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Obstacles to crop diversification and cotton harvest mechanisation: Farm survey evidence from two contrasting districts in Uzbekistan

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Abstract

The dominance of cotton in the irrigated areas of Central Asia has long been criticized for its ecological effects on salinization and desertification. From an economic point of view, this monoculture ties producers to state procurement, has led to the recurrent mobilization of manual labour during harvest campaigns and makes farmers vulnerable to water availability and crop failure. Crop diversification and harvest mechanisation have been proposed as strategies to mitigate these effects, provide alternative income generation channels and increase farmers' flexibility in dealing with reduced water availability. This contribution uses 2014 survey data from two districts in Uzbekistan, Jondor in Bukhara province and Zangiota in Tashkent province, to inform this debate by identifying real-world obstacles to these strategies. The first district is dominated by the conventional cotton and wheat rotation introduced after 1991. The second district is home to a wide range of high-value crops (HVC), in particular fruits and vegetables. The evidence shows how HVCs can be a profitable alternative to the state-mandated monocultures. Moreover, water productivity of HVCs is much higher. Even so, there is practically no hands-on experience of harvest mechanisation in the traditional cotton region so far. In addition to the state delivery targets, a lack of finance, absent connections to city markets, missing role models and the complete inexperience of farmers with alternative technologies will impede a further expansion of crop diversification and the mechanisation of harvest operations.

JEL: O33, P28; Q12; Q15

Keywords: Cotton, high-value crops, crop diversification, harvest mechanisation, Uzbekistan.

Zusammenfassung

Hindernisse bei der Einführung diversifizierter Fruchtfolgen und der mechanisierten Baumwollernte: Ergebnisse einer landwirtschaftlichen Betriebsbefragung in zwei unterschiedlichen Landkreisen in Usbekistan

Die Verbreitung der Baumwolle in den Bewässerungsgebieten Zentralasiens wird seit langem für ihre ökologischen Effekte der Versalzung und Wüstenbildung kritisiert. Von einem wirtschaftlichen Standpunkt aus betrachtet bindet diese Monokultur die Erzeuger an staatliche Aufkaufstellen, sie erfordert die wiederkehrende Mobilisierung von Arbeitern während der Erntekampagne und sie bedeutet eine hohe Verwundbarkeit der Bauern gegenüber Wasserverfügbarkeit und Ernteausfall. Die Einführung diversifizierter Fruchtfolgen und die Mechanisierung der Baumwollernte sind als Strategien zur Milderung dieser Effekte vorgeschlagen worden. Sie schaffen Möglichkeiten der alternativen Einkommenserzielung und erhöhen die Flexibilität der Bauern im Umgang mit verringerter Wasserverfügbarkeit. In diesem Beitrag verwenden wir Daten einer Betriebsbefragung aus dem Jahr 2014 aus zwei Landkreisen Usbekistans, Jondor in der Provinz Buchara und Zangiota in der Provinz Taschkent, um realweltliche Hindernisse bei der Umsetzung dieser Strategien zu ermitteln. Der erste Landkreis ist durch die nach 1991 eingeführte, herkömmliche Baumwoll-Weizen Fruchtfolge geprägt. Im zweiten Landkreis werden vorwiegend Kulturen mit hoher Wertschöpfung (sog. High Value Crops, HVCs) angebaut, vor allem Obst und Gemüse. Die Daten zeigen, auf welche Weise HVCs

eine gewinnbringende Alternative zu den staatlich verordneten Monokulturen darstellen können. Auch ist die Wasserverwertung dieser Kulturen deutlich höher. In dem herkömmlichen Baumwollanbaugebiet liegen allerdings keinerlei praktische Erfahrungen mit der Erntemechanisierung vor. Die staatlichen Ablieferungsquoten, ein Mangel an geeigneten Finanzierungsquellen, fehlende Verbindungen zu städtischen Märkten, fehlende Rollenmodelle und die vollständige Unerfahrenheit der Bauern mit alternativen Anbautechniken werden die Ausweitung des Anbauspektrums und die Einführung mechanisierter Baumwollpflücker behindern.

JEL: O33, P28; Q12; Q15

Schlüsselwörter: Baumwolle, high-value crops, Diversifizierung, Erntemechanisierung, Usbekistan.

Резюме

Препятствия на пути диверсификации сельскохозяйственных культур и механизации уборки хлопка: Данные обследования фермерских хозяйств в двух отличительных районах Узбекистана

Преобладание хлопкопроизводства на орошаемых землях Центральной Азии является объектом продолжающейся критики из-за его экологических воздействий на засоление и опустынивание. С экономической точки зрения, такая монокультура привязывает производителя к системе государственных закупок, сопутствует периодической мобилизации ручного труда во время уборки урожая, а также увеличивает уязвимость фермерских хозяйств к уровню водообеспеченности и неурожая. Диверсификация культур и механизация уборки урожая были предложены в качестве стратегий по смягчению этих последствий, обеспечению альтернативных доходообразующих каналов и повышению гибкости фермеров в решении проблем с уменьшением водообеспеченности. Для информационного подкрепления проводимых дискуссий путем выявления реальных препятствий во внедрении этих стратегий в исследовании используются данные обследования фермерских хозяйств в двух районах Узбекистана: Жондорский район Бухарской области и Зангиатинский район Ташкентской области. Первый район состоит в основном из традиционного хлопкопроизводства и севооборота с участием пшеницы, введенного после 1991г. Второй район включает в себя различные высокотоварные культуры, в частности овощи и фрукты. Согласно данным обследования, высокотоварные культуры могут быть выгодной альтернативой выращиванию монокультур. Кроме того, продуктивность водопользования на высокотоварных культурах гораздо выше. Несмотря на это, в районе, традиционно производящем хлопок, отсутствует практический опыт в механизированной уборке урожая. В дополнение к системе госзакупок, препятствиями для дальнейшей расширенной диверсификации культур и механизации уборки урожая, скорее всего, будут нехватка финансовых средств и отсутствие связей с городскими рынками, а также отсутствие успешных примеров и фермерского опыта в применении альтернативных технологий.

JEL: O33, P28; Q12; Q15

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1 Introduction

The dominance of cotton in the irrigated areas of Central Asia has long been criticised for its ecological effects on salinization and desertification in the Aral Sea basin (Glantz et al., 1993; Spoor, 1993; Lerman et al., 1996; Spoor, 1998). From an economic point of view, this monoculture ties producers to state procurement, has led to the recurrent mobilisation of manual labour during harvest campaigns and makes farmers vulnerable to water availability and crop failure (Bobojonov et al., 2013; Aleksandrova et al., 2014). Along with cotton, wheat is considered a strategic crop in Uzbekistan. After 1991, cultivation was drastically expanded as part of the national programme of grain self-sufficiency. Although its production offers options for implementing conservation agriculture in irrigated areas, wheat is still cultivated following conventional practice and, similar to cotton, linked to the state procurement policy (Kienzler et al., 2012). Both cotton and wheat now occupy most arable land of farms that specialise in cotton-grain production although other crops are available that generate higher farm income. On the menu of potential remedies proposed by policy advisers and donors, two strategies have figured prominently: crop diversification and mechanisation of farm operations (ADB, 2013). The former is assumed to mitigate adverse environmental effects of cotton monoculture, increase rural income through alternative income generation channels and increase farmers' flexibility in dealing with reduced water availability (Bobojonov et al., 2013). The latter is hoped to reduce the need for internationally much criticised labour campaigns during cotton harvest. The Uzbekistani government has announced plans to boost cotton mechanisation recently (ADB, 2013).[1]

The aim of this report is to document field evidence on production, crop diversification and farmers' attitudes towards mechanisation that helps to inform the ongoing policy debate and to identify real-world obstacles to pursuing these strategies. In the following, we use survey data to compare the production outcomes and experiences of farmers operating in two districts in Uzbekistan, Jondor in Bukhara province and Zangiota in Tashkent province. The first district is dominated by the conventional cotton-wheat farms, the second is home to farms that specialise in a wide range of high-value crops (HVCs), in particular fruits and vegetables. The two districts thus provide real world insights into the differences between mono-cultural and state controlled and diversified and more flexible production systems. Harvest mechanisation levels are low in both districts.

In the following chapter 2, we describe the process of data collection and introduce the study regions. Chapter 3 provides a quantitative analysis of the surveyed farms' factor endowments with regard to land, labour, variable inputs and finance. Chapter 4 focuses specifically on the state of farm mechanisation in the two study regions and farmers' attitudes towards cotton harvest mechanisation. Chapter 5 documents production and marketing outcomes as well as labour utilisation during harvest, and presents model calculations of crop-specific gross margins and water productivity. Chapter 6 summarises the farmers' own assessments concerning alternatives to cotton-wheat and their related knowledge levels. Chapter 7 concludes with a summary of the main obstacles to mechanisation and crop diversification and a set of policy recommendations.

[1] See also http://uzbekistan.org/cotton-fair-2015/archive/4367/; http://www.textileexcellence.com/news/details/289.

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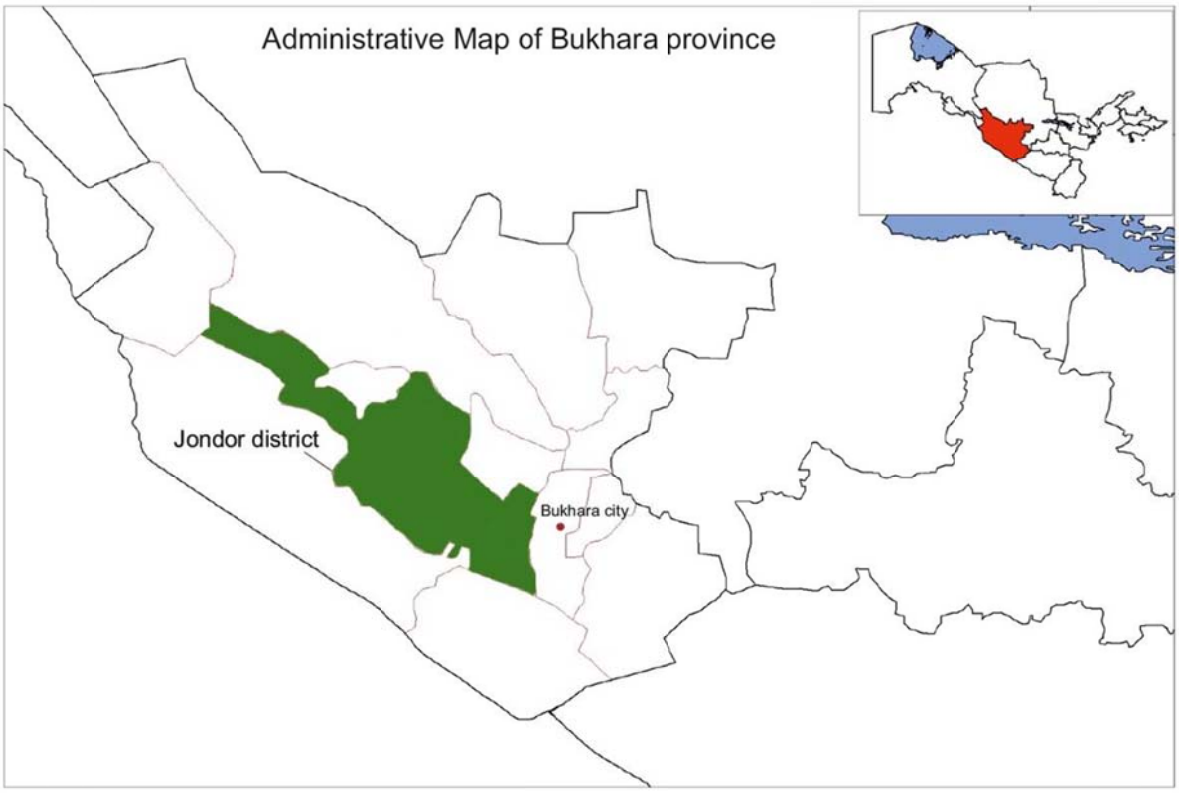
The evidence coming from the two survey regions shows how HVCs can be a profitable alternative to the state-mandated monocultures. Moreover, it demonstrates that water productivity of HVCs is much higher. Even so, there is practically no hands-on experience of cotton harvest mechanisation so far, as the necessary machinery is not available on the fields. In addition to the state delivery targets, a lack of finance, absent connections to city or other markets, missing role models and the complete inexperience of farmers with alternative cropping patterns will likely impede a further expansion of crop diversification and the mechanisation of harvest operations in those rural areas of Uzbekistan currently dominated by cotton-wheat producing farms.

2 DATA COLLECTION AND STUDY REGIONS

The data for this report was collected in the framework of the Technical Assistance project TA-8567 "Innovations for Agriculture Modernization" funded by the Asian Development Bank (ADB) (ADB, 2013). Data collection was carried out by Nazar Business and Technology, LLC, (NBT) based in Tashkent, Uzbekistan, in cooperation with IAMO, under the lead contractor GFA Consulting Group GmbH in Hamburg, Germany. The project's objective was to provide support to further development of cotton mechanisation and crop diversification activities already initiated by ADB's earlier support programme. The two survey regions were selected purposefully as representing a traditional cotton area and a typical horticultural area in Uzbekistan.

Jondor district is located in the south west of Bukhara province (25 km from Bukhara city), with the central town of Jondor (Figure 1). It consists of 9 small towns and 13 rural citizens assemblies (37 mahallas). Based on official statistics, the population of Jondor district comprises 152,200 people, mainly Uzbeks (96 %), less Tajiks (2.4 %) and other nationalities. The population density amounts to 29.7 people per km^2. The total area of farm lands in Jondor district is 86,088 ha. In 2014 there were 510 farms registered in the district, including 309 farms growing the main crops of cotton and wheat on 51.3 % of total irrigated area in the district. The rest of the farm lands are used for livestock breeding and production of fodder, i.e. 47.5 % of farm lands. Farms producing fruits and vegetables occupy less than 1.5 % of farm lands in Jondor district (Table 1).

Figure 1: Map of Jondor District, Bukhara Province



Source: NBT.

Table 1: Number of farms and their land endowment in survey regions

Administrative unit	All farms		Farms producing									
			Cotton and wheat		Vegetables and melons		Horticulture and viticulture		Livestock		Others	
	Number of farms	Average land per farm (ha)	Number of farms	Average land per farm (ha)	Number of farms	Average land per farm (ha)	Number of farms	Average land per farm (ha)	Number of farms	Average land per farm (ha)	Number of farms	Average land per farm (ha)
Tashkent province	**6051**	**69.8**	**2833**	**103.6**	**650**	**25.4**	**1809**	**19.0**	**539**	**118.7**	**220**	**63.2**
Zangiota district	500	25.1	0	0	287	29.4	174	17.0	36	32.4	3	1.7
Bukhara province	**3953**	**184.6**	**2679**	**122.5**	**67**	**10.3**	**642**	**8.2**	**508**	**778.4**	**57**	**2.8**
Jondor district	510	168.8	309	142.9	1	7.0	93	11.7	104	392.8	3	2.3

Source: MINISTRY OF AGRICULTURE AND WATER RESOURCES OF UZBEKISTAN, 2014.

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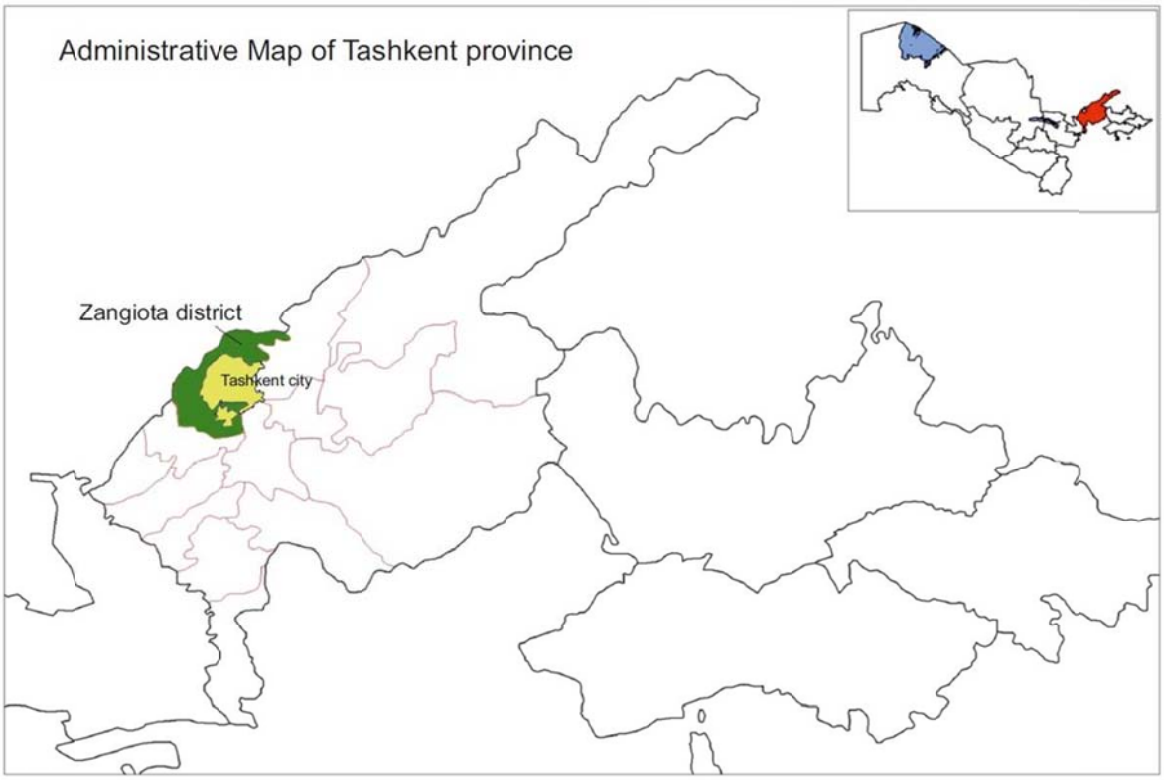
Zangiota district is located in the north-east part of Tashkent province (Figure 2). The total area of the district is 382.9 km^2, the central town is Keles. It consists of 21 rural citizens' assemblies and 151 mahallas. The population of Zangiota district is 348 900 people, mainly Uzbeks (85.8 %), Kazakhs (6.7 %), Tatars (2.0 %), Russians (1.6 %) and other nationalities. There are 500 farms in Zangiota district mainly producing wheat, fruits and vegetables on 12,550 ha of farm land. Cotton is not produced in this district, which has traditionally been geared towards fruit and vegetable supply for the nearby capital Tashkent.

Figure 2: Map of Zangiota District, Tashkent Province



Source: NBT.

In total 250 farmers were surveyed during the data collection, including 100 farmers mainly producing cotton and wheat in Jondor district of Bukhara province and 150 farmers mainly producing vegetables and fruits in Zangiota district of Tashkent province. In both provinces the number of samples comprised about 30 % of the total number of farmers producing the same crops in the districts.

To survey farms in the two districts, a special questionnaire was developed (see appendix 1 for a reproduction). Prior to conducting the farm survey in the survey districts, the questionnaire and instructions for interviewing and sampling procedures were field tested to approve and adjust the research instruments. For conducting the survey, 10 interviewers (5 in each province) were hired and special training was provided to them on how to interview the farmers and fill in questionnaires. The farm survey was held during November 14-28, 2014 in both provinces (Tashkent and Bukhara) and 250 farmers were surveyed in total. This particular survey time was chosen to get the results of cotton production for 2014. The survey was launched in both districts at the same time (in parallel). Respondents were selected randomly from the total list of farms that was provided by the Ministry of Agriculture and Water Resources (MAWR), stratified by administrative units.

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The refusal rate of respondents for the entire sample size amounted to 10 %. Some farmers had no time for the interview or they were not willing to share their financial information. Each interview took 1.5 to 2 hours to complete.

To ensure a high quality of the data collection the field manager of NBT supervised the sampling procedures, he visited 10 % of the surveyed farms (chosen randomly), and he cross checked the questionnaires for completeness and accuracy. Omitted answers were recorded and inconsistencies were cleared out.

3 FACTOR ENDOWMENT OF FARMS IN THE SURVEY

3.1 Summary statistics

Farms in Jondor district are endowed with about three times as much land as farms in Zangiota district (Table 2). The share of irrigated land is slightly smaller in Jondor, where most of the land is used for cotton production. No cotton is cultivated in Zangiota district. Whereas labor intensity in Jondor is lower than in Zangiota, farms are more often equipped with tractors.

Table 2: Summary farm statistics by survey region

Indicator	Jondor district	Zangiota district
No of farms in sample	100	150
Total land per farm (ha)*	76 (55; 105)	20.8 (14; 35.8)
Share of irrigated land (% of total land)*	81.8 (71.6; 91.2)	91.3 (86.5; 93.6)
Share of land under cotton (% of total land)*	67.4 (56; 72)	0 (0; 0)
Labor input (FTE per ha)*	20.2 (14.4; 25.7)	33.4 (22.5; 47.1)
Tractors per farm*	1 (1; 2)	0 (0; 1)

Notes: * Median (1st quartile; 3rd quartile). FTE = full time equivalent (242 working days).

According the survey results most of the farmers growing vegetables and fruits in Zangiota districts are 41-60 years old. Farmers growing cotton and wheat in Jondor district are younger, aged 31-50 years (Table 3).

Table 3: Distribution of respondents according to age cohorts

Age	Jondor district	Zangiota district
18-30 years	6.0 %	7.3 %
31-40 years	26.0 %	12.7 %
41-50 years	34.0 %	31.3 %
51-60 years	31.0 %	38.7 %
Older than 61	3.0 %	10.0 %

As seen from Table 4, 55 % of surveyed farmers in Zangiota district have higher education, whereas percent of farmers with higher education in Jondor province is less by 21.7 %. On average respondents in both districts have more than 15 years of experience in agriculture.

Table 4: Distribution of respondents according to schooling level

Education	Jondor district	Zangiota district
Higher	33.3 %	55.0 %
Incomplete higher	0 %	0.7 %
Secondary special (college)	36.4 %	5.4 %
Secondary professional (vocational school)	18.2 %	28.9 %
Secondary general	12.1 %	10.1 %

Farmers cooperate with each other more in Zangiota district, 81 % of farmers positively responded to the question if they carry out any farm activities with other farmers. In Jondor district 63 % of farmers cooperate with each other. In most cases farmers cooperate with each other advising on farming and within farmer's unions. Farmers who have machinery usually rent it to other farmers, but without contract, on mutual agreement.

3.2 Land endowment

The distribution of farms according to their size in the two surveyed districts presented in Figure 3 shows a clear distinction between farms that specialize in cotton and wheat production and horticulture-garden farms. The farms in Jondor district that mainly specialize in cotton and wheat are much larger than those in Zangiota. The average farm size in Bukhara is about 98 ha. The average size of the interviewed 150 farms in Zangiota district is about 31 ha. The smallest farm is 1.5 ha and the largest one reaches 250 ha.

Figure 3: Land endowment of farms

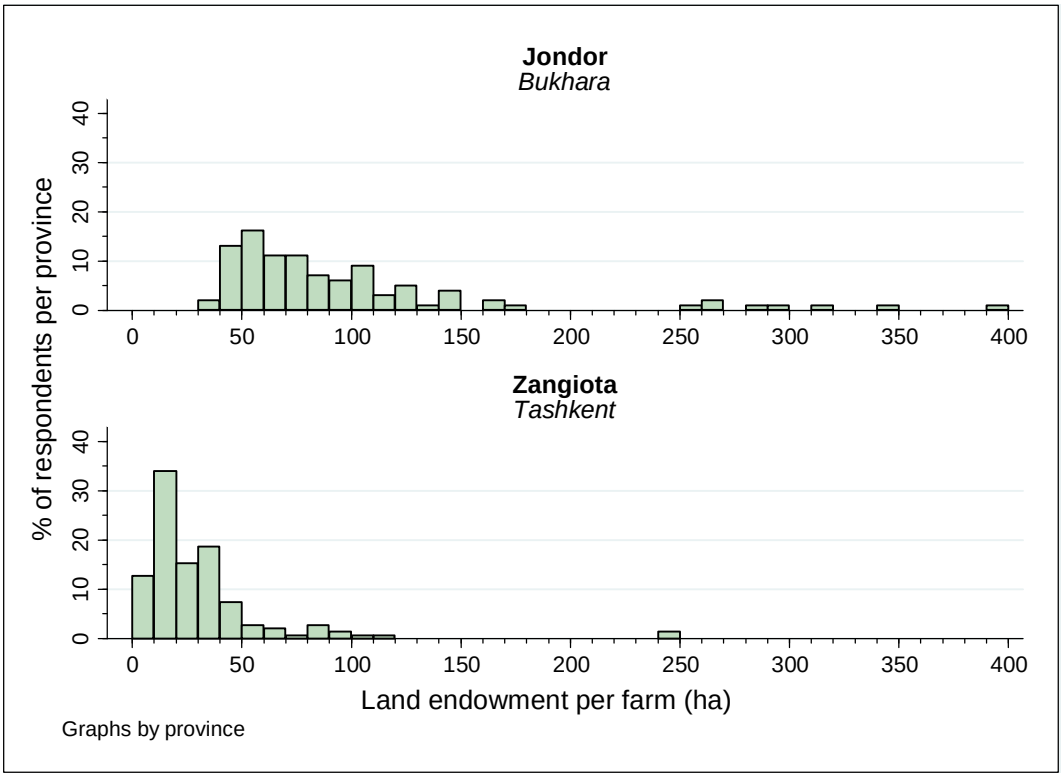
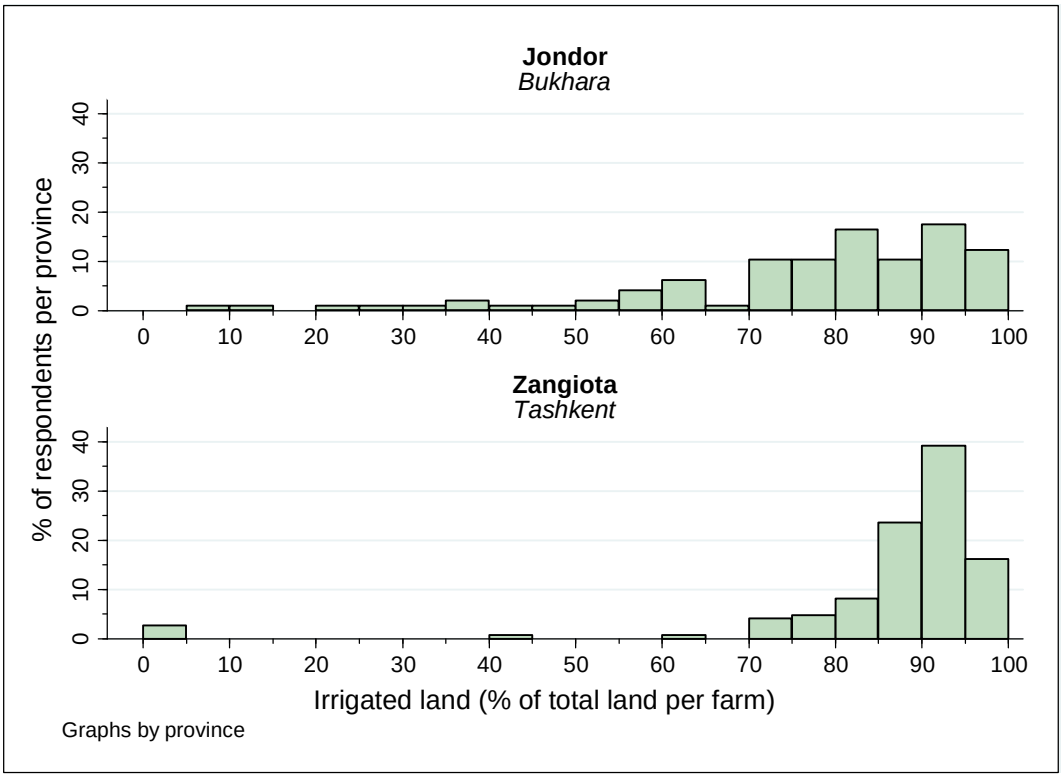


Figure 4 shows the share of irrigated land in total area cultivated by farms in the two districts. About 90 % of farm land in Zangiota district is irrigated. Their larger counterparts

that specialize in the two strategic crops and located in Jondor district have about 70 % of land under irrigation. While more than half of farms in the former have irrigated land over 90 % of their leased land, the same applies only to one third of farms in Jondor district. Such difference can be due to climatic and soil conditions of the two locations as well as initial conditions related to the quality of the irrigation network and water supply issues.

Figure 4: Endowment with irrigated land



Farmers in Zangiota district are endowed with more productive soils when measured by the bonitet index. Bonitet is a system that classifies land based on its potential productivity using a 100-point scale. A bonitet index range of 41-60 stands for lands with average productivity. The average bonitet index for these farms is about 60, and for those in Jondor about 50. As Figure 5 shows, almost half of Zangiota farms display an average bonitet index over 60, while only 20 % of farms in Jondor have land with quality over 60 bonitet points.

While there was no cotton production among the 150 farms interviewed in Zangiota district, the average share of cotton in total sown land in Jondor district was about 63 %. As shown in Figure 6, about three fourths of interviewed farms in Jondor district allocated at least half of their total sown area for cotton production.

Figure 5: Distribution of soil quality

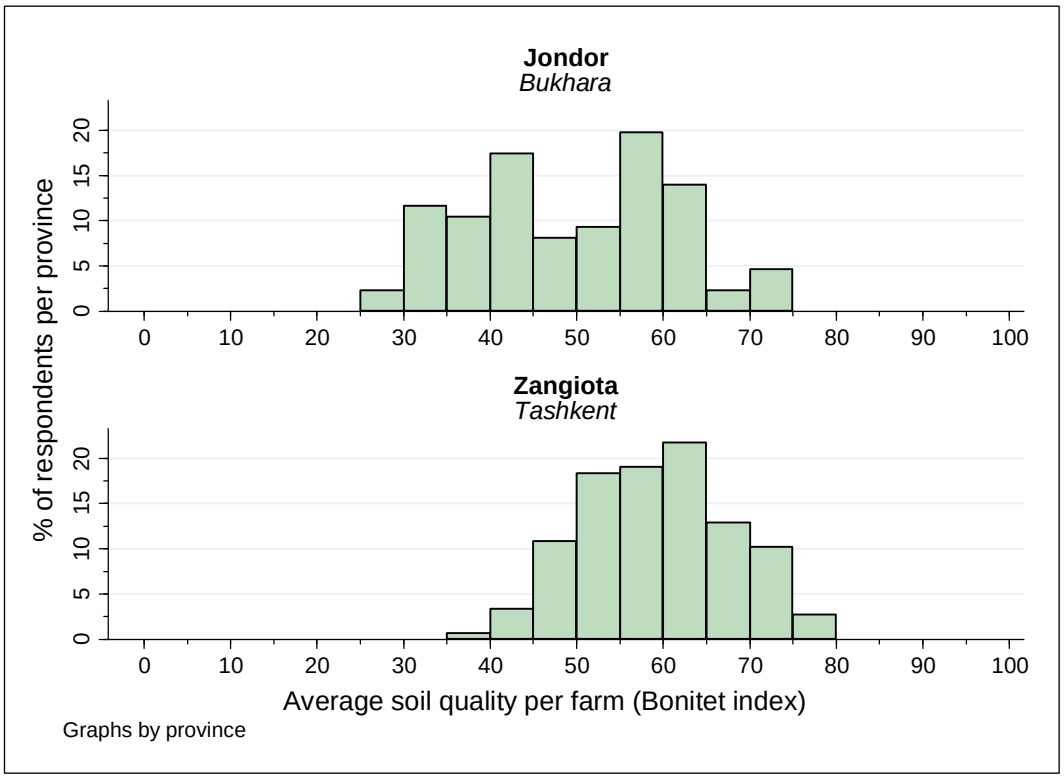
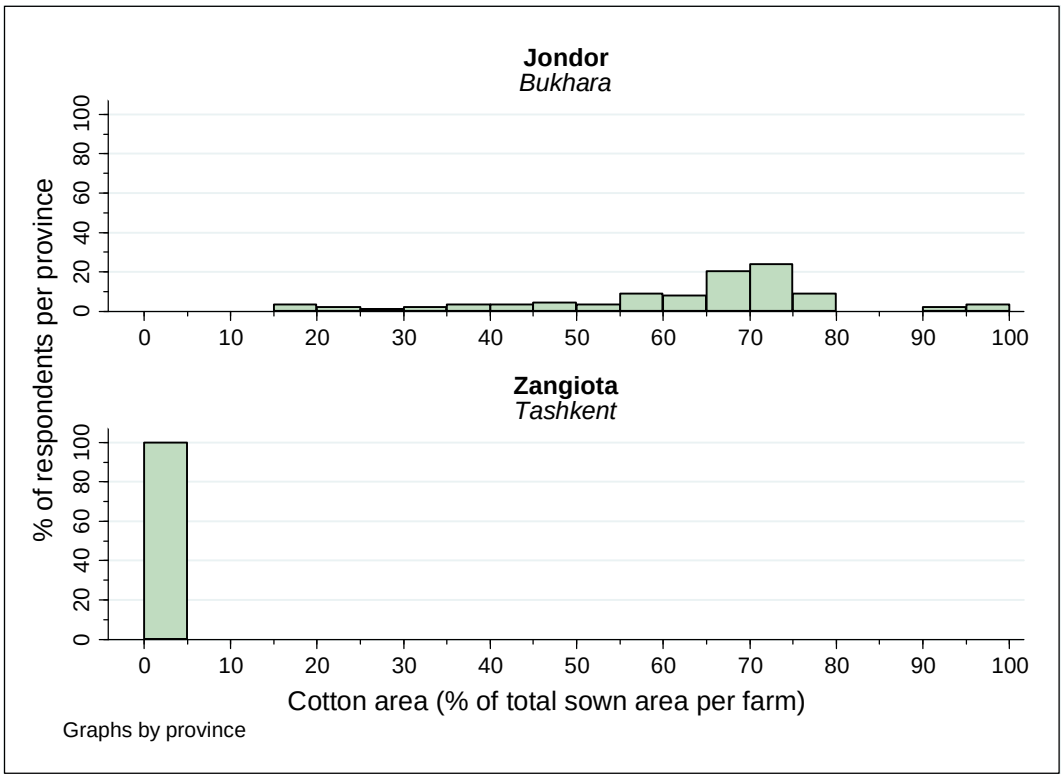


Figure 6: Cotton area on farms



3.3 Labour use

While farms in Jondor are endowed with much more land than in Zangiota (Table 2), they employ much less labor per ha. Figure 7 displays the labor/land ratio by survey region. In the box plots, the line dividing the box represents the median, whereas the lower and upper limits of the box represent the first and third quartiles of the distribution. Lower and upper whiskers delimit the most extreme data point within first (third) quartiles minus (plus) 1.5 times the inter quartile range, and thus graphically illustrate the dispersion of the individual observations.

Figure 7: Labour/land ratio by survey region

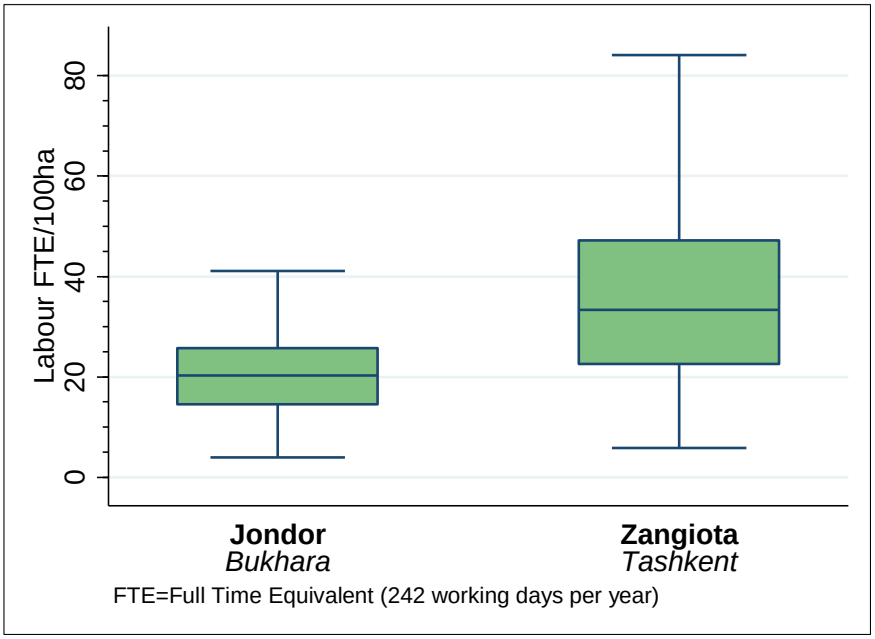
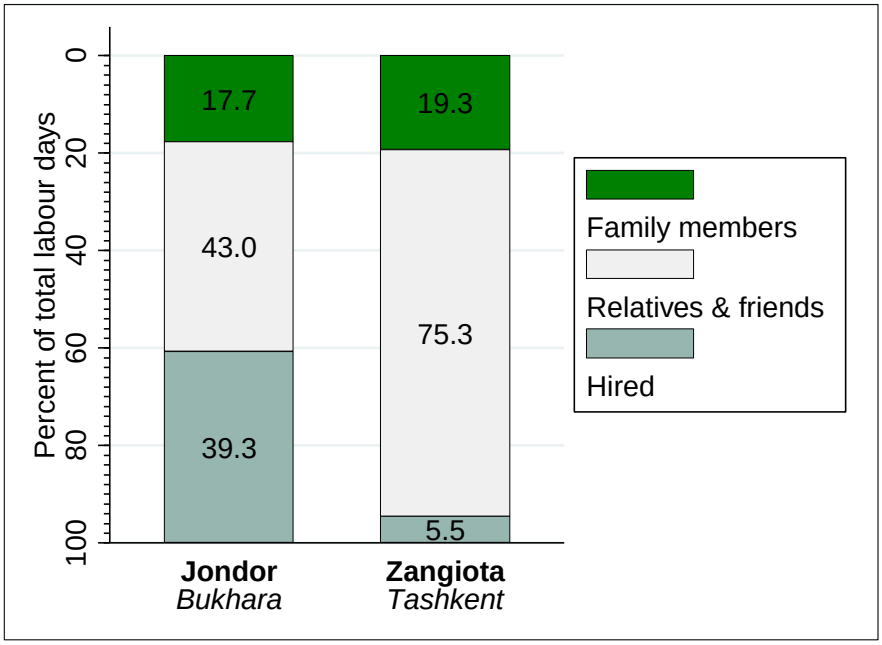


Figure 7 shows that agricultural production in both districts is quite labour intensive. In Jondor, this is likely due to labour-intensive cotton harvesting practices, whereas fruit and vegetable production in Zangiota also requires a lot of manual work. As cotton harvesting is primarily based on mobilised labour specifically hired for this purpose, the share of hired workers in total labour input is higher in Jondor than in Zangiota (Figure 8).

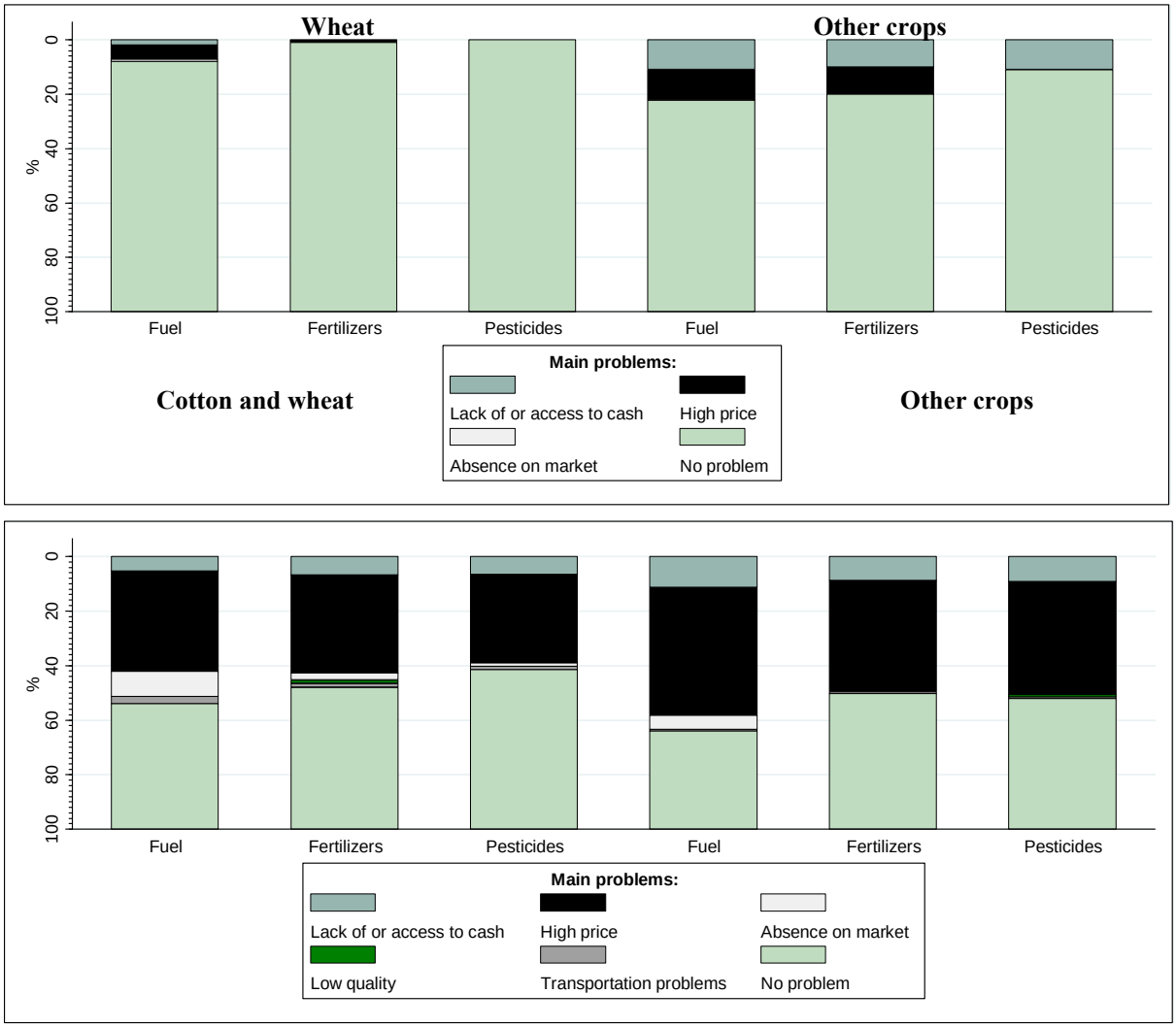
Figure 8: Labour composition by survey region



3.4 Access to variable inputs

As shown in Figure 9, as part of the state procurement system farmers in Jondor (upper figure) experienced less problems with getting fuel, fertilizers and pesticides for cotton and wheat production than for other crops. Compared to input access in Jondor district, farmers in Zangiota (lower figure) had more problems not only in accessing inputs for other crops, but also for wheat production. High input prices were reported as the major problem related to the access to inputs in Zangiota. The fact that cotton and wheat farmers have preferential access to essential inputs sponsored by the government in Jondor may explain these differrences in farmers' perceptions.

Figure 9: Farmers' opinion about problems with obtaining diesel fuel, fertilisers and pesticides in Jondor (upper) and Zangiota (lower) districts



3.5 Financing arrangements

In the sample of 250 farmers, almost two thirds had experience with short-term and 15 % with long-term loans in the last 3 years. However, the access to loans differs across the provinces. While almost three fourths of farmers in Jondor district obtained short-term loans, the share for Zangiota was only 52 %. The figures are lower for long-term loans where only 19 % of farmers in Jondor and 8 % in Zangiota had experience with long-term loans. As Figure 10 shows, there is a difference between the survey districts in the received amount of short-term loans per hectare. The majority of farmers in Zangiota received short-term loans up to 494,500 UZS per ha (215 USD/ha). The average amount of loans in Zangiota was only about one half of that in Jandor.

Figure 10: Amount of short-term loans received by farms by survey regions (USD/ha)

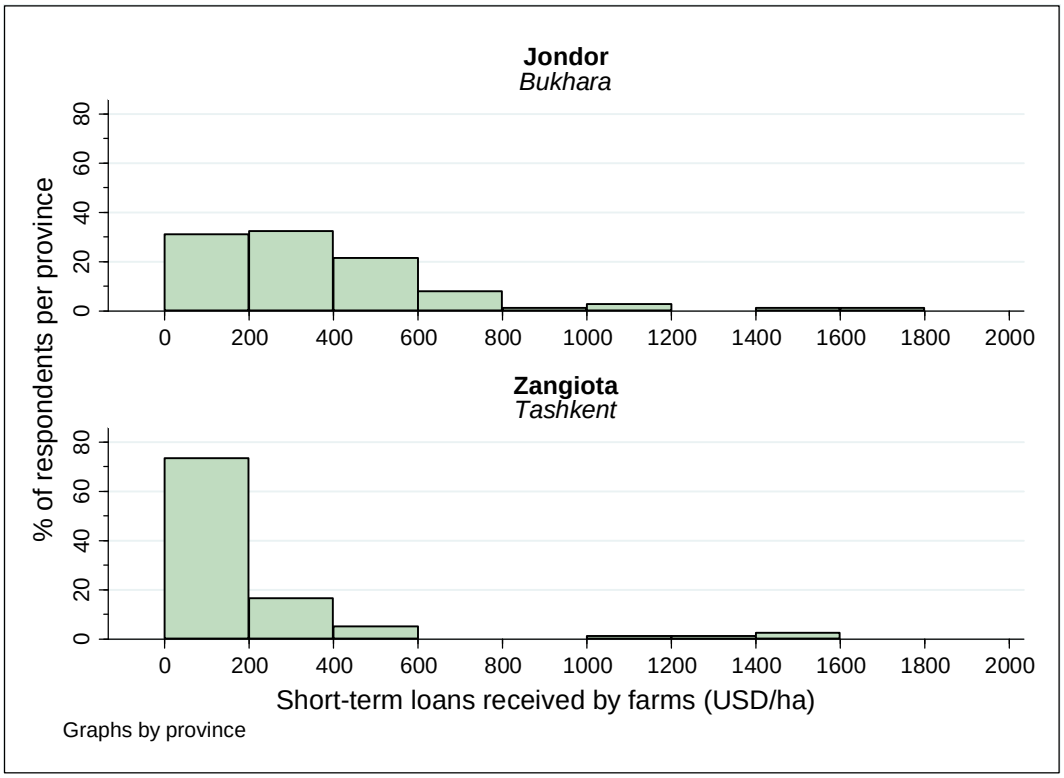
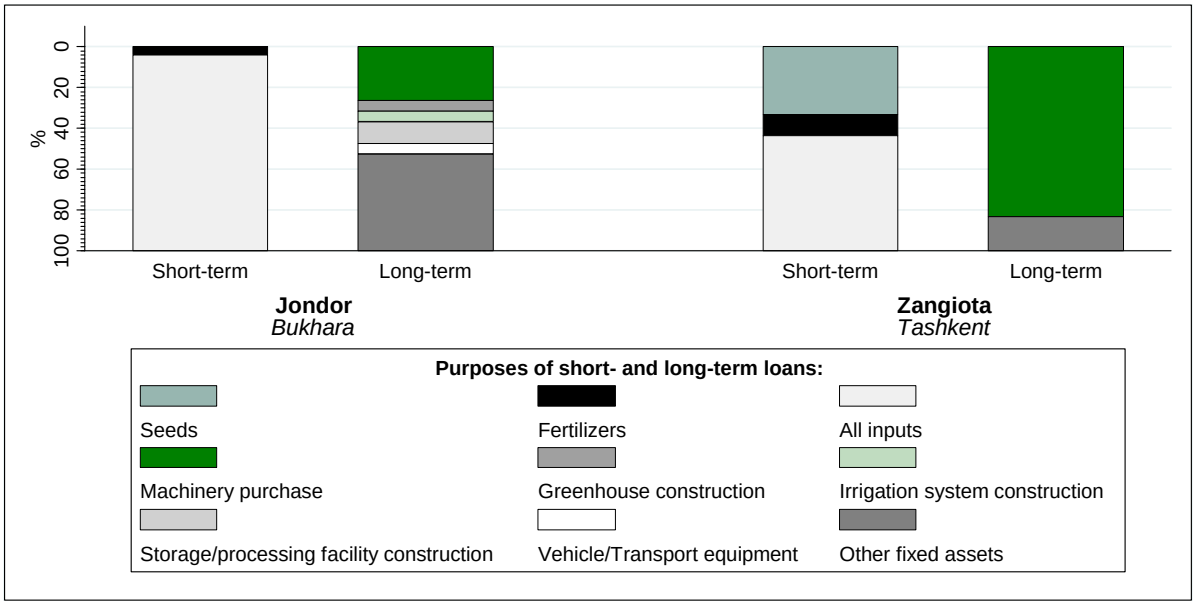


Figure 11 shows the difference in the purpose of the obtained short- and long-term loans by the interviewed farmers in Jondor and Zangiota. The cotton-wheat producing farms in Jondor mainly used the short-term loans for purchasing various production inputs, while farmers in Zangiota used almost 40 % of these loans only for purchasing seeds.

The difference in the use of long-term loans is also interesting. About 80 % of Zangiota farmers who obtained long-term loans used these loans for purchasing machinery, while three fourths of farms in Jondor used these loans for various construction purposes.

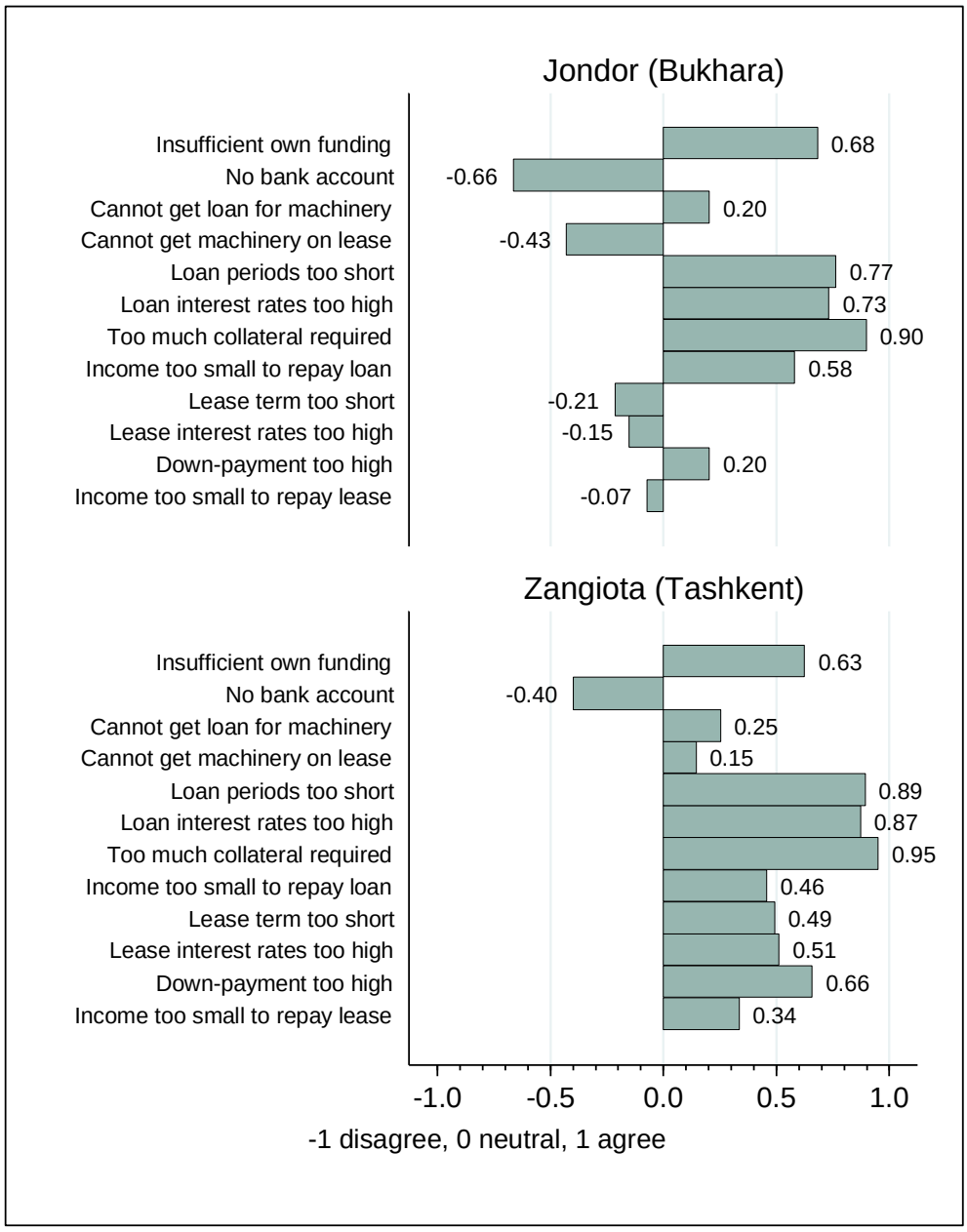
Figure 11: Purpose of short- and long-term loans in two regions



According to the farmers' responses only 35 % of respondents in Jondor and 5 % in Zangiota had experience with purchasing machinery or equipment via leasing contracts during last 3 years.

There are different patterns of farmers' responses to the main financial issues in the two survey districts (Figure 12). While farmers in Zangiota agreed on the most of the financial issues except for the absence of a bank account, cotton-wheat producing farmers in Jondor mainly complained about the lack of own funds and problems with obtaining loans such as short period of payment, high interest rates, collateral requirements and lack of income to repay the loans. In contrast to farmers in Zangiota, they have no issues related to leasing contracts expect for high down-payment.

Figure 12: Financing arrangements: Perceived obstacles by survey regions



4 FARM MECHANISATION

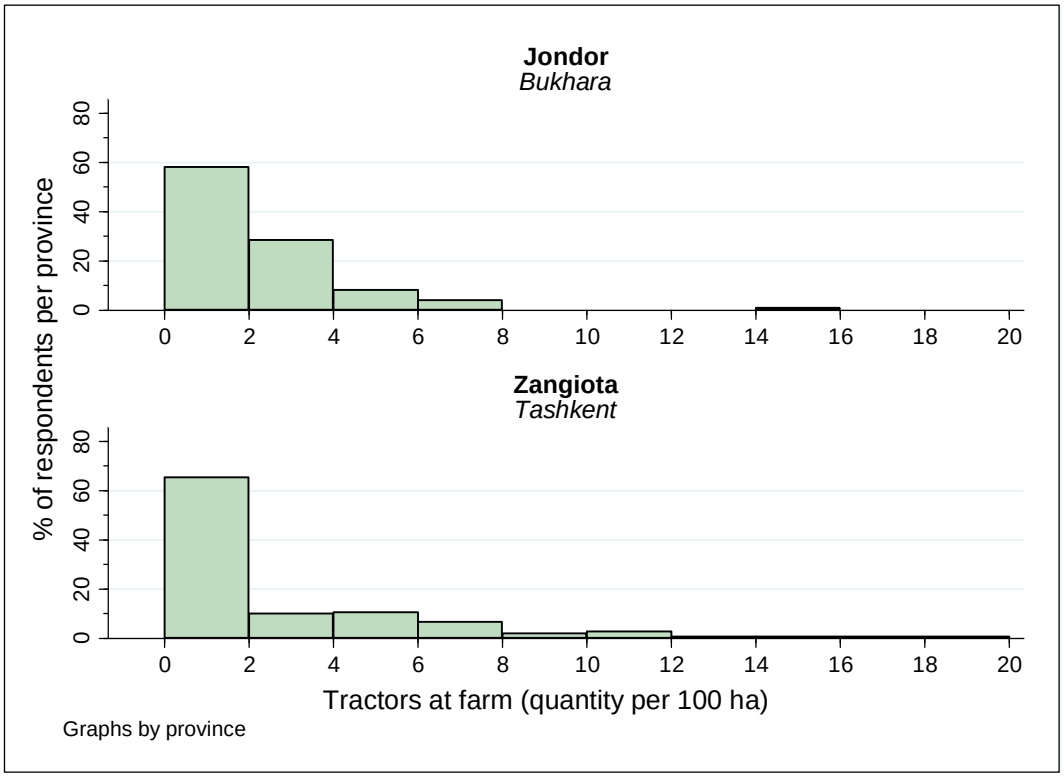
4.1 Endowment with machinery

About 60 % of interviewed farms in Jondor district possess small and heavy tractors, while in Zangiota only 37 % of farms have tractors and mainly rely on hired machinery. In fact, the farmers in Zangiota were more engaged in hiring out their machinery and provide services outside of their farm (47 % of responses) than those in Jondor district (32 % of responses).

On a per farm basis, cotton-wheat producing farms in Jondor district own more tractors than their smaller counterparts in Zangiota. On average, farms in Jondor are equipped with two tractors, while this number is about 1.7 for Zangiota farms. However, as Figure 13 shows,

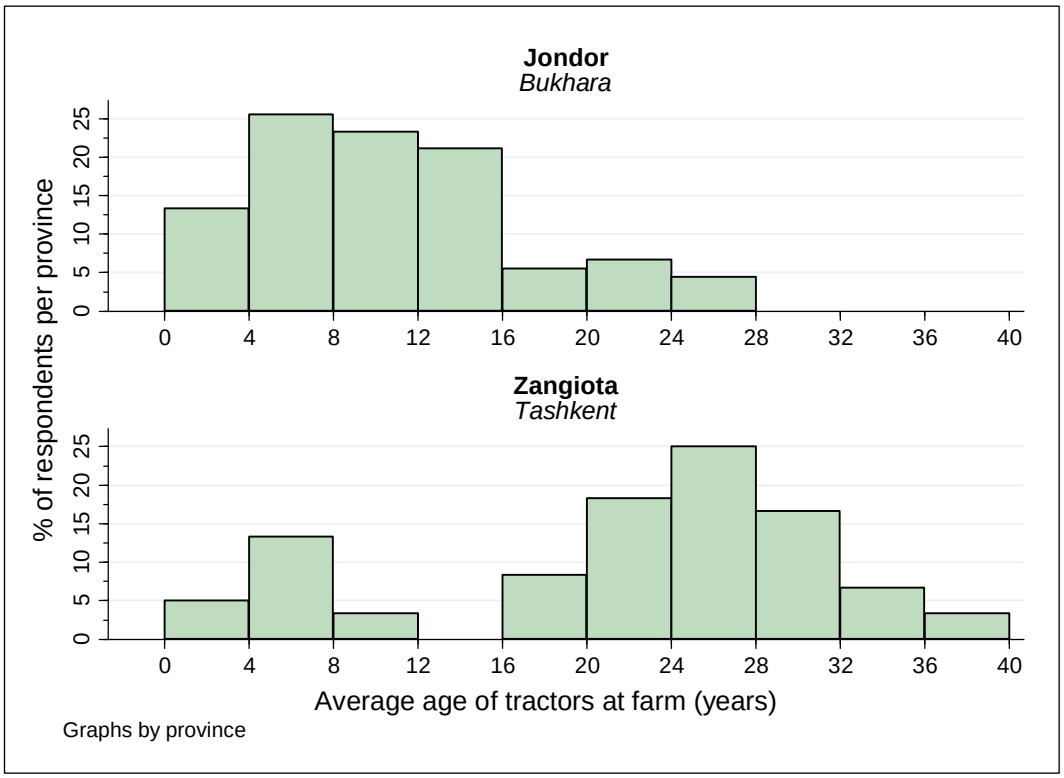
when measured on a per hectare basis, there is no big difference in the equipment by tractors between the two provinces.

Figure 13: Number of small and heavy tractors at farms by district



A comparison of the quality of small and heavy tractors when measured in their use life, farmers in Jondor district have newer tractors. The average age of these tractors is about 10 years with the oldest one reaching 25 years, while in Zangiota district it is almost 21 years with the oldest one 38 years in service. As it is presented in Figure 14, about 85 % of tractors owned by the interviewed farms in Jondor district are not older than 16 years, while only 23 % of farms in Zangiota district possess tractors of the same use life.

Figure 14: Average age of small and heavy tractors by district

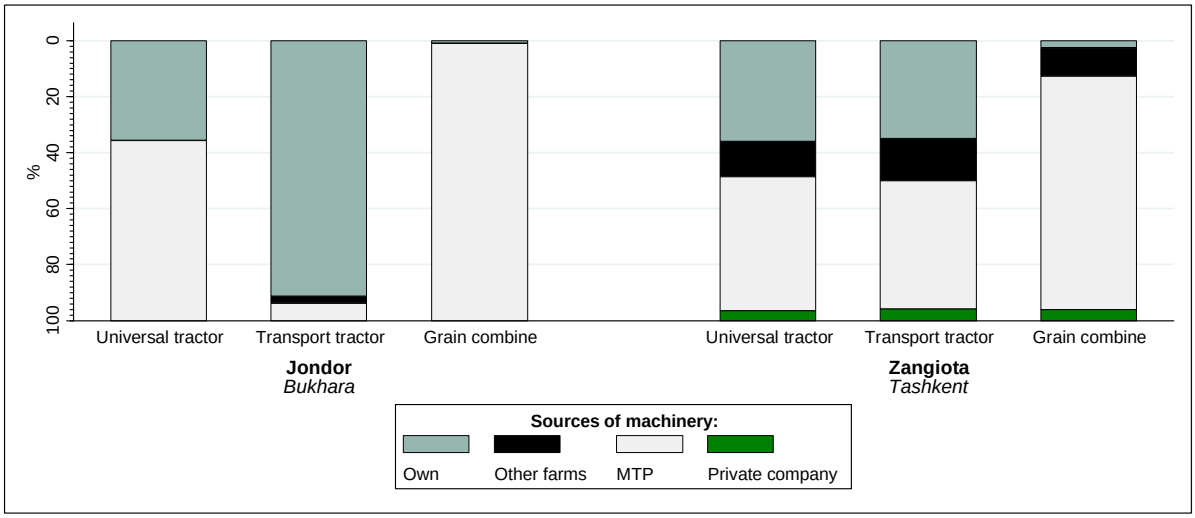


4.2 Access to machinery rentals

There is also clear distinction between the two surveyed districts regarding the sources of machinery. As is it shown in the Figure 15, concerning the use of universal and transport tractors and grain combines, farmers in Jondor district have either to rely on own machinery or machinery services available in Machinery Tractor Parks (MTPs). Their dependence on MTP machinery is higher in terms of access to grain combines. In Jondor district, cotton producing farms reported that they had not used cotton harvesters.

Farmers in Zangiota district who are more commercial-oriented than those in Jondor district are less dependent on services provided by MTP, and rely on additional sources for machinery services, such as other farms and private companies.

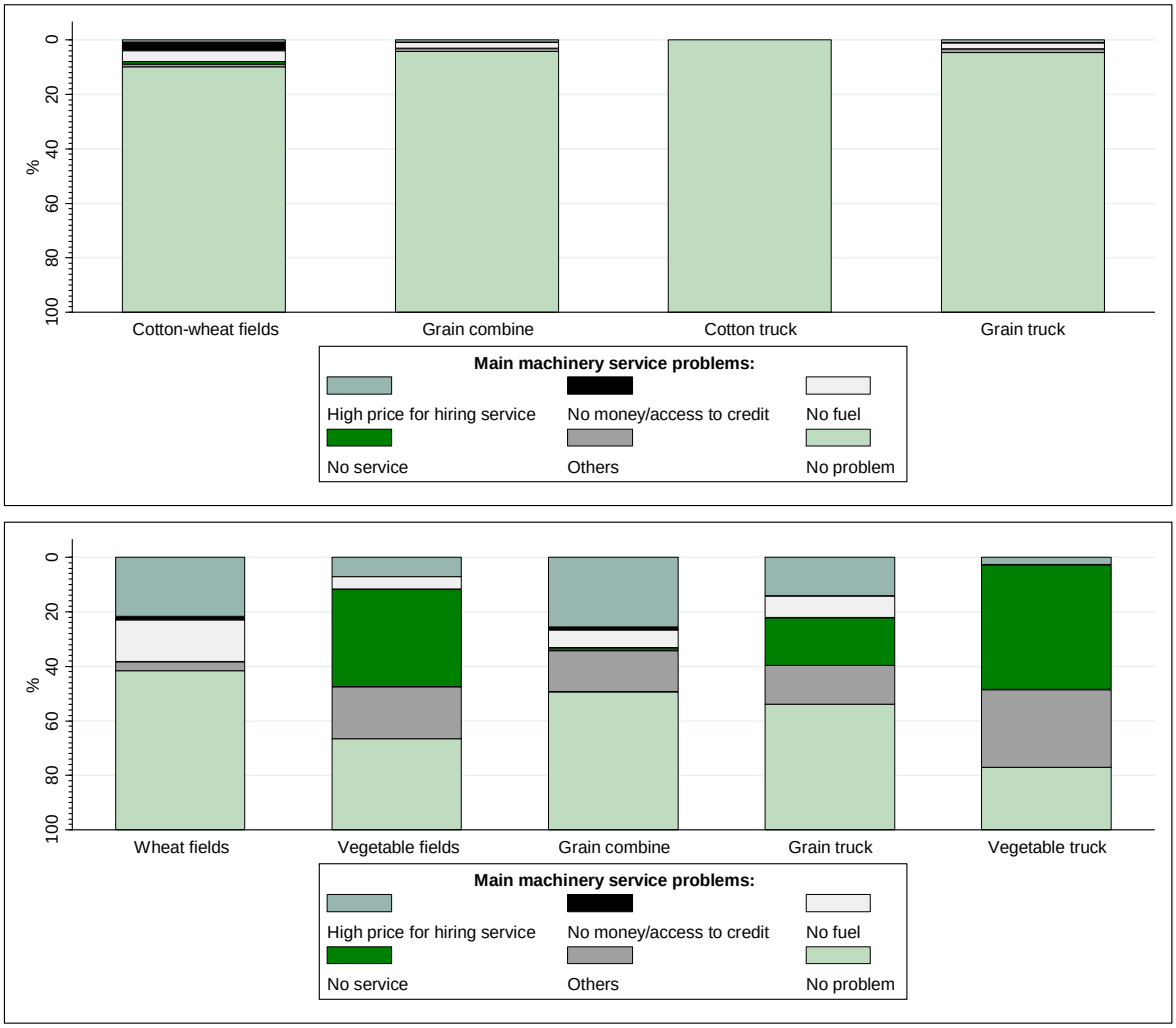
Figure 15: Main sources of machinery in the two survey regions



When comparing the problems related to hiring machinery services, they vary depending on the type of machinery and crop for which the service is being hired. For instance, as Figure 16 shows, only in a few cases did the interviewed farmers in Jondor (upper figure) report problems related to obtaining tractors for their cotton and wheat fields. There were almost no problem for them in obtaining machinery for transporting cotton and wheat harvests and no issues related in hiring grain combines.

Compared to this, almost 40 % of interviewed farmers in Zangiota (lower figure) reported about problems in finding tractor services for their wheat fields, and almost two-third of farmers experienced problems with finding machinery for their vegetable fields. Compared to Jondor, almost a half of farmers in Zangiota experienced problems related to the access to grain combines and trucks for transporting grain harvest. Finding a lorry for transporting vegetable harvest for Zangiota farmers was the most problematic issues, primarily due to the absence of such service.

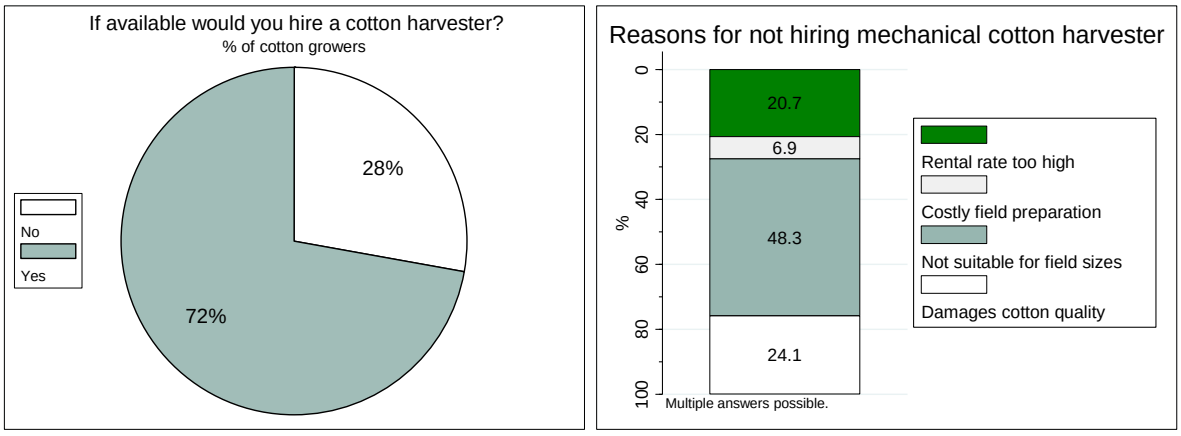
Figure 16: Farmers' opinion about problems with hiring machinery services in Jondor (upper) and Zangiota (lower) districts



4.3 Attitude towards mechanised cotton harvesters

In the 2014 season, no mechanised harvesters were employed in Jondor district at all, the only district in the sample where cotton was grown. However, 72 % of farmers said they would hire a cotton harvester if it was available (Figure 17, left panel). Among those 28 % who would not consider this, almost half of the concerns were about a mismatch of the machinery with their field sizes (Figure 17, right panel). Others expect it would damage the quality of the harvested cotton, yet others that it would be too costly or that it would require too much preparatory work on the fields.

Figure 17: Farmers' opinion about mechanical cotton harvesters

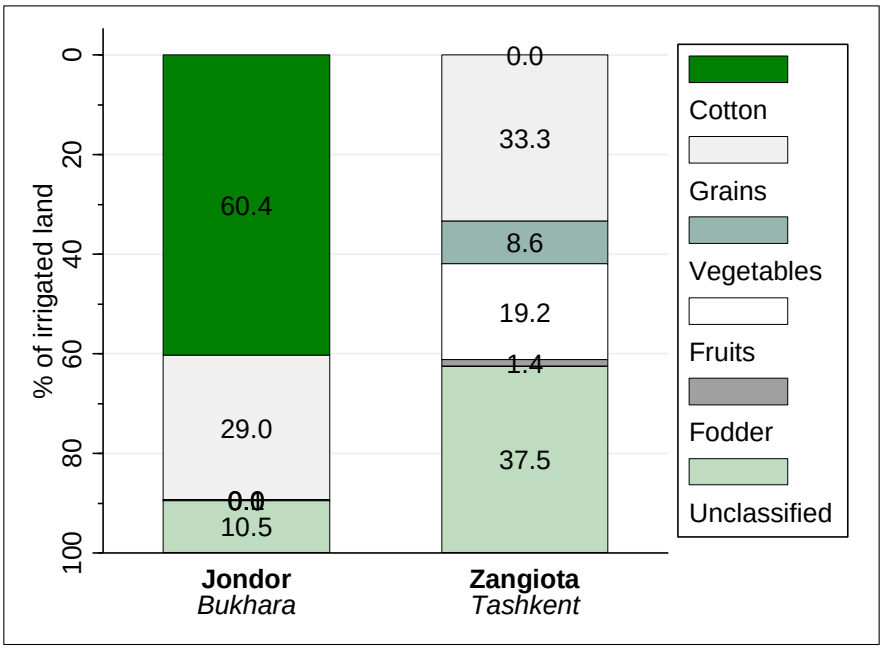


5 AGRICULTURAL PRODUCTION OUTCOMES

5.1 Cropping patterns

Figure 18 gives an overview of how the irrigated agricultural land in the surveyed farms was allocated to different crops, separately for both survey regions. It clearly shows the difference in cropping patterns in the two survey districts. While Jondor district is dominated by a cotton-wheat production system, with cotton produced on 60 % of the total irrigated area, there is no cotton production at all in Zangiota district. Farmers in the latter area allocate one third of cropland to wheat or other grains on average. They also cultivate a large variety of vegetables and fruits. The survey did not record the full inventory of crops for each farm but only main crops, so that a significant share of land is denoted as unclassified. But it seems fair to say that a typical farm in Zangiota district cultivates 20 ha of farmland, of which at least 6-8 ha are under HVCs.

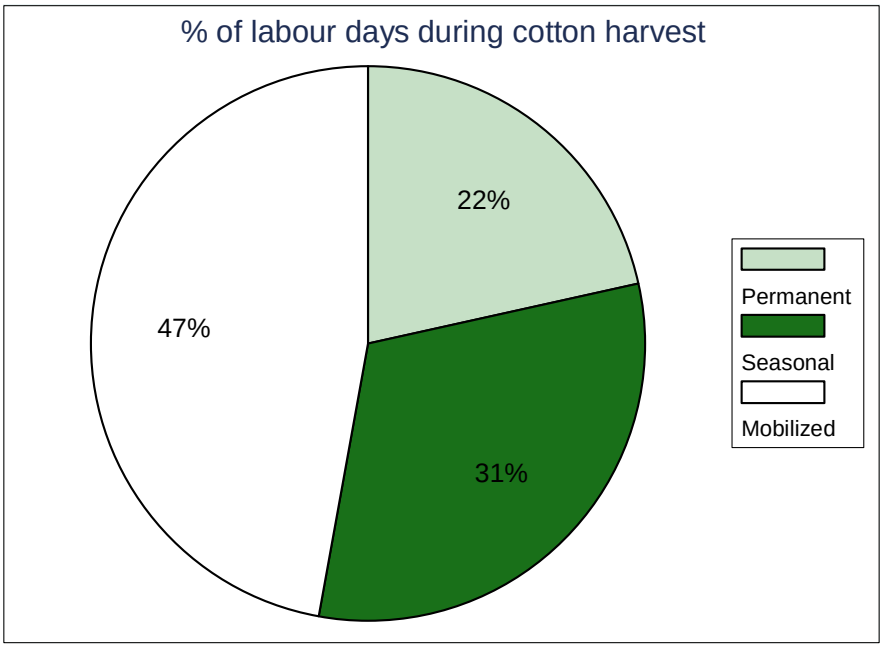
Figure 18: Land share allocated to different crops by survey regions



5.2 Labour utilisation during cotton harvest

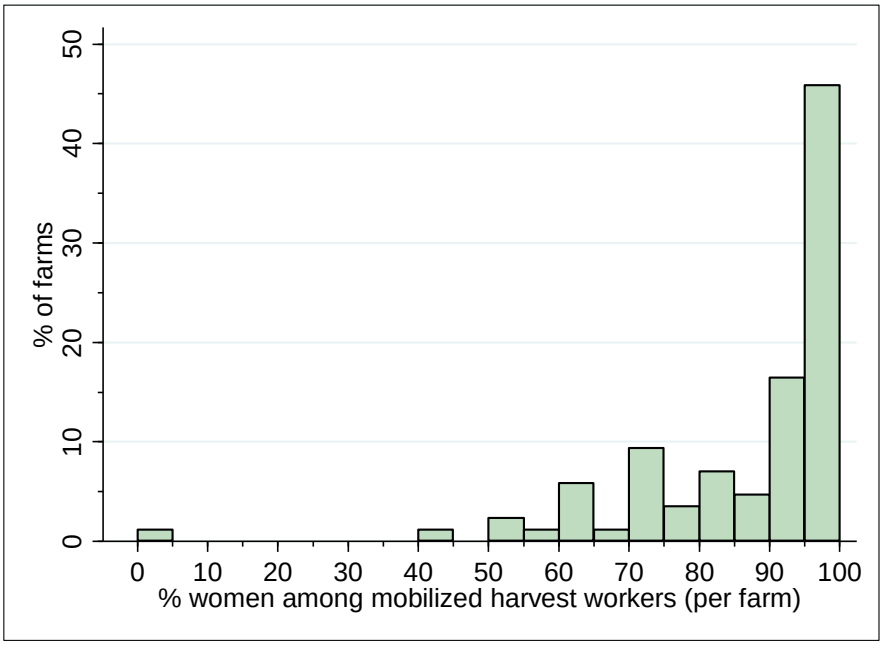
Figure 19 confirms that almost half of the total labour input during cotton harvest is supplied by workers specifically mobilised for this task. Another significant share of labour input is provided by seasonal workers which are also engaged in other work than cotton harvesting.

Figure 19: Labour input during cotton harvest in Jondor district



Most workers mobilised during cotton harvest are female. As Figure 20 shows, the mobilized workforce consists entirely of women on almost half of the cotton producing farms in the survey.

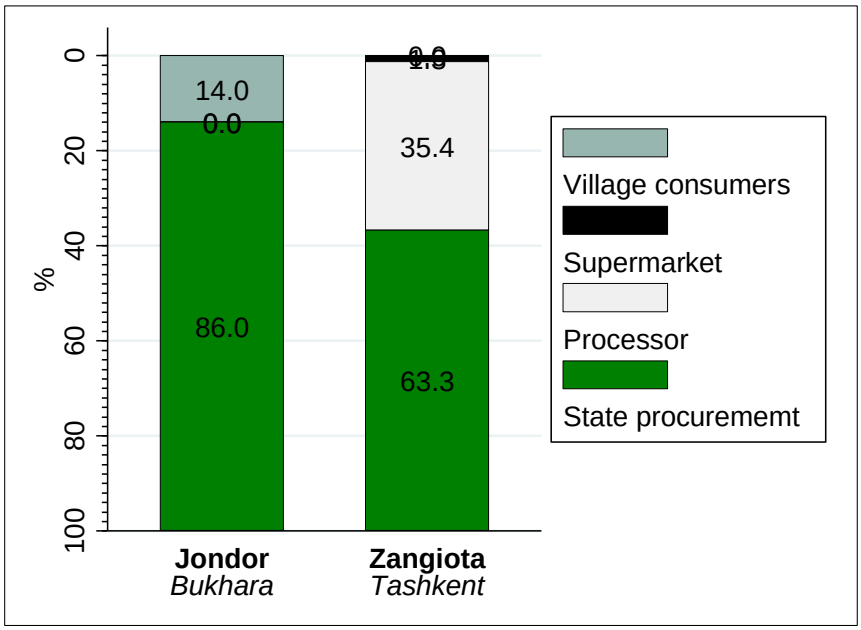
Figure 20: Gender relation in mobilised labor during cotton harvest (Jondor district)



5.3 Marketing of farm products

While cotton is produced entirely under the state procurement regime, farmers are required to sell only a half of their wheat harvest to the state-operated mills. The remainder may be sold privately or kept for own consumption. In the survey, farmers were asked about the most important sales channels for their produce by crop. Figure 21 shows that even in Jondor district, 14 % of farmers consider village consumers as their main sales channel. In Zangiota district, about one third of farmers deliver mainly to a local processing company.

Figure 21: Major sales channels for wheat by survey region



According to Figure 22, sales prices for wheat can differ widely by sales channel. Whereas the wheat price under state procurement was about 41,400 UZS/dt (18 USD/dt) in both Jondor and Zangiota regions, farmers supplying to local consumers could realise more than 69,000 UZS/dt (30 USD/dt). Sales to the processing company in Zangiota allowed only marginal top-ups on the procurement price.

Figure 22: Sales prices for wheat by survey region

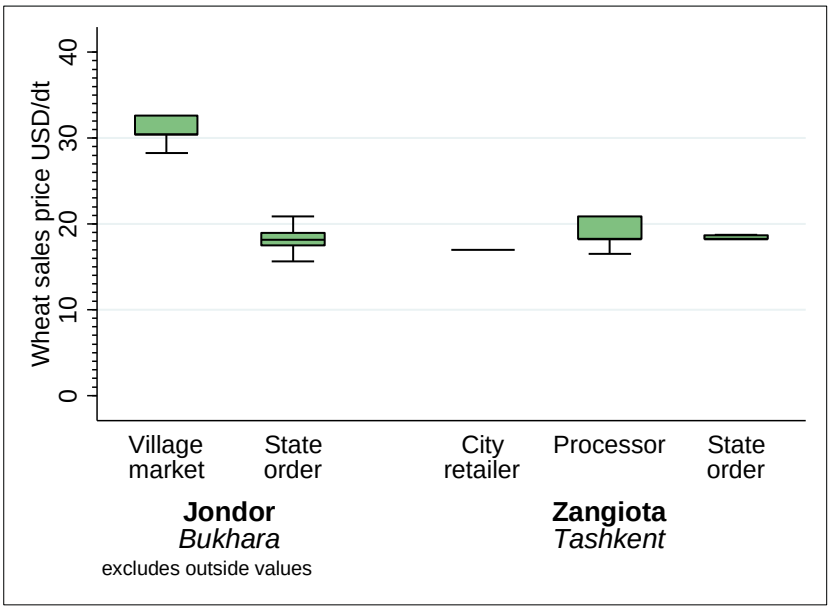
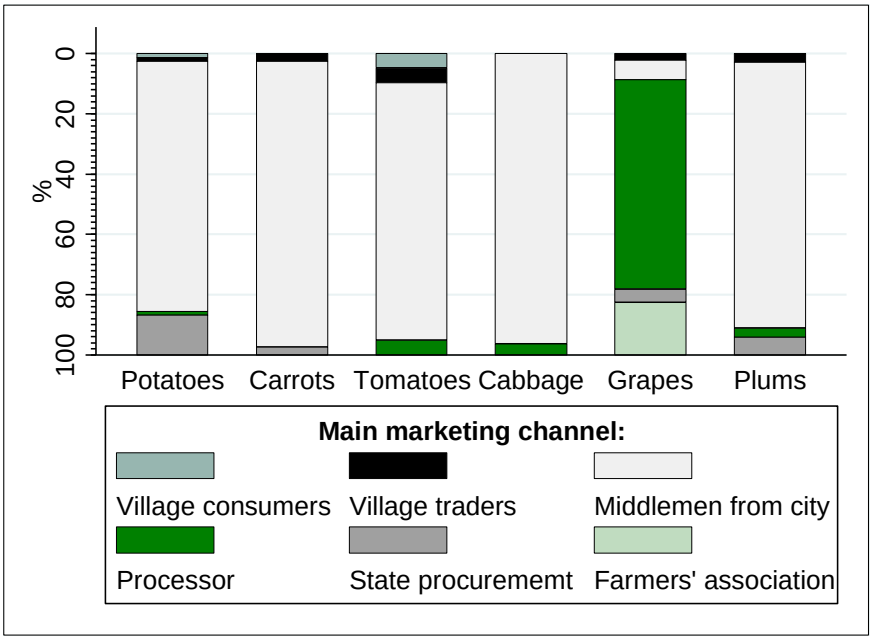


Figure 23 presents the main marketing channels for a variety of high-value crops (HVC) produced in Zangiota district. Most prevalently, farmers sell their products via local middlemen and traders to city markets or other outlets in nearby Tashkent. The only exception to this rule is grapes, which are typically bought by local processors or in which farmers' associations handle the marketing.

Figure 23: Major marketing channels for HVCs in Zangiota district

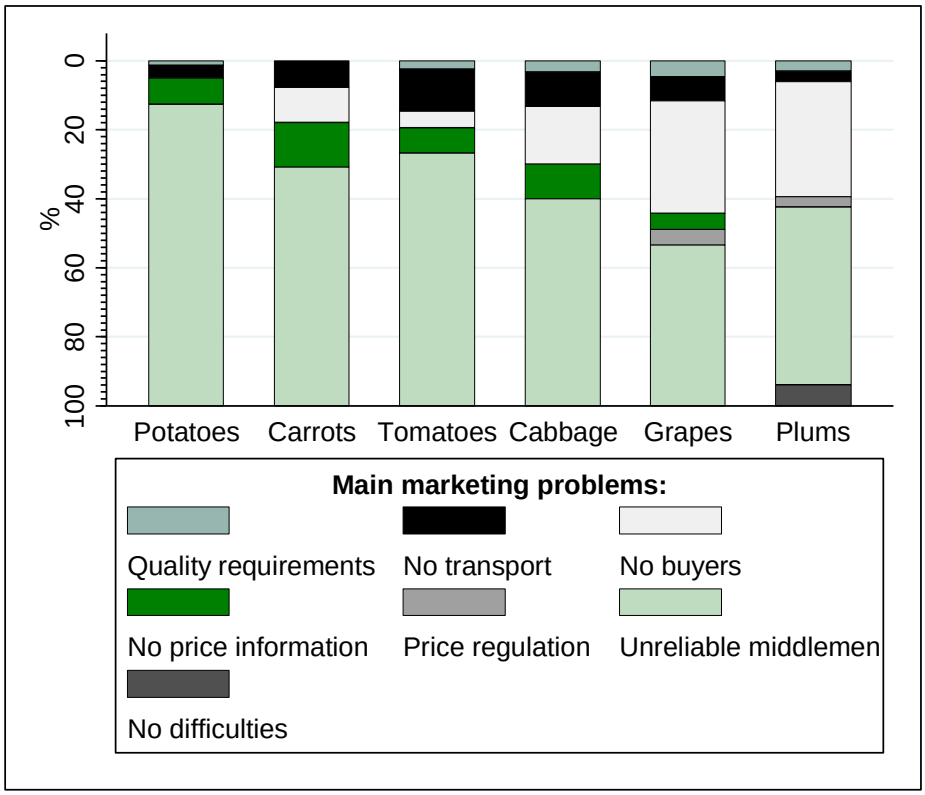


To understand the potential for future diversification of cropping patterns, farmers were asked about perceived problems in marketing their crops. Figure 24 displays the results for Zangiota. For all crops, the reliability of middlemen, i.e. the traders who connect farmers with city markets, is the most frequently mentioned concern. Among the problems are that middlemen exercise their monopsony power to keep most of the trade margin for themselves. Farmers got the impression that their products are underpriced by middlemen and

that they are not offered a fair deal. Another frequent complaint is about a lack of buyers. Most prevalent for grapes and plums, it may be due to the seasonality of these crops. During harvest season, huge quantities may not find sufficient buyers in the absence of storage and processing facilities. Other problems are related to a lack of transport and lacking market information.

93 % of farmers in Zangiota district said they could sell more of their produce if they wanted. In Jondor, 76 % of respondents held this opinion. By implication, market saturation for agricultural products does not seem to be perceived as a problem, particularly not by fruit-vegetable farmers in Zangiota district.

Figure 24: Marketing problems for HVCs in Zangiota district



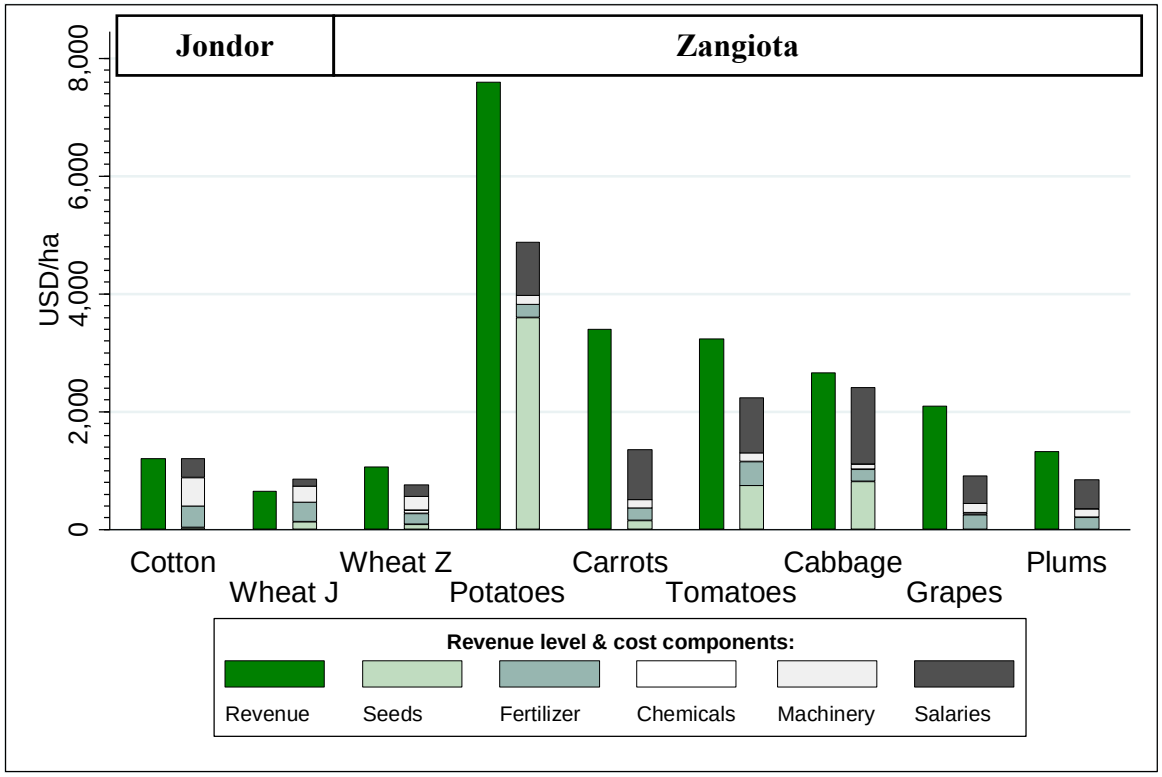
5.4 Gross margins of main crops by survey region

The survey included detailed questions about the revenue and cost patterns associated with different crops, thus allowing a crop-specific gross margin calculation and hence an assessment of the relative on-farm competitiveness of crops. As gross margins are defined as crop-specific revenue minus variable costs per ha, Figure 25 compares revenues and variable costs for eight different crops currently cultivated in Jondor and Zangiota districts. If the revenue bar is higher than the compound cost bar, there is a positive gross margin and the crop makes a contribution to farm income. If the revenue bar is smaller than the cost bar, the farmer has to cross-subsidize the crop from other income sources.

The numbers included in Figure 25 reflect an average tendency in the farm-individual data collected during the survey. As such they can be considered as typical examples of gross margins realised in the two survey regions in 2014. Depreciation or replacement costs for permanent crops were not considered in the calculations. The figure is based on the detailed model calculations given in Appendix 2.

Figure 25 displays gross margins for cotton and wheat in Jondor district and for wheat, potatoes, carrots, tomatoes, cabbage, grapes and plums for Zangiota. Gross margins were calculated on the basis of USD/ha, using an exchange rate of 2,300 UZS/USD.

Figure 25: Gross margins of main crops by survey regions in 2014



As the figure shows, cotton was barely breaking even and wheat production ("Wheat J") was loss making under the price and cost conditions prevailing in Jondor in 2014. The wheat gross margin was calculated under the assumption that farmers receive the price offered under the state procurement regime (Figure 22). Wheat ("Wheat Z") and all HVCs produced in Zangiota were generating profits. Potatoes and carrots led to gross margins in the range of 4.6 mln. UZS/ha (2,000 USD/ha) and more. Whereas fertiliser and machinery costs are significant cost components for cotton and wheat production in Jondor, seed costs and salaries are most important for HVCs in Zangiota.

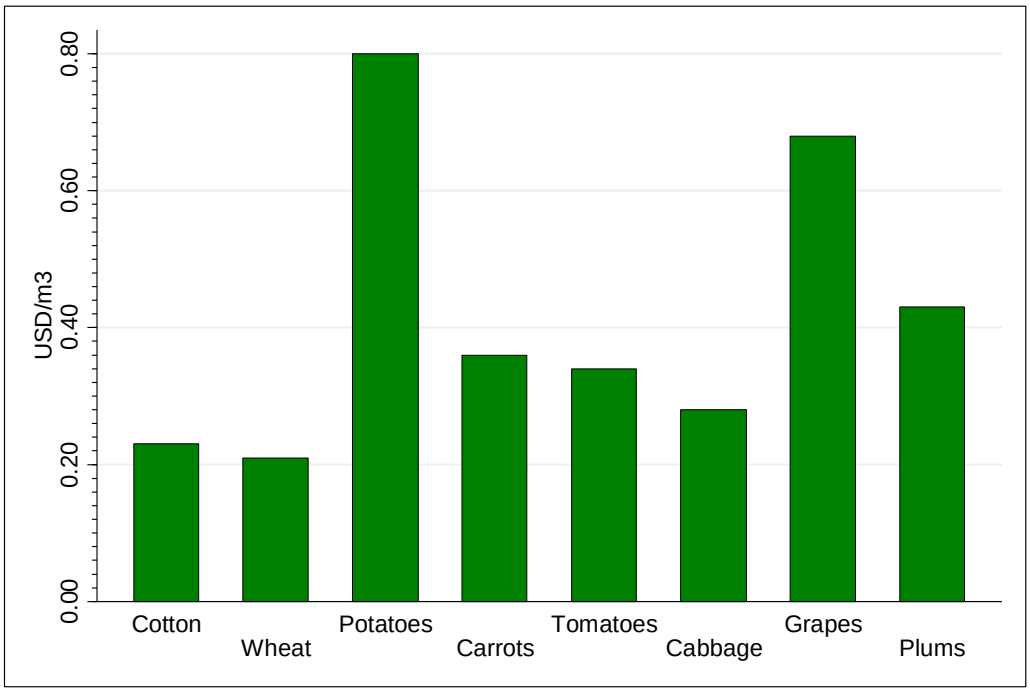
The negative gross margins for Jondor raise the question how farming can be economically sustainable with no profit generating crops in the cropping portfolio. One answer is given by Figure 22, showing that farmers sell a part of their wheat harvest to village consumers at a much higher price. Moreover, it is likely that farmers' statements on fertiliser costs and salaries are based on normative guidelines proposed by the government, and not necessarily on actual expenses. In addition, some of the fertiliser obtained through state provision channels may have been diverted away for use in other crops.

5.5 Water productivity

The revenue calculations before allow us to also determine the value of crop output per cubic meter of irrigation water consumed in 2014 prices (Figure 26). Water consumption in the figure is based on official irrigation norms per crop (see appendix 2 for details). It shows that, in the reported period, water productivity of HVCs was much higher than in cotton and

wheat. A diversification away from the traditional production system will thus also increase the economic return to water input, measured as the monetary value of crop output.

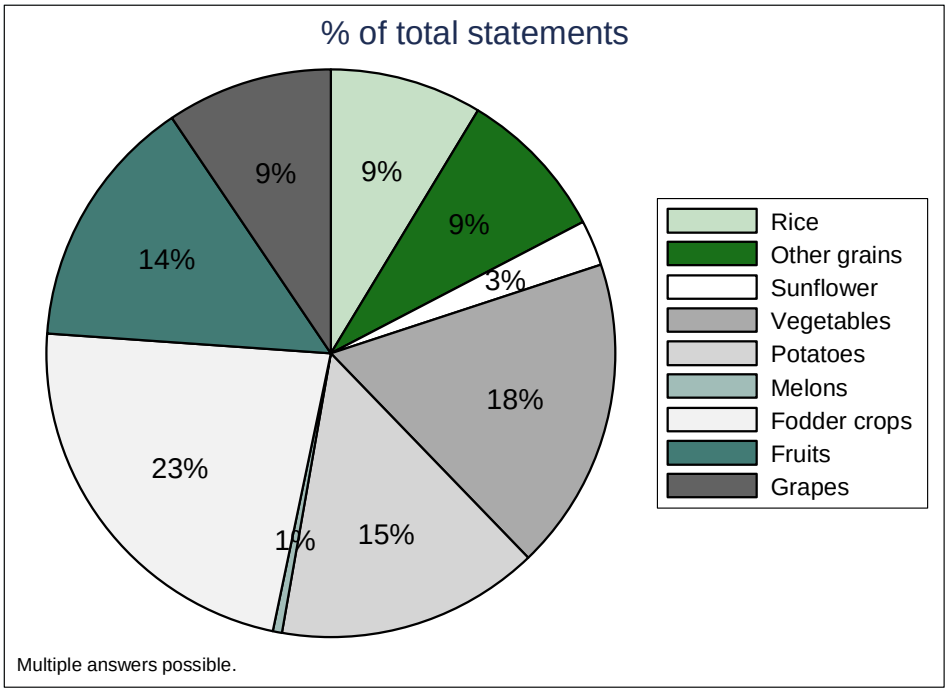
Figure 26: Water productivity by crop



6 ALTERNATIVES TO THE COTTON-WHEAT PRODUCTION SYSTEM PREFERRED BY FARMERS IN JONDOR DISTRICT

To understand the prospects for crop diversification in the Jondor survey district, farmers were asked about their preferred alternative to the practiced cotton-wheat production system. Moreover, information was collected about farmer skills and training needs they perceive for the future development of their businesses.

Figure 27: Preferred alternatives to cotton and wheat in Jondor district



During the survey, farmers were asked which type of crop they would grow instead of cotton and wheat. Figure 27 summarizes the responses for farmers in Jondor district. The most preferred alternatives were fodder crops, vegetables, potatoes and fruits. Farmers generally confirmed that they had the necessary skills to grow these alternative crops.

The questionnaire also collected information about the subject areas of previous training courses farmers attended. They are shown in Figure 28 for both survey regions. Farmers in Jondor district mostly participated in courses on the technology of wheat and cotton production and the application of fertilizers. Farmers in Zangiota district attended a broader set of courses, ranging from fertilizer application and chemical plant protection to biological plant protection and cotton and wheat production. Of course, the mere attendance of courses says little about the actual skills acquired. 17 % of farmers in Jondor district and 5 % in Zangiota district reported that they never took part in any training course.

Figure 28: Subject areas in which farmers received training previously

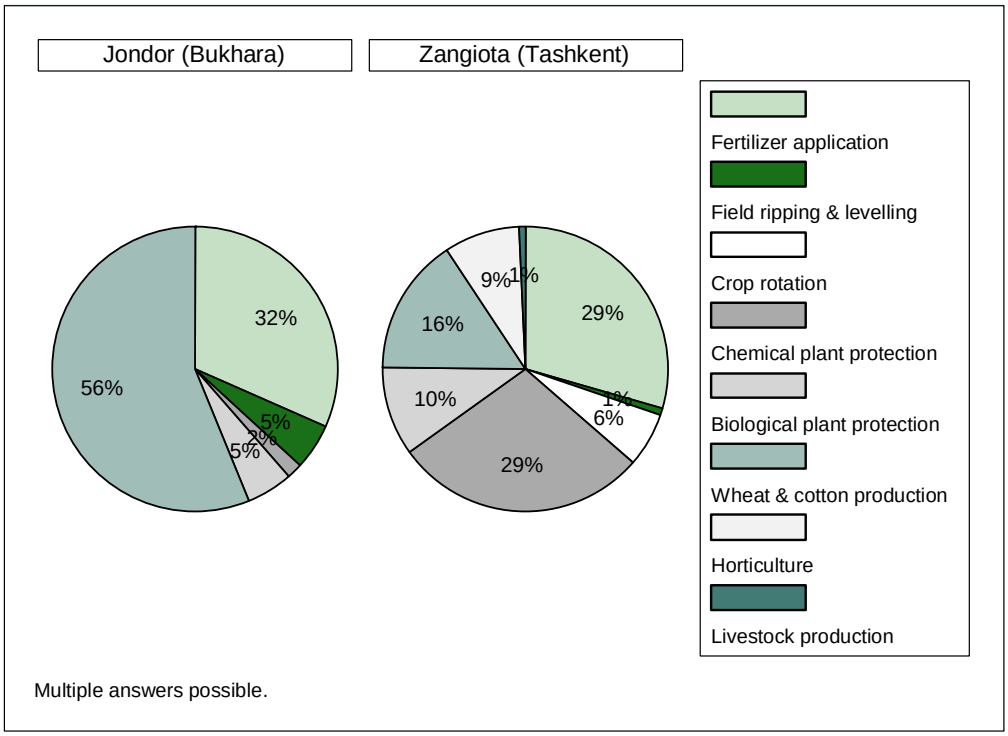
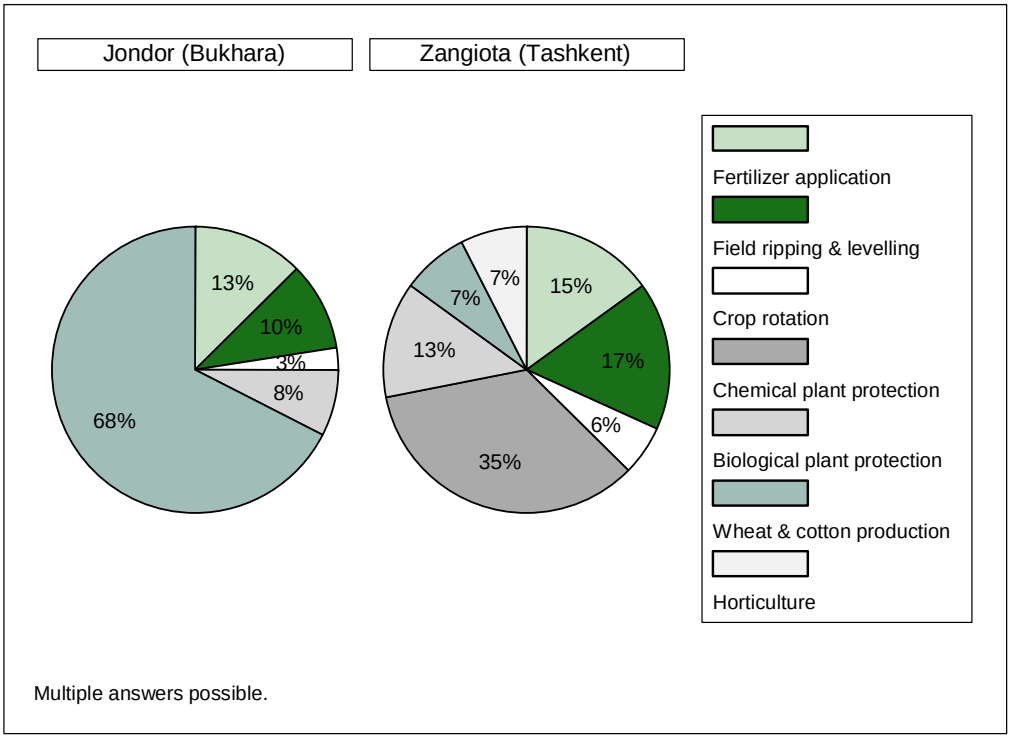


Figure 29: Subject areas in which farmers expressed a desire to learn more



Moreover, farmers were asked in which areas they would desire to receive further training. According to Figure 29 almost 70 % of responses by farmers in Jondor district concerned additional training on cotton and wheat production. Farmers in Zangiota district were mostly interested in chemical plant protection, field ripping and leveling, as well as fertilizer application.

7 CONCLUSIONS

7.1 Current state of agricultural production in Jondor and Zangiota districts

Agriculture in Jondor district of Bukhara province is dominated by the traditional cotton-wheat production system that emerged widely in the aftermath of Uzbekistan's national independence. Typical farm sizes are about 70-80 ha. On average, 60 % of irrigated land is cultivated with cotton. To the contrary, there is no cotton production in the more small-scale farming structures of Zangiota district of Tashkent province. Crop portfolios are much more diverse, including a substantial share of fruits, vegetables and permanent crops such as grapes and fruit trees. A typical Zangiota farm cultivates 20 ha of farmland, of which 6-8 ha are under HVCs.

More than half of the farmers in Zangiota district possess a higher education. This is the case for only one third of the farmers in Jondor district. Production systems in both survey regions are currently very labour intensive. Half of the labour force during cotton harvest in Jondor district is drawn from mobilised sources, and by far most of the mobilised workers are women. In 2014, there were no mechanised cotton harvesters available to farmers.

Most tractors in Jondor district were acquired within the last ten years, whereas most tractors in Zangiota still originate from the Soviet period. Moreover, farmers in Jondor own more tractors than farmers in Zangiota. However, there is no big difference in tractor density in both districts. Farmers in Zangiota are more engaged in hiring in/out machinery services not only from MTPs but also from other farmers. There appear to be shortages of machinery services in particular for preparing fields for vegetables and transporting vegetable harvest. A similar pattern is observed in the access to diesel fuel and fertilisers: farmers in Jandor have better access to these inputs for cotton and wheat production than vegetable producers in Zangiota.

While a majority of farmers obtained short-term loans for current input purchases, only 14 % took long-term loans (e.g. for machinery purchases) within the last three years. Most short-term loans were in the range of 300 USD and less. In general, leasing arrangements for machinery purchases were used by 17 % of farmers. However, there is a difference when compared across the districts: almost one-third of farmers in Jandor have experience with leasing, while only 5 % have in Zangiota.

Most cotton and wheat is supplied to state procurement agencies in Jondor district. However, wheat is also sold in village markets at almost double the price. Farmers in Zangiota district distribute most of their crops via middlemen and traders who are active on city markets in nearby Tashkent.

According to revenue and cost patterns reported by the farmers interviewed, cotton and wheat production was generating losses on some farms in Jondor district. However, revenues can be improved by supplying to village markets and local consumers in addition to state procurement agencies. To the contrary, HVCs grown in Zangiota are typically generating profits, sometimes with margins of several thousand USD per ha. Moreover, the economic return to water use is much higher for HVCs as compared to the conventional cotton-wheat production system.

7.2 Survey evidence on the main obstacles to the mechanisation and diversification of cotton-wheat production systems in Jondor district

Going practice of all production processes and in particular cotton harvest is heavily based on manual labor. While most farms are equipped with tractors and trucks or can access them via MTPs, shortages during harvest time do occur. Mechanised cotton harvesters are currently not available. However, three out of four cotton growers would welcome the availability of cotton harvesters.

If the Uzbekistani government is determined to pursue the mechanisation and diversification of cotton-wheat production system, the following obstacles are to be expected:

- Access to financial arrangements is deficient, in particular with regard to long-term loans allowing machinery purchases. Most farmers in both survey regions complained about high collateral requirements, short loan periods and high interest rates. Access to leasing arrangements was easier in Jondor than in Zangiota district. On the other hand, it is difficult for farmers to accumulate own funds, as cotton and wheat sales via state procurement are hardly covering the production costs.
- Some farmers fear that harvesters may not be compatible with field sizes, that they provoke additional preparation work or impair cotton quality.
- Role models concerning crop diversification among local farmers are lacking, as very few farmers in Jondor are currently engaged in HVCs. Among the alternatives to cotton-wheat that are most preferred by Jondor farmers are fodder crops, potatoes, vegetables and fruits. However, these considerations are of a widely hypothetical nature so far.
- Marketing channels for HVCs are not developed in Jondor district. Unfair trading practices and underpricing by middlemen was a significant concern for Zangiota farmers. At the same time, farmers in Zangiota consider their output markets to be underserved and saturation does not seem to be a concern.

7.3 Policy recommendations

The survey results on cropping practices in Zangiota district offer a number of insights for crop diversification in Jondor. While farmers in Zangiota demonstrate how to engage in the profitable cultivation and marketing of HVCs, they also face a set of constraints that provide lessons to be learned for other regions. Based on the understanding that the Uzbekistani government wants to promote diversified crop rotations and increased mechanisation levels of harvesting operations, the following recommendations follow from our insights so far:

- At present, alternatives to cotton and wheat monocultures are entirely hypothetical for most of the farmers in Jondor district. Many Jondor farmers expressed a theoretical willingness to engage in the cultivation of HVCs, but the mandatory delivery targets are determining current practice and are firmly entrenched in farmers' minds. They have no practical experience in growing other crops and using other technologies. If the government is interested in promoting diversified cropping patters, e.g. via partially reducing the target area for cotton and wheat or entirely shifting to HVCs, this should be clearly communicated to farmers and a credible commitment to crop diversification should be made. Policy imperatives as well as training and extension services at the local level should be adjusted accordingly.

- One reason why farmers do not have a realistic view of alternative options to cotton and wheat could be that entrepreneurs on up- and downstream markets are constrained to develop viable factor supply, processing and marketing facilities for alternative cropping patterns. The experience of Zangiota district shows that reliable connections to city markets are crucial for the economic success of HVCs. Even close to the capital Tashkent, cultivators complain about lacking market access as traders and middlemen are perceived as widely exploitative. Competition on output markets should thus be increased, for example by introducing market information systems, standardisation and grading protocols, and by encouraging the development of alternative value chains for HVCs. In general, the spread of transparent and reliable trading standards and the professionalization of up- and downstream businesses serving agriculture should be promoted.
- Evidence from Zangiota also shows that access to essential inputs such as seeds and fertiliser is more problematic if farmers do not have preferential access to these inputs under the government sponsorship of cotton and wheat. If alternative crops are to be promoted, the access to essential inputs should be liberalised and competition on input markets be increased.
- Some farmers in Jondor district already now have in mind to replace cotton and wheat production by fodder crops. Options for the development of livestock production in Jondor district as an alternative or complement to HVCs should thus be considered. With an increasing urban population, demand for high-quality livestock products will rise.
- The evidence from the survey calls into question whether cotton and wheat are economically attractive crops for farmers under current pricing and marketing conditions. If the promotion of farmers' investment in mechanised cotton harvesters is on the policy agenda, the potential profitability of cotton for farmers should be ensured. There is ample evidence from other studies how a reform of the state procurement system for cotton may achieve this goal (DJANIBEKOV et al., 2015; POMFRET, 2000; RUDENKO et al., 2009). In Jondor, low administrative prices also jeopardise the profitability of wheat production.
- The government may play an active role in promoting the new harvesting technology, but it should be introduced stepwise via demonstration type operations. To avoild the Soviet failure of the state-directed diffusion of cotton harvest mechanisation described in POMFRET (2002), farmers might need to make themselves familiar with the new technology and it may have to be adjusted to local conditions.
- If the capital intensity of cotton production is to be increased, the availability of financial services needs to be improved. Under the condition that farmers can make profits from existing cotton-wheat system, loans for machinery purchases should be made available on more favourable terms for farmers. More favourable terms do not necessary imply that interest rates should be subsidised. More important is that transparent and reliable financial service providers are actually accessible to farmers. These service providers should be familiar with the specifics of agricultural production in the served regions so that they can assess the credibility and prospects of farmers' business plans and make loan decisions that are independent from political imperatives.

- The aforementioned changes need to be embedded in an overall strategy of absorbing excess labour in agriculture and providing the rural population with alternative employment opportunities. A reduction of labour intensity in agriculture will be eased by the availability of non-farm employment opportunities and by a generally improved business climate in the country.

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APPENDIX 1: SURVEY INSTRUMENT

TA 8567-UZB:
Innovations for Agriculture Modernization Project
FARM SURVEY QUESTIONNAIRE

Q1. |___|___| Interviewer Code
Q2. |___|___|___| # of Questionnaire

The aim of the survey is to assess the productivity and distributional effects of farms in Uzbekistan. Your assistance would be greatly appreciated.

CONFIDENTIALITY

All information provided would be totally confidential. Data will only be used in aggregate form. Names and details of individuals will not be released to Government Department or any other organization or to the Public.

PASSPORT

Q3. Province: Tashkent…..1 Bukhara…..2

Q4. District: Zangiota…..1 Jondor…….2

Q5. Makhalla: _____

Q6. Village (kishlak): _____

Q7. Respondent's name: _____

Q8. Farm name: _____

Q9. WCA's name: _____

Q9. Date of Interview: Day ____ Month _____ 2014

THANKYOU FOR YOUR COOPERATION AND ASSISTANCE!

Interviewername _____

A. GENERAL INFORMATION

[Interviewer: Make sure that the respondent is the **farm manager (director)** who is the most knowledgeable about the farm's activities – no exceptions!]

A1. How old are you (question to farm manager)? _____ years

A2. What is your education?

	Only one answer	
Higher	1	**Continue**
Incomplete higher	2	**Continue**
Secondary special (college)	3	**Continue**
Secondary professional (vocational school)	4	**Continue**
Secondary general	5	**Go to q. A4)**
Incomplete secondary	6	**Go to q. A4)**

A3. Do you have any special education in agriculture or farm management?

Yes….....…1
No….....…2

A4. How many years of experience in agriculture do you have? _____ years

A5. When was your farm founded? _____

A6. What is the major specialization of your farm?

Production of cotton and wheat…….....…….…….1
Production of wheat and vegetables.....2
Horticulture…….....…..……....3
Vegetables growing …….....……4
Livestock…….....…….……5
Viticulture…….....…….6
Apiculture …….....……..…7
Other (specify) _____

A7. What are the other activities your farm engaged in? (Select all that apply)

Production of cotton and wheat…….....…….…….1
Production of wheat and vegetables.....2
Horticulture…….....…..……....3
Vegetables growing …….....……4
Livestock…….....…….……5
Viticulture…….....…….6
Apiculture …….....……..…7

A8.Does the farm carries out any farm activity jointly with other farms/ farmers?

Yes….....…1 Continue
No….....…2Go to section B

A9. What are these activities, what formal or informal form of cooperation did the farm choose and what is your opinion on the current level of cooperation?

	A9.1.						A9.2.					
Activities	Form of cooperation *(circle ONE answer)*						Cooperation level *(circle ONE answer)*					
1A. Crop production	0	1	2	3	4	5	0	1	2	3	4	5
1B. Livestock production	0	1	2	3	4	5	0	1	2	3	4	5
2. Processing	0	1	2	3	4	5	0	1	2	3	4	5
3. Sale of products	0	1	2	3	4	5	0	1	2	3	4	5
4. Joint use of machinery and equipment	0	1	2	3	4	5	0	1	2	3	4	5
5. Purchase of farm inputs	0	1	2	3	4	5	0	1	2	3	4	5
6. Mutual credit	0	1	2	3	4	5	0	1	2	3	4	5
7. Consulting and professional advice	0	1	2	3	4	5	0	1	2	3	4	5
8. Other (*specify*) _____	0	1	2	3	4	5	0	1	2	3	4	5

0 – Do not carry out such kind of activity 1 – Informal Agreement 2 – Formal contract 3 – Farm association/union 4 – Cooperative 5 – Other (specify) _____	0 - Do not carry out such kind of activity 1. Very good results 2. Adequate for our needs 3. Must be expanded 4. Not satisfied with the arrangement 5 I do not know

B. FARM LAND AREA AND CONDITIONS

B1. What is the total area of your farm land (ha)?

Total area	
Sown area	
Irrigated area	
Land area not used due to high salinity or high GWL	
Land area not used due to other reasons (please specify)	

B2. Was the area of your farm changed (increased or decreased) since it was established?

Yes….....…1
No….....…2 Go to B4

B3. IF YES, when and what area was at your farm?

B3.1. Year of farm size change	B3.2. Farm size before the change, hectare

B4. What is the average soil fertility rate (bonitet ratio) of your lands? _____ mark

B5. How do you evaluate ground water level of your lands?

GWL	**Share of farm land in %**
High (0-1.5 m depth)	
Medium (1.5-2 m depth)	
Low (lower than 2 m)	

B6. How do you evaluate soil salinity level of your lands?

Soil salinity level	**Share of farm land in %**
Highly saline	
Medium saline	
Low saline	
Non saline	

B7. How do you evaluate condition of on-farm irrigation and drainage network?

Bad	Satisfying	Good
1	2	3

B8. Where is your land located along the irrigation water supply network?

At the head of canal ….....1
At the middle……...…….2
At the end……..……3

B9. Which water source you use for irrigation?

Surface waters (river, sai, canals)….....…..1
Ground waters (vertical boreholes)….....…2
Drainage waters…….....…3
Mixed waters…….....……4

B10. What is the irrigation water supply rate of your lands? _____%

B11. How would you evaluate the functioning of your WCA? (Circle one answer)

Bad	Satisfying	Good
1	2	3

B12. Did you pay Irrigation Service Fee in 2014?

Yes.....1
Partly.....2
No.....3

B13. How far is your farm located from the district center _____ km.

C. FARM LABOR

C1. What labor has the farm used in the last 12 months?
Include those who receive WAGE IN CASH OR IN KIND for work undertaken. Do not include laborers hired together with their equipment or machinery. [0 if none, no blanks!]

Labour	C1.1. Permanent			C1.2. Seasonal		
	Number of persons	Total number of months	Incl. women	Number of persons	Total number of days	Incl. women
Members of household						
Relatives						
Friends and/or neighbours						
Hired labour in production						

C2. How much of different labor participated at cotton harvesting at your farm during last 12 months? Farmers not producing cotton please proceed to next section.

Type of labor during cotton harvesting	C2.1. Total number of persons	C2.2. Total days they harvested cotton	C2.3 Including share of women (in %)	C2.4 Total amount paid, mln. UZS
Permanent farm workers				
Seasonal workers				
Seasonal mobilized workers				

C3. What other costs did you make for workers involved in the cotton harvesting?

Type of cost	Total amount, mln. UZS
Transportation of workers to cotton fields	
Food for workers	
Renting living place for workers	
Other costs (SPECIFY)_____	
Other costs (SPECIFY)_____	

D. FARM ACCESS TO INPUTS

D1A. Where do you buy the inputs for cotton and wheat production at your farm? (indicate two main sources)

Input	Purchased from (main source)	Purchased from (second main source)
1 Cotton seeds		
2 Wheat seeds		
3 Fertilizers		
4 Pesticides, herbicides		
5 Diesel fuel		

1 – State company or shops that belongs to the state
2 – Authorized private shops
3 – Private company
4 – Local market
5 – Other farmer
6 – Other (specify)_____

D1B. Where do you buy the inputs for other crop production at your farm? (indicate two main sources)

Input	Purchased from (main source)	Purchased from (second main source)
1 Other grain seeds		
2 Potatoes for planting		
3 Vegetable seeds		
4 Fertilizers		
5 Pesticides, herbicides		
6 Diesel fuel		

1 – State company or shops that belongs to the state
2 – Authorized private shops
3 – Private company
4 – Local market
5 – Other farmer
6 – Other (specify)_____

D2A. Please indicate problem(s) in getting production inputs for cotton wheat:

Input	Circle max. THREE important problems)						
1 Cotton seeds	1	2	3	4	5	6	
2 Wheat seeds	1	2	3	4	5	6	
3 Fertilizers	1	2	3	4	5	6	
4 Pesticides, herbicides	1	2	3	4	5	6	
5 Diesel fuel	1	2	3	4	5	6	

1 – Lack of cash / access to cash
2 – High price
3 - Absence on the market
4 – Low quality
5 – Transportation problems
6 – No problems
Other (specify)

D2B. Please indicate problem(s) in getting production inputs for other crops:

Input	Circle max. THREE important problems)						
1 Other grain seeds	1	2	3	4	5	6	
2 Potatoes for planting	1	2	3	4	5	6	
3 Vegetable seeds	1	2	3	4	5	6	
4 Fertilizers	1	2	3	4	5	6	
5 Pesticides, herbicides	1	2	3	4	5	6	
6 Diesel fuel	1	2	3	4	5	6	

1 – Lack of cash / access to cash
2 – High price
3 - Absence on the market
4 – Low quality
5 – Transportation problems
6 – No problems
Other (specify)

E. FARM MACHINERY AND ASSETS

E1. Please provide the following information relating to farm machinery owned by you as of November 2014.

Type (If more than one recorded for Type, provide information for the most recent)	Tractor	Heavy tractor for plough	Seeder	Cultivator	Grain combine	Cotton harvester	Lorry and trailer	Other *(specify)*
E1.1. Quantity								
E1.2. Age (years)								
E1.3. Condition when bought [a]								
E1.4. How Financed [b]								
E1.5. Price Paid (UZS million)								
E1.6. Total value (UZS million) Provide value for all equipment for each type (not only most recent).								
E1.7. Who operates this machinery in your farm? [c]								
E1.8. Do you use this machinery for providing services outside of your farm? (Yes=1;No=2)								

a) 1 – New 2 – Used	b) 1 – Bank credit 2 – Lease 3 – Own funds 4 – Other	c) 1 – Myself (farm manager) 2 – A permanent worker employed in my farm 3 – A seasonal worker not employed in my farm

E2. Machinery purchase and sales in previous 5 years (starting from 2009). Please provide the following information relating to farm machinery currently or previously owned by you.

	E2.1.Purchased		E2.2.Sold	
Type	**Quantity**	**Total Cost (UZS million)**	**Quantity**	**Total Received (UZS million)**
1 Tractor				
2 Heavy tractor for plough				
3 Seeder				
4 Cultivator				
5 Grain combine				
6 Cotton harvester				
7 Lorry and trailer				
8 Other *(specify)*				

E3. Other Farm Equipment Owned

Type (If more than one recorded for Type, provide information for the most recentl)	Irrigation system (m^2)	Grain storage facility (ton)	Fruit and vegetable storage facility (ton)	Wheat mill (tegirmon)	Processing facility (ton)	Irrigation pump
E3.1. Size/Number						
E3.2. Age (years)						
E3.3. Condition when bought[a]						
E3.4. How financed[b]						
E3.5. Price paid (UZS million)						
E3.6. Value now (UZS million) (Provide value for all equipment for each type (not only most recent)						
E3.7. Do you use this equipment to provide services for others, outside of your farm?						
Notes: a) New -1; Used -2; b) Bank credit – 1; Lease – 2; Own funds -3; Other -4.						

E4. Have you ever received training in operating machinery?

Yes….....…1
No….....…2 Continue to E6

E.5 If YES, who provided you these trainings?

State Extension Company.....1
Private Extension Company.....2
Local university teachers.....3
A private (commercial) expert.....4
Other (Specify)_____

E6. Farm Assets. Please provide an estimate of the value of the following assets owned by you.

Type	Total Value (UZS million)
Greenhouse	
Farm machinery and equipment	
Storage facilities, warehouse	
Processing facilities	
Other farm buildings	
Vehicles and transport equipment	
Other	

E7. Which kind of livestock does your farm own and how many heads at present time you have?

#		Quantity, heads	Average value per head, UZS
1	Total cattle		
2	Including cows		
3	Sheep		
4	Goats		
5	Horses		
6	Chickens		

F. MACHINERY ACCESS

F1. Does your farm use the following machines in working condition and F2. What is the main source of supply?

	F1		F2					
	Yes	**No**	**Main source (max. two)**					
1 Universal tractor	1	2	1	2	3	4	5	6
2 Transportation tractor	1	2	1	2	3	4	5	6
3 Mini tractors	1	2	1	2	3	4	5	6
4 Ploughs	1	2	1	2	3	4	5	6
5 Seeder	1	2	1	2	3	4	5	6
6 Cultivator	1	2	1	2	3	4	5	6
7 Grain combine	1	2	1	2	3	4	5	6
8 Cotton harvester	1	2	1	2	3	4	5	6
9 Lorry and trailer for transporting cotton harvest	1	2	1	2	3	4	5	6
10 Lorry								
11 Harvester								
12 Other *(specify)*	1	2	1	2	3	4	5	6

1 – Farm uses own machines.
2 – Farm receives machines or mechanical field services (machine and operator) from other farms (for free).
3 – Farm hires machines or mechanical field services (machine and operator) from other farms.
4 – Farm hires machines or mechanical field services (machine and operator) from Machinery and Tractor Park (MTP).
5 – Farm hires machinery services from private machinery contractor
6 – Other (specify).

F2. What is the main problem in hiring this machinery?

	(max. THREE)				
1 Tractor for cotton and wheat fields	1	2	3	4	5
2 Heavy tractor for plough on cotton and wheat fields	1	2	3	4	5
3 Tractor for vegetable fields					
4 Heavy tractor for plough on vegetable fields					
5 Cotton Seeder					
6 Cultivator	1	2	3	4	5
7 Grain combine	1	2	3	4	5
8 Cotton harvester	1	2	3	4	5
9 Lorry and trailer for transporting cotton harvest	1	2	3	4	5
10 Lorry and trailer for transporting grain					
11 Lorry and trailer for transporting vegetable					
12 Other *(specify)*	1	2	3	4	5

1 – High price of hiring the service.
2 – No money or access to credit to hire.
3 – Machinery is available, but fuel is not available
3 – No machines / mechanical field services available nearby for hiring.
4 – Other problem (specify)_____
5 – No problems

F3. If you would have an access to hire a service of appropriate cotton harvester, would you hire it for harvesting cotton from your fields?

Yes….....1 Skip to G1
No….....2

F4. IF NO, what would be the reason of not hiring cotton harvester (max. 3 answers)?

I believe it would be too expensive to hire cotton harvester.....1
Cotton harvester would demand additional costs for preparing cotton for harvesting.....2
It would not suit the size of my cotton fields.....3
It would damage the soil quality of my land.....4
It would damage the quality of cotton.....5
Other problem (specify)_____

G. FARM PRODUCTION AND INPUT USE

G1. Indicate please your farm agricultural crop pattern harvested in 2014? Please fill in the empty fields other crops you have grown in your farm in 2014 and related data to it.

Agricultural crops	Area (ha)	Gross production, (ton) actual	Average yield, (c/ha)	Is it a primary or secondary crop? Primary =1 Secondry = 2
Cotton				
Wheat				

G2. Total labor use for manual work at the above mentioned crops. Please fill in the empty fields other crops you have grown in your farm in 2014 and related data to it.

Crop name	G2.1. Permanent workers		G2.2. Seasonal hired workers		G2.3. Annual paid wages	
	Number of persons	Number of days	Number of persons	Number of days	Mln. UZS	In kind in mln. UZS
Cotton						
Wheat						

H. FARM INCOME

H1. Please, give following information concerning GROSS MARGIN of 2 main crops produced in 2014 (write crop name in the heading of the column):

Indicator			**Measurement unit**		
Average sale price			kg/UZS		
Income			‘000 UZS/ha		
Profit			000 UZS/ha		
Seeds		q-ty	Kg/ha		
		price	UZS/kg		
Including	Nitrogen	q-ty	Kg/ha		
		price	UZS/kg		
	Phosphorus	q-ty	Kg/ha		
		price	UZS/kg		
	Potassium	q-ty	Kg/ha		
		price	UZS/kg		
	Costs for manure	q-ty	Kg/ha		
		price	UZS/kg		
Plant protection / pesticide, herbicide		q-ty	Kg/ha		
		price	UZS/kg		
Machinery service costs			UZS/ha		
Oil/diesel and lubricants		q-ty	Litre/ha		
		price	UZS/litre		
Salaries (in % to total expenses)			%		
Electricity costs (in % to total expenses)			%		
WCA service fee			‘000 UZS/ha		
Taxes (in % to total expenses)			%		
Other expenses			‘000 UZS/ha		

H2. Please, give following information concerning GROSS MARGIN of 2 secondary crops produced in 2014 (write crop name in the heading of the column):

Indicator			**Measurement unit**		
Average sale price			kg/UZS		
Income			‘000 UZS/ha		
Profit			000 UZS/ha		
Seeds		q-ty	Kg/ha		
		price	UZS/kg		
Including	Nitrogen	q-ty	Kg/ha		
		price	UZS/kg		
	Phosphorus	q-ty	Kg/ha		
		price	UZS/kg		
	Potassium	q-ty	Kg/ha		
		price	UZS/kg		
	Costs for manure	q-ty	Kg/ha		
		price	UZS/kg		
Plant protection / pesticide, herbicide		q-ty	Kg/ha		
		price	UZS/kg		
Machinery service costs			UZS/ha		
Oil/diesel and lubricants		q-ty	Litre/ha		
		price	UZS/litre		
Salaries (in % to total expenses)			%		
Electricity costs (in % to total expenses)			%		
WCA service fee			‘000 UZS/ha		
Taxes (in % to total expenses)			%		
Other expenses			‘000 UZS/ha		

I. MARKETING OF AGRICULTURAL PRODUCTS

I1. Indicate the farm production of the last 12 months and the marketing channels used. [Only fill in white fields].

	I1.1.	I1.2.	I1.3.		I1.4.	I1.5.		I1.6.
Product	Total production (kg)	Consumption by workers and quantity given away for free or used on the farm (kg)	Sales in cash or barter in the last 12 months		Main Marketing Channel (ONE only) [a]	In the farm's main marketing channel, did the farm market under contract?		In the farm's main marketing channel, how many weeks after delivery is the farm paid?
			kg	Average price per unit (UZS)		Yes	No	
Wheat grains						1	2	
						1	2	
						1	2	
						1	2	
						1	2	
						1	2	
						1	2	
						1	2	

a)
1 – Directly to consumers (market, door to door, by the road)
2 – Wholesalers, traders in village
3 – Wholesalers, traders in Tashkent
4 – Directly to local supermarket
5 – Directly to supermarket in Tashkent
6 – Agro-processing enterprise
7 – Procurement enterprise / State order
8 – Other farm enterprise
9 – Farmer association or cooperative
10 – On CIS and neighboring foreign markets
11 – On other (distant) foreign markets
12 – Other (specify)

I2. Could your farm market more of its agricultural produce if it wanted to? [ask everybody]?

Yes….....……1
No…….....2

I3. What are the main problems related to marketing agricultural produce?

Product	Main difficulties (circle max. THREE!)								
Wheat	1	2	3	4	5	6	7	8	9 _____
Rice	1	2	3	4	5	6	7	8	9 _____
	1	2	3	4	5	6	7	8	9 _____
	1	2	3	4	5	6	7	8	9 _____
	1	2	3	4	5	6	7	8	9 _____
	1	2	3	4	5	6	7	8	9 _____
	1	2	3	4	5	6	7	8	9 _____
	1	2	3	4	5	6	7	8	9 _____

1 - Minimum quality requirements to sell this crop
2 – Minimum quantity requirements to sell this crop
3 – Transportation problems
4 – Do not know enough buyers for this crop
5 – Do not know price of this crop
6 – Price regulation by the Government or the local authority for this crop
7 – People who compel to overprice or set too low prices, sell products to them or through their mediation
8 – No difficulties
9 - Other difficulties (specify)

I4. Farm storage and expertise in standardization and certification. Please fill in the empty fields other crops you have grown in your farm in 2014 and related data to it.

	I4.1.	**I4.2.**		**I4.3.**		**I4.4.**	
Product	Where do you store your harvest? [a]	Would you like to export your products by yourself?		Do you know how to export your products (procedure and required permissions)?		Do you know about the system of standardization and certification of products?	
		Yes	No	Yes	No	Yes	No
Wheat grains		1	2	1	2	1	2
		1	2	1	2	1	2
		1	2	1	2	1	2
		1	2	1	2	1	2
		1	2	1	2	1	2
		1	2	1	2	1	2
		1	2	1	2	1	2
		1	2	1	2	1	2

a)
1 – Separate room at house
2 – Special storage warehouse
3 – Special storage warehouse equipped with fridge
4 – At fields well covered

I5. Fill in the following table for farms producing cotton and wheat. Ask each question

	I5.1.	**I5.2.**	**I5.3.**	**I5.4.**
Crop	Which of these crops would you grow instead of cotton and wheat? Circle	Do you know how to grow this crop? Yes=1 No=0	Where would you sell this crop? (ONE only) [a]	Would you be interested in specific training in production and marketing of this crop? Yes=1 No=0
1 Rice	1			
2 Other grains	1			
3 Sunflower seeds	1			
4 Vegetables	1			
5 Potatoes	1			
6 Melons	1			
7 Fodder crops	1			
8 Fruits	1			
9 Grapes	1			
10 Other1____	1			
11 Other2____	1			

a) 1 – Directly to consumers (market, door to door, by the road)
2 – Wholesalers, traders in village
3 – Wholesalers, traders in Tashkent
4 – Directly to local supermarket
5 – Directly to supermarket in Tashkent
6 – Agro-processing enterprise
7 – Procurement enterprise / State order
8 – Other farm enterprise
9 – Farmer association or cooperative
10 – On CIS and neighboring foreign markets
11- On other (distant) foreign markets
12 – Other (specify)

J. FINANCING SOURCES

J1. Loans obtained by farm

Do you have a bank account (Yes – 1; No – 2)	
If yes:	
which bank	
for how many years	
Have you received a short-term loan (< 12 months) in the last 3 years (Yes – 1; No – 2)	
If YES, how many times	
If "Yes", for most recent	
Purpose[a]	
Amount (UZS million)	
Term (months)	
Interest rate (%)	
Monthly payment (UZS)	
Collateral provided [b]	
Collateral providedas percentage of loan (%)	
When received (month and year)	
Amount outstanding	
If NO, how did you pay for farm inputs (Insert main source: Own funds – 1, Input supplier credit – 2, Loan from family/friends – 3, Local government fund – 4)	
Have you received a long-term loan (> 12 months) in the last 3 years (Yes – 1; No – 2)	
If YES, how many loans	
If yes, for most recent	
Purpose[c]	
Amount (UZS million)	
Term (years)	
Interest rate (%)	
Monthly payment (UZS)	
Collateral provided[d]	
Collateral providedas percentage of loan (%)	
When received (month and year)	
Amount outstanding (UZS million)	

Notes: **a. Loan purpose:**
(Seed – 1; Fertilizers – 2; All inputs – 3; Labor – 4; Machinery hire – 5; Crop processing – 6).
b. Collateral provided:
(Land – 1; Farm house – 2; Farm buildings – 3; Other real estate – 4; Farm equipment/vehicles – 5; Personal guarantee – 6)
c. Loan purpose:
(Building construction – 1; Machinery purchase – 2; Greenhouse construction – 3; Irrigation system construction – 4; Storage/processing facility construction/purchase – 5; Vehicles/transport equipment – 6; Other fixed assets – 7)
d. Collateral provided:
(Land – 1; Farm house – 2; Farm buildings – 3; Other real estate – 4; Farm equipment/vehicles – 5; Personal guarantee – 6)

J2. Leasing contracts made

Have you purchased machinery or equipment in the last 3 years through a leasing company(Yes – 1; No – 2)	
If YES, how many times	
If YES, for most recent	
Name of leasing company	
Item purchased[a]	
Amount of lease (UZS million)	
Term (years)	
Downpayment required (%)	
Interest rate (%)	
Monthly payment (UZS)	
Collateral provided[b]	
Collateral providedas percentage of loan (%)	
When received (month and year)	
Amount outstanding	

a. Item purchased:
(Tractor – 1; Trailer – 2; Plough – 3; Seeder – 4; Cultivator – 5; Harvester – 6; Other – 7).
b. Collateral provided:
(Land – 1; Farm house – 2; Farm buildings – 3; Other real estate – 4; Farm equipment/vehicles – 5; Personal guarantee – 6)

J3. Farm Finance Issues. Please indicate on a scale of 1 to 3 (1 being "Disagree"; 2 being "Neither agree nor disagree", 3 being "Agree") your feeling regarding access to finance for machinery finance on your farm.

Issue	**Score (1 to 3)**
1. Own funds for machinery purchase are limited	
2. No account/relationship with local bank	
3. Unable to get bank loan for machinery	
4. Unable to obtain machinery on lease	
5. Bank loan available but term (period) too short	
6. Bank loan available but interest rate too high	
7. Bank loan available but collateral needed too high	
8. Bank loan available but farm income not high enough to repay	
9. Machinery lease available but term (period) too short	
10. Machinery lease available but interest rate too high	
11. Machinery lease available but down-payment required too high	
12. Machinery lease available but farm income not high enough to pay installments	

J4. Who is responsible for financial matters on your farm?

Farm director……...1
Farm employs a permanent worker for this……2
Farm hires (occasional) a person to provide this type of services……...……3

J5. Have you (farm director) ever received any training in financial matters (planning, book-keeping, etc)?

Yes…….....1
No……2

K. ACCESS TO INFORMATION AND FARMING SKILLS

K1. What information channels farm management use to get information on farming-related matters?

	Circle max. THREE
1. TV programs	1
2. Newspapers	2
3. Written material/leaflets	3
4. Agricultural projects	4
5. Internet	5
6. Other farmers	6
7. Agro-processing enterprise	7
8. Household based farmers / friends	8
9. Local Hokimiats	9
10. Extension / advisory service proving firm	10
11. A local private expert	11
12. A university lecturer	12
13. None	13
14. Other (specify)_____	14

K2. Did you participate in trainings on farming before?

Yes….....…1
No…….....2 If no then skip to K5.

K3. Which topics were covered during those trainings?

Application of manure and mineral fertilizers….....1
Deep ripping and laser leveling…….....……2
Crop rotation…….....…...3
Chemical protection of plants.....4
Biological protection of plants…….....5
Agro technics of wheat and cotton production ….....…6
Other _____

K4. Have you practiced knowledge and skills obtained in the trainings?

Yes….....…1
No….....….2

K5. What topics would you like to learn more?

Application of manure and mineral fertilizers….....1
Deep ripping and laser leveling…….....……2
Crop rotation…….....3
Chemical protection of plants.....4
Biological protection of plants…….....5
Agro technics of wheat and cotton production ….....…6
Other _____

APPENDIX 2: EXEMPLARY GROSS MARGIN AND WATER PRODUCTIVITY CALCULATIONS

	Cotton	Wheat Jondor	Wheat Zangiota	Potatoes	Carrots	Tomatoes	Cabbage	Grapes	Plums
Farms in the sample producing this crop	99	97	49	41	27	15	20	40	14
Yield dt/ha	25	36	53	200	200	180	205	70	88
Price USD/dt	48	18	20	38	17	18	13	30	15
Revenue USD/ha (A)	**1200**	**648**	**1060**	**7600**	**3400**	**3240**	**2665**	**2100**	**1320**
Seed cost USD/ha	30	130	90	3600	150	750	810	0	0
Fertiliser cost USD/ha	370	330	180	230	220	400	210	250	200
Plant protection USD/ha	0	0	50	0	0	0	0	25	0
Machinery, energy USD/ha	480	280	240	150	140	150	90	165	145
Salaries USD/ha	330	115	200	900	850	940	1300	470	500
Water service USD/ha	8	8	13	13	13	13	13	13	13
Total cost USD/ha (B)	**1218**	**863**	**773**	**4893**	**1373**	**2253**	**2423**	**923**	**858**
Water consumption m3/ha (C)	5300	3100	3100	9500	9500	9500	9500	3100	3100
Water productivity USD/m3 (A)/(C)	0.23	0.21	0.34	0.80	0.36	0.34	0.28	0.68	0.43
Gross margin USD/ha (A-B)	**-18**	**-215**	**287**	**2707**	**2027**	**987**	**242**	**1177**	**462**

Notes: Data items are authors' estimates based on the general tendency reported in the survey data. Water consumption is taken from official irrigation norms for hydromodule zone III.

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