IMPROVING WATER AND LAND PRODUCTIVITY OF MARGINAL FARMS IN CENTRAL ASIA: LESSONS FROM THE “BRIGHT SPOTS”

AMELIORATION DE LA PRODUCTIVITE DE L’EAU ET DE LA TERRE DES FERMES MARGINALES EN ASIE CENTRALE : LEÇONS APPRISES “DES ENDROITS SPECIAUX”

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ABSTRACT

Land degradation of agricultural areas in Uzbekistan and Turkmenistan, specifically due to soil salinization, has resulted in significant declines in agricultural productivity. This study builds upon previous limited work on ‘Bright Spots’ by focusing on specific farming enterprises in the two target countries. The objective of this study was to identify factors that contributed to the enhanced performance of ‘Bright Spots’ in each of the target countries and based on this evaluation assess possible options for expansion and out-scaling of ‘Bright Spots’ to larger areas. The analysis confirms that while the resource endowment in terms of quality of land was almost identical for both the ‘Bright Spots’ and Control objects studied, the performance of the former was superior with respect to productivity and profitability. An analysis of biophysical and economic indicators of ‘Bright Spot’ farms in Uzbekistan indicated that the profitability of cotton production was predominantly dependent on inputs to the production system that had a significant impact on groundwater depth below the soil surface. In order to out-scale ‘Bright Spots’ innovative approaches in addressing existing knowledge gaps that link the products of research, and in this case ‘induce innovation’, with the majority of beneficiaries are required. This may take the form of creating linkages between farmers, researchers and markets through the formation of learning alliances. In addition, the development of enabling policies that address issues related to inequitable access to land and resources that would enable farmers to invest in rehabilitation is required. The provision of incentives which trigger private investment in rehabilitation would potentially stimulate

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individuals into addressing resource degradation. This would require access to financial instruments to enable investment to take place.

Key words: *Marginal farms, Central Asia, water and land productivity, Bright spots, socio-economic indicators.*

RESUME

La dégradation des terres agricoles en Ouzbékistan et au Turkménistan, en raison de la salinisation du sol, a abouti aux baisses significatives de la productivité agricole. Cette étude se base sur le travail entrepris dans le passé sur 'les Endroits spéciaux' en mettant l'accent sur les entreprises agricoles spécifiques dans les deux pays identifiés. L'étude vise à identifier les facteurs qui contribuent à l'amélioration de la performance des 'Endroits spéciaux' dans chacun des pays identifiés, et compte tenu de cette évaluation, examine les options possibles de l'expansion des 'Endroits spéciaux' sur les plus grandes superficies. L'analyse confirme que tandis que la dotation de ressource par rapport à la qualité de terre était presque identique pour tous les deux types de terre - 'les Endroits spéciaux' et les endroits de contrôle - la performance des premiers étaient supérieurs en ce qui concerne la productivité et la rentabilité.

L'analyse des indicateurs biophysiques et économiques des 'Endroits spéciaux' en Ouzbékistan indique que la rentabilité de la production du coton dépendait surtout des contributions du système de production qui avait un impact significatif sur la profondeur d'eau souterraine au-dessous de la surface du sol. En vue d'augmenter les Endroits spéciaux, il est nécessaire d'avoir les approches innovatrices pour remplir les écarts qui existent dans la connaissace pour lier les produits de recherche et la plupart des bénéficiaires.

Toutes ces activités exigent la création des liens entre les fermiers, les chercheurs et les marchés par la formation des alliances. De plus, il est nécessaire d'avoir les politiques qui abordent les questions telles que l'accès inéquitable à la terre et aux ressources pour permettre aux fermiers d'investir dans la réhabilitation. La disposition des incitations permettra à l'implication des investissements privés dans la réhabilitation. Cette mesure permettra aux individus de traiter la question de la dégradation des ressources. Cela exigera l'accès aux instruments financiers.

Mots clés : *Fermes marginales, Asie centrale, productivité de l'eau et de la terre, endroits spéciaux, indicateurs socio-économiques.*

1. INTRODUCTION

Sustainable development cannot take place without reversing land and water resource degradation. There is a critical need to enhance the livelihoods of rural communities before or in tandem with addressing natural resource issues. Recent studies indicate that sustainable rural livelihoods have become a significant challenge for households even in the most productive areas of Central Asia such as Fergana Valley (Nizamedinkhojaeva. 2006). While a more general picture of land and water degraded areas in the region would indicate that rural communities are trapped in a vicious cycle of deteriorating land and water quality, poor yields, declining incomes and purchasing power, increasing poverty, poor investments in land and water resource rehabilitation (Bucknell et al, 2003). There is also evidence that many communities in Central Asia do have considerable capacity to adapt to environmental degradation (Sherr, 2000; Ul-Hassan *et al*., 2005).

Without addressing constraints to livelihoods, the capacity and ability of individuals and communities to resolve resource based issues are however limited. A previous assessment of individual farmers and farming communities undertaken at a global and local scale, revealed that there are farmers and farming communities that are performing at significantly higher levels in terms of productivity and farm incomes than the average, while curtailing environmental degradation or coping with prevailing constraints (Pretty *et al*., 2006; Ul-Hassan *et al*., 2005). Such communities might pursue a variety of coping mechanisms to deal with environmental degradation and stress, and some communities might adopt strategies which, both improve natural resources *and* reduce household poverty by protecting and preserving the asset base, diversifying and improving on-farm production systems, or taking out credit to invest in future production or resource protection (Sherr, 2000; Ul-Hassan *et al*., 2005).

The term 'induced innovation' has been used to describe the ability of individuals and communities in overcoming both biophysical and social constraints in addressing livelihood issues (Leach and Mearns, 1996; Mortimore and Adams, 1999; Tiffen, 2002; Tiffen *et al*., 1994; Tiffen and Mortimore, 2002; Wiggins, 1995). It would appear that there are a range of mutually inclusive factors - or drivers, which influence the development of this 'innovation' that include how well societies adapt to rapid population growth, globalization, market development, technological change, climate change, and agro-ecological conditions (Kuyvenhoven and Ruben 2002; Lopez 1998; Mortimore and Harris 2005 Niemeijer and Mazzucato 2002; Pender *et al*. 2001; Scherr 2000). A key element in the argument for induced innovation is the development of markets or possibly, in the case of some of the newly independent Central Asian states, market liberalization, movement towards decentralized economies and land reform. Significant agricultural reform has occurred within the region, mainly targeted at 'privatizing' the large collective farms that were established during the Soviet era. These reforms include the establishment of smaller private and cooperative farms in order to improve the efficiency and equity of existing production systems. Land reforms generally trigger actions in key areas for pro-poor agricultural growth, by improving the incentives for land operators to invest in improved technology, and by increasing equity and hence elasticity in poverty reduction with respect to growth (Dorward, *et. al*. 2004).

Agricultural transition in the Former Soviet Union (FSU), particularly in Central Asia, has not been smooth. The reform efforts in the rural sector were thwarted by a lack of suitable markets and institutions. This resulted in increased barter trade, self-sufficiency policies and an increased role for the household in agriculture (Spoor, 2003). Therefore, the role of market forces in agricultural production is still very weak. The progress of agricultural reforms in Central Asia is dynamic and ongoing, quite complex in nature, and highly differentiated according to geographic locations (Spoor, 1997). The common weaknesses of agricultural reforms in Central Asia are institutional vacuums, lack of supportive legal frameworks and an absence of effective extension services (Spoor, 2003).

Within Uzbekistan, the move to privatize land through cooperative farming has, in the majority of cases, led to declining productivity and net incomes (Ul-Hassan et al., 2005). However, there are instances where privatized individual farms and smaller cooperative farms have capitalized on these changes and performed at levels exceeding the norm (Ul-Hassan *et al*., 2005). These have been termed 'Bright Spots' in the published literature and are characterized by individuals or communities that have made changes, which have led to a reversal of land and water degradation (Scherr, 2000) while enhancing livelihoods and thus, represent an example of Boserup's (1965) induced innovation. A global assessment of the impact of documented 'Bright Spots' has recently been published indicating the extent and impact of these productivity enhancing approaches on food security and water productivity, carbon sequestration and reduced pesticide applications (Pretty *et al*., 2006).

There is evidence (cf. Scherr, 2000) that the 'downward spiral' in livelihoods and resource degradation is both avoidable and reversible in many circumstances, if public policies are supportive, as these can positively influence micro-scale factors that determine how farmers adapt to environmental pressures. Due to the transition from central planning to a market economy, Central Asian farmers have seen a myriad of policy changes since independence. The simultaneous changes in many policies had severely affected their understanding of the operating environment, as well as the opportunities that arise associated with these changes (Ul-Hassan, *et al*., 2005). These drastic changes also affected their access to key assets and resources. Thus, in addition to a dwindling and deteriorating resource base, Central Asian farmers have had to contend with, in most instances, unsupportive policies, weak or underdeveloped markets and monopolized service providers. In the context of emerging markets and evolving public policies, more pro-active policies and functional markets, supported by research and analysis, are needed to balance environmental and anti-poverty objectives simultaneously. Public policies could enhance access to, and the productivity of, poor people's natural resource assets and engage them as partners in public resource management. Such policies are yet at their formative stage in Central Asia, and only slowly emerging. Similar arguments have been forwarded by Kusters *et al* (2006), who assert that development interventions do not automatically reconcile conservation and development objectives. Rather, relevant agencies should formulate realistic objectives, and also consider the potential negative effects of their development interventions and policies. The downward trends in Central Asian environmental security, productivity and incomes in some of the newly independent States can thus be partly attributed to inhibitory policies and market barriers.

The 'Bright Spots' in Central Asia clearly indicate the potential of individuals and communities in overcoming inhibitory policies, market barriers, and other impediments without significant external assistance (Ul-Hassan, *et al*., 2005). The opportunity arises in studying the attributes of these 'Bright Spots' that pertain to their success and investigate the potential to expand them through knowledge transfer, influencing changes in policy and institutional structures.

As an extension to the previous limited study undertaken in 2004 by Ul-Hassan *et al*. (2005) in Uzbekistan's of cooperative farming systems, the current study has focused on 'private' farms in Uzbekistan and has been expanded to include Turkmenistan. The objectives of this study was to identify factors that contributed to the enhanced performance of 'Bright Spots' in each of the target countries and based on this evaluation assess possible options for expansion and out-scaling of 'Bright Spots' to larger areas.

2. MATERIALS AND METHODS

The term 'Bright Spot' refers to individuals, communities or households who have adopted practices and coping strategies to address resource degradation in a sustainable manner whilst maintaining or enhancing food security and income generation. An important attribute of these 'Bright Spots' is their reduced risk and vulnerability to the conditions framed by the external environment, such as governmental policies.

Uzbekistan: A multistage purposive sampling technique (Patton, 1990) was used to select the Bright spots and control objects that consisted of 5 stages in Uzbekistan. The five stages involve a logical progression in the selection process that is both quantitative and qualitative. The selection process focuses on the identification of farmers/communities that despite having similar biophysical constraints and operating under the same socio-economic and policy environment are performing above the average. The identification of individual 'Bright' spots is based on finding the most extreme external environment (land degradation) that prevails and therefore represents the most robust forms of 'Bright Spots'. This was achieved through the following steps.

Stage 1 – Identification of Provinces with the highest incidence of irrigated salinity: Using national statistics, data from the Ministries of Agriculture and Water Resources pertaining to the extent of salinized irrigated areas in each of the Provinces were reviewed. On reviewing a range of data sets from the Syrdarya Province was identified as having the highest level and extent of salinized agricultural land currently in production.

Stage 2 – Identification of the Administrative Districts within the selected Province, with the highest level of irrigated salinity: The focus of this stage was to identify the specific Administrative District in the selected Province (i.e. Syrdarya) where the identification of 'Bright' spots would be undertaken. Two criteria were used to identify the target District. Using National statistics on the extent of irrigated lands that are affected by salinity and an associated classification of land into salinity classes, the extent of saline soil within a District was determined (Table 1). In an assessment of Administrative Districts of Syrdarya Province, Mirzaabad District had the highest percentage of irrigated land that fell within the moderate and severely saline (57.6%) categories. Contrasting this, the Sayhunabad District had a mere 13.1% of its irrigated area that falls within the aforementioned range (Table 1).

Stage 3 – Assessment of soil quality at the Administrative District level: The criteria used in the assessment of soil quality are the Bonitet values. The Bonitet value is an effective qualitative and quantitative measure of the productive capacity of soils that is robust and is not prone to subjectivity (Ul-Hassan et al., 2005). It has a scientific basis and is a composite index that incorporates a number of biophysical factors. During the Soviet era production fields were assessed on a 5 year basis to determine their Bonitet values in order to set production levels for cotton and wheat to meet the 'plan' for the farming unit. The average Bonitet values as determined over two periods 1991 and 1999 for each of the Administrative Districts of Syrdarya Province are presented in Table 2. By comparing the changes in Bonitet values over the two periods, an assessment can be made on a qualitative basis of changes that have occurred to the resource basis, either positively or negatively.

Table 1. Classification of irrigated area into salinity categories in each of the 9 administrative Districts of Syrdarya Province. Values in table represent the % of irrigated area affected by different degrees of salinity and STD represents the standard deviation from the mean.

No.	District	Leached and low saline (2-4 dS/m)	Moderate saline (4-8 dS/m)	Severely saline (8-16 dS/m)	Miscellaneous Non classified land.
1	Akaltin	60.3	15.5	7.8	16.4
2	Bayaut	61.5	17.8	5.6	15.1
3	Sayhunabad	48.7	43	4.1	4.2
4	Gulistan	62.4	30.9	4.4	2.3
5	**Mirzaabad**	**36.9**	**45.9**	**11.7**	**5.5**
6	Sharaf Rashidov	66.0	5.6	21.3	7.1
7	Mekhnatabad	51.3	26.4	13.0	9.3
8	Syrdarya	60.2	17.1	5.7	17.0
9	Havast	55.7	25.2	9.2	9.9
	Mean (STD)	55.9(±8.5)	25.3 (±12.4)	9.2(±5.2)	9.2(±5.4)

Table 2. Mean Bonitet values for Administrative Districts of Syrdarya Province over two time periods, 1991 and 1999. STD is the standard deviation from the mean.

No.	Districts	Average Bonitet Grade 1991	Average Bonitet Grade 1999	Difference (±)
1	Akaltin	60	53	- 7
2	Bayaut	58	51	- 7
3	Sayhunabad	55	51	- 4
4	Gulistan	54	50	- 4
5	**Mirzaabad**	**46**	**42**	- 4
6	Sharaf Rashidov	49	45	- 4
7	Mekhnatabad	35	40	5
8	Syrdarya	66	52	- 14
9	Havast	44	45	1
	Mean (STD)	52(±9)	49(±5)	- 4

A comparison of the Bonitet values for Administrative Districts of Syrdarya Province over the period 1991 to 1999, indicated that Mirzaabad has the lowest Bonitet value in 1999 (42) having undergone a decline of 4 points since 1991 (Table 2). It is interesting to note that out of the nine Administrative Districts in the Province only two Districts (Mekhnatabad and Havast) showed a positive increase in Bonitet values between the aforementioned periods, suggesting that in the majority of cases there has been a steady decline in the productive capacity of land resources. As Mirzaabad had the highest overall percentage and total of moderate and severely salinized irrigated land, coupled with the fact that there has been a decline in the Bonitet value between 1991 and 1999, this Administrative District was selected to go forward into stage 4.

Stage 4 – Identification of communities with the lowest land quality (i.e. Bonitet) values within the targeted Administrative District: Communities in this case refer to villages that were formerly kolkhoz and sovkhoz territories under the former Soviet Union (FSU), that after the land reforms post-independence were re-structured into individual farming units. From a statistical perspective, most of the agricultural land and water information are disaggregated down to the community level or farm associations. Based on soil quality assessments of irrigated soils of Mirzaabad district using farmer associations, communities were selected wherein the search for possible 'Bright' spots would be undertaken. Within the old irrigation zone of Mirzaabad district the lowest Bonitet grade was observed for the Dekhkanabad Farms Association (42) based on data collected in 1997 (Table 3). It is to be noted that this farming association has undergone a dramatic decline in Bonitet value from 51 as determined in 1991 (Table 3). In the new irrigation zone, the lowest Bonitet grade was observed in the A. Kulbekov Farms Association (38) (Table 3). These two farmer associations were selected as target areas for the identification of 'Bright' spots and 'Control' objects for further studies as they both fall within the same irrigation command area.

Table 3. Soil quality assessment of farmer associations in the Mirzaabad District of Syrdarya Province (ha).

Name of Farms Association	**Badlands**		**Below average**		**Average**		**Good**		**Best**		**Total (ha)**	**Average bonitet grade**	
	I class	II class	III class	IV class	V class	VI class	VII class	VIII class	IX class	X class			
	Bonitet Grade											1997	1991
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100			
Ok-Oltin				129	820	840		256			2045	51	67
T. Akhmedov				267	1110			576			1953	51	51
Mirzachul				2575	804						3379	38	40
Tashkent				113	3161		259				3533	45	43
Dekhkanabad				**952**	**1100**	**195**	**55**				**2302**	**42**	**51**
G. Akhmedov				2407		877	182				3466	41	47
Beruni			1810	531		175					2516	38	42
Ulugbek				1351	210						1561	39	40
Dustlik				212	1161	334					1701	44	45
A. Kulbekov			**498**	**1005**		**44**	**91**				**1638**	**38**	**-**
K/H tehnikum				97							97	38	-
Total for District			2308	9639	8366	2465	587	832			24197	42	46

Stage 5 – The final step in the selection process is the identification of individual farmers from each of the target farmer associations: In the case of Dekhkanabad Farmers Association there are a total of 69 individual farmers that make up the association. Similarly, the A. Kulbekov

Association comprised of 74 farming units. Based on the following three criteria farmers were selected to go forward into a comprehensive assessment:

- crop (cotton-wheat) yield per Bonitet grade
- meeting the state quotas on a continuous basis
- positive reputation of the farm among local authorities and neighboring farmers.

Bright spot farms, 5 from each of the farm associations and an equivalent number of control objects were selected. Individual visits to each of the identified farms were undertaken and data on production levels was collected along with income generation.

Turkmenistan. Dashoguz Province is located in the northern part of Turkmenistan and was the focus of the study. It has a mean annual precipitation of 77 mm and is the most severally affected Province by irrigation induced salinity. Agricultural production in Dashoguz Province is based on irrigated wheat and cotton. The water source that feeds irrigation systems in the province is the Amu-Darya River. Collection of data in Turkmenistan followed a different approach. Here the focus was on individual farmers that had been identified as superior farmers (termed *Mulkdars*) and control objects that represent the average farmer productivity in the region. Selected data on yields of wheat and cotton were collected for the years 2003 to 2005 along with basic information on the production practices of farmers. This information although limited, does provide insights into the performance of individual farmers.

2.1. Statistical analysis

Descriptive statistics and relationship analysis were the main analytical tools used to describe differences between the two groups. In this respect differences in means and medians of variables between 'Bright' spots and Control objects were compared. These differences were compared using an unpaired t-test for means and the Mann-Whitney test as a non-parametric counterpart for comparing medians. The non-parametric Mann-Whitney test was the preferred test for significance since the data were from a small population and they did not conform to a normal distribution (Mullee, 2002). It is of note that an unpaired parametric t-test with a 95% confidence interval was used for comparisons, however, parametric tests assume a Gaussian distribution, which is difficult to verify for small samples (Motulsky, 1995).

The relationship and effects between variables were tested and approximated by a linear regression model and other suitable statistical models depending on the type of dependent and independent variables. The statistical program Statistix 7 (Analytical Software, 2005) was used to test relationships and approximate the effects.

3. RESULTS

3.1. General Characteristics

Uzbekistan: The Hungry Steppes ('Mirzachul') has the highest degree of salinity and land degradation in the country. Syrdarya Province falls within this region and, as discussed above, formed the focus for the identification of bright spots (Figure 1). The province has 279,100 ha of irrigated land, 89.9% of which is affected by varying degrees of salinity. The Province comprises nine administrative districts, the majority of which are under the state quota system for the production of agricultural commodities. Since the government plans to transfer all of the current agricultural producing areas to individual farms by 2008, the selected bright spots are currently held by individual farmers who have been farming under the changed policy for more than 3-5 years and can thus be described as 'quasi-private' since they are still required to operate under the quota system.

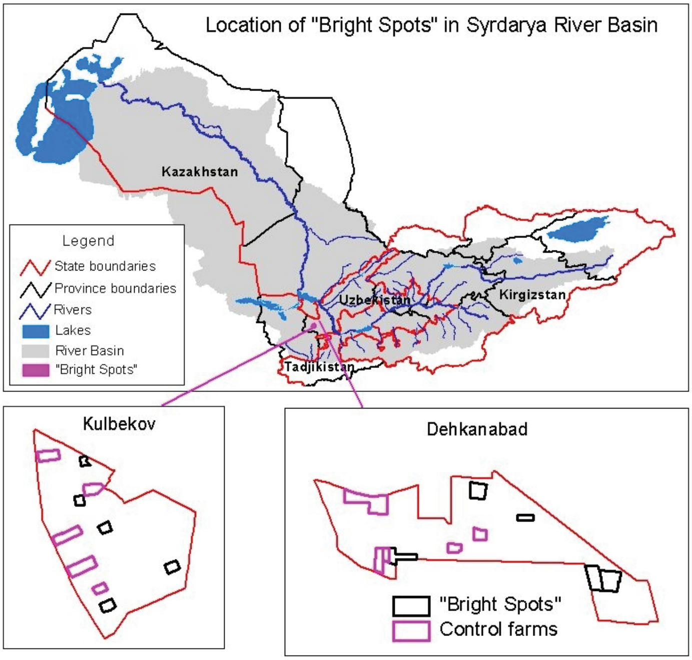


Fig. 1. Map showing the location of Bright spots and control object farms in the two farming associations in Syrdarya Province Republic of Uzbekistan.

'Private farms' in Uzbekistan are something of an anomaly, given that the state retains ownership of the land. Here, the management of the farming enterprise is privatized to an individual or a family. This 'manager' has to submit a business plan to the state, accept to produce the state-determined target level of outputs (only for cotton and wheat producing farms) of state-planned crops, agree to buy the inputs from state input suppliers, and agree to sell the target levels of outputs to state procurement organizations. The manager is free to decide on the levels of input use (water, labor, fertilizer, seed, machinery, pesticides and herbicides, etc.) and time of cultivation. All business has to be transacted through a state financial institution and transparent records have to be maintained. The farm is liable for inspection by state agencies responsible for agriculture, labor, taxation, and environment at any time. The 'private' farmers in Uzbekistan are best described as individual (as opposed to cooperative) agricultural producers rather than private farmers.

Turkmenistan: Dashoguz Province has the highest degree of land degradation associated with salinity in the country. In discussing the 'Bright' spots in Turkmenistan it is important to put into context the current farming systems. Since 1990 there has been a significant shift from collective farming structures to a more individualized agriculture within the context of so-called “peasants associations” (*daikhan berleshik* in Turkmen) where the collective and state farms have parceled out large fields to individual leaseholders (Lerman and Brooks, 2001; Lerman and Stanchin, 2004). The role of the associations is firstly, the “guardians” or “administrators” of state-owned agricultural land that is distributed to leaseholders for cultivation. Secondly, the associations are charged with maintaining rural infrastructure in the villages and they receive a certain payment from the leaseholders for this service. Thirdly, they are the conduit for transmitting state orders to the leaseholders and enforcing compliance (Lerman and Stanchin, 2004). As in the past, production targets for wheat and cotton are assigned to peasant associations; the association manager divides the overall quantities among leaseholders so that the full target is met or exceeded. These two commodities are sold exclusively through the state marketing organization (Lerman and Stanchin, 2004). Commodities that are not subject to state order, such as vegetables, milk or eggs are generally produced under different institutional arrangements on the family household plot (not on the leasehold) and are sold in the nearby market or through private traders (Lerman and Stanchin, 2004). The average size of these household plots is 0.2 ha.

The focus of the study is on leasehold farms that have an average size of 4 ha where cotton and wheat are grown under state order. The ‘Bright’ spots are drawn from an elite group of farmers called *mulkdars* (*mulk* meaning ownership). The identification of *mulkdars* was initiated in 1996 by the President of Turkmenistan to reward farmers who consistently outperformed the plan yield levels for this land over a period of three to four years. The identification of *mulkdars* is the responsibility of the hyakimliki (district governor) who verifies the performance of these farmers. Farmers who fall into this elite group are reward with land ‘ownership’ rights and in some cases, a small tractor from the President. Currently there are approximately 500 *mulkdars*. Control objects were selected from the same farmer associations and represent the poorest performing farmers.

3.2. Productivity characteristics

In the discussion that follows the outcomes from analysis are discussed within the context of each of the countries.

3.2.1. Uzbekistan

a. Crop productivity

Within the context of a planned agricultural commodity market, a key attribute of the ’state order’ system is the maintenance of detailed productivity records. Yields of cotton and wheat from individual farming units are meticulously recorded and maintained in order to make sure that planned quotas are met. This source of information allows one to determine how production of wheat and cotton has changed over time, particularly during the period prior- to and post-privatization. Yields of cotton and wheat were compared between the two groups of farmers prior to privatization (farmers under the Shirkat system of farming) with current productivity levels (Figure 2 and 3). During the Shirkat era there was little difference between the two groups with respect to cotton production, however, the ‘Bright’ spot group had higher production levels with respect to wheat (Figure 2). Post-privatization, yields of both commodities increased significantly (P<0.05) in the case of the 'Bright' spot group whilst yields tended to decline in the Control objects (Figure 2 and 3). This would suggest that both groups were operating at the same productivity levels prior to the commencement of the privatization process and that with privatization the 'Bright' spot group achieved higher performance levels compared to the Control objects.

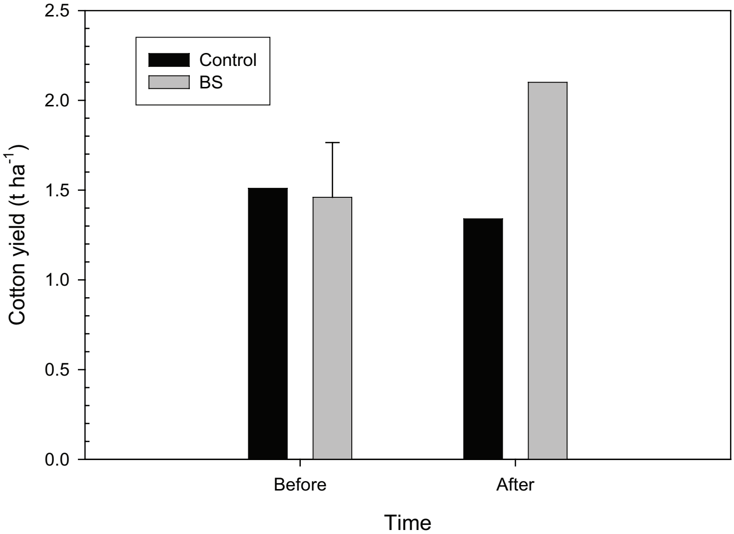


Fig. 2. Changes in cotton yield over two consecutive periods, pre- (Before) and post- (After) privatization for the 'Control' object and Bright spot (BS) farming systems in the administrative District of Mirzaabad, Uzbekistan. n=10; vertical bar represents the least significant difference (P<0.05) between population means.

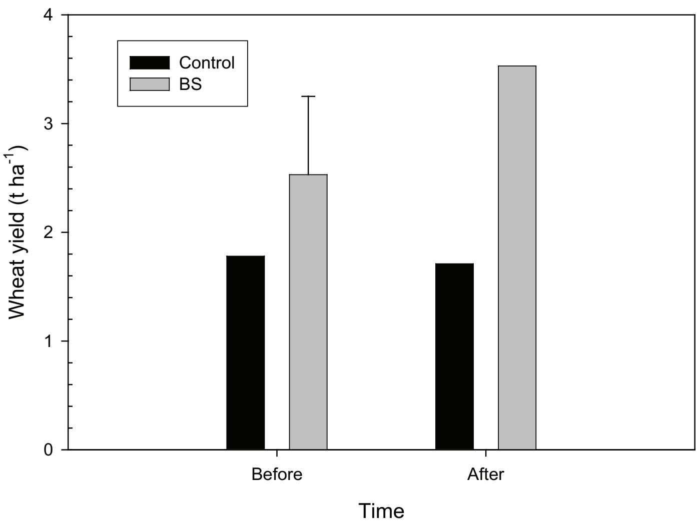
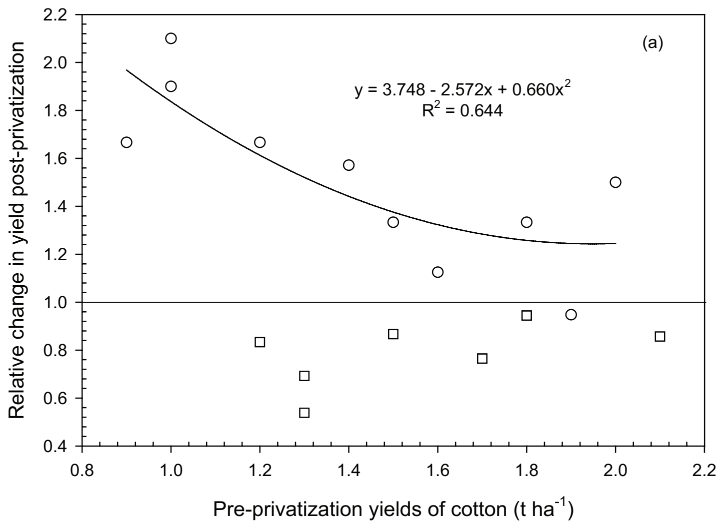


Fig. 3. Changes in wheat yield over two consecutive periods, pre- (Before) and post- (After) privatization for the 'Control' object and Bright spot (BS) farming systems in the administrative District of Mirzaabad, Uzbekistan. n=9; vertical bar represents the least significant difference (P<0.05) between population means.

The performance of individual farmers and variations between farmers and groups is succinctly described by plotting changes in relative yield of the two commodities against pre-privatization yields (Figure 4a and 4b). Values >1 represent an increase in yields post-privatization with <1 denoting a decrease in productivity. All of the Control objects realized relative yield declines post-privatization whilst, except for one case for each commodity, relative changes in yield for ‘Bright’ spots were >1 (Figure 4a and 4b). The relationships between relative change in yield versus pre-privatization yield for the ‘Bright’ spot group resulted in significant ($p>0.05$) coefficients of determination (R^2) suggesting a diminishing relative yield change the higher the initial pre-privatization yield. No such relationship was found for the Control objects (Figure 4a and 4b).



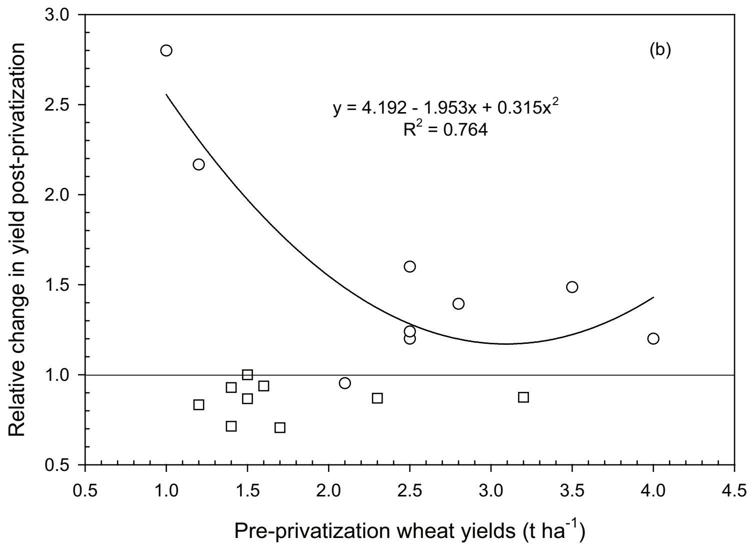


Figure 4. Relative change in yields of cotton (a) and wheat (b) post-privatization for the Control (□) object and ‘Bright’ spot (○) farmers with respect to pre-privatization yields.

In order to assess whether actual yields of cotton and wheat were significantly different between groups, an unpaired t-test and median test was performed on the data sets from the two groups. The statistics confirm the significantly higher yields achieved in both commodities on the 'Bright' spot farms compared to the control objects (Table 4). As the production of these two commodities is controlled under a quota system, production levels for each farmer are set and it is expected that the farmer will sell the requisite amount to the State at the end of the season. This level of production is termed the 'plan'. As discussed previously, the 'plan' level of production is based on the production capacity of soils and is generated using the average Bonitet value for the farm. Since the Bonitet values for the 'Bright' spot and control objects were similar, there should be no major difference in the 'plan' yields for both the groups. A comparison of the 'plan' yields for cotton and wheat between the two groups of farmers indicates that the means and medians did not differ significantly from each other (data not presented). Thus the expected 'plan' production levels of the two groups were similar. A comparison between the 'plan' and 'actual' yields achieved for the two groups, indicate that in the case of 'Bright' spots actual yields were significantly ($p>0.05$) higher than 'plan' yields for both commodities which was not the case in the Control objects (Table 4). This is important from an economic perspective as it predicates the viability of these farming enterprises. Farmers who are able to exceed planned quota levels are able to utilize the surplus to their own benefit. However, failure to meet plan target levels can have severe financial implications and possible revoking of land entitlements.

Table 4. Descriptive statistics and level of significances for relationships between 'plan' and actual yields of cotton and wheat yields for the two groups in Mirzaabad District, Uzbekistan. SD = standard deviation from the mean

Farmer group	Plan	Actual	Significances
Mean ± SD	**Cotton Yield (t ha^{-1})**		
Control object	1.49 ± 0.27	1.31 ± 0.36	0.228
Bright spot	1.72 ± 0.19	2.07 ± 0.40	0.024
Median (min; max)			
Control object	1.45 (1.10; 1.90)	1.30 (0.70; 1.80)	0.131
Bright spot	1.80 (1.40; 2.00)	2.00 (1.50; 3.00)	0.036
Wheat Yield (t ha^{-1})			
Mean ± SD			
Control object	1.73 ± 0.52	1.48 ± 0.54	0.319
Bright spot	2.07± 0.79	3.48 ± 1.06	0.006
Median (min; max)			
Control object	1.60 (1.30; 2.80)	1.30 (1.00; 2.80)	0.131
Bright spot	1.80 (1.00; 3.00)	3.10 (2.00; 5.20)	0.045

Whilst it is clearly evident that the performance of the 'Bright' spot group of farmers is superior to the Control objects, the question arises as to how these two groups relate with respect to the performance of the entire population of farmers from which these groups were derived?

To address this question data on cotton yields from the 120 farmers that make up the two Farmer Associations were assessed. The difference between mean actual and 'plan' yields per hectare for cotton was plotted against the 'plan' yield for all farmers (Figure 5). A total of 35% of farmers fell short of meeting the 'plan' yield target level, 19% met the 'plan' yield requirements and 46% of the farmers exceeded the plan target yields. This would suggest that less than 50% of farmers are exceeding their quota commitments and hence benefiting from the sale of production surpluses to markets that are not controlled by the state. However, as discussed previously if it is assumed that prior to the privatization phase the majority of farms were just meeting 'plan' production levels, it can be argued that with privatization a considerable number of farmers (46%) have increased production levels and are potentially benefiting economically from their efforts.

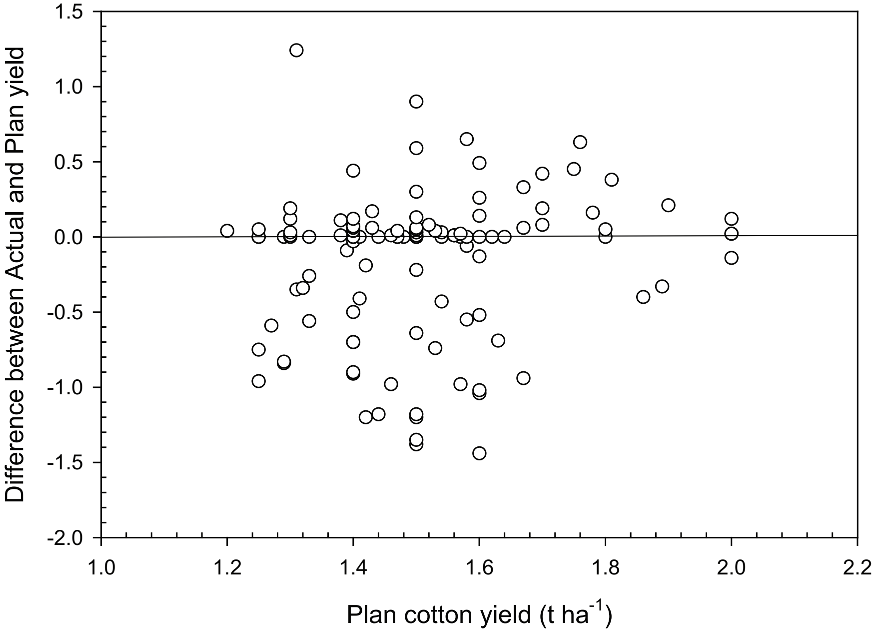


Fig. 5. Relation between the difference of actual and 'plan' cotton yields versus the 'plan' yields for 120 farmers in the two farming associations in the administrative District of Mirzaabad, Uzbekistan from which Bright spot and Control objects were identified. Data are from the 2005 growing season

b. Biophysical Characteristics

From the previous discussion clear differences in the productivity levels of the two groups of farmers are evident. Intuitively one could assume that the disparities in yield might in part be associated with differences in biophysical attributes between the two groups. Selected biophysical attributes including the areas of irrigated cotton and wheat; Bonitet value; soil phosphorus and potassium; soil organic matter; and depth to ground water table were analyzed to determine whether there were significant differences between the 'Bright' and control farmer groups (Table 5). It is of note that the mean areas cultivated to each crop and labor per irrigated area were not significantly different between the two groups suggesting that the size of irrigated area and number of laborers were similar (Table 5). The Bonitet values for each of the groups are virtually the same (Bright spot 42.5(±4.6) and control object 41.2(±3.1)) suggesting from a biophysical perspective the productivity potentials of each of the groups were virtually identical (Table 5). Furthermore there were no significant differences between the 'Bright' spot and control object farms in soil organic matter contents, soil phosphorus and potassium (Table 5) indicating that soil biophysical attributes were the same between the two groups and therefore may not have contributed to differences in the performance of the two groups.

Table 5. Descriptive statistics and level of significances for selected biophysical attributes of the 'Bright' spot and Control object farms in the Mirzaabad District, Uzbekistan. SD = standard deviation from the mean

Attribute	Bright spot farmers	Control object farmers	Significances
Mean ± SD			
Area under cotton (ha)	16.0 ± 14.1	13.8 ± 10.47	0.696
Area under wheat (ha)	12.5 ± 6.7	12.0 ± 3.9	0.848
Area per labor unit (ha/unit)	4.6 ± 3.6	6.5 ± 2.7	0.214
Bonitet value	42.5 ± 4.6	41.2 ± 3.1	0.473
Soil organic matter (%)	0.651 ± 0.134	0.651 ± 0.108	0.940
Soil phosphorus (mg kg^{-1})	11.69 ± 5.51	15.21 ± 6.89	0.223
Soil potassium (mg kg^{-1})	346.8 ± 74.6	363.5 ± 89.2	0.654
Depth to water table (m)	1.62 ± 0.37	0.95 ± 0.27	0.000

Whilst the Bonitet value is a qualitative index for the farming unit as a whole in meeting target yields of cotton and wheat, it can be viewed as reflecting an aggregated value for the farm. It may not reflect the individual biophysical attributes or productivity potential of individual fields or farming units. This limitation is supported by data pertaining to the percentage of production fields on each of the individual farming units that is affected by low, moderate and high salinity (Table 6). Since the two groups had similar Bonitet values (Table 5) there were differences in the number of farms affected by different salinity levels (Table 6). For example the number of 'Bright' spot farms that had land classified as highly saline was 5, contrasting that of the 8 in the control objects (Table 6). More importantly, the mean groundwater height was significantly higher in the control objects (0.95±0.27 m) when compared to the Bright Spots (1.62±0.37 m) (Table 5). These two factors would invariably contribute to the lower production potential of the control objects as evidenced in the yield data of cotton and wheat. The fact that there are differences in the percentage of land affected by salinity and groundwater height between 'Bright' spots and control objects that are not reflected in the Bonitet values indicates a possible limitation in utilizing this index to assess the production of wheat and cotton in the data sets at the farm level. A regression of Bonitet values against yields of cotton and wheat indicated that there is no significant relationship (data not presented). One could infer from this that intrinsic soil properties as assessed in this index are not contributing to the overall performance of the two crops due possibly to the aggregated nature of this index.

Table 6. Per cent of production fields classified as having low, moderate and high salinity levels and the groundwater height below the soil surface for Bright spots and Control objects in the Mirzaabad District, Uzbekistan

Farmer	Low salinity (2 – 4 dS m^{-1})	Moderate salinity (4 – 8 dS m^{-1})	High salinity (8 – 16 dS m^{-1})	Groundwater height (m)
	I. Bright Spots			
Alpomish	70	30	-	1.75
Sultonkhon avlodi	12	-	13	1.00
Norin	-	57	43	2.00
Raim ota	87	6	-	1.75
Zomin	-	52	48	2.00
Bodomsoy	18	-	-	1.00
Nuroniy	20	80	-	1.75
Istiklol	-	-	13	1.50
Umar ota	-	50	-	2.00
Vijdon toji	15	10	5	1.50
Count	6	7	5	-
Mean (±SD)*	37.0 (±32.7)	40.7 (±26.7)	24.4 (±19.6)	1.62 (±0.37)
	II. Control Objects			
Bahor	20	50	30	0.70
Ibn Sino	-	26	4	0.80
Abdushokhid	-	25	25	0.90
Bobo Koh	20	20	-	1.50
Ropkon	-	50	36	1.20
Pirkhol	20	-	16	0.90
Laylakota	-	31	26	1.00
Holmat aka	12	-	-	1.00
Zomin toshduduk	-	28	28	1.00
Sadir Rakkos	10	54	36	0.50
Count	5	8	8	-
Mean (±SD)*	16.4 (±4.9)	35.5 (±13.5)	25.1 (±10.6)	0.95 (±0.27)

Note: SD = Standard Deviation.

A regression of cotton and wheat yields against the height of groundwater from the soil surface resulted in a highly ($P<0.001$) significant linear relationship, and reasonably high correlation coefficients suggesting that groundwater depth is a major determinant in crop performance that accounts for a significant proportion of the observed variability between the two groups of farmers (Figure 7). In addition, high water tables are often associated with salinity and are a contributing factor to the overall problem. Hence it is suggested that water table height could be viewed as a surrogate for salinity or soil quality.

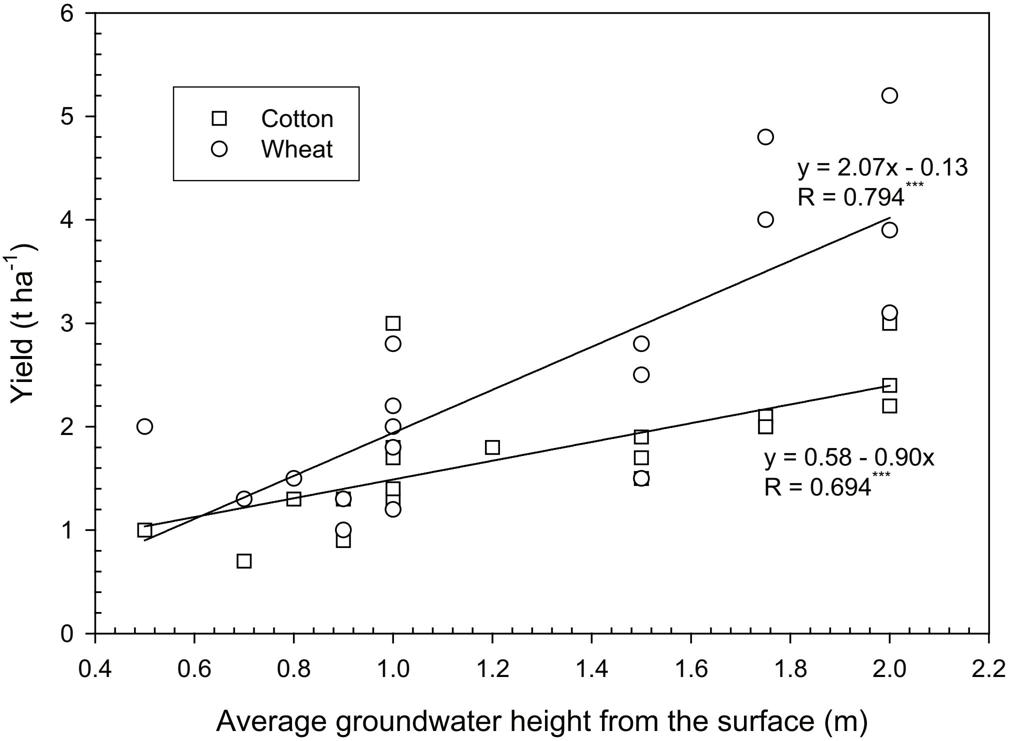


Fig. 7. Relationship between groundwater depth from soil surface and yields of cotton and wheat for 'Bright' spots and control objects for farming systems in the administrative District of Mirzaabad, Uzbekistan.

c. Economic Characteristics

Limited economic data on the performance of the farming units was collected. Of that data collected statistically significant differences between the two groups were observed with respect to annual salaries of labor units, production costs and profits for each of the commodities (Table 7). It is of note that there was a considerable range in these values between and within each of the groups indicating the variable nature of these attributes. The annual salaries of labor were significantly higher for 'Bright' spot workers when compared to the Control objects, this being attributed in part to the better economic performance of the former as evidenced by the higher net profits from the production of cotton and wheat. The production costs for both commodities were higher in the 'Bright' spots cases that resulted in higher profit margins for this group (Table 7). It is of note that in the case of the control objects, negative returns in the production of wheat and cotton were observed clearly indicating the dire situation on some farms (Table 7).

Further socio-economic indicates were collected that reflect the contrasting performance and financial capacity of these two groups (Table 8). The higher number of private motor cars and refrigerators within the ‘Bright’ spot group of farmers would reflect greater ‘affluence’ associated with increased disposable incomes. Furthermore, the higher number of farms having transport and tractor units within the ‘Bright’ spot group would reduce dependence on the centralized services commonly utilized for field operations. In addition, the ‘Bright’ spot farms had higher total numbers of cattle and sheep with chicken numbers being larger in the case of the control objects (Table 8).

Table 7. Descriptive statistics and level of significances for selected economic attributes of the ‘Bright’ spot and control object farms in the Mirzaabad District, Uzbekistan. SD = standard deviation from the mean. Soum is the local currency; 1000 Soum is equivalent to USD1.

Commodity	Bright spot farmers	Control object farmers	Significances
Mean ± SD			
Annual income labor (‘000’ Soum/ labor)	414 ± 163	233 ± 139	0.016
Net production costs for wheat (‘000’ Soum ha^{-1})	213±148	102±21	0.042
Net profit wheat (‘000’ Soum ha^{-1})	237±542	8±33	0.223
Net production costs for cotton (‘000’ Soum ha^{-1})	371± 121	270±90	0.050
Net profit cotton (‘000’ Soum ha^{-1})	187±75	28±31	0.000
Individuals investment in the farming enterprise at privatization (‘000’ Soum ha^{-1})	1185±540	349±188	0.002
Median (min; max)			
Annual income labor (‘000’Soum / labor)	425 (100; 640)	160 (110; 500)	0.028
Net production costs for wheat (‘000’ Soum ha^{-1})	195 (46; 533)	100 (73; 136)	0.080
Net profit wheat (‘000’ Soum ha^{-1})	53 (0; 1680)	18 (-61; 46)	0.005
Net production costs for cotton (‘000’ Soum ha^{-1})	341 (250; 666)	250 (137; 416)	0.072
Net profit cotton (‘000’ Soum ha^{-1})	194 (75; 296)	35 (-22; 83)	0.000
Individuals investment in the farming enterprise at privatization (‘000’ Soum ha^{-1})	1000 (500; 2000)	350 (100; 600)	0.000

Table 8. Selected socio-economic indicators of 'Bright' spots and control objects from the Mirzaabad District, Uzbekistan.

Farmer	Number of families that own cars	Number of families with refrigerators	Number of transport units on farm	Number of tractors on farm	Cattle on farm	Sheep on farm	Chickens on farm
	Bright spot farms						
Alpomish	3	11	-	-	8	-	-
Sultonkhon avlodi	1	3	-	-	1	-	28
Norin	2	10	1	1	5	2	30
Raim ota	4	4	2	3	8	-	10
Zomin	1	6	3	4	1	8	10
Bodomsoy	-	-	-	-	-	-	10
Nuroniy	-	-	-	-	6	-	10
Istiklol	-	1	1	1	3	2	10
Umar ota	1	3	1	1	10	20	35
Vijdon toji	1	1	-	-	-	-	-
Count	8	8	5	5	8	4	8
Total	13	39	7	10	42	32	143
	Control farms						
Bahor	-	-	1	1	-	-	10
Ibn Sino	1	1	-	-	2	-	12
Abdushokhid	-	-	-	-	2	-	6
Bobo Koh	-	-	-	-	-	-	6
Ropkon	-	1	-	-	10	8	100
Pirkhol	-	2	-	-	2	-	6
Laylakota	2	2	-	-	1	-	8
Holmat aka	-	1	-	1	1	2	10
Zomin toshduduk	-	-	-	-	1	-	10
Sadir Rakkos	1	3	-	-	4	-	15
Count	3	6	1	2	8	2	10
Total	4	10	1	2	23	10	183

A potential factor influencing the performance of the farming operation is the ability of a farmer to make investments in the farming enterprise. One of the questions put to farmers was the amount of individual investment that went into the establishment of the farming enterprise post privatization. An analysis of the extent of individual investment revealed that 'Bright' spot farmers invested significant higher (mean: 1000, range: 500 – 2000 '000 soums) funds into the farm when compared to the control objects (mean: 350, range: 100 – 600 '000 soums) (Table 7). Hence 'Bright' spot farmers were able to mobilize greater funds to invest in the enterprise upon privatization than the control objects.

A clear biophysical constraint, namely elevated water tables, appears to have had a significant impact on the yield of cotton and to a lesser degree wheat, suggesting the importance of managing the water table. This is best achieved through maintenance of surface and sub-surface drainage systems and networks that require significant investments. Implicit in this is the notion of greater access to resources, both financial and physical, and a degree of flexibility in undertaking farm operations. A stepwise regression of independent variables on net profit from cotton production was undertaken to determine the importance of both biophysical and economic variables. The independent variables included water table height, production cost of cotton, initial investment in the farm, number of tractors per farm and annual salary of labor were used as input in a stepwise regression. The only two variables found to significantly (over 88% of variance accounted for) influence net profitability of cotton production was water table height and production cost of cotton and were described by the following equation:

$$\text{Net profit cotton ('000 Soum/ha)} = 0.319 \pm 0.61\text{PCost} + 74.99 \pm 26.15\text{WHeight} - 125.47; \quad R^2 = 0.888$$

where Pcost is the production cost of cotton in '000 Soum/ha and WHeight is the water table height in m from the surface.

3.2.2 Turkmenistan

a. Crop Productivity

In Turkmenistan the focus of the study was confined to individual farmer plots within the *daikhan berleshik*, who in the case of 'Bright' spots were identified as *Mulkdars* whilst control objects were effectively neighboring farmers. Wheat is the dominant crop represented in the sample surveyed with 8 farms being assessed. In contrast only 5 'Bright' spots and control farms were sampled that grew cotton. The average size of wheat 'Bright' spot and control farms were 2.8±0.1 and 4.1±1.1 ha with a mean Bonitet value of 53 over both groups. The size of cotton farms assessed in the survey was the same for both groups at 2.1 ha and the mean Bonitet value for the Bright spot and control farms were 45 and 41 respectively.

The yields for three consecutive years for both crops are presented in Table 9. 'Bright' spots consistently outperformed control objects over all years with the yield differential in some years between groups being an order of magnitude higher. Over the 3 years that harvests were monitored the mean yield of wheat for the 'Bright' spots and control objects were 5.22±0.51 and 0.57±0.07 t ha^{-1} clearly showing the superior performance of the former group. Similarly, overall mean yields of cotton for 'Bright' spots and control objects over the 3 year period were 4.31±0.36 and 0.89±0.17 t ha^{-1}. In a survey of 94 farmers in the area from which the current sample of farmers were drawn in 2006, mean wheat and cotton yields were 1.6 and 1.2 t ha^{-1} respectively. These figures clearly show that both the 'Bright' and control objects were performing well above or below the mean production levels for the region.

Table 9. Descriptive statistics and level of significances for wheat and cotton at 'Bright' spot and control object farms in the Dashoguz Province, Turkmenistan. SD = standard deviation from the mean

Attribute	Bright spot farmers	Control object farmers	Significances
Mean ± SD	**(t ha^{-1})**		
Wheat production 2003 (n=8)	5.22 ± 2.90	0.71 ± 0.48	0.000
Wheat production 2004 (n=8)	5.77 ± 2.87	0.59 ± 0.29	0.000
Wheat production 2005 (n=8)	4.66 ± 1.62	0.46 ± 0.13	0.000
Cotton production 2003 (n=5)	3.98 ± 1.58	0.54 ± 0.59	0.011
Cotton production 2004 (n=5)	4.40 ± 1.51	0.92 ± 0.62	0.012
Cotton production 2005 (n=5)	4.64 ± 1.02	1.42 ± 0.40	0.011

In the survey of these farms data was collected on farming practices that were used in the production of each of the commodities (Table 10). These data included land preparation practices; application of manures and inorganic nutrients; irrigation and leaching regimes; and weeding practices. It is clearly evident that there were differences between each of the groups in particular in the amount of manure applied to each of the crops, rate of phosphorus application and the depth of cultivation (Table 10). In a stepwise regression analysis of mean wheat yield against these agronomic attributes, the amount of manure applied was the only attribute retained in the regression equation that explained 62% of the variance. Similarly, a stepwise analysis for cotton of the same attributes resulted in ploughing depth being the only attribute retained that explained 81% of the variance.

Table 10. Farming practices and inputs used in the production of wheat and cotton crops by 'Bright' spot and control farmers in Dashoguz Province, Turkmenistan. Standard deviations of the mean are presented

Attribute	Bright spot farmers	Control object farmers
	Wheat	
Land leveling, number of passes	1.8 ± 0.3	1.3 ± 0.5
Ploughing depth (cm)	34.3 ± 1.1	31.8 ± 2.2
Weeding operation (number)	2	1.25 ± 0.4
Leaching volume (m^3 ha^{-1})	1525 ± 46	1512 ± 35
Total irrigation applied (m^3 ha^{-1})	1325 ± 70	1187 ± 188
Manure (t ha^{-1})	5.2 ± 0.5	1.2 ± 1.3
Phosphorus (kg ha^{-1})	356 ± 105	181 ± 84
Nitrogen (kg ha^{-1})	281 ± 99	256 ± 46
	Cotton	
Land leveling, number of passes	2	1.6 ± 0.5
Ploughing depth (cm)	37 ± 2	31 ± 1
Number of weeding operation	4	3.2 ± 0.4
Leaching volume (m^3 ha^{-1})	1560 ± 54	1480 ± 130
Manure (t ha^{-1})	9.2 ± 1.0	1.4 ± 1.3
Phosphorus (kg ha^{-1})	200	80 ± 109
Nitrogen (kg ha^{-1})	300	230 ± 44

4. CONCLUSIONS AND DISCUSSION

The dismantling of collective farms in Uzbekistan and Turkmenistan has in part resulted in the enhanced performance of the agricultural sector. It is widely recognized that land reforms around the world have a political dimension (Ellis 1999) and are a key driver in enhancing productivity and land stewardship. One could argue that the expected benefits from agricultural transformation in FSU countries, especially in Central Asia, may only be realized once effective institutional and political changes take place that support private land ownership. However, within the current environment there are encouraging signs that farmers are responding to liberalization of the agricultural sector and are benefiting through higher productivity levels, this certainly being the case in both of the target countries.

There are distinct similarities between the two target countries in that they have approached land ownership in a cautious and phased approach, while retaining a planned agricultural sector based on wheat and cotton. In this study we have deliberately focused on identifying 'Bright' spots in the most degraded (salinized) lands in each of the countries. There are certain elements of incentives being present in the two cases studied. In Uzbekistan, farmers that exceed the planned production levels for cotton and wheat are entitled to keep the excess and thus sell into a market. This often takes the form of selling to neighboring farmers who were unable to meet the plan at prices that are higher than that being offered by the State or to smuggle excess cotton across the border into Kazakhstan where prices are significantly higher and reflect world market prices. A further incentive is the threat of having land reallocated to another owner if they are unable to meet the plan production levels successively. Indeed, in the current study three of the control objects have had their land titles revoked by the state in 2006. In the case of Turkmenistan, the threat of being made landless due to revocation of leasehold titles is clearly a factor. There is also the possible incentive of being recognized as an elite farmer, *mulkdar*, by the President along with the leasehold entitlement for life that is not subject to confiscation if the plan is not met. Hence the two cases show clear attributes that would fit with the concepts of 'induced innovation'.

Productivity and economic indicators clearly suggest that 'Bright Spots' are operating at a significantly highly level than control objects and confirm the results from a limited number of cases reported previously (Ul Hassan et al., 2005). It is also of note from an analysis of the entire population of farmers from which 'Bright Spots' were identified in Uzbekistan, that 46% of farmers exceeded the 'plan' cotton yields (Figure 6) suggesting the potential for these farmers to benefit individually from the sale of this surplus.

In describing the requirements for the development of 'Bright Spots' in Uzbekistan and Turkmenistan the overwhelming contributing factor is having the ability to access inputs that are critical to these production systems. In Uzbekistan having access to financial resources in order to purchase inputs and services appears to be a fundamental difference between the two groups. The mobilization of financial resource influences a farmer's ability to mobilize labor resources, reduced dependence on centralized services, increase production inputs allowing greater attention to infield operations. Similarly in Turkmenistan access to resources i.e. manure and attention to agronomic practices (i.e. deep ploughing in the case of wheat) all appear to be important in the development of 'Bright Spots'. The overall strategy amongst the 'Bright Spot' farmers seems to be that they have taken reforms and gradual privatization as an opportunity, and envisioned its continuity, and formulated their own coping and adapting strategies.

Uzbekistan had dismantled the collective and cooperative farms by late 2006, and turned their management over to the private individuals. Turkmenistan has taken a more staged approach to land reform and the development of an open market economy. What appears to be a common element of 'Bright Spot' farmers in the two countries is that they exhibit entrepreneurial attributes that have enabled them to succeed. Moving from a collectivized system of production that assigned employees to specific tasks i.e. tractor driving to managing an entire farming enterprise is in itself a significant achievement in the case of the 'Bright' spot farmers. The question thus arises: How does one out-scale the successes of 'Bright' spots? This could best be achieved through two complementary approaches. Firstly, conventional extension services as commonly used to disseminate knowledge are not established in these countries and it is highly unlikely that resources will be forthcoming to establish formal extension and knowledge based platforms in both countries through centralized government systems within the foreseeable future. Innovative approaches in addressing this knowledge gap that links the products of research, and in this case 'induce innovation', with the majority of beneficiaries are required. This may take the form of creating linkages between farmers, researchers and markets through the formation of learning alliances. Indeed, this approach is currently being trialed in each of the countries with positive results.

Secondly, the development of enabling policies that address issues related to inequitable access to land and enable farmers to invest in land resources. For example, in Uzbekistan, farm sizes associated with the initial stages of privatization were too small to be viable enterprises. Subsequent changes to policy have resulted in larger farm units being allocated to individuals in 2006. Further, the provision of incentives which trigger private investments in rehabilitating lands and reversing salinity could also potentially stimulate individuals into addressing resource degradation. Such incentives may not necessarily tax state finances. For example, if farmers were allowed to withdraw cash from the banks, they would be able to pay their labor and service suppliers swiftly, which will ensure timely farm operations, such as maintenance of irrigation and drainage infrastructure. Likewise, reducing the prevailing monopoly of the state service companies, such as machine parks, fertilizer providers, etc., would not only bring in private investments and increased service levels through competition, but will also generate additional employment in rural areas.

What appears to be a logical model for countries in transition, such as Uzbekistan and Turkmenistan, for reversing land degradation is that both the pace of liberalization as well as the depth of such reforms needs to be balanced and widened. While the pace has already been accelerated through privatizing the management of all lands in Uzbekistan, it is highly desirable that instead of tailoring complicated procedures for strict compliance, and evaluating farmer’s performance against procedural steps, the authorities should evaluate farmer’s performance against the targets of production, livelihood generation and sustaining the environment. By adopting such an approach, farmers will not have to spend significant amounts of effort on addressing administrative constraints, but rather they would be in a position to invest time in devising and implementing strategies for remediation of bio-physical and environmental constraints and enhancing productivity and profitability of farms.

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