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AgriSciences**

**Farming system analysis in rural and peri-urban areas
of Osh province, southern Kyrgyzstan**

Master's thesis

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Declaration

I hereby declare that this thesis entitled **“Farming system analysis in rural and peri-urban areas of Osh province, southern Kyrgyzstan”** is my own work and all the sources have been quoted and acknowledged by means of complete references.

In Prague, 22 April 2016

.....

Monika Kosová

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Abstract

Total number of 50 households, 25 from rural and 25 from peri-urban areas, were incorporated in the study focused on analysis of household resources capacity and use, land-use management and household income diversification. Special attention was given to role of homegardens, as a traditional and integral part of households in the target area. Targeted households differed in proximity to province centre, in ethnic composition and access to land resources. Data on historical background of local farming systems were collected via discussions with key-informants and direct observations was used in order to get deeper insight into the target area. Data on household resources capacity and use as well as income structure and volume were collected via semi-structured interviews with households' heads and their wives. Study identified differences between rural and peri-urban areas in both resources management and capacity, income distribution and land-use systems. Rural farming systems were based particularly on field crop production, while peri-urban farming systems devoted significant proportion of their land-use system to fruit orchards. Both land-use systems were highly correlated with total family income. Peri-urban households generate more income from off-farm activities, while rural household have more income from farm crop production. Households in rural area have lack of opportunities to work off-farm, so they pursue to maximise a profit from the field crop production and selling products from the field generated the main source of income for the household. The survey nevertheless identified preferred crop species planted in targeted homegardens in both study sites in time of the survey, mainly for subsistence food production and only minor additional household income was derived from selling their surplus product.

Keywords: land-use system; household resources; homegardens; income diversification; Osh province; Kyrgyzstan.

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1 Introduction

Kyrgyzstan quickly went through demographic changes and rapidly liberalized the agricultural market and prices, distributed land to the farmers, and even recognized the rights of private ownership of land and allowed restricted agricultural land transactions. During the years of transition from a planned to a market economy, the living standard of the Kyrgyz people deteriorated sharply, rural employment decreased and poverty increased (USAID 2011; Brück et al. 2013; Megoran 2013; UNDP 2013). Furthermore, dramatic rise in food and fuels prices due to the global economic and financial crisis during the period 2008-2010, affected many households, who fell into poverty (USAID 2011; Bierbaum and Gassmann 2012). Followed by an outbreak of political instability in 2010 with conflicts between ethnic Kyrgyz and Uzbeks in the southern part of the country, whereby Osh city was engulfed in a massive intercommunal violence between these ethnics (USAID 2011; Megoran 2013). Nevertheless, those conflicts negatively influenced farming systems development in the whole country, but poor southern regions was affected most (UNDP 2013). Generally, household represents the primary unit of production and consumption in different farming systems worldwide (see e.g. (Brush and Turner 1987; Eckman 1994; Upton 1996; Spring 2000; Doppler 2006) and household income has been recognized as the most useful indicator reflecting economic success of particular households (Brush and Turner 1987; Upton 1996). Household members have potential access to different sources of income and their participation in the income sources may have different effects on poverty and income distribution (Saith 1992). Household income is further classified into farm and off-farm (Saith 1992; Ellis 1993; Doppler 2006) and the structure is thus influenced also according to the opportunities in external environment of particular farming system. Households living in peri-urban areas tend to generate more income from off-farm activities, while rural ones are more focused on farm production (Ellis 1998; Barrett et al. 2001). Nevertheless land and labour are common resources in farming systems, the amount of labour available and necessary for production determines the nature of the households (Brush and Turner 1987). Capacity and ownership of land resources represent a crucial

indicator of household economic success as well. The most common resources recognized within the farming systems are natural resources, such as fields, homegardens, water or forests, and human resources, particularly labour force. (Ellis 1998; Doppler 2006). Generally, gender composition of the households plays a significant role for participating in the design and management of agro-biodiversity of farm production and possibly might be one of the stimulus for the ongoing household security (Eckman 1994; Ellis 1998; Popova 2002; Kumar and Nair 2004; World Bank 2009). Consequently men and women have different needs, priorities, and knowledge about current production (Kumar and Nair 2004; World Bank 2009).

Household resources capacity and use also reflects maintaining of the farm production (Reyes-García et al. 2005), particularly homegardens, which represent a traditional farming system involving integrated production in combination with various species of trees and crops nearby the homestead, occasionally in association with livestock (Kumar and Nair 2006; Peyre et al. 2006). The role of the homegarden for the household economy may differ according to particular products and their utilization Traditional homegardens provide a stable supply of products and socio-economic benefits for households which maintain them (Niñez 1987; Christanty 1990; Kumar and Nair 2004; Nair 2006; Kabir and Webb 2009) and they are intensively managed mainly by household labour (Fernandes and Nair 1986; Shajaat 2005). Homegarden management practices reflect socioeconomic and demographic characteristics of households resulting in diversification of production between both edible plants production as well as species supposed to provide household with additional income as well (Fernandes and Nair 1986; Kumar and Nair 2004; Kabir and Webb 2009; Kala 2010; Vlkova et al. 2011). In Kyrgyzstan 10 % of the total arable land is used for traditional homegardens with an average size of 0.11 hectare per household (Akramov and Omuraliev 2009). Nevertheless, homegardens have a potential to meet economic, social, and environmental conditions of households for their sustainable livelihoods (Nair 2006).

2 Literature review

2.1 Household as an economic unit

Household represents the primary unit of production and consumption in different farming systems worldwide (see e.g. (Brush and Turner 1987; Eckman 1994; Upton 1996; Spring 2000; Doppler 2006)). They can be identified as a social group of people who reside in the same place, share foods and usually make collective decisions over resource management to generate household income (Baerwald 1955; Meillassoux 1981; Ellis 1993; Doppler 2006). Household income has been recognized as the most useful indicator reflecting economic success of particular households (Brush and Turner 1987; Upton 1996) and could be further classified into farm and off-farm (Saith 1992; Ellis 1993; Doppler 2006). As farm income comprises benefit from crops and livestock production, including both consumption and cash from selling surpluses, off-farm income comprises wages, exchange labour compensation, activities related to collecting and/or gathering of products from external environments, running small businesses or government support and remittances (Ellis 1998; Doppler 2006). Household income varies from year to year, and also seasonally, depending on the outcome of farm production, sales and prices of the products (Ellis 1998), and income diversification into off-farm activities should probably increase incomes and reduce risk (Otte and Upton 2005).

Household members have however different potential to benefit from produced income and very often its distribution does not reflect the contribution of individual members to income generation (Saith 1992). Household income structure is thus influenced also according to the opportunities in external environment of particular farming system. Households living in peri-urban areas tend to generate more income from off-farm activities, while rural ones are more focused on farm production (Ellis 1998; Barrett et al. 2001). In many rural areas, goods and services are largely produced and traded locally within the village economy,

because of their limited access to the major urban markets (Otte and Upton 2005). Gender composition of the households, i.e., differences in the proportion of men and women in a household, has a very important role on resources use as it plays a significant role for participating in the design and management of agro-biodiversity of farm production and possibly might be one of the stimulus for the ongoing household cash, food and nutrition security (Eckman 1994; Ellis 1998; Popova 2002; Kumar and Nair 2004; World Bank 2009). The size and structure of the incomes of household members from all sources differ for men and women. Despite the fact that global trends show that women have lower average wages, and it is more difficult for them to achieve the same level of economic welfare as for men, mainly because of gender discrimination, differences in the behaviour on the labour market related to their unequal role functions in the family (Casper et al. 1994; Christopher et al. 2000; Popova 2002). Furthermore, they require income opportunities that allow time for child care, maintaining household and also crop production (World Bank 2009).

Land is the one of the most important natural resources and not only for cultivation, but also for a variety of socio-economic activities. Land is the property and thus the goods. Rights to land are usually held by the household as a single decision-making unit rather than by individuals or general social institutions, such as communities which are often organized corporately with defined boundaries and control of resources (Brush and Turner 1987). Capacity and ownership of land resources represent a crucial indicator of household economic success as well. The most common resources recognized within the farming systems are natural resources, such as fields, homegardens, water or forests, and human resources, particularly labour force (Ellis 1998; Doppler 2006). Correspondingly, the amount of labour available and necessary for production determines the nature of the households (Brush and Turner 1987).

2.2 Homegardens: How traditional, flexible and multi-purpose farming system is used by farming households?

Household resources capacity and use also reflects maintaining of the farm production (Reyes-García et al. 2005), particularly in the case of very specific farming systems – homegardens. Generally, homegardens represent a traditional farming system involving integrated production in combination with various species of trees and crops nearby the homestead, occasionally in association with livestock (Kumar and Nair 2006; Peyre et al. 2006). Additionally, they are quite flexible regarding to agro-biodiversity composition and use due to their long-term developed over centuries as a result of farmers’ adaptations to changes in both external and internal conditions in farm-household system (Kumar and Nair 2004). Particularly, if they receive the same level of constant attention from the owners’ household and have similar structural and functional properties as other homegardens located near homes they could be also classified as homegardens (Drescher et al. 2006).

Despite the fact their role within the household economy differ according to particular products and their utilization, they provide a stable supply of products as well as socio-economic and environmental benefits for households, which is typical particularly for traditional gardens (Niñez 1987; Christanty 1990; Kumar and Nair 2004; Nair 2006; Kabir and Webb 2009). Furthermore, they have been recognized to have a potential to contribute to food security at household level, especially during the time of shortages in food supplies, e.g. before harvest (Ellis 1998). Homegarden management practices thus always reflect socioeconomic and demographic characteristics of households resulting in diversification of production between both edible plants production as well as species supposed to provide household with additional income as well (Fernandes and Nair 1986; Kumar and Nair 2004; Kabir and Webb 2009; Kala 2010; Vlkova et al. 2011). Those shifts of use can be done, whereas homegardens are intensively managed mainly by household labour (Fernandes and Nair 1986; Shajaat 2005).

Above all, gender issues play significant roles in management, use, and plant conservation through different tasks and responsibilities in production. Consequently men and women have different needs, priorities, and knowledge about production (Kumar and Nair 2004; World Bank 2009). Usually, men and women share homegarden activities, but the role of women in homegardens is less visible than for men, because their tasks are most closely linked to their role in the household (Howard 2003; Kabir and Webb 2009). Generally speaking, subsistence-oriented homegardens tended more domain of woman (Upton 1996; Howard 2003; Trinh et al. 2003). Thanks to their practical experiences, women are typically responsible for a large part of food production, which is closely linked to food security. Women are most often involved in the selection of seeds, improvement, conservation and sustainable use of plants varieties, caring of small livestock and also management and saving (FAO 1990; World Bank 2009). The purpose of home gardening was primarily outlined as the food supply for family consumption, respectively for its nutritional benefits as well as for barter with neighbours (Brownrigg 1985; Fernandes and Nair 1986; Kumar and Nair 2004). However, homegardens have a huge potential to meet economic, social, environmental, and institutional conditions for sustainable livelihoods and thus contribute to sustainable agricultural production (Nair 2006).

2.3 Kyrgyzstan: Natural resources, demographic and social context

Kyrgyzstan is a mountainous and landlocked country located in the Central Asia and lying between 39° and 43° N and 69° and 80° E (Fitzherbert 2006) and covering 199,949 km² (UN Statistics Division 2016). The country is bordered on the north by Kazakhstan, on the south by China and Tajikistan and on the west by Uzbekistan. About 94 % of the country is situated over 1,000 metres above sea level and 40 % at more than 3,000 metres above sea level, ordinarily covered under glaciers and permanent snow (FAO 1997). The climate is characterised as continental, but with significant variation by reason of wide range of altitudes. Basically, summers are warm and winters are cold, except for the high altitude areas. Water resources together with the grazing lands represent the most valuable natural

resources of Kyrgyzstan ([Fitzherbert 2006](#)) Country's abundant water resources include glaciers, lakes, rivers, and groundwater, but unevenly distributed across the country. However, irrigation is necessary for intensive cropping, but is extremely wasteful. The distribution infrastructure is old and poorly maintained ([UN 2009](#)). Basically, more than 70 % of the arable land depends on irrigation for its productivity ([USAID 2011](#)). Agriculture plays important role in the economy, but only 7 % of the total land area is suitable for arable farming and 44 % of the land is used as a pasture for livestock. Moreover, animal husbandry remains considerable part of the agricultural economy ([UN 2009](#)).

Population of Kyrgyzstan was 5.836 million people in 2014 with population density 30.4 people per km² of land area ([UN Statistics Division 2016](#)). Life expectancy at birth is 70 years, in detail female life expectancy is 75 years and male 67 years. Approximately 99.2 % of population is literate ([UNDP 2015](#)). About 64 % of the population resides in rural areas and 36 % in urban areas ([World Bank 2016](#)), though, urban areas have seen rapid growth, whereas rural migrants seeking urban employment, which is often in remote, mountainous areas with limited infrastructure and market access. The population is ethnically diverse. The main ethnic groups are Kyrgyz (65 %), Uzbeks (14 %), Russians (13 %), followed by Dungun, Tajiks and other ethnic groups ([USAID 2011](#)). Majority of the population are Muslims (about 75 %), second main religion belong to either Russian or the Ukrainian Orthodox church (20 %) and the remaining 5 % belong to other religions groups ([UN 2009](#)). Under the Constitution of the Kyrgyz Republic, women and men are considered equal. Nevertheless, the application of customary law brings woman to adverse position, because of strong emphasis on the maintenance and support of the household as a unit in terms of land rights in the event of marriage, divorce or death of a spouse ([USAID 2011](#)).

Kyrgyzstan is the one of the poorest countries in the world ([USAID 2011](#)). The country's GDP in 2014 was 7.404 billion USD and is ranked as lower middle income. Annual GDP growth was 3.6 %. Services remain the largest sector of national economy (56 %), followed by industry (26.7 %) and agriculture (17.3 %). The agricultural sector is important as a

source of income and about 33 % of the inhabitants are employed in agriculture ([World Bank 2016](#)). There are 65 % of inhabitants in productive age. Total labour force comprises total 2,727,997 people and 8.1 % of whom are unemployed, more concretely 7.3 % of male unemployed and 9.1 % of female unemployed. The reason why people cannot get out of income poverty can be lack of access to suitable jobs, with a reasonable salary and income security and as well as the differences between rural and urban job opportunities. Child labour is also common in Kyrgyzstan, because of income poverty and low quality of education, while bringing some extra income to poor families. It takes many negative consequences, such as neglected schooling ([World Bank 2007](#)). Country's HDI ranking 120th place of 188 countries with value 0.655, which is classified as a medium human development ([UNDP 2016b](#)). Approximately 38 % of the inhabitants live below the poverty line ([UNDP 2016a](#)), and 75 % of the country's poor people live in rural areas ([USAID 2011](#)). According to Human Development Report 2015 poverty in Kyrgyzstan would be much higher without remittances ([UNDP 2015](#)). Received personal remittances comprise 30.3 % of total GDP ([World Bank 2016](#)) and labour migrants working mainly in Russia and Kazakhstan ([Magilevsky and Omorova 2011](#)). As is well known, corruption negatively also affects economic growth ([Mo 2001](#); [Gyimah-Brempong 2002](#)). The level of corruption in Kyrgyzstan ranked 123th out of 168 countries (with the first being the least and 168th the most corrupt). Corruption perception index reached 28 points out of 100 ([Transparency International 2015](#)).

2.4 What is the role and management of farming systems in southern Kyrgyzstan?

In the 1990s, during the early years of transition from a central planned to a market economy, the living standard of the Kyrgyz people deteriorated sharply and poverty increased ([Brück et al. 2013](#); [UNDP 2013](#)). After the dissolution of the Soviet Union national income dropped by 74 % between 1991 and 1994 ([USAID 2011](#)). Hyperinflation and rising unemployment led to dramatic increase of poverty rates and also social

inequality (Fisher et al. 2004; Magilevsky and Omorova 2011) and food prices approached 1,000 % in 1993 (World Bank 2007). There followed a decrease in rural employment and poor young people from the rural surroundings moved into cities to seek alternative employment opportunities (Megoran 2013). It was due to radical market-based reforms, which started immediately with restructuring of state-owned agricultural enterprises into cooperative or corporate farms as well as land privatization (USAID 2011). Prior to independence, small household plots were allowed mainly for large share of local food production (USAID 2011). Land and agrarian reform divided more than 75 % of cultivated land into land shares, which are now privately owned by farmers. Subsequently more than 80 % of the rural population is agricultural landowners (UN 2009). Individuals received long term transferrable use rights for land shares ranging from 0.1 to 1 hectare (USAID 2011). Agricultural sector has recovered mainly due to growth in individual sectors of household plots and peasant farms, while the old-style agricultural enterprises continued in its decline. The individualization of landholdings has been also accompanied by shift of livestock inventories from agricultural enterprises to family farms, when collective and state farms have lost practically all their livestock. It has resulted in a significant increase of individual farms in agricultural production (Lerman and Sedik 2009).

Nevertheless, agriculture sector was growing very slowly in the 2000s. Small farms dominated and orientation was mainly semi-subsistence, which was good in ensuring food security of rural households (Magilevsky and Omorova 2011). Attitudes were still influenced by the Soviet experience, as well as the structure of Kyrgyz society, which dominated the political and administrative life (Fitzherbert 2006). Furthermore, dramatic rise in food and fuels prices due to the global economic and financial crisis during the period between 2008 and 2010, affected many households particularly in rural, marginal and/or mountainous areas and large households, who fell into poverty (USAID 2011; Bierbaum and Gassmann 2012). The situation get even worse in June 2010 when conflicts between ethnic Kyrgyz and Uzbeks raised up in the southern part of the country, whereby Osh city was engulfed in a massive intercommunal violence between these groups (USAID 2011; Megoran 2013). Nonetheless, those incidents negatively influenced farming systems

development in the whole country, but poor southern regions was affected most. National human development index in Osh region ranked 0.585 was lower than northern regions, which are ranked between 0.608 and 0.803 (UNDP 2013). On the hand, despite of those events, Kyrgyzstan went relatively smoothly through the rapid demographic changes and liberalization of its agricultural market and prices, land distribution among the individual farmers, recognition of the rights of private ownership of natural (land) resources and even allowance of restricted agricultural land transactions. These changes led however to land fragmentation, which was mainly a problem in the southern provinces of Kyrgyzstan, which have higher population density compare to the northern regions (Akramov and Omuraliev 2009; UN 2009). Especially in Osh province, there were about 70 % of farmer's landholding equal or smaller than one hectare. Before above described events, 10 % of the total arable land was used for traditional homegardens with an average size of 0.11 ha per holding, which were believed to be maintained by more than 900,000 households (Akramov and Omuraliev 2009). Furthermore, rural areas have often relapsed into subsistence agriculture and bartering. It is important to note that the informal sector plays an important role in the country (Fisher et al. 2004).

3 Aims of the Thesis

The objective of the thesis was to analyse farming systems in both rural and peri-urban areas in Osh province, which is situated in the southern part of Kyrgyzstan.

Considering in rural-urban gradient, specific objectives of the thesis were to document:

- (i) household resources capacities and use,
- (ii) land-use management and preferred plant species,
- (iii) household income diversification, and
- (iv) role of homegardens in household economy.

4 Methodology

4.1 Study sites description

The study was conducted in southern part of Kyrgyzstan, Osh province, which covers an area of 29,000 square kilometres, located in the Fergana Valley near the border with Uzbekistan, and with population of nearly 1.2 million inhabitants ([Kazbekov et al. 2009](#)). Chosen study sites include rural and peri-urban areas, which differ in proximity to province centre (Osh city), in ethnic composition and access to land resources. Firstly, rural farming systems in Aravan district lie about 30 km west of province centre. Secondly, peri-urban farming systems in Tuleyken, Kara-Suu district, are located approximately 6 km south of Osh city (see Fig. 1).

Osh, as the administrative centre of Osh province, is the second largest city in Kyrgyzstan, and lies around 300 km as the crow flies from the capital city – Bishkek. Osh province has a large population of ethnic Uzbeks ([Liu 2012](#)), which is characterized by cultural, social and economic relationships of both Uzbekistan and Kyrgyzstan, but still with tensions over sharing space throughout the region ([Megoran 2013](#)). Majority of inhabitants lives in rural areas, concretely 83 % of the total province's population ([National Committee on Statistics 2010](#)).

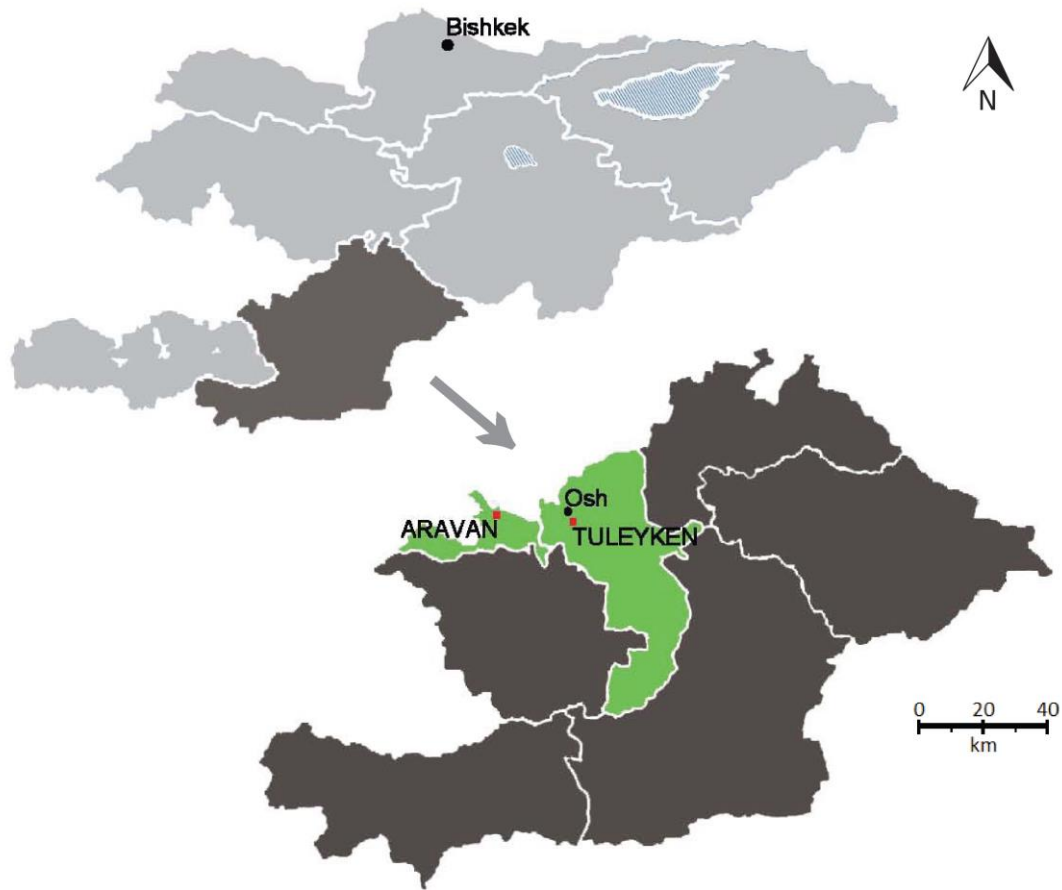


Figure 1 Study area location, Osh province, southern Kyrgyzstan

This province is a fascinating region for any study, as it is one of the few suitable areas for agricultural production in the country, especially because of its landscape profile, soil fertility, and water availability. Additionally, chosen study area has important historical value and until these days the population is diversified in terms of ethnic origin, religion, and employment or education level. The southern part of Kyrgyzstan represents a part of fertile Fergana valley (FAO 1997) with average elevation of exceeding 750 m a.s.l. Generally, the climate Osh neighbourhood is cold and temperate, which is characterized by the rainier winters than summers.

Our study sites' climate is classified as humid continental climate (Dsa by the Köppen-Geiger system) in the case of Tuleyken. However, the climate in Aravan is characterized as a local steppe climate, which is classified as cold semi-arid climate (BSk by the Köppen-Geiger system). Average elevation of researched rural farming systems was 763 m a.s.l. and 978 m a.s.l. for peri-urban farming systems. In Tuleyken, the average annual temperature is 11.7 °C and the variation in temperatures throughout the year is 28.7 °C. The highest average temperatures in Tuleyken are measured in July (24.9 °C) and the lowest average temperatures occur in January (-3.8 °C). The average annual temperature in Aravan is slightly higher than in Tuleyken, with an average 12.8 °C. The variation in temperatures throughout the year is 28.3 °C. The highest average temperatures are measured in July (25.8 °C) and the temperatures are lowest on average in January (-2.5 °C). The average annual rainfall is greater in Tuleyken (379 mm) than in Aravan (293 mm). The least amount of rainfall is measured in August, with an average of 6mm in Tuleyken and 3mm in Aravan. The greatest amount of rainfall is measured in March, with an average of 55 mm in Tuleyken and 43 mm in Aravan. However, agriculture is highly dependent on irrigation. As the main sources of irrigation water for Osh province are the Naryn River, the Akbura River and Aravan River (Kazbekov et al., 2009). According to National Statistical Committee of the Kyrgyz Republic (NSC KG) the Human Development Index (HDI) of both study sites was equal with value 0.606, which was slightly higher than the HDI of the whole Osh province ranked 0.594. The HDI value of Osh province was the lowest across the country. Multidimensional Poverty Index was 0.061 in both study sites, which indicates the size of the population experiencing poverty and deprivation (Tab. 1).

Table 1 Study area characteristics, Osh province, southern Kyrgyzstan

Indicator	Aravan (rural area)	Tuleyken (peri-urban area)
Distance to Osh city (km)	30	6
Latitude	40.515	40.4823
Longitude	72.4992	72.8265
Avg. altitude (m.a.s.l.)	763	978
Climate classification (by the Köppen-Geiger system)	BSk	Dsa
Avg. annual temperature (°C)	12.8	11.7
Avg. temperature in January (°C)	-2.5	-3.8
Avg. temperature in July (°C)	25.8	24.9
Avg. annual rainfall (mm)	293	379
Avg. rainfall in August (mm)	3	6
Avg. rainfall in March (mm)	43	55
Human Development Index (by NSC KG)	0.606	0.606
Multidimensional Poverty Index (by NSC KG)	0.061	0.061

Sources: ([UNDP 2013](#); [Climate-Data 2016a](#), [2016b](#))

4.2 Data collection and analysis

Household survey was maintained in during the July-August period 2014. A total number of 50 households were included in our survey, 25 from rural and 25 from peri-urban areas. Combination of discussion with village leaders and application of snowball method enabled us to identify suitable households for our research ([Goodman 1961](#); [Bernard 2006](#)). Household heads were approached individually and were asked for their willingness to participate in our survey. We have never started an interview unless both man and woman were present in order to cover wide range of resource management practices at farm as well as household level. Russian language, which is common for all ethnics in the target area, was used during all data collection process and subsequently translated into English. Questionnaires were however developed in both Uzbek and Kyrgyz languages in order to reduce potential losses in transfer of information between interviewer and respondents.

Direct observation and semi-structured interviews were used as the main tools for data collection on external and internal resources of farm-household system. Furthermore, data on historical background of local farming systems were collected via discussions with two key-informants, local chief of agribusiness company and respected village leader, and, extension agent.

Data were collected within inter-disciplinary team unit to get more deep insight into the local farming systems practices and efficiency. Firstly household demographic factors such as age, gender composition, ethnicity, level of education and occupation were obtained. For the purpose of our study, only people permanently living under the same roof were considered as household members. Secondly, information on farm characteristics, income diversification, food-generating activities, cash balance, land-use system, preferred crop species, waste management and extension services were gathered with specific attention to local homegardens (see Tab. 2). Additionally, geographical location, farm size and altitude of each household were recorded using a Garmin GPS.

4.3 Data analysis

The data were organized and analysed with the Microsoft Excel 2013 and the IBM SPSS Statistics 22.0. As the main statistical analyses were applied descriptive statistics and Pearson correlations among the variables to explore pair-wise relationships between them (Cuanalo de la Cerda and Guerra Mukul 2008). Two-tailed Student t-test for independent samples were used to test the significance of the differences between rural and peri-urban areas (Polesny et al. 2014).

Table 2 Questionnaire outline used for data collection in rural and peri-urban areas, Osh province, southern Kyrgyzstan

Questionnaire outline		
Description	Question used	Answer odds
Land-use type	Which plots does your farm have?	open-ended question
	Total area	open-ended question
	Quality of soil	not enough fertile / enough fertile / wery
	Distance from your house	next to house / 10 min walk / 30 min walk
	Slope	flat / small slope / steep
	Irrigated	yes / no
	Livestock	yes / no
	Ownership	own / rented / shared
Household demographics	Household member	open-ended question
	Date of birth	open-ended question
	Gender of household member	open-ended question
	Years of schooling	open-ended question
	Ethnicity	open-ended question
	Occupation	farmer / other
	Activities of household memebers	farm / homegarden / household / off-farm job (if yes = number of years)
Homegarden	Reason	fresh food production / selling / place for recreation / house protection / strong tradition (importance from 1 to 4)
	Most important cash input	own labour / hired labour / fertilizer / pesticides / land preparation / seeds and seedlings (importance from 1 to 4)
Preferred plants	What kind of plants do you prefer?	open-ended question
	Use of plants	household / sell / improve soil
	Price per kg (min-max)	open-ended question
Livestock	What kind of animal do you have?	open-ended question
	Number	open-ended question
	For what reason?	open-ended question
Agricultural waste	What do you do with agricultural waste of residuum?	composting / burning / energy / fodder / other

Questionnaire outline (continued)		
Description	Question used	Answer odds
Financial situation	Describe your financial situation	I can pay for all my needs / Incomes and outcomes are rather in balance / I have difficulties to pay for my needs in some months / I have difficulties to pay for my needs all year
Credit or loan	Do you have credit or loan regarding to agriculture? Amount Interest rate Payback period Source	yes / no open-ended question open-ended question open-ended question open-ended question
Investment	Do you have any major investment during last two years?	yes / no (house reparation / education / illness / farm machinery / other)
Annual cash income	Crops from the field Crops from the orchard Crops from the homegarden Livestock Off-farm job Other	open-ended question open-ended question open-ended question open-ended question open-ended question open-ended question
Annual cash expenditures	Farm Household Health care Education Other	open-ended question open-ended question open-ended question open-ended question open-ended question
Cooperatives	Are you member of any association/cooperative?	yes / no (If yes, for how many years?)
Extension services	Do you use any consultations	yes / no

5 Results

5.1 Household characteristics

Total number of 120 individuals in rural area and 116 in peri-urban were included in our survey. Gender balance was rather equal having male-female ration 48:52, and 50:50 respectively. Household size was similar in both study sites. In rural area varied from 2 to 7 with a mean of 4.8 (± 1.58) and average household size in peri-urban area was 4.64 (± 1.73) and varied from 2 to 9 members per household. Average age of household members in both areas was very similar, but average age of household head was slightly higher in peri-urban area. On average, each household member older than 15 years attended school for 10 years. No significant differences are not in the case of labour force (see Tab. 3).

Household decision making processes among farms in both study areas were similar. The male head of the household made decisions concerning agriculture and discussed them with other male adult members, sometimes with other farmers. Then he distributed responsibilities to the various household members, occasionally after consultation with his wife, parents and others. Rural households showed higher ethnic diversity as 64.2 % of the respondents were Uzbek origin, while the others were Kyrgyz 35.8 %. Only one surveyed household was found to be a multi-ethnicity family. On the contrary, households in peri-urban area were all of Kyrgyz origin.

Table 3 Household demographics in rural and peri-urban areas, Osh province, southern Kyrgyzstan

	Rural farming systems		Peri-urban farming systems		T-test
	(n=25)		(n=25)		($\alpha=0.05$)
	Mean	SD	Mean	SD	Sig. (2-tailed)
Number of household members	4.80	1.58	4.64	1.73	0.734
Male	2.32	1.25	2.32	1.14	1.000
Female	2.48	1.48	2.32	1.25	0.681
Average age of household members	37.75	12.65	37.61	8.81	0.965
Household head age (year)	50.80	12.21	53.12	7.99	0.430
Years of schooling: age 15+ (year)	10.06	1.42	10.29	1.04	0.187
Number of dependent members per household (<15 and >59 years)	1.28	1.43	0.92	0.95	0.301
Labor force per household (15-59 years)	3.52	2.06	3.72	1.77	0.715
Male labour	1.84	1.31	1.76	1.13	0.818
Female labour	1.68	1.22	1.96	1.17	0.411

Certain differences were observed in using human resources for particular activities a farm-household system. Peri-urban households seem to use more labour to manage their farm, local homegardens and also household, compare to rural households ($p=0.002$, $p=0.053$, $p=0.036$ respectively). These activities were also positively correlated to household labour force $r=0.815$ (p -value 0.01) in peri-urban area. Furthermore, peri-urban households were also much more involved in off-farm activities. The frequency and intensity of off-farm work depended on household need, number of household members, availability of off-farm work, and time required for farming. Off-farm activities were significantly different between both study sites with p -value 0.000 and a positive correlation was found with household labour force $r=0.460$ (p -value 0.05) and off-farm income $r=0.396$ (p -value 0.05) in peri-urban area. In case of experience with particular activities, peri-urban households spent significantly more time for off-farm and also household activities than rural households, with p -values 0.004 and 0.028 respectively (see Tab. 4).

Table 4 Human resources for particular activities in rural and peri-urban areas, Osh province, southern Kyrgyzstan

	Rural farming systems		Peri-urban farming systems		T-test
	(n=25)		(n=25)		($\alpha=0.05$)
	Mean	SD	Mean	SD	Sig. (2-tailed)
Farm activities (individuals per household)	2.76	2.13	4.56	1.66	0.002
Homegarden activities (individuals per household)	3.56	1.90	4.56	1.66	0.053
Household activities (individuals per household)	3.44	2.00	4.56	1.66	0.036
Off-farm activities (individuals per household)	0.36	0.76	1.92	1.55	0.000
Farm activities (years of farming)	13.23	9.56	17.13	8.29	0.130
Homegarden activities (years of farming)	16.41	9.37	18.56	8.37	0.395
Household activities (years)	12.25	7.88	17.66	8.95	0.028
Off-farm activities (years)	2.80	5.02	8.99	8.89	0.004

Female employment outside the household was relatively low in rural area, 20 % of women had off-farm job, but in peri-urban area the situation was more balanced, 40.48 % of women had off-farm job. Generally, women were often more involved in caring of the livestock, working in the kitchen and taking care of children.

5.2 Land-use system

Surveyed households were predominantly small holders with average farm size less than one hectare. Nevertheless, there was higher occurrence of larger farms (> 1 ha) among peri-urban households (20 %), compare to rural area (12 %). Average total farm size in both study sites was similar, but certain differences could be observed in land-use management (see Tab. 5) Rural area had larger homegardens and fields ($p=0.091$, $p=0.000$) and a positive correlation was found between field size and total landholding agriculture size ($r=0.933$, p -value 0.01). On the contrary, peri-urban farming systems had considerably

larger orchards, $p=0.029$, and it was positively correlated to total household agricultural landholding ($r=0.907$, p -value 0.01).

Table 5 Household land resources in rural and peri-urban areas, Osh province, southern Kyrgyzstan

	Rural farming systems		Peri-urban farming systems		T-test
	(n=25)		(n=25)		($\alpha=0.05$)
	Mean	SD	Mean	SD	Sig. (2-tailed)
Total landholding agriculture size (ha)	0.744	0.180	0.779	0.775	0.831
Homegarden size (ha)	0.067	0.053	0.046	0.033	0.091
Orchard size (ha)	0.302	0.216	0.483	0.811	0.029
Field size (ha)	0.670	0.198	0.364	0.313	0.000

Figure 2 shows land used types in both study sites. In rural area fields were determined as the main land use type, which represented 86 % of total household agricultural landholding. Homegarden represent 9 % of total household agricultural landholding and orchard represents only 5 % of total share in rural area. In peri-urban area, orchard were determined as the main land use type, which represented 50 % of total household agricultural landholding, followed by field, which represented 45 % of total household agricultural landholding. Homegarden covered only 5 % of total household agricultural landholding in peri-urban area. Figure 3 shows examples of typical field in both rural and peri-urban areas.

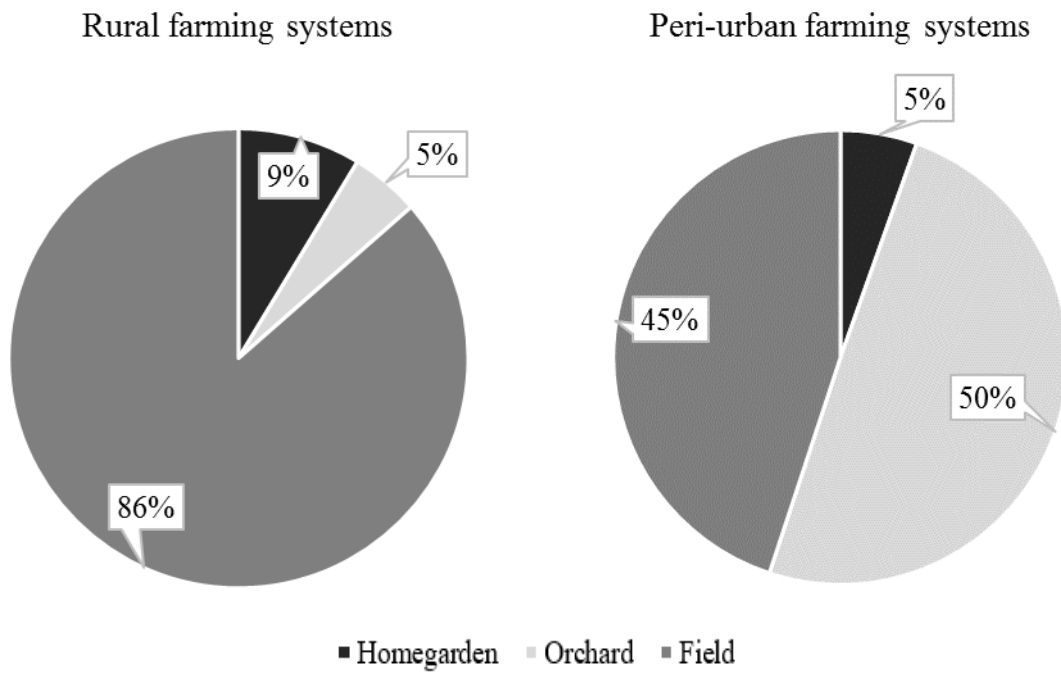


Figure 2 Main land use types in rural and peri-urban areas, Osh province, southern Kyrgyzstan



Figure 3 Examples of typical field in rural and peri-urban areas, Osh province, southern Kyrgyzstan

Generally, renting land is not very common in both study sites and only one rural and five peri-urban households rented some plots (one rural field, one peri-urban field and four peri-urban orchards). Correspondingly, quality of soil of particular land-use types, e.g. field, orchard and homegardens, was similar for both study sites. Most respondents rated the quality of the soil on their plots as sufficiently fertile, some even assessed it as very fertile, but only a few of the respondents criticized their plots as not enough fertile (two fields in rural area and one orchard in rural area). Figure 4 shows comparison of particular land-use types by average soil quality and average proximity to family house. Almost all the homegardens were situated next to the house, just only one homegarden in peri-urban area was about 30 minutes walking from home. Generally, rural orchards and fields were located farther than peri-urban, on average around 10 minutes' walk. All household members wanted to keep their plots and maintained their agricultural production in the future.

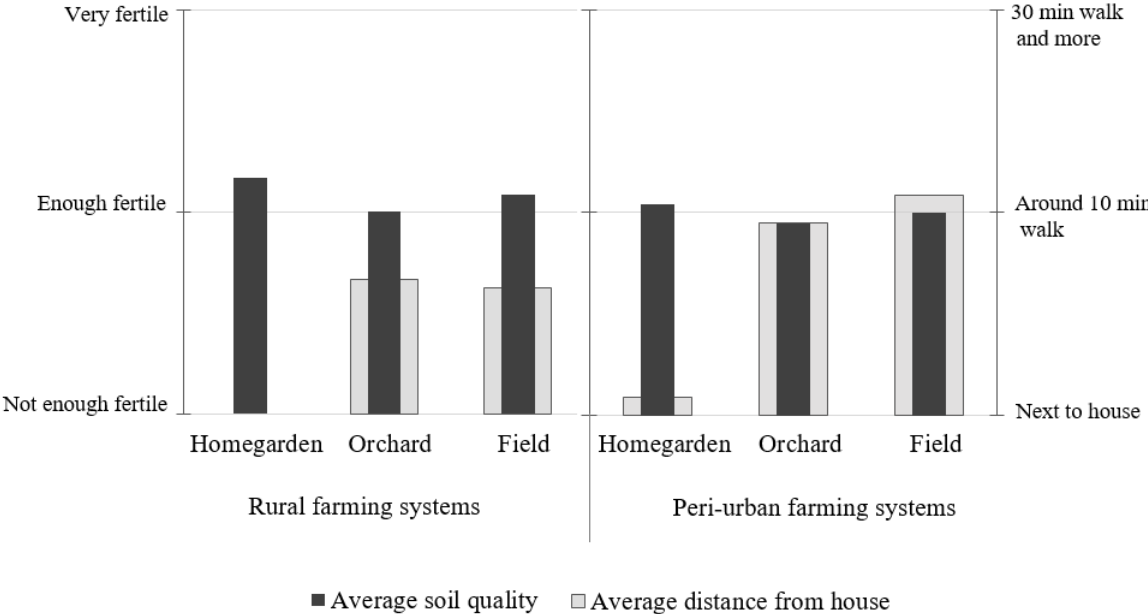


Figure 4 Comparison of the land-use types by average soil quality and average distance from house among rural and peri-urban farming systems, Osh province, southern Kyrgyzstan

Furthermore, most of plots were irrigated in both areas, but only in peri-urban area, there were a few unirrigated plots (one homegarden, two orchards and two fields). Farmers also thought that they have sufficient access to water necessary for irrigation. Surface water was mainly used for this purpose and most fields were located near canals, but farmers (mostly from rural area) indicated that it happens sometimes that they do not have enough water available, especially in summer.

5.2.1 Homegarden

Households maintained their homegardens mainly for food production. The majority of them were subsistence production systems, even though some additional household income was derived from selling their surplus product. Figure 5 shows the reasons for maintaining homegardens in both areas. Their importance was measured on a scale from 1 to 4. The main reason for maintaining a homegarden was that they provide fresh food production for households. The second most important reason was a strong tradition to have a nice homegarden. The reasons, such as a place for recreation and a protection against sun or wind, represented similar relevance for households, but they were more important for households in peri-urban area. In contradiction, having a homegarden for cash income generation from selling their production was not regarded as important Figure 6 shows examples of typical homegardens in both rural and peri-urban areas..

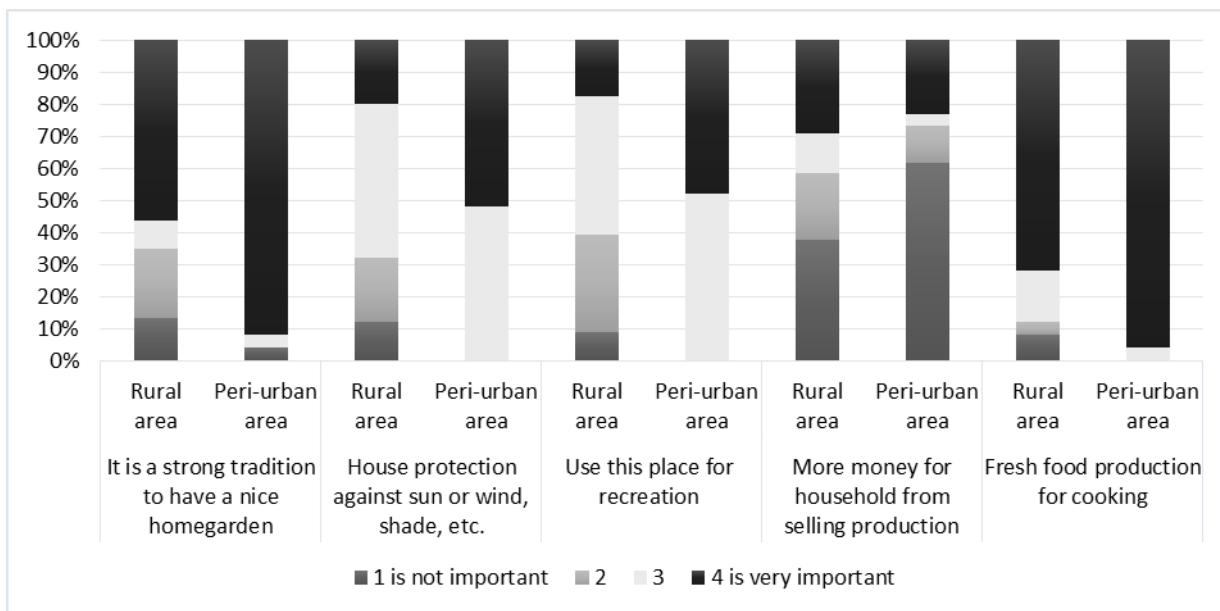


Figure 5 Reasons for maintaining a homegarden by level of importance in rural and peri-urban areas, Osh province, southern Kyrgyzstan

A total of 49 species of preferred plants were identified across the 50 homegardens in rural and peri-urban areas. Household members obtained from homegardens at least 3 and not more than 18 different plant products in rural area and at least 2 and not more than 19 different plant products in peri-urban area, for the benefit of space for working as well as for recreation. Figure 7 represents the most preferred and frequently documented species in the homegardens in rural and peri-urban areas. *Prunus avium* (wild cherry) was the most documented species in both areas (90 % of households in rural area and 80 % in peri-urban area) and *Prunus armeniaca* (apricot), which was documented in 85 % of households in rural area and in 75 % of households in peri-urban area. *Vitis vinifera* (grape vine) was cultivated rather in rural area compare to peri-urban area, it was one of the most preferred plant in 90 % of the households in rural area and in peri-urban area it was preferred only in 40 % of the households. Furthermore, *Prunus persica* (peach) were also more preferred in rural area than in peri-urban area. It was documented in 75 % of the households in rural area and only 25 % of households in peri-urban area preferred this plant. Followed by

Malus domestica (apple) in 65 % of the households, *Solanum lycopersicum* (tomato) in 60 % of the households, *Diospyros kaki* (persimmon) in 60 % of the households, etc. However, in peri-urban area, *Solanum lycopersicum* and *Solanum tuberosum* (potato) were further documented as ones of the most preferred plant species in 75 % of the households compare to rural area, where especially *Solanum tuberosum* was much less documented in the area (only in 5 % of the households). Followed by *Malus domestica* in 65 % of the households, *Cydonia oblonga* (quince) in 40 % of the households, *Vitis vinifera* in 40 % of the households, *Zea mays* (corn) in 40 % of the households, etc.



Figure 6 Examples of typical homegarden in rural and peri-urban areas, Osh province, southern Kyrgyzstan

As mentioned above, households maintained their homegardens mainly for subsistence production, but some additional household income was derived from selling their surplus product. This withhold mainly the fruits that they had in surplus. For example in rural area, one third of the *Vitis vinifera* (grape vine) production was sold at the local market in the price range from 0.60 to 1.50 USD/kg and approximately half of *Prunus armeniaca* (apricot) production was sold at the local market in the price range from 0.30 to 1 USD/kg with higher prices for dried products. On the other hand, sales of surplus products of surveyed households in peri-urban area were less frequent. For example, a quarter of *Prunus avium* was sold at the local market in the price range from 0.60 to 1.50 USD/kg and

a fifth of *Prunus armeniaca* production was sold at the local market in the price range from 0.30 to 1 USD/kg (from 1 to 2 USD/kg for dried products).

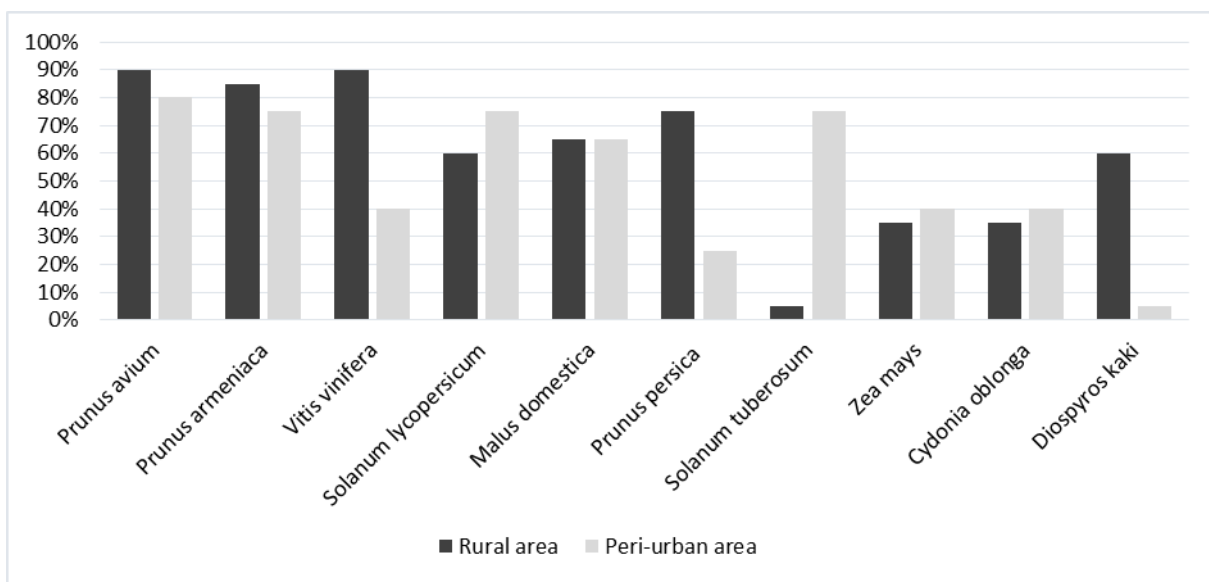


Figure 7 Most preferred plant species in homegardens in rural and peri-urban areas, Osh province, southern Kyrgyzstan

Figure 8 represents the most important sources of homegarden inputs in rural and peri-urban areas (measured by level of importance). The most important inputs of homegardens were similar in both study sites, which were inputs into their own labour, fertilizers, and seeds and seedlings. However, except for one significant difference: input into land preparation. In rural area it was indicated as more important, but in peri-urban area it was ranked as a less important input of the homegarden.

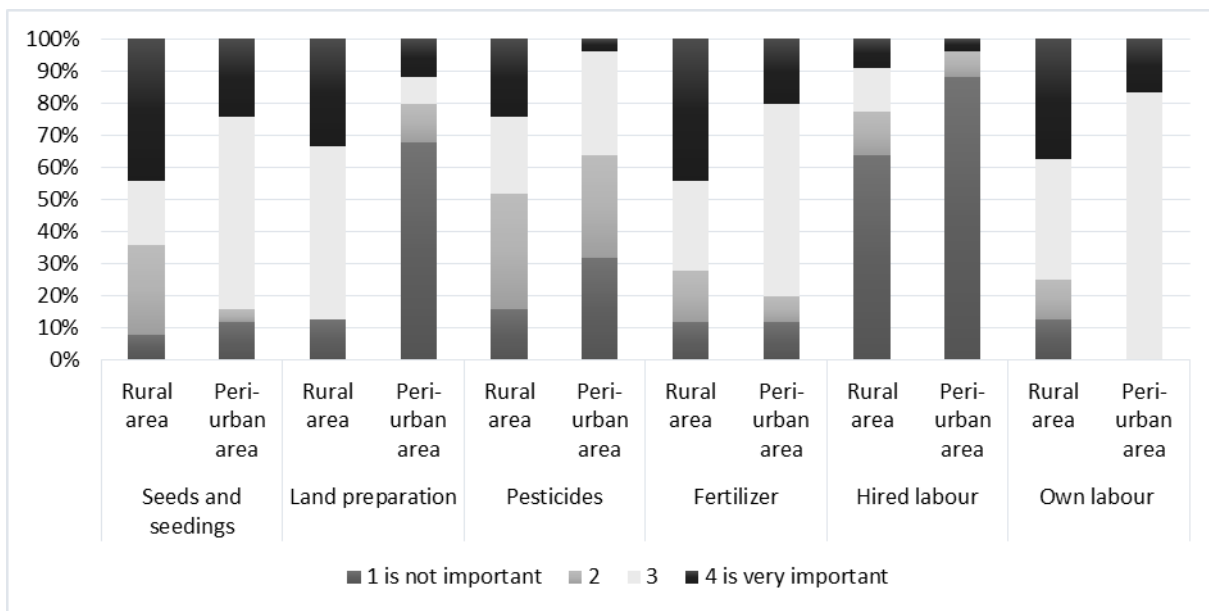


Figure 8 Main sources of homegarden inputs by level of importance in rural and peri-urban areas, Osh province, southern Kyrgyzstan

Nevertheless, an average of 3.6 individuals (± 1.9) per household in rural area regularly contributed to homegarden activities, distributed almost equally between men (55 %) and women (45 %). In peri-urban area, more individuals per household contributed labour to homegarden activities with a mean of 4.6 (± 1.6) individuals per household, with absolutely equal gender distribution. The individuals maintained their homegardens in average 16.4 years (± 9.4) in rural area and 18.5 years (± 8.4) in peri-urban area. There was found a positive correlation between homegarden activities and household activities $r=0.965$ (p-value 0.01) and with farm activities $r=0.500$ (p-value 0.05).

5.3 Livestock resources

Household members in rural and peri-urban areas raised livestock particularly for their consumption. Figure 9 shows the distribution of livestock in rural and peri-urban areas. Most households owned cows, calves, rams and sheep in both areas. Furthermore, peri-urban farming systems raised also horses, donkeys, goats and poultries and rural farming systems raised extra oxen/bulls. Generally in peri-urban area, livestock production was more frequent. The majority of the rural farming systems (84 %) had cows with a mean of 1.33 (± 0.58) per household, which were raised mainly for milk production, but additionally they were raised also for meat production. Similarly, peri-urban households (80 %) had cows with a mean of 1.90 (± 1.52) per household, which were raised only for milk production. Furthermore, 72 % of peri-urban households kept calves with a mean of 1.67 (± 0.91) per household, followed by rams, which were raised in 60 % of peri-urban households with a mean of 10.40 (± 7.79) per household (only for meat production). Compared to peri-urban area, 64 % of rural households had calves with a mean of 1.31 (± 0.48) per household and 44 % of rural households had rams with a mean of 4.91 (± 3.08) per household (raised for meat production and for special occasions). Moreover, rural farming systems (16 %) of household kept sheep with a mean of 7.00 (± 2.94) per household (raised for meat production) and just 8 % of peri-urban households had sheep with a mean of 12.50 (± 10.61) per household.

In addition, 28 % of peri-urban households had horses with a mean of 2.71 (± 1.7) per household, used mainly for draft but also for milk production, in this case it could be used to produce kumis, which is a fermented dairy product traditionally made from mares milk. Followed by 20 % of peri-urban households, which had donkeys with a mean of 1.20 (± 0.45) per household (used only for draft), 16 % of peri-urban households had goats and 12 % had also poultries. On the other hand, 20 % of rural households had also oxen/bulls with a mean of 1.20 (± 0.45) per household (raised for meat production).

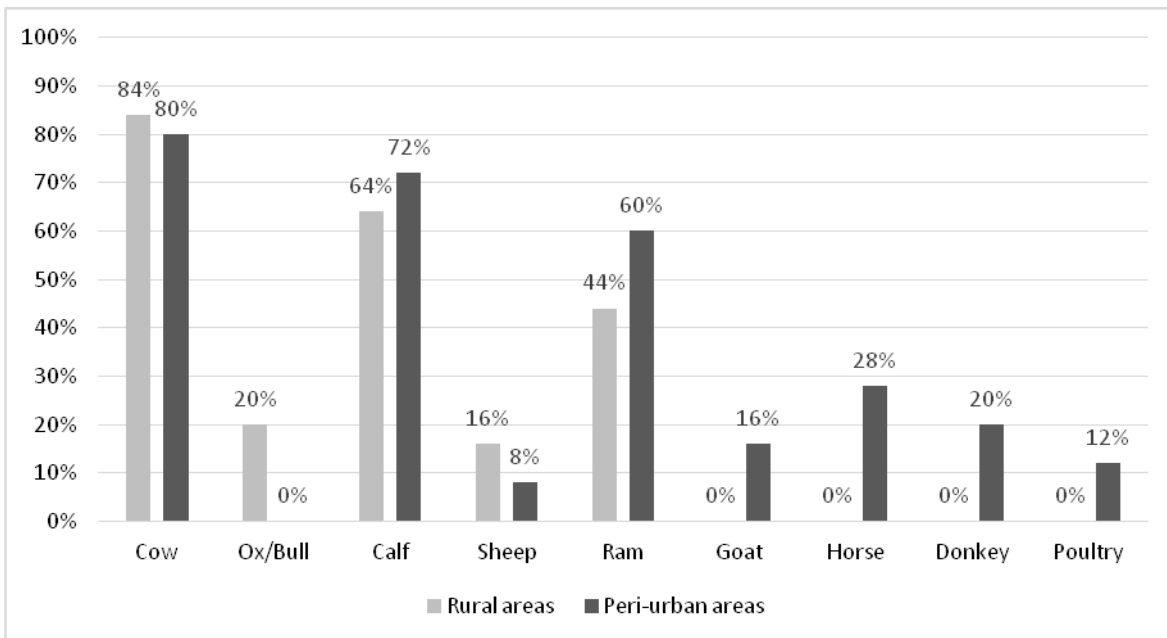


Figure 9 Distribution of livestock in households in rural and peri-urban areas, Osh province, southern Kyrgyzstan

Additionally, part of livestock production was occasionally used for selling at local markets. Rural farming systems were mostly selling goat, mutton and beef meat at the local market, but only one household was selling mutton meat mutton in Osh (centre of province) as well. Peri-urban farming systems were selling mutton and goat meat mainly at the urban market in Osh, but one household was selling goat meat in rural area as well. In case of milk production, nine households in peri-urban area were selling cow milk and dairy products at the urban market in Osh, in order to boost their income a little bit. Moreover, there was one household, which was selling chicken eggs at the urban market in Osh.

5.4 Financial situation of households

Household members evaluated their current financial situation. Table 6 shows the detailed financial overview of households. In rural area 52 % of respondents thought that they could pay for all household needs and their household generated even surplus in comparison with peri-urban area, where 60 % of households had difficulties to pay for their needs mainly during the winter season. At that time, household consumption needs are mismatched with uneven income flows.

Table 6 Financial situation overview of households in rural and peri-urban areas, Osh province, southern Kyrgyzstan

	Rural farming systems (n=25)	Peri- urban farming systems (n=25)
% of households who cannot pay for all household and farm needs and their household generated even surplus	52	4
% of households who had their incomes and outcomes rather in balance	28	36
% of households who had difficulties to pay for their needs in some months	20	60
December - March (%)	80	67
March - April (%)	20	13
Unspecified (%)	0	20
% of households who had difficulties to pay for their needs all year	0	0

Table 7 shows households, which took a credit or loan regarding to agriculture in both areas. In peri-urban area 40 % of the households, which is two times more than those in rural area, took a loan regarding to agriculture in average amount of 3,115 USD (± 2933.6). Interest rate ranked from 10 % to 30 % with a mean of 17.7 %. The average loan amount in rural area was slightly higher, specifically 2,346 USD (± 1641.3). Interest rate ranked from

10 % to 28 % with a mean of 20.6 %. Average payback period was 1.2 years long in both areas. The main sources of credit or loan were microcredit companies, which are focused on rural area and provide services to clients who do not have access to financial services.

Table 7 Households credit/loan regarding to agriculture in rural and peri-urban areas, Osh province, southern Kyrgyzstan

	Rural farming systems	Peri- urban farming systems
	(n=25)	(n=25)
% of households who had a credit or loan regarding to agriculture	20	40
Average amount of the credit or loan (in USD)	3,115	2,346
Average interest rate (%)	21	18
Average payback period (year)	1	1
Source of credit or loan		
Bank (%)	20	20
Microcredit company (%)	80	80

Table 8 shows major investments/expenditures of households during last two years in both areas. Approximately 96 % of households in rural and peri-urban areas had some major investment or expenditure during last two year. Rural households mainly invested into house reparation (63 %), followed by expenditures in education for children (46 %) and farm machinery (42 %). Households in peri-urban area invested primarily in farm machinery (83 %), than equally (79 %) into house reparation, education for children and health care of household members.

Table 8 Major investments/expenditures of households during last two years in rural and peri-urban areas, Osh province, southern Kyrgyzstan

	Rural farming systems	Peri- urban farming systems
	(n=25)	(n=25)
% of households who had any major investment/expenditures during last two years	96	96
House reparation (%)	63	79
Education for children (%)	46	79
Illness of household member (%)	38	79
Farm machinery (%)	42	83
Other (%)	4	0

5.4.1 Income generation activities

Surveyed households in rural area earned on average 3,918 USD per year ($\pm 2,690$) and households in peri-urban area earned on average 2,490 USD per year ($\pm 1,676$). Table 9 shows main cash income generating activities in rural and peri-urban areas. There were significant differences between total income and income from field crop production, with p-values of 0.030 and 0.000 respectively.

Table 9 Household annual cash income diversification in rural and peri-urban areas, Osh province, southern Kyrgyzstan

	Rural farming systems (n=25)		Peri-urban farming systems (n=25)		T-test ($\alpha=0.05$)
	Mean	SD	Mean	SD	Sig. (2-tailed)
Total annual cash income	3,917.85	2,636.08	2,490.25	1,641.96	0.030
per household member	849.32	604.87	666.90	564.68	0.286
per labor unit	1,167.49	894.53	906.59	872.17	0.317
Annual cash farm income	2,878.92	2,091.71	884.95	1,312.44	0.000
per ha cultivated land	4,144.39	3,453.17	1,524.58	1,418.39	0.002
per household member	624.70	436.00	266.90	460.71	0.008
per labor unit	826.10	586.20	351.68	653.28	0.012
as % of total annual cash income	77.83	21.69	40.18	36.09	0.000
Annual cash off-farm income	491.54	1,002.08	736.92	1,223.38	0.451
as % of total annual cash income	8.38	15.02	23.80	35.03	0.056
Annual cash income from other sources	547.38	853.78	868.38	1,129.23	0.263
as % of total annual cash income	13.78	18.76	36.03	36.68	0.011

Majority of households in both study sites tend to diversify their income sources, e.g. 92 % in rural and 84 % in peri-urban relied on more than one income sources. Six different income categories were identified. Figure 10 show household income diversification in rural and peri-urban areas. In rural farming systems, selling products from the field generated the main source of income for the household, which represented 58 % of total income. The income composition was different in peri-urban farming systems. Income from the field crop production represented one of the smallest share (4 %) of total income. On the contrary, income obtained from other sources (e.g., pension, remittance, money from government etc.) represented the major source of total income (35 %) together with income from off-farm job (29 %). The difference in income gained from the orchard crop production was also obvious, concretely 3 % in rural farming systems and 19 % in peri-urban farming systems. But the minor part of total income was both equal, 2 % in rural farming systems and 3 % in peri-urban farming systems.

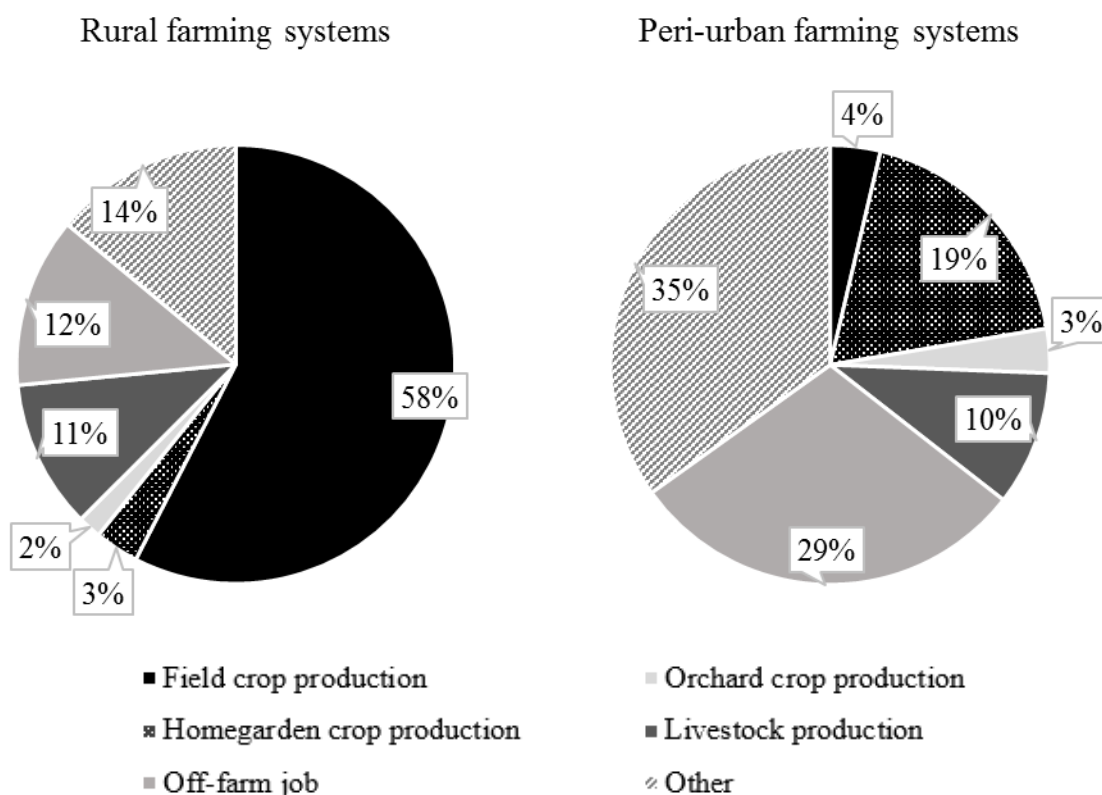


Figure 10 Income diversification in rural and peri-urban farming systems, Osh province, southern Kyrgyzstan

5.4.2 Expenditures structure and use

In case of household expenditures, there were found significant differences between all expenditures in both study sites. Figure 11 show main households expenditures in rural and peri-urban areas. In both study sites the largest share of total household expenditures was represented by household expenses consisting of electricity fees, firewood, food, water, equipment, house repair, transport, etc. (41 % in rural area and 51 % in peri-urban area). Farm inputs (i.e. fertilizer, seeds, fuel, fodder, farm equipment, transport, etc.) covered the second largest share of total household expenditures (24 %) in rural area, followed by other expenditures (e.g. government taxes, gifts, etc.) represented 15 % of total household

expenditures. Education (including books for children, school bus etc.) represented 11 % of total household expenditures and the smallest share of total household expenditures (9 %) was represented by health care expenses. In peri-urban area, the second largest share of total household expenditures represented other expenditures (23 %), followed by education expenses (16 %). Finally, the smallest shares of total expenditures were represented by health care expenses (5 %) and farm expenses (5 %).

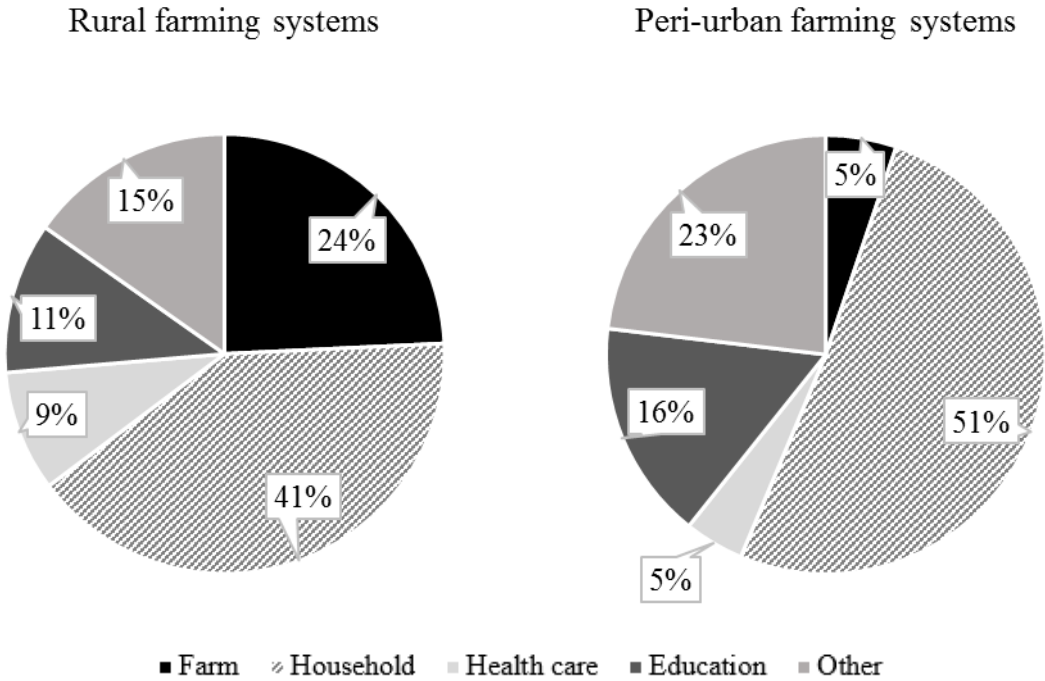


Figure 11 Household expenditures in rural and peri-urban areas, Osh province, southern Kyrgyzstan

5.5 Farm waste management

Study identified five categories of waste produced in farm-household system and their different ways of management in rural and peri-urban areas (see Fig. 12 and 13). Generally, most of households used the waste in several ways. Majority of wastes were used as a fertilizer, fodder and source of energy especially for heating and cooking. Only few households also used wastes for composting. Very common was also burning farm waste without any further utilization, particularly for crop and wood residues. Nevertheless, proper management of agricultural waste contributes not only to cost savings, but also contributes to a more sustainable system. In most of households, the waste was used in several ways, as in the case of animal dung. In rural area 92 % of the respondents (100 % in peri-urban area) declared using animal dung as fertilizer, which was useful to increase crop yields, and 40 % of the respondents (91.67 % in peri-urban area) used it as fuel, particularly for heating and cooking. Crop residues were mostly used as fodder (by 60 % of the households in rural area and 96 % in peri-urban area) and fertilizer (64 % in rural area and 88 % in peri-urban area). Similarly wood residues, which were mainly used as fuel for heating and cooking (by 54.17 % of households in rural area and 96 % in peri-urban area).

Moreover, rests from the kitchen were used mainly as fodder for the livestock and/or pets (92 % of households in rural area and 96 % of households in peri-urban area) and as a fertilizer (28 % in rural area and 96 % in peri-urban area). Finally, 100 % of the households used ash as fertilizer across the study sites. They mostly tried to use well the agricultural waste. Nevertheless, proper management of agricultural waste contributes not only to cost savings but also contributes to a more sustainable system.

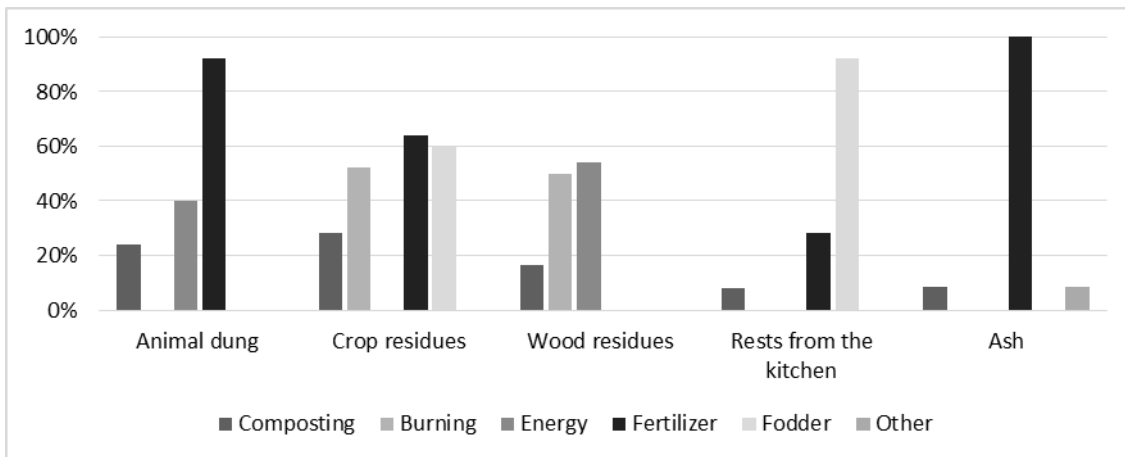


Figure 12 Agriculture waste utilization in rural farming systems, Osh province, southern Kyrgyzstan

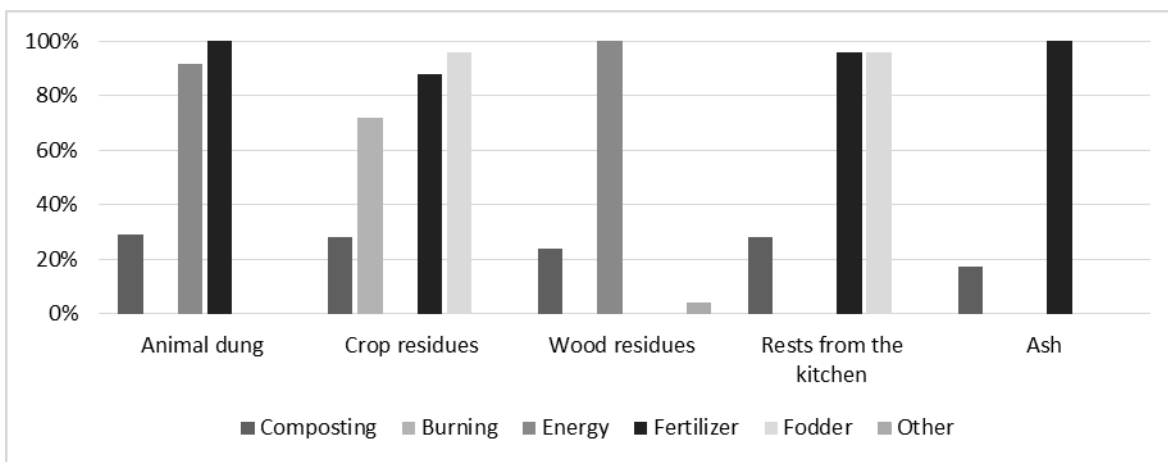


Figure 13 Agriculture waste utilization in peri-urban farming systems, Osh province, southern Kyrgyzstan

5.6 Consultations and extension services

In rural area 80 % of surveyed households used some consultations and extension services for their farm activities. In peri-urban area, it was only 8 % of the households, because they mentioned that it is not effective enough and that they had a lack of necessary information and advices. However, 40 % of households in rural area were member of some association or cooperative that helped them to produce and/or sell products from their farm. The remaining households stated that they were not members of any association or cooperative, including non-members in peri-urban area. They were more dependent on themselves. Respondents were asked to mention what kind of information and advices they would prefer to receive from local extension services. Most common answer was they would like to receive information about new techniques relating to cultivation, fertilizers, pesticides, irrigation and composting (in rural area), and crop drying (in peri-urban area). Moreover, they would like to learn more about new technologies for agricultural production and they would like to receive new good quality seed and literature about agricultural production in understandable way for rural farmers. Finally they would like to get a loan or credit with low interest rate.

6 Discussion

6.1 Household resources capacities and use

Compared to rural area the households in peri-urban area had a larger agricultural landholding size, had a larger number of livestock and working off-farm tended to be higher. Rural households had a higher mean number of household members, which were more likely to reside on-farm. Gender balance was rather equal in both areas. Majority of targeted respondents in rural area were of Uzbek ethnic origin and rest of the respondents were Kyrgyz. It may be because rural target area is located close to the Uzbek border. However, only one surveyed household was found to be a multi-ethnicity family in the area. On the contrary, households in peri-urban area were all of Kyrgyz origin. It could be said that the Uzbeks reside in rural area and in addition they also form part of the urban population, while peri-urban area are more dominated by Kyrgyz. It can be explained by traditional settlements, post-Soviet dissolution of the collective farm system and current sharing and dividing space of modern urban Osh ([Megoran 2013](#)). Rural Uzbeks stay more in border areas of Fergana Valley. Different ethnic composition is reflected in their preferences regarding different traditional food and agricultural products and also different livelihood strategy.

However, both areas differ greatly in human resources use for particular activities. It has to do with the focus of agricultural production and its commercialization. While households in peri-urban area are more focused on orchard fruit production, processing the products and working off-farm for the purpose of earnings. Households in rural area have lack of opportunities to work off-farm, so they pursue to maximise a profit from the field crop production. Generally the agriculture sector absorbed most of the unemployed labour in Kyrgyzstan ([Light 2007](#)). The large majority of household members in peri-urban area have some off-farm job ([FAO 2007](#)). It has to do with available job opportunities, which is

higher in cities, particularly in Osh (Evenson and Pingali 2007; UNICEF 2011). Peri-urban areas have the advantage that they are closer to the city and thus are suitable for daily commuting to work (Wiggins and Proctor 2001; UNICEF 2011). On the other hand, rural households are investing more time into their agricultural production than peri-urban households.

Farmers in peri-urban area were more dependent on themselves that they were not members of any association or cooperative and most of them did not use any consultations and extension services for their farm activities. Generally in transition economies, where the market environment is still underdeveloped and not fully functional, there is a strong psychological resistance to cooperation due to years of abuse of the socialist concept prior to a transition (Lerman 2004). On the other hand, almost half of the households in Aravan were members of a cooperative and they more frequently used extension services for an improvement of farm activities. Farmers cannot optimize their practices without information and training. However, establishment of cooperatives could allow small farmers to share the burden of expenditures. Thus, promoting the establishment of cooperatives could improve access of farmers to agricultural machinery and services (Akramov and Omuraliev 2009).

6.2 Land-use management

Surveyed households were predominantly small holders with average farm size less than one hectare. Average total farm size in both study sites was similar, but certain differences could be observed in land-use management. Rural farming systems had larger homegardens and fields, while peri-urban households had considerably larger orchards. In rural area fields were determined as the main land use type, orchards in peri-urban area. Capacity and ownership of land resources represent a crucial indicator of household economic success as well (Ellis 1998; Doppler 2006). Private ownership of land in Kyrgyzstan became common during the transition from a central planned to a market economy (ARD 2007). Generally,

surveyed households owned almost all plots and renting land is not very common in both study sites. Nevertheless, renting is usually used for expanding the size of the plots, improving agricultural production and increasing household income (Rahman 2010). However, economy in Osh province is closely tied to the land. The rates of land ownership are very high and widespread, so that most households have a place to live and opportunity for subsistence production, which is important particularly for households with low incomes (UNICEF 2011).

However, irrigation is necessary for intensive cropping, but is extremely wasteful. The distribution infrastructure is old and poorly maintained (UN 2009). Nevertheless, most of plots were irrigated in both areas, but only a few unirrigated plots were in peri-urban area. Farmers thought that they have sufficient access to water necessary for irrigation. Surface water was mainly used for this purpose and most fields were located near canals, on the other hand rural farmers indicated that it happens sometimes that they do not have enough water available, especially during summer season. The problem is irrigation erosion, which affecting about 97 % of irrigated land due to the poor state of irrigation systems, such as gravity type surface watering. Salinization and waterlogging are also common problem mainly in irrigated valleys (UN 2009). Study results indicate that most respondents rated the quality of the soil on their plots as sufficiently fertile, some even assessed it as very fertile, but only a few of the respondents criticized their plots as not enough fertile.

6.3 Household income diversification

Household income has been recognized as the most useful indicator reflecting economic welfare of particular households (Brush and Turner 1987; Otte and Upton 2005), but is considered prone to several flaws (Glewwe and Van der Gaag 1988, 1990; Lipton and Ravallion 1995). Household income varies from year to year depending on the outcome of farm production, sales and prices of the products, and also varies seasonally, which refers to difficulties for timing of surveys. Problems of measurement, such as irregular and

intermittent income sources over time periods, occur in context of both farm and off-farm activities (Ellis 1998).

Selling products from the field generated the main source of income for the rural households. Certainly it can be explained by the fact that annual crops in rural area have greater demands on inputs annually and also they cultivate crops with a higher market potential. On the other hand, orchards are historically given, they need rather practises such as pruning, fruit harvesting, cutting the grass, etc., which is hardly valued. Although peri-urban households sell their orchard fruit production, but they much more keep it for their own consumption. Many of these orchards could be considered as well as the homegardens.

Household income is thus influenced also according to the opportunities outside of particular farming system. Generally, our study confirmed the fact that peri-urban households generate more income from off-farm activities, while rural household have more income from farms, which in correspondence with other studies (Barrett et al. 2001; Lerman 2004; Nair 2006; UNICEF 2011). In many rural areas, goods and services are largely produced and traded locally within the village economy, because of their limited access to the major urban markets (Otte and Upton 2005).

Study documented differences among peri-urban and rural areas resources capacity and use. Nevertheless, households from peri-urban area has lower income compare to rural area, which is in correspondence with national survey done by UNDP (2013). According to UNICEF (2011), households in Osh and Jalal-Abad provinces have on average higher incomes than rural households. Urban households have also more opportunities work off-farm and in rural area most of inhabitants mainly worked on their own land.

6.4 Role of homegardens in household economic

Households maintained their homegardens mainly for their subsistence production, even though some additional household income was derived from selling their surplus product thus they had minimal impact on the household income. The study results confirm that the primary role of homegardens is traditionally to support the food security (Brownrigg 1985; Fernandes and Nair 1986; Torres 1988; Ellis 1998), and provide a stable supply of products as well as socio-economic and environmental benefits for households (Niñez 1987; Christanty 1990; Kumar and Nair 2004; Nair 2006; Buchmann 2009; Kabir and Webb 2009). Traditional homegardens had mostly small land size (Peyre et al. 2006) and in most cases the average size of homegarden is much more less than a hectare and subsistence practises predominated (Fernandes and Nair 1986). It also corresponds to our research. Average size of rural gardens was 0.067 ha, which was slightly higher than peri-urban average size 0.046 ha. In terms of soil fertility, rural homegardens received the highest grade among all household plots. The most preferred species were *Prunus avium*, *Prunus armeniaca* in both study sites. In addition, *Vitis vinifera* was also the most documented species in rural area and otherwise *Solanum tuberosum* was more documented in peri-urban area. Species composition of homegarden is the result of personal preferences of household members with respect to particular subsistence (Kumar and Nair 2006). Seeds and seedling, fertilizers and own labour of household members were the main sources of inputs in both areas.

Men and women share homegarden activities, but women are often involved in tasks regarding the household (Howard 2003; Kabir and Webb 2009) and they are more responsible for food production (FAO 1990; World Bank 2009). Numerous studies suggest that the women are often responsible, with or without the assistance of the male members of household, for homegarden activities (Murray 2001; Greenberg 2003; Howard 2006). Nevertheless household members consume almost everything from the production (Peyre et al. 2006). Therefore share of homegardens on total household income generation is the lowest compared to other sources of cash income, this applies to both areas. Homegardens

are intensively managed by household members (Fernandes and Nair 1986; Shajaat 2005). Study results have shown that more than three household members in rural area, and more than four members in peri-urban area, contributed to homegarden activities, distributed almost equally between men and women. Similarly, a study of Nicaragua reported that on average of three household individuals contributed labour to homegarden activities (Méndez et al. 2001). The fact, the degree to which households have access to work off-farm influence the role of the homegardens in the overall farming systems (Wiersum 2004). Expectations on the future use of the homegarden are similar across the households in rural and peri-urban areas. Farmers would like to extend their homegardens and also pass them to the next generations.

6.5 Suggestions for further research

Despite the fact that homegardens were used mainly for fresh food production, they also have many other benefits, as a place for recreation, protection against sun or wind, and their traditional purposes as well as aesthetical and ecological purposes (Kumar and Nair 2004). We recommend further research focused on homegardens, particularly explore their cultural role within households, the role in traditional cuisine and definitely their agrobiodiversity. Their potential enhancement of economic and ecological benefits, assuming that agrobiodiversity and structural complexity of these homegardens increased (Thompson et al. 2010).

Nevertheless, as it showed that selling products from the field had the biggest contribution to household cash income in rural area, we recommend further study with focus on field crop production, with special attention to improve of produce with a higher market potential, which can lead to growth of household income (Rahman 2010). Moreover, it could help to understand the role and importance of agriculture production for local households. Most household members in peri-urban area have some off-farm job for the purpose of earnings compared to rural area. Therefore the local government should support

the development of infrastructure (UN 2009; Thompson et al. 2010) We also recommend further study on local employment opportunities, but we have to note that the shadow economy plays an important role in the country (Fisher et al. 2004). However, even though peri-urban households work off-farm so they are still dependent on agriculture. Agricultural extension services could be an effective tool to disseminate right agricultural practices through better pasture management, pest management, improved cultivation techniques as well as organic farming (Anderson and Feder 2007; UN 2009) and also government should intensify their active role in provision of agricultural extension services. Farmers cannot optimize their agricultural production without particular information and professional education (Lerman 2004).

6.6 Study limitations

However, our data has to be understood in the light of certain limitations. Particularly peri-urban area could generate part of their income from temporary jobs, probably connected to even unofficial economy. Secondly, all area was influenced by recent political tensions, which could affect household economy, particularly in peri-urban area via decrease the number of employment opportunities in Osh city, which was affected the most. Despite the fact that the questionnaires were collected during July, when was celebrated Islamic Ramadan as a month of fasting and the research results cannot be generalized to overall population of both areas, because they are based on 50 households, concretely on total 236 household individuals.

7 Conclusion

The research provides a deeper insight into socioeconomic characteristics of rural and peri-urban farming systems in Osh province, southern Kyrgyzstan. Study documented differences among both study sites in both resource management and capacity, income distribution and land-use systems. Rural households had a higher mean number of household members, which were more likely to reside on-farm. Gender balance was rather equal in both areas. Majority of targeted respondents in rural area were of Uzbek ethnic origin and while peri-urban area are dominated by Kyrgyz. However, both areas differ greatly in human resources use for particular activities. It has to do with the focus of agricultural production and its commercialization. While households in peri-urban area are more focused on orchard fruit production, processing the products and working off-farm for the purpose of earnings. Households in rural area have lack of opportunities to work off-farm, so they pursue to maximise a profit from the field crop production and selling products from the field generated the main source of income for the household. Although peri-urban households sell their orchard fruit production, but they much more keep it for their own consumption. Rural farming systems had larger homegardens and fields, while peri-urban households had significantly larger orchards and larger number of livestock. Private ownership of particular land use types, e.g. field, orchard and homegardens, were very common in both areas and farmers perceived the quality of soil on their plots as sufficiently fertile, some even, especially homegardens, assessed as very fertile. However, households in both study sites maintained their homegardens mainly for subsistence production, but some additional household income was derived from selling their surplus product. Therefore share of homegardens on total household income generation is the lowest compared to other sources of cash income.

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