctuates between 12^{0}- 14^{0}C. In January 3,7 - 4,3^{0}C, August - 23,6 – 23,9^{0}. The absolute maximum up to 38-42^{0}C; the absolute minimum up to 17- 29^{0}C. Sediments 1100-2100 mm-mm. Monsoon winds are typical; the basic water arteries are Rv. Rioni and Kvirila.

Climatic conditions of the region stipulate that most of plants in Imereti, in this case Feijoa, adapted to the conditions very well which is the showing of adaption to climate and soil.

Chapter 3. Development of agroecological technologies for Feijoa on alluvial soils

For research we made a section in the territory of Geguti, Tskaltubo, in plain relief conditions. The soil is covered with grass and dewberry bushes (Image 1,2,3).

Image 1. Image 2. Image 3.

From morphological description of alluvial carbonate soil of Geguti meadow there is displayed that the soil profile is characterized with big thickness, granular-clumpy in the upper layers, weakly demonstrated structure of depth, content of stones, dump, whizzes from the surface.

Researching soils is alluvial as it is located on the bank of the Rv. Rioni; such soils are very poor due to irrigation by frequent sediments. Especially humus and other organic substances are very less, that's why these soils have no structures. Humus and carbonate soils made from limestone are spread on a small area. After morphological description of the (Table 1) section we have taken soil

samples from separate horizons and conducted a chemical analysis (Table 2).

Table 1

Morphological description of the soil section on experimental land in Geguti (2009)

Hor. A0 0-20 sm	Light brown color, light clay, carbonate, with granular-clumpy structure, is covered with grass roots
Hor. A 20-45 sm	Dark brown color, with clumpy structure, has roots of plants, earthworms, calcium, horizon is clay.
Hor. B 45-75 sm	Brown color, cloddy structure, has roots, stones of small and average size.
Hor. Bc 75 -100 sm	Light brown color, without structure, much gravel, cobble-stones of different size, transits to alluvial layers.
Hor. C 100-110sm	The soil is mostly mixed into the big cobble-stones.

Table 2

Chemical analysis of the section taken from Geguti research land

Horizon	Exchange acidity mg/eq. 100g.n	Total absorbed bases Ca+Mg mg/eq.	Hydrolyzed nitrogen mg.100g.n.	Digesting phosphorus mg. 100 g.n	Exchange potassium mg. 100g.n.	Humus %	PH In water suspension
A_0 0-20	1,0	18,0	19,0	16,8	14,1	3,21	7,60
A 20-45	0,9	21,0	19,0	15,0	13,6	1,55	7,65
B 45-75	0,8	25,0	18,6	14,5	12,8	0,60	7,60
B_C 75-100	0,5	48,0	17,4	4,6	8,0	0,40	7,69
C 100-110	0,3	47,0	23,3	3,0	4,1	0,10	7,70

From the table is displayed that the soil reaction is a weak alkali. Total alluvial carbonate absorbed bases is high, according to horizons it raises from 18.0 mg/eq. to 48.0 mg/eq in 100g soil.

Hydrolyzed nitrogen, which participants are the part of nitrate, nitrite, ammoniac and general nitrogen which is in the process of insulation and goes into mineral, namely ammoniac, is averagely given in A_0 horizon-16.8 mg, in lower horizon it increases (17.4 23.3mg).

In Imereti region, in the village Geguti, we meet alluvial carbonate soils of the meadow, in which P^{H} in the water extraction is

7.6 (AO), it's not changed in lower horizons (B, Bc) and is stable - 7.6mg.

According to mechanical structure the soil is the average clay, according to unit horizon the number of physical clay fraction reaches 46-48%. Correspondingly, content of the sediment fraction is low, but the content of physical sand fraction is high.

On the researching land, before making the test, we have taken the soil sample from three depth: 0-20, 20-40, 40-60sm. At the laboratory we made it to dry-air condition, we treated, grinded, sifted in 1mm diameter sieve and made chemical analysis, which details are given in the table 3.

Table 3

Agrochemical index of Geguti research land before the test

#	Depth of taking the sample	P^{H} In Water extraction	Humus %	Hydrolyzed nitrogen mg.100g.n	Digestible phosphorus mg. 100g.n.	Exchange potassium mg.100g.n.	Sum of absorbed bases Ca+Mg mg/eq.
1	0-20	7,06	3,0	20,1	17,0	13,9	19,0
2	20-40	7,08	2,1	17,0	14,2	12,7	20,3
3	40-60	7,06	2,0	13,0	13,0	10,2	21,0

From the table there is displayed that the soil is averagely provided with phosphorus and potassium, hydrolyzed nitrogen is below average 10.1 mg in 100gr soil, total absorbed bases is high and it is increased according to depth, humus is 3% in the upper layer, in the lower layer it's decreased.

The area reaction is neutral, deviates to the weak alkali which is profitable for Feijoa.

Before planting Feijoa plants the research land was ploughed again, harrowed and planned. The pits of depth 40sm and width 75sm have been made. In the pits we applied 2 kg burnt manure and 200gr triple difficult fertilizer, in which nitrogen, phosphors and potassium is 16-16-16%.

Feijoa was planted at the end of November in 2009 on the area 5x4 sq.m. In each pit was planted biennial plant, 30 plants, 6 rows, 5-5 plants in the row. After planting we washed the plants (Image 4,5,6).

Image 4 Image 5. Image 6.

Cultivation of plantation with biennial plant is better that with annual one as the plant is stronger and it starts fruiting earlier after planting.

The area of feeding of a Feijoa plant is 20 m^2. The area between Feijoa rows is great until it covers the whole area with its crown. Reclamation of the area is available with annual intermediate crops. Using inter-row spacing of the intermediate crops means additional harvest and increasing of productivity of the soil.

In first years of cultivation of perennial crops in their inter-row spacing we can apply biennial plants so as not to prevent growing and development of the basic crops (feijoa) and to provide

cultivation of the soil and increase productivity. For this purpose we used biennial legume plants and granular crops as are soybean and corn.

The rhizobiums on the roots of soybean transform atmospheric nitrogen into digestible form for the plant, they enrich the soil with nitrogen which don't wash from the soil as a nitrate nitrogen and provides receiving of ecologically clean product.

By plough of the green mass of soybean the soil is enriched with organic mass that makes the soil productive.

Corn, cultivated crop, cleans the soil from weeds and hoes it. It partially delays bad impact of wind on the basic crops and makes profitable conditions for growing young plants. At the same time by cultivation of intermediate crops we intensively use the area so that not to hinder growing and development of the basic crop and we receive additional yield after planting Feijoa within 4-5 years.

In 2010, we planted intermediate crops considering the schedule. In autumn we made registration of the yield of intermediate crops. In autumn, after harvesting, we took samples of the soil from the research land in the depth of 0-20, 20-40 and 40-60sm. After proper preparing of the soil we determined humus in % and number of hydrolyzed nitrogen in order to understand what kind of impact did intermediate crops have on productivity of the soil (Table 4).

Table 4

Chemical analysis of the soil of the research land in Geguti after harvesting

#	Version	Depth of taking a soil sample sm	Humus %	Total absorbed bases (Ca+Mg) mg/eq 100g n	Hydrolized nitrogen mg 100g n	Digestible phosphorusmg 100g n.	Exchange potassium mg 100g n.
1	Control	0-20	3,0	20,9	20,9	11,5	13,8
		20-40	1,1	22,0	17,0	10,0	11,5
		40-60	0,5	23,5	13,0	9,8	10,0
2	Granular corn	0-20	2,99	20,5	20,3	11,0	12,5
		20-40	1,05	19,8	17,5	9,0	11,0
		40-60	0,06	29,0	14,0	9,0	9,5
3	Granular soybean	0-20	3,02	21,0	22,8	10,9	12,1
		20-40	1,9	28,0	17,8	9,5	10,9
		40-60	1,0	29,5	14,5	9,1	8,8
4	Corn+soybean mixed	0-20	3,01	19,6	22,2	10,1	11,0
		20-40	1,4	22,0	18,0	8,5	9,5
		40-60	0,9	30,0	13,9	8,0	8,2
5	Soybean plough	0-20	3,03	22,0	24,6	12,0	13,0
		20-40	1,75	26,5	22,8	11,1	12,1
		40-60	1,30	34,0	20,5	10,5	10,5

The table displays that in the soil there is observed tendency of humus increasing. If in control version humus is 3.0%, in corn version humus reduced with 0.01%, in soya version it increased with 0.02% than the control one. Humus increased with 0.01% by mixing soybean and corn in sowing version than the corn version separately. Humus increasing tendency is distinctly displayed in the version

when soybean is sowed as a green fertilizer and ploughed into the soil in florescence phase.

There humus is 3.03%, increasing with 0.03% than the control, with 0.04% - than the corn version, with 0.03% than the corn + soybean version. In the 5th version humus is distinctly increased dueto great green mass of soybean which is ploughed intothe soil and is transformed into organic substance and is accumulated as humus which is the basic index of raising productivity of the soil.

Except the control version hydrolyzed nitrogen raised in all versions. (soybean for grains) 22.8mg in 100gr, in corn version- 20.3mg; in the 4th version (corn + soybean) 22mg, in the 5th version hydrolyzed nitrogen is higher than all other versions- 24-6%. It can be explained by the fact that soybean is a leguminous plant, which has rhizobiums on the roots by which it makes fixation of atmosphere nitrogen and accumulates biologically pure nitrogen in the soil. This nitrogen is absorbed by the soil and not washed. By sowing intermediate crops total absorbed bases, phosphorus and potassium have been increased as well.

In 2011 all land treatment measures have been held according to the schedule of the test like the previous year. In 2011 autumn, we made registration of harvest of the intermediate crops c/ha. Their index display that 2011 was unprofitable than 2010 that was provoked by hot summer and strong winds, in the second version- 16.6 c/ha, in the third version- 15.0c/ha, in the fourth version -18.3 c/ha. In 2011 autumn, after harvesting, we took soil samples and determined content of nitrogen and humus that gives us possibility to say that intermediate crops has a positive impact on fertilization of the soil. Based on index we can say that in 2011, as we mentioned, it was a hot summer, strong winds, harvest diminished and content of hydrolyzed nitrogen increased. Forasmuch as nitrogen wasn't washed off, due to less sediments we received less harvest from the

soil. Hydrolyzed nitrogen is more in the 5th version than in the control version, where soybean was sowed and ploughed into the soil in florescence phase.

In 2012, in the vegetation period, in the terms as specified according to test schedule, we held land treatment measures.

In parallels of weeding feijoa rows we applied difficult fertilizer (Amofoska) which improves plant feeding regime and supports its growing and development.

In April we ploughed Feijoa inter-row spacing for sowing intermediate crops. The soil was ploughed in depth of 20sm. In autumn we registered harvest and recalculated c/ha. Besides, additional harvest from interim crops, intermediate crops sowing is necessary for protecting Feijoa young trees from high temperature and strong winds as it was in 2010-2012.

We carried out a chemical analysis of the soil after the harvest, it displays that the intermediate crops sowing in inter-row spacing annually observes humus growth tendency, especially in 5th version (soybean plough) growth is 0.09% than the control one, in the 3rd version - 0.04%- corn for grain (Table 5, Diagram 1,2).

Table 5

Impact ofintermediate crops on hydrolyzed and humus indicators in the soil (2012)

№	Versions	Depth of taking a soil sample sm.	Hydrolized nitrogen mg.100g.б	Humus %
1	Control	0-20	20,1	2,99
		20-40	18,0	1,00
		40-60	15,5	0,90
2	Granular corn	0-20	20,5	2,99
		20-40	17,6	1,05
		40-60	11,3	1,00
3	Granular soybean	0-20	22,9	3,04
		20-40	17,1	1,90
		40-60	20,5	3,01
4	Corn+soybean mixed	0-20	20,5	3,01
		20-40	19,0	1,80
		40-60	17,7	1,00
5	Soybean plough	0-20	26,4	3,08
		20-40	10,0	2,10
		40-60	19,5	1,9

Intermediate crops three -year average data see Table 6.

Table 6

Impact of intermediate crops on productivity of the soil 3 years (2010-2012) average findings

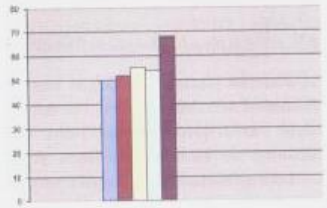
№	Version	Depth of taking grain soil sm	Hydrolyzed nitrogen mg/ 100 g.r.			Average findings of 3 years	Humus %			Average findings of 3 years
			2010	2011	2012	mg 100gr.	2010	2011	2012	
1	Control	0-20	20,9	20,9	20,1	**20,6**	3,0	2,99	2,99	**2,99**
		20-40	17,0	16,9	18,0		1,1	1,05	1,00	
		40-60	13,0	13,6	18,5		0,6	0,90	0,90	
2	Corn for grain	0-20	20,3	20,8	20,5	**20,5**	2,99	2,99	2,99	**2,99**
		20-40	17,5	20,0	17,6		1,05	1,00	1,05	
		40-60	14,0	20,2	11,3		1,60	0,70	1,00	
3	Soybean for grain	0-20	22,8	22,0	22,9	**22,0**	3,02	3,03	3,04	**3,03**
		20-40	17,8	20,0	17,1		1,90	1,90	2,00	
		40-60	14,5	21,0	15,2		1,00	1,10	1,90	
4	Corn + soybean mix	0-20	22,2	20,6	20,5	**21,1**	3,01	2,01	3,01	**3,01**
		20-40	18,0	20,0	19,0		1,40	1,80	1,80	
		40-60	13,9	19,8	17,7		0,90	1,20	1,00	
5	Soybean plough in florescence phase	0-20	24,6	24,1	26,4	**25,0**	3,05	3,05	3,08	**3,06**
		20-40	22,8	20,5	20,0		1,75	2,00	2,10	
		40-60	20,5	19,5	19,5		1,30	1,30	1,30	

According to three years index by using intermediate crops hydrolyzed nitrogen increased in 100gr soil. In the 3rd version - 2.6 mg/ in 100gr soil than in the control and corn version; in 4th version – 0.6mg, as for 5th version where soybean was ploughed in florescence phase, hydrolyzed nitrogen increased with 3.4mg than in other versions.

In the schedule there is also given humus index according to versions. In control and corn version humus didn't change. In 3rd version (soybean for grain) there is observed humus growth tendency, on the ground of three years average index – 0.04%. In the 5th version humus growth tendency exceeded all versions. The increase equaled 0.07%.

Diagram 1

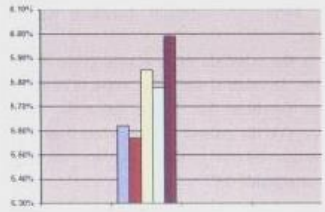
Soil productivity growth tendency Hydrolyzed nitrogen 3 of (0-20,20-40,40-60sm depth) index in mg/100g soil



Version I. Control (without intermediate crops);
Version II. Corn for gram;
Version III. Soybean for grain;
Version IV. Corn + soybean for grain;
Version V. soybean plough in the soil in florescence phase;

Diagram 2

Soil productivity growth tendency
Humus (Total data of 3 depth: 0-20,20-40,40-60sm, %)



Version I. Control (without intermediate crops);
Version II. Corn for grain;
Version III. Soybean for grain;
Version IV. Corn + soybean;
Version V. soybean plough in the soil in florescence phase;

Feijoa Experimental plantation in Geguti was not completely productive in the period of holding the research that's why index of feijoa productivity isn't given in the work. According to experimental versions we have studied feijoa growth dynamics which considers holding biometrical measures according to height (sm.) of the plant, for which height of three plants was measured in every version of the test at the end of vegetation period.

Studying of feijoa growth dynamics on Geguti experimental land by using (Table 7) intermediate crops displayed in the versions that the best condition of growing and development of the plant was

in 5th and 3rd versions (soybean plough in florescence phase and soybean for grain).

Table 7

Feijoa growth dynamics according to experimental versions (data of three years)

#	Versions	2010	2011	2012	Average	Percentage evaluation with control %
1	Control	83	90	102	92	100
2	Corn for grain	83	92	102	93	102
3	Soybean for grain	87	102	124	103	121
4	Corn + soybean	84	100	14	99	112
5	Soybean plough	84	110	135	110	132

On feijoa plant there was discovered Coccus hesperidum L. and Ceroplastes sinensis Del Guer. From diseases there was mentioned: Phyllosticta feijoae Art and Pestalotia versikolor Art. We used combined mixture of 0.2% karbofos and 0.5% zineb. We made first sprinkle before starting vegetation, and the second- in May-June.

Diseases and pests on intermediate crops wasn't detected

Chapter 4. Economic efficiency

For establishing economic efficiency of Feijoa plant we used index of perfectly productive plantation cultivated on the homestead land in the territory of Village Bashi, Samtredia, as the feijoa plants

on our experimental land is very young.

The selling price of 1kg feijoa fruit is 1.50 GEL. Expenses of agrotechnology (cultivation, sowing, fertilization, considering salaries issued for performance of works) for growing plants amounted to 1500 GEL; 500 GEL – for care (1 plant- 1 GEL); picking of 1kg fruit - 15 Tetris; Considering selling price and productivity of feijoa the sum from realization amounted 113254 GEL; Expenses of production equals 2925 GEL.

From the above-mentioned, we can say that Feijoa is sufficiently profitable and productive crop. The expenses on cultivation of plantation will be soon covered by the income from harvest.

This crop should hold the important place in strengthening of the national economics in the future.

Conclusions and recommendations

On the basis of test held during three years we can do the following conclusions

1. Imereti Region alluvial soils are developed on old alluvial layers. They are characterized with profile of medium and large size, they are stony, carbonate and whizzes.
2. According to mechanical content the soil is mainly medium and heavy clay. The number of physical clay fraction is 32-67% averagely.
3. Imereti zone soil and climatic conditions meet environmental requirements of Feijoa, which creates a real opportunity for industrial spreading of the crop.
4. Feijoa can be cultivated on poor, alluvial soils after their proper cultivation, namely, by sowing intermediate crops inter-row spacing of the young feijoa plantations.

5. Cultivation of plantations with biennial plant has advantages than with annual plant: the plant is stronger and starts fruiting sooner after planting.
6. For raising productivity of soil in cultivated perennial crops on alluvial soils, it's better to use legumes (soybean) as they have rhizobiums on the roots by which it makes fixation of atmosphere nitrogen and accumulates biologically pure nitrogen in the soil. This nitrogen is absorbed by the soil and not washed. Rhizobiums absorb nitrate nitrogen and the plant uses it intensively. In this case we receive ecologically pure product. Besides, soybean gives much green mass which we've ploughed into the soil in the period of florescence phase. Much number of organic substances is accumulated into the soil in the form of humus which increases productivity of the soil.
7. In feijoa inter-row spacing by sowing of intermediate crops (corn, soybean) we rationally use the area and receive additional income during 4-5 years after cultivation of plantation, until the inter-row spacing is covered with the plant crown.
8. For cultivation of low productive soils manure is a broadly spread fertilizer, but in West Georgia manure reserve is very small and expensive, it should be applied dozen t/ha which increases cost of the product. Therefore, in organic fertilizers green fertilizers or green manure have preferences.
9. Well developed soybean plant oppresses weeds which is very important as for economics as well for nature protection as we'll avoid application of chemicals against weeds and we'll have ecologically pure product.
10. Feijoa grows capability especially in 5th and 3rd versions (soybean plough into the soil in the period of florescence and

soybean for grain). Correspondingly there height is 130-120sm. Especially the best growing was displayed in 5th version. In West Georgia zones, namely in Imereti alluvial soils feijoa crops is well developed and fruited.

11. Attention should be paid to the fight against pests and diseases. The most important thing of growing technology of feijoa is to protect the plant from harmful organisms. On this action is depended fertile, stable and qualitative harvest of feijoa.
12. Feijoa is sufficiently profitable crops and by cultivation of its plantation the income derived from harvest will soon cover all expenses.

Letter of reference

1. Soil and climatic conditions of Imereti zone satisfies basic bioecological requirements of Feijoa sellowiana which makes real possibility of extending in industry.
   Feijoa can be grown at poor, alluvial and humus-carbonate soils on a greatly inclined slope after their relevant cultivation, especially, by sowing intermediate crops (legumes) in inter-space of the young feijoa plantation.
2. For the purpose of soil enrichment comparatively preferable intermediate crop among legumes is soybean as it gives great green mass (20-30t/ha), has strong roots and the corn bacteria on the roots makes fixation of the atmospheric nitrogen and accumulates biologically clean nitrogen in the ground, which is the cheap source of nitrogen. It isn't washed from the soil and doesn't pollute the environment as it can be happened in case of appling fertilizers and manure.
3. There is noticed increasing tendency of humus and hydrolyzed nitrogen according to versions. According to

given indexes the 5th version holds the first place. On the ground of the abovementioned we can give advice to interested persons with Feijoa to sow annually soybean in inter-space of the young Feijoa plantation for the purpose tilling it down in the period of florescence until Feijoa doesn't develop the whole feeding area.

Basic regulations of dissertation work and results of research is displayed in the publications:

1. Agroecological environment of alluvial soils in Tskaltubo. International Scientific Conference "problems of the fields of subtropical zone and the ways of solving" , Kutaisi, 2010
2. "About Producticity of Alluvial Soils in Samegrelo (Georgia)"- Annals of Agrarian Science, vol.10; no.4. 2012
3. "Agroecological environment for feijoa crops in Imereti Alluvial soils", Botanic gardens in preserving diversity of plants- part II, Batumi, 2013
4. "Feijoa spreading in Imereti region,, – periodical scientific journal Novation, Kutaisi, 2015
5. „Intermediate Cropsina Youg Feijoa Plantation onImereti Alluvial Soils". - Annals of Agrarian Science, vol.13, no.1, 2015