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PROFITABILITY OF CROP PRODUCTION IN AZERBAIJAN

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ABSTRACT

In the modern world, where food security has become one of the main challenges of society, profitability of agricultural production gains a specific importance. Thus the main objective of this study is to determine the most profitable structure of sown area in Azerbaijan through allocation of the sown area according to requirements of crops and the natural-climatic conditions of the regions.

Taking these factors into account the profitability of current structure of sown area in Azerbaijan has been analyzed. The analysis, have been implemented on crop and regional level. This is important, as Azerbaijan has 10 economic regions and natural-climatic conditions of these regions differ from each other. Also, each group of crops requires specific temperature and water resources. In order to gain the main goal, the profit of each group of crops per hectare for the last ten years for each region of the country and the average profit for this period has been calculated. Based on the comparison of results the most profitable crops for each region have been determined. The natural-climatic conditions of the regions and temperature and water requirements of each group of crops have also been analyzed in order to find the evidence based reasons for the profitability of different crops in different regions. And based on the results of this analysis the more profitable structure of sown area for the country have been determined. Detailed calculations, analysis and research taking into account new socio-economic conditions make this study a valuable document and the results of this research can be used to assure the food security of the country, as a background information for policy making in agriculture, regional development programs, specialization of agricultural production in regions and so on.

Key words: food security, agriculture, efficiency, profitability, profit, land use, land resources

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Introduction

In the modern world, where food security has become one of the main challenges of society, efficient use of lands, profitability of agricultural production gains a specific importance. As it is known, land is the main production factor in agricultural production and accordingly, one of the most important factors for ensuring the food security of the country. This role of land and the fact of limitation of utilized agricultural area make land resources of the highest value. Also, the number of population is increasing annually. Despite the increase of number of population, increase of land area of the country is impossible. That is why it is crucial to think about efficient use of land resources taking into account the profitability of agricultural production.

Azerbaijan is one of those countries, with limited land resources. That's why efficient use of land and implementation of measures to prevent land is important from points of view of current and future security of the country (Akif Hamza oglu Veliyev, 2015). Due to increase of number of population, utilized agricultural area per capita decreasing year by year and currently amounts 0.5 ha. According to the estimations, average sown area per capita should be 0.5 ha in order to ensure food security of the country. In Azerbaijan this figure amounts 0.2 ha. Which makes efficient use of land resources one of the most important problems to be solved (Akif Hamza oglu Veliyev, 2015).

At current stage of development, state policy of Azerbaijan is mainly focused on self provision of the country by all food crops. And as bread is the main food in the country, wheat production is given the highest priority. The sown area of the most profitable agricultural products as grape, fruit and tea is decreased year by year. The situation is even so dangerous that, grape and tea can be totally disappeared from the agricultural production cycle. But these sectors of agricultural production are the most profitable and the most labour intensive sectors. Development of these sectors will help to solve the problem of unemployment in rural areas and increase the incomes of agricultural producers. (Akif Hamza oglu Veliyev, 2015)

In the current structure of sown area in Azerbaijan, 62.05% of sown area is used for cereals and dried pulses. 37.8% of total sown area is used only for production of wheat. 25% of sown area comes for fodder crops, 16.5% for potatoes, vegetables, watermelons and melons and only 2.7% for industrial crops (SSCofAR, 2016). From the point of view of profitability, this structure can not be accepted as the most efficient structure of sown area.

The calculations show, average profit per hectare of wheat is much lower compared to fruits, vegetables, potato, grape and so on. So, in case of substitution of wheat with other crops it is possible to earn extra incomes and use that extra income for wheat import. With wheat production in nearly 40% of total sown area, Azerbaijan loses the extra incomes which can be earned from other crops.

Another issue regarding profitability of agricultural production is the low level of wheat yield. According to official statistics, average yield of wheat in the country amounted only 2.6 ton/ha for the last ten years and 2.7 ton/ha in 2013 (SSCofAR, 2015). But, according to FAO statistics in 2013 the yield of wheat in China amounted 5.0 ton/ha, in France 7.3 ton/ha and in Germany 7.9 ton/ha and the world average was 3.3 ton/ha which is 20% higher. Even in Africa the average was higher as it was 2.8

ton/ha (Faostat, 2015). According to the facts mentioned above, there's still space to increase the total amount of wheat production without increasing the sown area. All what is needed is just to determine the most profitable regions for wheat production and invest in those regions for wheat production.

Thus, the main objective of the research is to determine the most profitable structure of sown area in Azerbaijan through allocation of the sown area according to requirements of crops and the natural-climatic conditions of the regions.

Taking these factors into account the profitability of current structure of sown area in Azerbaijan will be analyzed. The analysis will be implemented on crop and regional level. This is important, as Azerbaijan has 10 economic regions and natural-climatic conditions of these regions differ from each other. Also, each group of crops requires specific temperature and water resources. First of all, the profit of each group of crops per hectare for the last ten years for each region of the country and the average profit for this period will be calculated. In the next stage the results of calculations will be compared and the most profitable crops for each region will be determined. Also, based on the natural-climatic conditions of the regions, temperature and water requirements of each group of crops the more efficient and profitable structure of sown area for the country will be determined.

Theoretical bases of the problem

At present, the problem of efficient use of land resources become urgent from both national and global points of view. Increasing number of ecological disasters as floods and draughts all over the world, increasing number of population and relatively increasing demand for food, and increasing socio-economic problems are the key factors making efficient use of land resources one of the main tasks of the modern world. Also, managing land-use rights, restrictions and responsibilities in accordance with land policies and sustainable development principles enhances the value of land resources (Armands Auzins, Ineta Geipele and Iveta Stamure, 2013.). Today the world is towards to understand the need for application of efficient and sustainable land use systems. According to the FAO (1999) *"continuing land degradation and increasing numbers of people living in poverty are among the symptoms of the current pressure on land resources. To date, the world's response to the two challenges of satisfying human needs and maintaining the integrity of global ecosystems has been less than successful"*. The need for efficient use of land resources was recognized even earlier. These problems were *clearly recognized during the United Nations Conference on Environment and Development (UNCED) in 1992 in Rio de Janeiro (Brazil) which called for an integrated approach to the planning and management of land resources* (FAO/UNEP, 1999).

Land resources of Azerbaijan are also under stress and in future this will only increase. According to official statistics of Azerbaijan Republic (2014), population of the country is 9.5 million and total land area is 86.6 thousand km^2. Utilized agricultural area amounts 47.7 thousand km^2 or 55.1% of total area. Due to increase of number of population, utilized agricultural area per capita has decreased for 38.3% during last 43 years (1970-2013) and amounts 0.5 ha. According to the data of State Statistical Committee of Azerbaijan, average population growth in every 20 years is equal to 36,7% and in 2055 the population of Azerbaijan will increase to 17-18 million, in 2095 to 33 million. Accordingly, utilized agricultural area per capita will approximately

decrease to 0.3 ha by 2055 (SSCofAR, 2014). According to these facts it becomes clear that not only in the world, also in Azerbaijan land resources are under stress and efficient use of lands is the only way for meeting the increasing demand of the population. In addition, the main use of land is agricultural production. Because, for industrial, construction and other this kind of purposes geography, landscape, climate and water availability is not as important as it is in case of agricultural production. In case of agricultural production, even each type or group of crops require a specific climate, temperature and water resources. That's why even in planning the constructions of industrial centers, enhancing the urban areas this factor should always be taken into consideration.

Now, the world community recognizes the fact that land resources are under stress and trying to solve the problem using different techniques and approaches. According to the above mentioned the stress on land resources is mainly connected to population growth and increasing demand for food. Different approaches and technologies are used for solving this problem taking into account the efficient use of land resources. From this point of view, profitability of crop production can be accepted as the most appropriate indicator to measure the efficiency of using of land resources.

Generally the concept of efficiency is an economic theory. Efficiency can be determined as the ratio between the result of a process and the resources consumed to achieve this result. According to this approach efficiency of land use can be referred as an economic category and be determined as the ratio between the land-use effect (a result) and consumed resources to achieve this effect (Armands Auzins, Ineta Geipele and Iveta Stamure, 2013). Efficiency is also, referred as production of the same quantity with less use of resources (Hazi Eynalov, 2002.). According to this approach, efficiency is the increase of production quantities with the use of the same amount of resources. And of course if the profit is determined as the difference of the incomes and production costs for the unite of product, increase of production by means of using the same amount or less resources will automatically increase the profit. So, profit can be used as the main indicator to measure the efficiency. But, there's another aspect of efficiency. The above mentioned approaches mainly take into account the quantity of produce. And in case of agricultural production with this approach, efficient use of lands would mean increase of produce from the same area. But, it is not the only way which could be referred as the efficiency of land use. The increase of profits from the same area can be gained through different ways. First of all, increase of production quantities increases the efficiency of land use. Of course increase of production quantities with the same or less use of resources means the increase of profit. Also, the efficiency can be gained through better allocation of sown area. There are several factors which can approve this theory. First of all, depending on the different reasons the selling prices for the unite of different crops differ from each other. For example, in 2013 in Azerbaijan average selling price of grains amounted 21.7 manats per 100 kg, while for potatoes this figure amounted 41.0 manats, fruits 44.1 manats vegetables 24 manats per 100 kg. Selling price is just one factor affecting the income per unit and relatively the profit. There are other indicators which play the main role in creation of profit per unit of product in agriculture. The cost price of the product is also one of the main factors affecting the level of selling prices and later the level of profit. And this indicator can also be different for different crops. And the last important factor affecting the profit is the yield

of crops. Yield is important from the point of view of the efficiency, as the land plays a role of the main production mean in agriculture yield per unit of land area is an important indicator which should be taken into account. Depending on the specific characteristics of crops the yield can also be different for different crops. Thus, the main indicators affecting the profit in agriculture are cost price, selling price and yield of crops. Interrelation of these indicators can be summarized as the following:

$$P_a=(I_a-CP_a)*Y_a$$

Where, P_a is the profit of the unit of product a, I_a is the income of the unit of the product a, CP_a is the cost price of the unit of the product a and Y_a is the yield per hectare of the product a.

From the first point of view it seems to be very simple. But as it was mentioned before, agricultural production is a sphere which completely differs from the other sectors of economy as here the production process completely connected to natural processes. There are such a factors affecting the production process which are not important in other sectors of economy. The environment, the land and the specific characteristics of crops are among the factors influencing the production results. That's why some region which is suitable for a given crop can be absolutely unsuitable for another crop causing the decrease of yield and relatively the level of profitability. That's why allocation of sown area should be implemented depending on the specific characteristics of crops and natural-climatic conditions of the regions in order to increase the efficiency of land use in the country.

Method

The core idea and the main target of evaluation of profitability of crop production is the necessity of increasing efficiency of usage of land resources taking into account the public benefit. According to the set objective of research, different indicators can be used for evaluation of efficiency of land use. In choosing methods for analysis, these indicators play the central role.

As it was mentioned in the previous chapter, in efficiency the main attention is focused in relationship between the achieved outcome and the resources consumed to produce this outcome (Armands Auzins, Ineta Geipele and Iveta Stamure, 2013). And from this point of view, profit can be used as one of the best indicators for measuring the efficiency, as it is the difference between the cost price and income. Profit can also be one of the most appropriate indicators reflecting the public benefit of usage of land resources. If to take into account the fact that food security of the country is the main strategic goal of state policy and food security means physical and economic access to preferred food, profit can be used as one of the most appropriate indicator in this case.

Profit can be illustrated as the following:

$$P_a=I_a-CP_a$$

Here, P_a is profit of the product a, I_a is the income from the sale of product a and CP_a is the cost price of the product a. And to use profit as an indicator to measure the efficiency of land use, this indicator should be connected to land resources. For this purpose it is needed to calculate the profit for per unit of land area. In this case, the above put formula for calculation of profit can be changed as the following:

$$P_a=(I_a-CP_a)*Y_a$$

Here, a new variable Y_a is added. It shows the yield of the product a, and the rest of the formula is the same. With this formula it is possible to calculate the profit of a

given product based on per hectare and make comparative analysis. But as the data on incomes is not available, using selling price instead of income is reasonable. It will not make big changes in the result. And the final formula for the calculation of profit will be as the following:

$$P_a=(SP_a-CP_a)*Y_a$$

Here, SP_a is the selling price and the rest of formula is unchanged.

Thus, using this formula, the profit for different groups of crops is calculated.

Materials

It should be noted that, all of calculations are made based on the data of SSCof AR and the data of private farms is used as the share of these farms in total agricultural production is above 90%. The crops are generalized under ten groups by the SSCofAR: Grains, Cotton, Sugar beet, Tobacco, Tea, Potato, Vegetables, Market-garden crops, Fruit and berry, Grape. The period of analysis cover ten years from 2004 to 2013. The area of analysis is the whole country which consists of ten economic regions: Absheron ER, Ganja-Gazakh ER, Shaki- Zagatala ER, Lankaran ER, Guba-Khachmaz ER, Aran ER, Yukhari Garabagh ER, Kalbacar-Lachin ER, Daglig-Shirvan ER, Nakhchivan ER. So, according to the main objective of the research, profit for each group of crops, for each year of the last ten years period and for each economic region is calculated and the results are compared on crop and regional levels. Also, the data from the manual for universities by M.A.Museyibov "Physical geoFigurey of Azerbaijan", the manual for universities by G.Sh.Mammadov "Soil science and the bases of soil geoFigurey" and FAO reports on crop water relations and water management prepared by Land and Water Division of FAO have been used for further analysis. Based on this data, the temperature and precipitation conditions and the types of soils in the regions of the country and the water and temperature requirements of crops have been determined. As the result of analysis, the most profitable and suitable regions for each group of crops is determined.

Natural-climatic conditions of the regions

Temperature of the regions

Analysis of natural-climatic conditions of the regions is one of the important parts of the study. As natural climatic conditions, mainly temperature and precipitation conditions of the regions are taken into account. Because, temperature and precipitation are among the most important factors affecting the yield of crops. For the analysis the data from physical geography of Azerbaijan will be used (M.A.Museyibov, 1998).

As the landscape of the country is divided into plain, foothill and mountainous areas and the temperature of these areas differ from each other, data for different areas will be analysed separately. It is also necessary to note that some of the economic regions have plain and mountainous areas. First of all temperature of plain areas will be analysed. In table 1, the data from different observation stations is given.

The main part of Aran (Salyan, Kudermir, Mingachevir) and Absheron (Baku) economic regions, parts of Yukhari-Garabagh (Agdam), Guba-Khachmaz (Khachmaz), Ganja-Gazakh (Ganja, Gazakh) and Lankaran (Lankaran) economic regions are placed in plain areas. Also parts of Daghlig Shirvan and Nakhchivan economic regions have plain areas. According to the table 3, generally the temperature of plain areas can be assessed as a temperate.

Table 1. Average temperature for January, July and Year in plain areas of Azerbaijan, C^0

Points in regions	January	July	Annual average
Khachmaz	1.2	24.6	12.2
Baku	3.4	25.5	14.2
Salyan	2.2	26.4	14.6
Lankaran	3.1	25.7	14.1
Kurdemir	1.4	27.3	14.5
Mingachevir	2.7	27.6	14.8
Agdam	1.4	25.0	13.1
Ganja	0.7	25.4	13.1
Gazakh	-0.7	23.7	11.8
Average	1.7	25.7	13.6

The annual average is around 13 C^0. In July the average temperature is around 25 C^0 and in January it is mainly near 2 C^0 which means mainly above 0 C^0. Only in Gazakh region average January temperature goes below 0 C^0 and amounts -0.7 C^0.

Table 2, contains the temperature indicators for the foothills and lower mountainous areas of Azerbaijan.

Table 2. Average temperature for January, July and Year in foothills and lower mountainous areas of Azerbaijan, C^0

Points in regions	January	July	Annual
Guba	-2.2	21.7	9.8
Khizi	-1.1	21.7	10.1
Shamakhi	-0.6	23.2	11.0
Zagatala	0.6	23.6	12.5
Khankendi	-0.5	22.2	10.8
Gubadli	1.5	25.1	13.2
Nakchivan	-4.9	27.6	12.9
Ordubad	-2.6	23.9	11.6
Average	-1.2	23.6	11.5

Parts of Guba-Khachmaz (Guba, Khizi), Daghlig Shirvan (Shamakhi), Shaki-Zagatala (Zagatala), Yukhari Garabagh (Khankendi, Gubadli) and Nakhchivan economic regions (Nakhchivan, Ordubad) go into this area. According to the table 4, average temperature of this area is considerably lower compared to the plain areas. As, annual average changes around 11 C^0, while in January it goes below zero and amount -1.2 C^0 and in July the average temperature changes around 23 C^0. The maximum and minimum of averages is observed in Nakhchivan economic region. In January the average temperature amounts -4.9 C^0 while in July it amounts 27.6. These temperatures make the climate of the region extreme, making it very hot in summer and very cold in winter.

In table 3, temperature indicators for middle mountainous areas of Azerbaijan is given.

Parts of Guba-Khachmaz (Kiriz, Qonaqkend, Elibey), Ganja-Qazakh (Gedebey, Dashkesen), Kalbajar-Lachin (Kalbajar, Shusha), Nakhchivan (Shahbuz) and Lankaran (Lerik) economic regions are placed in middle mountainous areas. Also, parts of Daghlig Shirvan and Shaki-Zagatala economic regions are placed in middle mountainous areas of Azerbaijan.

Table 3. Average temperature for January, July and Year in middle mountainous areas of Azerbaijan, C^0

Points in regions	January	July	Annual
Kiriz	-5.5	13.9	4.7
Qonaqkend	-2.2	19.2	8.1
Elibey	-3.8	15.4	5.7
Gedebey	-2.8	17.2	7.4
Dashkesen	-3.7	15.6	6.0
Kalbajar	-1.5	18.9	8.4
Shusha	-2.2	19.3	8.6
Shahbuz	-4.3	24.8	11.2
Bist	-5.6	22.1	9.3
Lerik	0.0	20.0	9.8
Average	-3.2	18.6	7.9

According to the table 3, the temperature is considerably lower compared to previous areas. The differences are big especially compared to plain areas. As the average annual temperature of these areas amounts only 7.9 C^0 while in plain areas this figure was above 13 C^0. And the average in January amounts -3.2 C^0 which was 1.7 in plain areas. Average in July amounts 18.6 C^0 which shows even in summer times the weather is quite cool.

Precipitation in the regions

In case of precipitation, the area is divided into lowland and mountainous areas (M.A.Museyibov, 1998). First, the data for the lowland areas of the country will be analysed based on the data of the table 4. For these analysis, the data of monthly level of precipitation as well as the average for year will be used. Also, it should be noted that, the data is given on regional level.

Table 4. The precipitation in lowland areas, mm

Points in regions	Absolute height, metr	months												Year
		1	2	3	4	5	6	7	8	9	10	11	12	
Kurdemir	7	20	23	34	36	42	34	18	18	29	34	31	22	341
Yevlakh	15	14	11	22	28	41	31	20	14	25	28	31	13	278
Agsu	165	26	31	44	58	48	44	18	18	35	48	44	26	440
Goychay	107	28	33	47	49	43	45	20	10	37	47	48	26	433
Ganja	303	9	12	15	28	36	36	20	17	23	19	20	11	246
Qazakh	390	14	18	28	47	65	70	34	18	31	21	29	18	393
Agdam	378	18	18	37	55	88	74	32	28	41	37	18	14	460
Beylegan	62	26	14	26	29	26	29	8	8	22	26	35	16	265
Khachmaz	30	27	24	24	24	24	21	10	21	34	44	48	41	342
Mashtaga	28	28	16	16	17	11	9	6	7	21	32	15	31	245
Puta	-20	11	8	11	12	6	3	3	3	7	14	18	14	210
Bilasuvar	5	25	25	35	41	14	14	11	8	17	33	30	22	275
Jalilabad	22	30	34	34	22	13	9	4	26	65	85	65	43	430
Lankaran	-20	77	84	94	53	28	27	16	64	165	226	163	114	1111
Astara	-21	70	78	112	62	39	37	28	94	188	284	198	102	1292

Aran (Kurdemir, Yevlakh, Goychay, Beylegan, Bilesuvar) and Absheron (Mashtaga, Puta) economic regions totally and parts of Guba-Khachmaz (Khachmaz), Daglig Shirvan (Agsu), Ganja-Gazakh (Ganja, Gazakh), Yukhari Garabagh (Agdam),

Lankaran (Jalilabad, Lankaran, Astara) economic regions belong to lowland areas. Also some part of Nakhchivan economic regions go into this area.

According to the data of the table 6, unlike the temperature, level of precipitation in regions considerably differs even if the regions belong to the same lowland area. The driest region of the country is Absheron economic region with 227.5 mm per year. The second driest region of the country is the lowlands of Nakchivan economic region, where the annual precipitation changes around 250 mm. For lowlands in Aran and Yukhari Garabagh economic regions the average changes between 350.7 and 362.5 mm respectively. In lowlands of Daglig Shirvan the annual precipitation changes around 440 mm, while in lowlands of Guba-Khachmaz this figure amounts 342 mm. In lowlands of Ganja-Gazakh economic region the annual precipitation amounts 319.5 mm. Lankaran economic region is the most interesting region. If in one part of the lowlands of the region annual precipitation amounts only 430 mm annually, in the other part this figure amounts 1201.5 mm which is actually the maximum for the country. The data of the table show that the lowlands of the country except Lankaran economic region mainly are dry and especially Aran, Absheron, Nakhchivan and Yukhari Garabagh economic regions can be accepted as the most driest regions.

As it was mentioned above, the second part for precipitation analysis are the mountainous regions of the country (Table 5).

Table 5. The precipitation in mountainous areas, mm

Points in regions	Absolute height, metr	months												year
		1	2	3	4	5	6	7	8	9	10	11	12	
Zagatala	518	25	40	55	81	147	124	89	67	134	78	60	39	939
Shaki	636	22	35	51	76	99	96	56	20	85	60	57	29	692
Shamakhi	749	31	36	49	62	51	51	22	19	41	54	48	29	493
Maraza	760	23	27	39	50	42	39	15	15	31	42	39	23	385
Guba	615	25	23	33	41	50	59	33	40	78	57	53	31	527
Elibey	1750	36	48	72	109	194	170	109	85	170	97	72	48	210
Giriz	2000	15	20	29	49	73	93	49	34	59	39	20	10	490
Gadabay	1452	14	24	32	55	91	103	51	43	40	39	37	20	549
Istisu	2200	32	45	52	52	64	116	52	58	45	64	32	32	644
Shusha	1304	27	25	49	76	124	102	48	38	59	55	27	19	649
Shamkir-Goygol	2470	49	32	65	57	105	105	105	57	40	57	65	65	810
Nakhchivan	878	22	20	27	40	39	20	6	8	7	18	26	18	251
Ordubad	1035	22	25	28	42	53	19	9	5	10	17	28	18	276
Paraqachay	2400	61	70	77	114	144	54	24	15	31	46	77	55	768
Dilmadi	450	84	101	151	84	50	50	34	117	252	370	252	135	680
Lerik	1100	35	45	45	40	60	30	12	24	96	90	66	36	500
Kelvez	1800	15	24	27	33	27	15	15	18	33	45	24	24	300

Shaki-Zagatala (Zagatala, Shaki) region totally, parts of Dagliq Shirvan (Shamakhi, Maraza), Guba Khachmaz (Guba, Giriz, Elibey), Ganja-Gazakh (Gadabay, Istisu, Shamkir-Goygol), Yukhari Garabagh (Shusha), Nakhchivan (Nakhchivan, Ordubad, Paraqachay), Lankaran (Dilmadi, Lerik, Kelvez) go into this region. According to the data of the table 7, the driest regions in this category are the mountainous regions of Nakhchivan economic region with 263.5 mm annual precipitation. In mountainous areas of Daghlig Shirvan, Guba-Khachmaz, Lankaran and Yukhari Garabagh the level of annual precipitation is relatively equal with 500 mm in average. Annual precipitation in mountainous areas of Ganja-Gazakh is considerably

higher compared to other regions. The level of annual precipitation in mountainous areas of this economic region changes around 667.7 mm. But the highest level of annual precipitation is observed in mountainous areas of Saki-Zagatala economic region. In these areas the annual precipitation changes around 815.5 mm which is the maximum for mountainous regions of the country.

Profitability analysis

As it was mentioned before, profit is taken as the indicator for evaluation of the efficiency of land use. Thus, the efficiency of each group of crops will be analysed based on the level of profitability per hectare of sown area. Analyses will be carried on for each group of crops separately.

Grains. The first group of crops for analysis is grains. Average Profit, yield, cost price and selling price are given in the table 6.

Table 6. Average profit of grain crops, manat/ha

	profit	average yield, 100kg/ha	average cost price, 100kg/manat	average selling price, 100kg/manat
Azerbaijan Republic	192.5	26.2	11.8	19.1
Absheron ER	136.5	14.4	11.3	20.6
Ganja-Gazakh ER	283.1	30.3	10.5	19.9
Shaki- Zagatala ER	242.1	25.6	14.1	23.3
Lankaran ER	246.8	21.5	12.7	24.0
Guba-Khachmaz ER	182.6	22.2	13.4	21.5
Aran ER	232.2	28.7	9.4	17.6
Yukhari Garabagh ER	171.4	26.2	13.2	19.5
Kalbacar-Lachin ER	211.8	27.6	15.8	23.5
Daglig-Shirvan ER	187.7	21.6	10.2	19.0
Nakhchivan ER	514.7	31.4	12.4	29.3

According to the table, the highest level of profit is observed in Nakhchivan ER with 514.7 manats/ha. This figure is 2.7 times higher compared to country level. In Ganja-Gazakh, Lankaran, Shaki-Zagatala and Aran economic regions average profit is also, comparatively higher. Which means, production of grains is more efficient in these regions.

Profitability of agricultural products including grains, is connected to several reasons and factors. As it is well known, agriculture is closely connected to natural and climatic conditions and the soil is one of the main production means. High quality of soil is one of the main factors having impact on yield and quality of agricultural products. But, even if the quality of soil is not at the highest level, it is possible to increase it using fertilizers and other chemical means. That is why generally the most important factors having impact on the yield and quality of agricultural products are the temperature and water resources. In case of water requirements of crops, there's still space for adaptation to the environment by application of irrigation systems. As, even if the natural water supply (precipitation, rivers, lakes) in the region doesn't meet the requirements of crops it is possible to use irrigation systems and establish the production. But in case of temperature the situation is completely different. If the

temperature of a region doesn't meet the requirements of crops it is difficult to adapt to the environment. Of course establishment of greenhouses and other this kind of systems is another possibility. But in this case, the cost price of the production will increase. Also, establishment of greenhouses for grains or other perennial crops is impossible taking into account the area needed for production. That's why it is of crucial importance to analyze the natural climatic conditions of the regions and namely temperature conditions and water availability in the regions. In this situation there's also need to research the natural and climatic conditions of regions in order to better allocate the agricultural lands for agricultural production according to the water and temperature requirements of crops.

For Azerbaijan the main crop under the group of grains is wheat and in case of grains the attention will mainly be focused on wheat.

According to FAO reports, winter wheat requires a cold period or chilling (vernalization) during early growth for normal heading under long days. For winter and spring wheat minimum daily temperature for measurable growth is about 5°C. Mean daily temperature for optimum growth and tillering is between 15 and 20°C. Occurrence of (spring) frost is an important factor in selection of sowing date. A dry, warm ripening period of 18°C or more is preferred. Mean daily temperatures of less than 10 to 12°C during the growing season make wheat a hazardous crop. Wheat is relatively tolerant to a high groundwater table. The crop is moderately tolerant to soil salinity. For high yields water requirements (ETm) are 450 to 650 mm depending on climate and length of growing period. (FAO/2015, Crop Water Information).

In case of daily temperature almost all of the regions are suitable for wheat growth with the average temperature around 20^0C. But as a dry, warm ripening period of 18°C or more is preferred the central part of the country, namely Aran economic region and part of Nakhchivan, Ganja-Qazakh and Lankaran economic regions are more suitable for wheat. As the ripening period of wheat is from May to July and this period requires dry and warm weather, above mentioned regions are more suitable with warm temperature and relatively dry season with the lowest level of precipitation. As it was mentioned in previous chapters, the level of precipitation during May, June, July in these regions are much lower compared to mountainous regions. Also, as it was mentioned wheat is comparatively tolerant to groundwater and soil salinity while other crops are not. And central part of the country (Aran economic region, part of Ganja-Gazakh and Lankaran economic regions) has the problems of salinity and the level of groundwater is high in this area (G.Sh.Mammadov, 2007). These factors and the results of profitability analysis show that production of grains (wheat) is more efficient in Nakhchivan, Ganja-Gazakh, Lankaran and Aran economic regions.

Cotton

In case of cotton, the situation is different.

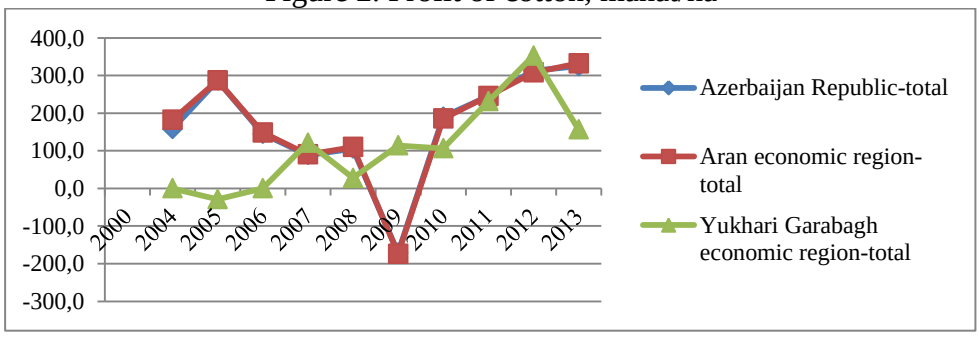
As cotton requires specific natural and climatic conditions it is grown mainly in Aran ER and partly in Yukhari Garabagh ER. Tabale 7, includes the economic data for cotton and according to the data of the table The average profit for the last ten years amounted 171.5 manats/ha for Aran ER and 108.2 manats/ha for Yukhari Garabagh ER. This figure is considerable lower compared to potential opportunities.

Table 7. Average profit of cotton, manat/ha

	profit	average yield, 100kg/ha	average cost price, 100kg/manat	average selling price, 100kg/manat
Azerbaijan Republic	168.5	15.6	26.1	30.7
Aran ER	171.5	15.5	23.0	29.5
Yukhari Garabagh ER	108.2	15.7	29.1	31.9

But, as it is shown in the Figure 2, the situation is changing and the efficiency is getting higher. Especially, in Aran ER, the average profit per ha during the last 4 years was comparatively higher and amounted 267.9 manmats/ha. In 2013 profit amounted 332.2 manats/ha.

Figure 2. Profit of cotton, manat/ha



At present cotton is produced only in Aran and Yukhari Garabagh economic regions. It is mainly connected to specific characteristics of this crop which requires maximum sun shine and dry weather. And these conditions are met in Aran and Yukhari Garabagh economic regions.

For cotton, germination is optimum at temperatures of 18 to 30°C, with minimum of 14°C and maximum of 40°C. For early vegetative growth, temperature must exceed 20°C with 30°C as desirable. For proper bud formation and flowering, daytime temperature should be higher than 20°C and night temperature higher than 12°C, but should not exceed 40 and 27°C respectively. Temperatures between 27 and 32°C are optimum for boll development and maturation but above 38°C yields are reduced. The crop is tolerant to soil salinity. Depending on climate and length of the total growing period, cotton needs some 700 to 1300 mm to meet its water requirements (ETm). (FAO/2015, Crop Water Information).

According to the data from previous chapters, the temperature requirements for cotton are met in Aran and Yukhari Garabagh economic regions with average temperature between 25-30^{0}C in June, July and August. And the level of rainfall in this region is also low (table 4. in Appendix). Regarding water requirements, the region is equipped with irrigation systems and big network of water channels. Although the irrigations systems are old and need reconstruction. The biggest rivers of Kur and Araz flowing through the region and allows to renew and build new irrigation systems and channels in the region.

Also, being tolerant to soil salinity cotton is one of the most suitable crops for Aran region where the level of soil salinity is at the highest level.

Sugar beet

In case of sugar beet the situation is similar to cotton. It is mainly grown in central part of the country, in Aran and Yukhari Garabagh economic regions due to more suitable natural conditions. Table 8, shows the economic indicators for sugar beet.

Table 8. Average profit of sugar beet, manat/ha

	profit, manat/ha	average yield, 100kg/ha	average cost price, 100kg/manat	average selling price, 100kg/manat
Azerbaijan Republic	519.9	303.2	2.6	4.5
Aran ER	606.2	298.3	2.7	4.5
Yukhari Garabagh ER	429.7	308.0	2.5	4.5

The average profit for the last years is relatively equal. In Aran ER this figure amounted 606.2 manats/ha, in Yukhari Garabagh ER it amounted 429.7 manats/ha. No constancy is observed in the level of profit.

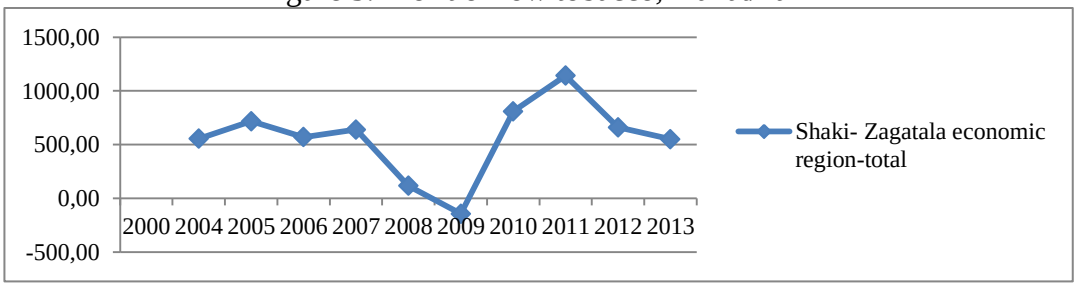
The crop is believed to originate from Asia. The crop is grown in different climates. Seed germination is possible at 5°C but the effective minimum is considered to be 7 to 10°C. Higher temperatures during vegetative growth are preferred, but high sugar yields are obtained when night temperatures are between 15 and 20°C and day temperatures between 20 and 25°C during the latter part of the growing period. During this period temperatures greater than 30°C greatly decrease sugar yields. For high sugar yields and low vegetative growth in the latter part of the growing period, progressively cooler nights should be accompanied by an exhaustion of available soil nitrogen and soil water (FAO/2015, Crop Water Information).

Sugar beet requires comparatively warm climate and is tolerant to salinity. That's why it is more suitable for Aran and Yikhari Garabagh economic regions.

Tobacco

For tobacco the similar situation is observed too. Tobacco is mainly grown in Shaki-Zagatala region as this region is the most suitable region for tobacco production from the point of view of the most appropriate natural conditions. Figure 3, shows the changes in profit of tobacco.

Figure 3. Profit of row tobacco, manat/ha



Average profit for the last ten years amounted 561.7 manats/ha and in 2011 the level of profit even increased to 1142.2 manats/ha. But after 2011 constant decrease is observed.

Tobacco is grown under a wide range of climates but requires a frost-free period of 90 to 120 days from transplanting to last harvest of leaves. Optimum mean daily

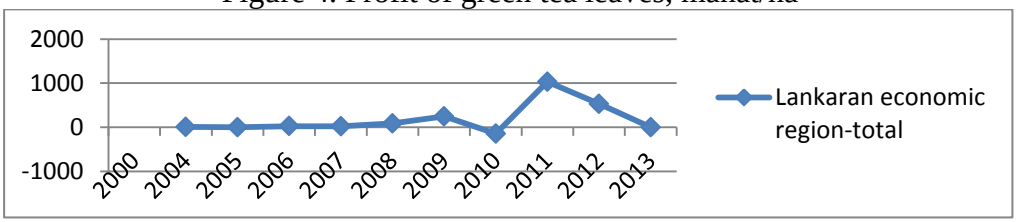
temperature for growth is between 20 and 30°C. A dry period is required for ripening and harvest of the leaves. Excess rainfall results in thin, lightweight leaves. Sun-cured or oriental tobacco requires a relatively dry climate to develop its full aroma. Except for some short-day varieties, cultivated tobacco is day-neutral in its response to flowering. The water requirements (ETm) for maximum yield vary with climate and length of growing period from 400 to 600mm (FAO/2015, Crop Water Information).

Taking into account all of factors mentioned above the most appropriate regions for tobacco production are plain areas of Sheki-Zagatala and Dagliq Shirvan regions. As, the average temperature in these regions is around 23^0C, wheather is comparatively dry and annual precipitation is around 600 mm. And another important factor is the level of salinity of the soil. The soil salinity in these regions is below 0.25% which means the soil is clean and tobacco prefers clean soil as quality of the leaves is affected by soil salinity. Otherwise the Aran economic region could also be a suitable area for tobacco production.

Green tea leaves

The situation in production of green tea leaves is similar to tobacco production. Green tea leaves are produced in Lankaran economic region due to natural conditions. The figure 11 shows that the level of efficiency is relatively unstable and the average of profit for the last years amounted 3.3 manats/ha. It varies between 1030 manats/ha in 2011 and -143.8 manats/ha in 2010. After 2011 decrease of profit is observed.

Figure 4. Profit of green tea leaves, manat/ha



The optimum mean daily temperature for growth is 23 to 30°C. Growth is markedly reduced above 38°C and below 13°C. Active root growth occurs when soil temperatures are higher than 12° C. Injury is caused by a temperature of -3°C occurring over several hours. Temperatures of -8°C cause branches to wither and -10°C generally kills the tree entirely. Tea trees are sensitive to a high salt concentration in the soil. In general total water requirements vary between 900 and 1200 mm per year (FAO/2015, Crop Water Information).

According to the specifications mentioned above the most appropriate region for tea is some part of Lankaran economic region. As the average temperature in January is 3.1^0C and average in July is 25.7^0C. The annual precipitation amounts more than 1111 mm in two regions of economic region which is suitable for the tea production and which is not met in other regions.

Potato

The next product for analysis is potato. Table 9, provides economic data for cotton.

Unlike previous four commodities, potato can be grown all over the country. Potato is one of the most profitable products in the country.

Table 9, shows that almost in all of the regions average profit for the last ten years amounted higher than 1500 manats/ha. Only in case of Daglig-Shirvan economic region profit is lower and amounts 817 manats/ha. But as there was no data available for the last two years for this region, it is possible that the average can be higher. The maximum level of average profit was observed in Guba-Khachmaz economic region with 6127.6 manats/ha, which is quite high for the country. Nakhchivan and Ganja-Gazakh economic regions are also of the high profits with 3057.9 and 2885.7 manats/ha respectively.

Table 9. Average profit of potato, manat/ha

	average	average yield, 100kg/ha	average cost price, 100kg/manat	average selling price, 100kg/manat
Azerbaijan Republic	3068.9	147.1	19.0	37.8
Absheron ER	1682.3	73.2	13.3	40.1
Ganja-Gazakh ER	2885.7	180.1	18.7	37.0
Shaki- Zagatala ER	1826.8	90.1	22.8	42.9
Lankaran ER	1578.8	140.4	18.6	30.0
Guba-Khachmaz ER	6127.6	98.9	16.5	31.9
Aran ER	1992.2	107.6	18.3	36.7
Daglig-Shirvan ER	817.0	65.1	29.7	35.1
Nakhchivan ER	3057.9	134.1	14.8	37.3

Generally potato is relatively efficient in all regions compared to other commodities. But the most efficient regions for this product are Guba-Khachmaz, Nakhchivan and Ganja-Gazakh regions. This is mainly connected to specialization of the regions based on natural conditions.

Yields are affected by temperature and optimum mean daily temperatures are 18 to 20°C. In general a night temperature of below 15°C is required for tuber initiation. Optimum soil temperature for normal tuber growth is 15 to 18°C. Tuber growth is sharply inhibited when below 10°C and above 30°C. Potato varieties can be grouped into early (90 to 120 days), medium (120 to 150 days) and late varieties (150 to 180 days). For rainfed production in dry conditions, flat planting tends to give higher yields due to soil water conservation. Under irrigation the crop is mainly grown on ridges. The crop is moderately sensitive to soil salinity with yield decrease. For high yields, the crop water requirements (ETm) for a 120 to 150 day crop are 500 to 700 mm, depending on climate (FAO/2015, Crop Water Information).

According to the requirements of the crop, the best fitting regions for the production are mountainous regions of Ganja-Gazakh and Guba-Khachmaz regions. Where the average temperature in growth period changes between $15\text{-}20^0$C which is close to the optimum for potato. Also, the annual precipitation in these regions changes between 500-700mm which also helps the soil to be maintained at a relatively high moisture content. Also, some regions of Lankaran economic region are suitable for potato production.

Vegetables

Indicators of vegetable production are similar to potato. As it was with potatoes, production of vegetables is efficient in all regions of the country. According to the data

of table 10, the country level average of profit for the last ten years amounted 1798.4 manats/ha.

In all regions profit per hectare was higher than thousand manats, except Lankaran and Daglig-Shirvan economic regions with 719.8 and 605.6 manats/ha of profits respectively.

Table 10. Average profit of vegetables, manat/ha

	profit	average yield, 100kg/ha	average cost price, 100kg/manat	average selling price, 100kg/manat
Azerbaijan Republic	1798.4	143.2	7.5	20.0
Absheron ER	1731.3	89.8	7.4	26.7
Ganja-Gazakh ER	1258.9	155.6	8.2	14.6
Shaki- Zagatala ecER	1178.0	97.9	14.1	26.0
Lankaran ER	719.8	216.9	7.2	10.5
Guba-Khachmaz ER	2743.6	195.1	7.9	22.0
Aran ER	1616.6	116.5	7.0	20.7
Yukhari Garabagh ER	1291.5	143.1	6.0	14.8
Daglig-Shirvan ER	605.6	75.3	14.8	22.9
Nakhchivan ER	1232.3	101.9	7.7	19.2

The highest level of average profit is observed in Guba-Khachmaz economic region with 2743.6 manats/ha. In Absheron and Aran economic regions profitability of vegetables are also high with 1731.3 and 1616.6 manats/ha respectively. In Ganja-Gazakh, Shaki-Zagatala and Yukhari Karabakh average profit amounts around 1200 manats/ha.

As in Azerbaijan the main crops under vegetables are tomato and cucumber, mainly the requirements of these products will be taken into account. Optimum mean daily temperature for growth is 18 to 25ºC with night temperatures between 10 and 20ºC. The crops are very sensitive to frost. Temperatures above 25ºC, when accompanied by high humidity and strong wind, result in reduced yield. Dry climates are therefore preferred for tomato production. The crop is moderately sensitive to soil salinity. Total water requirements (ETm) after transplanting, of a tomato crop grown in the field for 90 to 120 days, are 400 to 600 mm, depending on the climate (FAO/2015, Crop Water Information).

According to the requirements of crops the most suitable regions for vegetables are plain parts of Guba-Khachmaz and Aran regions where the average temperature during production period is around 20-25^{0}C and the precipitation is around 500mm. Plain areas of of Daghlig Shirvan and Lankaran economic regions are also of good potential as these regions have similar natural conditions.

Market-garden crops

In case of market-garden crops the situation is different compared to potato and vegetables. If previous two crops can be grown all around the country and be efficient, market-garden crops require specific natural and climatic conditions and depending on that factor, these crops are not grown in all regions. The table 11, shows profit and other economic indicators for market-garden crops.

Table 11. Average profit of market-garden crops, manat/ha

	average profit, manat/ha	average yield, 100kg/ha	average cost price, 100kg/manat	average selling price, 100kg/manat
Azerbaijan Republic	987.0	132.8	6.5	13.8
Absheron ER	1002.4	78.1	6.4	18.9
Shaki- Zagatala ER	1021.0	169.6	6.6	20.5
Aran ER	773.9	120.3	9.9	16.0
Yukhari Garabagh ER	720.3	79.4	12.5	20.5
Kalbacar-Lachin ER	717.5	136	6.2	11.9
Nakhchivan ER	2293.7	121.5	4.8	13.4

According to the table the average profit of market-garden crops on country level amounts 987 manats/ha.

The higest profitability is observed in Nakhchivan economic region with 2293.7 manats/ha. In Shaki-Zagatala and Absheron profitability is also relatively high and amounts 1021.0 and 1002.4 manats/ha respectively. Although Aran and Kalbajar-Lachin regions have suitable natural conditions for production of market-garden crops the level of profit amounted only 773.9 and 717.5 manats/ha respectively.

These crops prefer a hot, dry climate with mean daily temperatures of 22 to 30°C. Maximum and minimum temperatures for growth are about 35 and 18°C respectively. The optimum soil temperature for root growth is in the range of 20 to 35°C. Fruits grown under hot, dry conditions have a high sugar content of 11 percent in comparison to 8 percent under cool, humid conditions. The crop is very sensitive to frost and moderately sensitive to salinity. Water requirements for the total growing period for a 100-day crop range from 400 to 600 mm market-garden crops (FAO/2015, Crop Water Information).

According to crop requirements the most suitable regions for market-garden crops are Aran and Absheron economic regions. As, the average temperature is equal to requirements which is around 25-27^{0}C and the weather in these regions are dry with low level of precipitation. Also, lowland parts of Nakhchivan and Yukhari-Garabagh regions are also suitable for production of market garden crops. But the level of precipitations is lower than required and that's why irrigation is required.

Fruit and berries

The next group of crops are fruit and berries. Table 12 contains economic data for fruits and berries.

For each region a specific type of fruits or berries are characteristic depending on natural and climatic conditions. According to the table, average profit of fruits on country level for the last ten years amounted 1874.8 manats/ha which is relatively high. The highest profitability is observed in Nakhchivan region with 4264.5 manats/ha. In Lankaran region average profit amounts 3178.4 manats/ha and in Aran 2402.0 manats/ha. In Shaki Zagatala and Guba-Khachmaz average profit was also relatively high and amounts 1992.4 and 1554.0 manats/ha respectively. In Absheron and Daglig-Shirvan profitability is lower.

Table 12. Average profit of fruit&berries, manat/ha

	average profit, manat/ha	average yield, 100kg/ha	average cost price, 100kg/manat	average selling price, 100kg/manat
Azerbaijan Republic	1874.8	70.9	14.4	40.6
Absheron ER	173.8	7.8	21.4	44.2
Shaki- Zagatala ER	1992.4	31.4	17.1	80.0
Lankaran ER	3178.4	110.5	22.5	51.1
Guba-Khachmaz ER	1554.0	72.6	15.0	36.4
Aran ER	2402.0	95.4	9.0	34.0
Yukhari Garabagh ER	931.0	65.8	19.2	31.3
Daglig-Shirvan ER	833.9	71.7	10.6	22.3
Nakhchivan ER	4264.5	133.6	10.3	51.7

But according to natural climatic conditions each region is more suitable for specific type of fruits.

Olive

Olive trees have been sparsely planted for centuries, without irrigation, on marginal lands in Mediterranean climate conditions because of their high resistance to drought, lime and salinity. Olive trees are sensitive to waterlogging and temperatures below -10 °C. Chilling is needed for flower bud differentiation. Lack of chilling results in scarce and uneven formation of flower buds. Chilling requirements vary with the cultivar but at least 10 weeks below 12 °C are usually needed for abundant flowering. Olive trees are very resistant to drought and show a high capacity to recover from prolonged drought periods. Trees can completely re-hydrate within three days of irrigation after a water deficit that reached a leaf water potential (LWP) of -4.0 MPa. Olive trees withstand long periods of drought and can survive in very sparse plantings even in climates with only 150-200 mm annual rainfall. However, economic production requires much higher annual precipitation or irrigation (FAO/2015, Crop Water Information).

According to requirements the most efficient region for olive trees are Absheron and Aran regions. As annual precipitation in these regions are more than 200 mm the environment can be accepted as the most appropriate area. As, the land of Aran region are of the high salinity and are not suitable for the most of crops and fruit trees, also the low level of precipitation and draughts makes production of olives in these regions very efficient. The same goes for Absheron economic region.

Apple

Most apples are grown in temperate zones because of the high chilling requirements for proper bud break in the spring. The optimum climatic requirements might be characterized as cool to cold winters followed by a rapid rise in temperature in spring. Rainfed apple orchards can survive and be productive in temperate zones without irrigation, whereas the survival of apple orchards in arid and semi-arid zones depends on the availability of water for irrigation throughout most of the growing season. The performance of apple in terms of crop yield, fruit size, fruit quality, storability, and longterm productivity are highly dependent on irrigation and irrigation management (FAO/2015, Crop Water Information).

According to requirements the most suitable regions for production of apples are parts of Guba-Khachmaz, Sheki-Zagatala, Daglig Shirvan and parly Ganja-Gazakh economic regions. As these regions have required chilling in winters and enough precipitation.

Plum

Cultivated plums include two main species, European (*Prunus domestica* L.) or 'prunes' and Japanese plums (*Prunussalicina* L.). European plums are cultivated in temperate climates to fulfil chilling requirements and to enable proper bud break. They are relatively late flowering, while Japanese plums grow better in temperate-warmer regions, as their chilling requirements are less. Early varieties can be grown without irrigation in arid climates with rainfall as low as 300 mm/season and midseason varieties require at least 400-500 mm/season. However, productivity and fruit size in these conditions are usually low and, therefore, most plantations are irrigated, especially in arid and semi-arid climates. A distinction should be made between plums for fresh fruit production and those for dried fruit production (prunes), as dry matter accumulation is less sensitive to water stress than is the increase in fresh weight, particularly during the last stages of fruit development. In addition, lower fruit hydration rates resulting from water deficits may also offer an advantage for post-harvest fruit processing in the case of prunes for dry fruit production. Thus, prune trees are considered to be moderately resistant to water stress. Thus, long-term deficit irrigation of young trees causes a reduction in productivity by reducing tree size (FAO/2015, Crop Water Information).

According to requirements, the most suitable areas for prune trees is Nakhchivan economic region. Where the trees can fulfill the chilling requirements. Also, as these trees are resistant to water stress and the average level of precipitation of the economic region is around 250 mm/year. As the other trees are sensitive to water stress plums (prune) are the most appropriate trees for the region. For Japanese plums northern part of the country - Guba-Khachmaz, Daghlig Shirvan, Shaki-Zagatala and Ganje Gazakh economic regions - is more suitable. Where the levels of average temperature and precipitation are similar to requirements of trees.

Pear

Pears are grown in a wide-range of climates, from cool to warm and from humid to arid-areas. The major factors limiting for the expansion of pear production in warm regions are insufficient chilling temperatures during winter and the occurrence of diseases such as fireblight. Pear trees are not a drought resistant species and its commercial production in areas with dry seasons depends entirely on irrigation (FAO/2015, Crop Water Information). As pear is not considered drought resistant the central part of the country is not suitable for these trees. Aran economic region totally, parts of Daglig Shirvan, Ganja-Gazakh, Yukhari Garabagh can be included into this area which is not suitable for pears. Also, Nakhchivan economic region is not suitable for pear trees with its draught climate.

Peach and cherry

Peach production is limited worldwide by its relatively narrow range of climatic adaptation. On the one hand, it flowers early and is quite sensitive to frost–particularly at flowering- but on the other, it has chilling requirements that are not met in some of the frost-free areas of the temperate zones and the subtropics. The fruit is usually

consumed fresh and, because consumers in many world areas prefer large-size fruit, peach is grown mostly under irrigation even in many subhumid areas. Peach chilling requirements, usually computed during dormancy as hours above 7^0C, vary widely among varieties, but in some may be substantial. The water use rates of peach trees are similar to other *Prunus* species, such as nectarines or plums (FAO/2015, Crop Water Information).

According to the requirements the fruits can be produced in mountainous regions of Guba-Khachmaz, Daghlig Shirvan, Sheki-Zagatala, Ganja-Gazakh, Lankaran and Nakhchivan economic regions.

Nuts (walnuts, chestnuts and hazelnut)

Cultivated in temperate climates. Nut orchards have high water use rates as because of the high leaf, tall tree stature, and near full ground cover when the trees are fully mature. The trees require chill in winter and 600-700 mm/year precipitation of average (FAO/2015, Crop Water Information). The mountainous regions of Guba-Khachmaz, Daghlig Shirvan, Sheki Zagatala, Ganja-Gazakh, Lankaran and partly Nakhchivan economic regions are suitable for these trees.

Apricot

Apricot grows well in temperate regions; however, it is also able to tolerate very low temperatures during winter. Particularly, *P. sibirica* can tolerate air temperatures of about -35 °C, and soil temperatures down to -13 °C at the 40 cm depth did not damage its roots. In areas of winter and spring rainfall, water stress conditions rarely occur before harvest in early cultivars, particularly when soils are deep and with high water-holding capacity (FAO/2015, Crop Water Information)..

As the coldest region of the country is Nakhchivan economic region apricots can be grown in this region. While other trees can not resist the low temperatures apricot can tolerate these critical temperatures in winter.

Pomegranate

Semiarid climate with mild winters and hot summers are ideal for its growth. Pomegranates can be successfully grown in areas with temperature ranging from 25-35 C and an annual rainfall of 500- 800 mm. Hot and dry climate during fruit development improves its fruit quality. The plants are affected if the temperature remains below 11^0C for a longer time. Temperatures lower than -15C and higher than 40C as well as severe sunlight can damage the products. Old and sweet **pomegranate trees** are more sensitive toward cold weather. Sudden cold in spring is also harmful for blossoms and leaves (FAO/2015, Crop Water Information).

According to the requirements, Aran and Absheron economic regions are the best areas for production of pomegranate. Nakhchivan economic region could also be suitable, but the maximum in summer time and minimum in winter can harm the trees.

Citrus

The optimum mean daily temperature for growth is 23 to 30°C. Growth is markedly reduced above 38°C and below 13°C. Active root growth occurs when soil temperatures are higher than 12° C. Most citrus species tolerate light frost for short periods only. Injury is caused by a temperature of -3°C occurring over several hours. Temperatures of -8°C cause branches to wither and -10°C generally kills the tree entirely. Flowers and young fruits are particularly sensitive to frost and are shed after very short periods of temperatures slightly below 0°C. Dormant trees are less

susceptible to frost. Strong wind is harmful to citrus trees because flowers and young fruits fall easily; windbreaks are provided where necessary. Water requirements for high production vary with climate. In general total water requirements vary between 900 and 1200 mm per year. (FAO/2015, Crop Water Information).

The only region suitable for citruses is Lankaran economic region. The average temperature in January stays above 3^0C and the annual level of precipitation is above 1111mm.

Grape

The next product is grape. Historically grape was important for the whole country. Especially in soviet period, grape was one of the main sources of incomes for the country. Later, due to changes in socio-political and economic life, grape production was shifted into secondary group of importance. Table 13 shows the profit and other economic data for grape.

Table 13. Average profit of grape, manats/ha

	profit, manat/ha	average yield, 100kg/ha	average cost price, 100kg/manat	average selling price, 100kg/manat
Azerbaijan Republic	1021.8	73.3	18.6	32.1
Shaki- Zagatala ER	3255.9	79.1	26.9	71.9
Guba-Khachmaz ER	5576.1	102.4	36.8	88.1
Aran ER	957.8	68.6	24.2	38.2
Daglig-Shirvan ER	591.9	49.0	17.9	29.9
Nakhchivan ER	5500.9	136.3	12.0	50.7

According to the table, the average profit on country level amounts 1021.8 manats/ha. But in regional level the level of profit is much more higher. As in Guba-Khachmaz region average profit amounts 5576.1 manats/ha, in Nakhchivan region 5500.9 manats/ha and in Shaki-Zagatala region 3255.9 manats/ha. In Aran region profitability is lower and amounts 957.8 manats/ha.

The lowest level of profitability is observed in Daglig-Shirvan with 591.9 manats/ha. It should be noted that in soviet period this region was one of the biggest producers of grape and with the highest level of profitability.

Grape needs a long, warm to hot, dry summer and a cool winter. The subtropics with winter rain are most suited. In climates with a cool winter, the grape can survive temperatures down to -18°C, but once new growth begins, minor frost will kill the fruiting shoots. Under cool to moderate warm weather, fruits ripen slowly and produce dry table wines of good quality. In warmer climates, the heat before and during ripening favours a high sugar content, which makes fruits better suited for port and sherry production. High production can be obtained under rainfed conditions. Grape vines are moderately sensitive to soil salinity. (FAO/2015, Crop Water Information).

According to requirements plain areas of Guba-Khachmaz, Lankaran, Daghlig Shirvan, Ganja-Gazakh and Sheki-Zagatala regions are suitable for grapes. As the average level of precipitation changes around 400mm/year and the average temperature in July is around 23-25^{0}C these regions can be accepted as the most efficient regions for grape production.

According to statistics, the most efficient regions for grape production are Guba-Khachmaz, Nakhchivan and Shaki-Zagatala regions.

Conclusion

As the analysis show agricultural lands of Azerbaijan can be used more efficiently. According to official statistics more than half of sown area is used for production of grains while the profitability of these products is considerably lower compared to different types of other agricultural products.

Table 14. Average profit of agricultural products in Azerbaijan Republic-total

	Average profit for 2004-2013, manat/ha	Average sown area for 2004-2013, ha/year	Total profit For 2004-2013, manat/year
Grains	192.5	920476.9	177191803,3
Cotton	168.5	56430.2	9508488,7
Sugar beet	519.9	5974.7	3106246,53
Tobacco	561.7	1636.9	919446,73
green tea levaes	222.8	1507.2	335804,16
Potato	3068.9	66717.6	204749642,6
Vegetables	1798.4	80405.4	144601071,4
market-garden crops	987.0	30821.5	30420820,5
fruit and berry	1874.8	117818.6	220886311,3
Grape	1021.8	13200.4	13488168,72

According to the table, the average profit of grains in the country amounts 192.5 manats/ha, while for potato this figure amounted 3068.9 manats/ha or 15.9 times more compared to grains. In case of fruit and berries these figures amounted 1874.8 and 9.7, for vegetables 1798.4 and 9.3, for grape 1021.8 and 5.3, for market garden crops 987.0 and 5.1 respectively.

It means in average every year agricultural producers losing this amount of money per ha. If to take into consideration the total area of grains, the amount of loss is millions (table 14).

There are several reasons for the establishment of this production structure in the country:

- First of all, bread from wheat flour is the main food for the country;
- Beginning from 2007 subsidies (total 80 manats) are provided to wheat and rice producers based on per hectare and this factor stimulate the land owners to produce wheat;
- Problems in accessing the markets.

The last one is the most important reason. Due to the problems in accessing the local and international markets, the lack of infrastructure and other relative problems the land owners begin to produce grains and especially wheat. Because, in case of grains they can use it as feed in livestock production, also for home consumption producing flour. But in case of other products if they can't sell it, the product is damaged and lost.

To solve these problems to make changes in current subsidy system would be useful. Yield based subsidy system could be more efficient compared to area based subsidy system. It means, to provide more subsidies to producers with higher yields.

The next measure could be establishment of better conditions for accessing the markets in big cities of the country, also support in export. This, could stimulate the land owners to produce more efficient products.

Establishment of the regional distribution centers is also, one of the ways for more efficient use of agricultural lands of the country.

Taking into account the results of study the next structure of sown areas on regional level is suggested:

According to natural conditions and the results of profitability analysis production of grains (wheat) is more efficient in plain areas of Nakhchivan, Ganja-Gazakh, Lankaran and Aran economic regions.

According to the data from previous chapters, the temperature requirements for cotton are met in Aran and Yukhari Garabagh economic regions with average temperature between 25-30^{0}C in June, July and August. And the level of rainfall in this region is also low (table 4. in Appendix). Regarding water requirements, the region is equipped with irrigation systems and big network of water channels. Although the irrigations systems are old and need reconstruction. The biggest rivers of Kur and Araz flowing through the region and allows to renew and build new irrigation systems and channels in the region. Also, being tolerant to soil salinity cotton is one of the most suitable crops for Aran region where the level of soil salinity is at the highest level.

Sugar beet requires comparatively warm climate and is tolerant to salinity. That's why it is more suitable for Aran and Yikhari Garabagh economic regions.

Taking into account all of factors, the most appropriate regions for tobacco production are Sheki-Zagatala and Dagliq Shirvan regions. As, the average temperature in these regions is around 23^{0}C, wheather is comparatively dry and annual precipitation is around 600mm.

According to the specifications, the most appropriate region for tea is some part of Lankaran economic region. As the average temperature in January is 3.1^{0}C and average in July is 25.7^{0}C. The annual precipitation amounts more than 1111 mm in two regions of economic region which is suitable for the tea production and which is not met in other regions.

According to the requirements of potato, the best fitting regions for the production are mountainous regions of Ganja-Gazakh and Guba-Khachmaz regions. Where the average temperature in growth period changes between 15-20^{0}C which is close to the optimum for potato. Also, the annual precipitation in these regions changes between 500-700mm which also helps the soil to be maintained at a relatively high moisture content. Also, some regions of Lankaran economic region are suitable for potato production.

According to the requirements of crops the most suitable regions for vegetables are parts of Guba-Khachmaz and Aran regions where the average temperature during production period is around 20-25^{0}C and the precipitation is around 500mm. Parts of Daghlig Shirvan and Lankaran economic regions are also of good potential as these regions have similar natural conditions.

According to crop requirements the most suitable regions for market-garden crops are Aran and Absheron economic regions. As, the average temperature is equal to requirements which is around 25-27^{0}C and the weather in these regions are dry with low level of precipitation. Also, lowland parts of Nakhchivan and Yukhari-Garabagh regions are also suitable for production of market garden crops. But the level of precipitations is lower than required and that's why irrigation is required.

In case of fruits, different fruits have different requirements. That's why it is more reasonable to go through each fruit separately.

According to requirements the most efficient region for olive trees are Absheron and Aran regions. As annual precipitation in these regions are more than 200 mm the environment can be accepted as the most appropriate area. As, the land of Aran region are of the high salinity and are not suitable for the most of crops and fruit trees, also the low level of precipitation and draughts makes production of olives in these regions very efficient.

According to requirements the most suitable regions for production of apples are parts of Guba-Khachmaz, Sheki-Zagatala, Daglig Shirvan and parly Ganja-Gazakh economic regions. As these regions have required chilling in winters and enough precipitation.

According to requirements, the most suitable areas for prune trees is Nakhchivan economic region. Where the trees can fulfill the chilling requirements. Also, as these trees are resistant to water stress and the average level of precipitation of the economic region is around 250 mm/year. As the other trees are sensitive to water stress plums (prune) are the most appropriate trees for the region. For Japanese plums northern part of the country - Guba-Khachmaz, Daghlig Shirvan, Shaki-Zagatala and Ganje Gazakh economic regions - is more suitable. Where the levels of average temperature and precipitation are similar to requirements of trees.

Nut orchards have high water use rates as because of the high leaf, tall tree stature, and near full ground cover when the trees are fully mature. The trees require chill in winter and 600-700mm/year precipitation of average. The mountainous regions of Guba-Khachmaz, Daghlig Shirvan, Sheki Zagatala, Ganja-Gazakh, Lankaran and partly Nakhchivan economic regions are suitable for these trees.

As the coldest region of the country is Nakhchivan economic region apricots can be grown in this region. While other trees can not resist the low temperatures apricot can tolerate these critical temperatures in winter.

According to the requirements, Aran and Absheron economic regions are the best areas for production of pomegranate. Nakhchivan economic region could also be suitable, but the maximum in summer time and minimum in winter can harm the trees.

The only region suitable for citruses is Lankaran economic region. The average temperature in January stays above 3^{0}C and the annual level of precipitation is above 1111mm.

According to requirements plain areas of Guba-Khachmaz, Lankaran, Daghlig Shirvan, Ganja-Gazakh and Sheki-Zagatala regions are suitable for grapes. As the average level of precipitation changes around 400mm/year and the average temperature in July is around 23-25^{0}C these regions can be accepted as the most efficient regions for grape production.

According to statistics, the most efficient regions for grape production are Guba-Khachmaz, Nakhchivan and Shaki-Zagatala regions.

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