Research on Local Seed Potato Value Chain Gaps and Bottlenecks in Tajikistan

POTATO PRODUCTION SUPPORT AND RESEARCH TO IMPROVE FOOD SECURITY IN KHATLON, TAJIKISTAN

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INTRODUCTION

In Tajikistan, 5.5 million people (70% of the population) reside in rural areas\(^1\). Despite the country’s small share of arable land, which is estimated at 7% of the national territory (around one million hectares), agriculture is one of the most important sectors of the economy, providing employment for two thirds of the population. The share of the agricultural sector in the country’s GDP was estimated at 18.7% in 2010\(^2\) and agricultural products make up 30% of official exports\(^3\). Most of the country’s agricultural land is dedicated to cotton, potato, cereals, pasture for cattle and small ruminants, horticultural crops, vegetables, melons, orchards and vineyards\(^4\).

Through land reform, the government has tried to break up larger farms into smaller plots and make them available to commercially-oriented farmers and households for food production. These reforms and others, such as creating more secure and marketable land-use rights, have helped to drive productivity gains and greater welfare for farmers\(^5\). Following independence, Tajikistan’s 562 collective farms were divided into tens of thousands of small, independent farms\(^6\). Many of these newly-minted farmers previously worked as laborers on the collective farms; others were employed in non-agricultural jobs. Almost all lacked the business and marketing skills they needed to run a successful small farm. Farmers strongly need access to business training and affordable capital to improve their operations. The inability to access credit to finance improvement is a major hindrance throughout rural areas, though particularly in Khatlon province. With few options for upgrading, farmers continue to use the worn-out infrastructure and equipment from the Soviet period and employ low levels of inputs such as improved seed, fertilizer and pesticides. Depleted soil fertility further exposes the country’s farmers to the risk of crop failure.

Tajikistan acceded to the World Trade Organization (WTO) in March 2013. Tajikistan ranked 143rd out of 189 economies in the World Bank’s Doing Business report for 2014\(^7\). The Tajikistan Ministry of Economic Development and Trade has developed a WTO implementation plan which, if implemented, would materially improve Tajikistan’s economic position by opening export markets. However, the Government of Tajikistan has a long road ahead to achieve these milestones. In the interim, increased access to agricultural technologies that decrease the cost of production and increase farmers’ profit margins are essential to kick starting economic growth and reducing poverty.

This is particularly true in Khatlon, which has the largest population (over 2.5 million), agricultural area (33 percent) and cropped area (49 percent) of any province in Tajikistan. It has 60 percent of the country’s cotton, 50 percent of cereals, and 40 percent of its land dedicated to livestock, making it significant in terms of its contribution to the country’s agricultural output\(^8\). The province’s location in southwestern Tajikistan also gives it a favorable climate for the production of high-value horticultural products.

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1 Agency of statistics of Tajikistan 2013
2 TajStat 2011
3 FAO 2011
4 FAO 2013
6 USAID, Feed the Future Tajikistan FY 2011-2015 Multi Year Strategy
8 Ministry of Agriculture of the Republic of Tajikistan, UN FAO and UN World Food Programme (WFP), Crop and Food Security Assessment Mission Report: Tajikistan (Dushanbe: September 2011)
export crops, as well as potato, and for the development of inter-cropping systems that allow for two harvests per year. Yet Khatlon has the largest number of people living below the poverty line and the highest rates of under-nutrition of any province in the country. USAID, through the Feed the Future initiative, is consequently working with the Government of Tajikistan (GoTJ) to improve farmer livelihoods and nutrition throughout Khatlon province.

The main goals of this study were to assess the efficiency of the country’s potato value chain; identify potential opportunities to engage potato-value-chain actors to promote economic growth; and evaluate ways in which financing can improve the scale of operations, the value of harvests, and inclusion of additional players, while strengthening horizontal and vertical linkages. This report examines potato production chains and identifies opportunities for potato value chain financing.

Potatoes occupy an important place in the ‘shopping basket’ of goods mostly commonly consumed by Tajikistan’s population, being the second most consumed agricultural crop after cereals. Potato consumption is growing every year and amounted to 33.3 kg/person in 2014. In the event that the price of fertilizers, pesticides or other inputs rise, and price for potatoes is not regulated by the respective authorities, a significant reduction in the market price for potatoes can significantly decrease farmers’ incomes. Potato producers in the country’s southern and central regions are especially vulnerable, since they do not have appropriate warehouses for storing potatoes when prices are low.

This study examines potato value chains and recommends the promotion of potato as a tool for improving diets and decreasing child malnutrition. It is necessary to ensure that farmers have access to quality seed, fertilizers and pesticides, as well as light machinery, to improve seed potato production. Loans and subsidies could be key to scaling up production of quality seed potato, as well as guaranteeing the purchase of the seed that farmers produce. Definition of efficient seed potato value chains that could provide good profits for financial institutions is a next stage of development. It will require a more detailed analysis and intensive, rather than extensive development.

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9 AgTCA TAJIKISTAN, AGRICULTURAL TECHNOLOGY COMMERCIALIZATION ASSESSMENT, JUNE 2014
Methodology

Both primary and secondary sources were used for this study. Semi-structured expert interviews with representatives of different organizations and farmers were conducted in various regions of Tajikistan (Sughd, Khatlon, Rasht, Gisar) and on different administrative levels over the course of two months in 2015. Secondary sources included various publications and reviews, studies and data from the National Statistics Agency (Tajstat), the State Agency for Standardization, and the Ministry of Agriculture. Qualitative methods included in-depth interviews, site visits and field observations. Information was collected from an array of value-chain actors including: potato farmers, beneficiaries of USAID-supported projects, representatives of farmer associations, potato storage center and warehouse managers, and representatives of processing, wholesale, retail and export companies.

The seed potato value chain study’s main objective was to understand the potato production sector in Tajikistan and to identify gaps, bottlenecks and potential opportunities for engaging actors in the seed potato value chain in order to contribute to economic growth. Tajikistan’s potato value chains were already the focus of development projects. Microfinance institutions typically engage in value-chain financing by providing loans to agricultural producers, however some also serve processors (dairy, grain mill), providers of input (seeds, fertilizers), traders and procurement companies. These institutions have managed to extend their financial services beyond farmers thanks to external guidance and technical assistance.
I. GENERAL CONTEXT

Tajikistan is located in the south east of Central Asia, with total area of 143,000 km² (55,300 mi²). The territory of Tajikistan shares western and northern borders with the republics of Uzbekistan (910 km) and Kyrgyzstan (630 km), in the south with Afghanistan (1,030 km), and in the east with China (430 km). The total length of the border is 3,000 km. It capital is Dushanbe. Tajikistan is a mountainous country with altitudes ranging from 300 to 7495 meters; 93% of the territory is mountainous and it forms part of the two highest mountain systems of Central Asia - the Tien Shan and Pamir. The climate is continental, subtropical and semiarid, with average January temperatures ranging from -61°C (Lake Bulunkul) to +22°C (Pyanj), and July temperature ranging from -8°C (Lake Bulunkul) to +45°C (Pyanj).

Tajikistan is a small, landlocked, low-income country. Despite the fact that only seven percent of its territory is land arable land, agriculture is a cornerstone of the country’s economy; the sector employs around 75 percent of the labor force and contributes 20 percent to gross domestic product (GDP). Of the approximately 8 million Tajiks, more than 70 percent live in rural, agricultural areas. Tajikistan’s major agricultural products include cotton, grains, dried and fresh fruits, vegetables, cattle, sheep, and goats. Livestock account for a significant portion of total agricultural production. Factors limiting land use for agriculture include the country’s mountainous topography; water, electricity and sanitation constraints; and lack of mechanization. These geographical and infrastructural limitations, along with constraints within the enabling environment for agriculture, prevent the sector from reaching its full potential.

Tajikistan’s main physical features are its geographical location and topography, being the most mountainous republic in Central Asia. It is also characterized by the extremely limited arable land, intense cultivation and an excessive labor surplus of the majority of rural areas. Another important feature is the highest population growth rate (3-3.5% annually) in the region, which presents serious challenges for securing and maintaining a sufficiently high level of agricultural output per capita. There is also a low level of migration away from rural areas and extremely weak development of urbanization. There are also great differences in the levels of economic and social development between the valleys and mountainous rural areas, which is caused by a sharp vertical zoning and distribution of agricultural production and the intensification of cotton farming in areas where it is not traditionally efficient, and where there is a lack of full compliance with the rational use of land, climate and labor aiming in attempts to accelerate economic development. Mountainous areas are 1.5 - 3 times behind the cotton-growing valleys in the level of productivity; they have the lowest working-age population and 30-35% of total resources. This creates a need for measures to equalize the levels of socio-economic output within the region in the near future. This is especially urgent given the possibility of further expansion of cotton production.

Following the dissolution of the Soviet Union, the country’s main production units, known as kolkhozes and sovkhozes, were dissolved. Agricultural reform in Tajikistan has been an on-going process since 1997, as the state attempts to distribute land to farmers. According to the FAO, Tajikistan has four types of agricultural production units: 1) household plots, 2) individual and family dekhan (peasant) farms, 3) collective dekhan farms and 4) agricultural enterprises (successors of former state farms). Only the first two groups are true family farms. ‘Agricultural enterprises’ are in fact specialized state-owned farms. Official statistics make it impossible to differentiate between dekhan farms of different types. Recent estimates show, however, that

10 Agriculture of the Republic of Tajikistan, Agency of Statistic, 2014
collective *dehkan* farms – which constitute less than five percent of all *dehkan* farms in Tajikistan – control more than one-third of the arable land in the *dehkan* farm sector. Despite the significant presence of collective *dehkan* farms, the agricultural sector in Tajikistan is now largely individualized: nearly 65% of arable land is in family farming (household plots, individual *dehkan* farms, and family *dehkan* farms).

At present, 89,702 large, medium and small enterprises and organizations are involved in the production of agricultural production. This includes 372 state farms, 119 associations of *dehkan* farms, 621 collective *dehkan* farms, 6 agricultural companies, 16 joint stock companies, 456 agricultural cooperatives, 518 farms belonging to enterprises and organizations, and 87,594 *dehkan* farms. Production reached more than 9 billion somoni in 2014, including vegetables (14,532 million somoni) and livestock (6,489.1 million somoni).

Most farms are small, vulnerable and under-financed, with 70% of farm owners lacking sufficient knowledge of how to run a farm. Most of those small-scale farmers are poor and unable, or unaccustomed to pay for agricultural advisory services. Farmers used to receive free agricultural extension through the Soviet *kolkhoz* system, and in recent years, from non-profit organizations. Many farmers used to be in professions unrelated to agriculture. In addition, many men went abroad to look for jobs during the transition period, leaving the old people, children and women behind. There is consequently a growing number of female farmers in Tajikistan.

Farming in Tajikistan today requires that a farmer be a multi-tasking entrepreneur, with specific agricultural knowledge as well as basic financial, legal and marketing skills, and the ability to find all the needed inputs and machinery. Land reforms aimed to break larger farms into smaller plots and make them available to commercially-oriented farmers and householders for food production. Those reforms and others, such as creating more secure and marketable land use rights, have helped to drive productivity and welfare gains for farmers. Presidential Decrees dated October 9, 1995 № 342 and December 1, 1997 № 874 were fundamental for this transition of the rural economy toward a market one, and achieving food self-sufficiency, laid in the foundation for a sustainable increase in agricultural production.

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13 Socio-economic situation of Tajikistan, Agency of Statistic, 2014
2. POTATO PRODUCTION AND MARKETS

2.1. Potato Production in Tajikistan

The potato has been grown in Tajikistan since beginning of 20th century, and is currently present in all soil and climatic areas of the country. The main potato-growing areas are mountainous and piedmont areas where the soil and climate are the most favorable for the crop. They are grown in various soils, but the best yields are in well-cultivated, light- and medium-textured loams. The lower soil density and the better the root access to air, the higher the yield.

Potato production is concentrated in piedmont and mountainous areas over 1800 meters above sea level. Most potatoes are grown in the mountainous Zeravshan and Rasht Valleys, at 1700 and 3300 meters above sea level (MASL) respectively, and in the piedmont Ghissar Valley, at 700-800 MASL. Potatoes are also grown intensively in the Ganchi and Shahristan Districts. Potato has also become one of the main crops for lowland farms during last 3-5 years, thanks to its use in inter-cropping systems between cotton or wheat crop cycles.

“Early,” or rapidly maturing potatoes, are farmed mainly in Khatlon province, where the climate/soil conditions are best. Total cultivation area for this crop on public and private farms reached 35,500 ha in 2014. A total of 853,700 tons of potatoes were produced there in 2014. The average crop yield per hectare was 23.6 tons. Public farms produced 91,730 tons (10.7%), dekhan farms produced 343,450 tons (40.3%) and individual households produced 418,599 tons (49%). In general, the area under potato cultivation is about 5% of cropland(source: the Academy of Agricultural Sciences)14.

2.2. Potato Imports and Exports

Tajikistan imported 29,100 tons of potatoes in 2014, including 20 tons of seed potatoes. Potato imports decreased by 31.2% in 2014 compared to 2013.

According to the Agency for Statistics, Republic of Tajikistan (ASRT) there was no exports of potatoes in 2014. However, potato producers in Jirgatal province and Gonchi district reported that citizens of Kyrgyzstan and Uzbekistan buy their seed and market potatoes.

2.3. Potato Demand in Tajikistan

Based on the consumer basket, per capita potato consumption should be 45 kg per year, but according to government data, real per capita consumption was 33.3 kg in 201415.

Potato is the second most important staple after bread for the population, and Tajikistanis use it in a variety of dishes. While domestic potato production has grown, it is still not enough, meeting only 98% of the domestic demand, with the difference being imported. A Presidential Decree has declared that potato production of potatoes should be increased to 1 million tons per year through the dedication of more land to the crop and the use of better varieties.

14 Food security and poverty. Agency of Statistic, 2015
15 Prices’ of Republic of Tajikistan, Agency of Statistic, 2015
2.4. Production Losses

Constraints for potato production include poor seed quality; non-compliance with agricultural techniques; diseases, pests and inefficient means of combating them; a lack of mechanized harvesting resources; and lack of standard storage facilities. According to numerous researchers, the potato losses on the farm are growing each year in Tajikistan, due mainly to a number of diseases and pests, reaching 23-29%, and up to 50% in some years. Potato beetles cause widespread damage in Tajikistan, with losses ranging from 18.4% to 44.7%, depending on the year and variety. In addition to direct crop losses, there is some reduction in the quality of tubers as a result of reduced output. This is caused by high-density colonization of the plants by pests in particularly vulnerable phases of its lifecycle – budding and blooming. A differentiated economic threshold has been designed for the harmfulness of potato beetle, which equals 1 imago and 1 larva per plant during the budding phase and 5 imago and 5 larvae per plant at blooming phase. In the colder areas, this is less of a problem, but in areas with warmer climates, potato beetles destroy a substantial percentage of harvests. Scientific discoveries have greatly enhanced efforts to control this pest effectively, but most Tajikistani farmers are either unaware of them or don’t have access to necessary pesticides.

At the farm level, losses due to improper harvesting (cuts) and postharvest handling (lack of curing) average about 4 - 5%. Another 5% of losses occur at the retail level. These losses can be reduced if harvest and post-harvest practices at the farm level are improved.

2.5. Production Characteristics

In the case of the large number of smallholders who are involved in potato, household labor is predominantly utilized for farm and postharvest management. Medium-sized and big farmers, on the other hand, hire workers. Hired labor is also used for postharvest and value adding activities. Potato production in Tajikistan is based on the block, or modular (randomized) principle and includes nine major phases: primary (deep autumn) tillage, pre-planting soil preparation, seed preparation, planting, further plant treatments, harvesting, post-harvest management, storage and preparation for sale.

More than 50% of the cost of growing potatoes is for the purchase of inputs such as seed potatoes, fertilizers, agrochemicals for pest and disease control and fuel. This figure is higher for potatoes than for other vegetables, nevertheless potato production is generally profitable.

2.6. Input Supply

Inputs for potato farming include seed potatoes, fertilizers and chemicals to protect plants against pests and diseases. As farmers have little access to elite seeds, they often use the seeds they grow themselves, or buy cheap seed potatoes in the market. Fertilizers are also scarce and expensive for most farmers in this region. Since the farmers often don’t have enough money to purchase the fertilizer they need, they pay for it with their crop – two tons of potatoes per ton of fertilizer. Agrochemicals are available in specialized shops, but the not all the farmers have the funds to purchase and apply them on time, so treated fields become infested quickly due to cross contamination from adjacent untreated fields. Mineral fertilizers are imported in the country, and most are nitrogenous, phosphorus and potassium. An average of 120 kg of mineral fertilizers is applied per hectare, but this dosage is much less than optimal. Agrochemicals are entirely imported and the responsible national authorities don’t always control the quality of imported fertilizers and pesticides.
2.7. Postharvest and Potato Storage

The potato harvest begins in May in the Khatlon region, in late June and early July in the Hissar Valley, and in late August and early September in Sugd and Rasht Valleys. In Khatlon and the Hissar Valley, other crops are planted in the same plots following the potato harvest. Farmers undertake postharvest activities such as sorting and cleaning in the field. Wholesalers don't grade potatoes, rather they sell all sizes together. Commercial potato growers generally sell their produce immediately upon harvesting, without taking such postharvest steps as curing, grading or packaging. However, small farmers who sell their own harvests in the market generally undertake such activities before taking their potatoes to the market. In other cases, traders carry out postharvest operations such as grading, weighing, and packaging before transporting potatoes to market, though they generally do this on their farms where they purchase the potatoes.

Potatoes produced in the southern and central regions are generally sold upon harvest, due to the lack of standard storages. Farmers in the mountainous areas who take their own potatoes to the market generally store potatoes in adapted warehouses (dugouts of 5-10 tons) until February or March of the following year. Seed stored in mountain areas is kept until April of the following year for early planting. However, losses during storage are high: an average 30-40% of the crop is lost during harvesting, transportation and storage; sometimes the losses can be as high as 60%, according to interviews with farmers.

2.8. Potato Sales and Types of Markets

The country’s potatoes are mainly sold via informal channels, such as at open-air markets, where farmers and vendors pay little attention to prescribed handling and storage standards. Major markets include the country’s large urban centers.

Smallholders often survive on barter trade, exchanging potatoes for necessities. Due to Khatlon’s relative remoteness location, its villagers face many obstacles to getting their crops to market. They cannot deliver their potatoes to other parts of the country, as transportation requires a lot of fuel and potatoes may not survive lengthy travel. High transportation costs affect the sales price. Big traders purchase potatoes from commercial farmers, who have scale of production, and village-level traders who serve as local collectors. These traders are also retailers of food and other goods that farmers need. The big traders, on the other hand, are specialized vegetable traders who sell to wholesale markets and deal only in large quantities. These traders generally sell their product to commission agents in the wholesale markets. The market is characterized by a large number of middlemen, but most potatoes end up in the wholesale and retail markets of Dushanbe, or other cities. There are three major wholesale markets in Dushanbe where potatoes are purchased for distribution in the city and other regions of the Republic. Based on agreements, the retail markets can also directly import potatoes for sale and storage. Early potato is transported from Khatlon province (250km) and other districts of the republican subordination (50km) to Dushanbe. Potatoes from the Sugd and Rasht Valleys (350km) are also transported to Dushanbe for consumption in the capital or distribution to other districts.

16 KHATLON DEPARTMENT OF AGRICULTURE
2.9. Potato processing

In Tajikistan are potatoes are generally not processed into potato chips, starch or frozen peeled and sliced potatoes, as is commonly done in Europe and Northern America, for lack of investment and the relatively high costs of potatoes. However, a few enterprises have recently started producing potato chips on a small scale.

2.10. The importance of potato for farmers

Potato production is very important for small farmers and private farms in Tajikistan, where most farmers grow at least some potatoes. A specific feature of Khatlon and the Hissar Valley is that potatoes are grown at the start of the summer, and following the harvest, farmers cultivate cereals, beans, oilseeds and vegetable crops on that same irrigated land.

The distribution of “early” potato varieties, which can produce tubers within 90-100 days, could be a boon for farmers in Khatlon, since their potato harvest has traditionally gone to the market in May, whereas the price of fresh potatoes harvested in spring is nearly twice that of fresh potatoes in the summer. Soil and climatic conditions of this region offer the potential for producing 20-25 tons of the early potatoes per hectare. Production of spring potatoes has many advantages, primarily:

- The short production period leaves fields available in June for planting vegetables (tomatoes, cucumbers, carrot) or legumes for a fall harvest;
- spring potatoes require only 2-3 irrigations and one weeding during the growing period;
- the harvest is gathered before the seasonal epidemics of Colorado beetle and other pests;
- the market price of spring potatoes is higher than price for potatoes harvested in the previous fall;
- growing spring potatoes ensures year-round availability of potatoes and partly solved seed potato storage issues.

The production cost of one kilogram of potatoes ranges from 0.90 to 1.10 somoni, where the cost of transport is 10 diram (0.10 somoni) per kg per 100 km. The average price of 1 kg of commercial potato in retail markets was 2.39 somoni in January 2014, whereas from March to May rose from 2.75 to 3.95 somoni. As the harvest began, in June, the price of fresh potatoes dropped to 2.30 somoni, but increased to 2.73 in October. In November and December, the average price reached 3.1 somoni. The farm price is 25-30% less than the wholesale market in 2014, and the difference between wholesale and retail markets is 10-15%. The price for seed potatoes was 3.20–3.30 somoni in the fourth quarter of 2014, and it dropped to 1.3 - 1.5 somoni by spring 2015, whereas the price of consumption potatoes averaged 2.91 somoni in the first quarter of that year.

The highest net profit a farmer can get from potato production in early spring and is about 3 somoni/kg, or about 75,000 somoni/ha (USD $15,000/ha). Net profit from potato harvested in the summer is 50,000 somoni/ha (USD $10,000/ha).
2.11. Cross-Cutting Services

a) Agriculture Extension

Various improvements have been made over the years with the aim of increasing potato yield. Farmers began to use small-sized equipment for crop processing, to pay more attention to the quality of seed, and to use organic and mineral fertilizers. Particular attention has been given to pest management. Training in soil analysis, appropriate use of fertilizers, crop management and integrated pest management are all needed to increased production, but farmers have traditionally gotten most of their agricultural information from neighbors, magazines etc. Tajikistan’s Ministry of Agriculture consequently organized a farmer service center called TochikAgrolising, which provides extension services to 886 dekhan farms. The farmers’ service center has 705 tractors, 556 combines and other agricultural machinery, with a total value of 90.3 million somoni.

b) Market Information

Although farmers have information about nearby markets where they’ve sold their produce, they know little about markets located farther away, which are a potential source of sales. Thanks to email, telephone and other means of communication, farmers are able to keep track of retail markets prices, which helps them to determine the value of the potatoes in their field. There are no government restrictions on the delivery of products to the market, though serious obstacles to tapping into distant markets, as described above.

c) Financing (loans and leasing)

Lack of small scale financing for small potato farmers is a common obstacle to increasing production. Loans and/or leasing would provide small farmers with the opportunity to access the equipment needed to improve production. However, interest of loans to farmers from Tajikistan’s banks is very high. Faced with numerous financial and marketing challenges, many farmers retain certain nostalgia for the Soviet era of collective agriculture and look to the government (or donors) to provide for them.

While inflation is less than 10%, interest on loans for both farmers and agribusinesses are between 24-26% per annum. Repayment periods are also very short, often no more than 90 days. Bank savings rates are roughly 18% per annum. Such terms are prohibitive for both capital investment and operating loans. A new credit bureau has been established in Tajikistan, but its effect on lending practices is not yet apparent. Accordingly, most agribusinesses and farmers do not generally access commercial credit. The most significant source of funding for agriculture is through donors—either through grants, voucher programs, or credit guarantees. Some of these programs link farmers and agribusinesses to banks and other financial institutions. However, long-term relationships between banks and agribusinesses are unlikely until the cost of commercial credit declines.
3. POTATO SEED

3.1. Seed Acquisition and Accessibility

There are 65 seed farms in Tajikistan for the production of seeds for cereals, vegetables and forage crops, cotton and potatoes, located in different regions of the country. Among them are 17 farms with a total area of 11,500 hectares that are dedicated to growing seed potatoes. Those farms are located in Sugd region (4), Khatlon region (1), District of Republican Subordination (11) and the Gorno-Badakhshan Autonomous Oblast (1). 15 of them are dekhan farms and two are agricultural enterprises. In addition to the seed farms for growing conventionally reproduced seed, other farms produce potato seed. Farms of the Institute of Horticulture and Vegetable Growing, under the Tajik Academy of Agricultural Sciences (TAAS), produced more than 500 tons of seed potato of local varieties and sold it to farmers in 2014.18

The Institute of Horticulture and Vegetable Growing in Jirgatal is conducting the multiplication of potato micro tubers, botanical seeds, axillary buds and cutting at pilot sites in Hissar, Dangara and Ganchi districts. Trials on multiplication of potato micro tubers are also being carried out the Institute of Botany, Plant Physiology and Genetics’ experimental station in Jirgatal district.

Farmers of Khatlon province and the Gissar Valley use seed potatoes produced in Sugd and the Rasht Valley. Generally, farmers of the mountainous areas multiply seed potato using traditional methods. Farmers in the mountainous areas of southern and middle regions mainly use seed produced in those mountainous areas, since they have no other options as of yet. Some may also get seed from other countries, but only in small amounts (15-20 tones a year), whereas on a national level, farmers need 110,000 tons of seed potatoes per year. Some farmers purchased 15 tons of two new varieties of potatoes with the help from German Agro Action in 2014. In recent years, variety regeneration has mainly taken place at the experimental stations of the TASS Institute in Jirgatal and Ganchi districts, with the direct support of CIP.19

Potato is a gender-friendly crop, since women participate in many potato-farming activities. However, men tend to have more information about the potato production, since they are mainly managing this industry. Regardless of gender or ethnicity, all farmers want to get higher yield. The level of awareness of good agronomic practices is higher among farmers with large plots and compared to smallholder households.

Farmers generally have information about the availability of seed in the farms of Sugd and the Rasht Valley. However, they lack specific information on the number, variety, and reproduction and are thus unable to calculate expected benefits. Farmers store seed using traditional methods, but because of the lack of specialized storages, seed potatoes often begin to germinate earlier, and during its transportation over long distances, the quality decreases.

Information about the new potato varieties released by donor agencies within specific projects is communicated through the workshops, seed farm associations and farmers, but that information doesn’t always reach the buyer. The Institute of Horticulture and Vegetable Growing, TAAS, has produced publications about the new potato varieties adapted to the country’s different agro-climatic zones, with information on their maturity and reproduction rates. These materials and recommendations are usually distributed to farmers. In response to farmer requests, the Institute has developed the following: 1) recommendations on planting and cultivation under different climatic conditions; 2) agricultural technology for

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18 Food security and poverty. Agency of Statistic, 2015
19 Semi-annual report, Potato production support and research to improve food security in Khatlon, Tajikistan, 2015, June.
cultivation, pest management, land treatment and potato storage; 3) recommendations on botanical seed cultivation; 4) methodologies for fall (early), spring and summer planting. Distribution of potato varieties among the regions was also determined; a national standard on the acceptance and a methodology for seed evaluation was established; and 14 potato varieties adapted to different agro-climatic conditions were released.²⁰

The main potato varieties used in Tajikistan are: Kondor (Agrico), Picasso (Agrico), Nevsky (Russia), Cardinal (Holland), Jukowskyramni (Russia), Cosmos (Agrico).

3.2. Seed Quality

Risks are high for farmers when purchasing seed, since seed is sold and purchased with neither certificate nor guarantee of seed quality. There are consequently many cases when degeneration of potatoes due to diseases transmitted by seed potatoes result in very low yields. Low quality seed is at least in part responsible for low potato yields in the lowlands, which average 2.2t/ha, whereas in mountainous areas, farmers may harvest 40t/ha and even more.

There are no specialized farms for the cultivation and storage of seed potatoes in Tajikistan. The potato sector produces both commercial and seed potato, because the difference between the prices of consumption and seed potatoes is insignificant. Farmers simply want to produce more marketable tubers and sell them as quickly as possible. No farms are adapted specifically for the production of seed potatoes and long-term seed storage. Most importantly, there is no state subsidy for the production of seed potato.

3.3. Seed Producers and Seed Availability

Seed potato from the seed farms is similar to that produced by farmers, but in the majority of cases, it doesn’t meet the requirements of the southern and middle regions, due to its late maturity and low reproduction. There are almost no incentives for farms to practice the strict management and coordination of seed production for the needs of different areas, and there is little difference between prices for consumption and seed potato. In fact, the price of seed potato was 52% lower than that of consumption at the beginning of 2015. 70-80% of the potato produced in the country is for consumption, so a small portion of the harvest is used as seed potato. There is high demand for high-quality seed potato, but most have to farmers use potatoes from their own harvest as seeds. There are as of yet no imports of high-quality seed from seed potato-producing countries. Farms dedicated to seed potato production could be profitable, if they implemented best practices for production and storage.

It is of vital importance to monitor the activity of seed production farms, renew seed material in accordance with the global science standards, and provide them with appropriate storage and field facilities for the sustainable development of the seed sector. There is also a need to date potato seed and guarantee that seed producers can earn a decent price. To resolve such challenges, a complex approach to seed multiplication

²⁰ Socio-economic situation of Tajikistan, Agency of Statistic, 2014
should be introduced in the farms, specifically the production of micro tubers, mini tubers, elite and reproductive tubers.

There are no specialized markets for seed potatoes, so seed material is delivered to markets together with consumption potato. There is also very little information about the country’s seed market, the amount of seed material, varieties and seed reproduction. It is thus reasonable proposal to organize one unique network of information on all the parameters of potato seed.

Recommendations on seed potato production and storage have been published for seed potato farms in the “Seed Potato National Standards of the Republic of Tajikistan.” However, not all farmers are following these guidelines and standards. Nevertheless, seed potato producers can receive no-cost consultations from specialists from the Academy of Agricultural Sciences, the Ministry of Agriculture and local governments.

According to a Ministry of Agriculture plan, farms dedicated to seed potato production are evaluated annually by the Approbation Committee and recommendations are made for improvements. In addition, the results are shared in the conferences and seminars conducted at the Academy of Agricultural Sciences of Tajikistan.

4. REGULATION AND POLICY AFFECTING FARMERS USE OF QUALITY SEED

4.1. General Policies and Seed/Variety Regulation

The Republic of Tajikistan has established phytosanitary and quarantine inspection for plants as well as state seed inspection under the Ministry of Agriculture. Officers control and prevent the import of non-standard products at the border. A national seed potato standard developed in 2014 regulates seed potato quality requirements. The Academy of Agricultural Sciences has published recommendations for the production of seed potato for both lowland and highland conditions, and recommends varieties according to agro-climate and soil zones.

The following policies and regulations control seed potato production in Tajikistan:

- LAW OF THE REPUBLIC OF TAJIKISTAN (RT) “ABOUT SEED PRODUCTION”, 5.01.2008, # 355
- MINISTRY OF AGRICULTURE ORDER FOR CARRYING OUT TESTS, REGISTRATION AND PROTECTION OF PLANT VARIETIES. MOA RT # 144, 27.07.2011
- SEED PRODUCTION DEVELOPMENT PROGRAM, 2010-2014. GOVERNMENT RESOLUTION RT 28.05.2009, # 297
- POTATO PRODUCTION DEVELOPMENT PROGRAM IN RT. 2012-2016. GOVERNMENT RESOLUTION RT 3.04.2012, # 128
- TECHNOLOGY OF SEED POTATO PRODUCTION. INSTITUTE OF HORTICULTURE AND VEGETABLE, ACADEMY OF AGRICULTURAL SCIENCES OF RT, 2004
- NATIONAL STANDARD OF RT “SEED POTATO” DEVELOPED BY THE INSTITUTE OF HORTICULTURE AND VEGETABLE, AAT AND PRESENTED TO THE MINISTRY OF AGRICULTURE OF RT, 2013.

Seed potato production area has been increased by 1,000 hectares in 2015 through consultancy services, which is 5-6 times more than the area under seed potato in 2014. There are presently three bio laboratories operating in Tajikistan to insure virus free seed potato production. However, their capacity is low – annually they produce 30,000 micro tubers, which is insufficient for local seed demand. Access to high
quality seed is especially difficult for the poorest farms and women, because of its high price: 0.80-1 Somoni per micro tuber. (US $0.2-0.15/micro tuber).

Tajikistan has initiated the procedure for acceding to the International Union for the Protection of New Varieties of Plants (UPOV) Convention. In Tajikistan, citizens of countries members of the or UPOV, as well as individuals who have a domicile in the territory of a UPOV member country, or legal entities having registered representation on the territory of a member country, enjoy the same rights that are provided in the Tajik Act for Citizens of the Republic of Tajikistan.

5. **SEED MULTIPLICATION TOOLS AND TECHNIQUES**

Each year, Tajikistani farmers use more than 110 thousand tons of reproductive and conditionally reproductive potato seed. Most of that seed is multiplied through vegetative and generative methods in small and medium farms. Seed is also produced through the method of reproduction of meristems, axillary buds and by cutting in the country's scientific-research and production institutions. Vegetative multiplication is, however, the primary technique for seed potato provision in the Republic.

Methods of seed multiplication from meristems, axillary buds, botanical seeds and cuttings are used in biotechnology laboratory of the Institute of Horticulture and Vegetable Growing, TAAS, and on the experimental fields of this Institute. Multiplication of seed potatoes from the meristem is also conducted in the laboratories of Biotechnology Institute of Physiology and Genetics, Academy of Sciences of the Republic of Tajikistan and the Tajik Agrarian University. Despite the fact that there are three biological laboratories operating in the country, production of virus-free micro tubers is only 20,000 pcs per year, which is extremely insufficient for supplying the country's seed farms. To increase the production of micro tubers in the existing laboratories, there is a need to improve techniques and technology, as well as organize mass multiplication of micro tubers in specialized farms.

Farmers generally supply their own seed, which they visually evaluate, but in the majority of cases, it is almost impossible to determine the degree of seed reproduction. All farms use the same cultivation technology based on the vegetative multiplication of tubers of different reproductions. Each year, they select the best seed and sell the rest of their harvest as consumption or seed potatoes. In all types of farms, except for the farms of specialized institutes, seed quality is poorly controlled. Farmers aren't interested in producing quality seed material for sale because there are no economic benefits for doing so.

Technology of potato cultivation for different regions was developed by the Institute of Horticulture and Vegetable Growing, TAAS, and consequently introduced to farmers. Equipment and techniques are determining factors in the technological process of potato cultivation, and there is demand for mini equipment and special techniques for potato planting, processing and harvesting. Salespeople don’t guarantee the quality of fertilizers and pesticides, and the respective authorities don’t properly inspect the quality of those fertilizers and pesticides. Because half of the seed potatoes used in the country is produced by the private sector, it is necessary to ensure that those farmers have access to reproduction of seed, quality fertilizers and pesticides, light machinery, soft loans, state subsidies to scale the activity up, and to guarantee the purchase of the seed they produce.
The key condition for seed multiplication in the foothills and mountainous areas is to provide the improved variety with the highest reproduction, following up with agricultural extension on cultivation techniques, timely monitoring of pests and other preventive measures. Working with varieties that are suitable for the valleys, foothills and mountain areas is essential, since agro-climatic conditions affect the multiplication rates of seed potato. Soil analysis should be done before planting, crop rotation followed, and application of fertilizers application and irrigations should be followed properly, as well as remedial treatments against pests and diseases.

6. THE INTERVENTION – CONCLUSION AND RECOMMENDATIONS.

- Potato is an extremely important staple food in Central Asia. There is a great need for high yielding potato varieties that are virus resistant, drought, heat and saline tolerant and therefore adapted to local growing conditions, which would contribute in economic growth of country.

- Accumulated traditional knowledge and skills among potato growers provides an opportunity for easy adoption of new potato production technologies and varieties. The Government of Tajikistan has identified potato as a high value income-generating crop and its policies are supportive.

- To International Potato Center (CIP) has introduced three drought-tolerant, virus-resistant potato clones in Tajikistan under the USAID-supported project: “Potato production support and research to improve food security in Khatlon, Tajikistan”. Seed potatoes harvested from those CIP clones are being used, but seeds of commercial varieties, including ‘Aladdin’, have to be renewed every year. This is because, despite their high productivity, commercial varieties are not resistant to virus diseases and their productivity decreases significantly from one year to the next, reaching 8–10 t/ha. The advantage of the virus-resistant CIP clones is that they can reduce farmers’ expenses on seed procurement for three years (the average price for seed potato is 5–7 somoni/kg). Consequently, introduction of CIP’s virus-resistant clones can result in 63,000 somoni/ha of additional income for farmers through savings on seed potato expenses over the course of three years.

- Most important strengths of the potato sector in Tajikistan include the fact that the climate is quite suitable, especially in Khatlon province, where two growing seasons are available for crop production. As the second growing season is very hot in Khatlon province, potato is a suitable crop to prepare for vegetables, which can be grown for the period of August-November. Since farmers have poor access to seed for the second growing season, CIP recommends that part of the seed potatoes harvested in June be used, after dormancy has been broken, for planting in the second growing season of the lowlands.

- Because of poor access to seed potato on the local market, many farmers buy seeds from November by March. Farmers need to be trained in different methods of potato cultivation to adapt to changing variables such as weather conditions, availability of seed, fertilizer availability, and the purpose of potato cultivation (whether for sale or food).
Yearly potatoes are planted in November–December in a pre-prepared soil under the high beds. Those potato tubers spend the winter dormant in the soil and germinate when the soil temperature is acceptable (Feb.–Mar.). Potatoes should be planted in the fall to reduce the risks of years when abundant rainfall and low temperatures do not allow early potato planting in the spring. This method allows obtaining early sprouts of potatoes in spring, and use of spring precipitation and temperature for early and high yield production. A disadvantage is the risk of low winter temperatures, when tubers can be damaged by frost. This method makes it possible to protect the spring planting potatoes from non-favorable weather conditions, using a plastic film. Potato yields from plots planted under plastic film is obtained 10 days earlier than in the other conditions. A cost of early potato harvested under plastic film was 2 somini/kg. As the late potato price is 1.5 somini/kg, farmers can get 15,000 somoni/ha additional income through introduction of this new technology of early potato production. This modern technique of potato production under plastic film can be used in Khatlon to provide early potato to local markets and ensure additional income for potato producers who take advantage of the window in early spring. On the basis of survey analysis, demonstration techniques of potato cultivation under different planting dates, and improved techniques of early potato production under plastic film are most popular among the farmers.

Adoption of appropriate abiotic and biotic stress-tolerant varieties suitable to location specific conditions and adoption of improved production management practices are the main focuses for future interventions in Tajikistan's potato sector. In addition, access to knowledge and information on improved postharvest techniques (sorting at harvest, storage, pre-sprouting), breaking dormancy, and PS to improve local farmer-based seed production, integrated disease and pest management, sustainable soil management/integrated nutrient management are the other key factors that need to be addressed for successful potato production.

Khatlon province has suitable agro-climate conditions for potato production, so potato can be included in the livelihood package for farmers. Because of potato's high nutrition value, represents an opportunity to reduce malnutrition and support food security in Tajikistan.

Potato value chains were identified as the potential high values, which can use as opportunities to contribute in poverty reduction and the eradication of malnutrition in the country. Because potato is rich in micronutrients (iron and zinc), they can help to diversify diets and address the problem of child malnutrition, prevalent in Tajikistan.

The need for an extension of CIP's intervention is clear: (1) Tajikistani farmers need to improve their skills and knowledge in potato agriculture and technology, such as integrated pest management, and the diseases- and stress-tolerant CIP potato clones need to be distributed (2) CIP-resistant clones can help farmers save money on seed potato for three years.

Long-term recommendations include introducing or improving production standards, quality control standards, seed sale standards, development of a system for seed potato certification, and improvements in linking farmers to quality extension services.