The Kyrgyz Agro-Input Enterprise Development Project

A Survey of the Customers of the Association of Agro-Businessmen of Kyrgyzstan (AAK): An Impact Survey

An International Center for Soil Fertility and Agricultural Development

P.O. Box 2040
Muscle Shoals, Alabama 35662, U.S.A.

www.ifdc.org

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A Survey of the Customers of the Association of Agro-Businessmen of Kyrgyzstan (AAK): An Impact Survey Comparing 2003 Baseline Data with 2004 Results

Acknowledgments

The baseline survey of the customers of the Association of Agro-Businessmen of Kyrgyzstan was conducted between October 31, 2003 and December 26, 2003 in Kyrgyzstan. A follow-up impact survey was conducted from December 13, 2004 to January 24, 2005. To assess the impact of private input dealers in Kyrgyzstan, this report compares the data and findings of the two surveys. The dedicated work of the interviewers is noted with appreciation. Nodir Badalov, Roza Jusubalieva, Ubaidulla Abdullaev, and Alisher Kasymov were a pleasure to work with and did excellent interviewing during fieldwork. Thomas P. Thompson, IFDC Senior Scientist—Sociology and Consultant, designed a methodology, questionnaire, and trained the interviewers. Dilshod Abdulhamidov entered, verified, and analyzed the data. The support of the entire IFDC-Osh staff is appreciated.

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Summary

The data on AAK customers (farmers who purchase their inputs from AAK dealers) and non-customers (farmers who do not purchase their inputs from AAK dealers) presented and discussed in this report serve as baseline and impact data. When customers are compared with non-customers for the period 2003-2004, the following salient differences emerged from the data.

Sales of Farm Produce

- The greatest difference between AAK customers and non-customers is evident on the revenue realized from the sale of farm products in 2003 and 2004. Among customers total income from the sales of farm products increased from US $76,579.20 in 2003 to US $135,005.10 in 2004 or by about 43.0%. In contrast, that income among non-customers decreased from US $34,368.80 in 2003 to US $23,395.48 in 2004, or by about 32.0%. Therefore, mean household income among customers increased significantly from US $1,160.29 in 2003 to US $2,045.53 in 2004. Stated in another way, mean income per household member among AAK customers increased from US $221.36 in 2003 to US $723.49 in 2004 or by about 69%.

Gender and Sales of Farm Produce

- The percentage of AAK customer households that sold no farm produce declined dramatically and significantly from 64.4% in 2003 to only 21.8% in 2004. That figure also declined for non-customers significantly but less dramatically from 61.5% in 2003 to 40.2% in 2004.
- On a percentage basis, women in the households of customers and non-customers became more involved in the sale of farm produce. Among customers, that percentage increased

significantly from 14.0% in 2003 to 42.2% in 2004. That figure also increased for non-customers significantly but less dramatically from 19.0% in 2003 to 35.0% in 2004. One may conclude that, compared with men, improvements in agricultural production increase the workload of women.

Land

- AAK customers significantly increased the mean land area owned by 60.0% from 1.0 ha in 2003 to 1.6 ha in 2004. In sharp and direct contrast, non-customers significantly decreased the mean land area owned by about 18.0% from 1.1 ha in 2003 to 0.9 ha in 2004.
- The percentage of AAK customers reporting cultivation of irrigated land increased from 98.5% in 2003 to 100.0% in 2004. Non-customers reported no significant change in the cultivation of irrigated land. Regardless of customer status, the mean irrigated land area cultivated did not change significantly during the period between the baseline and impact surveys.

Agricultural Credit

- The aggregate amount of credit received by AAK customers increased and doubled from US $6,392.00 in 2003 to US $12,821.00 in 2004. The most notable lenders to AAK customers were the Kyrgyz Agricultural Finance Corporation and various credit unions. The mean amounts loaned to AAK customers by these sources in 2003 were US $974.00 and US $652.00, respectively. In 2004 those figures increased to US $2,777.66 and US $1,928.50, respectively.

Fertilizer Use

- Compared with non-customers, AAK customers were greater users of nitrogenous fertilizers during 2003 and 2004. Between the baseline and impact surveys, the percentage of customers using nitrogenous fertilizers increased from 94.1% to 95.5% and from 86.7% to 87.7% among non-customers, but that change is not statistically significant.

- For all crops, among customers mean applied N was 144.6/ha in 2003 and 142.5/ha in 2004 or a negligible decrease of about 1.5%. For all crops, among non-customers mean applied N was 176.7/ha in 2003 and 93.7/ha in 2004 or a substantial and significant decrease of about 47.0%. Again it may be reasonably concluded that, compared with non-customers, in general AAK customers are consistent and benefit from private sector extension advice on N application.

Seed Sources for Irrigated Crops

- **Cotton—**During 2003-2004, AAK customers significantly reduced purchases of cotton seed from bazaars and increased purchases of that seed from seed dealers. Non-customers also changed their sources of cotton seed significantly and reduced reliance on their own saved seed by substantially increasing purchases from seed dealers. Thus, dealers became the preferred source for cotton seed and farmers purchased higher quality seed.
- **Maize—**Non-customers did not significantly change their sources of maize seed. They continued their reliance on bazaars, saved seed, and lastly, seed dealers in that order. AAK customers significantly changed their sources of maize seed. In 2003, about 28.6% purchased that seed from dealers but in 2004, that was reduced significantly to 16.0%. A significant change to the use of saved seed is evident in that, in 2003, 28.6% used their own seed and in 2004 that increased to 48.0%. This trend suggests that customers may be purchasing quality maize seed in alternate years.
- **Onion**—AAK customers significantly increased their reliance on onion seed from bazaars. The percentage of customers purchasing that seed from bazaars increased from 71.4% in 2003 to 100.0% in 2004. Non-customers substantially and significantly increased their purchases of onion seed from seed dealers. In 2003, 33.4% of non-customers reported such purchases and in 2004 that increased to 100.0%. This may again suggest a cycle of using quality seed from dealers in alternate years.
- **Potato—**AAK customers used their own saved potato seed and in 2004 that increased significantly to 35.7%. Non-customers continued their reliance on potato seed from bazaars and to a lesser extent on their own saved seed without significant change. Note that among non-customers, although use of own seed increased from 20.0% in 2003 to 33.3% in 2004 and bazaar purchased decreased from 80.0% in 2003 to 66.7% in 2004,

these changes are not statistically significant. It also should be noted that the fresh market price at planting time for potatoes declined dramatically in 2004.

- **Tomato—**Customers reduced the use of their saved and bazaar-purchased tomato seed. Customer purchases of higher quality tomato seed from dealers increased significantly from 42.9% in 2003 to 71.4% in 2004. Non-customers significantly reduced the purchase of tomato seed from bazaars from 66.7% in 2003 to 28.6% in 2004 and significantly increased use of their own tomato seed from 16.7% in 2003 to 57.1% in 2004.
- **Wheat—**Non-customers significantly reduced the purchase of wheat seed from dealers from 20.6% in 2003 to a mere 5.6% in 2004. Their purchases from bazaars and use of own wheat seed increased, but not significantly. The majority of customers relied on dealers for wheat seed in 2003 (53.1%) and 2004 (61.3%) and their own seed in 2003 (37.5%) and 2004 (32.3%). However, these changes are not statistically significant.

Crop Yields

- AAK customers significantly increased yields for cabbage and cotton. For cabbage the mean yield increased from 10,500 kg/ha in 2003 to 65,000 kg/ha in 2004. For cotton those figures are 1,949 kg/ha and 2,557 kg/ha, respectively. Mean yields of sunflower decreased significantly among customers from 2,231 kg/ha in 2003 to 1,450 /kg/ha in 2004. This is the only crop among customers where a significant decline was recorded *(The KAED project did not introduce new sunflower varieties in 2003 or 2004).*
- Among non-customers, statistically significant decreases in yields were reported for four crops—maize, onion, rice, and wheat. Significant mean increases in yields were reported for alfalfa and cotton. Clearly, compared with non-customers, the mean yields of the crops of AAK customers show that crop yields were stable or improved. That is substantially attributable to the private sector extension advice provided by AAK dealers.

Introduction

The Kyrgyz Agro-Input Enterprise Development (KAED) project aims to improve the productivity and profitability of agriculture in southern Kyrgyzstan by developing and strengthening the agri-input sub-sector. The purpose of the Association of Agro-Businessmen of Kyrgyzstan (AAK) customer survey is to compare baseline and impact data that describe the agricultural input use of AAK customers compared with that of non-customers. Non-customers are those farmers, usually neighbors of AAK customers, who purchase inputs and obtain advice from sources other than AAK dealers or use little or no inputs. This report presents data from 2003 and 2004, which will be used to document change, development, and benefits of purchasing and using agricultural inputs from of the AAK dealers. It is the establishment of a business relationship with AAK dealers that is the principal difference between customers and non-customers.

Methodology and Sample

Methodology

The questionnaire for customers and non-customers of AAK consists of 14 questions and is based on interviews with 68 customers and 75 non-customers in 2003. In 2004, 66 customers and 65 non-customers were interviewed. The data in Table 1 show the distribution of customers and non-customers in 2003 and 2004. With the exception of the Jalalabad oblast, there is no significant difference in the number of customers and non-customers that were interviewed in 2003 and 2004.

Table 1. Distribution of Customers and Non-Customers Surveyed by Oblast in 2003 and 2004

Oblast	Customer						Non-Customer					
	2003		2004		Difference	P(T<=1)	2003		2004		Difference	P(T<=1)
	Number	Percent	Number	Percent			Number	Percent	Number	Percent		
Osh	34	50.0	35	53.0	3.0	0.36	39	52.0	34	52.3	0.3	0.48
Jalal-Abad	24	35.3	18	27.3	-8.0	**0.16**	22	29.3	18	27.7	-1.6	0.42
Batken	10	14.7	13	19.7	5.0	0.22	14	18.7	13	20.0	1.3	0.42
Total	68	1.0	66	100			75	100	65	100		

The Questionnaire

The major variables included in the questionnaire to assess differences between AAK customers and non-customers are: socio-demographic information about the farmer, farm labor, household composition, information about the farm, household consumption of farm produce, household gender composition, produce marketing by gender, distances to market and fields, land use and tenure, credit, input use by crop, source of seed, crop production and yields, sale of farm products, and remittances received by farmers. Each interview required 30-45 minutes to complete.

Analytical Procedure

The differences between AAK customers and non-customers are presented as percentages and means. The differences are analyzed by the use of a one-tailed t-test and assume unequal variances. A difference between customers and non-customers on any particular variable is evaluated by the value of P (T<=t). The value of 0.20 or less is used here to indicate the level of statistical significance associated with the observed difference between customers and non-customers, that is the probability of rejecting the hypothesis that difference = 0 with the alternative hypothesis difference > 0. The lower this number, the greater is the probability that there is an actual difference between costumers and non-costumers. For example, a value of 0.21 or greater indicates that a difference may actually exist, but with less probability of being certain and a greater probability of being wrong. These criteria and the 0.20 “cut-off” point are used here to describe and discuss differences between AAK customers and non-customers throughout this report and are shown in bold font in the tables. Differences between variable values for customers and non-customers are absolute.

Socio-Demographic Characteristics

The data in Table 2 show a comparison of an array of socio-demographic characteristics of AAK customers and non-customers in 2003 and 2004.

Table 2. A Comparison of the Off-Farm Employment, Household, Labor, Demographic, and Income Characteristics of AAK Customers and Non-Customers in 2003 and 2004

Characteristics	Customer						Non-Customer					
	2003		2004		Difference	P(T<=1)	2003		2004		Difference	P(T<=1)
		SD		SD				SD		SD		
Off-Farm Employment of Farmers (%)	39.7		37.9		-1.8	0.41	28.0		33.8		5.80	0.23
Annual Off-farm Income of Farmers (Mean US $)	372.0	402.8	631.9	947.4	259.9	**0.11**	343.9	350.9	705.5	1168.0	361.6	**0.09**
Months of Off-Farm Employment of Farmers (Mean)	9.4	3.5	10.2	3.3	0.8	**0.19**	9.9	3.9	11.3	2.4	1.4	**0.10**
Household Members, 16-60 Years of Age Employed Off Farm (%)	21.7		16.9		(4.8)	**0.10**	15.0		14.4		(0.6)	0.44
Household Members Months of Off-Farm Employment (Mean)	9.1	3.4	8.8	3.6	(0.3)	0.35	10.8	2.5	9.7	3.7	(1.1)	**0.09**
Household Members Annual Off-Farm Income (Mean US $)	258.6	264.3	331.0	354.9	72.4	**0.15**	246.3	201.6	365.3	454.5	119.0	**0.10**
Women Household Members Months of Off-Farm Employment of (Mean)	9.7	3.8	10.7	3.8	1.0	**0.17**	10.8	2.6	8.9	4.5	(1.9)	**0.10**
Women Household Members (16-60 years) Employed Off-Farm (%)	16.9		13.9		(3.0)	0.26	14.7		11.5		(3.2)	0.24
Women Household Members Annual Off-Farm Income (Mean US $)	147.9	121.4	211.4	198.2	63.5	**0.14**	161.8	113.9	181	97.2	19.2	0.31
Household Members Providing On-Farm Labor (Mean)	3.5	2.3	3.7	2.1	0.2	0.29	2.5	1.4	2.9	1.7	0.4	**0.11**
Remittance Received by Farmers (%)	2.9		4.5		1.6	0.31	6.7		3.1		(3.6)	**0.17**
Remittance Received Annually by Farmers (Mean US $)	114.1	23.1	222.2	225.0	108.1	0.25	193.9	219.3	535.7	252.6	341.8	**0.13**
Total Annual Household Off-Farm Income (Mean US $)	337.4	534.3	449.9	773.4	112.5	**0.17**	207.8	354.8	422.7	959.7	214.9	**0.05**
Persons per Household (Mean)	4.5	2.5	4.7	2.1	0.2	0.25	3.7	1.9	4.7	2.4	1.0	**0.01**
Age of Household Members (Mean)	25.9		26.7		0.8	0.25	27.3		23.4		(3.9)	**0.01**

Off-Farm Employment of Farmers

Although the percentage of AAK customers reporting off-farm employment declined and increased among non-customers, that percentage shows that no statistically significant change occurred between the baseline survey of 2003 and the impact survey of 2004. The small change (-1.8%) in such employment among customers may suggest less of a need or interest in off-farm activities.

Off-Farm Employment and Income of Farmers

During 2003-2004 the off-farm incomes of customers and non-customers increased significantly. The mean annual off-farm incomes of non-customers increased from US $343.90 to US $705.50 or by about 51.0%. For customers such income increased from US $372.00 to US $631.90 or by about 41.0%. The data in Table 2 show that the increased off-farm income of non-customers is attributable to a mean increase of 1.4 months of employment since the baseline survey in 2003. That figure for customers is 0.8 months. Thus, compared with non-customers, off-farm income of customers increased significantly but with a smaller increase in mean annual months worked.

Off-Farm Employment of Household Members

As shown further in Table 2, the percentage of household members employed off-farm among AAK customers decreased significantly from 21.7% in 2003 to 16.9% in 2004. Among non-customers such employment also decreased from 15.0% in 2003 to 14.4% in 2004. In the latter case, the difference is not significant by the 0.20 rule used in this report.

During 2003-2004, the mean annual months of off-farm employment of household members in customer households declined from 9.1 to 8.8, but that change is not significant. In contrast, among non-customers those figures are 10.8 and 9.7, respectively. This change is statistically significant.

The mean annual off-farm incomes of household members of AAK customers and non-customers increased significantly during 2003-2004. Among customers, that mean income increases from US $258.60 to US $331.00 or about 21.9% and among non-customers from

US $246.30 to US $365.30 or about 32.6%. Thus, although the percentage of household members of customers and non-customers who work off-farm decreased, their mean annual income increased significantly. We now turn to the subject of women and their role in and contribution to household income.

Off-Farm Employment and Income of Women Household Members

In regard to contributions of women to household income, the data in Table 2 show that among AAK customer households, the mean annual months of off-farm employment among women increased significantly from 9.7 in 2003 to 10.7 in 2004. In sharp contrast, among non-customers such employment decreased significantly from 10.8 in 2003 to 8.9 in 2004. For customers and non-customers, there was no statistically significant change in the percentage of household women between the ages of 16 and 60 who reported off-farm employment during 2003-2004.

The data in Table 2 also show that the increases in mean annual household income of AAK customers are substantially attributable to the work of women. Their mean income from off-farm employment increased significantly from US $147.90 in 2003 to US $211.40 in 2004. Among non-customers, those figures are US $161.80 and US $181.00, respectively, and do not represent a statistically significant change.

On-Farm Labor

The mean number of household members providing on-farm labor among AAK customers was 3.5 in 2003 and 3.7 in 2004, a negligible and insignificant change. This shows stability in the demand for household labor among AAK customers. In contrast, among non-customers, those figures are 2.5 and 2.9, respectively, and represent a statistically significant change. This is very likely a result of a significant increase in the mean household size of non-customers between the baseline and impact surveys. That increase in available household labor is not likely explained by new relatives and their children being added to non-customer households. The mean number of persons per household among customers changed only slightly and is without significant change.

Receipt of Remittances

Although remittances to the households of AAK customers increased from an average of US $114.10 in 2003 to US $222.20 in 2004, that increase is not statistically significant. The data on remittances to non-customer households are remarkably different. In 2003 the average remittance for non-customers was US $193.90 and increased significantly to US $535.70 in 2004. Thus, non-customer households are significantly more dependent on remittances than the households of AAK customers.

Annual Household Income from Off-Farm Employment

Finally, in regard to Table 2, between 2003 and 2004 the mean annual household income from off-farm employment increased significantly for AAK customers and non-customers. But, that increase was more dramatic among non-customers. Among customers, the mean household income from off-farm employment was US $337.40 in 2003 and US $449.90 in 2004 or about 25.0%. For non-customers, that income averaged US $207.80 in 2003 and US $422.70 or about 51.0%. Thus, compared with non-customers, AAK customers are significantly less dependent on income from off-farm sources.

Distances from Household to Fields and Markets

Table 3 shows a comparison of the distances from households to fields and markets among AAK customers and non-customers in 2003 and 2004. One would expect these distances to be constants rather than variables. However, compared with non-customers, the data suggest that AAK customers are more likely to reside and remain significantly closer to markets. It would suggest further that the AAK customer base is developing around and near market centers. Customers reported a mean of 7.8 km to market in 2003 and 6.9 km in 2004, a significant decrease. That proximity complements the ease of purchasing inputs and selling farm products.

Table 3. A Comparison of the Distance From Household to Fields and Markets Among AAK Customers and Non-Customers in 2003 and 2004

Distance	Customer						Non-Customer					
	2003		2004		Difference	P(T<=1)	2003		2004		Difference	P(T<=1)
	Mean	SD	Mean	SD			Mean	SD	Mean	SD		
	(km)		(km)				(km)		(km)			
From household to field	3.3	4.3	2.9	7.5	-0.4	0.27	3.6	5.7	3	9.4	-0.6	0.23
From household to market	7.8	2.8	6.9	3.9	-0.9	**0.07**	9.4	4.4	9.2	9.2	-0.2	0.45

SD = Standard Deviation.

Land Cultivation and Tenure

The data in Table 4 show a comparison of the total land cultivated by AAK customers and non-customers in 2003 and 2004. No significant differences in the mean total land area cultivated by customers and non-customers were observed. The percentages of customers and non-customers cultivating owned land also did not change significantly in the time period between the baseline and impact survey. These data show some interesting figures on land tenure that separate AAK customers from non-customers in a significant manner.

AAK customers significantly increased the mean land area owned by 60.0% from 1.0 ha in 2003 to 1.6 ha in 2004. In sharp and direct contrast, non-customers significantly decreased the mean land area owned by about 18.0% from 1.1 ha in 2003 to 0.9 ha in 2004. One may conclude that compared with non-customers, AAK customers realized a more favorable position to purchase additional land, expand agricultural production, and improve their standard of living through agriculture. AAK customers also expanded cultivation on rented land.

The percentage of AAK customers cultivating rented land increased significantly from 48.5% in 2003 to 60.6% in 2004. There was no significant change in the percentage of non-customers cultivating on rented land during 2003-2004. The data in Table 4 also show that the percentage of non-customers cultivating state land increased significantly from 4.0% in 2003 to 7.7% in 2004. For AAK customers, there was no significant change in this percentage. Concerning the mean state land area cultivated, there were no significant changes for customers or non-customers during the period 2003-2004. AAK customers also reported a significant increase in the cultivation of irrigated land. The percentage of AAK customers reporting cultivation of irrigated land increased from 98.5% in 2003 to 100.0% in 2004. Non-customers reported no significant change in the cultivation of irrigated land. Regardless of customer status, the mean irrigated land area cultivated did not change significantly during the period between the baseline and impact surveys. Unlike customers, where there was no significant change, the percentage of non-customers cultivating rainfed land decreased significantly from 32.0% in 2003 to 15.4% in 2004. Among non-customers, the rainfed land area increased significantly from 1.3 ha in 2003 to 2.0 ha or 35.0% in 2004. There were no significant changes in the rental costs of irrigated or rainfed land during the period of 2003-2004.

Table 4. A Comparison of Land Cultivated by AAK Customers and Non-Customers in 2003 and 2004

	Customer						Non-Customer					
	2003		2004		Difference	P(T<=1)	2003		2004		Difference	P(T<=1)
	Mean	SD	Mean	SD			Mean	SD	Mean	SD		
Total Land Area Cultivated (Mean ha)	7.3	36.9	6.3	11.6	-1.0	0.42	1.6	1.8	1.6	1.8	0.0	0.45
Farmers Cultivating Owned Land (%)	95.6		93.9		-1.7	0.33	97.3		98.5		1.2	0.32
Area of Owned Land (Mean ha)	1.0	0.6	1.6	2.2	0.6	**0.02**	1.1	1.1	0.9	0.8	-0.2	**0.20**
Farmers Cultivating Rented Land (%)	48.5		60.6		12.1	**0.08**	32.0		33.8		1.8	0.41
Rented Land Area (Mean ha)	12.5	52.8	7.1	14.0	-5.4	0.29	1.5	1.6	1.6	1.7	0.1	0.46
Farmers Cultivating State Land (%)	7.4		9.1		1.7	0.36	4.0		7.7		3.7	**0.17**
State Land Area (Mean ha)	3.4	2.9	6.1	9.7	2.7	0.27	1.0	0.8	2.0	2.5	1.0	0.21
Farmers Cultivating Irrigated Land (%)	98.5		100.0		1.5	**0.16**	98.7		98.5		-0.2	0.46
Irrigated Land Area (Mean ha)	4.8	19.4	5.3	11.2	0.5	0.43	1.2	1.3	1.3	1.3	0.1	0.28
Farmers Rainfed Land (%)	20.6		22.7		2.1	0.38	32.0		15.4		-16.6	**0.01**
Rainfed Land Area (Mean ha)	12.2	38.9	4.7	5.9	-7.5	0.24	1.3	1.2	2.0	1.8	0.7	**0.12**
Irrgated Land Rental Price (Mean US $/ha)	104.5	68.2	118.7	81.7	14.2	0.22	103.2	71.1	112.9	78.5	9.7	0.33
Rainfed Land Rental Price (Mean US $/ha)	22.4	32.2	14.8	10.1	-7.6	0.32	15.2	7.8	17.5	7.3	2.3	0.37

SD = Standard Deviation.

Agricultural Credit

The data in Table 5 show no significant differences in the percentage of customers and non-customers who received loans in 2003 and 2004. Compared with 2003, amount of the average loan for customers and non-customers increased significantly in 2004. As presented in Table 6, the number of AAK customers and non-customers receiving agricultural loans remained virtually unchanged in the period 2003-2004. Among customers, the number receiving loans increased from seven in 2003 to eight in 2004. Among non-customers that number decreased from seven in 2003 to six in 2004. Assuming that farmers have a universal interest in obtaining credit, it may be concluded that obtaining an agricultural loan in Kyrgyzstan is difficult, regardless of customer status. That said, the aggregate amount of credit received by AAK customers increased and doubled from US $6,392.00 in 2003 to US $12,821.00 in 2004. The most notable lenders to AAK customers were the Kyrgyz Agricultural Finance Corporation and various credit unions. The mean amounts loaned to AAK customers by these sources in 2003 were US $974.00 and US $652.00, respectively. In 2004 those figures increased to US $2,777.66 and US $1,928.50, respectively.

The aggregate amount of credit received by non-customers increased from US $3,098.00 in 2003 to US $5,238.00 in 2004. The most notable lender to non-customers in 2003 was the Kyrgyz Agricultural Finance Corporation with a mean loan amount of US $833.00. In 2004, the most notable lender to non-customers was the Bai Tushum Credit Company with a mean loan amount of US $1,547.00. Compared with baseline data, AAK customers clearly received more credit than non-customers and demonstrated improved credit worthiness in 2004.

Table 5. A Comparison of Agricultural Loans Received by AAK Customers and Non-Customers in 2003 and 2004

Loan Characteristic	Customer						Non-Customer					
	2003		2004		Difference	P(T<=1)	2003		2004		Difference	P(T<=1)
		SD		SD				SD		SD		
Farmers receiving loan (%)	10.3		12.1		1.8	0.37	9.3		9.2		-0.1	0.49
Loan Amount (Mean US $)	913.0	218.8	1,602.7	1,757.1	689.7	**0.15**	442.6	421.4	873.0	795.6	430.4	**0.14**

SD = Standard Deviation.

Table 6. The Sources of Credit Received by AAK Customers and Non-Customers in 2003 and 2004

Lender	Customers					Non-Customers				
	Number of Farmers Receiving Loan		Total Amount of Loan (US $)		Difference	Number of Farmers Receiving Loan		Total Amount of Loan (US $)		Difference
	2003	2004	2003	2004		2003	2004	2003	2004	
ACTED	0	0	0	0	0	2	1	359	119	-240
Agricultural Farms	0	0	0	0	0	0	1	0	953	953
Agroplast Processing Company	0	1	0	36	36	0	0	0	0	0
Baitushum Credit Company	1	2	870	595	-275	0	2	0	3,095	3,095
Credit Unions	1	2	652	3,857	3,205	1	1	65	357	292
Kyrgyz Agricultural Finance Corporation	5	3	4,870	8,333	3,463	3	1	2,500	714	-1,786
Rural Advisory Service	0	0	0	0	0	1	0	174	0	-174
Total	7	8	6,392	12,821	6,429	7	6	3,098	5,238	2,140

Fertilizer Use by Product Type

Compared with non-customers, Table 7 shows that AAK customers were greater users of nitrogenous fertilizers during 2003 and 2004. Between the baseline and impact surveys, the percentage of customers using nitrogenous fertilizers increased from 94.1% to 95.5% and from 86.7% to 87.7% among non-customers, but that change is not statistically significant. The percentage of customers using phosphatic fertilizers decreased from 13.2% in 2003 to 12.1% in 2004 and is also not statistically significant. The percentage of non-customers using phosphatic fertilizers declined substantially and significantly from 8.0% in 2003 to 4.6% in 2004. The data on the use of potassic fertilizer show a substantial and significant increase for AAK customers and a substantial and significant decrease for non-customers. Although small, the percentage of customers using potassic fertilizer increased significantly from 2.9% in 2003 to 7.6% in 2004. Among non-customers, 2.7% reported using potassic fertilizer in 2003, but that use was reported as nil in 2004 which represents a very substantial and statistically significant decrease. A balanced fertilizer program is an important and beneficial crop management practice that is emphasized by AAK dealers through private sector extension services. Increased NPK use is attributable to KAED project support that facilitated the import of 60 mt of blended product in 2002. NPK sales continued through 2004. It is expected that the private sector will independently import NPK products in late 2005. It appears that such advice is being used by a small but increasing number of AAK customers and distinguishes them from non-customers.

Table 7. Fertilizer Use by Type of Product Among AAK Customers and Non-Customers in 2003 and 2004

Type of Fertilizer Product	Customer				Non-Customer			
	2003	2004	Difference	P(T<=1)	2003	2004	Difference	P(T<=1)
Nitrogenous (%)	94.1	95.5	1.4	0.36	86.7	87.7	1.0	0.43
Phosphatic (%)	13.2	12.1	-1.1	0.42	8.0	4.6	-12.6	0.21
Potassic (%)	2.9	7.6	4.7	**0.11**	2.7	0.0	-2.7	**0.09**

Applied Nutrient N

Data on nutrient N applied/ha by customers and non-customers for cotton and 10 food crops in 2003-2004 are shown in Table 8. Among non-customers and with the exception of cabbage, there were no statistically significant increases in applied N/ha during 2003-2004.

Again, among non-customers substantial and highly significant decreases in applied N/ha were reported for cotton, potato, rice, sunflower, and wheat.

Table 8. A Comparison of Nutrient N Applied by AAK Customers and Non-Customers on Irrigated Land by Crop in 2003 and 2004

Crop	Customer						Non-Customer					
	2003		2004		Difference	P(T<=1)	2003		2004		Difference	P(T<=1)
	Mean	SD	Mean	SD			Mean	SD	Mean	SD		
	(kg/ha)		(kg/ha)				(kg/ha)		(kg/ha)			
Cabbage	79.5	112.4	247.5	116.7	168.0	**0.12**	92.6	48.4	247.5	0.0	154.9	**0.05**
Carrot	91.2	135.6	-	-	-	-	324.8	267.8	-	-	-	-
Cotton	151.4	64.6	174.4	83.6	23.0	**0.10**	162.8	81.0	133.0	68.0	-29.8	**0.08**
Cucumber	113.0	66.5	355.0	346.5	242.0	0.25	13.7	19.4	-	-	-	-
Maize	86.5	67.8	116.0	98.5	29.5	**0.14**	92.8	73.5	93.5	80.3	0.7	0.35
Onion	294.3	296.7	132.0	46.7	-162.3	**0.10**	381.5	303.1	33.0	-	-348.5	0.21
Potato	258.9	162.5	177.3	142.1	-81.6	**0.07**	341.1	224.3	158.7	139.9	-182.4	**0.01**
Rice	152.6	76.2	89.4	89.4	-63.2	**0.09**	200.6	177.5	111.9	86.9	-88.7	**0.20**
Sunflower	145.3	222.7	64.6	51.9	-80.7	**0.16**	98.0	131.8	47.1	61.8	-50.9	**0.11**
Tomato	100.9	114.8	104.3	33.3	3.4	0.47	79.7	26.9	106.1	135.3	26.4	0.32
Wheat	116.9	61.4	124.5	61.1	7.6	0.31	135.1	99.3	99.9	75.3	-35.2	**0.08**

SD = Standard Deviation.

Among AAK customers, substantial and highly significant increases in applied N/ha during 2003-2004 were reported for cabbage, cotton, and maize. Significant decreases in applied N/ha were reported for onion, potato, rice, and sunflower. Increased N applied/ha was reported for cucumber, tomato, and wheat but without statistical significance. In the most general sense, of the 11 crops shown in Table 8, applied N/ha by customers and non-customers increased for 6 crops and decreased for 4 crops. Neither group reported applied N for carrots in 2004. For all crops in Table 8, among customers mean applied N was 144.6/ha in 2003 and 142.5/ha in 2004 or a negligible decrease of about 1.5%. For all crops, among non-customers mean applied N was 176.7/ha in 2003 and 93.7/ha in 2004 or a substantial and significant decrease of about 47.0%. Again it may be reasonably concluded that, compared with non-customers, in general AAK customers are consistent and benefit from private sector extension advice on N application.

Applied Nutrient P

Data on nutrient P applied/ha by customers and non-customers for cotton and 10 food crops in 2003-2004 are shown in Table 9. Among customers and with the exception of maize, there were no statistically significant increases in applied P/ha during 2003-2004. AAK customers reported substantial and significant decreases in applied P/ha for cabbage, cotton, potato, tomato, and wheat.

Table 9. A Comparison of Nutrient P Applied by AAK Customers and Non-Customers in Irrigated Land by Crop in 2003 and 2004

Crop	Customer						Non-Customer					
	2003		2004		Difference	P(T<=1)	2003		2004		Difference	P(T<=1)
	Mean	SD	Mean	SD			Mean	SD	Mean	SD		
	(kg/ha)		(kg/ha)				(kg/ha)		(kg/ha)			
Cabbage	31.2	44.1	0	-	-31.2	**0.14**	-	-	-	-	-	-
Carrot	0	-	-	-	-	-	18.0	35.9	-	-	-	-
Cotton	7.4	38.5	1.9	8.4	-5.5	**0.20**	14.6	60.6	0	-	-14.6	**0.13**
Cucumber	32.5	46	177.7	239.0	145.2	0.27	-	-	-	-	-	-
Maize	0	-	4.6	20.8	4.6	**0.14**	4.8	19.2	0	-	-4.8	**0.17**
Onion	0	-	0	-	-	-	21.7	37.6	0	-	-21.7	0.33
Potato	36.6	73.5	15.6	55.4	-21.0	**0.18**	22.1	87.4	24.4	48.5	2.3	0.46
Rice	2.9	86.7	32.5	65.0	29.6	0.21	0	-	1.7	4.2	1.7	**0.18**
Sunflower	0	-	0	-	-	-	4.1	-	0	-	-4.1	**0.17**
Tomato	83.6	194.0	7.4	20.0	-76.2	**0.17**	12.8	31.3	0	-	-12.8	**0.18**
Wheat	2.8	11.1	0.9	5.2	-1.9	**0.19**	13.8	55.6	0	-	-13.8	**0.08**

SD = Standard Deviation.

Among non-customers, significant increases in applied P/ha during 2003-2004 were not reported for any crop. Significant decreases in applied P/ha were reported for cotton, maize, sunflower, tomato, and wheat. For all crops in Table 9, among customers mean applied P was 28.1/ha in 2003 and 76.2/ha in 2004 or an increase of about 171.2%. For all crops, among non-customers mean applied P was 14.0/ha in 2003 and 13.1/ha in 2004 or a decrease of about 6.4%. Again, in general, it may be reasonably concluded that compared with non-customers AAK customers are consistent and benefit from private sector extension advice on P application.

Applied Nutrient K

Data on nutrient K applied/ha by customers and non-customers for cotton and seven food crops in 2003-2004 are shown in Table 10. Among customers there were statistically significant increases in applied K/ha for cotton, maize, and wheat during 2003-2004. It is instructive to note that these crops received no K application in 2003. This suggests that balanced plant nutrition is occurring among AAK customers but the base remains small. AAK customers reported a significant decrease in applied K/ha for potato. No significant changes were reported for cabbage, cucumber, and tomato. AAK customers reported no applied K for onion in 2003-2004. Among customers, applied K decreased from a mean of 20.2 kg/ha in 2003 to 3.2 kg/ha in 2004. That anomalous change is due to nil K application for cabbage and cucumber in 2004. Among non-customers, the application of K during 2004 was not reported for any crop shown in Table 10. The use of K through NPK use was stimulated by the KAED project. Thus, customers benefited through training of dealers who provide advice on the use of NPK products.

Table 10. A Comparison of Nutrient K Applied by AAK Customers and Non-Customers in Irrigated Land by Crop in 2003 and 2004

Crop	Customer						Non-Customer					
	2003		2004		Difference	P(T<=1)	2003		2004		Difference	P(T<=1)
	Mean	SD	Mean	SD			Mean	SD	Mean	SD		
	(kg/ha)		(kg/ha)				(kg/ha)		(kg/ha)			
Cabbage	31.2	441.0	0	-	-31.2	0.25	0	-	0	-	0	-
Cotton	0	-	6.8	23.6	6.8	**0.05**	1.3	6.3	-	-	-	**0.18**
Cucumber	32.5	46.0	0	-	-32.5	0.25	0	-	0	-	0	-
Maize	0	-	0.4	2.2	0.4	**0.16**	0	-	0	-	0	-
Onion	0	-	0	-	-	-	21.7	37.6	0	-	-21.7	0.33
Potato	7.6	22.3	0.6	2.9	-7	**0.06**	2.6	11.6	0	-	-2.6	**0.16**
Tomato	9.3	24.6	7.4	19.6	-1.9	0.44	0	-	0	-	0	-
Wheat	0	-	0.9	5.2	0.9	**0.16**	0.76	4.5	0	-	-0.76	**0.16**

SD = Standard Deviation.

Nutrient N Use on Rainfed Sunflower and Wheat

Table 11 shows a comparison of nutrient N applied by AAK customers and non-customers on rainfed land for the important crops of sunflower and wheat in 2003 and 2004. AAK customers applied no nutrient N on sunflower in 2003. However, customers applied a mean N rate of 11.0 kg/ha for wheat in 2003 and 61.8 kg/ha in 2004. That increase is dramatic, significant, and a result of private sector extension advice offered by AAK dealers and practiced by customers. Among non-customers, between 2003 and 2004 there were no significant changes in nutrient N applied on rainfed sunflower and wheat.

Table 11. A Comparison of Nutrient N Applied by AAK Customers and Non-Customers on Rainfed Land for Sunflower and Wheat in 2003 and 2004

Crop	Customer						Non-Customer					
	2003		2004		Difference	P(T<=1)	2003		2004		Difference	P(T<=1)
	Mean	SD	Mean	SD			Mean	SD	Mean	SD		
	(kg/ha)		(kg/ha)				(kg/ha)		(kg/ha)			
Sunflower	0.0	-	0.0	-	-	-	23.2	46.2	10.5	18.1	-12.7	0.25
Wheat	11.0	23.5	61.8	19.9	50.8	**0.001**	43.2	51.8	51.4	38.1	8.2	0.37

SD = Standard Deviation.

Seed Sources for Irrigated Crops

Table 12 shows a comparison of sources of seed purchases among AAK customers and non-customers for cultivation on irrigated land by type in 2003 and 2004. In regard to seed quality, the expected quality of seed is highest among seed dealers, followed by that purchased at

bazaars, and own seed saved by farmers is likely of the lowest quality. Of course, the cost of seed with a tradeoff for quality is a prime consideration when farmers choose a source.

Table 12. A Comparison of Sources of Seed Purchases Among AAK Customers and Non-Customers in Irrigated Land by Type in 2003 and 2004

Seed	Source of Seed	Customers				Non-Customers			
		Percent of Farmers		Difference	P(T<=t)	Percent of Farmers		Difference	P(T<=t)
		2003	2004			2003	2004		
Alfalfa	Own	0	0.0	0.0	-	0.0	0.0	0.0	-
	Bazaar	100	100.0	0.0	0.50	100.0	100.0	0.0	0.50
	Seed Dealer	0	0.0	0.0	-	0.0	0.0	0.0	-
Cabbage	Own	0	0.0	0.0	-	33.3	0.0	-33.3	0.25
	Bazaar	100	100.0	0.0	0.50	0.0	100.0	100.0	**0.02**
	Seed Dealer	0	0.0	0.0	-	66.7	0.0	-66.7	**0.13**
Carrot	Own	0	0.0	0.0	-	0.0	0.0	0.0	-
	Bazaar	75	0.0	-75.0	-	75.0	0.0	-75.0	-
	Seed Dealer	25	0.0	-25.0	-	25.0	0.0	-25.0	-
Cotton	Own	2.7	5.7	3.0	0.26	13.0	0.0	-13.0	**0.03**
	Bazaar	18.2	8.6	-9.6	**0.11**	56.6	51.9	-4.7	0.37
	Seed Dealer	81.1	85.7	4.6	0.30	30.4	48.1	17.7	**0.10**
Cucumber	Own	0	0.0	0.0	-	50.0	0.0	-50.0	-
	Bazaar	50	50.0	0.0	0.50	0.0	0.0	0.0	-
	Seed Dealer	50	50.0	0.0	0.50	50.0	0.0	-50.0	-
Maize	Own	28.57	48.0	19.4	**0.14**	31.3	34.6	3.4	0.41
	Bazaar	42.9	36.0	-6.9	0.34	56.3	53.8	-2.5	0.44
	Seed Dealer	28.6	16.0	-12.6	**0.18**	12.5	11.5	-1.0	0.46
Onion	Own	14.29	0.0	-14.3	0.28	33.3	0.0	-33.3	0.25
	Bazaar	71.4	100.0	28.6	**0.19**	33.3	0.0	-33.3	0.25
	Seed Dealer	14.3	0.0	-14.3	0.28	33.4	100.0	66.6	**0.13**
Potato	Own	16.67	35.7	19.0	**0.11**	20.0	33.3	13.3	0.22
	Bazaar	27.8	21.4	-6.4	0.34	80.0	66.7	-13.3	0.22
	Seed Dealer	55.6	42.9	-12.7	0.24	0.0	0.0	0.0	-
Rice	Own	77.78	75.0	-2.8	0.46	75.0	50.0	-25.0	0.21
	Bazaar	11.1	25.0	13.9	0.26	25.0	33.3	8.3	0.39
	Seed Dealer	11.1	0.0	-11.1	0.24	0.0	16.7	16.7	**0.19**
Sunflower	Own	44.44	60.0	15.6	0.23	28.6	33.3	4.8	0.41
	Bazaar	55.6	40.0	-15.6	0.23	71.4	66.7	-4.8	0.41
	Seed Dealer	0	0.0	0.0	-	0.0	0.0	0.0	-
Tomato	Own	28.57	14.3	-14.3	0.26	16.7	57.1	40.5	**0.07**
	Bazaar	28.6	14.3	-14.3	0.26	66.7	28.6	-38.1	**0.09**
	Seed Dealer	42.9	71.4	28.5	**0.14**	16.6	14.3	-2.3	0.46
Wheat	Own	37.5	32.3	-5.2	0.33	41.2	50.0	8.8	0.27
	Bazaar	9.4	6.5	-2.9	0.33	38.2	44.4	6.2	0.33
	Seed Dealer	53.1	61.3	8.2	0.26	20.6	5.6	-15.0	**0.08**

Alfalfa

Among customers and non-customers, alfalfa seed was exclusively purchased at bazaars in 2003-2004. This can be explained by the fact that there are very few sources of alfalfa seed in southern Kyrgyzstan. Thus, farmers either have to locate their seed from northern Kyrgyzstan or purchase from the bazaar.

Cabbage

AAK customers purchased cabbage seed exclusively at bazaars in 2003-2004. For non-customers, there was a sharp and pronounced shift in their sources of cabbage seed between 2003 and 2004. In 2003 about one-third of non-customers used their own saved cabbage seed and two-thirds purchased that seed from dealers. In 2004, 100.0% of non-customers reported exclusive cabbage seed purchases from bazaars, a highly significant change in seed sources. It is likely that the quality of all seed sold in bazaars is superior to that saved by farmers but inferior to that sold by seed dealers.

Carrot

Neither customers nor non-customers surveyed cultivated carrots in 2004.

Cotton

During 2003-2004, AAK customers significantly reduced purchases of cotton seed from bazaars and increased purchases of that seed from seed dealers. Non-customers also changed their sources of cotton seed significantly and reduced reliance on their own saved seed by substantially increasing purchases from seed dealers. Thus, dealers became the preferred source for cotton seed and farmers purchased higher quality seed.

Cucumber

Non-customers did not report the cultivation of cucumber in 2004. AAK customers remained equally as likely to purchase cucumber seed from bazaars as from seed dealers about 50.0% from each source.

Maize

Table 12 shows that during 2003-2004, non-customers did not significantly change their sources of maize seed. They continued their reliance on bazaars, saved seed, and lastly, seed dealers in that order. AAK customers significantly changed their sources of maize seed. In 2003, about 28.6% purchased that seed from dealers but in 2004, that was reduced significantly to 16.0%. A significant change to the use of saved seed is evident in that in 2003 28.6% used their

own seed and in 2004 that increased to 48.0%. This trend suggests that customers may be purchasing quality maize seed in alternate years.

Onion

AAK customers significantly increased their reliance on onion seed from bazaars. The percentage of customers purchasing that seed from bazaars increased from 71.4% in 2003 to 100.0% in 2004. Non-customers substantially and significantly increased their purchases of onion seed from seed dealers. In 2003, 33.4% of non-customers reported such purchases and in 2004 that increased to 100.0%. This may again suggest a cycle of using quality seed from dealers in alternate years.

Potato

Concerning potato seed, in 2003, 16.7% of AAK customers used their own saved seed and in 2004 that increased significantly to 35.7%. Non-customers continued their reliance on potato seed from bazaars and to a lesser extent on their own saved seed without significant change. Note that among non-customers, although use of own seed increased from 20.0% in 2003 to 33.3% in 2004 and bazaar purchased decreased from 80.0% in 2003 to 66.7% in 2004, these changes are not statistically significant.

Rice

Table 12 also shows that in 2003 and 2004 customers (75.0%) maintained a pattern of great reliance on their own rice seed. In contrast, non-customers reduced use of their own rice seed from 75.0% in 2003 to 50.0% in 2004 and significantly increased purchases of rice seed from dealers from nil to 16.7% in 2004.

Sunflower

In 2003-2004, no significant changes occurred in the sources of sunflower seed reported by AAK customers and non-customers. The data suggest that customers may also be in a cycle of using saved and purchased sunflower seed because purchases from bazaars decreased from 55.6% in 2003 to 40.0% in 2004 but the use of own seed increased from 44.4% to 60.0% during the same period.

Tomato

Tomatoes are a profitable crop in southern Kyrgyzstan. Customers reduced the use of their saved and bazaar purchased tomato seed. Customer purchases of higher quality tomato seed from dealers increased significantly from 42.9% in 2003 to 71.4% in 2004. Non-customers significantly reduced the purchase of tomato seed from bazaars from 66.7% in 2003 to 28.6% in 2004, and significantly increased use of their own tomato seed from 16.7% in 2003 to 57.1% in 2004.

Wheat

Non-customers significantly reduced the purchase of wheat seed from dealers from 20.6% in 2003 to a mere 5.6% in 2004. Their purchases from bazaars and use of own wheat seed increased but not significantly. The majority of customers relied on dealers for wheat seed in 2003 (53.1%) and 2004 (61.3%) and their own seed in 2003 (37.5%) and 2004 (32.3%). However, these changes are not statistically significant.

Seed Sources for Rainfed Crops

Table 13 shows the sources of seed for rainfed sunflower and wheat. These data quantify a contrast between AAK customers and non-customers for both types of seed.

Table 13. A Comparison of Seed Sources for Rainfed Sunflower and Wheat Among AAK Customers and Non-Customers in 2003 and 2004

Seed	Source of Seed	Customers				Non-Customers			
		Percent of Farmers		Difference	P(T<=t)	Percent of Farmers		Difference	P(T<=t)
		2003	2004			2003	2004		
Sunflower	Own	75.0	25.0	-50.0	**0.08**	66.7	100.0	33.3	**0.12**
	Bazaar	25.0	75.0	50.0	**0.08**	33.3	0.0	-33.3	**0.12**
	Seed Dealer	0.0	0.0	0.0	-	0.0	0.0	0.0	-
Wheat	Own	75.0	20.0	-55.0	**0.01**	43.8	50.0	6.3	0.41
	Bazaar	12.5	0.0	-12.5	**0.12**	37.5	25.0	-12.5	0.32
	Seed Dealer	12.5	80.0	67.5	**0.01**	18.9	25.0	6.1	0.39

Sunflower

The use of own seed for rainfed sunflower among customers dramatically and significantly decreased from 75.0% in 2003 to 25.0% in 2004. Purchases of that seed from

bazaars significantly increased from 25.0% in 2003 to 75.0% in 2004. A majority of non-customers (66.7%) used their own saved seed for rainfed sunflower in 2003, but in 2004 that percentage increased significantly to 100.0%. Again, an alternate seed use cycle is evident.

Wheat

During the period between the baseline and impact surveys, the percentage of customers using their own seed for rainfed wheat significantly decreased from 75.0% in 2003 to 20.0% in 2004. Conversely, those purchasing that seed from dealers increased very significantly from 12.5% in 2003 to 80.0% in 2004. If there were indeed a cycle of alternate seed use, one would expect the reverse to occur in 2006. No significant changes in the sources of seed purchases among non-customers were reported, and the major sources were saved seed (50.0%), followed by bazaars (25.0%), and least from dealers (25.0%) in 2004.

Crop Yields on Irrigated Land

As shown in Table 14, during 2003 and 2004, AAK customers significantly increased yields for cabbage and cotton. For cabbage, the mean yield increased from 10,500 kg/ha in 2003 to 65,000 kg/ha in 2004. For cotton those figures are 1,949 kg/ha and 2,557 kg/ha, respectively. Mean yields of sunflower decreased significantly among customers from 2,231 kg/ha in 2003 to 1,450 /kg/ha in 2004. This is the only crop among customers where a significant decline was recorded. Customers reported a mean increased yield of wheat from 3,580 kg/ha in 2003 to 3,789/kg/ha in 2004 but these increases are without statistical significance. Decreased yields were reported for alfalfa, maize, onion, potato, rice, and tomato but are not significant. Among non-customers, statistically significant decreases in yields were reported for four crops—maize, onion, rice, and wheat. Significant mean increases in yields were reported for alfalfa and cotton. Clearly, compared with non-customers, the mean yields of the crops of AAK customers show that crop yields were stable or improved. That is substantially attributable to the private sector extension advice provided by AAK dealers.

Table 14. A Comparison of Yields Obtained by AAK Customers and Non-Customers in Irrigated Land by Crop in 2003 and 2004

Crop	Customer						Non-Customer					
	2003		2004				2003		2004			
	Mean (kg/ha)	SD	Mean (kg/ha)	SD	Difference	P(T<=1)	Mean (kg/ha)	SD	Mean (kg/ha)	SD	Difference	P(T<=1)
Alfalfa	6,367	5,137.8	2,000	-	-4,367	0.31	4,241	1,198.5	6,344	2,342.3	2,103	0.21
Cabbage	10,500	13,435.0	65,000	35,355.3	54,500	**0.12**	8,722	9,826.7	25,000	-	16,278	**0.14**
Carrot	33,388	28,722.3	-	-	-	-	25,402	16,276.7	-	-	-	-
Cotton	1,949	524.1	2,557	736.6	608	**0.001**	1,738	587.7	2,059	823.8	321	**0.06**
Cucumber	4,125	3,005.2	38,333	40,069.4	34,208	0.22	3,333	2,357.0	-	-	-	-
Maize	5,627	2,031.9	5,543	3,295.0	-84	0.46	5,108	2,567.5	4,116	2,838.8	-992	**0.13**
Onion	24,762	15,105.4	16,500	190,091.9	-8,262	0.33	19,643	1,988.5	2,000	-	-17,643	**0.01**
Potato	18,456	8,718.3	16,405	11,241.8	-2,051	0.29	17,966	8,146.4	17,296	13,947.0	-670	0.40
Rice	3,542	1,642.3	3,125	1,813.6	-417	0.35	2,190	905.4	1,972	1,603.5	-218	0.40
Sunflower	2,231	1,449.7	1,442	721.9	-789	**0.08**	1,622	666.6	1,088	507.5	-534	**0.02**
Tomato	19,690	14,916.6	18,286	13,176.1	-1,404	0.43	14,917	6,754.0	15,143	14,565.1	226	0.49
Wheat	3,580	1,039.2	3,780	1,127.9	200	0.23	3,576	1,190.0	3,154	1,140.3	-422	**0.11**

SD = Standard Deviation.

Crop Yields on Rainfed Land

Table 15 shows mean yields of rainfed sunflower and wheat among customers and non-customers in 2003 and 2004.

Sunflower

Among customers, without significant increase or decrease, mean yields of sunflower were stable in 2003-2004. In contrast, those yields among non-customers decreased significantly from 1,429 kg/ha in 2003 to only 801 in 2004.

Wheat

Mean rainfed wheat yields among AAK customers increased from 1,889 kg/ha in 2003 to 2,176 kg/ha in 2004 but that change is without statistical significance. Likewise, those yields increased among non-customers from 2,134 kg/ha in 2003 to 2,391 kg/ha in 2004 without statistical significance.

Sales of Farm Produce

The greatest difference between AAK customers and non-customers is evident in Table 16, which shows comparative data on the revenue realized from the sale of farm products in 2003 and 2004. Among customers, total income from the sales of farm products increased from US $76,579.20 in 2003 to US $135,005.10 in 2004 or by about 43.0%. In contrast, that income among non-customers decreased from US $34,368.80 in 2003 to US $23,395.48 in 2004, or by about 32.0%. Therefore, mean household income among customers increased significantly from US $1,160.29 in 2003 to US $2,045.53 in 2004. Stated in another way, mean income per household member among AAK customers increased from US $221.36 in 2003 to US $723.49 in 2004 or by about 69%.

Table 15. A Comparison of Wheat and Sunflower Yields Obtained by AAK Customers and Non-Customers on Rainfed Land in 2003 and 2004

Crop	Customer						Non-Customer					
	2003		2004				2003		2004			
	Mean (kg/ha)	SD	Mean (kg/ha)	SD	Difference	P(T<=1)	Mean (kg/ha)	SD	Mean (kg/ha)	SD	Difference	P(T<=1)
Sunflower	1,625	1,172.3	1,061	207.6	-564	0.21	1,429	1,228.9	801	610.9	-628	**0.14**
Wheat	1,889	652.3	2,176	943.2	287	0.23	2,134	912.9	2,391	1,787.1	257	0.40

SD = Standard Deviation.

Table 16. A Comparison of Revenue from the Sale of Farm Products by AAK Customers and Non-Customers in 2003 and 2004*

Revenue	Customer						Non-Customer					
	2003		2004				2003		2004			
	Mean	SD	Mean	SD	Difference	P(T<=1)	Mean	SD	Mean	SD	Difference	P(T<=1)
Total (US $)	76,579.20		135,005.10		58,425.90		34,368.80		23,395.48		-10,973.32	
Mean (US $)	1,160.29	1,568.5	2,045.53	5,500.9	885.24	**0.11**	458.25	696.4	359.93	673.8	-98.32	**0.20**
Mean (per household member US $)	221.36	294.1	723.49	2,637.6	502.13	**0.06**	111.23	183.4	88.27	177.7	-22.96	0.23

SD = Standard Deviation.

*These data exclude two customers in 2003 whose revenues were excessively anomalous and unrepresentative.

Gender and Sales of Farm Produce

The data in Table 17 further confirm and support the observations on the sale of farm produce and elaborate those data in light of the role of women in the sale of farm produce. The percentage of AAK customer households that sold no farm produce declined dramatically and significantly from 64.4% in 2003 to only 21.8% in 2004. That figure also declined for non-customers significantly but less dramatically from 61.5% in 2003 to 40.2% in 2004.

Table 17. A Comparison of Household Members Engaged in Selling Farm Products by Gender in 2003 and 2004

Gender of Seller	Customer				Non-Customer			
	2003	2004	Difference	P(T<=1)	2003	2004	Difference	P(T<=1)
No Sales (%)	64.4	21.8	-42.6	**0.001**	61.5	40.2	-21.3	**0.001**
Men (%)	21.6	36.0	14.4	**0.001**	19.5	24.8	5.3	**0.05**
Women (%)	14.0	42.2	28.2	**0.001**	19.0	35.0	16.0	**0.001**
Total	100	100			100	100		

On a percentage basis, women in the households of customers and non-customers became more involved in the sale of farm produce. Among customers, that percentage increased significantly from 14.0% in 2003 to 42.2% in 2004. That figure also increased for non-customers significantly but less dramatically from 19.0% in 2003 to 35.0% in 2004. One may conclude that, compared with men, improvements in agricultural production increase the workload of women.