SYSTEM FOR RICE INTENSIFICATION: ENHANCING FOOD SECURITY AND INCREASING INCOME FOR SMALLHOLDER FARMERS IN TAJIKISTAN

Oxfam in Tajikistan Economic Justice Programme Case Study

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Oxfam

System for Rice Intensification (SRI): Transforming Productivity, Enhancing Food Security and Increasing Income for Smallholder Farmers (SHFs) in Tajikistan

Oxfam has launched an ambitious System for Crop Intensification (SCI) programme in Tajikistan with a view to transforming crop productivity and the food security landscape in the country. Within the broader framework of SCI, a field trial of System for Rice Intensification (SRI) was carried out in Khatlon region in the summer cropping season of 2018. Preliminary results from the limited trial show an increase in rice productivity of up to 60 % using standard SRI methodology (compared to traditional methods). Furthermore, there was a dramatic reduction in the use of seeds, fertilizers and water, which led to a significant cutback in the cost of rice cultivation for farmers. For a food deficient, ecologically fragile country like Tajikistan, with limited availability of land and water for crop cultivation, climate-smart practices in SCI offer the potential to support productivity gains and the restoration of agro-ecological systems in rural areas. Oxfam and its partners plan to conduct further field demonstrations and research on SCI across Tajikistan to further test the result and develop a standard package of practice. This will be followed up by a scaled-up programme on SCI across the country, leading to enhanced food security for the poor and improved productivity and income for smallholder farmers (SHFs).

1. Introduction

Tajikistan, a landlocked country with a population of 8.8 million (2017), is in a state of chronic food deficiency with 60 % of its domestic food requirements met from imports. As the poorest country in the Commonwealth of

Independent States (CIS) region (GDP per capita $812, poverty headcount 31.3 % in 2017)[1] the food insecurity takes an economic toll on the limited financial resources of the nation, making it dependent on other countries and thus adding to its strategic vulnerability. The food shortage is due to many factors including the following.

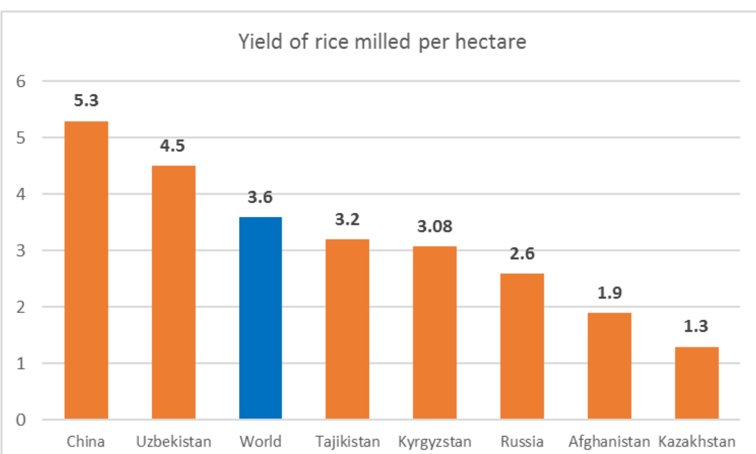
1. Low productivity of main food grains like wheat and rice.
2. Limited availability of land for agriculture, less than 7 % of land is under cultivation while 93 % of the country is mountainous.
3. Large tracts of agricultural land, especially in the southern region of Khatlon, have become saline with poor drainage as a consequence of intensive cotton farming over many decades, making them unfit for productive agriculture.
4. The infrastructure and services required for cultivation (e.g. irrigation systems, extension, farm machinery, input supply) are highly constrained, making farming a high-investment/low-return proposition.
5. The mounting impact of climate change has aggravated risks to farmers from gradual changes in agro-ecological systems to loss of agro-biodiversity and increasing frequency of sudden climate events, such as drought, pest attacks and flooding.

Research conducted by Oxfam[2] shows that more than 30 % of households in Khatlon region face climate vulnerability in their agriculture-based livelihoods. From the perspective of poor SHF households, low production of food grain has an alarming impact on food security – in 2016, 40 % of households in Khatlon reported starvation due to food shortage.

Tajikistan's national policy on agriculture identifies three priority areas:[3]

1. Enhancing national food and nutritional security and safety.
2. Sustainable management of natural resources and improved resilience to climate change.
3. Sustainable agriculture productivity and competitiveness.

Another key policy framework, National Development Strategy (2016–2030) envisions improving the living standards of the population in four main areas, one being improving food security and the population's access to good-quality nutrition. To achieve this goal, the country will have to make major investments towards boosting productivity, improving farming infrastructure, augmenting extension services, deepening the supply-chain for agriculture input and building a competitive market for agricultural produce.



[1] World Bank website: http://www.worldbank.org/en/country/tajikistan/overview

[2] Socio-economic baseline in Khatlon region (2016) conducted by Oxfam.

[3] FAO website: http://www.fao.org/3/a-bp563e.pdf

Figure 1: Rice cultivation in Tajikistan: comparison with other producers.

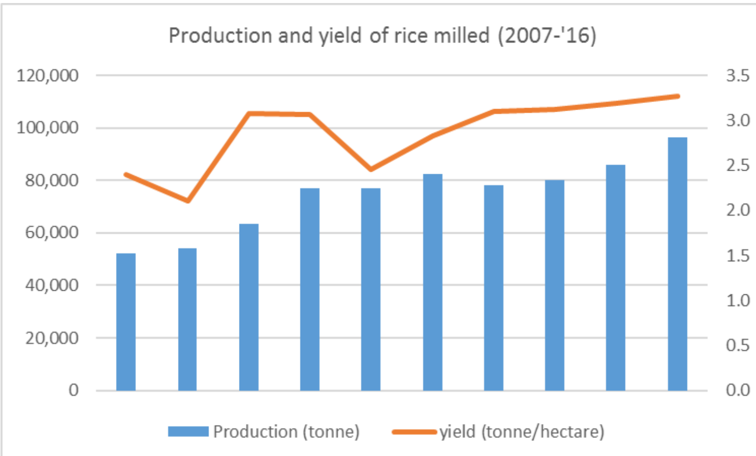


Figure 2: Rice cultivation in Tajikistan: comparison of production and yield.

Rice is one of the two main food crops of Tajikistan, wheat being the other. As of 2016, Tajikistan produced 96,476 tonnes of rice (ranked 76 in the world) from 13,678 hectares of agricultural land, with an average yield of 3.2 tonnes of rice milled per hectare (ranked 66 in the world). There is a net annual shortage of nearly 40,000 tonnes of rice, which is met from imports. Both the production of rice in the country and yield per hectare of milled rice has shown erratic and slow growth over the past decade (Figure 2).[4] A comparison of the yield of rice milled per hectare in 2016 for the region (Figure 1) shows Tajikistan performing below world average (3.6) and below neighbouring countries like Uzbekistan and China. There is a strong similarity between Tajikistan and Uzbekistan in terms of agro-ecological and development context, but Tajikistan is 40 % less productive than Uzbekistan, a disparity that could be partly explained by differences in agricultural methods used.

Regional picture on rice cultivation

Based on the data available on regional coverage of rice cultivation, there is an interesting change in cultivation pattern (Table 1). While there is an overall increase of over 14 % of land under rice cultivation in the country as a whole %over a 15-year period, in the same period, land under rice cultivation in Khatlon region reduced to almost 50 % of the 1991 figure. This can be explained by increasing water shortage and drought conditions prevailing in the oblast, which forced farmers to abandon rice cultivation in many areas. In contrast, the massive increase in land cultivated in Sughd is mostly due to improvements in farming infrastructure (such as irrigation) in the oblast especially in the northern plains, which has in turn boosted the productivity of this region. An analysis of the data indicates that mere increases in land area under rice cultivation can only lead to marginal increases in gross production. For significant improvement in productivity, new, high-yielding methods of rice cultivation need to be tested. The SRI offers one such technique, which holds the potential to boost productivity using climate-resilient practices.

[4] FAO website: http://www.fao.org/faostat/en/#country/208

Table 1: Land under rice cultivation in different oblasts in Tajikistan (hectares)

Oblast	1991	2011	2012	2013	2014	Change 1991–2014
Sughd	4257	6610	6256	7610	7283	+3026
Khatlon	4433	2360	2411	2591	2311	-2122
Region around	699	1294	1584	1518	1513	+834
All oblasts	9389	10264	10251	11719	11107	+1719

Photo: Oxfam in Tajikistan

2. System for Rice Intensification (SRI): relevance to Tajikistan

Photo: Oxfam in Tajikistan

Rice productivity in Tajikistan has remained persistently low over the past decade and an infusion of new techniques to boost domestic production is crucial for Tajikistan to move towards a greater level of food security. In order to be equitable and sustainable, strategies to increase food production will need to protect environmental and human health, be accessible and economical for the SHF, be gender appropriate, preserve or enhance biodiversity, and provide a buffer against the challenging climate.

While there will certainly be no single solution that addresses all of these issues, SRI shows promise and is particularly well-suited for the realities of SHF in Tajikistan. SRI is a dynamic and adaptive agro-ecological approach to increasing rice production while decreasing purchased inputs and allowing farmers to better utilize existing resources. While many agricultural development models rely on synthetic inputs, often in combination with modern crop varieties, SRI is primarily a knowledge-based management system, which can be used with any variety of rice. This is especially important for a country like Tajikistan where farmers' access to quality inputs is severely limited, and therefore any approach to increase productivity through an intensive input-based approach is less likely to yield optimal results and long-term sustainability.

SRI puts in place holistic plant and soil management characterized by aerobic soils, fertilization with organic matter and significantly reduced plant densities (80–95 % in most circumstances).[5] Despite the dramatic reduction in plants and de-emphasis on synthetic inputs, yield typically increases by 30–50 %, and in many cases 100 % or more.[6] As the following section on the field pilot study carried out by Oxfam in Khatlon shows, the SRI method achieved dramatic reductions in inputs and water requirements, and increases in productivity levels.

How the SRI method works

The key to SRI is a physical change in how the plants grow. Rice plants are highly adaptable, and given plenty of space and healthy conditions, they can produce more or fewer shoots, known as tillers. Under favourable conditions, a single rice plant may produce 40, 60 or even 120 tillers, each of which can produce panicles heavy with grain. In the conventional system of rice cultivation employed in Tajikistan, rice plants are typically densely crowded, fields may be flooded, and seedlings linger for weeks in tightly packed nurseries. As a result of this cultivation approach, each plant may produce only four or five tillers, far less than the potential maximum.


Photo: Oxfam in Tajikistan

With aerobic and biologically rich soils and less competition for resources, SRI management results in far deeper and broader root systems, making the plants sturdier, more efficient and healthier overall. As a result, SRI fields are better able to resist pest and disease attacks and withstand drought and severe wind or storms.

3. Oxfam experiment with SRI in Tajikistan: strategy, methodology and result

As a first step towards long-term intervention in SCI, Oxfam introduced SRI by conducting a series of field experiments in Kurghantube region (KT) of Khatlon oblast in Tajikistan. The field experiments were designed to test and compare the key parameters of SRI vs traditional methods using a Farmers' Field School approach. The basic parameters for the comparator, such as inputs, water usage, agriculture machinery and yield, were measured methodically over the summer rice season of 2018 to check differences in yield per hectare and finally compare the RoI.

[5] Farmers in the Khatlon region typically use 120kg of seed per hectare in the traditional method; SRI uses 20kg of seed.

[6] USAID, Feed the Future Programme (2015). System of Rice Intensification (SRI) Volunteer Handbook Peace Corps Publication No. M0118V.

Strategy for SRI pilot

There are two districts in the KT where rice is grown. Over the past decade, Oxfam has worked actively with the rice growing farmers of the region, initially by organizing them under the Producer Group (PG) platform, building their capacity to improve practices, connecting the PGs to village agronomists to help SHFs access quality inputs, which is another major challenge in the Khatlon region. In recent years, under the GREAT and TRIGGER projects of Deutsche Gesellschaft für Internationale Zusammenarbeit (GiZ), Oxfam combined PGs into commodity clusters (higher level institutions, functioning mostly at the district level) and in case of KT as rice cluster, with a view to aggregating demand for inputs and improving access to agriculture markets. Oxfam's long-standing engagement with the SHF, suppliers and stakeholders in the region was crucial for introducing SRI to KT. Other important strategic considerations are shown in Figure 3.

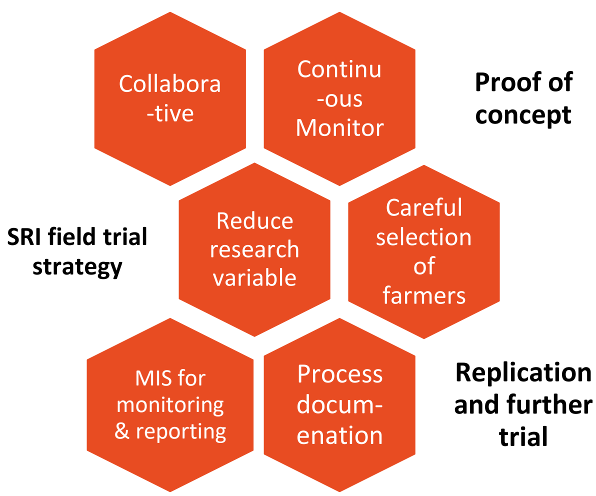


Figure 3: Strategic considerations.

1. **Identify lead farmers and village agronomists for the experiment:** The first critical phase of the pilot was to identify lead SHFs and local agronomists from Oxfam's existing PG/cluster network based on their ability and inclination to bring innovation, try out new practices, make investments and bear risks. Four viable farmers from the PG and village agronomy networks were identified for the SRI pilot. The farmers provided the land both for the SRI experiment and for the control (see section 4 Methodology for trial) and Oxfam provided inputs of machinery and the services of local agronomists to support the experiment.

2. **Engage with stakeholders in experiment stage:** Oxfam purposefully conducted the SRI experiment with the active collaboration of the important stakeholders in the agriculture sector. This included development agencies, the relevant government department, agriculture resource centres and UN agencies (Annex IV). These institutions were involved in the pilot from the beginning, starting with initial dialogue and farmer selection right through every stage of the field process. This strategy is critical for generating initial interest, enhancing capacity to replicate in diverse conditions and for building confidence in the results. Furthermore, it also helped Oxfam to conduct strategic dialogues and advocacy with the government agencies to support the initiative in the region. It is easier to convince farmers and agriculture agencies of the potential of new best practices if they are made part of the whole experimentation process, starting with the phase to build proof of concept on the new package for SRI.

3. **Keep field experiment simple:** Field experimentation in agriculture can be complex and challenging to organize. Oxfam deliberately reduced the number of variables in the experiment to gain results that are easy to comprehend and compare. For example, topography, soil quality and location of both treatment and control plots were comparable. Within the sub-set of treatment plot and the control plot, only one local seed variety and the same inputs, same spacing and irrigation pattern were used to generate a broad comparison. A set of treatment and control plots were kept adjacent to each other for quick visual comparison on results.

4. **Intensive monitoring and field-based support:** The adoption of a new best practice over a traditional method presents significant barriers, including technical, logistical, and financial obstacles. Furthermore, it requires a significant mindset shift for the farmers. To overcome these impediments, Oxfam provided not only technical and subsidy support, but also intensive monitoring of SRI methods employed at each stage of the field trial. Oxfam's staff and network of agronomists in the region provided field support ranging from training and field management to tackling water issues and arranging for new kinds of machinery required for SRI. Such close monitoring ensured the full adoption of the SRI approach, while boosting the capacity and confidence of the farmers involved in the trial.

5. **Maintain a robust Management Information System (MIS) on research:** To fully understand the results from the treatment and control plots, Oxfam devised an MIS to generate and analyse data coming from the field. The MIS was instrumental in facilitating strong and continuous monitoring of activities and crops – adaptive management based on changing situations, such as sudden drought or pest attacks – and finally in assessing the results. Oxfam shared the results on outputs derived from the MIS with collaborating agencies, which helped in sustaining the interest of the key stakeholder throughout the entire crop cycle.


Photo: Oxfam in Tajikistan

6. **Ongoing documentation of process:** Ensuring comprehensive documentation of the process is important for learning and dissemination of the best practices identified. The entire field trial process of SRI was documented in video and photographs to serve this purpose and to re-calibrate the field practice based on evidence emerging from the documentation process. Since SRI is a new method for rice growing in

Tajikistan, the documentation will serve to promote further experimentations in diverse settings across the country paving the way for further innovation and scale-ups.

4. Methodology for trial[7]

For the SRI demonstration, an action research was carried out in the 2018 summer rice season in Balkhi district, KT region. A quasi-experimental field research methodology was designed with four treatment plots of 0.25 hectares each under SRI cultivation and four control plots of same size using traditional cultivation methods. The SRI methodology was derived from the standard protocol[8] using a good quality local seed variety, Qizil-Qiltig, for seedlings and for raising nursery beds. The standard methodology was customized to adapt to the local conditions related to topography (undulating), soil quality (high degree of salinity), availability of water for irrigation (seasonal drought, limited availability), and local availability of inputs and machinery (new equipment for marking and weeding). Based on the principle of SRI, the following practice was adopted for the trial (Table 2).

	SRI principles	Practice adopted for trial	Overall results of practice
1	Early, careful plant establishment	• Seed sorting: germination test by salt water • Seed treatment/pre-germination • Careful raised-bed nursery management and careful transplanting at the two-leaf stage: soil boxes were used	• Germination rate of 95% in three plots and 70% in one due to drought
2	Reduced plant competition	• Only one seedling per hill • Wide spacing between plants (25cm), using a square grid pattern • Careful nursery preparation with low density seedling and young transplanting	• Deeper and stronger roots • Seed requirement reduced to one third compared to traditional method
3	Biologically active soil enriched from active matter	• Use of organic matter (compost, manure, green manure) • Soil biological activity enhanced through decreased tillage	• Resilience to drought • Improvement in soil fertility
4	Careful water and soil management to avoid flooding or drought stress during vegetative growth phase	• Intermittent irrigation: three days wet and seven days dry • Weeding to avoid competition	• Water requirement reduced by 70% • Average number of tillers 15, in some cases 20

Table 2: SRI principles and practice adopted in trial.

Overcoming constraints

Based on the experience and lessons of the trial, the most important challenges faced were related to the management of water, weeds, soil and labour.

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[7] See Annex 1: SRI Fact sheet for details on methodology.

[8] World Bank website: https://olc.worldbank.org/content/part-producing-more-crops-drop-innovative-way-rice-cultivation

Managing water: Due to a severe seasonal drought in the Khatlon region during the summer rice season, managing water for irrigation was a big challenge. Most of the seasonal crops in the region, including rice, suffered loss on account of less rainfall and less availability of canal water. Climate impacts over the past years have resulted in erratic rainfall patterns and subsequent increased severity and frequency of drought and pest attack. For SRI adoption at large scale, farmers in the region may have to recalibrate the cropping season, arrange irrigation water and chose farmland carefully.

Weed management: Due to larger spacing between plants in SRI compared to the conventional method, weeds grew extensively, competing for soil moisture and nutrition with the paddy crop, thus blunting the gains of the new method. Weed removal is labour intensive and difficult to carry out in large plots. In SRI, seedlings transplanted from the nursery faced less weed invasion compared to direct seedling transplantation and therefore the former practice should be promoted in future plots. Further weed-removal equipment, such as cono-weeders are effective, but their availability in local markets is a bottleneck. In the SRI trial, Oxfam worked with local agro-equipment fabrication firms in KT to generate the supply of weeders and land markers. However, for scaling-up, the production and supply of this equipment must also ramp-up significantly.


Photo: Oxfam in Tajikistan

Soil organic matter management: Soil quality in the Khatlon region is poor, with large-scale problems of salinity and poor drainage resulting in waterlogging. Decades of intensive cotton cultivation using high doses of chemical fertilizers and pesticides, and high water usage, has degraded the soil fertility and porosity. There is a general absence of knowledge and practice in the production and usage of organic matter (manure, compost and green manure) and the application of eco-friendly methods, such as mulching, crop cover and so on. This is despite the abundant supply of stubble and residue from crops such as rice, household waste and animal manure in rural areas. Convincing famers to shift to new methods is not easy because old practices are deeply embedded. As initial evidence from the trial shows, what seems to work is side-by-side SRI demonstration plots showing the advantages of using organic matter versus the traditional practices of not using organic fertilizers. When farmers see a clear contrast in the health and performance of the SRI plants, they tend to change their mind on this.


Photo: Oxfam in Tajikistan

Labour and time management: SRI often changes the timing and nature of certain aspects of labour involved in rice production. Precisely how this affects labour practice varies greatly, depending on local conditions and traditional methods. In some places, SRI reduces labour cost and in some it increases them. Often labour cost goes up initially, then decreases with time as farmers become habituated to SRI. Based on the assessment of this trial, the overall labour input for SRI came out higher than the traditional method, mostly since farmers spent more time on new practice, such as raising nursery plants, land preparation (e.g. levelling), transplanting single seedlings onto each hill, weeding and intermittent irrigation. Use of equipment can reduce labour costs and bring efficiency gains; however, this will be dependent on access to the relevant equipment being improved. To be clear, on the economics of SRI cultivation, cost benefit analysis should be carried out, taking labour and input cost together, to compare returns with traditional methods.

5. Preliminary result and analysis[9]

In overall terms, preliminary analysis of SRI shows a massive improvement in productivity, revenue and RoI, compared to the traditional method of rice cultivation. The immediate results can be analysed from four perspectives: environmental, input cost, yield and RoI. It is important to note here that these results are preliminary, based on a trial carried out on a limited scale, in a defined geography and derived only from one season of output. There is a likelihood that all these aspects may show variance within the region and across the country, due to endogenous and exogenous factors and the application of diverse practices but based on broad principles of SRI. The direction of the demonstration trial, however, is reliable and indicates that major gains may be possible for SHFs if farmers shift from traditional to SRI methods for rice cultivation.

Analysis of input

The trial shows a net saving of 10 % for cost of cultivation with SRI compared to the conventional method (Figure 4). While the total input cost for one hectare of land under SRI was TJS 8,466, it was TJS 9,390 for a one-hectare plot under traditional cultivation methods. SRI shows clear efficiency gains in seedling preparation (60 % saving in input cost) since a third fewer seeds are required for SRI compared to traditional methods; irrigation (73 % cost saving), SRI is highly water efficient requiring much less water and resulting in a saving on costs of irrigation – this is especially critical for the drought-prone region of Khatlon where water availability for irrigation is often erratic and insufficient; and finally land preparation, where there is marginal cost saving of

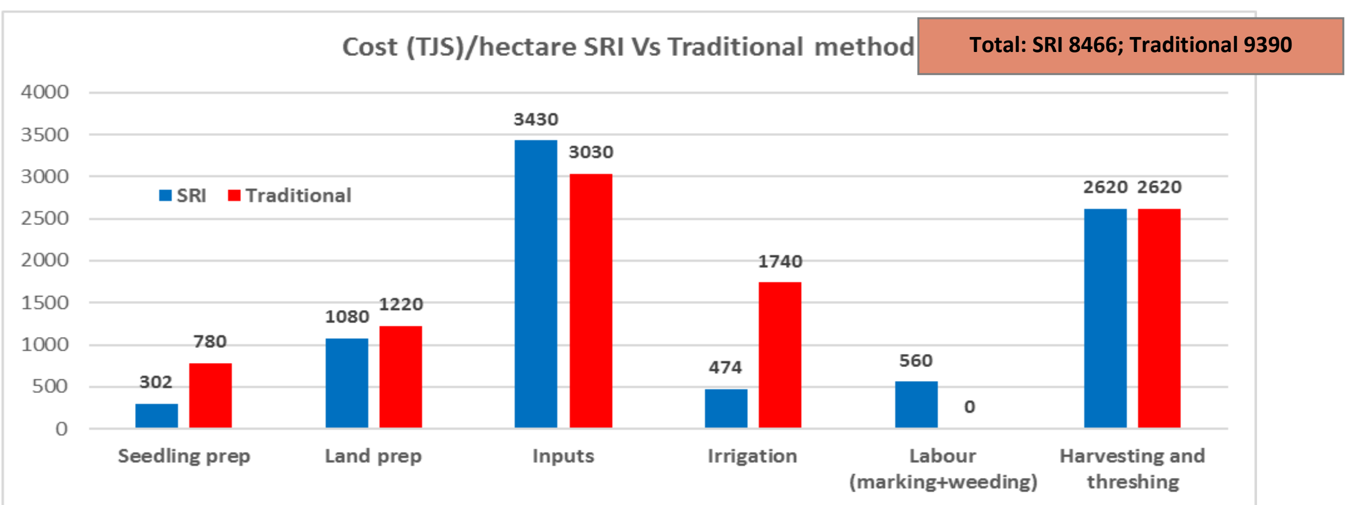


Figure 4: Cost comparisons.

[9] See Annex II for details of results analysis.

11 %. Although unlike the traditional method there is no ploughing in SRI, levelling of land is necessary with SRI farming, which incurs a consequent labour cost. However, in most cases this is a one-time cost that will not be required for future SRI crop cycles.

There is an overall increase in inputs cost for SRI of around 13 %, mostly due to the purchase and application cost of organic fertilizer (TJS 1,000 per hectare). This is due to the lack of a competitive market in the region for organic input. The cost of main fertilizers (N+P+K) was the same for both plots, while traditional methods incurred additional expenses for herbicide application. There was no chemical pesticide used on the SRI plots, which also offers major environmental benefits from the new method. Overall labour costs in SRI were higher due to the additional cost of field markings and weeding.

Analysis of environmental cost

SRI offers huge environmental benefit compared to traditional methods of rice cultivation, making it a clear winner in terms of environmental sustainability. There are both short and long-term impacts of SRI versus traditional methods, where the former entails a net saving in water requirement (more crop per drop), less use of chemical fertilizers and elimination of chemical pesticides, which together shows a demonstrable positive impact on soil health, improved agricultural productivity and enhanced crop performance. As the trial results show, SRI reduced water demand to less than a third compared to traditional methods; use of organic matter shows clear improvement in soil quality, and elimination of pesticides shows enhanced resilience of crops to drought and pest attack.

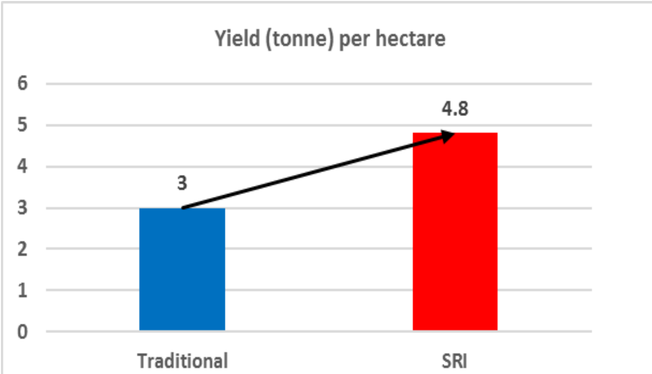
Photo: Oxfam in Tajikistan

Furthermore, based on global experiences of SRI, it can be assumed that in the long-term, SRI techniques will contribute to a reduction in greenhouse gasses (GHGs), with less methane emission from the flood irrigation of paddy fields traditionally used, and will stimulate regeneration of local biodiversity.

Analysis of yield, revenue and RoI

SRI shows a major increase in productivity of 60 % over the traditional method. The net yield of rice from traditional methods was only 3 tonnes per hectare compared to 4.8 tonnes from the SRI (Figure 5). This is despite the challenges of first-time experiment, using plots and skills of traditional rice growing farmers and with limited availability of high-level expert advice on SRI in the country.

There was a corresponding jump in the sales revenue realized by the farmers (assuming the same sale price for both SRI and non-SRI rice) from TJS 19,500 per hectare to TJS 31,200; an increase of 60 % (Figure 6). Since there is a limited market for organic rice in the country, the full potential sale price of the SRI rice is untapped, but in a competitive market for organic rice, its sale price would be much higher.



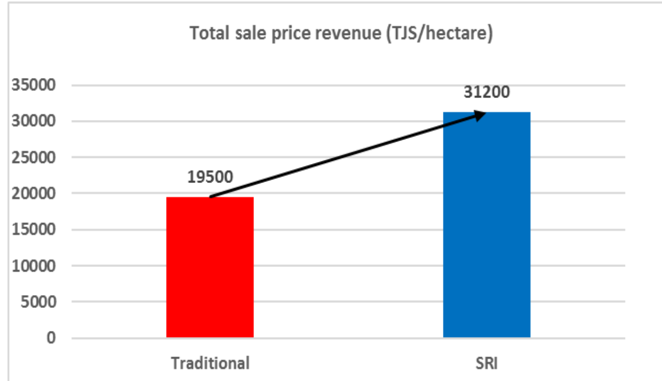


Figure 5: Yield.

Figure 6: Price revenues.

The most important measure of financial benefit, the RoI, which takes into account cost and benefit for SRI versus the traditional method, shows a big 2.5 times increase with SRI (268%) compared to traditional methods (107 %) (see Figure 7). This means that the net return to farmers employing SRI cultivation techniques is more than 2.5 times the cost, while in traditional techniques, the farmer is getting only a marginal return of 7 % over and above all their expenses.

Photo: Oxfam in Tajikistan

It is important to highlight that the above results have been derived from a small-scale trial carried out in a limited geography, which was also adversely affected by unusually hot weather conditions and water scarcity that year, which may have tempered the results. Furthermore, most of the Village Advisory Model (VAM) agronomists who were supporting and participating in the trial lacked experience in SRI, which resulted in periodic technical missteps that may also have skewed the results. Therefore, it is acknowledged that for more robust evidence on the effectiveness of SRI techniques in the context of Tajikistan, a larger-scale scientific trial, spanning multiple cropping seasons and covering diverse agro-climatic zones of the country, is essential to standardize the package of practice.

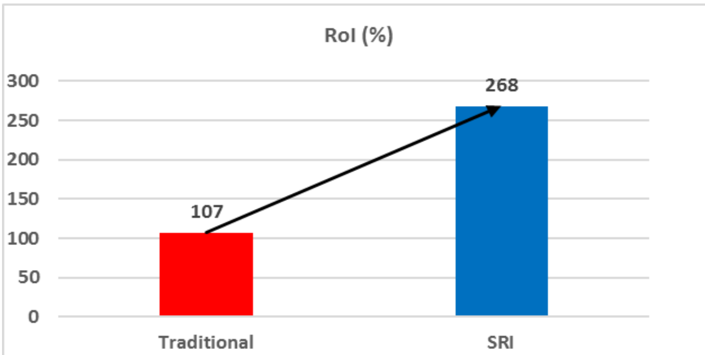
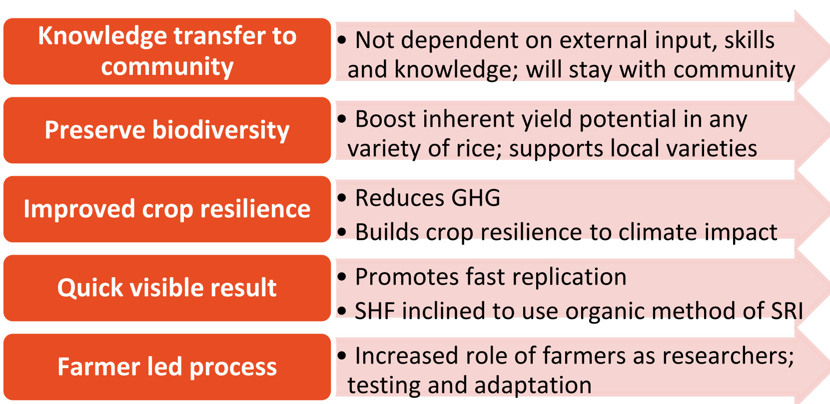


Figure 7: RoI.

6. Conclusion and next steps

The preliminary results from this SRI pilot study suggest that Oxfam's mission to overcome poverty in Tajikistan would receive a major boost from the widespread adoption of SRI farming techniques. Improving production of food grain will address food security, increase income and fortify the resilience of SHFs, many of whom are women. SRI is based on sound agro-ecological principles, which is crucial for a climate sensitive, ecologically fragile country like Tajikistan. A summary of SRI alignment with Oxfam goals is presented in Figure 8. There are challenges for farmers in the initial adoption of environmentally sound practices; however, these could be overcome with increases in the provision of robust extension services.

Figure 8: SRI alignment with Oxfam goals.



The implications arising from the potential large-scale adoption of SRI over the traditional method of rice cultivation in rural areas of Tajikistan needs deeper analysis over the coming years. The agricultural production system in Tajikistan is deeply embedded within the broader reality of existing social norms where gender relations play an important role in reinforcing or challenging existing power structures in households and communites. The agriculture economy of Tajikistan is in a state of transition with new laws and policies framed to improve access to land and allow farmers relative freedom to grow crops of their choice. This provides opportunities to farmers to expand and diversify their livelihoods. On the other hand, the large-scale male migration from the countryside, mainly to Russia, has led to a large proportion of female-headed households. This has, in many cases, increased the burden on women of unpaid care work. Against this backdrop, SRI may disrupt the existing division of labour in the rice production system, which is currently male dominated, towards more equitable participation of women in the cultivation process. SRI introduces new production methods where many activities, like raising seedling in nurseries, transplanting and weeding, may be performed by women, resulting in an overall increase in their workload. With increased role for women in cultivation, men may potentially be further alienated from agricultural activities (Box 1). The existing power dynamics in gender relations in rural households is such that increased contribution of women in labour may not translate into increased decision-making power for them in the near future. Furthermore, because of the limited freedom on mobility and decision-making power available to women, they may face constraints in organizing labour for SRI, especially in the absence of men. However, one may hypothesize that dynamic interactions between these factors will stimulate a directional shift in the gender role, where women may begin to claim a greater share in the contested space of household decision-making. In this scenario, Oxfam can help play the role of a facilitator, supporting a process where gender norms co-evolve with changes to the rice production roles.

Follow-up on SRI trial

After the successful trial of SRI methods for rice cultivation, Oxfam is now seeking to scale-up the model in three distinct stages:

1. Expand field trials in four locations spread over the Panjakent and Khatlon oblast.
2. Scale-up the model in select districts where Oxfam has an active presence in the agriculture sector.
3. Disseminate the trial results at national and regional levels to generate interest and possible replication.

To raise the awareness of this innovative step in the Tajikistan agriculture sector, a series of events is planned in Khatlon, and at a national level, to share the results with key government departments, partners and development agencies. The communication materials, including a video of the SRI methodology, will be finalized for sharing broadly with stakeholder agencies.

Box 1: Gender dimension in SRI versus traditional rice cultivation: Experience and lessons from Vietnam

Historically, female and male farmers in Vietnam share many of the tasks in conventional rice farming. Men, however, generally perform land-preparation tasks, while seedling preparation and weeding are commonly assigned to women. All others – harvesting, uprooting, transplanting – are generally shared tasks. These divisions of labour have not significantly changed with the adoption of SRI methods, although there is indication that transplanting and uprooting tasks are being increasingly left to older women farmers with lessening assistance from male farmers. The study also shows that the volume and heavy labour components of uprooting and seedling preparation have lightened, and as a result, have provided women with more time for domestic work, paid work on other farms and backyard livelihoods. On the other hand, for men, land preparation tasks have become more intensive due to the need for more meticulous seedbed preparation tasks, while weeding has also taken up more time from women.

Female adopters reported that the savings from purchasing seeds and fertilizers was a chief benefit they derived from practising SRI farming, while both female and male adopters agreed that higher yields, decreased labour input in transplanting, and the reduction of the risk of crop failure during longer dry periods were other noteworthy benefits. Adopters, however, also cited more weeding, heavier land preparation tasks and more complicated water management and transplanting procedures as the downside of SRI farming. Some female heads of households are particularly disadvantaged since they have less access to male labour for land preparation and rely heavily on reciprocal exchange labour arrangements. These arrangements do not always guarantee that the exchange co-workers have knowledge of SRI methods. The decision to adopt SRI farming was less contentious between women and men, contrary to earlier expectations. Most female adopters reported that their husbands supported their decision to use the new technology. Some early adopters were able to convince sceptical spouses through the evidence of higher rice yields. In other cases, husbands seemed to care less about farming in general, including SRI, probably due to improved incomes that were coming from non-farm occupations.

Source: Bernadette P. Resurreccion & Edsel E. Sajor (2008). *Gender Dimensions of the Adoption of the System of Rice Intensification (SRI) in Cambodia*. Oxfam America


Photo: Oxfam in Tajikistan

Next steps

As mentioned at the outset, this Oxfam SRI initiative was conducted under the broader programme framework of System for Crop Intensification (SCI). Based on the principles of SRI, Oxfam is looking to conduct field trials with two additional crops in the Kulyab region: wheat starting in the November season of 2018, and leguminous plants in the following year. In different parts of the world, the application of SRI principles and technology to crops like wheat and sugarcane have shown very promising results, much like those seen with rice. Since wheat is the principal food grain of Tajikistan and the Khatlon oblast, Oxfam plans to carry out an expanded version of this trial spread over the entire northern part of Khatlon.

To augment the technical resources, Oxfam will capitalize on existing knowledge platforms between India and Tajikistan, drawing on the expertise of India to help build the research and technical capacity of agricultural institutions in Tajikistan to take up SCI on a large-scale.

Oxfam will partner with organizations interested in food-security programming to build a core partnership base to expand the scope and scale of the SCI programme. The ongoing partnership with institutions on SCI will be expanded with a focus on advocacy for the SCI approach with the agriculture department of the government of Tajikistan. With further technical and financial assistance, Oxfam will look to establish a resource centre in the department to anchor country-wide trials and implementation of SCI.

Oxfam visualizes a central role for technology in the dissemination and replication of agriculture best practices in a cost-efficient manner for the future development of SCI agriculture. In recent years, the agriculture programme has extensively promoted extension services and market information through IT networks, with partners playing a key role. To further increase the use of technology, Oxfam will seek to collaborate with new-age development agencies[10] that have experience of harnessing the power of IT to expand new technologies and best practices in agriculture development.

[10] One example is Digital Green, a global development organization that empowers smallholder farmers to lift themselves out of poverty by harnessing the collective power of technology and grassroots-level partnerships. Website: http://www.digitalgreen.org/

Annex 1: Fact sheet from SRI

SYSTEM FOR RICE INTENSIFICATION (SRI): QUICK FACT SHEET

A Climate-Smart Methodology enhancing • Productivity • Water Conservation • Livelihoods • Biodiversity • Resilience to Climate Stress • Environmental Quality

1. INTRODUCTION

SRI technology originated in Madagascar to raise rice productivity and reduce poverty and is now benefitting Small Holder Farmers (SHFs) in 50 countries. SRI modifies conventional practices of paddy cultivation by managing plants, water, soil and nutrients in more effective ways, which raises the productivity of the available land, labour, water and energy and enhances food security for vulnerable SHFs. As rice is one of the main food crops in Tajikistan, adoption of SRI methods can reduce demand for irrigation water, seeds and fertilizers while improving yield and protecting the environment.

Six basic management principles in SRI:

1. Transplant young seedlings when 8–15 days old
2. Plant seedlings singly and avoid trauma to the roots
3. Give optimally wider spacing
4. Avoid continuous flooding of paddy fields
5. Actively aerate the soil
6. Enhance soil organic matter

2. METHODOLOGY OF SRI PRACTICE

2.1 Transplant the young seedling when 8–15 days old: In the SRI method, seedlings that are 8–15 days old are transplanted directly in the field. This preserves their potential for tillering and rooting, compared to the conventional method of transplanting, which transplants seedlings after 20–30 days. The small nursery area and short growing period for seedlings allow farmers to schedule their nursery preparation only after they have confirmation of arrival of summer rain for the season.

SRI nursery

Land preparation

Transplanting of seedlings

2.2 Plant seedlings singly and avoiding trauma: Seedlings are transplanted quickly, within 15–30 min of gentle removal from nursery. They are carefully transplanted at the shallow depth of 1–2cm. Unlike the conventional method where seedlings are transplanted under flooded conditions, in the SRI method, seeds are transplanted into optimally moist soil. They do not experience shock, which impedes growth.

Photos: Oxfam in Tajikistan

2.3 Give optimally wider spacing: Seedlings are spaced widely, at least 25 x 25cm, and in some cases, if soil fertility is very good, even 50 x 50cm, and in a square pattern, rather than in rows. Transplanting a single plant per hill radically reduces the plant population by 80–90%.

Line transplanting

Single plant per hill

2.4 Avoid continuous flooding: Optimum water management for SRI is to alternate drying and wetting, which avoids continuous flooding of paddy fields and minimizes the water requirement for paddy cultivation.

2.5 Actively aerate the soil: The soil is actively aerated, and weeds are removed using mechanical weeder, such as rotating hoe or cono-weeder

2.6 Enhance soil organic matter: Application of organic matter or compost is highly encouraged to improve the soil's organic matter. The principle 'feed the soil and soil will feed the plant' is a sound management strategy to develop the soil ecosystem.

3. SOME ADVANTAGES OF SRI PRACTICE

Less water: Yield can double or more with only half as much water.
Higher yield: Higher crop production per hectare and per day/hour of labour.
Environmental benefit: Reduces agro-chemicals and methane emissions, reduces extraction of water.

Annex II: Results from SRI field trial

PRELIMINARY RESULTS FROM SYSTEM OF RICE INTENSIFICATION (SRI) DEMO - PLOTS J. RUMI DISTRICTS, Khatlon (year 2018)							
№	Item	SRI Technology					Traditional
		Jamoat Guliston Village Maskva Shodiev Nurmuhammad	Jamoat Frunze Village Hosilot Azamov Khurshed	Jamoat Madaniyat Village Smidt Hasanov Muhammad	Jamoat Madaniyat Village Mehnat Sherov Kholmumin	SRI	
A	SEEDLING PREPARATION						
1	Land area for preparation of seedling	0.02	0.02	0.02	0.02	0.08 (ha) / (ra)	N/A
2	Field area for transplanting of seedling	0.25	0.25	0.25	0.25	1 (ha) / (ra)	1 (ha) / (ra)
3	Data of planting for seedling	5/17/2018	5/18/2018	5/17/2018	5/23/2018	4 days 4 руз	N/A
4	Data of transplanting of seedling to the field	26/27/28.06.2018	03/04/05.07.2018	28/29/30.06.2018	01/02/03.07.2018	12 days 12 руз	N/A
		Cost (TJS)	Cost (TJS)	Cost (TJS)	Cost (TJS)	Cost (TJS)	Cost (TJS)
1	Select good seeds Qizil-Qiltig (28kg x 6,5s = 182som)	45.5	45.5	45.5	45.5	182	780
2	Labor force for preparation seedling area (1 person * 30 som)	30	30	30	30	120	N/A
B	LAND PREPARATION						
1	Plowing-0.25ha (machinery, disel)	155	155	155	155	Total SRI	620
2	Level the field 20som per person one day	150	150	150	150	600	600
3	Mark the field with grids 20som per person one day	20	20	20	20	80	N/A
4	Transplanting seedlings 20som per person one day * 5 person = 100som	100	100	100	100	400	N/A
C	USING MINERAL, ORGANIC FERTILIZER, HERBICIDE AND FUNGECIDE						
1	Mineral fertilizer (N+P+K)	570	570	570	570	2280	2280
2	Service for mineral fertilizer (5 per 30s*1 day = 150 som)	37.5	37.5	37.5	37.5	150	150
3	Organic fertilizer	250	250	250	250	1000	N/A
4	Herbicide	N/A	N/A	N/A	N/A	0	600
D	WATER MANAGEMENT (3 days wet 7 days dry)						
1	Watering (37000 cube per ha/30% = 11 100 for 0.25 ha=225som)	56	56	56	56	224	740
2	Watering (1 person 1ha /250som)	62.5	62.5	62.5	62.5	250	1000
E	EQUIPMENTS						
1	Using rake equipment for grids field 1 person *50s*1day=50som	50	50	50	50	200	N/A
2	Using equipment for weeding control 4 person*30*3=360som	90	90	90	90	360	N/A
F	HARVESTING						
1	Harvesting- 50som per person one day * 10 person = 500som	125	125	125	125	500	500
2	Transortation cost from the fields to home - 600 som	150	150	150	150	600	600
3	Using machine for separate straw from rice- 1 520som	380	380	380	380	1520	1520
FORECAST YIELD (Tonne)							
Using SRI methods. Harvest per ha/8 ton*60% = 4t 800kg						4.8 tonne/ha	
Traditional method non SRI. Harvest per ha/5 ton*60% = 3ton						3 Tonne/ha	
FORECAST REVENUE (TJS)							
SRI Rice (selling in local market - 1kg * 6,5s (10 ton * 6,5s= 31 200 som)						31200	
Traditional method rice (selling the in local market - 1kg * 6,5s (3 ton * 6,5s= 19 500 som)						19500	
Return on Investment (RoI), %: Revenue-Investment/Investment*100						268	107

Annex III: Operational plan for SRI pilot

OPERATIONAL PLAN PILOT OF SYSTEM OF RICE INTENSIFICATION (SRI) IN BALKHI DISTRICT OF KHATLON OBLAST, TAJIKISTAN						
Activity No	Activity description	Target indicator	Methodology	Responsible	Timeframe	Progress and comments
1. Consultations and preparations						
1.1	Team orientation and brainstorming	The team is technically aware of the approach; SRI adaptation to Khatlon context (including technical and nontechnical aspects); Detailed action plan is developed;	Video materials, workshop and discussions	Project Coordinator	April 1 - April 10	
1.2	Selection of land for demonstration plots as well as control plots (4 demo-plots)	4 demonstration plot lands are selected in Balkhi; including 4 control lands; Land owners (farmers and VAs) agree with all conditions; Agreements signed with landlords;	Pre-defined criteria; field monitorings; discussions with landlords	Agronomist	April 10 - 15	
1.3	Procurement of input, tools and equipment (Oxfam will provide input, landlord will provide land, labour and all taxation costs, landlord will also make sure all documentation, landlord will benefit from final harvest;)	Required input for 4 demo-plots and entire production season is purchased, including visibility signs; All tools and equipment will be handed over to VAs;	Procurement process	Project Coordinator	April 15 - May 5	
1.4	Formation of core working group (Govt, ministries, institutions, I/ NGOs etc) who will participate within all stages of pilot	Core working group of experts is formed	Official letters and face-to-face discussions	Programme Leader	May 1 - May 10	
1.5	Preparation of initial materials (technology card, demo-plot record books, audio-video materials etc)	Revised technology card based on SRI method is developed; demo-plot record books developed and relevant personnel trained	Review of traditional technology card based on innovative methods and techniques of SRI	Agrinomist	April 26 - May 15	
1.6	Round Table in Balkhi district to kick-start the pilot	Kick off meeting; seedling production start	Core group, target farmers and local authorities will participate; First half presentations, second half field work (seedling production)	Project Coordinator	May 15 to May 20	
2. Land preparation						
2.1	Soak the field for 5 days before plowing	field ready for transplanting	Traditional method	Farmer	May 10 - May 15	
2.2	Harrow 2-3 times with 2-3 day pause (water and soil mixture)		Traditional method	Farmer / Agronomist	May 15 - May 25	
2.3	Fertiliser application (or chemical equivalent)		Organic fertilisers / pesticides	Farmer / Agronomist	May 25 - May 30	
2.4	Field levelling to allow water reach all areas (including formation of water ditches)		Traditional method	Farmer / Agronomist	May 25 - May 30	
2.5	Mark the field with grids (25 x 25 and 30 x 40)		Using new tools (local made)	Farmer / Agronomist	June 1 - June 10	
3. Seedling preparation (nursery)						
3.1	Selection of good seeds (by soaking seeds in salt water)	Seedlings ready for transplanting	Use only drowning seeds	Farmer / Agronomist	May 15 to May 20	
3.2	Sow seeds in seedbags and portable plates (with a mixture of soil, compost and chicken manure)		Nursery	Farmer / Agronomist	May 15 to May 21	
3.3	Spraying of organic fertliser after 2 days of sowing (spray organic pesticide if required)		Nursery	Farmer / Agronomist	2 days after sowing	
3.4	Daily watering of nursery		Nursery	Farmer	Daily for 8 - 15 days	
4. Innovative transplanting						
4.1	Plant one seedling at each intersection (hills)	Seedlings are transplanted	Before the third leaf appears; at shallow depth of 1-2 cm; allow not more than 30 mins from seedbed to transplanting;	Farmer / Agronomist	June 1 - June 10	
5. Intermittent irrigation						
5.1	Irrigation in cycles (3 days wet, 7 days dry)		3 days wet, 7 days dry (can be modified); begin after 10 days of transplanting;	Farmer / Agronomist	June 20 - June 30	
5.2	Continious irrigation (when cracks apper)		Keep thin layer of 1-2 cm water; irrigation should stop from 1-2 weeks before harvest;	Farmer / Agronomist	June 30 -	
6. Rotary weeding						
6.1	Rotary weeding with special equipment (local made)	remove all weeds and turn them into green manure	weed 10-12 days after transplanting; repeat 2-3 times every 10-12 days;	Farmer / Agronomist	June 15 - July 15	
7. Final stages and products						
7.1	Harvesting through traditional methods	Rice is harvested	Traditional method	Farmer / Agronomist		
7.2	Analysis of demo-plot record books, including control plots		through pre-designed MIS	Farhod / Seyed	September end	
7.3	Field research report describing the process and outcomes in detail	Report of pilot		Farhod / Seyed	September end	
7.4	SRI Technology card (step by step guide, costs, recommended amounts and timeframes etc)	Technology card developed		Abbos / Farhod	September end	
7.5	Rice Production Technology through SRI (training manual handbook)	Training manual handbook		Abbos	September end	
7.6	Rice Production Technology through SRI (training manual DVD)	Training manual DVD		Videographer	September end	
7.7	Round Table in Balkhi district to present the final results of the pilot	Results of pilot, recommendations and next steps	Core group, target farmers and local authorities will participate; First half presentations, second half field work (seedling production)	Farhod / Seyed	September end	

Annex IV: List of agencies who participated in the SRI trial

No	Name of agency	Contact person
1	Ministry of Agriculture of Republic of Tajikistan	Suhrob Naimov
2	Academy of Agriculture Sciences of Republic of Tajikistan	Dilovar Sherali
3	Tajik Agrarian University	Professor Gulov Saidali
4	Department of Economic Development and Trade of Khatlon Oblast	Davlatkhuja Mirzoev
5	Department of Agriculture in Khatlon Oblast	Sirojov Mehnatullo
6	Department of Agriculture in Balkhi district	Ghulomov Jamoliddin
7	Department of Economic Development and Trade of Balkhi district	Mamadov Khursand
8	Madaniyat Jamoat of Balkhi district	Quvatov Nurali
9	Frunze Jamoat of Balkhi district	Zokirov Tojiboy
10	Guliston Jamoat of Balkhi district	Mirzoev Ahmadjon
11	Mountain Societies Development Support Programme (MSDSP) AKDN	Jiyonkhon Zulfiev
12	SAROB Cooperative	Abdusalomova Chamangul
13	Water Users' Association "Zarnissor" of Balkhi district	Dodarbekov Abdusalom
14	Water Users' Association "Nahri Dusti" of Balkhi district	Saifulloev Abdullo
15	Water Users' Association "Guliston-S" of Balkhi district	Savlatov Turra
16	Local agriculture specialist / village advisor	Boymurodov Abdughaffor
17	Local agriculture specialist / village advisor	Yusupov Eshtemir
18	Local agriculture specialist / village advisor	Samiev Ibrohim
19	Local agriculture specialist / village advisor	Hasanov Muhammad
20 21	Rice producer cluster of producer groups in Balkhi district	Shodiev Nurmuhammad

22	**Rice producer cluster of producer groups in Balkhi district**	**Sherov Kholmumin**
23	**Rice producer cluster of producer groups in Balkhi district**	**Azzamov Khurshed**
24	**Rice producer cluster of producer groups in Balkhi district**	**Kurbonov Fazliddin**
25	**Rice producer cluster of producer groups in Balkhi district**	**Musoev Mahmurod**
26	**Rice producer cluster of producer groups in Balkhi district**	**Boymirzoev Shavkat**

Photo: Oxfam in Tajikistan

DISCLAIMER:

The Towards Rural Inclusive Growth and Economic Resilience (TRIGGER) project was implemented by Oxfam GB in Tajikistan along with Deutsche Gesellschaft für Technische Zusammenarbeit (GIZ) and the financial support of BMZ.

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PREPARED BY:

Seyed Faiz Hayat – Economic Justice Programme Manager, Oxfam GB in Tajikistan

CONTRIBUTORS:

Farhod Khalikov – Deputy Economic Justice Programme Manager, Oxfam GB in Tajikistan
Kiyomiddin Izzatov – Marketing Specialist, Oxfam GB in Tajikistan
Abbos Karimov – Programme Officer, Oxfam GB in Tajikistan
Jumaboi Gulmadov – Agronomist, Oxfam GB in Tajikistan

EDITED BY:

John Smythe – Business Development Analyst, Programme Funding Team, Oxfam GB
Jonathan Puddifoot – Head of Business Development, Oxfam GB