Final Report from CIMMYT

A Report Submitted to the Agency for Support of the Development of the Agricultural Private Sector
AZERBAIJAN CGS

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Tavan Region
Azerbaijan CGS Final Report

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1. Introduction

Agriculture occupies an important place in the national economy of Azerbaijan. In 1999 the share of agriculture in the national economy was 28.69%. The population of Azerbaijan in 1999 was a little over eight million people of which 51% were urban and 49% rural; 42.3% of the population depends on agriculture.

Since its independence in 1991, Azerbaijan has carried out profound reforms in almost all segments of its economy, including the agricultural sector. State farms have been abolished and the land and livestock distributed among 800 thousand people; nearly 40 thousand enterprises, comprising small farmers, private property based producers' cooperatives and other agribusinesses have been created. Price controls on inputs and outputs were eliminated, as well as the administrative-command system, state-owned enterprises for marketing and agro-processing.

The agricultural sector has undergone profound changes and, at present, consists of private farmers, leasers, producer cooperatives, agro-processing units, service organizations and other private enterprises.

Despite these changes in the agricultural economy, the national agriculture research system, its management and infrastructure have remained unchanged. Research institutions face enormous financial difficulties and as a result many highly qualified scientists have abandoned research. The old system of priority setting and control does not correlate with the current economic realities, but continues to function as in the past.

Given the current economic realities of the agricultural sector in Azerbaijan, there is an urgent need to find mechanisms to improve the cost effectiveness and efficiency of the agricultural research and extension system. A comprehensive strategy to reform the agricultural knowledge system is a long term undertaking. The Competitive Grant System (CGS) is a mechanism to jump start the reform process by providing mechanisms to identify and implement projects in areas of research, extension and training that would have immediate impact on the resource poor farmer's ability to enhance productivity and profitability.

The Agriculture Development and Credit Project of the Agency for the Support of the Development of the Agricultural Private Sector in Azerbaijan seeks to reform and re-invigorate the national agricultural research system in support of the modernization of the country's agriculture and the development of private farming. This entails the re-orientation of agricultural research towards meeting high priorities of the sector, the building of a capacity for on-farm technology assessment and the development of a national strategy for reforming agricultural research and the agricultural knowledge system in general. CGS is envisaged as a first step in achieving this goal.

During the first phase of this project, the emphasis will be on initiating result-oriented research and research and extension projects in order to jump start the productivity and profitability of resource poor farmers. These efforts are to be executed through a CGS by
awarding complementary financial support to selected priorities making use of the current research and extension system.

As the CGS moves forward, new mechanisms will be developed to identify longer term goals in research, extension and training. A comprehensive strategy to reform agricultural research, extension and training will be the final aim, so that the research and extension system is sustainable and relevant to new economic realities and social needs.

To accomplish the above goal, the Agency for Support to the Development of the Agricultural Private Sector (ASDAP, hereinafter called the “the Client”) and the International Maize and Wheat Improvement Center (CIMMYT, hereinafter called “the Consultant”) entered into a contract on 15/11/2000, whereby the Consultant agreed to provide the aforementioned services to the Client.

This report by the Consultant, at the end of the contract period, is a comprehensive account concerning the state of affairs of the CGS in Azerbaijan. The report is organized in eight chapters. The Introduction provides background information that led to the initiation of CGS and the contact with CIMMYT. The second chapter Expected Outputs describes the expected outcome of the contract with CIMMYT and what has been achieved. The third chapter Consultation Missions is a factual statement concerning the number of missions undertaken by the consultants in accomplishing the goals of the CGS. The fourth chapter Problem Analysis and Priority Setting presents the general agricultural scene in Azerbaijan and gives an in-depth description of various aspects of priority setting undertaken in achieving the goals of CGS. Chapter five provides an in-depth Sector by Sector Analysis of sectors where CGS is operational. The Current Status of CGS is described in chapter six. For a project to be successful there must be proper Evaluation and Monitoring, explained in chapter seven. In our opinion the CGS is a very successful project. However, there is always room for improvement, and chapter eight provides some Suggestions for the Future aimed at making the CGS even better.
2. Expected Outputs

A brief description of the project’s expected outputs is given below.

- **A functional CGS in place.** During the course of this contract, the six consultants visited Azerbaijan a total of 21 times and provided more than 330 person-days of service. This has resulted in an operational manual for the project, and the establishment of an efficient CGS secretariat and an effective priority setting process. The consultants also aided scientists in developing grant proposals, helped the secretariat in evaluating individual project proposals and conducted on-site evaluation and monitoring of CGS projects. Thus it can be safely stated that an effective and efficient CGS capable of handling the future needs of Azerbaijan is in place.

- **An approved operational manual for the CGS.** A CGS implementation manual was developed in collaboration with the project secretariat staff, and a final draft was handed over to the CGS Secretariat on 5/03/2001.

- **At least two stages (tranches) of CGS projects approved.** During the course of this contract, a total of 21 grant projects in two stages were approved and became operational.

- **Reports by topic specialists.** Specialists reported on problems and solutions for each of the topics, assessed institutional capacities and made recommendations for improving the sector. After each visit the topic specialists assessed each of their subject areas. Their observations form part of the first and second progress reports, and their assessment subsequent to these reports form part of this final report.

- **Training in participatory research methodology.** The participatory research methodology specialist visited Azerbaijan twice during the course of this contract and provided methodology training. The information generated through this process was used for the second round of priority setting.
3. Consultation Missions

The Consultant agreed to deploy the following six specialists to accomplish the tasks at hand.

1. Dr. G. Varughese, Team Leader and Competitive Grant Specialist for 100 days.
2. Dr. A. Morgounov, Topic Specialist - Field Crops for 45 days.
3. Dr. P. Wall, Topic Specialist - Natural sources for 45 days.
4. Dr. C. Boyer, Topic Specialist - Horticulture for 45 days.
5. Dr. R. Blake, Topic Specialist - Livestock for 45 days.
6. Dr. E. Meng, Topic Specialist - Participatory Research for 50 days.

During the contract period, the six consultants made a total of 21 field visits to Azerbaijan. The dates of their visits are noted below.

- George Varughese, November 18 to December 24, 2000.
- Erika Meng, October 16 to November 12, 2001.
- George Varughese, October 30 to November 17, 2001.
- Patrick Wall, April 11 to April 30, 2002.
- Charles Boyer, August 20 to September 17, 2002.
- Robert Blake, August 23 to September 1, 2002.
- George Varughese, August 23 to September 3, 2002.
- Alexei Morgounov, December 15 to December 20, 2002.
4. Problem Analysis and Priority Setting

**CURRENT STATUS OF AGRICULTURE IN AZERBAIJAN: GENERAL DESCRIPTION OF THE AGRICULTURAL SECTOR**

Agriculture occupies an important place in the national economy of Azerbaijan. In 1999 the share of agriculture in the national economy was 28.69% of which the share of crops was 17.47% and livestock was 11.22%. The population of Azerbaijan in 1999 was a little over eight million people of which 51% were urban and 49% rural; 42.3% of the population depends on agriculture.

The land area of Azerbaijan is over eight million hectares, of which 41% is plains (delta of the Kur and Aras rivers) and 59% is hilly or mountainous (big and small Caucasus and Tslish mountains). Only 18.8% of the total area, or 1,622,129 hectares, is arable. However, 88% of arable land is irrigated. Due to various limitations that the emerging farmers face, only 58% of arable land, or 941,200 hectares, was cultivated in 1999.

The Caspian Sea and the Caucasus Mountains influence weather patterns in Azerbaijan. Warm winters and hot summers are characteristic of the lowlands in the eastern and central parts of the country. Subtropical climate is prevalent in the rainy southeast. Other regions are dry or semi-arid. Based on the agro-climatic conditions, the country is divided into 10 production zones.

Since independence in 1991, the Government of Azerbaijan has made a vigorous effort to restructure the agricultural sector. Today 813,000 families own close to 75.7% of the arable land. An overwhelming percentage of this is individual smallholdings of less than one hectare per head. The number of private enterprises in agriculture has also increased dramatically during this period and today they number more than 40,000. The average holding of these enterprises is 3.97 ha. State controls over inputs and outputs were totally removed. However, new systems are yet to emerge and even though the farmers are free to make their own decisions concerning what to grow, how to grow, what inputs to use and how to dispose of their produce, the lack of formal and informal systems supporting inputs and outputs has resulted in enormous difficulties for the farming community. Yet another important factor is that many of the farmers are farming for the first time in their life. They lack experience, and there is no extension service to assist them.

Before independence, 61.4% of the cultivated area used to receive an average of 135 kg of mineral nutrients per hectare. Today only 5.4% of the area receives mineral nutrients, and the quantity per hectare is down to 43.1 kg. There is also substantial reduction in the use of certified seeds. Both of these inputs have a significant impact on crop productivity.

Azerbaijan is a deficit country for almost all agricultural products, except fruits and fish. The largest deficit was for cereals: in 1999 it imported more than 700 thousand metric tons of wheat or wheat flour. Substantial amounts of milk and milk products (197,000 tons), meat and meat products (43,800 tons), eggs (120,700 units), potatoes (38,600 tons), and vegetables (21,900 tons) were also imported. Hence there is an urgent need to
increase the production and productivity of both crops and livestock so that the country can achieve better food security.

Based on their contribution to the national economy, there is no major shift in the relative position of crops and livestock between 1990 and 1999. Percentage share of crops has decreased slightly, from 63.5% in 1990 to 60.1% in 1999. Consequently the share of livestock has increased from 36.5% to 39.1%. Thus the relative priority for these two sectors should be in a proportion of 60:40.

Crops

There has been a dramatic shift in the cropping pattern in Azerbaijan between 1990 and 1999. Cereals continue to be the most important crop. However, the share of area occupied by the cereals has shifted from 32.6% to 55.5%. At present there is almost no difference between forage crops, horticultural crops, industrial crops and potato and vegetables with respect to the proportion of area each one of them occupy. They range between 10.6% to 11.6%.

<table>
<thead>
<tr>
<th>Crops</th>
<th>% area in 1990</th>
<th>Rank in 1990</th>
<th>% area in 1999</th>
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<td>1</td>
<td>55.5</td>
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<td>10.6</td>
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<td>Potato and vegetables</td>
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<tr>
<td>Forage crops</td>
<td>29.2</td>
<td>2</td>
<td>10.8</td>
<td>4</td>
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</tbody>
</table>

Cereals

Wheat by far is the most important cereal in Azerbaijan. Both bread and durum wheat are important and between them they occupy almost 55.5% of the cultivated area. With respect to the pre-independence period, area at present is 11% below and the production is 22% below, indicating reduction in productivity. There is some rice, maize, rye and triticale under cultivation. However, they occupy very little area or have only regional importance and for the consideration of CGS these small grains may be treated as specialty crops. In 1999, Azerbaijan imported more than 700 thousand tons of wheat and wheat flour. From the national food security point of view, cereals should continue to be the number one priority crops.
Horticultural Crops

As a group horticultural crops rank second having 11.6% of area devoted to their cultivation. During the 80's Azerbaijan used to produce close to 2 million tons of grapes. However, policies initiated in 1986 discouraged viticulture and close to 90% of the plantations were destroyed. As a result the production today is only 5% of what it was in the 80's. Potential for expanding table grape production is excellent. Area devoted to tea shrank by 59% and the production by some 92%. Area under sub-tropical fruits experienced a reduction of 39%. However, the production of fruits in 1999 was 36% more than that of the 1990 harvest. The increase in productivity is probably a reflection of better accountability. Fruit orchards today are in private hands while during the pre-independence period they belonged to the public sector.

Potato, vegetables and melon

At present potato, vegetables and melon combined occupy 11.4% of the cropped area and are ranked as the third most important group. Area under all of these crops increased in comparison to the pre-independence days. Potato increased from 23,800 ha. to 37,900 ha. vegetables from 40,300 ha. to 46,200 ha, and melon from 9,100 ha to 22,400 ha. Both potato and melon have shown increases in productivity in addition to increase in area. Although the areas under vegetables have increased by some 15%, the actual production in 1999 was 22% less than the 1990 harvest. This would indicate that there is a sharp drop in the productivity of the vegetable crops.

Forage Crops

Forage crops were the second most important group of crops during the pre-independence period and used to occupy more than half a million hectares: a close second to the cereal crops. However in 1999 the area under forage crops was only 20% of what it used to be during the pre-independence period. This could have important implications for the productivity of livestock in the future.

Industrial Crops

Cotton and tobacco used to be very important crops during the pre-independence period. However, their area has dropped by a magnitude of 64% and 70%, and production has dropped to a tune of 82% and 84% respectively in 1999. This would indicate a sharp drop in productivity in addition to drop in area. Today the industrial crops rank the lowest among the crops having only 10.6% of the total area devoted to their cultivation. It should be noted that the industrial crops provide high employment for the rural farm workers and also they are important components in the cropping system.

Specialty Crops

There are a number of minor crops like grain legumes, oils seeds, small grains other than wheat and medicinal plants. These crops may not show up in the statistics because they occupy much smaller area. However they still are important and are important for the
sustainability of productivity of the major crops by serving as rotation crops and at the same time contributing to the national economy. It should also be noted that many of these crops are important for the dietary habits of the Azeri people and they are important for the nutrition.

Livestock

Livestock represents the single most important agrarian sector in Azerbaijan. Livestock is composed of cattle (including buffalo), sheep (including goats), pigs and poultry. After an initial drop in their number during the reorganization, the numbers of cattle and sheep have recovered and today are 4% and 2% respectively more than what they were in 1990. However, the number of pigs is only 17% of what it was in 1990. This dramatic drop is attributed to the dispute over the land where the pig industry was the strongest. Poultry numbers also show a dramatic drop between 1990 and 1999, and today are only 48% of what they were in 1990. As a result the relative price of poultry meat in Azerbaijan is high. Feed grains and feed mixtures used to come from other parts of USSR during the pre-independence period and this has stopped altogether. A second significant factor is the lack of buyers for the old collective poultry chicken producing facilities, resulting in them going out of use. Although the number of cattle has recovered the meat production today is only 60% of what it was in 1990. However, the milk production has more than recovered and it is 2% above the 1990 mark. Wool production is back to what it was in 1990, but egg production is only 53% of what it was in 1990.

Natural Resources

Issues related to Natural Resources, especially those related to land and water, are very important. Of the total land mass of 8,641,506 hectare 1,609,424 hectare is arable land and of which 1,097,169 hectare has irrigation potential. Almost 42% of the land mass is prone to forces of erosion. Salinity is another major problem, and approximately 611,000 hectare is affected. Nine percent of this total is almost completely unproductive, 21% has medium salt build up and 70% has at present low levels of salinity. Rainfall in general in Azerbaijan is low and the ground water reserves are also low. However, it is worth noting that almost 80% of the arable land has some form of irrigation available. Fifty-nine percent of the land area of Azerbaijan is in hilly and mountainous regions. Cultivation is most common where the slope is between 2° to 12° and in exceptional cases it extends up to 15°.

Mechanization, Electrification and Agro-Engineering Services

Lack of appropriate machinery, spare parts and services are important bottle necks to enhancing the productivity of agriculture. Timely implementation of activities is of immense importance for the success of a production system. Availability of suitable machinery, spare parts, maintenance of machinery and farmer knowledge in all these aspects are fundamental to increasing the productivity of agriculture. Establishment of private enterprises in providing services to farmers is also important to enhance the productivity.
Agricultural Economy

The profound reforms in the Agrarian sector undertaken by the Government of Azerbaijan since its independence have resulted in the emergence of a large number of small holder farmers. These reforms also resulted in the abolition of centralized procurement, processing and distribution systems. At present the market structures for inputs and outputs are very weak. In addition the emerging farming community lacks experience in farm management and production technologies. Proper use of natural resources, availability of cheap labor and use of appropriate production technology coupled with the development of proper marketing system could trigger rapid developments in the agricultural sector.

Agricultural Research

Azerbaijan has a long tradition of excellence in agricultural research. First field surveys in Azerbaijan were conducted in 1894 and the following year experimental fields were established. The first experimental station was for cereal and cotton breeding and this was established in Ganja in 1925. Over the years a number of research stations and institutes were added and today there are some 26 research institutes related to agricultural research of which 15 are under the Ministry of Agriculture and 6 are under the Academy of Science, 3 under the authority of State Melioration and Water Economy, one each under the State Land Committee and Azerforest operating in Azerbaijan. In addition there is one institute fully dedicated for teaching agriculture under the Ministry of Education. A total of 6046 people work in these institutes of which 1257 are professional staff, 150 have professor status and the rest have PhD level training. Having this kind of scientific capacity, it was assumed that CGS could have a jumpstart. However this proved to be a wrong assumption.

During the past few years the agricultural sector has undergone significant reforms and today 75.7% of the arable land is under private ownership and most of the farmers have less than one hectare of land. Priorities for agricultural research still are based on the old realities and there is an urgent need to set priorities based on the current realities.

A second crisis that the research institutes are facing relates to their financial situation. There is almost no money available for research support and almost all the money goes for salaries and benefits. Hopefully the CGS will help Azerbaijan in defining the most important priorities in agricultural research and shall fund these priority areas. CGS only aims at jump starting those activities which could have an immediate impact upon the resource poor farmers. However, the ultimate aim is reorganization of the agricultural knowledge system so that research and extension will be sustainable and have relevance to the circumstances of the ultimate beneficiaries.

Priority Setting Process

Priority setting is the cornerstone of the Competitive Grant System (CGS) and the success of the CGS rests entirely on this process and its outcome. A series of actions,
activities and events took place during the months of October and November culminating in a national priority setting workshop in Baku on November 29 to December 1, 2000.

It was essential to develop a reference document where, all those who were participating in the various events leading to the priority setting could find most of the relevant information concerning agriculture in one place. Hence, a team comprising researchers, policy makers from the Ministry of Agriculture and the staff from the Competitive Grant Secretariat put together a comprehensive review document entitled “Agricultural Review”. This document does provide vital information concerning the current status of agriculture in Azerbaijan. Topics that are covered include area, production, natural resources, infrastructure, and current status of the processing industry, some discussion on agrarian policy and a description of the agrarian research system. Copies of this document were given to all those who took part in various discussions leading up to the priority setting.

During the month of November 2000, five regional consultation meetings were held, one each in Baku, Ghanja, Khachmaz, Khizi, and Salya districts of Azerbaijan. The Secretariat staff used these events for training the participants in problem analysis and priority setting. Farmers, representatives from farming associations and scientists from the Ministry of Agriculture and the Academy of Science were the participants. At the concluding session of these meeting the farmers and farming associations were asked to choose their representatives to participate at the national priority setting workshop.

The national priority setting workshop was held in Baku from November 29 to December 1, 2000. About 150 people consisting of farmers, representatives of farming associations, private enterprises, NGOs’, scientists and policy makers attended this all-important workshop. The Honorable Minister of Agriculture chaired the first and the last plenary sessions of this workshop. At the opening session the Honorable Minister of Agriculture talked about the role of agriculture in the Azerbaijan economy, Prof. J. A. Aliev presented the past and present situation of agricultural research in Azerbaijan, and Dr. G. Varughese of CIMMYT discussed the importance of priority setting. After the opening session the workshop broke up into nine working groups. Working groups were formed either on the basis of commodities or on the basis of scientific disciplines. These working groups met for a day and a half each defining their goals, analyzing in depth the technical problems that each of these sectors were facing today and looking at possible solutions. At the end, each of the working groups produced a list of priorities. These priorities were presented to the final plenary session and the workshop adopted them as the priorities to be pursued by the Competitive Grant System. Details of their findings and the list of priorities are presented in the following sections of this report. However, it is important to note that these priorities refer only to major themes and there is need for further refining the priorities, so that each of the themes could be further delineated into components. The Secretariat would undertake the task of conducting in-depth problem-cause analysis for each of these themes during the period of February-April, and also shall conduct special training sessions for all the potential participants to teach them the details of project development (refer section 4.6 and 4.7).
PROBLEM ANALYSIS AND IDENTIFICATION OF PRIORITY AREAS

Crops

Wheat production
Cereals constitute the most important segment of the agrarian economy of Azerbaijan and 55.5% of the sown area belongs to the cereal crops. Since the initiation of agricultural reform, the proportion of cereal area has increased substantially. Almost all the area under the cereals belong to either bread or durum wheat. Barley, rye, rice, maize and triticale occupy very small areas or are important in some niches and thus their priorities are treated under speciality crops. Azerbaijan at present is only 70% self sufficient in wheat and wheat products. From national food security point of view wheat occupy the first place among the various agricultural sectors. Opportunities for further expanding the area, enhancing the productivity and profitability of wheat are excellent.

The main obstacles in achieving these important goals are:
1) Inadequate research and promotion of research results for improving the cropping system, and cropping practices that can optimize productivity and/or reduce the cost of production.
2) Lack of adequate supply of good quality wheat seed at a reasonable price in the various production zones.
3) Inadequate efforts in identifying appropriate varieties for the various production zones.
4) Lack of proper maintenance and use of appropriate agricultural machinery in order to establish a good seedbed, weed control, and timely and efficient harvest.
5) Absence of appropriate service mechanisms to address the technical needs of producers.
6) Unacceptable levels of crop losses due to inadequate disease control, and
7) Inability in finding cost effective solutions for soil salinity, drought and heat.

The following activities could result in improving the productivity and profitability of cereals cultivation in Azerbaijan:
1) A concerted effort in the promotion of appropriate cropping systems, and cropping practices that could reduce the cost of production and at the same time result in optimum yields that are profitable for the producers and/or on farm verification or validation of technologies.
2) A combined effort by public and private enterprises and contract farmers in producing and promoting good quality seed.
3) Development and promotion of new crop varieties that are adapted to the various agro-climatic zones of Azerbaijan, which are high yielding, have stable productivity, have resistance to the major diseases, and have acceptable industrial quality.
4) A combined effort by the public and private enterprises in removing the constraints of agricultural machinery.
5) Development of effective partnerships between farmers, researchers, and extension workers in addressing the problems of the producers.
6) Efforts in finding solutions that could minimize the effect of extreme conditions (salinity, drought, heat and erosion) may have some effect in improving productivity.

Horticultural production
Agro-climatic conditions of Azerbaijan are ideal for horticultural crops. Various subtropical fruits, grapes, and tea were, and will continue to be, important for the national economy. Percentage of area under horticultural crops in 1999 was 11.6%. Opportunities to develop export markets are also good for various horticultural products.

The problems are:
1) Lack of proper management of the orchards due to poor return to investment.
2) Lack of adequate processing and marketing.
3) Lack of exploitation of export market and export promotion.

Options that could make cultivation of horticultural crops profitable are:
1) Promotion of technologies that could increase the productivity and quality of the fruits and reduce the cost of production, resulting in increased profitability.
2) Development of small scale private nurseries for the commercialization of fruit trees and seedlings.
3) Promotion of cottage industries for fruit preservation.
4) Promotion of export markets.
5) Promotion of intensive table grape cultivation, and
6) Rehabilitation of old tea plantations.

Potato, vegetable, and melon production
Potato, vegetables, and melons together occupy 11.4% of the cropped area. The share of potato is 4.1%, while that of the vegetables is 4.9% and melons 2.4%.

Potato. The share of potatoes in the national economy has expanded rapidly since the reorganization of agriculture. Problems that the producers face are enormous and similar to that of the cereal sector. They are:
1) Inadequate supply of quality seed and seed storage.
2) Lack of improved varieties that combine productivity, quality and disease resistance.
3) Lack of proper cropping systems and cropping practices, resulting in low productivity. This also includes farmer's inability to grow potatoes for the early market.
4) Lack of support in controlling insects and diseases at the onset of those problems.
5) Lack of adequate machinery, and
6) Lack of an extension service to support the needs of farmers.
Rapid progress in productivity and profitability in potato production could be achieved by:

1) Development of proper seed production and seed storage of appropriate varieties through a concerted effort by the public and private sectors should have very high impact.
2) Development of varieties that combine productivity, quality and disease resistance should guarantee stable production.
3) Development of appropriate cropping systems and cropping practices to optimize productivity and enhance profitability for the producers needs urgent attention.
4) An early warning system in preventing catastrophic epidemics by insects and diseases is an essential activity in safeguarding potato production.
5) Like the other sectors in agriculture strengthening the extension service should pay handsome dividends.

**Vegetables.** Productivity and profitability of vegetable crops could be enhanced by effective partnership between public sector research and extension on one hand and private enterprises and NGO's on the other hand. The major problems that the vegetable sector faces are:

1) Lack of technology that promote intensive small scale production.
2) Lack of supply of good quality seeds of recognized crops and varieties.
3) Lack of adequate control of insect pests and diseases.
4) Lack of adequate maintenance of pure genetic stocks of both introduced and local varieties.
5) Lack of knowledge in building cheap green houses to exploit early and late markets.
6) Lack of adequate advisory services.

Activities that will have maximum impact are:

1) Promotion of small scale private sector seed production and marketing.
2) Promotion of intensive small scale production system.
3) Promotion of pest and disease control measures.
4) Promotion of cheap green houses using locally available material and technology.
5) Support to maintain pure stocks of genetic resources, and
6) Strengthening of extension service.

**Industrial crops**

Industrial crops (cotton, tobacco, and silkworm), except sugar beet, used to be very important for the economy of Azerbaijan before the farm privatization. However, ever since the reorganization the industrial crops have experienced dramatic declines in both area and production because the farmers have switched over from cash crops to crops that will assure their survival under the difficult economic conditions that the country has been facing. The drastic decline seems to have ebbed and the area seems to be stabilizing. Cotton today is the most important industrial crop and it occupies 10.1% of the cropped area, whilst the area devoted to tobacco is only 0.5%.
Current problems are:
1) Lack of appropriate production technology suitable for the small holders.
2) Lack of quality seed.
3) Lack of adequate plant quarantine measures.

A well orchestrated program of demonstrating a production package consisting of good varieties, good seed, appropriate production practices and crop protection should open windows of opportunity for sustaining cotton cultivation. Since the area is going to be small the research institutions themselves should be able to mount a seed production system with cooperation and collaboration of farmer.

Specialty crops
A number of specialty crops, some of them having sub regional importance and others with some future potential, but all having the potential to increase the diversity of crops merit some attention. Crops that merit attention are, sugar beet, grain legumes (chickpea and lentils), oilseeds (sunflower, Soya and groundnut), and cereal crops like rice, maize, barley, bye, and triticale. The area of all these crops will remain small but, as a group they merit some attention, so that the farmers will have a better array of crops at their disposal when they start looking for better crop options for rotation. Also these crops are important for the food and feed security of the nation and are important ingredients for human nutrition.

Crop Protection

Many participants at the national priority setting meeting pointed out the problem that there is no systematic approach to evaluating insecticides and fungicides in Azerbaijan. The net result is that commercial people bring in very dangerous products, products that are ineffective and substandard, and sell them to innocent farmers causing losses to the farmer as well as losses to the national economy and danger to the environment. There is an urgent need to initiate a systematic approach in evaluating all phytosanitary products, deciding their dosage and time of application and making this information available to the farmers so that they are more knowledgeable and less likely to be cheated.

Livestock Production

Livestock represents the single most important agrarian sector in Azerbaijan (39.1%). Both small and medium size herds owned by small family farms dominate this sector. As a result of farm liberalization, this sector has made substantial progress in the past few years. Livestock problems are of four types:
1) Low livestock productivity,
2) Inadequate veterinary services,
3) Poor range land and forage production, and
4) Lack of processing capacity and poor marketing.
Low livestock productivity
The most common factors contributing to low livestock productivity in Azerbaijan are poor selection processes, lack of breeding and artificial insemination, lack of proper nutrition and, finally, lack of proper housing. Amelioration or finding solutions to these problems could dramatically improve the productivity of livestock. Interventions that could give immediate results are:
   a) Introduction of highly productive breeds of cattle for milk and/or beef, sheep for both meat and wool, poultry for eggs and meat, combined with adaptive research to make constant improvement of the herds through selection and breeding.
   b) Introduction of cheap local feed grains in the diet and development of rations that include local ingredients, and
   c) Development and promotion of cheap indigenous housing technology.

Inadequate veterinary service
Lack of timely preventive control measures against infectious, parasitic and other diseases of animals and birds are causes for low productivity and profitability of livestock. Intervention through a concerted effort by the public veterinary service could make dramatic improvement in animal and bird health and this in turn could increase the productivity and profitability of the livestock sector.

Poor rangelands and low forage production
Poor natural pastures, overgrazing and lack of adequate forage production due to inadequate management and lack of forage seed supply all contribute to the poor nutritional intake by the animals resulting in low productivity and profitability. Introduction of technologies to improve natural meadows and range-land including reseeding, development and introduction of cultivation technology of various forage cereals, forage grasses, and leguminous crops as mixed crops, as solid stands, or as interplanted crops to enhance the supply of forages for the animals is yet another way of improving the productivity and profitability of livestock.

Lack of processing capacity and poor marketing
Enhancing the productivity and profitability of livestock should automatically reduce the price of the primary products, allowing small scale processing units to come alive assuring a constant supply of meat and meat products, milk and milk products and eggs and poultry meat to the public at large in Azerbaijan at reasonable prices.

Natural Resources
The reorganization and break up of large farms into small holdings has resulted in many problems related to the efficient use of soil and water resources. The most important of these are:
   • Management structures for sharing the soil and water resources are yet to emerge.
   • Lack of information on the current use of land and water by the farmers.
   • Depletion of soil fertility due to lack of use of fertilizers.
   • Lack of monitoring water quality.
• Poor water drainage and water quality resulting in soil salinity.
• Lack of appropriate tillage practices and crop rotations.

There is urgent need to initiate research and demonstrate technologies that are already available that could improve soil fertility, soil structure, improve the quality of water and irrigation practices, and reduce salinity. These activities are important in establishing sustainable production systems.

**Mechanization**

All agricultural equipment and machinery were attuned to the needs of large collective farms and all of them came from the former USSR. The break up of these collective farms into small holdings made much of this equipment obsolete. The loss of a supply of spare parts and support for maintenance resulted in the unavailability of machinery and services to small farmers. At present only a small percentage of the machinery needs of the farming community are met by the obsolete fleet. Current statistics indicate that only 52% of tractor needs, 14% of tillage equipment and seeding devices, 23% of combine harvesters, 44% of mowing machines, 19% of hay presses, 4% of fertilizer spreaders and 6% of sprinkler needs of the country are met by this highly detoriated fleet. Even the machinery that is in service has been poorly maintained and most is inappropriate for the needs of small holder farming. Very little new machinery has been purchased by the farmers since independence, mainly due to lack of capital.

The major problems of the farm mechanization sector are:
• Lack of a clear strategy concerning the needs of machinery.
• Lack of appropriate and adequate equipment and machinery for the needs of small holder farmers.
• Poor use of the available equipment due to lack of knowledge.
• Lack of technical service, spare parts and poor maintenance.
• Lack of experience in farming by emerging farmers.
• Lack of appropriate equipment for small holder farming.
• Lack of alternate energy sources.
• Lack of knowledge concerning simple processing of agricultural products.

Potential solutions are:
• Enhance the efficiency of the currently available fleet.
• Organization of consultation services and private enterprises and providing them training concerning the use and maintenance of machinery.
• Promotion of simple production technologies and adaptive research.
• Promotion of new seed treatment methods.
• Promotion of alternate energy sources.
• Introduction of appropriate machinery for the small holders.
• Demonstration of farm products processing to the farmers.
Agricultural Economy

Azerbaijan upon independence broke off most of the economic links with the former USSR which resulted in major market disruption. Abolition of state procurement, elimination of state control on inputs and outputs, elimination of the administrative-command system, and finally the elimination of state owned enterprises for marketing and agro-processing has also added to the economic confusion. A new economic order and system is yet to take roots and as a result the economic efficiency has declined in all segments of agriculture and related industry. The net result is negative economic growth, increase in unemployment and a lowered standard of living.

The major problems of the agrarian economy are:
- Legislation regulating many of the agricultural economic aspects not yet in place.
- Economic linkages between various segments like production, processing, marketing, and infrastructure are very weak. In certain cases monopolistic tendencies prevent this integration.
- Enterprises as well as farmers lack experience in operating under market economy.
- Lack of education in handling accounting at all levels of agriculture.
- Low profitability due to inefficient production and high cost of production.
- Lack of experience in adapting to options that are demand driven.
- Lack of knowledge in farm management or processing systems by the farmers and entrepreneurs.

Potential solutions are:
- Legislation to facilitate a smooth transition to a market economy.
- Promotion of technologies through demonstration that could reduce the cost of production and thus increase the economic efficiency.
- Making information available to private enterprises concerning inputs, outputs, potential markets and raw material.
- Establishment of small but efficient private enterprises for agricultural product processing and services.
- Organization of effective management and marketing systems.

Human Resource Development

A limited number of competitive scholarships for short term training at leading research centers abroad, aimed at improving the technical capabilities of Azeri researchers and acquainting them with the newer developments in science, should be available under this project and should be awarded strictly on the basis of merit and national priority as stated above for the various commodities

CGS IMPLEMENTATION STRATEGY AND PRIORITY TOPICS

It is understood that all the results, information and products that are developed under the CGS will fall under the “public goods” category. The CGS aims at supporting mainly
adaptive research, technology validation, and its dissemination which will have an immediate impact on resource-poor farmers through enhanced productivity and profitability. It also aims at building collaboration between and among public institutions, private enterprises, farmers, and NGOs.

The CGS as it is designed has a life span of four years. However the time lag between the inception and first announcement inviting project proposals took almost a year the effective time available for the implementation of CGS will be only three years and hence it may be advisable to extend the project by at least one more year. The ARB recommends that project awarding should be staggered over the full length of the project period through three to four announcements. Most of the projects will be of two year duration. However, a few projects having three year span could also be considered. Towards the end of the second year the ARB will undertake an internal evaluation of all the approved projects. This will permit the ARB to ascertain the efficiency, effectiveness and potential impact of the ongoing projects and also permit an assessment of problems that were encountered during the implementation of these ongoing projects and allow the ARB to develop strategies to overcome those during the later years. Also it is recommended that the operational manual of CGS should be reviewed immediately after the first set of project contacts are signed and solutions for the problems encountered should be incorporated (after it is approved by the Board and clearance by the World Bank). This process of review of the manual should be repeated at least a few more times during the life span of the CGS.

Applicants for the CRG are encouraged to include more than one priority topic in each of their proposals. It is possible that in some cases almost all priorities of a commodity may get included in a project proposal. Projects that are multidisciplinary in nature and that include inter institutional collaboration and those encourage participation of the private sector, farmer associations and/or NGO’s shall receive higher priority.

It is advisable that all potential participants (crop scientists, animal scientists, economists, agronomists, plant pathologists, entomologists, agricultural engineers, some farmers and any other potential participants together with the Secretariat staff) of a project should get together to do an in depth problem-cause analysis. This exercise should result in the identification of components that are important for the success of all projects and all potential participants will be advised to include these components in the proposal. Also it is proposed to hold special training sessions for all potential participants to teach them how to prepare project proposals. The Secretariat proposes to hold these problem-cause analysis workshops and training sessions during the months of February to April, 2001.

**Priority Topics**

Priority areas that merit support are ranked and grouped according to commodities and commodities are listed according to their relative importance to the national economy of Azerbaijan. The expectation of the ARB is that scientists belonging to the disciplinary institutes join hands with the commodity scientists in developing multidisciplinary collaborative projects. The only exception to this recommendation is crop protection
because the use of phytosanitary products are essential for the success of many crops and there is very little knowledge nor control over their use or commercialization.

**Constraints Analysis**

During the period of February 8 – 15, 2001, Constraints Analysis Workshops were held with the participation of Secretariat staff, international consultants, national researchers and a few farmers to define the principal problems, their causes and possible solutions, of the major crops in Azerbaijan: wheat, cotton, and potatoes. CGS Secretariat is planning to hold similar workshops to do detailed analysis for livestock, horticultural crops and vegetable crops during the coming months. In each workshop (one for each crop) participants were asked to write their ideas of problems on cards. These were then discussed and analyzed to determine the underlying problem, defined as a factor which directly limits the productivity of the crop (in terms of both yield and economic productivity). Once problems had been defined, participants were shown cause-problem flowcharts, prepared beforehand, for each problem, and then discussed possible solutions for each of the major causes. The list of possible solutions was tabulated and for each possible solution, consensus was reached on the marginal cost of applying the recommended solution, the likely benefit in terms of percentage increase in productivity, and the percentage of the total area occupied by the crop for which the particular solution was technically valid.

It should be stressed that firm data based on on-farm results was not available for many of the responses analyzed. This obviously brought a large degree of uncertainty into the analysis, but was the best available information. However, although the results of this constraints analysis will be useful for determining the initial thrusts of the proposed projects, these should definitely include exploratory and/or validation trials aimed at clarifying the priorities and the interactions between factors.

Once all possible solutions had been assessed, Secretariat staff together with international consultants, and, in the case of wheat, with some knowledgeable researchers, defined other factors related to each solution. Initially it had been proposed to use the formula from the World Bank Manual for calculating the Net Efficiency (N) of each potential solution:

\[ N = \frac{(V \cdot k \cdot p \cdot a)}{C} \]

Where “V” is the gross value of the commodity, “k” is the proportion increase in yield or economic productivity, “p” is the probability that the research or extension program will be successful (scale of 0 to 1), “a” is the suggested adoption rate of the technology (proportion of farmers who will be likely to adopt in 10 years) (scale of 0 to 1), and “C” is the cost of the research or extension activity.

However, it became clear that, whereas this formula is useful for comparing commodities or total technological programs, it was not adapted to analyzing potential solutions within
a single commodity. Therefore a new formula was developed, based on the expected cost: benefit ratio of the proposed technology:

\[ N = \frac{B}{C} \times A \times p \times a \]

Where B is the net benefit expected from the technological intervention, C is the marginal cost of the technology and A is the proportion of the total area of the crop for which the technology is technically valid. The other factors "p" and "a" are the same as in the original formula shown above.

Using this formula, Net Efficiency of each potential solution was calculated. The potential benefit of the technology to small farmers, the risk associated with the use of the technology and its environmental impact were assessed and scored on a scale of 1 to 5. In the case of environmental impact, a score of 3 was assigned to environmentally neutral technologies, 4 and 5 to technologies that affect positively the natural resource base, and scores of 1 and 2 to technologies that have potentially negative effects on the environment. A final score was calculated using weighted values of Net Efficiency (weight 0.75), benefits to small farmers (0.12), risk (0.05) and environmental impact (0.08). This score was then used to prioritize all potential problem solutions within the commodity.

**PROJECT PRIORITIES**

**Field Crops**

**Wheat**

As per the above description a group of stakeholders met during Feb. 13 to Feb.15, 2001 and discussed in depth, problems their causes and potential solutions related to the wheat production in Azerbaijan. In case of irrigated wheat 27 potential technologies were evaluated and ten of them were judged to have potential for adoption. Using the same methodology a similar number of technologies were found to have potential for adoption under the dry land conditions. These technologies were subsequently grouped under the three themes which were already advertised as the subjects for project submission.

**Production technology**
- Optimum seeding time
- Optimum seed rate
- Seed and irrigate
- Chemical weed control
- Calibration of harvest equipment
- Mineral fertilizer
- Crop rotation (caution this is a longer term research issue)

**Seed production**
- Efficient seed production.
- Seed treatment.
**Project development strategy.** Taking into account that adapted high yielding and disease resistant and or drought tolerant wheat varieties and good seed will be part of any production package it is suggested that all those groups of people who are developing project proposal for wheat production technology should be responsible for all the wheat demonstrations. This would means that the other two wheat projects will not conduct on farm demonstrations and as a result US$ 20,000 from these projects should be reallocated to the production project. So, the value of production project will be US$ 90,000 and the other two projects will have a value of US$ 30,000 each.

All three projects should undertake on farm verification of technologies as well as adaptive research in refining technologies that were identified to have potential for adoption by small holder farmers. Also it is recommended that the production project undertake on-farm verification of other potentially promising technologies to determine their value as demonstrable technologies the following year. This last recommendation is due to the fact that the priority-setting process had to be based on assumptions with little reliable field data. The developers of projects should include all the priority factors listed above, but may also, at their discretion, include other factors such as conservation tillage which they believe to be important.

**Cotton**

The group of people selected to do problem - cause analysis met on Thursday February 8 and Friday February 9, 2001 and looked at 31 technologies and assessed them for their value as potential solutions to enhance the profitability of cotton in Azerbaijan. The following 12 technologies were judged to have sufficient merit to be considered to be included as part of the project proposals. However, it is worth noting that the group felt that the two private enterprises who are actively involved in promotion of cotton cultivation and cotton marketing should some how be involved with this project and without their participation the chances for success will be limited.

- An efficient seed production program to supply good quality seed at a reasonable price.
- Minimum tillage. (This may require many years before benefits to occur)
- Varieties with good productivity, fiber quality and disease resistance.(This is also a longer term goal.)
- Appropriate crop rotation.(This is a longer term subject.)
- Seed treatment against diseases.
- Strategies to control cotton worm which damages seedlings.
- Coordination between tillage and irrigation to enhance the irrigation efficiency.
- Winter plowing to conserve moisture.
- Pre-irrigation to enhance seedling emergence.
- Optimum date of seeding.
- Use of sweep plows cultivation to control perennial weeds.
- Use of insecticides.

Since there is only one cotton project it is recommended that all those who make applications to this project should consider the above technologies as part of the proposal.
In addition they may consider undertaking validation of some of the other issues in the farmer fields as potential technologies for the future use.

**Potato**

Problem - cause analysis for potato was done on Thursday February 14 and on Friday February 15, 2001. Twelve out of seventeen technologies that were considered were found to be useful and are listed below. Applicants of the project may consider using the other technologies also in their proposal for validation at their discretion.

- Efficient irrigation regime.
- Use of insecticides.
- Pre-sowing cultivation.
- Use of fertilizer.
- Roll seedbeds for obtaining finer seedbed.
- Use of fungicides.
- Chemical weed control.
- Use of organic manure.
- Use of green manure.
- Terracing to reduce erosion.
- Varieties with high yield, quality and disease resistance and,
- A system to produce high quality seed at reasonable cost.

**Specialty crops**

The following conclusions were derived based on discussions held with stakeholders who came to do problem - solution analysis for the other crops and a few selected scientists who are currently involved with these specialty crops.

**Grain legumes.** There are no statistics available concerning the area under grain legumes. It is estimated that around 10,000 ha. is devoted to chickpea and lentil, and that chickpea is much more important than lentil. Area under chickpea could be around 7,000 ha. and almost all of it is grown by small holder farmers in their homestead. Chickpea is planted in the spring and it is a dry land crop. Three Kabuli type local varieties of unknown origin are in use and all three have low productivity and also are susceptible to ascochyta and fusarium: both important diseases.

In the 80’s two new varieties having much better yield potential were released. However, both of them had black seed coat and as a result they were not accepted by the farmers. At present an introduction from ICAARD (International Center for Agricultural Research for Dryer Areas) having good grain appearance, yield potential and resistance to both ascochyta and fusarium is in its final stages of evaluation for release as a new variety.

Once this new variety becomes available it will remove the most important constraint of chickpea and lack of seed and promotion of the new variety to the farming community will remain as the most important problems. It is suggested that the CGS consider inviting a proposal for the promotion of the new chickpea variety.
In the case of lentils the area is much smaller and there are neither new varieties nor technology readily available for promotion and so this crop should not be considered for CGS.

Maize. Maize is an important minor crop in Azerbaijan and it is mainly grown by those farmers having chickens at home where the maize grain is used for chicken feed. There is no QPM available in Azerbaijan. It is suggested that the CGS consider a small project for the introduction of QPM and testing its usefulness to enhance the income of small holder farms.

Horticultural Crops

Fruits and nuts
A group of stakeholders conducted a constraint analysis workshop on April 26 and 27, 2001. During this analysis, problems related to pome fruit, stone fruit and nut production were discussed in depth and potential solutions were analyzed. A total of 17 different technologies and solutions were analyzed and evaluated based on potential to enhance productivity and profitability. This resulted in five areas for project development as listed below. In addition, eight broad specific needs for project activities related to service, information delivery tools and economic/market studies were developed. Cost analysis for these was not possible. These needs should be considered of equal importance for project development. They are described under the following section on technology delivery. Because limited funds are available, projects should address problems for or two of the following crops, apple, hazelnut, pomegranate and sweet cherry and one focus on one or two districts. Further consideration concerning the production problems of grapes and tea lead to the conclusion that these crops should be treated as independent and hence should be supported as separate subprojects.

- Pruning for optimal fruit yield and quality
- Efficient irrigation technology
- Integrated strategies to control insects, weeds and diseases
- Propagation/grafting of high yielding adapted varieties (national coordination/certification)
- Mineral fertilization

Technology delivery. The projects should address the need to develop bulletins and fact sheets for the farmer on existing and improved varieties, production technology and pest control. In addition a strategy should be presented for field days and on-farm research to demonstrate and promote appropriate technology. This could include private vendor/fee based information services on nutrition, pruning, irrigation and pest management. Finally, an economic analysis of the national market is needed to identify high value niche markets and the private sector needs to be involved in exploring and evaluating export markets.

Grapes and tea
Since the problems of table grapes and tea were similar to fruit and nut crops and since we had discussions of these crops during the national workshop, it was decided that no
formal constraint analysis was needed for these crops. The findings of the national workshop were confirmed through discussions with scientists during April.

Grapes. The major constraint for grape production is the reestablishment of vineyards lost after the government decision to remove vineyards in order to reduce alcohol production. The project should focus on the propagation and grafting of table grapes and the promotion of technologies to establish productive new vineyards.

Tea. Many of the constraints for tea production are similar to those described above for tree fruits and nuts. The project should focus on propagating improved tea clones, the establishment of productive new plantations and the rehabilitating existing plantations.

Vegetable Crops

A group of stakeholders conducted a constraint analysis workshop on April 24 and 25, 2001. During this analysis four major problem areas related to vegetable production were discussed in depth. Potential solutions to production constraints were analyzed on April 30. A total of 35 different technologies and solutions were analyzed and evaluated based on the potential to enhance productivity and profitability. Thirteen technologies related to integrated crop production were identified as having merited being included as part of the project proposals. These could be grouped into the following 6 areas for project development. Projects should address problems on one or two of the following crops, tomato, cucumber, onion and cabbage, and focus on one or two districts.

- Optimum seeding time and densities
- Efficient irrigation technology
- Variety demonstration plots
- Adequate fertility (mineral or organic fertilizers and green manure)
- Integrated strategies to control insects, weeds and diseases
- Crop rotation (long range)

Technology delivery and training. The constraint analysis workshop identified a number of areas where technology transfer to the private sector is appropriate. These can be achieved through workshops, bulletins or field days. The availability of seeds for locally adapted high quality vegetable varieties was identified as a critical problem. The private production of vegetable seeds should be supported through training workshops and consulting. Information/consulting services on cultivation and harvesting mechanization should be developed. Finally a national economic and market analysis for vegetable crops is needed. The results of this analysis need to be delivered to the farmer and buyer in a form that will allow timing of production schedules to maximize profit.

Livestock

Livestock production, veterinary services, feed production and feeding. Various groups of stakeholders, aided by CGS Secretariat staff members, conducted a constraints analysis for key livestock production themes (livestock production, veterinary services
and feed production and feeding) on March 14-17 and March 28-29, 2001. Problems related to livestock productivity and their potential solutions were discussed in depth. It was agreed to further review the constraint analysis results with the assistance of international consultants to select priority research areas to be addressed by the CGS program.

During his May 7-25 consultancy visit to Azerbaijan, Professor Robert Blake had the opportunity to evaluate the constraint analysis outcomes together with Secretariat staff. This joint evaluation process involved many interactions also with personnel from several research institutes and appropriate departments of the Ministry of Agriculture, and with farmers, university professors, personnel of private enterprises and processing plants and others in Azerbaijan. This section of this document emerged as a result of these CGS priority setting activities and numerous interactions. Its purpose is to provide potential participants with additional information and guidelines for preparing project proposals for the livestock component of the CGS.

Outlined herein are the following additions, which builds on and expand the initial announcement dated January 13, 2001:

1) Capacity-building objectives for year one of the CGS and their relationships to subsequent research investments in a second round of proposal competition;
2) guidelines for project proposals in priority thematic areas; and
3) revised deadline for submitting proposals.

**Capacity-building objectives: Year One**
A key objective in the first year of the CGS-sponsored activities is to identify the most capable participants and the research issues for continued support. Investments by the CGS will build capacity during the next three years to produce valuable information (e.g., comparisons of alternative practices and technologies) in priority problem-solving areas. Therefore, successful projects must be sharply focused on at least one relevant component related to the identified themes. Successful proposals will be funded up to US$ 5000 for one year. Larger budgets will be considered only with compelling justification.

**Competitive grants in subsequent years**
Based on achievements of research finding, team building and other learning relevant to CGS capacity-building guidelines and objectives, additional support may be solicited with a subsequent proposal in a second round of open competition. These proposals may involve additional activities and correspondingly larger budgets than for the CGS projects funded in the first year.

**Guidelines for component project proposals**
Successful proposals must be clearly focused and achievable in the timeframe of the first year. In addition to the conditions outlined in the initial announcement, proposals are expected to contain:
1) a statement of the problem,
2) the principles, concepts or issues involved in the research inquiry (justification),
3) the information or learning that constitutes the project objective,
4) the research, or problem-solving, methods, measurements or other observations that will inform about the project objective,
5) the expected output, application and impact of the project,
6) explanation about how the results would benefit farmers and future research endeavors, and
7) a detailed budget that carefully shows how the proposed expenditures would support the activities in #4 and #5.

Suggested priorities and issues for component projects

Logical framework in the near term. Like all agriculture, productivity and net economic returns from livestock are affected by a hierarchical system of forces. Many of these forces, or factors, are considered among the broad CGS themes, where some factors are likely to be more limiting than others, especially in the short time period covered by the CGS. Within this framework, and in response to market (and marketing) opportunities, productivity and profitability payoffs to farmers may be partitioned into animal, health, nutrient, and whole-farm management that

1) increases output,
2) reduces cost (and avoid costly factor interactions),
3) improves input use efficiency, which includes
4) the reduction of losses in actual production or productivity potential.

Given the short period for the CGS program (3 years), germplasm substitution (e.g., semen importation and artificial insemination in cattle) is put aside as a priority in this grant competition. Reasons for this decision include the relatively long time period and cost involved in animal germplasm (breed or gene) substitution, and the associated risks of genotype-environmental interaction. The livestock situation parallels that of wheat production in Azerbaijan: Incentive is nil to shift to varieties with higher productive potential without first controlling weeds. More fundamentally, greater productivity and profitability are obtained from improved weed control regardless of the variety. Livestock productivity also follows a pattern of response to the most limiting factors. Therefore, germplasm (breed) substitution should succeed the successful implementation of other animal management and marketing practices (e.g., nutrition, health), most of which, if not all, should be expected to benefit farmers regardless of breed type. In the near term, forage germplasm options to improve dietary nutrient supply for ruminants are more likely to be beneficial (and feasible to achieve).

Species priorities. The priority livestock species for the targeted smallholder farming systems are large ruminants (cattle, buffalo), small ruminants (sheep and goats), and household poultry.

Research priorities. The following areas, or sub-themes, under which research projects may be prepared, are especially aimed at stimulating the net incomes of smallholder farmers. These areas emerged from CGS priority setting activities and numerous
interactions with research institutes, farmers, universities, private enterprises and others in Azeri agriculture. No hierarchy of importance is implied in this listing. Interested parties are invited to prepare proposals for a component project in any of these areas, which fall under the main themes that were identified in the initial announcement. [For illustration purposes, see the appendix for some ideas about relevant research questions.]

- Livestock product marketing or feed marketing opportunities.
- Integrated (or component) health control strategies.
- Profitable nutrition management to alleviate dietary bottlenecks (e.g., energy, protein, mineral) for animal groups (or species) with high income-earning potential.
- Profitable grazing strategies for pastures, rangelands, or meadowlands (for example, early grazing of cereals).
- Efficient housing options to reduce animal health problems and improve animal productivity.
- Efficient feed storage options to maintain nutritive quality.
- Efficient methods for better managing organic inputs (excreta, composting) to increase supplies of nutrients from animals, especially for use in horticultural and vegetable production.

**Crop Protection**

**Problem analysis and priorities**

On May 11, 2001 Friday two of the technical advisers from the CGS Secretariat plus two of its international consultants met with the director and selected staff members of the crop protection institute to discuss about non crop specific constraints that are to be considered to be included under the CGS priorities. After a lengthy and fruitful discussion we have concluded that the following subjects merit consideration under the CGS.

- White fly was a major problem in Azerbaijan. However, we were given to understand that it is under control because of the use of an integrated pest management strategy. This very successful strategy is in peril because of the financial difficulties the crop protection institute is experiencing. Hence, one option available to the crop protection people is to revitalize this known and successful strategy so that the crops of the resource poor farmers of Azerbaijan will continue to have protection against this very dangerous insect.

- Application of pesticides at times may be the only viable option for controlling pests and diseases. Since, most of the farmers are small, availability of small equipment to apply pesticides will be essential. CGS, should consider supporting the acquisition and demonstration of small equipment.

- There is a general lack of easy to follow pamphlets and manuals dealing with insects, pests and diseases and their control. CGS should consider supporting the production and distribution of this.

- Crop protection institute has a very successful biologic control strategy available to control cotton boll worm. It was agreed that the scientists of the crop protection institute will become active participants of the cotton project so that this strategy becomes an integral part of the cotton effort.
• Large fruit orchards were privatized and at present 20 to 30 owners share a single orchard where each producer control two or three rows of trees. For control of pests and diseases this is a nightmare situation. Net result is very poor quality fruits resulting in low returns. It is suggested that attempts should be made to bring together owners of a single orchard together into an informal association to practice combined pest and disease management strategy so that they all benefit as a group. CGS could support efforts of bringing together two or three of these groups so that a combined strategy could be implemented. This is one area where a collaborative project could be developed between the crop protection institute and the horticultural institute.

Total money available for non crop specific crop protection activities is US$ 15,000. This money if properly deployed could support most of the above activities. It is left to the scientists of crop protection to decide what activities they feel confident and could be converted into good competitive proposals.

**PRIORITY SETTING REVISITED**

A National Consultancy was held during November 6 and 7, 2001. It had two main objectives. One, review the CGS priorities and second, review various implementation procedures and develop strategies for the next cycle of projects. Information that became available through the Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA) that were undertaken during the past few months by the CGS Secretariat and the vast experience of the stakeholders of this meeting were the main factors guiding the proceedings of this meeting.

Around 60 people representing various segments of the Azeri Agriculture participated at this consultancy. During the first morning, the meeting reviewed the progress of CGS to-date and then the meeting was divided into two study groups, so that each of the themes of this consultancy could be analyzed in depth. On the second day in the afternoon both the study groups presented their findings and recommendations at the final plenary session and it was endorsed by the group. Findings of this consultancy are documented below:

**Review of CGS Implementation Strategies and Recommendations**

The participants discussed in detail various aspects concerning project development and its implementation and suggested the following strategies for the future.

**Training**

In response to the first announcement inviting project proposals, a total of 66 proposals were received by the Secretariat. However, the quality of project proposals was very poor to unacceptable. The Secretariat staff and consultants had to invest a lot of additional time working with the project developers in up grading those proposals which showed some promise till they became acceptable. We attribute the poor quality of the proposals mainly to the poor scientific preparedness of the Azeri scientists and their inability to be in touch with the developments in science in world at large. The working
group recommends that training be considered as an important priority of CGS. It also recommends that the allocation of training slots should be based on CGS priorities and selection of candidates should be based on merit and competition. In addition the working group suggests that the following training activities should be undertaken:

- Provision of group training for English for two groups of scientists one each in Baku and Ganja. Same group of people should also be exposed to the common computer software and internet navigation.
- In-country group training to expand the working knowledge and develop practical experience of the scientists.
- Provision of visiting scientists and short term training positions to centers of excellence, universities or international centers abroad. It is anticipated that the trainees during their stay at these centers would develop skills in developing project proposals and also would return with at least one solid project proposal for to be considered by CGS.

Farmer participation in CGS activities
The success of any project where farmers are involved depends on the quality of their involvement and commitment. So, it is recommended that if farmers are involved in any project then they should be an active participant to research planning, research execution and also should have a role in extending the outputs of the research activity.

Scientific collaboration
Agricultural research in Azerbaijan is undertaken by many institutions, some of them highly specialized. Collaboration of scientists coming from diverse disciplinary institutions is essential in addressing complex production problems and resolving them. Institutional structure was found to be a hindrance for developing true collaboration between scientists. The working group recommends the following strategy in resolving this problem of lack of scientific collaboration.

Projects dealing with complex production problems will have a number of components and many times the components will be handled by scientists coming from different institutions. It is suggested that the CGS should invite individual scientists and groups to submit concept notes for each of the components explaining how would they resolve a given problem which is part of a larger production constraint. There will be a number of concepts notes for each of the themes and also concept notes dealing with other themes. The Secretariat should evaluate each of the concept notes and select the best proposal for each of the themes or components. All the individuals that have submitted the successful concept notes would form the team responsible to develop and execute that project. This team should be asked to develop the project proposal incorporating all the ideas emanating from their concept notes into one comprehensive project proposal. This would encourage scientists to develop collaboration from the very beginning of a project and having worked together in developing the proposal and work plans together should encourage them to work together better.
Size of projects
There was some discussion concerning how big the projects should be. It was resolved that the size of the project will depend upon the complexity of the problem that is under study and hence be highly variable and the Secretariat should make the final judgment concerning the size of a given project taking into account the importance of the theme and its priority under CGS.

Participation of NGOs and the private sector
The working group recommends that the participation of these groups is desirable and efforts should be made to enhance their involvement.

Timing of project announcements and phasing of projects
It is suggested that announcements should be staggered throughout the year so that the Secretariat Staff could efficiently handle the proposals. This would mean that project awards will be staggered throughout the duration of CGS.

Should the successful projects be given an opportunity for automatic extension
The general opinion was that it should not but they should be allowed to compete with others in the successive rounds.

Recognition to outstanding teams
It is recommended that one year after the completion of each cycle of projects, each of them should be evaluated for impact and those projects that have made a remarkable impact, the team members should be nationally recognized. There is need for further dissuasion in making this proposal operational.

Review of Priorities and Recommendations
The main objectives of the working group were to review and if necessary revise priority research areas for the second stage of CGS projects to be announced in 2002. This included a review of existing priority commodity areas for project proposals, as well as the consideration of additional themes of research such as training and economics research.

Information from the RRA and PRA farm surveys as well as experience of the participating working group members was utilized for the prioritization of commodity areas. Data were presented to the working group on the most important crops by region according to area planted, value of agricultural production and the interest and importance expressed by surveyed farmers. Information was also provided on the principal abiotic and biotic stresses by crop and by agro-ecological zone (plain/irrigated, hill rainfed/irrigated, and mountain rainfed).

It was agreed that no specific diseases and pests would be discussed in the review of priority setting but that identified problem areas such as weeds in cereals and insects for fruit trees should be noted and targeted later when developing specific priority topics within the crop areas. Given the importance of livestock and livestock products to farmer
income and the interest expressed by farmers in livestock production, improvement of forage quality also was identified as an important area for research.

A matrix of regions and commodity areas was created that overlaid priority areas using the differing criteria of area planted, value of production, and farmer interest/importance. The priority areas thus identified were then compared with existing projects to check for gaps in the existing priorities/projects. The matrix reflects the diversity of crops and activities of farmers in Azerbaijan and the importance of integration among different farming activities, as well as common issues appearing across all regions.

The following priority areas were reconfirmed on a national basis:
- Cereals (including technology dissemination, seed production, and variety promotion)
- Fruits
- Vegetables
- Livestock, including forage research
- Crop protection with emphasis on weeds in field crops and insects and diseases for fruit crops

A second group of priority areas targeted for specific regions was also identified. These priority areas include:
- Cotton in Mil-Garabakh, Mugan-Salyan, and Plain Shirvan
- Potato in Gazakh-Ganja, Mugan-Salyan, and Lenkoran-Astara

Several commodities were identified as having importance in a limited area and were therefore determined to be of lower priority for the second stage. The importance of these commodities may be reconsidered in future priority setting. They include:
- Grain legumes
- Tobacco
- Maize
- Tea
- Sugar beets
- Melons
- Oil crops

The results of the farm surveys also suggested that four abiotic constraints were frequently experienced across some regions which possibly justified separate project themes:
- Drought (rainfed areas)
- Salinity (irrigated plains)
- Wind and water erosion (hillside and mountainous terrain)
- Shortage of water (irrigated plains)

Based on group discussion, the working group decided to retain the current crop-oriented organization of priorities rather than to change to a cropping system orientation. Information on abiotic stresses by agro-ecological zone should instead be incorporated.
into future individual project proposals. Project proposals should address as priorities regions/zones in which these abiotic stresses pose serious constraints for commodity production. Additional information can be provided from the farm survey results to supplement existing knowledge of affected regions.

Research priorities for livestock were also addressed briefly. It was suggested that given the existing well-funded World Bank project on veterinary health (16 billion manat), the scarce CGS resources may be better invested in areas of livestock production other than animal health. Two areas deserving attention were identified using farmer responses and local expertise:

- Quality of feed for cattle and sheep
- Fluctuations in the supply of feed available during the year

In response to the third main area of interest reflected in the farm survey, the decline in breed stock, the CGS position on research on artificial insemination was clarified. Since this type of research involves long time frame, it would not be appropriate for fund allocation through the CGS.

**Economics Research**

The inclusion of economics research as a separate theme was discussed. It was pointed out that existing project proposals often include an economics component that is crop specific which should continue. However, it was agreed that a separate theme on broader economics research was justified. Several suggestions were made regarding possible areas of research:

- Comparative analysis of on farm profitability for newly established private farmers
- Improved understanding of farmer resource allocation for input use and marketing decisions
- Ongoing farm level surveys for assessment of research impacts and emerging priority areas
- Analysis of domestic and export market opportunities and constraints for specific commodities
- Analysis of the potential importance of minor and specialty crops that were not previously prioritized by the CGS

**Training**

Three main themes were identified for training of researchers:

1. Short-term in country training to be open on a competitive basis to researchers involved in project planning and implementation
   - Language training (English and German), 30-50 persons for a period of up to 6 months
   - Computer training (word processing, spreadsheet use, internet navigation), 30-50 persons for 3-4 weeks
2. Short-term in country training to be open on a competitive basis to project participants
   • On farm research methods
   • Techniques for technology and information transfer
3. Long-term applied international training (1-6 months) for key participants of approved projects in topics relevant to project research
   • International centers
   • Universities / Other research institutions

**Operational Strategies**

**Brief review of first cycle priorities**

For the first cycle of CGS projects in Azerbaijan, priorities were set based on the importance of commodities. Share of agriculture to the GDP is around 28% and this can be further broken down as share of livestock 40% and the rest 60% being crops. Share of crops was further sub-divided and the largest share 37.3% belongs to wheat. Share of horticultural crops was 7.8% and that of industrial crops was 7.2%. Vegetable account for 4.3% and the share of potato was 3.4%. Based on this above distribution it was decided that wheat should have three projects and horticulture, cotton, vegetable and potato should have one project each.

There are a number of minor and specialty crops under cultivation however, they occupy so little area and thus fail to be reported in the statistics. Since these specialty crops contribute substantially to the diversity of crops and also provide alternatives to farmers for crop rotation, it was decided that two small projects one each for grain legumes and maize should also be awarded during the first cycle.

In the case of livestock, seven themes were identified, and proposals for small projects dealing with one or more of these themes were invited to be submitted.

Themes like natural resource management, agricultural machinery, crop protection, economics, and human resource development were also considered for prioritization. It was agreed that all activities dealing with natural resources, agricultural machinery and economics should become part of commodity projects and hence these themes should not be considered as stand alone project. Human resource development was considered important, but it was agreed that it will be considered for funding only during the second cycle.

Since a number of insects and diseases can move from one crop to another it was recommended that a small project dealing with issues of this nature should be awarded for crop protection.

**Suggested second cycle priorities**

The national consultancy held on November 6 and 7, 2001, reconfirmed that wheat, horticultural crops, and vegetables should continue to have the same priority like the first cycle.
Industrial crops and potato have only regional importance and since they received support during cycle one, should receive a diminished priority during cycle two. Specialty crops did not appear at all in the RRA and PRA and hence are recommended to be dropped from consideration for cycle two. Savings resulting from these activities should be assigned to the newly identified priorities.

There is a much larger project already operational in Azerbaijan dealing with animal health, so it is suggested that resource allocation under CGS for livestock should be reduced by one third and the savings should be allocated for the newer priorities.

A number of crop research themes were identified that should receive attention during cycle two. It is suggested that project developers should take into account these themes while they develop project proposals.

Agricultural economics was recognized as a new priority and the working group recommended providing support to this activity during cycle two. It was pointed out that existing project proposals often include an economics component that is crop specific which should continue. However, it was agreed that a separate theme on broader economics research was justified. Several suggestions were made regarding possible areas of research:

- Comparative analysis of on farm profitability for newly established private farmers
- Improved understanding of farmer resource allocation for input use and marketing decisions
- Ongoing farm level surveys for assessment of research impacts and emerging priority areas
- Analysis of domestic and export market opportunities and constraints for specific commodities
- Analysis of the potential importance of minor and specialty crops that were not previously prioritized by the CGS

REFINING THE STRATEGIES, PRIORITIES AND IMPLEMENTATION MECHANISMS

The process of refining the implementation of the CGS project continued during the 3rd National Meeting of CGS project on priorities and strategy conducted in Baku on December 17-18, 2002. The meeting was attended by 70-80 people including the CGS secretariat and board, Agriculture Development and Credit Project (ADCP), World Bank, GTZ, CIMMYT, MOA, directors of the leading research institutes, executors of the project, farmers. Since the national meeting took place after the termination of the contract with CIMMYT only one consultant (Dr. A. Morgounov) attended the meeting. The plenary session summarized the achievements and posed the challenges for the coming years. It was followed by the discussions in two working groups, which came to the following conclusions.
Recommendations on Strategy and Priorities (1st Working Group)

Training
- The meeting agrees to organize intensive courses on language and computer technologies: one each in Baku and Gyandja.
- Young scientists who completed the English training should be send for short-term visits to international centers and universities.
- Organization of a national traveling workshop with participation of the project leaders and executors.

Collaboration
- During the selection process for the new projects the priority will be given to those project proposals which provide collaboration between different institutions.
- The meeting agreed that the soil fertility, soil conservation, soil erosion, water saving technology, stress factors, crop rotation, economic analysis, plant protection and mechanization of soil tillage should be also given consideration and higher priority.

Involvement of NGOs in the project
- The meeting agreed to involve NGOs as parental institution or one of collaborating institutions in the future projects.

Sustainability of grant projects
- CGS should follow the impact of the projects (the degree of dissemination of varieties and technologies).
- Information consulting centers of Agriculture Development and Credit Project (ADCP) should give priorities to those farmers who are involved in CGS program.
- Adjust the research system to dissemination of the grant projects outputs.

Priorities
The structure of agricultural commodities as contribution to GDP in percentage in 2001 is the following:

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eggs</td>
<td>3.1</td>
</tr>
<tr>
<td>Milk</td>
<td>20.0</td>
</tr>
<tr>
<td>Meat</td>
<td>19.0</td>
</tr>
<tr>
<td>Grape</td>
<td>1.6</td>
</tr>
<tr>
<td>Fruit</td>
<td>10.0</td>
</tr>
<tr>
<td>Forage crops</td>
<td>5.5</td>
</tr>
<tr>
<td>Melon crops</td>
<td>2.5</td>
</tr>
<tr>
<td>Tobacco</td>
<td>0.5</td>
</tr>
<tr>
<td>Potato</td>
<td>7.5</td>
</tr>
<tr>
<td>Vegetables</td>
<td>8.6</td>
</tr>
<tr>
<td>Cotton</td>
<td>1.7</td>
</tr>
<tr>
<td>Cereals</td>
<td>20.0</td>
</tr>
</tbody>
</table>
The meeting agreed to emphasize the following priorities:

- Cereals including barley and maize breeding.
- Fruits, grape, tea (red juice orange, Nakhichevan grape without stones, local varieties of fruits)
- Vegetables: potato (fresh potato all year round)
- Cotton (early maturing)
- Drought stress, water stress, salinization.
- Livestock production, forage production and bee-keeping.

Approaches for announcing the next projects
- The meeting agreed that all new priorities can be announced for competition.
- The on-going project can only be extended based on their economic efficiency and outputs.

Reports on grant projects
- The annual and final reports on grant projects should be clear reflecting effect of each treatment or combination of the treatment and economic analysis including the rate of return.

Awards to the best projects
- The awards are applicable to projects, which completed one year.
- The meeting agreed to award three best projects after evaluating them using the special evaluation form.

Preparation of proposal on modernization of agricultural knowledge and information system
- The meeting agreed to discuss the proposal on modernization of AKIS prepared by the Agric. Science Center, MOA and GTZ

Recommendations on Implementation Mechanisms (2nd working group)

Enhancement of scientist-farmer relations
- During selection of the target farmers the data available in the regional consulting centers of ADCP should be used.
- While working with the farmers the experience and links of the regional centers of the agricultural research should be used.
- The cooperation between the project and the local county and village level administration and bodies should be enhanced.

Enhancement of cooperation between CGS and other components of the ADCP project
- Organization of the field days and workshops by the consultants of the regional centers at those sites where CGS implements the projects.
- Regional consulting centers should participate in the projects as collaborating institutions.
• While selecting the target farmers the priorities should be given to those regions where the regional centers are established.

Main directions of dissemination of the project outputs
• Conduct the workshops, field days, publication of the leaflets, brochures by the project executors.
• Organization of the field days for the new farmers by the regional centers consultants.
• To teach the farmers how to disseminate the project outputs.
• Application of the results by the market information dissemination groups of the regional consulting centers.
• Information about the project outputs by the regional centers at mass media.

Evaluation of further project impacts
• Conduct anonymous surveys in the project area by the project executors.
• Conduct the surveys by the consultants of the regional consulting centers.
• Evaluation of the economic efficiency of the projects by the CGS secretariat and project executors.

Sustainability of the CGS projects
• Credit component of the ADCP should target the CGS project farmers.
• The farmers involved in CGS program should allocate some part of the income to other farmer holdings.
• Stimulate the farmers who are involved in CGS program in the future to use the same technology used in the CGS program.

Enhancement of collaboration within the CGS project
• Joint discussion of the projects and results as well as organization of the joint workshops by the project executors.
• While reviewing new project proposals the priority should be given to those which provide collaboration between the institutions.

Extension of the grant projects
• After the cereals projects end there is a possibility to combine them in one new project and in this way extend their duration.
• Expand and extend the forage and livestock projects and respectively increase their budget.
• The project on perennial crops need to be extended because of the nature of the crops to have clear understanding on the technologies.

Training of personnel within the CGS project
• Organization of the language and PC courses for young scientists.
• Training course on agronomy, accounting and economic analysis.
• Organization of the training courses by the consultants of the regional centers in the region.
• International training of selected specialists in scientific centers.
The discussions and the recommendations of the 3rd National Meeting partly reflect the strategy and the operational mode developed earlier and very much in line with the project objectives taking into consideration the experience obtained during the first year of project implementation. Especially positive developments are: a) solid plans for training which would start with the English course; b) recognition of the other extension component of the ADCP project and plans towards coordinated and joint activities. c) serious approach to reporting of the results, evaluation of the project and award of the best teams, and d) efforts to involve in CGS organizations beyond the public sector research institutes. On the other hand there are several issues which could have been addressed and given consideration to have the CGS more efficient, productive and sustainable:

- Farmers sharing the benefits of the technologies. The results of the first year indicated that in some cases the yield of the farmers was doubled due to better varieties and technologies. The regular rule of the extension work is that farmers share the additional profit obtained due to technologies to those who developed and/or delivered them. This could be a very important factor for motivation of the project teams if the products/funds returned by the farmers can be used for expansion of the work and for compensation of the project participants.

- The economic projects through CGS not being materialized. There is justification for the projects being entirely devoted to farm level economics, issues related to on-farm profitability and competitiveness of different crops, measure of the technology impact and economic efficiency of different technology components. Prioritization of these projects and their implementation will assist the CGS project in evaluation of the projects as well as assist in better investment of the project funds.

- A detailed training program is needed. Though the meeting endorsed the training, however more detailed evaluation of the training needs and training plan is well justified. Some very useful training can be done without English. At present there is an urgent need for a local course to all projects on how to evaluate the economic benefit/losses from different treatments of the on-farm experiments. Management courses are also well justified. Training components needs more detailed work plan.

- The possibility of merging the projects in the future. The proposal was made to consider merging some of the projects with wheat project being a possibility. Since every project has very focused objectives and agenda there is a danger that they will be diluted. Another danger is that with the time the project will evolve to fund regular on-farm activities of the institutes implemented within their research agenda. New projects can have expanded objectives but the criteria for selection and operation mechanism should remain the same.
5. Sector by Sector Analysis

FIELD CROPS

The current analysis was conducted at the beginning of the project in February 2001. The changes in the status of the crop by the end of 2002 are reflected at the end of each section.

The list of the field crops to be considered during this period of time was based on priorities defined during a number of priority-setting meetings and follows the CGS manual section “Priority Topics”:

1. Wheat
2. Barley
3. Triticale
4. Rye
5. Rice
6. Oats
7. Maize
8. Potato
9. Grain legumes
10. Industrial crops
11. Oil crops

The report below summarizes the impressions from the visits to different institutions as well as communication with the CGS Secretariat.

Wheat

Status of wheat production
Wheat always was important crop in Azerbaijan. In the past (before 1991) Azerbaijan was assigned the responsibility of producing durum winter wheat for the USSR and instead was supplied with bread wheat grain and flour from Russia and Ukraine. In the late 80s the wheat area was around 300 000 ha and durum wheat occupied 60-70%. After the 1991 gradually wheat area increased to 425 000 ha in 1999 and the proportion of durum wheat reduced to 20-30 %. The major wheat production at present is under irrigated conditions in the following eco-regions: Muga-Salyan – 100 000 ha, Shirvan – 70 000 ha, Karabakh-Mil – 65 000 ha. In total irrigated wheat occupies around 300 000 ha or 70 %. The major biotic stresses in this environment are yellow rust and loose smut.

Most varieties currently grown in Azerbaijan are susceptible to yellow rust and the losses in the epidemic year reach 20-30%. Loose smut is widespread due to utilization of poor untreated seeds and it results in yield losses and deterioration of grain quality. Lack of water for irrigation is widespread and wheat frequently suffers from the periods of lack of water even in irrigated environments. Improvement of water use efficiency by crop management and utilization of better varieties is very important. The crop maturity in
May coincides with the periods of hot weather resulting in shriveled grain. Tolerance of cultivated varieties to heat stress is very important. Many irrigated areas suffer from salinity, which can account for the yield loss of the magnitude of 10-35%. Production constraints that substantially impede the yield are: poor seedbed preparation and poor germination due to lack of or poor machinery; abundance of weeds; utilization of poor seeds; planting of unadapted varieties; break of the crop rotations resulting in planting wheat after wheat and accumulation of diseases and pests; uneven and untimely irrigation, harvest and post-harvest losses; and others.

Part of wheat area is located in rainfed, semi-arid environments. The yield here is less compared to irrigated areas but the crop is very important for the farmers as it is a source of the staple food. The diseases common in irrigated land also important here though the spread of leaf diseases (yellow rust) is less pronounced due to low humidity. The drought and heat tolerance become very important in this environment. The rainfed wheat is normally planted in higher altitude in hilly or mountainous areas where winter is colder and frost tolerance/winter hardiness become important. The cropping system in rainfed areas is different from irrigated and includes utilization of fallow and higher proportion of wheat. However, the production constraints are very similar to the irrigated regions but much more pronounced due to the fact that in general the farming community poorer compared to the irrigated plains. Part of the wheat is planted in higher rainfall areas of Sheki-Zakatala regions. The biotic, abiotic and production constraints are very similar to irrigated areas though some additional diseases like leaf rust and powdery mildew have significance.

2002 status. Wheat production increased substantially and reached almost 2 mln t. The demand for grain in 2002 was low and the grain prices at harvest were in a range of $60 per ton not justifying the production costs. This was partly due to weather conditions favorable for wheat in spring 2002. The production increase is also partly attributed to increased use of inputs.

Wheat variety development

Institutional arrangements and breeding system. The wheat sector in Azerbaijan has the longest tradition of research and therefore most developed programs and infrastructure. At present the wheat breeding is almost entirely concentrated in the Azerbaijan Research Institute of Farming (ARIF) with its network of the research stations. Both winter bread wheat and winter durum wheat varieties are bred and traditionally Azerbaijan was a leader in the development of the durum wheat varieties in the USSR. The bread wheat varieties bred by ARIF also possess high yield potential combined with good quality. In the 90s with the changed priorities the bread wheat started to dominate as consumption switched to locally produced wheat grain.

The wheat breeding department in the ARIF consists of 10 breeders including 5 PhDs. The wheat breeding system is a fairly sophisticated network of stations addressing the major production environments. Crosses and advance of the F1-F2 generations are made in Absheron, where the ARIF is based. The F3 is distributed to five regional experimental stations. The activities of the stations, the personnel working on wheat and infrastructure
are presented in Table 5.1. The breeding work in the ARIF is supported by the following research programs: physiology, quality, genetic resources, genetics (each program with 2-4 scientists). The wheat breeding network of ARIF is well coordinated. Backup in biotechnology and plant physiology is also provided by the Institute of Botany (Academy of Sciences).

Wheat research/breeding on a small scale is also conducted in the Institute of Genetics and Breeding (Academy of Sciences). The main objective of the institute is collection and maintenance of genetic resources as well as their utilization in wide crosses. The loss of Karabakh Experimental Station working on cereals seriously affected the activities of the institute in applied wheat research despite the availability of qualified personnel. The basic research conducted in the Institute on Genetics and Cytology on wide crosses has limited applied value and therefore may be irrelevant for the Competitive Grant System. The Azeri Agricultural Academy has a Department of Breeding and Seed Production and a group working on wheat. This group has limited access to land and mainly tests lines/varieties provided by ARIF.

External sources of varieties/germplasm are international centers, some bilateral donor agencies and private companies. The international centers CIMMYT and ICARDA play an important role in providing a range of wheat germplasm to ARIF. After several cycles of selection the best lines are incorporated in the advanced yield tests and if competitive with the local germplasm are submitted for official tests and if approved are promoted with the farmers. Essentially, the international centers do not play an independent role in the development of wheat varieties in Azerbaijan. Some donor agencies/projects from Turkey and Iran attempted to bring substantial quantities of new wheat varieties and promote them directly with farmers. In most cases these efforts failed as the imported varieties were not adapted to local conditions and their seed production was not maintained by the experienced seed producers. Some private companies (Tovuz-Baltiya) imported small amounts of wheat varieties from Russia (Krasnodar) to test directly with the farmers. The varieties from Krasnodar are officially released in Azerbaijan and their testing in Azerbaijan is well justified if the proper methodology of the testing is followed. The capacity of private companies for implementing this work is not clear at present. There are no private breeding companies or NGO working on wheat variety development in Azerbaijan.

**Varieties to be promoted.** Up to now the ARIF wheat breeding network was very successful in breeding both durum (15 varieties) and bread wheat (6 varieties) varieties for irrigated conditions. The yield potential of new varieties under optimal conditions approaches 7-8 t/ha combined with acceptable quality. At the same time the availability of the varieties for rainfed conditions or supplementary irrigation is limited. The official List of the Registered Varieties for 2001 includes the following wheat varieties: durum wheat – Mugan, Mirbashir 50, Shir-Aslan 23, Turan, Garagylchik 2, Terter, Vugar, Kyzyl Bugda 1, Barakatly 95, Alindja 84 (all from Azerbaijan); bread wheat – Akinchi 84, Gyimatly 2/17, Mirbashir 128, Tarragi, Zardabi, Gurgana, Azeri, Perzivan 1 (all from Azerbaijan), Bezostaya 1, Birlik, Yubileynaya 75, Spartanka, Olimpiya 2, Grekurn 75/50, Yubileynaya 75 (all from Russia). Presently some 10-12 new varieties from ARIF
(including two resulting from cooperation with CIMMYT and ICARDA) are being officially tested in different eco-regions.

However, the seemingly wide choice of wheat varieties in the recommended list and a number of new being tested does not mean that farmers have reliable varieties in their hands. First of all most currently grown bread wheat varieties are susceptible to yellow rust, which has become a severe problem over the last 3-4 years. These varieties need to be replaced by resistant ones. Secondly, there is not enough data especially on-farm to suggest which particular variety/s should be promoted in each eco-region. Wide-scale on-farm variety validation trials are needed to identify 2-3 best options for farmers in each region. The best new Azeri varieties, which are being officially tested now, can be included in on-farm verification trials. These can be complimented by a few best Russian varieties from Krasnodar. Within two years it will be obvious which varieties should be promoted.

Important components/activities of the project/s on variety development and promotion

- Detailed analysis of the variety performance data from different sources;
- Economic analysis of the grain utilization and development of the requirements for grain quality;
- Wide-scale on-station and on-farm variety verification trials;
- Wide scale on-farm variety demonstration trials;
- Establishment of procedure for testing of new varieties for resistance to diseases under artificial conditions;
- Establishment of procedure for testing of new varieties for tolerance to major abiotic stresses;
- Establishment of procedure for testing of new varieties for end-use quality;
- Promotion campaign for new varieties using publications/field days, etc.

Integration options for wheat variety promotion projects

The identification of the best most suitable wheat varieties can be conducted under the leadership of ARIF as it has the knowledge and experience in wheat breeding. The ARIF stations can be active in organizing field activities in respective eco-regions. Possible cooperators in this project/s can be the Variety Testing Commission through some of its sites assigned to participate in the project. The private companies can be very instrumental in organizing on-farm activities. The ARIF and the Institute of Crop Protection can cooperate on disease testing. ARIF and the Institute of Botany can cooperate on testing for abiotic stresses. ARIF, Institute of Genetics and Breeding, Variety Testing Commission can cooperate on quality testing. The Institute of Agricultural Economics can take a lead in economic analyses. Private farmers which fields will be used for the activities can participate in the project. International centers (CIMMYT and ICARDA) can play important role in project preparation and implementation as well as can contribute financially to some priority projects.

2002 status. The last few years clearly demonstrated that almost all local bread wheat varieties are susceptible to yellow rust and have yield losses up to 30-40%. New varieties
were identified deriving mainly from international cooperation (Nurlu, Azametly, Gobustan) which are high-yielding and resistant to diseases. They are being aggressively promoted in 2002-2003 season. The wheat breeding system strengthened and developed a logical national framework with the institute in Baku and the stations united by a national uniform trial and several nationwide activities. The cooperation with international centers straightened as a result of CGS project. If there is good choice of varieties for irrigated conditions, identification of better germplasm for the rainfed areas remains high priority.

**Wheat seed production**

*Institutional arrangements for wheat seed production.* Wheat (cereals) seed production remained largely unchanged from the past. The centralized system had three levels of seed production. The breeding institutions were responsible for maintenance breeding and breeder’s seed production. This seed was given to specialized farms normally closely associated with the research/breeding institutions to produce super elite and elite seed generation. These in turn were passed to the second level of specialized farms responsible for producing certified seed for mass production. The system worked well in the past and served big farms. However, in the last 10 years changes in the structure of production units, deteriorated machinery, and low farmer capacity to buy inputs resulted in poor status of the cereal seed production industry.

In 1994 the ARIF established the Scientific-Production Corporation "Elita" with the purpose of providing the quality cereals seed to producers. It comprised of ARIF and its network of experimental stations and also included 13 specialized seed producing farms in major eco-regions. The objective was to produce 5000-7000 t of high quality cereal seed annually. However, the seeds even being produced by the farms are not easily sold to the farmers due to the fact that the price of seeds is high and the farmers are not able to buy it. The Ministry of Agriculture regulates the seed production and the price and the seed farms even willing to sell for lower price are not able to do this. The seed farms have not been privatized. At the same time the government provides very little support and eventually their infrastructure, machinery and equipment deteriorates. The alternative seed suppliers are medium size or larger private farms (50-200 ha), which are interested in new varieties and seed multiplication. Normally they obtain quality seed of new varieties from research stations or farms and after 1-2 years of multiplication sell the seed to the neighbors. Some entrepreneurs bring grain/seed from abroad (Russia, Iran) and sell it for human consumption and forage. This grain is bought by farmers and used as seed. Naturally the quality of this seed is inferior and the varieties could be unadapted to Azeri conditions.

The pilot farms from the World Bank Project on post-privatization support have been establishing a model where selected private farms from the former big state or collective farms take the responsibility for supply of the seed for the small holdings in the area. They are supported to obtain the equipment and machinery. On average in the country hardly 10% of area is planted with certified seed. The agricultural services related to seed production (seed quality inspections laboratories and certification mechanisms) suffer
from low funding and probably need restructuring to adapt to changing seed production environment.

**Seed production models/mechanisms to be promoted.** The main objectives of the seed production project are identification of a financially sustainable mechanism for seed production as well as promotion of the information among the farmers on the value of the seed and varieties. Obviously at present there is no effective mechanism of seed production in place for cereals. New models for seed production based on self-financing involving private farmers, farmers associations/cooperatives, private companies can be developed. The role of the big farms can be clarified.

**Important project components/activities on wheat seed production**
- Economic analysis of different possible models of sustainable seed production taking into account the cost recovery of the breeder’s seed by the research establishments as well as cost recovery by seed producers multiplying the seed for regular farmers.
- Initiation of pilot seed multiplication models for fast and financially sustainable seed multiplication with emphasis on utilization of different types of seed enterprises (big farms, small holdings, associations/cooperatives).
- Review of the current system of licensing seed production activities and development of recommendations for its improvement.
- Comparison of different methods of maintenance breeding and breeder’s seed production and identification of the most suitable procedure.
- On-farm demonstrations of quality seed (including the seed treatment), their effect on yield and profitability of production.
- Education of farmers on seed quality and seed production through courses and publications.

**Integrated options for wheat seed production projects**
The most crucial integration for the seed production projects will be between the research institutes/stations and the farmers. Identification of different types of farms interested in seed production and capable of doing it will be very important. Cooperation with the economists will be needed for related components of the projects. Regulating agencies like MOA, Seed Inspectorates can be involved as well.

**2002 status.** Seed demand and the buying capacity remains low and the government made an attempt to regulate the seed import to the country to protect the market. Many farmers continue using the farm-saved seed. The companies importing grain from Kazakhstan, Canada, Russia also sometimes sell it at low price as seed. Subsidy from MOA for seed industry was allocated at a level of 600 mln AZManat but actually provided only 150 mln. Some land from the seed farms was privatized. Some activities of the private seed companies started but did not reach significant level. The industry remains mainly public with little support. On-farm seed maintenance and private enterprise development remains a priority.
Wheat Production Technology

Institutional arrangements for wheat production technology
The research on cereals agronomy is primarily concentrated in ARIF and its stations. There are 10 people working on technologies in the Department of Farming of ARIF. As with breeding - there is little agronomy research conducted in Apsheron headquarters itself. The experiments are mainly in the stations and reflect eco-regional constraints. There is little on-farm research conducted at present. The facilities for analysis of soil or biomaterial are limited. The Azeri Agricultural Academy situated in Gyandja has Department of Farming and Department of Crop Science. However, they have limited access to land and their prime responsibility is teaching. The relevant agronomy research is also conducted in the Institute of Erosion and Water Resources and in the Institute of Soil Sciences. The latter is part of the National Academy of Sciences. Both institutes have groups developing better irrigation technologies and protecting the soil from erosion and can participate in the projects addressing wheat production technologies.

Private companies like Tovuz-Baltia and EMA are involved in technologies as far as the application of chemicals is concerned. They import herbicides, pesticides, fungicides and while selling them to farmers provide technical support and advice through the network of agronomists based in different counties. Though this approach is not actual technology development but rather technology transfer – it plays very important role in defining the agronomy practices which farmers undertake in the field. The companies are very mobile and have motivated staff. Tovuz-Baltia has 170 permanent employees posted in 21 administrative counties. During the season the number of people grow to 500-600. This is a substantial force working directly with farmers.

Wheat production technology to be promoted/adapted
The basis of agronomy research is essentially fine-tuning of the technologies for new varieties. The perception of the researchers is that the basic technology of wheat production is known and consists of the timely soil tillage depending on the preceding crop, planting of 150-220 kg of seed at certain dates, application of fertilizers, crop protection against herbicides and pests, optimal irrigation regime, etc. Indeed application of all these agronomy measures will result in higher yield but not necessarily in higher profitability for the farmer on unit area taking into consideration the real prices of grain and inputs.

Another important consideration is the fact that the technologies were developed for big farms and some of them have limited value for the newly established small holdings. The wheat production technologies to be adopted/promoted through the CGS could belong to three types: promotion of the basic agronomy measures to the new farmers who lack the fundamental knowledge about growing wheat. These may include seeding rates, sowing dates, fertilizer rates, tillage options, weed control. The second type would be technologies requiring relatively significant input from the farmers for adoption either through the adjustment of the farming system or through investment in machinery but readily available from the local sources. These may include application of chemicals, change to new crop rotation, minimal tillage, better irrigation technologies and others.
The third group of technologies represents agronomic practices, which are needed for the farmers in Azerbaijan but not readily available from local sources. Before making recommendations to farmers, adoptive research will be required. Recommendations may include bed-furrow irrigation when wheat is planted on top of beds; minimal or zero tillage; utilization of low seeding rates combined with good seedbed preparation; consequences of planting wheat after wheat under irrigated conditions as common practice at present. All three types of technologies have justification for inclusion into COS. Below are some practical examples of agronomy to improve wheat production and increase its profitability based on research conducted primarily at ARIF network.

The recommended crop rotations are depending on the region: wheat-alfalfa-maize-wheat-wheat+maize-maize-wheat; wheat-alfalfa-wheat-wheat-vetch/oats-wheat; vetch/oats-wheat+maize-maize-wheat-wheat; fallow-wheat-wheat; sunflower or sorghum-wheat-wheat-grain legumes-wheat; under rainfed conditions – fallow-wheat-wheat-chickpea-wheat; sainfoin-wheat-wheat-occupied fallow-wheat. However, most of the farmers have two or three fields only. One smaller part of the land is occupied by perennial grasses for animals and set of crops (like vegetables, potato) for home consumption with the rest planted by wheat. In this case wheat is not rotated for several years and its share on the farm does not decrease. What would be optimal crop rotation scenario for different types of farms varying in land size. This is important issue, which needs research efforts. Other issues brought by the participants during the discussions:

- Weed control through pre-planting irrigation followed by cultivation.
- IPM to protect against diseases and pests.
- Green manure crops.
- Organic fertilizers.

**Important project components/activities on wheat technology**

- Wide scale on-farm demonstration of the basic wheat production agronomy.
- Development of crop rotation options for different types of farms.
- Demonstration/promotion of technologies with higher input for progressive farmers.
- On-station and/or on-farm adoptive research of progressive irrigation methods, zero tillage, low seeding rate technologies, and possibly low input technologies.
- All the components above can be accompanied by thorough economic analysis.
- Education of farmers on wheat production through courses, field days and publications.
- Some of the wheat technology components/activities can and should be integrated with the activities of wheat variety and seed projects.

**Integrated options for wheat technology projects**

ARIF and its network of stations can be consolidating institution to lead this component. Important role can be played by the Institute of Erosion and Irrigation, Institute of Soil Sciences, Institute of Crop Protection, Institute of Agric. Economics, Azeri Agricultural Academy. The company Tovuz-Baltia can compete in taking the leadership of the project in some eco-geographical regions or counties provided that they integrate with the public researchers/stations. International cooperation with CIMMYT can be instrumental for this
project with emphasis on novel production technologies both under irrigated and rainfed conditions. As in previous projects integration with farmers remains very important.

2002 status. The production has been improved due to simple increase of inputs and especially better weed control by herbicides. The private companies with their consultants are the main driving force delivering the inputs. Replacement of old varieties susceptible to diseases remains high priority. Training of new farmers on agronomy is also very important.

Other Small Grains (Barley, Triticale, Rye, Rice, Oats)

Production status
In the past barley occupied more than 200,000 ha but in the 90s its area reduced to 50,000-60,000 ha due to the fact that the crop was partly replaced by wheat though recently there is a tendency for increase in the area. Barley plays an important role as forage crop and it is also more salt tolerant crop. No malting barley is produced despite the fact that there is high capacity brewery in Baku which uses imported malt. Barley is normally planted after wheat. Both two-rows and six-row barley are cultivated. At present both Azeri and Russian varieties are officially registered in Azerbaijan. Most barley area is concentrated in Shirvan, Mugan-Salyan and Sheki-Zakatala. It is either grown in the irrigated plains where it is grazed in winter by animals or in the mountainous rainfed areas where it has advantage over wheat as more drought tolerant crop. Production constraints for wheat are also common for barley. Barley grain is utilized on farm and there is less trade involved compared to wheat.

2002 status. Recuperating poultry and sheep industry increased the demand for barley especially in the fall of 2002. Good barley varieties Karabakh 7, 21, 22 are available. On-farm demonstrations of varieties and technologies are well justified and the CGS project can well announce the project on barley as priority. The malt for beer is exported and the demand for the malting barley in the near future is not expected.

Though there is no statistics exists on triticale – its area is estimated as 12 000 ha at present. One local variety of triticale named Samur is officially released and the seed of this variety is available from ARIF station in Terter. Triticale is slowly gaining popularity for two reasons – it has yield advantage of 20-30% under salinity and it is better under rainfed conditions. Its production is limited by its usage. Though it is used for flour but the quality of the product is poor. Mixture of triticale with wheat grain has perspectives. New small mills can utilize triticale but though it should be used for feed it is used for human consumption because needed for food. The feed use is not well studied and grazing of triticale in winter is not studied at all. The crop has potential in Azerbaijan with many areas affected by soil problems, low input technologies and need of forage/feed for animals.

2002 status. Compared to other countries triticale is a known and practiced crop in Azerbaijan. There are regions where farmers know the crop and cultivate it. New triticale varieties originating from Mexico were identified and one under the name of Shirvan is
being officially tested and multiplied. The CGS project can make a difference in regard to triticale and make it good option for farmers in some regions of the country.

**Rye** is mainly grown in mountain foothills. One variety selected from the local rye population – Mirbashir 46 released and grown in Azerbaijan though the area is not clear. There is no high demand for the grain and it is subsistence crop which is grown when wheat suffers from winterkill or other stresses. However, the market potential is very high as the rye bread is three times more expensive compared to wheat.

**2002 status.** There is no change in the status of the crop but there is high demand from baking industry which is met by imports from Russia.

**Rice** is a traditional and important crop in Azerbaijan. The area under the crop is stable around 4000 ha and mainly situated in Lenkoran-Astara and Shirvan eco-regions. Local rice varieties from Azerbaijan are grown. One of the rice production problems – lack of herbicides and the technology of cultivation is not well defined and based on tradition. Some farmers obtain up to 6 t/ha. The small mills can clean the rice so that processing is not a problem. The competitiveness of local rice is that it is round in Azerbaijan and the neighboring countries (Iran, Turkey) grow long-grain rice not accepted by consumers in Azerbaijan.

**2002 status.** There is no growth potential for rice but it remains good profitable crop in Lenkoran, Astara, Masaly. Old local varieties and some from Iran are cultivated. No involvement from CGS is needed at present.

**Oats** occupies very little according to statistics – around 200 ha but plays much more important role because it is frequently intercropped with vetch or other crops for forage. Four varieties were released in the past including two local varieties. The last one is released in 1985 – Azerbaijan 60. The variety is for grain and forage.

**2002 status.** No change. If the pig and horses industry develops, a project can be justified.

**Institutional arrangements for small grains breeding and production research**

**Barley.** One breeder in ARIF works on rainfed barley and another breeder in Terter station works on irrigated barley. There is no specific agronomy research on barley. The maintenance breeding and seed production are conducted at Terter, Jelalabad and Gobustan stations. There is strong cooperation with ICARDA on barley improvement and some lines were identified which are competitive with the local checks. Very little if any research is conducted outside of ARIF on barley.

**Triticale.** There is one breeder and two technicians working on triticale breeding at ARIF. The bulk of the work including seed production is conducted at Terter station. No specific agronomy research on triticale is done. Some basic research is conducted at the
Institute of Genetics and Cytology. Cooperation with CIMMYT in variety development has been established.

**Rye, rice and oats.** No breeding or agronomy research for these crops is conducted in Azerbaijan. The only work done is rye and oats seed production at Terter station. Rice seed production is maintained by the farmers.

**Technologies to be promoted**

**Barley.** Variety Karabakh 22 – was identified as more salt tolerant for Udjar region. Other good varieties for promotion under rainfed conditions – Jalalabad 19, for irrigated – Kakabakh 21, 22, in mountains – Pallidum 596, Nakhchivan dani. Probably the on-farm, variety verification trials will be needed to identify the best suitable for small farmers. These can be combined with the demonstration of the basic agronomy for the crop. Two areas of barley cultivation will need adoptive agronomy research. Cultivation of barley under salinity needs better recommendations as part of the broader issue of improving production of saline soils. Utilization of barley for grazing which is relatively wide-spread needs adoptive research possibly including other crops (like triticale and wheat) which will give simple and effective recommendations for farmers. Possibility of growing malting barley can be evaluated provided that the breweries are interested.

**Triticale.** Promotion of this crop can be in three directions: green forage, feed grain, human consumption. This can be based on combination of seeding dates and varieties: 1) early planting (beginning of September) of early varieties for grazing in fall, cutting or grazing in winter/spring; 2) early planting of late (winter) variety for grazing after the first finished, may not be used for grain but for silage; 3) regular planting for grain, 4) planting of mixtures with barley or other crops. Technologies has not been developed so far for using triticale for grazing or forage and need to be addressed since this crop has high potential. General technology of triticale growing is more or less known and requires less inputs (intermediate between wheat and barley). Quality evaluation of the forage and grain needs to be done. Usage for alcohol production and for beer could be an option. Methodology of bread-baking from triticale can be addressed. Triticale needs wide-scale efforts in education of farmers on its value, production and utilization.

**Rye, rice and oats.** Low relative value of these crops may not justify their inclusion into CGS projects. However, if any efforts to be made for these crops, they can start from import of varieties from regions with similar environments and their evaluation under local conditions. Once the best varieties are identified, seed production and promotion with farmers will become very important.

**Important components/activities of the project/s on small cereals production**

**Barley and triticale**

- On-farm demonstration of better varieties and agronomy.
- Development of successful seed production models/mechanisms.
- Adoptive research on utilization of these crops under salinity.
- Adoptive research on utilization of these crops for grazing.
Adoptive research on triticale grain quality and technology of its utilization as feed and food.

Adoptive research on forage quality.

**Rye, rice and oats**
- On-station and on-farm selection of suitable varieties.
- On-station and on-farm testing of agronomy options.
- Promotion of better technologies with farmers.

**Integrated options for small grains breeding and production projects**
The projects aiming to improve barley production can be based on the ARIF and its network of station with good integration with ICARDA program and probably some institutions outside like Krasnodar ARI. For triticale the cooperation with CIMMYT both in germplasm development and grazing can be strengthened. For the work on utilization of these crops for saline environments it will be extremely important to define the target region. The work on forage and grazing options for these crops can be integrated with the Institute of Pastures and Forage. For rye, rice and oats identification of farmers groups interested in these commodities or possible processing industry interest will be a key element for justification of inclusion of these crops into CGS.

**Maize**

**Production status**
Maize is grown for grain everywhere though primarily in Sheki-Zakatala and Gyandja-Kazakh regions. The area in 1999 was around 28 000 ha. The grain is used for feed. At present mainly local populations are grown though the list of recommended varieties includes hybrids from Russia. The yield potential is more than 10 t/ha. Maize is planted in spring and normally 3 irrigations are given (2500-3000 m3/ha total). Important pests – corn ball worm and stem borer both controlled by chemicals. Disease – maize smut spread everywhere in the country. Weed control is done by symasin and atrazin. Maize is a crop, which over the last years gains popularity with farmers as the importance of livestock sector grows.

**Institutional arrangements for maize production technologies**
At present maize breeding work is concentrated at Zakatala Research Station of ARIF. There is a group of eight people working on all aspects of maize production including agronomy and seed production. Little work is done on maize outside of public domain.

**Technologies to be promoted**
Seed production of adapted open-pollinated varieties seems to be very important for promotion of maize with the small holding farmers. Basic maize agronomy for grain and silage should be demonstrated and promoted with farmers. Novel techniques like intercropping maize with other crops worth considering as adaptive research. Progressive farmers in particular specializing in livestock may consider hybrid maize and the possibility of hybrid seed production can also be looked at. Quality protein maize (QPM) adoption/development for Azerbaijan could be very important due to the fact that the
benefits for the livestock are very high. Modern crop protection measures can be promoted. Growing maize as summer crop needs to be looked at from the point of view of varieties and technologies.

**Important components/activities of the project/s on maize production**
- On-farm evaluation of the currently grown populations of maize at spring planting for grain and after cereals for silage/grain.
- Evaluation of QPM in the conditions of Azerbaijan and development of adapted QPM maize germplasm.
- Strengthening of maize seed production both on-station and on-farm.
- On-farm demonstration of suitable agronomy options for maize.
- Adoptive research on maize hybrids.
- Adoptive research on intercropping and forage.

**Integration options for maize production projects**
The number of people working on maize, especially agronomy, can be expanded and involve other ARIF stations. Since the maize seed production is profitable business private companies will be eventually involved and identification of a partner here will be very beneficial. The Azeri Institute of Forage can be a partner in comparing the maize forage with other options available to farmers. CIMMYT can be a partner in QPM research. Strong maize breeding program outside of Azerbaijan (Iran, Russia or multinationals) can be approached for cooperation on maize hybrids.

**2002 status.** Every year there is increased demand for maize. If in the past the it was 20,000 t, in 2002 – it was estimated as 150,000 tons of grain production. The demand is mainly due to recovery of the poultry industry. The seed production demand is very high. Iran is interested to cooperate on maize. Western companies are not present so far. Varieties-populations remain as a main production mean. Promotion of private seed companies working on maize is well justified.

**Potato**

**Production status**
Potato is one crop, which witnessed increase in production and productivity over the last years. Though the total area in 1999 was 38000 ha and it is grown in all eco-regions, the bulk of production is concentrated in Gyandja-Kazakh eco-region – 210000 ha. In some regions potato is grown in two cycles planting in February-March and harvesting in early summer. Planting in July and harvest in fall. These two cycles of potato in one season allow increasing the production and also multiplying the seed of new varieties very fast. The recommended crop rotation: perennial grasses (2 years)-potato-wheat-barley+winter vetch-potato may not be very suitable for the small farmers. The main diseases are: phytophtora, macrospores, viruses; insects: wire worm and Colorado leaf beetle. Traditionally Azerbaijan grew Russian and Baltic varieties of potato and the high generation seed were supplied from outside. Only in the 90s two local varieties of potato were released in the country. At present the seed production in most of the country is in such a state that difficult to say which varieties are grown. The flow of seed from Russia
and the Baltic states stopped but the new sources appeared: Iran, Turkey and Holland. It appears that the local and outside demand for Azeri potato drives the production higher but there are no systematic efforts in the production of seed – the key element of potato production.

Institutional arrangements for potato breeding and production
The public institution working on potato is the Azeri Institute of Potato and Vegetables situated near Baku. Its department of potato has six scientists with PhD working on breeding, agronomy, crop protection and seed production. The institute has three stations: Lenkoran (76 ha), Gusarchay (150 ha) and Tovuz (45 ha), which are involved in potato research, especially Tovuz. The potato department of the institute is severely under-funded and almost no operational money is supplied to the researchers. As a result very limited fieldwork is conducted especially on seed production. The technologies available at present in the institute are not able to reach the farmers due to the funding limitations.

Over the last several years the Tovuz-Baltiya private company briefly described above became very active in potato seed production. This was partly due to a grant from Holland to establish modern potato seed plant. The company imported Dutch potato varieties and technology and though not immediately but managed to increase the production of potato in the counties where it worked. At present the company has the set of machinery and facilities in Tovuz for potato seed production as well as a number of motivated and qualified specialists. Unfortunately, the Dutch technology was being introduced without comparing to the locally available and in isolation from the Institute of Potato and Vegetables. This isolation leaves the researchers and their products unrequested and, secondly, there is little chance of the best components of the local technology to reach farmers working with Tovuz-Baltya.

Technologies to be promoted
It is not clear at present which varieties exactly should be promoted with the farmers for different cycles of potato growing (spring and summer). Obviously the old Russian and Baltic varieties, the newest Azeri varieties and the imported varieties from Iran, Turkey and Holland were never compared in one trial. This is very crucial because different growing cycles require different maturity range. The technology of virus-free seed production is extremely important but may need substantial investment in the infrastructure of the green houses at the institute. Alternative options using natural conditions can be evaluated. The technology of obtaining two yields of potato in one year can be verified under realistic conditions in different target regions. There are concerns about the quality of the new introduced varieties, which can be evaluated considering two growing cycles. The crop protection measures for potato are clear and based at present on application of chemicals. These can be effectively promoted with the farmers. For the regions of specialized potato growing like Tovuz it can be important to look at the optimal rotation and farming system for small holdings with the dominance of this crop.

Important project components/activities on potato production
• On-farm evaluation of potato varieties for different eco-regions and growing cycles.
• Development/adoption of effective seed production mechanism and technology.
• On-farm research and verification of the optimal technologies to obtain two yields of potato in one year.
• Economic analysis of potato marketing taking into consideration quality.
• Development/adoption/demonstration of farming system for specialized potato farmers.
• Demonstration of crop protection measures for potato with economic analysis of their application.

Integrated options for potato production projects
The strength of Tovuz-Baltiya, its nationwide status of operation, capacity in terms of machinery and equipment questions the leadership of the Azeri Institute of Potato and Vegetables in implementing the potato project for Azerbaijan. Ideally, the two institutions can cooperate and prepare the joint projects merging the strength of Tovuz-Baltiya in extension with the strength of the institute in research/technologies. The ARIF stations in different eco-regions can be involved.

2002 status. Potato is an example of market-driven successful crop production. At the time of the USSR the plan for potato production was 100,000 tons and never accomplished now the production reached close to 700,000 tons - the 2-3 times increase over the last 5 years. Some regions obtain two yields and the early crop is exported to Russia. It also became evident that the varieties from Holland dominate as well as technological hybrid between the local and Dutch technology is most productive. Strong involvement of the private companies is evident. The private sector may well control the crop and no public involvement is needed in the future.

Grain Legumes (Chickpea, Lentil, Peas, and Beans)

Production status
There is no statistics on grain legumes. In the past – there were more than 10,000 ha including chickpea, lentil, beans, peas. At present the estimated area is 2000 ha. Chickpea and lentils are by far more important because they are used in a variety of national dishes: soups, plov, dolma, etc. There is across the border trade in grain legumes. Some chickpea is exported to Iran and lentil is imported from Iran and Turkey. For chickpea the highest demand is for big white grain varieties. Similarly, there is more demand for big grain lentil varieties though small grain varieties are cultivated at present. Both crops command high price on the market. There is no processing industry developed in the country. Chickpea and lentil are mainly cultivated in the rainfed areas of Gobustan and Jalalibad and are more drought tolerant compared to wheat and barley. These are traditional crops, which in the past did not receive high priority from the state. For instance the technology of cultivation is not developed and based on growing old traditional varieties using primitive methods like hand planting and harvesting. The biotic stresses are Askohita and Fusarium diseases. Pests (aphids, thrips and others) are also important. Peas and beans occupy even smaller area and mainly grown as garden crops.
Institutional arrangements for grain legume research
The needs of Azerbaijan in grain legume research are addressed through a program of grain legume breeding at ARIF. It consists of 3 scientists and 4 technicians. They mainly conduct research at ARIF stations in Gobustan and Jelalibad. There is also a group in the Azeri Institute of Potato and Vegetables working with the emphasis on vegetable legumes. Zakatala Research Station of ARIF has one scientist working on beans agronomy. Gobustlin Research Station of ARIF has one agronomist/breeder working on grain legumes. The grain legume program has limited operational resources and virtually no equipment/machinery for field and laboratory work. There is no laboratory facility for evaluation of grain legume quality. The technology of grain legume cultivation is not addressed in a separate program but through respective regional agronomy research in Gobustan and Jelalibad. There is no seed production functioning in Azerbaijan for grain legumes and farmers have to maintain their own seed for long time. Close cooperation has been established for grain legume breeding with ICARDA and through it with programs in Turkey and Iran. The germplasm exchange with these programs resulted in identification of superior varieties suitable for Azeri conditions.

Technologies to be promoted
The chickpea varieties currently included into the recommended list are all local or imported old varieties with poor quality. New variety bred at ARIF but not yet released is AZNIIZ 50, which is tall and suitable for mechanized harvesting with good quality and resistance to Askohita. Technology for cultivation of this variety should be clarified. Turkish variety Gokcha may have potential for Azerbaijan and can be checked. Possibly, well-targeted short-term on-farm adaptive research stage is required for chickpea to identify the best varieties available at present and technology components allowing to obtain higher yield. It could be pre-mature or irrelevant to try to develop and promote fully-mechanized industrial technology for chickpea at present. For lentil the main objective is to switch to big-grain (4-5 mm, TKW 50-60 g) varieties with higher yield and disease resistance. The only variety released at present is small-grained and late Azer developed in 1980. New entry from ICARDA Monsierra can be tested in Azerbaijan and promoted if the results are positive. Testing of modern varieties from the neighbor countries may also be an option. Lentil production technology can be clarified as well. For both crops seed production system should be established allowing fast promotion of new varieties.

Important components/activities of the project/s on grain legumes production
- Identification of better grain legume varieties through both on-station and on-farm experiments.
- Adaptive research to identify the best technology components for growing of grain legumes in rainfed conditions.
- Adaptive research to clarify the role of grain legumes in the rainfed cropping systems of small holders and possibly development of options favoring farmers specializing in grain legumes.
- Wide scale on-farm demonstration and promotion of the best technology components.
Integration options for grain legumes production projects

The work on grain legumes can concentrate in rainfed conditions of Gobustan and Jelalibad regions and therefore the linkages between the respective stations can be strengthened. Within ARIF broader involvement of the agronomy department in production technology development will be fully justified. The cooperation with ICARDA in the area of variety development can also be strengthened and possibly expanded to the production technology as well. Similar type of cooperation can be strengthened with the respective programs of Iran and Turkey. A partnership for quality assessment can be sought both inside and outside of the country.

2002 status. The chickpea suffered the outbreak of Askohita disease which devastated the crop in 2002 and almost tripled the prices making it very important crop. Some chickpea is sold to Iran. The new varieties selected from international germplasm are resistant and have very good potential in Azerbaijan. Lentil area is slightly increasing due to local demand. Some better new varieties are available.

Industrial Crops (Cotton, Tobacco, and Sugar Beet)

The industrial crops considered in this section are cotton, tobacco and sugar beet. All of these crops once being important for the industry in Azerbaijan went through changes resulting in reduction of the area and production.

Cotton

Production status

Cotton once occupied 0.5-0.6 mln ha with production around 1 mln t and presently barely produces 100 000 tons. Its major areas are in the following regions: Shirvan (24000 ha), Mugan-Salyan (29000 ha) and Karabakh-Mil (38000 ha). At present the cotton yield is twice lower compared to the 80s due to lower inputs, poor agronomy, machinery, etc. The reduction in cotton area had positive effect on control of soil-transmitted diseases like wilt. There are several agronomic problems with cotton production related primarily to poor soil tillage, inadequate pest (corn ball worm) control, harvest and poor seed. The major abiotic stresses affecting cotton are lack of water for irrigation and soil salinity, which can reduce the yield by 20-25%.

All varieties officially released in Azerbaijan are locally bred by the Azeri Institute of Cotton Growing. The latest varieties like Azeri 195 combine good yield potential with disease resistance. The varieties cultivated are early maturing to release the land for the following crop (normally wheat) but do not possess high fiber quality. The production technologies developed in the past are based on high inputs and designed for big farms. Cotton marketing represents one of the major challenges, as farmers are not willing to plant the crop unless the future product is contracted with guaranteed price and the inputs are provided. The processing of cotton is done in 19 plants belonging to only two industrial groups, which completely control the market by awarding the contracts for
cotton production. The contract conditions are not always favorable for farmers. The cotton obtained from farmers is processed to different degree and normally exported.

**Institutional arrangements for cotton research**

Cotton being a major crop in the past traditionally enjoyed high investments into research. The Azeri Cotton Growing Institute situated in Gyandja has long record of research on all aspects of cotton cultivation. The institute has the following departments: breeding, seed production, agrochemistry, agronomy, crop protection and irrigation. The institute has 157 employees including 27 PhD level scientists and 153 ha of land at its Gyandja location. The institute having national mandate for cotton research also has several stations in different regions: Salyan Research Station (565 ha) mainly involved in seed production, Mil Research Station (640 ha) and Shirvan Research Station (65 ha). On average there are 4-5 scientists at each station supported by up to 10 technicians. In addition there is small experimental cotton processing plant/center in Gyandja also belonging to the institute.

Seemingly elaborate and effective structure of the institute is not functioning properly for two major reasons. Firstly, government funding decreased dramatically as for other institutes and the production obtained does not provide enough operational funds. Secondly, as was mentioned above the monopoly for cotton marketing and processing left the institute and its stations behind the mainstream of cotton production in the country. In fact the two groups controlling the processing have their own understanding of the varieties to be grown and technologies to be applied. They try to bring foreign varieties from Turkey, Egypt and USA with better fiber quality but not necessarily suitable adaptation. This tendency is important for consideration of the contribution of different players to improving cotton production in the country.

In addition to the Azeri Cotton Growing Institute there is heavy involvement of Azeri Crop Protection Institute in the development of technologies for cotton. This institute is also situated in Gyandja and its main objective is development of reliable methods to protect cotton from pests and diseases. There are six departments in the institute: entomology, phytopathology, pesticides, mechanization, modeling and residual amount of pesticides with the average of 9-10 scientists in each department. The institute has no land of its own at all and cooperates with the commodity institutes, regional research stations and farmers to conduct the research. There are 5-7 locations across the country where one person from the Crop Protection Institute is posted to conduct/supervise the research. One of the important activities of the institute is testing and certification of the new chemicals brought from outside and not registered in Azerbaijan. This activity is compensated and the funds are partly used for operational expenses. The Azeri Agricultural Academy in Gyandja has certain capacity to work on cotton and has a large number of experts especially in agronomy. However, they do not have the land and infrastructure recourses. Private sector providing chemicals for crop protection (company EMA and the like) also plays important role in definition of the cotton production technologies.
Technologies to be promoted

At present there are nine Azeri cotton varieties released in the country including Azeri 195 newly released in 1999. The major feature of these varieties is that they are relatively early to fit the environment in Azerbaijan and release the land early enough for soil preparation for cereals. They vary in reaction to diseases, adaptation but all fall into medium-length fiber group, which does not obtain the highest market price. The fact that the private cotton groups try to bring and test foreign varieties indicates that the processing industry is not fully satisfied with the local varieties. Despite the fact that the new variety Azeri 195 has a number of positive traits, it might be worth comparing a local set of cultivars with varieties brought from outside to define the best genotypes meeting the requirements of the local industry as well as the export requirements.

There is dual approach for technologies promotion. On one hand the contract farmers will do what the contractor advises them and what inputs it provides. It is then up to the company agronomists/extension agents to ensure that the technology is followed. On the other hand the Cotton Growing Institute has certainly a number of good technology components to recommend to farmers. These may include lower-input technologies based on narrower row distance and higher seeding rates; irrigation of every other row to save water; good quality dressed seed; distribution of plant residues over the top of the soil; tillage practice; irrigation regime; etc. Additionally the Institute of Crop Protection offers a combination of agronomy practices, which substantially reduces the number of chemical applications to control pests. However, these technology components will remain unrequested and unused as long as the private cotton groups awarding the contracts remain uninterested in local research and its results.

Important project components/activities on cotton production

- Definition of the quality requirements and market research for the current and potential fiber consumers both inside and outside of the country.
- On-farm testing of the best varieties currently available in Azerbaijan including the imported germplasm combined with testing of the most important technology components to identify the appropriate production agronomy.
- Wide-scale demonstration/promotion of the best technologies for cotton growing.
- Applied research to develop the optimal crop protection system based on utilization of the variety of modern chemicals and agronomy measures.
- Applied research to optimize the cotton yields under salinity.
- Applied research to define optimal cropping system for small farmers specializing in cotton.

Integrated options for cotton production projects

The key cooperation, which needs to be established to have the projects on cotton included in the CGS, is the one between the research establishments and the processing industry in the country even if the latter is privatized and export oriented. This may require an intervention from the MOA or other authorities. As long as the institutes are concerned – the Cotton Growing Institute, the Crop Protection Institute, Azeri Agricultural Academy, the ARIF (looking at cotton-wheat interface) can establish the partnership for project/s on cotton production.
2002 status. The area under cotton is slightly decreasing and the yield is increasing. The monopoly of the cotton processing factories remained and becomes worth: the production is based on future deals with provision of inputs at higher prices and buying cotton at low cost. Some poorly adapted late varieties from Turkey and US are introduced. The situation remains the same: if the monopolies/industry do not find common footing with the local research institutions, very little can be changed.

Tobacco

Production status
In the past (mid 80s) tobacco occupied up to 17,000 ha providing an average yield of 4 t/ha. In 1999 tobacco covered 4500 ha and the average yield was 2 t/ha. The main area of tobacco cultivation is in the Sheki-Zakatala region close to the Georgian border. Around 50,000 people work on tobacco. There is a big tobacco factory in Baku, which annually needs 10,000 t. The factory buys only from two counties, Gobely and Gakh. They fulfill only part of its needs; the rest is imported. The factory contracts around 2500 ha annually and provides credits for inputs and seed bought from local research stations. There are eight tobacco-fermenting plants in the region. In the recent past there were several small tobacco factories in the region producing cheap cigarettes. They were closed for not meeting the quality requirements and due to competition from the big factory in Baku. Tobacco not sold in Azerbaijan is exported mainly to Russia. The share of tobacco planted in smallholdings is up to 80-85% with the rest planted to maize (grain), wheat, barley. As with other crops, the lack of inputs and poor seed severely reduce production.

The major diseases are perenospores, powdery mildew and bacterial diseases; insect pests are aphids, thrips and corn ball worm. Disintegration of the big farms resulted in smallholdings and many farmers with a lack of knowledge of agronomy and on-farm processing. For instance the farmers harvest leaves at once instead of 4-5 times to improve the quality. Drying is a big problem; quality is diminished if the leaves are exposed to rain. Small dryers would be necessary but not available at present.

Institutional arrangements for tobacco research
The ARIF is responsible for tobacco research and has a respective department with 8 people including 5 scientists (1 PhD). There is also staff assigned to tobacco research on the stations: Zakatala station – 5 people including 2 scientists (1 PhD); Sheki station –2 scientists (1 PhD) and 2 technicians. The program works in three directions: breeding, seed production and agronomy. Breeding started 40 years ago and the varieties released occupy 70% of the area. Breeding is conducted at Zakatala station based on crosses (550 a year). Agronomy research is conducted at Sheki station and covers broad areas: nutrient mixture in green houses, herbicides, planting rates and dates in green houses, crop rotations, fertilizers, herbicides, chemical and manual tipping, the number and timing of harvest. Crop protection is addressed through one person in ARIF responsible for tobacco as well more broadly by the Crop Protection Institute. Quality evaluation is done in Baku. Seed production is concentrated in Sheki station. Some agrochemistry research is conducted at the Institute of Soil in Baku; despite this, very little if any tobacco technology is developed outside of ARIF.
Technologies to be promoted
Both local, Turkish (Trapezond, Samsun) and Virginia type tobacco varieties are released in Azerbaijan. In general all measures that could improve the quality of the type of tobacco demanded by the market are worth considering. The new variety being promoted is a combination of two varieties, Samsun and Dubek. It is marketed well but has lower yield. At present it occupies less then 10% of the area. For the Zakatala region broad-leaf varieties may be justified based on their higher yield. Virginia varieties are also requested but need artificial drying. Lower seeding rates can be promoted to improve quality but need better seedbed preparation. Manufacturing of small artificial dryers will have big impact on the tobacco quality and can be investigated and promoted. Education of farmers for proper harvesting and drying is very important. The consequences of very high share of tobacco in crop rotation may be looked at to develop the recommendations for the small holdings which would take into account the cash flow from tobacco, household needs and soil fertility. Diseases and pests are important for tobacco cultivation and the optimal ingredients should be promoted with the farmers.

Important project components/activities on tobacco production
- Marketing analysis and development of the requirements for tobacco quality for local processing industry and export;
- On-farm demonstrations and promotion of the basic agronomy measures to obtain stable yield of the quality required by the industry.
- On-farm demonstration and promotion of modern crop protection measures.
- Identification/development and promotion of low cost economic dryers suitable for small farmers.
- Adaptive research to optimize the cropping system for small holdings specializing in tobacco.

Integrated options for tobacco production projects
Tobacco research group in the country is relatively small and well integrated. However, as in the case of cotton there is no strategic alliance with the processing industry, which is a key to well-targeted research/extension program. Cooperation with farmers will be critical for on-farm activities.

2002 status. No substantial changes were observed.

Sugar Beet

The absence of sugar processing facilities in Azerbaijan limits production of this crop though the environment is suitable and with inputs it can provide high yield. Most of the area planted to this crop is situated in Nakhichevan Autonomous Region (2500 ha). The harvest is taken to neighboring Iran for processing and the sugar is brought back to Azerbaijan. Annually more than 40,000 tons of granulated sugar is imported to the country. The list of released varieties for 2001 does not include sugar beet at all probably due to the fact this is a minor crop. Probably, the sugar beet growers in Nakhichevan region use Iranian varieties and technology components either from Iran or developed locally at Nakhichevan Center of Agricultural Research. This crop can be included in the
CGS projects proven its high regional importance. However, no specific research may be needed except verification of the current practices and education of farmers on optimal technologies. On the other hand, if on the government level the decision will be made to provide self-sufficiency in sugar, the priority will change and a more elaborate program can be developed.

2002 status. Remains very important crop in Nakhichevan region. Processed in Turkey and Iran and the technology is, thus, affected by border exchange.

Oil Crops

In 1999 the import of vegetable oil was almost 18,000 tons. At the same time there are no oil crops grown in Azerbaijan except maize, which is not specifically grown for oil. The efforts were made to study the sunflower and soybeans and even several varieties are released in the country. However, there is no commercial production of oil crops. This again as with sugar beet will depend on the priority of the government and there is potential in the country to grow oil crops to meet the national demand.

2002 status. Slightly increased interest to sunflower.

Issues To Be Addressed across the Commodities

There are several issues that need to be addressed across the commodities and will require a high degree of cooperation and coordination between projects.

On-farm activities

With a few exceptions (notably private sector) the research programs work primarily on-station with a few activities directly on farms in the target domain. The projects in the framework of CGS are expected to conduct a number of activities on farms. These activities need to be coordinated in order to utilize the same farms so that eventually the results on different commodities can be compared as well as their interaction can be identified. This will also result in less expenditure on common field work, travel, etc.

Salinity

The problem of saline soils is common for all crops cultivated under irrigated conditions. The task of improving the production under salinity or improving the fertility of such soils justifies special attention. With the current structure there is no separate project addressing the issue. However, it also cannot be solved in any of the commodity projects unless special assignment is done. Possibly the project dealing with cotton can be asked to prepare a sub-project on salinity involving other institutions as necessary. Alternatively, the Institute of Soil Sciences, ARIF, Azeri Agricultural Academy and others can be asked by the CGS Secretariat to prepare a separate project on salinity.

Crop protection

There are several important issues on crop protection in Azerbaijan, which justify separation of this subject into a project by its own. This is primarily related to the
procedure of importation, testing, certification and utilization of chemicals. The agronomic aspects of crop protection system and its place in the overall cropping system can be addressed through the eco-regional aspects of the commodity projects. Project on cereals under rainfed conditions can look at protection measures for associated crops (grain legumes). Project on cotton can take the whole issues of crop protection under irrigated conditions including cereals. Projects on potato and tobacco can look at mountain cropping system and crop protection across crops. In this case an active role of CGS Secretariat will be required to assign these tasks to certain research groups.

Crop rotation
The issue of crop rotation for the new small holders is of crucial importance. The rotations recommended in the past were based on understanding of the crop biology, soil properties and production needs. Many of them are no longer valid because the farmer having a small piece of land may not be able to have sensible rotation. He will also grow the crops, which would provide him either the highest economic benefit or maximum subsistence capacity for the household including animals. Here the same approach as with crop protection can be applied. Commodity projects will be taking the lead for separate environments and the associated production constraints.

Training
Training will be a key element of preparation for project submission and implementation. The table below summarizes the immediate training needed during the first year of CGS as far as field crops is concerned.

<table>
<thead>
<tr>
<th>Target group</th>
<th>Number of people</th>
<th>Type of training</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>CGS Secretariat</td>
<td>6</td>
<td>Course</td>
<td>English writing, reading and speaking</td>
</tr>
<tr>
<td>CGS Secretariat &amp; Board</td>
<td>4-6</td>
<td>Study tour</td>
<td>Visit the countries/programs with developed CGS</td>
</tr>
<tr>
<td>Researchers</td>
<td>100</td>
<td>Seminar</td>
<td>Project preparation and budgeting</td>
</tr>
<tr>
<td>Researchers</td>
<td>100</td>
<td>Seminar</td>
<td>Advances in field crop research</td>
</tr>
<tr>
<td>Researchers &amp; Farmers</td>
<td>200</td>
<td>Seminar</td>
<td>Conducting the on-farm research/demonstrations</td>
</tr>
<tr>
<td>Project leaders, key researchers</td>
<td>10</td>
<td>Seminar</td>
<td>Research management</td>
</tr>
<tr>
<td>Project leaders, key researchers</td>
<td>10</td>
<td>Study tour</td>
<td>Implementation of research projects</td>
</tr>
</tbody>
</table>
Overall Conclusions: Field Crops

The current public system of agricultural research for field crops in Azerbaijan is the most important structure involved in developing technologies and can actively participate in the CGS. There are also emerging private extension agencies which in some areas that could well compete with the public sector. There are no NGO's of size that could be involved in the framework of CGS. The basic technologies are available for all the important crops. However, they were targeted for big farms oriented towards high input use and may not be applicable at present. Several new tendencies in agronomy (water-saving irrigation methods, minimum or zero tillage, triticale for forage, etc.) are also not reflected in the technologies available at present. This well justifies adaptive research in the framework of CGS which can take longer than two years. The concept of on-farm experimentation and demonstration was not common in Azerbaijan and will need aggressive promotion in CGS.

The processing of high-value crops (cotton, tobacco) is controlled by a few private groups, which ignore the technologies and expertise in the country and introduce foreign varieties and growing techniques. Unless a dialog and understanding is established between the processing industry and public research, very little can be done to improve production through CGS. Successful CGS projects will need to have some part of the budget allocated to machinery and equipment because the present situation is very poor. Though the CGS rule does not allow allocation of the funds for salaries, it is highly desirable for Azerbaijan, where salaries are symbolic and poor motivation for researchers to take part in the projects. This issue should be raised by the CGS Secretariat with the World Bank. Taking into account that for some projects/commodities there is only one research group operating in the country, the competition for projects cannot be formal. It may need a thorough work with the research group/institution to develop good projects. Similarly, even when there is competition for the projects, the groups should be guided during the project preparation and fine-tuning stages due to the fact that there is limited experience in this area.

Table 5.1. Export-import (tons) of major commodities in Azerbaijan in 1999.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Export</th>
<th>Import</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tea</td>
<td>2468</td>
<td>3168</td>
</tr>
<tr>
<td>Sugar beet</td>
<td>36080</td>
<td>0</td>
</tr>
<tr>
<td>Sugar</td>
<td>0</td>
<td>40493</td>
</tr>
<tr>
<td>Tobacco</td>
<td>19089</td>
<td>0</td>
</tr>
<tr>
<td>Cotton</td>
<td>27437</td>
<td>0</td>
</tr>
<tr>
<td>Potato</td>
<td>0</td>
<td>30927</td>
</tr>
<tr>
<td>Rice</td>
<td>0</td>
<td>20495</td>
</tr>
<tr>
<td>Wheat</td>
<td>0</td>
<td>523113</td>
</tr>
<tr>
<td>Wheat flour</td>
<td>0</td>
<td>117665</td>
</tr>
<tr>
<td>Pasta products</td>
<td>0</td>
<td>13856</td>
</tr>
<tr>
<td>Vegetable oil</td>
<td>0</td>
<td>17855</td>
</tr>
</tbody>
</table>

Table 5.2. Description of research institutes and their stations working on field crops.

<table>
<thead>
<tr>
<th>Station</th>
<th>Region served</th>
<th>Environment</th>
<th>Arable land, ha</th>
<th>Number of employees</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Azeri Research Institute of Farming</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absheron (HQ)</td>
<td>Nationwide</td>
<td>Warm winter irrigated</td>
<td>66</td>
<td>298</td>
<td>Wheat and barley breeding, multiplication, pathology, quality, physiology, information support, grain legumes breeding, general agronomy</td>
</tr>
<tr>
<td>Tarter</td>
<td>Mil-Karabakh, Mugan-Salyan</td>
<td>Warm winter, irrigated wheat</td>
<td>532</td>
<td></td>
<td>Wheat, barley and triticale breeding, multiplication, irrigated agronomy</td>
</tr>
<tr>
<td>Zakatala</td>
<td>Sheki-Zakatala</td>
<td>Warm winter, high rainfall wheat</td>
<td>133</td>
<td></td>
<td>Wheat, maize and tobacco breeding, maize and tobacco agronomy and seed multiplication</td>
</tr>
<tr>
<td>Sheki</td>
<td>Sheki-Zakatala</td>
<td>Warm winter, high rainfall wheat</td>
<td>103</td>
<td></td>
<td>Wheat, maize and tobacco breeding, maize and tobacco agronomy and seed multiplication</td>
</tr>
<tr>
<td>Jelalabad</td>
<td>Mugan-Salyan</td>
<td>Warm winter, semiarid</td>
<td>160</td>
<td></td>
<td>Wheat, barley and grain legume breeding, rainfed agronomy</td>
</tr>
<tr>
<td>Gobustan</td>
<td>Gobustan, Shirvan</td>
<td>Cold winter, semiarid</td>
<td>240</td>
<td></td>
<td>Wheat, rye, barley and grain legume breeding, rainfed agronomy</td>
</tr>
<tr>
<td><strong>Azeri Institute of Potato and Vegetables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absheron (HQ)</td>
<td>Nationwide</td>
<td>Warm winter irrigated</td>
<td>80</td>
<td>216</td>
<td>Potato breeding and seed multiplication</td>
</tr>
<tr>
<td>Lencoran</td>
<td>Lencoran</td>
<td>Subtropical</td>
<td>76</td>
<td></td>
<td>Potato two cycles under irrigated conditions</td>
</tr>
<tr>
<td>Gusarchay</td>
<td>Guba-Hachmaz</td>
<td>Warm winter, high rainfall or irrigated</td>
<td>150</td>
<td></td>
<td>Potato breeding, multiplication, agronomy</td>
</tr>
<tr>
<td>Tovuz</td>
<td>Gyandja-Kazakh</td>
<td>Warm winter, irrigated or rainfed</td>
<td>45</td>
<td></td>
<td>Potato breeding, multiplication, agronomy</td>
</tr>
<tr>
<td><strong>Azeri Cotton Growing Institute</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gyandja (HQ)</td>
<td>Gyandja-Kazakh</td>
<td>Warm winter, irrigated</td>
<td>153</td>
<td>216</td>
<td>Cotton breeding, basic research, agronomy, crop protection</td>
</tr>
<tr>
<td>Salyan</td>
<td>Mugan-Salyan</td>
<td>Warm winter, irrigated</td>
<td>565</td>
<td></td>
<td>Cotton breeding, seed multiplication, agronomy</td>
</tr>
<tr>
<td>Shirvan</td>
<td>Shirvan</td>
<td>Warm winter, irrigated</td>
<td>65</td>
<td></td>
<td>Cotton breeding, seed multiplication, agronomy</td>
</tr>
<tr>
<td>Beylagan</td>
<td>Mil-Karabakh</td>
<td>Warm winter, irrigated</td>
<td>640</td>
<td></td>
<td>Cotton breeding, seed multiplication, agronomy</td>
</tr>
</tbody>
</table>
Table 5.3. Area (ha) under the field crops in different eco-regions of Azerbaijan in 1999 (data from MOA).

<table>
<thead>
<tr>
<th>Crop</th>
<th>Absheron</th>
<th>Shirvan</th>
<th>Guba-Khachmaz</th>
<th>Lenkoran</th>
<th>Mugan-Salyan</th>
<th>Sheki-Zakataly</th>
<th>Gyandja-Kazakh</th>
<th>Karabakh-Mil</th>
<th>Nakhichevan</th>
<th>Mountain Karabakh</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>232</td>
<td>85838</td>
<td>22041</td>
<td>36291</td>
<td>112932</td>
<td>47757</td>
<td>22553</td>
<td>83305</td>
<td>10487</td>
<td>1784</td>
<td>423220</td>
</tr>
<tr>
<td>Barley</td>
<td>196</td>
<td>17422</td>
<td>4451</td>
<td>1400</td>
<td>10569</td>
<td>9085</td>
<td>4404</td>
<td>4321</td>
<td>4247</td>
<td>401</td>
<td>56496</td>
</tr>
<tr>
<td>Triticale*</td>
<td>-</td>
<td>4000</td>
<td>350</td>
<td>-</td>
<td>4200</td>
<td>630</td>
<td>600</td>
<td>2220</td>
<td>-</td>
<td>-</td>
<td>12000</td>
</tr>
<tr>
<td>Rice</td>
<td>-</td>
<td>1417</td>
<td>-</td>
<td>1969</td>
<td>-</td>
<td>117</td>
<td>-</td>
<td>126</td>
<td>-</td>
<td>-</td>
<td>36294</td>
</tr>
<tr>
<td>Maize</td>
<td>-</td>
<td>2167</td>
<td>1883</td>
<td>316</td>
<td>799</td>
<td>10534</td>
<td>11302</td>
<td>1295</td>
<td>201</td>
<td>7</td>
<td>28504</td>
</tr>
<tr>
<td>Oats</td>
<td>4</td>
<td>138</td>
<td>-</td>
<td>-</td>
<td>9</td>
<td>-</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>171</td>
</tr>
<tr>
<td>Potato</td>
<td>114</td>
<td>1974</td>
<td>3803</td>
<td>3152</td>
<td>3402</td>
<td>2056</td>
<td>20939</td>
<td>1222</td>
<td>1224</td>
<td>111</td>
<td>38000</td>
</tr>
<tr>
<td>Chickpea</td>
<td>-</td>
<td>152</td>
<td>33</td>
<td>558</td>
<td>1107</td>
<td>46</td>
<td>-</td>
<td>9</td>
<td>447</td>
<td>-</td>
<td>2352</td>
</tr>
<tr>
<td>Lentil</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>268</td>
<td>617</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>887</td>
</tr>
<tr>
<td>Tobacco</td>
<td>-</td>
<td>-</td>
<td>9</td>
<td>290</td>
<td>-</td>
<td>4036</td>
<td>25</td>
<td>9</td>
<td>97</td>
<td>-</td>
<td>4466</td>
</tr>
<tr>
<td>Groundnut</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Soybean</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cotton</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>25028</td>
<td>-</td>
<td>3646</td>
<td>37557</td>
<td>-</td>
<td>-</td>
<td>94382</td>
</tr>
<tr>
<td>Sugar beet</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>180</td>
<td>2196</td>
<td>4</td>
<td>2394</td>
<td>-</td>
</tr>
<tr>
<td>Vegetables</td>
<td>370</td>
<td>-</td>
<td>7345</td>
<td>6312</td>
<td>3423</td>
<td>3948</td>
<td>7462</td>
<td>6601</td>
<td>3018</td>
<td>12</td>
<td>46312</td>
</tr>
<tr>
<td>Total</td>
<td>917</td>
<td>145092</td>
<td>39917</td>
<td>50557</td>
<td>166077</td>
<td>78218</td>
<td>70933</td>
<td>13635</td>
<td>21917</td>
<td>2319</td>
<td>712814</td>
</tr>
<tr>
<td>% of irrigated land</td>
<td>10.1</td>
<td>35.6</td>
<td>30.5</td>
<td>10.6</td>
<td>49.8</td>
<td>23.2</td>
<td>25.3</td>
<td>46.8</td>
<td>22.8</td>
<td>11.3</td>
<td>31.5</td>
</tr>
</tbody>
</table>

* - estimate
Table 5.4. Estimated number of people working on different commodities and subjects in the public system of Azerbaijan (data from MOA and observations).

<table>
<thead>
<tr>
<th>Crop/subject</th>
<th>Research/Technology development</th>
<th>Technology testing/approval</th>
<th>Extension</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Varieties Agronomy Seed Crop Protection</td>
<td>Varieties Agronomy Seed Crop Protection</td>
<td>All</td>
</tr>
<tr>
<td>Wheat</td>
<td>20 10 8 8</td>
<td>State Variety Testing Commission with 17 testing sites nationwide, 450 ha of land and 66 people</td>
<td>No formal system exists and verification done by researchers</td>
</tr>
<tr>
<td>Barley</td>
<td>2 1 1 1</td>
<td>Seed testing Inspectorate with a laboratory and staff in every county (2-3 people)</td>
<td>No formal extension exists at present</td>
</tr>
<tr>
<td>Triticale</td>
<td>2 1 1 1</td>
<td>Seed testing Inspectorate with a laboratory and staff in every county (2-3 people)</td>
<td>No formal extension exists at present</td>
</tr>
<tr>
<td>Rice</td>
<td>1 3 1 1</td>
<td>Seed testing Inspectorate with a laboratory and staff in every county (2-3 people)</td>
<td>No formal extension exists at present</td>
</tr>
<tr>
<td>Maize</td>
<td>4 3 1 1</td>
<td>Seed testing Inspectorate with a laboratory and staff in every county (2-3 people)</td>
<td>No formal extension exists at present</td>
</tr>
<tr>
<td>Oats</td>
<td>0 0 0 0</td>
<td>Seed testing Inspectorate with a laboratory and staff in every county (2-3 people)</td>
<td>No formal extension exists at present</td>
</tr>
<tr>
<td>Potato</td>
<td>4 2 3 1</td>
<td>Seed testing Inspectorate with a laboratory and staff in every county (2-3 people)</td>
<td>No formal extension exists at present</td>
</tr>
<tr>
<td>Chickpea</td>
<td>5 1 3 1</td>
<td>Seed testing Inspectorate with a laboratory and staff in every county (2-3 people)</td>
<td>No formal extension exists at present</td>
</tr>
<tr>
<td>Lentil</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tobacco</td>
<td>3 2 2 1</td>
<td>Seed testing Inspectorate with a laboratory and staff in every county (2-3 people)</td>
<td>No formal extension exists at present</td>
</tr>
<tr>
<td>Groundnut</td>
<td>2 1 1 1</td>
<td>Seed testing Inspectorate with a laboratory and staff in every county (2-3 people)</td>
<td>No formal extension exists at present</td>
</tr>
<tr>
<td>Soybean</td>
<td>2 1 1 1</td>
<td>Seed testing Inspectorate with a laboratory and staff in every county (2-3 people)</td>
<td>No formal extension exists at present</td>
</tr>
<tr>
<td>Cotton</td>
<td>15 7 7 6</td>
<td>Seed testing Inspectorate with a laboratory and staff in every county (2-3 people)</td>
<td>No formal extension exists at present</td>
</tr>
<tr>
<td>Sugar beet</td>
<td>3 4 2 1</td>
<td>Seed testing Inspectorate with a laboratory and staff in every county (2-3 people)</td>
<td>No formal extension exists at present</td>
</tr>
</tbody>
</table>
Table 5.5. Area and yield of the main field crops in 2001.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Area, ha</th>
<th>Yield, t/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals and legumes</td>
<td>760748</td>
<td>2.65</td>
</tr>
<tr>
<td>Grain</td>
<td>711817</td>
<td>2.6</td>
</tr>
<tr>
<td>Winter wheat</td>
<td>570769</td>
<td>2.68</td>
</tr>
<tr>
<td>Winter rye</td>
<td>2</td>
<td>0.75</td>
</tr>
<tr>
<td>Winter barley</td>
<td>141046</td>
<td>2.28</td>
</tr>
<tr>
<td>Winter and spring wheat</td>
<td>571554</td>
<td>2.68</td>
</tr>
<tr>
<td>Winter and spring rye</td>
<td>2</td>
<td>0.75</td>
</tr>
<tr>
<td>Winter and spring barley</td>
<td>146484</td>
<td>2.31</td>
</tr>
<tr>
<td>Total spring cereals</td>
<td>41142</td>
<td>3.73</td>
</tr>
<tr>
<td>Total spring legumes</td>
<td>7789</td>
<td>18.3</td>
</tr>
<tr>
<td>Spring wheat</td>
<td>785</td>
<td>2.8</td>
</tr>
<tr>
<td>Spring barley</td>
<td>5438</td>
<td>2.91</td>
</tr>
<tr>
<td>Oats</td>
<td>142</td>
<td>7.3</td>
</tr>
<tr>
<td>Emmer</td>
<td>130</td>
<td>2.11</td>
</tr>
<tr>
<td>Maize for grain</td>
<td>30860</td>
<td>3.78</td>
</tr>
<tr>
<td>Rice</td>
<td>3787</td>
<td>4.87</td>
</tr>
<tr>
<td>Chickpea</td>
<td>3109</td>
<td>1.98</td>
</tr>
<tr>
<td>Beans</td>
<td>3269</td>
<td>1.8</td>
</tr>
<tr>
<td>Lentil</td>
<td>925</td>
<td>1.39</td>
</tr>
<tr>
<td>Forage legumes</td>
<td>165</td>
<td>2</td>
</tr>
<tr>
<td>Other legumes (vetch, mash)</td>
<td>321</td>
<td>1.86</td>
</tr>
<tr>
<td>Cotton</td>
<td>83355</td>
<td>1</td>
</tr>
<tr>
<td>Sugar beet</td>
<td>1941</td>
<td>28</td>
</tr>
<tr>
<td>Tobacco</td>
<td>6288</td>
<td>2.03</td>
</tr>
<tr>
<td>Grain sunflower</td>
<td>5371</td>
<td>0.97</td>
</tr>
<tr>
<td>Soybean</td>
<td>261</td>
<td>1.22</td>
</tr>
<tr>
<td>Winter rape</td>
<td>12</td>
<td>0.04</td>
</tr>
<tr>
<td>Potato</td>
<td>55193</td>
<td>10.42</td>
</tr>
<tr>
<td>Forage crops</td>
<td>15136</td>
<td></td>
</tr>
<tr>
<td>Maize for silage</td>
<td>823</td>
<td>7.81</td>
</tr>
</tbody>
</table>

Source: Azeri Statistics Committee.

FRUITS AND VEGETABLES

This section is based on the four visits to Azerbaijan by the horticulture consultant, Dr. Charles Boyer. During these visits the consultant was involved in a variety of activities including analysis of the horticulture sector in Azerbaijan and constraints influencing the production and economic sustainability of horticultural crops. In addition, the capacities of research institutions were evaluated. These analyses were complemented by a series of priority setting activities. Based on the established priorities, the consultant reviewed, evaluated and provided suggestion for improvement of proposals submitted to the CGS in response to the first request for proposals. Finally, the consultant reviewed the implementation of projects approved in the first round of grants. This section of the report is organized by crop and includes parts of previous reports addressing the status of production, constraint analysis, analysis of institution capacity and evaluation of project
implementation. In addition, an evaluation of the implementation of other CGS projects is included here. A concluding section is included that provides broad general observations for the CGS Secretariat to consider in the future.

Tree Fruits and Nuts

Status of production
In 1990 tree fruits and nuts were grown on 136,000 hectares, accounting for 7.6% of the area sown to crops (1). By 1999, the proportion of the area sown to fruits and nuts had increased to 8.8%. However, due to the nearly 50% reduction in total cropping area during this period, the real production area for these crops decreased by approximately 39% or 53,500 ha. Over half (59%) of the production is located in the Guba-Khachmaz and Shaki-Zagatala regions. The data available for fruit and nut crops suggest substantial increases in total production (36%) and yield per acre (107%) in the same period (1). These data seem unlikely due to the agricultural reforms that were taking place and the losses of significant production inputs after the reform. It is more likely that the differences for 1990 and 1999 reflect differences in data collection and reporting of these crops in the two years.

In 1999, fruit production exceeded national demand by 14%. However, the quality of much of the crop is inferior to that of imported fruit. Fruit quality is significantly impacted by poor control of insects, such as codling moth, aphids, spider mites, whitefly and pear stem borer, and fungal diseases that infect fruits. Therefore, Azeri farmers are not benefiting from the high value end of the market. As little opportunity exists for exporting fresh fruit and processing capabilities have been lost, it is unlikely that significant income will be generated from the lower quality portion of fruit crops (excess production). A quick analysis of limiting factors influencing the quality of the crop provides the same general list of constraints as for other crops, including lack of inputs (fertilizer, water, and chemical pest control measures), poor crop management, lack of post-harvest handling and storage facilities, and poor understanding of the market. These factors are discussed further in the following section on constraint analysis.

Constraint analysis. A group of stakeholders identified a total of 17 different technologies and solutions with potential to enhance productivity and profitability of tree fruits and nuts. This exercise resulted in the identification of five areas for project development as listed below. In addition, broad needs for technology delivery were identified.

- Pruning for optimal fruit yield and quality
- Efficient irrigation technology and water utilization
- Integrated strategies to control insects, weeds and diseases
- Propagation/grafting of high yielding adapted varieties (national coordination/certification)
- Mineral fertilization

Technology delivery. Projects should address the need to develop bulletins and fact sheets for the farmer on existing and improved varieties, production technology and pest
control. In addition a strategy should be presented for field days and on-farm research to demonstrate and promote modern technology. This could include private vendor/fee based information services on nutrition, pruning, irrigation and pest management. Finally, an economic analysis of the national market is needed to identify high value niche markets, and the private sector needs to be involved in exploring and evaluating export markets.

**Institutional capacity.** Research for horticultural crops is primarily conducted by the Research Institute for Horticulture and Subtropical Crops. This is one of the oldest R.I.s in Azerbaijan and was established in 1926 by Academician N. I. Vavilov. It was moved to its present location in Guba from Absheron in 1963. The institute supports five additional experimental stations. At Guba, the institute primarily addresses pome fruit research. The other stations and their primary responsibilities are: Absheron – almond, pistachio and olive; Lankaran – citrus, lemon, mandarin and tea; Shaki-Zagatala – hazelnut, walnut and chestnut; Gabala – nuts and pome fruits; and Goychay – pome fruit, pomegranate, kinglet, fig and pistachio. The institute has 195 staff with 53 scientists of whom 25 have Ph.D. degrees. As with most R.I.s, a strong emphasis is placed on breeding and approximately 25% of their scientists are breeders for the various crops. The institute also serves as the repository for the national fruit and nut germplasm collection with a particular emphasis on preserving indigenous varieties. The institute is organized into eight departments including breeding, mechanization, plant nutrition, physiology and plant protection. Research under the Competitive Grant System could include researchers from the R.I.s for Plant Protection, Erosion and Irrigation, and Agricultural Economy and its Organization. Project cooperators also could be found at the Agricultural Academy of Azerbaijan, the Institute of Botany, the Institute of Genetics and Selection and the Institute of Agrochemistry and Soil Sciences.

Private sector partners are more difficult to identify. Some Azeri possibilities include the new nurseries that have developed and are providing seedlings and grafted seedlings to the farmer. Efforts should be made to identify the best nurseries, solicit their participation and provide training if necessary. Representatives from the recently rebuilt processing factory in Guba should be contacted as well. While the processing factories may not be interested in directly participating in the project, they may be willing to serve in a collaborator/advisor role.

**Grapes**

*Status of production.* Historically, grapes have been a significant component of Azerbaijan agriculture. In 1885, wine-grapes and wine accounted for approximately one-half of the annual farm income. German settlers who introduced technology and equipment significantly influenced the development of the wine industry and improved wine quality. Until 1991, grapes were one of the three most important agricultural crops in the country. Currently about 55% of the crop is grown in two regions, Gazakh-Ganja and Guba-Khachmaz. After independence in 1991, the government made the decision to reduce the production of wine in Azerbaijan. Many vineyards were removed and the area producing grapes was reduced from 181.4 thousand hectares in 1990 to 20.5 in 1999 (89%). In the same period, average productivity of vineyards has fallen by 54% from
70.6 to 33.5 t/ha. Similarly, total productivity fell by 90%. As a result, a once vigorous industry has been reduced to the point where production no longer meets the domestic demand. A subsequent result is that grape-processing facilities are working under capacity due to low production. This low capacity jeopardizes this value-added part of the industry.

For the remaining vineyards, lack of productivity is seriously influenced by under-utilization of fertilizer, water and chemical pest control measures. No mineral fertilizer is currently being used and organic fertilizer is used only when available from on farm animals. A major constraint to the re-establishment of vineyards is the high cost of initial investment (approximately $18,000 USD). At present no source of investment is available. Vineyard establishment also is hampered by the lack of equipment, and material required for building suitable trellis systems. However, limited quantities of grafted seedlings of Azeri developed varieties are available on different phyloxera resistant rootstocks through state seedling farms.

Constraint analysis. No formal constraint analysis was conducted for grapes. Limited discussions were held with a few scientists from the R.I. on Viticulture and Winemaking. Therefore, the conclusions are based on more limited information than for other crops. The major constraint for grape production is the re-establishment of vineyards lost after the government decision to remove vineyards in order to reduce alcohol production. Therefore, it was decided that the grape project should focus on the propagation and grafting of table grapes and the promotion of technologies to establish productive new vineyards.

Institutional capacity. Grape production is supported Azerbaijan by the Scientific Institute of Viticulture and Wine Making located near Baku. The institute supports both the wine-grape and table grape industries through 125 staff including 19 scientists with Ph.D. degrees. The eight laboratories are supported in the institute are breeding, biochemistry, agrochemistry, agrotechnology, processing information, plant protection and storage and drying. The breeding program is well developed and maintains a large germplasm collection. A core part of the collection includes locally developed varieties. These varieties have been selected based on disease resistance (particularly powdery mildew) and grape quality traits. Breeding efforts continue to develop promising new varieties. The champagne industry was originally based on Moldavia varieties, and these varieties have been used as parents in crosses to develop more locally adapted varieties.

The institute works with the State Seedling Farm to produce seedlings grafted on phyloxera resistant rootstocks. In 2001, 5000 grafted seedlings were being produced for sale. The institute maintains irrigated demonstration plots in Ganja and Shamakhi and a rain fed demonstration plot in Jalilabad. The demonstration plots are used to inform growers of new varieties and cultural techniques. The institute appears to be well positioned to support both the wine-grape and table grape industries. However, the financial limitations of vineyard establishment will need to be overcome. The institute currently has joint research with the Institute of Botany. Other potential participants are at the Agricultural Academy of Azerbaijan. Private sector participation should be sought.
from grape processors and wineries that are now working under capacity. They have an
equal stake in the success of CGS projects.

Tea

**Status of production.** Tea is a relatively minor crop in Azerbaijan. Production is limited
to two regions, Lankaran-Astara and Shaki-Zagatala. Of the nearly 6,000 ha in
production, 88% is in the Lankaran–Astara region. Tea is currently over-produced
worldwide. Therefore, attention to quality and ensuring a share of the domestic market is
critical. Currently five companies process the tea and the competition helps to maintain
the price. The Beta tea company (Turkish) currently pays part of its contracts in advance
which allows the utilization of the capital for the purchase of much need inputs.

**Institutional capacity.** Tea research is supported by the Lankaran experiment station
associated with the Research Institute for Horticultural and Subtropical Crops. Similar
potential partnerships exist with other state institutions as described for fruit and nut
crops. Processors should be approached as potential private sector partners.

**Constraint analysis.** As with grapes, no formal constraint analysis was conducted for tea.
Discussions were held with a few scientists during the first visit of the consultant as some
stakeholders for tea participated in constraint analysis workshop for tree fruits and nuts.
Therefore, the recommendations were based on more limited information. Many of the
constraints for tea production were similar to those described above for tree fruits and
nuts. It was decided that a tea project should focus on propagating improved tea clones,
the establishment of productive new plantations and the rehabilitation of old plantations.

Vegetable and melons

**Status of production.** Vegetable and melons are among the most widely grown crops in
Azerbaijan. Production of vegetables is distributed across most regions of the country. In
contrast, 76% of the production of melons is in the Garabakh-Mil, Shirvan and Mugan­
Salyan regions. The varied ecological zones of Azerbaijan allow year round production
of vegetables. The abundance of sunlight and low requirement for energy for heat allows
for cost-effective greenhouse production of vegetables as well. Vegetables are currently
produced in approximately 2000 ha of greenhouses. Vegetables produced in greenhouses
for the early and late seasons command a higher price due to market demand. The current
total production of vegetables is nearly sufficient to meet national needs (95.8%). In fact
vegetable production increased by 6,000 ha from 1991 to 1999. Unfortunately, declining
productivity in the same period (31.5%) resulted in a decrease in total production of
21.7%.

The ability to produce vegetables year round and the diverse climates in Azerbaijan make
vegetables crops attractive for development for export markets. Before independence
Azerbaijan served as the major source of fresh vegetables for a large part of the Soviet
Union especially the northern cities. As an example, 1000 tons of vegetables were being
shipped annually to Moscow. Approximately 120 kolkhozes were dedicated to vegetable
production. These were supported by a well-developed infrastructure for handling,
packaging and shipping of this produce. The structure consisted of 27 purchasing centers,
12 refrigerated storage facilities and 20 packaging houses. Upon independence all of these were destroyed or dismantled and returned to Russia. The export of fresh vegetables in the future will depend upon the production of high quality produce that will meet the quality standards of the importing country. These standards are higher than the standards previous used for the Russian market. This also will require capital to develop the market strategy/relationships, and postharvest handling/packaging facilities. Private sector exporters are in the best position to conduct the analysis of markets and develop and implement business plans.

The recent history of the vegetable processing industry is similar to history of the fresh vegetable industry. At independence 47 canning factories were in operation. Most are no longer in operation. As with fresh produce, the standards being used processed vegetables for the Russian market are not sufficient to compete on the world market. Recently a canning factory has been built in Guba through financing provided from Germany. The factory will be able to produce 100 g to 200 kg packages. It also will have the capacity to produce fruit juices. A recent contract has been signed with an Italian firm to develop a small-scale tomato juice and puree factory in Masalda. Both of these enterprises will drive the demands for improving product quality.

The production of melons may serve as model for free market agriculture in Azerbaijan. Unlike most other crops, the production and productivity of melons have significantly increased after agricultural reform. In 1999, melons were produced on 22.4 thousand hectares, a 124% increase from the area in production in 1990. Production of melons grew from 1.3% to 4.0% of the total crop area in this time. The productivity of melons also increased from 1990 to 1999. In 1990, the average yield was 7.4 t/ha. For 1999 the yield was 9.2 tons, which represents 24% increase. The increased production and attention to productivity is a direct response to a market opportunity. Production has gone from satisfying 65% of the home market needs to exceeding these needs by 55%. This excess production of melons could be used as an important entry point for gaining access to export markets. Attention must be given to ensuring that the very best quality melons are used for this market.

Constraint analysis. While a group of stakeholders met to identify constraints, they were unable to move past the identification of problems and principle causes. The outline provided below was developed by the consultant to aid the CGS staff. Related factors for the analysis were grouped as feasible. Technology delivery and training were also identified as a priority.

**Problem 1.** Lack of high yielding varieties that are suitable for the range of growing regions, production systems (field and greenhouse), and adapted to biotic/abiotic stress. Correlated with this is the lack of a system to produce high quality seed of existing proven varieties.

**Problem 2.** Production technology
- Subproblem 1: Low plant populations
- Subproblem 2: Mineral nutrition
• Subproblem 3: Water management
• Subproblem 4: Weed Damage
• Subproblem 5: Diseases (fusarium, phytophthora, viruses, etc.)
• Subproblem 6: Insects (whitefly, Colorado potato beetle, cabbage maggot, cicada and rodents)
• Subproblem 7: Salinization (effects about 10–20% of the production area)
• Subproblem 8: Mechanization

**Problem 3.** Postharvest storage and processing

**Problem 4.** Marketing

Potential solutions to production constraints were further analyzed by a smaller group of scientists. Thirteen technologies related to integrated crop production were identified as having merit for being included as part of the project proposals. These could be grouped into the following six areas for project development.

• Optimum seeding time and densities
• Efficient irrigation technology and water utilization
• Variety demonstration plots
• Adequate fertility (mineral or organic fertilizers and green manure)
• Integrated strategies to control insects, weeds and diseases
• Crop rotation (long range)

**Technology delivery and training.** The constraint analysis workshop identified a number of areas where technology transfer to the private sector is appropriate. These can be achieved through workshops, bulletins of field days. The availability of seeds for locally adapted high quality vegetable varieties was identified as a critical problem. The private production of vegetable seeds should be supported through training workshops and consulting. Information/consulting services on cultivation and harvesting mechanization should be developed. Finally a national economic and market analysis for vegetable crops is needed. The results of this analysis need to be delivered to the farmer and buyer in a form that will allow the timing of production schedules to maximize profit.

**Institutional capacity.** The Research Institute for Vegetable Growing, which was founded in 1965, is charged with serving the research needs for Azerbaijan. The main location of the station is in Absheron. In addition, the institute has six experiment stations located through the country to serve the needs of vegetable production in diverse environments. The institute has 3 Professors and 30 scientists with Ph.D. degrees. The institute’s total staff consists of a 261 researchers and support staff. Even with the on-going reforms, a few postgraduate students continue to be trained by institute scientists, primarily in the field of plant breeding. The institute is organized into eight departments, namely breeding, physiology, potato, mechanization, seed production, greenhouse production, plant nutrition, and technology transfer. As with other institutes, the R.I. of Vegetable Growing has had a strong emphasis on breeding locally adapted varieties. Researchers at the institute have developed 26 varieties of important vegetable crops that have been approved through the state variety testing system. However, the current state run seed production farms do not have the capacity to produce high quality seed of these varieties and farmer knowledge of varieties is low. Other public institutions that could
participate in research under the Competitive Grant System are the same as for horticultural crops. These include researchers from the Agriculture Academy of Azerbaijan, the Institute of Botany, the Institute of Genetics and Selection, the Institute of Agrochemistry and Soil Sciences, and R.I.s for Plant Protection, Erosion and Irrigation, and Agricultural Economy and its Organization.

Private sector participants should include representatives from the new private seed vendors, which have been established after independence. As these businesses are directly dealing with the farmers in making recommendations on varieties and other management techniques, they are part of the farmer-researcher partnership. The quality and reputation of their businesses will be improved with better information on the adaptation of different varieties. Similarly, contact should be made with the managers of the process plant recently developed in Guba and representatives of the Italian firm establishing a tomato juice and puree canning factory in Masalda. Their personnel could serve as partners/advisors for the project. Finally, a Dutch company is beginning to invest in greenhouse production in Ganja. They are currently constructing 19 ha of greenhouses and may invest further. Their participation in CGS grants could speed the rate of their investment into the greenhouse vegetable industry in Azerbaijan. Scientists developing proposals should make contacts with these organizations.

In total the researcher dealing with vegetable crops (excluding potato) were the most difficult to focus. This was first observed during the constraint analysis workshop. During this workshop scientists were argumentative and resistant to considering possibilities. The problem was further demonstrated when the CGS Secretariat was unable to arrange cooperation to finalize a proposal in vegetable crops for the first round of grants. In June of 2002, the consultant visited the Research Institute for Vegetable Growing. Discussion focused on the inability of researchers to resolve the issues preventing the establishment of a vegetable project. It is the consultant's conclusion that the personalities involved in the first stage of proposals prevented a productive dialogue. While the Director of the Institute tried to mediate a solution, this was unsuccessful. The Director expressed a commitment of taking the lead in developing a proposal for the second stage of grants. For new proposals researchers should be brought together early in the process to ensure that a cooperative project can be developed.

An additional observation of the consultant was that the level of on-going research at the institute had increased greatly in a year. For example the institute was participating with the Tovus-Baltiya LTD Company to evaluate Dutch varieties of potato for potential production in the Absheron region. While multiple factors have probably influenced this activity, including differences in rainfall in the two years, the Competitive Grant System appears to be one of contribution factor to the higher level of activity. This synergy of activities is clearly and additional benefit of the CGS program.

**General Observations and Suggestions for the Future**

The following section summarizes factors/issues that should be considered by the CGS secretariat and project leaders when developing new proposals.
• The development of concept notes and new proposals remains problematic. Researchers need to develop their ability to critically analyze researchable problems. This needs to start with the target audience whom they are trying to serve. The first question should be what are the problems that need to be researched? Researchers must continue to develop relationships with a large representative group of farmers and frequently interact and discuss problems. They also must realize that needs will change over time and their only access to this information is through the farmer. Problem identification should be followed by evaluation of what can be done to address these needs. Can they do research to address the problem? What would the potential impact be for a project addressing the problem? When analyzing the feasibility of research, the researcher should consider issues of complexity, cost, the equipment/infrastructure required and a self-appraisal of their own capacity as a researcher. The scientist needs to strike a balance between the need to accomplish research while serving the demonstration needs of small farmers. Finally the scientist needs to be more aggressive in seeking interdisciplinary, private sector or NGO cooperation. The skills that are needed for a successful project should be identified and the researcher should seek collaboration where these skills available.

As concept notes or proposals are developed, the scientist needs to understand that they must provide clear documentation for every aspect of the project - the assumption that they are the expert is not acceptable nor sufficient. The burden of analysis and proof is the responsibility of the scientist. For example, projects lack any reference to previous studies. When questioned, scientist indicated that they have done the work. If this is true, then they should be able to provide background data or results. Modern science is built on previous science. Scientists need to come into the 21st century and continually seek new knowledge and results from other scientists. Achieving this requires a complete change in the thinking of Azerbaijani scientists. They need to overcome pride of the past and a resistance to respecting and seeking new information from other sources. To have any chance of success this will require additional training - scientists need to be able to access information in English (and other languages) and electronically. This training should be included as an important component of the second phase of the CGS program.

• The current agricultural research system in Azerbaijan is bound to the past. Research institutes were developed to serve large collective farms (kolkhozes and solkhozes). Experimental designs were big and designed to serve a very different agricultural system. Scientists at research institutes express little interest in changing, are slow to acknowledge the realities of the new agricultural system and are resistant to collaborative and interdisciplinary research involving scientists from other institutes. The problems facing the small farmer need an integrative approach. Economic analysis and market realities are largely overlooked and information from other scientists is ignored or unknown. Every project needs to more fully examine the potential economic impacts that could be derived from results. Similarly, plant protection should be integrated into every crop project. Scientists also should be encouraged to break out of their traditional roles. A well trained plant scientist should be able to conduct meaningful research on a number of different crops - Scientists
should be evaluating the changing needs within their region of work – If needed they should change the emphasis of their research whether this research or crop resides in the traditional responsibilities of their institute or not. The problems are too great and resources too limited for researchers to be bound by tradition (especially when the need no longer exists or can be justified). The world is changing at a rapid pace, Azerbaijani scientist need to be committed to keeping up with the change or become extinct.

- On-farm workshops/demonstrations can be improved to achieve greater effectiveness. Each workshop should have a well-defined set of objectives. These objectives should be based on the desired learning outcomes for the participating farmers. An agenda should be developed in advanced and each presenter should be given a topic and allotted time. Presenters from other institutes or disciplines should be invited to present information on important timely problems or technology that is important for the farmers. Information and results should be presented in a written form to farmers during the workshop. Single page handouts are effective. Information can be presented with a simple flip chart using graphs, tables or illustrations. If collaborative projects and relationships are developed – teams of scientists should naturally develop around problems or cropping systems. The team then becomes the planning and implementation committee for workshops. Workshops should be continually changed and designed to address current issues as well as long-range technology transfer. To insure quality, workshops should be evaluated and this information should be documented by the scientists and reported to the CGS Secretariat.

Demonstration plots can be improved to allow informal learning through better signage. Signage for all projects should be uniform – In addition to a sign describing the basic features of the project – signs should be developed that effectively identify treatments such that a visiting farmer can observe any differences between treatments within the experiment. The signage should be viewed with the perspective of a farmer visiting the field for the first time. Would this farmer be able to understand the purpose and field layout for the project and thus make an independent interpretation of differences among treatments?

- The selection of farmer cooperators needs to be improved. In the case of first stage proposals, the short time frame available for identifying farmers may have influenced the selection process. Similarly, scientists were limited by the numbers of farmers with whom they had relationships. As scientists develop meaningful relationships with their target audience and more farmers, then the selection should become easier. The selection should always keep in mind the need for the farmer to be representative and capable of participating in the research, the accessibility of the location to other farmers in the regions for workshops and seminars and the potential for the demonstration to be effectively implemented. Different farmers and farms will be ideal for different projects. Therefore, the farmer participants should be naturally changing over time. The selection of participating farmers is only the first step in collaboration. Certainly, the engagement of the farmer in implementation of the project is critical. However, in addition, the farmer should be viewed as a continued
source of information and evaluation during the project? The farmer should be asked what they have learned, are they going to use this knowledge in the future, if so how and are they sharing this information with neighboring farmers? The change in behavior of the farmer following the project should be monitored and documented.

A commitment to publish results of CGS projects should be developed beginning with first stage projects. The reports (including data and data analysis) should be published in a publicly available format. The CGS Secretariat needs to develop a library/archive system to manage all project reports and other publications coming from CGS support. An annual report with project summaries might be one format. This publication can be done at low cost using current desktop publishing software – hard copies could be printed only as needed. These publications should provide a basis for identifying and justifying new problems or research areas for subsequent CGS projects and should be cited where pertinent in future proposals with other important literature.

**NATURAL RESOURCES**

**Analysis of Present Situation**

There are many problems associated with the degradation of the natural resources dedicated to agriculture in Azerbaijan today. The main types of degradation observed and/or evident in the results of the various institutes are:

- Soil chemical degradation
- Soil physical degradation
- Soil erosion – both by wind and water
- Salinization

There are also several factors associated with the inefficient use of the resources dedicated to agriculture, which in themselves exacerbate or lead to resource degradation:

- Inefficient use of water for irrigation
- Inefficient use of farm machinery

**Soil Chemical Degradation**

Soil organic matter in the cultivated areas of Azerbaijan is declining, and in some areas that have been monitored, SOM levels have fallen by 50% in the last 20 years. This has a large effect on the cation exchange capacity (CEC) of the soils and the levels of available nutrients. Although recommendations for many of the field crops include the application of farm yard manure (FYM), it appears that there is not sufficient manure for all crops and that this is preferentially applied to high value crops such as vegetables.

Although nitrogen and phosphorus fertilizers are available in Azerbaijan, potassium fertilizer is not. This is leading to a progressive decline in soil exchangeable potassium levels, and in many cases this is evidently now at yield limiting levels.
Micronutrient deficiencies have been identified in Azerbaijan. Boron and manganese deficiencies have been frequently encountered in the irrigated plains, and zinc deficiency has been identified in the rainfed areas.

Although soil chemical degradation can cause serious reductions in crop yields, it is far easier to overcome than are soil physical degradation, soil erosion and salinization. Although soil chemical fertility is reduced by declines in soil organic matter, its effects can largely be overcome with fertilizer application. However, the extent of crop responses to potassium application should be evaluated, and, if necessary, arrangements for the importation of potassium fertilizer undertaken.

**Soil Physical Degradation**

Soil physical degradation is associated with both soil erosion and salinization, and all these are exacerbated by intensive tillage. Soil structure is largely dependent on soil organic matter, and the decline in soil organic matter, itself a result of excessive tillage, largely accounts for the soil structural degradation evident in Azerbaijan. One of the immediate effects of this degradation is on surface sealing, and this has become a major factor, especially in the irrigated areas. Surface sealing restricts water access and infiltration rates, leading to reductions in water use efficiency. Another aspect of soil physical degradation is soil compaction and the formation of plough layers. Although the extent of this problem could not be ascertained, it is highly likely that it is a problem, given the intensiveness of soil tillage. Compaction, combined with surface sealing, reduces water infiltration rates, increases the frequency and severity of waterlogging and reduces the leaching of salts.

Soil physical degradation cannot be overcome as easily and quickly as soil chemical degradation, but requires changes in the production system, markedly reducing and preferably doing away with soil tillage. Overcoming soil sealing and crusting necessitates leaving crop residues on the soil surface to protect it from rain and radiation, and the irrigation of crops by furrow irrigation, so that the raised beds on which the crop grows are not covered by water.

**Soil Erosion**

Soil erosion in Azerbaijan has been reported in both the rainfed and irrigated areas. Overcoming wind erosion requires the protection of the soil surface with crop residues, preferably standing crop residues, and therefore limiting the grazing of these residues. Water erosion on steep lands can be reduced by structures which effectively reduce the slope and slope length, but also by management practices that increase water infiltration, reduce erodibility by restricting soil tillage, and maintain crop residues on the soil surface. In irrigated areas, where slope is not of particular importance in defining water erosion, water infiltration rates must be improved to restrict water run-off, generally by increasing soil organic matter and protection of the soil surface with crop residues.
Salinization

Salinization is a grave problem in Azerbaijan: the Soil Science Institute estimates that there are 1.2 million hectares of saline soil in the country. The causes of this salinization are multiple: insufficient water for leaching, high salt content of the river Kurr, poor infiltration rates (resulting from soil physical degradation) leading to inefficient leaching, and poor maintenance of the drainage system. Many of these factors are outside the control of the agricultural sector, but those factors related to soil structural degradation need to be addressed. Once problems of water infiltration have been ameliorated, the build-up of salt in the soil will be reduced, and leaching (both with and without acid treatment) will be more effective.

Inefficient Use of Irrigation Water

Much of the inefficiency in water use comes from the earth-lined canals of the distribution system which result in a loss of 50% of the irrigation water, and also help to raise the water table. At the field level, irrigation efficiency has been reduced by land sub-division and shorter irrigation runs. However, it should be possible to overcome this problem by adjusting the water flow into the row or basin. During field visits it was very evident that many fields are poorly leveled, leading to reduced irrigation efficiency and waterlogging and low yields in depressions in the field. A program of land leveling would pay handsome dividends in terms of both water use efficiency and crop yield. It would also increase the efficiency of salt leaching exercises.

Inefficient Use of Machinery

Excessive tillage has been mentioned in the previous paragraphs as one of the main causes of soil physical degradation, soil erosion, reductions in soil organic matter and the associated problems of poor chemical fertility and salt accumulation. At present it is common for farmers to make 10 tillage passes per season. Tillage pulverizes the surface soil, compacts the soil under the implement and brings vegetative matter into contact with oxygen and moisture, leading to its rapid decomposition. Many Institutes in Azerbaijan have worked with reduced tillage systems and shown good results.

At the same time the state of agricultural machinery in Azerbaijan is declining. Practically all farm operations are done with old equipment used on State Farms prior to independence and the sub-division of the land. Therefore this equipment is old, aging further, inefficient and its size is unsuitable for the small farms, unless farmers combine their land-holdings for tillage, harvest and spraying practices. Recently the Mechanization Institute has imported 1000 small tractors from Russia. If these have the right implements, and if adequate implements are developed for these tractors in Azerbaijan, this avenue should be far more advantageous to farmers than the large rented equipment.
Natural Resources and the Competitive Grant System

At least in its initial stages the CGS was set up to foster the demonstration of developed technologies in short-term projects. Although technologies are available in Azerbaijan to overcome some of the natural resource issues, such as technologies for crop fertilization and salt leaching, little work has been done on minimum and zero tillage, permanent bed irrigation systems, residue retention and other similar technologies aimed at reducing or reversing soil physical degradation. As such there was little scope to include these issues and technologies in the projects for funding by the CGS.

Almost by definition, natural resource issues require longer time spans for development and adoption than foreseen in the CGS. Because they are generally complex technologies that involve changes in many components of the farming system, efforts to develop and extend them using a linear vision of knowledge development in agriculture are extremely unlikely to be successful. Although projects funded by the CGS have endeavored to increase researcher-farmer contact this is not sufficient: complex technologies need to be developed with the participation of multiple agents, including researchers, in networks focused on farmer experimentation.

In the second call for projects by the CGS, a project on bed-planting of wheat was presented and has been accepted for funding. This represents a welcome change in strategy of the CGS, as it involves the development of new technologies on the farm with farmer participation. Bed planting itself offers benefits in water saving and would appear to be an excellent intermediate technology for the farmers of Azerbaijan. However, in the future other technologies such as zero tillage, residue retention and controlled traffic of farm machinery will need to be incorporated to be able to reap the full benefits and revert the soil structural degradation, with all its associated negative effects, provoked by soil tillage.

On-Farm Research

During the first phase of the CGS a short course on on-farm research was conducted, with the participation of members of many of the projects funded by the Scheme. Given time constraints of the researchers, this course really only gave an overview of the reasons for on-farm research and basic considerations in the management of an on-farm program. In the future, more emphasis should be placed on these aspects as it involves a complete break from the reigning research philosophy in Azerbaijan – and in many other countries.

Suggestions for the Future

The first phase of the CGS was based on a linear vision of technology development whereby researchers develop technologies and then pass the information on to farmers, either directly or via extension agents. Over and above the limitations of this philosophy, most of the recommendations on technological components that were available had been

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1 In this model, researchers develop new knowledge or technological options; these are passed to extension agents, who then pass them on to farmers. There is very little contact between farmers and researchers and knowledge flow is unidirectional. This is the model on which the CGS is based.
developed under conditions that did not represent those of the majority of the farmers of Azerbaijan.

Whereas the linear model of technology development and dissemination may work for simple, single-component technologies where all the steps in making adoption feasible are well known (e.g., the dissemination of a new variety once seed multiplication, seed treatment facilities etc. are established), it is extremely unlikely to work for more complex technological changes. It is imperative that this change in the research paradigm be incorporated into the agricultural development system of Azerbaijan, and I would suggest that the CGS should be a major force in promoting this change.

The new paradigm that should be adopted in Azerbaijan is the development of networks of stakeholders, including researchers, extension agents, farmers and other agents whose composition will change with the particular type of technology. For instance, with respect to new varieties, other agents may be seed producers and seed marketing agencies, seed treatment facilities, grain marketing agencies, millers etc. For a new tillage system, apart from the research, extension and farmer components, the network might include machinery manufacturers and distributors, service providers, water distribution agencies etc. Whatever the technology, the important aspect of these networks is that they focus on farmer experimentation with the new technologies under conditions representative of large groups of farmers. Where possible, researchers and extension agents should be conduits, not just providers, of information to other members of the network, should help the farmers to conduct valid experiments that can be logically analyzed (not necessarily statistically analyzed) and extrapolated to the conditions of other farmers.

With respect to natural resource management, it is important to promote efforts and networks on conservation tillage and conservation agriculture, including zero tillage technology. This will require awareness building not only among farmers, but initially among researchers, extension agents and other agents vital to the success of these systems.

LIVESTOCK

Sector Analysis, Problem Analysis, and Priority Setting

Various groups of stakeholders, aided by CGS Secretariat staff members, conducted a constraints analysis for key livestock production themes (livestock production, veterinary services and feed production and feeding) on March 14-17 and March 28-29, 2001. Problems related to livestock productivity and their potential solutions were discussed in depth. The emerging issues were (1) information and technology needs of farmers to increase productivity of their ruminant livestock, especially cattle and sheep, and (2) the relationship (mutual understanding) between farmers and scientists is "poor".

The national institutional establishment, which was designed for the defunct state farm environment, is generally acknowledged to be poorly matched with the needs of today's emerging market-oriented farmers. Understandably so, the scientist community is out of
touch with on-farm realities and associated livestock production issues. Unfortunately, there has been little investment for many, many years to update the capabilities of scientists, professors, research staff or research facilities. The predictable outcome is outdated professional capacity and the current low potential for carrying out problem-solving research matched to the market-oriented goals of a privatized livestock (agricultural) sector.

The priority livestock species for the targeted smallholder farming systems are large ruminants (cattle, buffalo), small ruminants (sheep and goats), and household poultry. Small ruminant production, especially sheep, is an area of apparent comparative advantage. The current national population of 6 million head is predicted to grow to 10 million head. Dairy sheep may merit special attention, especially for market-niche production of specialty cheeses.

After producing family food, the objectives of Azeri farmers center on income earned from saleable surplus. Family income potentials from sales of animals and their products depends on technologies that increase yields of herds and flocks, that reduce production losses, or that lowers input and marketing costs. Improvements in feed supply, forage quality and dietary quality are primary elements of more productive (profitable) Azeri livestock enterprises.

Correspondingly, a detailed rapid appraisal of livestock nutrition (feeding practices) is needed to better understand baseline practices of farmers (e.g., input use and related decisions) and to evaluate their disposition and preferences in adopting or adapting performance-enhancing practices and technologies. This information would help to design research projects with practical application (and use potential) by farmers.

Marketing limitations (opportunities) is a key area affecting productivity and profitability of livestock and whole-farm decision making. Basic information needs in this area are under-appreciated but crucial to the market-oriented successes being sought. Therefore, evaluation needs include wholesale markets, consumer needs and satisfaction, potential buyers and processing opportunities for livestock products. A market study using rapid (participatory) appraisal methods would provide useful information to farmers and market entrepreneurs to make necessary adjustments and for research planning.

Current and Future Needs for Technical Assistance, Training, Equipment and Infrastructure

Participants at the November 2001 national workshop agreed that language training and technical training are high-priority prerequisites for building research capacity in all agricultural disciplines. Priority technical (training) needs in livestock production sciences were principles of animal nutrition, ruminant nutrition focusing on growth and lactation, and nutrition management.

Consequently, participants agreed to reallocate financial resources to acquire the necessary skills to enable achievement of CGS objectives. Recognizing the obvious
consequence of this decision—that fewer resources would be available for research projects per se—there was consensus to concentrate CGS research activities on nutritional and feed (quality) aspects of cattle and sheep production, the principal species generating household income. Once animal science capacity is strengthened by updating it through the training of a professional cadre in-touch with producers then applied research can be carried out to secure better support of Azerbaijan’s livestock sector. This process also involves substantial planned events for interactions between scientists and with farmers and other players in the livestock sector.

**Assistance Needed in Project Development and Implementation**

*Language and technical training.* There is crucial need for the CGS (and the Azeri scientific community) to acquire competent skills in English, the language of information. Meeting this prerequisite will permit "harvesting" of technical information and ideas from other parts of the world for applied research and implementation in Azeri agriculture. This could be accomplished by an integrated training and research strategy with the following components.

- In-country instruction in English (i.e., language of information) for researchers.
  - Expected output from trainees: trainees would write summaries (in English and in Azeri) of journal articles in their area of research interest.

- Establish two information centers to support research with access to the international scientific literature. In addition to the purchase of computer equipment (computers with CD-ROM, modems, printer), this includes (means)
  - purchase of telephone line access,
  - purchase access to an array of on-line journals (e.g., *ScienceDirect*), and
  - purchase of a technical agricultural library, such as *The Essential Electronic Agricultural Library (TEEAL)*, a CD-ROM library that helps obviate internet connection limitations.

- Train selected scientists abroad in centers of excellence where English is used, including universities and international agricultural research centers of the CGIAR.
  - During training assignments of 3-6 months, trainees are obliged to develop concept notes to be used in the subsequent development of research proposals. Trainees at universities could 1) take one or two key courses during a semester, 2) work in a research laboratory, and 3) work with an extensionist who also maintains a research program.
  - When appropriate, send pairs of individuals or small teams to a training location.

- Upon their return home, scientists would co-plan research projects with producers to assure clear, mutually understood objectives and practical application.

*Relevant research questions and objectives, and quality of proposals.* Additional assistance will be needed in helping scientists and farmers to identify relevant questions, applied research objectives, and data collection and analysis to evaluate productivity options for herds and flocks. Technical training and access to the scientific literature are
crucial inputs. These are the key bottlenecks to developing research proposals that effectively target problems that are relevant to Azeri farmers.

**External peer review, monitoring, evaluation and implementation.** These same training needs apply to project reviewers from national institutions. Proposal/project review and evaluation by outside livestock scientists who are current in their field are essential for assuring that investments in applied research are useful in stimulating productivity and net economic returns from the Azeri livestock sector.

**Major Problems Encountered, Short-term Resolution, Suggestions for the Future**

Lack of opportunities to train scientists and exposure to current scientific literature were the major problem, and these could not be overcome without a re-allocation of funds. What is needed in any future activity, is to *integrate* professional capacity building (through training) with problem-solving (applied) research, focusing on dairy and meat production from cattle and sheep.

**PARTICIPATORY TECHNOLOGY DEVELOPMENT**

**Objectives**

The minimal level of interaction between scientific researchers and farmers in Azerbaijan has been cited as a problem by both Azeri personnel and outside observers. Combined with the extensive changes that have taken place in the farming system in the country in the last decade, the situation has resulted in a low level of understanding and familiarity with current practices, and the reasons for them, at the farm level. The objectives of the participatory technology development component of the CGS project consisted of the development and implementation of participatory techniques (1) for eliciting constraints currently experienced by farmers in Azerbaijan and (2) for assessing the state of current technology use and its usefulness in addressing the changing needs of today's farmers.

An important element of the participatory component involved training a group of researchers in activities designed to encourage increased interaction with farmers and to enable farmer input to be incorporated into the research priority setting process. Activities included both formal training and discussion sessions, including a day-long training seminar held in the CGS Secretariat office to provide an introduction to participatory concepts, as well as field level experience in conducting and analyzing farmer surveys. The farm level surveys attempted to raise awareness of actual on-farm practices and of the necessity of taking farmer concerns and constraints into consideration prior to researching or recommending technology solutions that otherwise could end up as options simply not viable for many farmers. Training was carried out during two visits to Azerbaijan in the spring and fall of 2001. Farmer surveys were completed by the trained Azeri team in the period between the two visits.
Farmer Survey Methodology

Two different but related types of surveys, a rapid rural appraisal (RRA) and a participatory rural appraisal (PRA) were carried out in Azerbaijan as part of the training process in the participatory development component. Both these surveys involved direct farmer interaction with a group of farmers, preferably between 8 and 10 individuals, from the village. This group interview structure allows the villagers to interact among each other during the information exchange and to provide a broad range of perspectives on the needs and constraints of the community. The sessions were organized to be more along the lines of informal discussions instead of a formal interview experience. The data collected and therefore the methods needed to analyze the collected data differ somewhat from that of a formal household survey. However, with careful sample selection, standardization of the questionnaire, and trained enumerators, the information from the surveys can be effectively used for a variety of objectives.

The RRA survey sites were selected reflect existing variation across factors exogenous to the farmers, such as topography, growing environment characteristics, infrastructural conditions, and prices. Infrastructural conditions include factors such as the proximity of agricultural experiment stations or other scientific/extension institutions, access to markets, and availability of irrigation. For example, selection criteria for villages in Guba Khachmaz can be illustrated using the following matrix:

<table>
<thead>
<tr>
<th>Infrastructure / Topography</th>
<th>Plain</th>
<th>Hilly</th>
<th>Mountainous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relatively good infrastructure</td>
<td>Khachmaz</td>
<td>Guba</td>
<td>Gusr</td>
</tr>
<tr>
<td>Relatively poor infrastructure</td>
<td>Khachmaz</td>
<td>Devici</td>
<td>Devici / Xizi</td>
</tr>
</tbody>
</table>

RRA surveys were conducted in a total of 55 villages covering every accessible province in the country. An average of six villages covering four to five rayons were surveyed in each province. Only one village was surveyed in Absheron, and for logistical purposes, Shirvan was divided into Mountain Shirvan and Plain Shirvan. One group of farmers was interviewed per village, and careful efforts were made to ensure that the group of farmers included both male and female farmers with differing levels of farming experience and different economic circumstances.

The PRA survey, in contrast, was designed to explore further the variation among farmers within a given village. From the 55 RRA villages, 19 villages (2 from each province with the exception of Absheron) were selected for an additional PRA survey. In each of these villages, we interviewed four groups of farmers using the following selection characteristics:

<table>
<thead>
<tr>
<th>Economic Circumstances / Gender</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good relative to other hhlds in village</td>
<td>1 group</td>
<td>1 group</td>
</tr>
<tr>
<td>Bad relative to other hhlds in village</td>
<td>1 group</td>
<td>1 group</td>
</tr>
</tbody>
</table>
A list of all surveyed villages is provided in Appendix 1. Information was gathered in areas that included farmer sources of technology information, current on-farm input use (including varieties), input sources, and problems with abiotic and biotic stresses. With the goal of placing the farmers' agricultural constraints and needs into a wider livelihood context, farmers' concerns in other areas were also solicited. By interviewing different groups of farmers within a village, it is also possible to explore the existence of different constraints and concerns for different types of farmers. In both the RRA and PRA surveys, efforts were made to minimize the possibility that the results would be completely unrepresentative of other villages with similar characteristics and that some sort of scaling up would be invalid. In each survey carried out, a series of basic characteristics was collected from the farmers participating in the surveys in order to know better to what extent the survey results can be scaled up.

Overall, the surveys were carried out successfully due largely to the diligence of the team of scientists trained for the activity. Some of the survey data was also analyzed and utilized as discussion points and inputs in the National Priority Setting Meeting organized by the CGS Secretariat in November 2001. Ideally, some kind of systematically collected farm level data would have also been utilized in the constraints analysis meetings that took place across the country in the early stages of the CGS. Although some farmers were included at those meetings, the selection process for those farmers was likely somewhat biased given the nature of past scientist/farmer interaction, and it is very unclear to what extent the concerns and constraints of the few farmers invited to participate in the constraints analyses reflected those of farmers across Azerbaijan. From our survey experience, it is clear that different types of farmers are present in the country and that they are faced with constraints arising from a wide range of factors. Simply by having “farmers present” could result in the erroneous assumption that constraints faced by all types of farmers are being addressed. This is not to say that there are not some constraints universally experienced among farmers in the country, but given the low level of systematically collected information on farm data, it is unwise to make too many general assumptions.

Selected Survey Data

Sources of technology information
By far the most prevalent sources of technology information used by the farmers in our surveyed villages were neighboring farmers and media sources such as television, radio, and written pamphlets. Farmers generally ranked the usefulness of the information from these sources as fair to good, although lack of electricity was cited in many villages as a constraint to the use of television and radio. Only in a limited number of villages were seed production farms, zonal experiment stations, and information and consulting services mentioned as potential sources of technological information. In several cases where consulting services were available, not all farmers were aware of the services. Regarding the original source of information about new wheat varieties, which we asked specifically, neighboring farmers, media, and former kolkhoz/sovkhaz (in the case of older varieties still cultivated) were the most frequent responses.
Knowledge about the sources farmers currently utilize for farming information can be potentially put to use by researchers. It would be also helpful to know if certain farmers in the community are more likely to be trusted as sources of technology information. If so, these farmers would be obvious choices to approach as participants in future on farm trials.

**Sources of seed**
Farmer saved seed was the overwhelming response to this question no matter what the crop. Other responses included periodic farmer seed exchanges and market purchases, particularly for vegetable and potato seeds.

**Input use**
The data collected implied low current levels of chemical use particularly for wheat production. Input use was in general higher for those villages with better access to vegetable and fruit markets, cotton processing facilities, or potato production. Yield gaps between maximum and minimum yields achieved by farmers in the village were often attributed to the inability to follow recommended practices due in turn generally to a lack of capital for input purchases.

**Credit availability**
Farmers cited relatives as the primary source of loans and emergency funds. However, while interest-free, these funds are constrained in size and subject to the circumstances of the relatives. We did not question individual farmers specifically about their access to and use of and credit; however, the group consensus in the large majority of villages indicated that credit from other sources - government banks, private banks, private lenders - was largely unavailable, either due to the non-existence of the source or to prohibitive costs.

**Wheat production and utilization**
Farmers across the country acknowledged an increasing trend in household level of wheat production over the last ten years. From the PRA responses, the importance of wheat as the household’s most important crop for home consumption was consistently at the top of the list in discussions about the advantages and disadvantages of various household activities, regardless of the group being interviewed. Other advantages of wheat that were commonly mentioned were ease in marketing surplus production and low labor requirements relative to other crops. Wheat residues are also valuable inputs for livestock production, another household activity that has increased over the last ten years.

The reported breakdown of wheat utilized in the household (for food or feed) and wheat sold varied among villages but none of the survey villages ever indicated that 100% of wheat produced was sold. The estimated percentage in most villages in the survey did not approach this amount. Household consumption remains a very important factor in wheat production although utilization will also vary from farmer to farmer within a given village. With respect to characteristics of specific wheat varieties currently cultivated, farmers were especially concerned with yield, lodging resistance, drought resistance, and disease resistance. However, good bread quality and milling quality were also equally emphasized. Some varieties, such as Bezostaya, had both of these qualities and appeared
to be easier to sell than other varieties. More work is needed to examine if certain types of farmers or farmers in certain regions are likely to be interested in different characteristics. Another area we did not explore in depth was whether or not farmers consumed their own wheat production after milling it or whether they exchanged wheat for already-milled flour at the mill. This could perhaps have some implications for farmer participatory selection.

**GENERAL OBSERVATIONS AND RECOMMENDATIONS**

**Ongoing Collection of Farmer Input and Improved Integration into CGS Research Activities**

The degree of separation between the participatory component and the rest of the CGS activities was a concern that was somewhat assuaged but never completely erased during the course of my two visits to Azerbaijan. Until the use of survey findings for the preparation of materials for the national priority setting meeting in November 2001, there existed very few linkages with respect to the development of proposals and activities for the CGS. That there has been progress in acknowledging the importance of farmer input and participation as a component in constraints analysis, priority setting, and the development of technologies is very positive. Investigators have made efforts to incorporate elements of farmer participation into the activities of the CGS projects now underway. However, efforts to deepen and better integrate these new concepts into the research system need to be continued so that scientists and administrators fully understand the reasons for their utilization and are not merely paying lip service to donor requirements.

Farm level diagnostics such as the PRA and RRA surveys carried out in 2001 are not one-time activities that can be checked off as accomplished after having taken place. This type of activity should continue to be carried out at regular intervals as part of a continuous process of farmer/researcher interaction, farm level information collection, and the utilization of that information. This is especially important given the rapidly evolving environment in which farmers operate that will constantly generate new constraints and opportunities. As these constraints and opportunities change, new research issues will appear in the short term and research priorities may need to be reassessed over the longer term. It is vitally important that the research community establishes and maintains an understanding of current farm level practices and, equally as importantly, of the reasons driving the behavior being observed. Without this understanding, research issues may be overlooked in lieu of ones that, while interesting, may not be of the most relevance to farmers. Similarly, an understanding of farmer constraints should also shape the technological solutions that are developed.

**Improved Methods to Identify Farmers and Inclusion of a Wider Range of Farmers into CGS Activities**

Closely related to the choice of research issue is the question of to whom the research should be targeted. Who are the farmers in present-day Azerbaijan? During the course of
the RRA and PRA surveys carried out in 2001, the survey team interacted with a wide range of people involved in farm activities. They reflect the large variation present today across the country in terms of level of experience in farming, crops cultivated, farm size, agro-ecological growing environment, and access to machinery, inputs, and technological information. It was not very clear how researchers in ongoing CGS projects selected participating farmers for their on-farm activities. The easiest and fastest solution would be to select farmers with whom an established relationship already existed, very likely a knowledgeable person from a former state or collective farm. As an additional benefit to the low transactions costs of identification, researchers could also to ensure to a more certain degree that their instructions would be followed accurately and that the likelihood of the activity’s success be increased. However, it is also not clear to what extent the results and experiences from these on-farm activities can be extended to other types of farms that maybe more representative of the current farming situation in Azerbaijan. By extending the network of farmers involved, albeit perhaps higher in transactions and monitoring costs, scientists can increase the likelihood of their research being relevant and utilized. Particularly since we also know from the survey data that one of the primary sources currently used for information on technology is neighboring farmers, it is even more important that this existing avenue of information transfer be utilized by understanding the farmers’ own networks.

Systematic Collection of Farmer Information/Increased Awareness of Farm Constraints

Systematic collection of information on farmers involved in CGS activities needs to be conducted to find out how their circumstances reflect those of other farmers in Azerbaijan. There is also a need for increased awareness of farm level constraints and their implications for technology development and utilization. Similar concerns were raised by Dr. P. Wall, the Natural Resources specialist, in his April 2002 report about the selection of farmers participating in demonstration trials. The suggestions he made regarding the complexity of the ongoing on-farm trials and the dubious representative status of the farmers involved need to be continually reinforced by the CGS Secretariat in their interactions with project scientists. Moreover, to be able to utilize fully the results of such participatory activities, collection of a minimal level of information on participating farmers should be required. With information on basic characteristics (e.g., age, education, farming experience, farm size, crops cultivated, etc.), the farmers can be placed in context with respect to other farmers in the region and country. This type of information will also enable recommendations to be better tailored, particularly if farmer groups happen to be non-homogeneous, something that is almost surely to be the case.

The treatments used in the field trials and the recommendations eventually made also need to be realistic—that is, in the realm of possibility for the farmers to whom they are being recommended. An example is the 20 tons/ha of manure recommended for wheat cultivation. In only three out of the 55 villages surveyed in the PRA/RRA process did the amount of manure used on wheat approach the 20 ton recommendation (the village of Baltali in Sheki, the village of Mazix in Zagatala, and the village of Ghojali in Kurdamir). Most other villages used significantly less, if any at all. Use of manure on cash crops such
as potatoes and vegetables was much more prevalent. Several farmers also commented on
the difficulty and cost of transporting manure to fields distant to the manure source.
Scientists not only need to be consistently aware of current on-farm practices and
constraints, but also be able to utilize the information in developing new approaches to
their research and in their interaction with farmers.

Analysis of the Economic Implications of New Technologies

Note that this is not tantamount to a recommendation that scientific research should be
limited to investigating alternatives with only low levels of input use. We hope that the
economic outlook and institutional development in Azerbaijan will continue to move
forward so that some of the most binding constraints for Azeri farmers will be loosened.
In any case, farmers should be able to observe different technology options and determine
which one would be suitable given their own circumstances at that point in time. Here,
another important point needs to be emphasized. In few, if any, of the ongoing CGS
projects that involved on-farm activities and treatment trials were there any resources or
time allocated to analyzing the economic implications to the farmers of the investigated
or recommended technologies. Simply looking at potential yield gains and failing to
place them in the context of economic possibility is implicitly ignoring a large part of the
farm level picture. A simple marginal cost analysis would be the minimum starting point
in integrating technological potential and economic feasibility for the benefit both of the
potential farmer clients and of the researchers themselves.

Improved Incorporation of Economics into CGS Projects

The absence of attention to economic implications may reflect the weak linkages in
general between the activities of agricultural researchers and economics researchers.
These linkages need to be encouraged and should not be limited to economic cost /
benefit and marginal cost analyses. Although they are useful, the collaboration should
also be expanded to include more frequent interaction and cooperation from the inception
of proposals through their implementation. This process will not take place overnight and
will require a simultaneous broadening of outlook on the part of scientists and an
improvement in the level and capacity of economics research in the country. As these
developments take place, perhaps administrators and agricultural scientists can obtain a
better understanding of the potential of contributions from economics research. At the
same time, economic researchers also need to realize the research issues with relatively
more practical applicability for agricultural scientists. Efforts on the part of the CGS
Secretariat to increase this mutual understanding are important to develop the
interdisciplinary respect and cooperation that will bring future research benefits.

One comment on the participatory variety selection form drafted for use by farmers in the
project entitled “A farmer participatory approach in identification and distribution of
wheat varieties.” This is an area in which an increasing amount of research has taken
place on the part of economists and social scientists, and the inclusion of their input in the
development of such a form would be useful. Input from the farmers themselves
regarding characteristics they feel are important in selecting wheat varieties in general
should also be incorporated. In developing such survey forms, I would recommend a focus group meeting organized with farmers (with efforts to involve farmers with a wide range of characteristics) in the area to identify these characteristics as specifically as possible. Given the importance of wheat for household consumption, the exclusive focus on production traits will likely only reflect part of the multiple objectives farm households must fulfill with their household wheat production. Leaving all the rest of the characteristics to fall into the "other" category may result in important consumption and utilization characteristics being overlooked. This could have an effect on the adoption of these varieties in the future.

**Improved Impact Assessment of CGS Projects**

One other element that did not seem to be emphasized in the current projects and that needs to be incorporated in the future is the importance of impact assessment. A better system to track and evaluate research impacts from the CGS projects needs to be developed. The scope of research impacts should not be limited to an accounting of how many new varieties are released or how many field trials were established but should also include information about the potential or realized effects on farmer welfare from the development and supply of technology. Are there any observed changes in technology use or in information sources being utilized? Any effects on farm level productivity and farmer livelihoods? In order to be able to assess these issues, more attention needs to be dedicated to the collection of baseline information and periodic follow up with participants. In other words, the incorporation of an economic component in the project from the outset that continues through the duration of the project. Without some baseline to start from, the assessment of impact will be at best very difficult and imprecise. Moreover, research with farmer participation is an iterative process in which farmer interaction ideally occurs at several stages in the process and not just at the beginning or at the end. With the solicited farmer input, improvements and adjustments can be made throughout the research process so that the usefulness of the research is maximized.

The low amount of support given to promote research projects in agricultural economics was disappointing. Particularly given the number of ongoing CGS projects involving the participatory development of new technology, the element of human behavior becomes especially important to consider. I hope that the suggestion to incorporate an economics component into existing and future project proposals will be taken seriously.
6. Competitive Grant Projects: Current Status

During the first stage a total of 12 projects were envisaged for the crop production sector. Given the fact that it was the first time experience for almost all the scientists to participate in a process of this kind, the delays in the project preparation, its revision and rewriting, and reviews by both national and international reviewers took more time than what was anticipated. A total of 11 crop related projects became operational as part of the first stage.

There were two good proposals dealing with vegetable production. The Board observed that if the participants of these two projects could get together and make a single proposal combining the positive aspects from each of these proposals, then it will serve the farmers of Azerbaijan much better than any one of these individual proposals. The authors are still working on making this combined proposal. Hopefully it will come up for approval of the Board before the second stage proposals.

Project proposals for the livestock sector were delayed due to the late start and it was decided that these shall be considered only after the secretariat has gained some experience in handling the crop sector projects. Also based on the initial experience that quality of the first proposals of the crop sector was very weak and poor, it was decided to invite proposals that are smaller in size dealing with single issues and shorter duration. A total of 36 proposals were received by the secretariat. Once again quality of almost all the proposals was very poor. After careful review by the secretariat 8 of the authors were asked to resubmit their proposals. These proposals were evaluated by both internal and external reviewers and the Board approved six of them and these were eventually cleared by the World Bank. Thus, a total of 17 projects were approved and became operational during the first stage period.

During the later part of 2002, concept notes for second stage project proposals were invited. After careful review of these concept notes, five of them were selected to be expanded to full project proposals. These were reviewed both by internal and external reviewers and finally was approved by the Board and cleared by the World Bank. These five second stage projects also became operational during 2002. All the 22 projects are listed below. Concept notes dealing with fruit crops, vegetables and industrial crops are being reviewed and once approved by the Board and cleared by the bank will also become operational during the second stage period.

**List of First and Second Stage Projects**

**First Stage Projects**

1. Efficient technology to increase wheat production – MQP-M-01/03
2. Development of sustainable wheat seed system in various agro-ecological regions of Azerbaijan – MQP-M-01/02
3. A farmer participatory approach in identification and distribution of wheat varieties - MQP-M-01/01
4. Application and demonstration of the technology ensuring increase in cotton productivity - MQP-M-01/06
5. Application and dissemination of new technology ensuring increase in apple, pomegranate, hazelnut and walnut productivity - MQP-M-01/07
6. Cultivation and distribution of high quality table grape seedlings resistant to phylloxera - MQP-M-01/09
7. Selection and promotion of high yield and resistant chickpea varieties in rainfed zones of Azerbaijan - MQP-M-01/10
8. On farm selection and distribution of high quality maize varieties and hybrids - MQP-M-01/04
9. Control measures against diseases and pests through application of effective pesticides and small sprayers in farmer holdings - MQP-M-01/11
10. A farmer participatory approach to increase the use of efficient technology for potato production by small-scale farmers - MQP-M-01/05
11. Propagation and dissemination of tea clones, and application of the methods ensuring increase in their productivity - MQP-M-01/08
12. A farmer participatory selection and distribution of new productive forage crops - MQP-M-01/22
13. Establishment of continuous green forage production all year round in irrigated condition of Azerbaijan - MQP-M-01/12
15. Application of progressive technological methods in raising calves - MQP-M-01/15
16. Application of new technology ensuring increase in productivity of buffaloes - MQP-M-01/16
17. Application of integrated control measures against animal and poultry diseases - MQP-M-01/13

Second Stage Projects

18. Farmer participatory selection and distribution of wheat varieties for the dryland regions of Azerbaijan - MQP-M-01/20
19. Application of efficient control measures against wheat weeds widespread in diverse regions of Azerbaijan - MQP-M-01/18
20. Promotion of efficient planting technology to improve irrigation efficiency and reduce seed rate - MQP-M-01/17
21. Promotion of wheat production in Nakhchivan Autonomous Republic through application of new high yielding wheat varieties and cultivation technology in farmer-holdings - MQP-M-01/17
22. To achieve sustainable crop production in farmer holdings through improvement of structure and filtration capacity of weak and medium saline soils - MQP-M-01/21
7. Competitive Grant Projects: Evaluation and Monitoring

During 2002, project consultants (18-19 April: Dr. P. Wall; 15-24 May: Drs. A. Morgounov and G. Varughese; 30 May-16 June: Dr. C. Boyer; August-September: Drs. C. Boyer and G. Varughese) visited many trial locations accompanied by Secretariat staff and project leaders. See the May 2002 field crop project evaluation in Appendix 2. Dr. Morgounov also visited Baku in December 2002, communicated with project participants and looked at yearly reports (where available and only the Azeri version with a translator) and the actual field data. Observations based on these visits concerning the conduct of CGS projects appear below.

**PROJECT: EFFICIENT TECHNOLOGY TO INCREASE WHEAT PRODUCTION**

**May 2002 Monitoring/Evaluation**

This is the largest project currently in operation under the CGS and is exclusively dedicated to on farm verification of wheat technology and demonstration. Trials are planted at nine different locations scattered across four different districts. At each location trials occupy some four hectares. The team visited five locations of this project during this monitoring mission. A lot of hard work and time were invested in establishing the trials, and the quality of the trials is an indication of the excellent dedication of the people involved. However, the trials are complicated, too big and could be confusing to the farmers. Thus it is suggested that these trials be simplified in the second year, as per the recommendations of Dr. Pat Wall. Also it is important that farmer participants be better informed about the purpose and objectives of these trials so that the treatments are not changed.

**December 2002 Monitoring/Evaluation**

The project obtained excellent field results and can be commended on conducting such elaborate trials at eight sites and completing them very well. The data of the first trial with varieties demonstrated (see table below) that if farmer varieties and seed are used in conjunction with improved technology, it is possible to obtain yield increases of 30-50%. However, changing the variety and using recommended technologies almost doubles yield under irrigation and more than doubles it under rainfed conditions.

Table 7.1. Results of a field trial using different variety and technology combinations under irrigated or rainfed conditions at eight sites.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield across 5 irrigated sites</th>
<th>Yield across 3 rainfed sites</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T/ha</td>
<td>+ to check (%)</td>
</tr>
<tr>
<td>Farmer variety &amp; technology (Check)</td>
<td>3.02</td>
<td>-</td>
</tr>
<tr>
<td>Farmer variety + recommended technology</td>
<td>4.00</td>
<td>+32</td>
</tr>
<tr>
<td>Akinci + recommended technology</td>
<td>5.53</td>
<td>+83</td>
</tr>
</tbody>
</table>
The second experiment compared split applications of nitrogen, in the fall and in spring, as well as the effect of phosphorus and organic fertilizer (data below). The data suggest that split nitrogen application using a 50-50 ratio did not have any effect compared to the application with a ratio of 30-70 (fall-spring). This was observed under both irrigated and rainfed conditions, with and without phosphorus and organic fertilizer. Application of 60 kg of phosphorus and organic fertilizer increased yield by 20-25% under both irrigated and rainfed conditions. The data obtained the first year will be sufficient, and this type of experiment may not be needed for the second year of the project.

Table 7.2. Results of a field trial comparing different split nitrogen application ratios under irrigated or rainfed conditions at eight sites, with and without phosphorus and organic fertilizers.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield across 5 irrigated sites</th>
<th>Yield across 3 rainfed sites</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T/ha + to check (%)</td>
<td>T/ha + to check (%)</td>
</tr>
<tr>
<td>N22 at planting &amp; N68 in spring</td>
<td>4.80 -</td>
<td>4.24 -</td>
</tr>
<tr>
<td>N45 at planting &amp; N45 in spring</td>
<td>4.80 0</td>
<td>4.22 -1</td>
</tr>
<tr>
<td>P60 + Org. fertilizer (20 t/ha) + N22 at planting &amp; N68 in spring</td>
<td>5.91 +23</td>
<td>5.10 +20</td>
</tr>
<tr>
<td>P60 + Org. fertilizer (20 t/ha) + N22 at planting &amp; N68 in spring</td>
<td>6.00 +25</td>
<td>5.17 +22</td>
</tr>
<tr>
<td>Average</td>
<td>5.37</td>
<td>4.68</td>
</tr>
</tbody>
</table>

The third experiment compared several technology components with and without fertilizer and with and without herbicide application. The summary data is presented below. Crop protection and additional irrigation improve the yield up to 20-30% and this is especially pronounced when fertilizer and herbicide are applied. Using the recommended technology without changing the variety does not give major yield increases, suggesting that the change should involve both the variety and technology. Low seeding rates are justified only when applying the recommended variety and technology. Under irrigated conditions the effect of the new variety and technology package increases with improved input from 18 (without fertilizer and herbicide) to 43% (with fertilizer and herbicide). Under rainfed conditions this tendency was not observed and the effect of variety and technology on yield is in a range of 18-28%. The effect of fertilizer (P60N90) under irrigated conditions is 38% and under rainfed conditions 32%. The effect of herbicide under irrigated conditions is 34% and under rainfed conditions is 16%. Unfortunately, the project did not provide detailed economic analysis of profitability of different treatments except mentioning that the farmer’s technology provided $60-80 profit per ha and the recommended treatments up to $400 per ha.
Table 7.3. Results of a field trial comparing several technology components with and without fertilizer, and with and without herbicide application.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Average yield across 5 irrigated sites</th>
<th>Average yield across 3 rainfed sites</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fertilizer (P60N90)</td>
<td>Without fertilizer</td>
</tr>
<tr>
<td></td>
<td>Herbicide</td>
<td>Yes</td>
</tr>
<tr>
<td>Farmer variety &amp; seed &amp; technology</td>
<td>T/ha</td>
<td>4.27</td>
</tr>
<tr>
<td>Farmer variety &amp; technology + crop protection</td>
<td>T/ha</td>
<td>5.44</td>
</tr>
<tr>
<td>Farmer variety &amp; technology + rodents protection</td>
<td>T/ha</td>
<td>5.64</td>
</tr>
<tr>
<td>Farmer variety &amp; technology + additional irrigation</td>
<td>T/ha</td>
<td>5.86</td>
</tr>
<tr>
<td>Farmer variety &amp; seed + recommended technology</td>
<td>T/ha</td>
<td>4.54</td>
</tr>
<tr>
<td>Farmer variety &amp; technology, variety + seed rate 120 kg/ha</td>
<td>T/ha</td>
<td>3.50</td>
</tr>
<tr>
<td>Recommended variety &amp; technology + seed rate 120 kg/ha</td>
<td>T/ha</td>
<td>4.77</td>
</tr>
<tr>
<td>Recommended variety &amp; technology</td>
<td>T/ha</td>
<td>6.12</td>
</tr>
<tr>
<td>Average</td>
<td>T/ha</td>
<td>5.02</td>
</tr>
</tbody>
</table>
Field activities for the 2002-2003 season were adjusted based on the previous suggestions and the data obtained. The project will concentrate in irrigated areas of Terter and Salyan regions and rainfed areas of Gobustan. In total seven counties are involved. The trials are much simplified compared to 2002. The number of varieties tested has been reduced to three (including new Nurlu and two others) plus the farmer variety. The seeding rates are 120 and 200 kg/ha. The field area at each site is 6 ha and the plot size is 0.8 ha. In the future the project plans to cover all the eco-regional zones of the country.

The overall impression of the project is that this is the biggest project and was very successful in field activities. Simplification of the design is important. The weak point is the lack of detailed economic analysis showing the cost-benefit analysis for each treatment. Tremendous amount of data should be analyzed and published in different formats.

**PROJECT: DEVELOPMENT OF SUSTAINABLE WHEAT SEED SYSTEM IN VARIOUS AGRO-ECOLOGICAL REGIONS OF AZERBAIJAN**

**May 2002 Monitoring/Evaluation**

Four farmers were contracted to participate in this project, two each in Barda and Gobustan. At each of the locations two varieties were multiplied for seed. Each variety occupies 2.5 ha and so in total this year there is 20 ha under seed multiplication in farmers fields. We have visited only one farm at Barda and each of the varieties at this farm is likely to yield close to 7 tons/ha. Seed rate was over 200 kg/ha. and row spacing was the normal commercial spacing. **It is suggested that in the future seed production fields should have a lower seed rate and each eighth row not seeded to facilitate entry of field workers to remove offtypes.**

Activities related to objectives one and two were not undertaken during the first year and these must be carried out during year two. Several other concerns are:

- To date there is no report on the survey of seed production systems in the pilot counties. This needs to cover the methodology used, the outcome of the study and the recommendations.
- Development of a better and more efficient early generation seed production system and maintenance breeding. This season an alternative scheme of early generation seed production should be tried in order to shorten the process by one year (to obtain the super elite in three years instead of four) maintaining the seed quality and quantity by increasing the multiplication rate. The alternative scheme should be applied on the head rows of some varieties planted in Terter station in 2001-02 season.
- The on-farm activities should demonstrate the advantages of the good seed and also the technologies which allow faster multiplication and higher multiplication rate: regular production seeding rates should not be used.
December 2002 Monitoring/Evaluation

The project obtained very good results in 2002. A total of 80 tons of seed was produced at four sites (table below). The seed was used by the farmers themselves and passed to other farmers in the same villages and further afield.

Table 7.4. Seed production data from four sites in 2002.

<table>
<thead>
<tr>
<th>Rayon</th>
<th>Site</th>
<th>Variety</th>
<th>Area, ha</th>
<th>Production, kg</th>
<th>Yield, t/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berde</td>
<td>Zumurhach</td>
<td>Qiymatly2/17</td>
<td>2.5</td>
<td>16250</td>
<td>6.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Turan</td>
<td>2.5</td>
<td>13750</td>
<td>5.50</td>
</tr>
<tr>
<td>Berda</td>
<td>Mirzalibeyli</td>
<td>Azery</td>
<td>2.5</td>
<td>12250</td>
<td>4.90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Berekety95</td>
<td>2.5</td>
<td>11750</td>
<td>4.70</td>
</tr>
<tr>
<td>Gobustan</td>
<td>Chalov rainfed</td>
<td>Akinchi84</td>
<td>2.5</td>
<td>7225</td>
<td>2.90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Berekety 95</td>
<td>2.5</td>
<td>6500</td>
<td>2.60</td>
</tr>
<tr>
<td>Gobustan</td>
<td>Hilmilli rainfed</td>
<td>Qiymatly 2/17</td>
<td>2.5</td>
<td>6825</td>
<td>2.73</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Berekety95</td>
<td>2.5</td>
<td>5750</td>
<td>2.30</td>
</tr>
<tr>
<td>Total/average</td>
<td></td>
<td></td>
<td>20.0</td>
<td>80300</td>
<td>4.01</td>
</tr>
</tbody>
</table>

Based on the suggestions made during the first year of the project the following modifications were made for the 2002-2003 season:

- Change of the regions and farmers: irrigated areas covered by Terter and Belayan, rainfed areas — Sheki and Jelalabad.
- The trial setup was changed in 2003 – there is one variety planted at three seeding rates (140 kg/ha, 180 kg/ha and 220 kg/ha) instead of two varieties planted at a high seeding rate in 2002.
- Based on the variety performance in 2002, especially in regard to yellow rust, new varieties were selected for promotion. These are Gobustan for Sheki region, Azametly for Jelalabad region, Gyimatly and Nulru for irrigated areas.
- Alternative early generation seed production methodology was initiated at the research station.
- The State Variety Testing Commission will be invited to the sites so that the data can be used for official release of the varieties.

Several suggestions were made:

- The project still did not report the progress towards analysis of the seed production system at the “rayon” level and there is a need to emphasize it.
- There is a need to record and analyze the movement of all the seed produced in the project and related economic aspects as it represents a realistic seed chain.
- The economic efficiency of seed production at the project sites (costs versus benefits) are not provided. This is a very fundamental issue.

The overall project evaluation is positive though the component related to analysis of the seed sector has to be strengthened.
May 2002 Monitoring/Evaluation

The project component related to disease screening is conducted on station at the Azeri ARI. Close to 1000 wheat varieties are under evaluation for rust and bunts at the Absheron station under the wheat varieties project. This project should facilitate identification of wheat varieties having better resistance to diseases. All the wheat varieties that are in the yield trial were inoculated for common bunt and are being evaluated in duplicate in order to reduce the probability of escape. It was too early to make a judgment of the results, but the level of infection was found to be very high. This same set of wheat varieties was also planted in duplicate for rust evaluation. The plots were surrounded by a susceptible variety. In general the infection level was high. Natural stripe rust inoculum was collected, washed with water and this water containing inoculum was sprayed on the test plots and the spreader rows. In most places the level of infection on test plots were higher than the spreader rows. Also the spreader rows did not look correct. It is suggested that a serious attempt should be made to multiply spreader varieties with disease protection so that a sufficient quantity of seed can be produced. Collection and conservation of inoculum is another activity very critical for the success of this program. Some of the basic equipment for this activity must be procured soon and also arrangements are to be made with Dr. Turabi of Iran and Dr. Amor of ICARDA who are currently visiting Azerbaijan, to assist in initiating the collection and conservation process.

This project has three on farm sites one each at Saatli, Tartar and Gobustan. At each of these locations, 100 wheat varieties (71 bread wheat and 29 durum) are being evaluated in three replications. The team visited the sites at Saatli and Tartar. At both these locations the trials are good and we should expect good results. At Gobustan the site is too remote and hence could not be visited. For practical reasons it is suggested that during the second year seed multiplication and evaluation can be combined into one activity by planting large strips of each of the varieties. However, all the varieties must be evaluated on station as well as on farm, as part of the regular on-farm evaluation.

Some additional comments are:

• In general the project has made good progress and conducted excellent on-station and on-farm field activities. The on-station activities on disease evaluation will be strengthened by the on-going collaboration with CIMMYT and ICARDA.
• Methodology for participatory variety selection by farmers. The draft form (Appendix 3) was developed which will allow the farmers to make their own judgment on the varieties.
• It was agreed that some negative selection would take place before harvest so that only the best varieties/lines will be harvested and evaluated for yield.
• The logistics of harvesting will require special attention to maintain the purity of the lines/varieties.
December 2002 Monitoring/Evaluation

The disease screening of 800 entries for yellow rust resulted in identification and selection of 80 entries which have been planted at three stations in the fall of 2002. The yellow rust work has been established and at the time of the visit some inoculation was made to generate the yellow rust spores for field inoculation.

Based on the field data from 2002 the selection of 24 best lines/varieties was made across three sites involved in the project (see table below). The selected lines were planted at three sites on plots of 500 m\(^2\) each. The total area of on-farm trials and multiplication is 10 ha. Some comments on the project: a) it was not clear how farmer evaluations of the varieties were combined with the agronomic data to make decisions on selection; b) it is satisfying that some of the lines selected in the project originated from international collaboration with CIMMYT and ICARDA; c) the next bottleneck to address in the variety selection procedure is bread-making quality. This project is a good candidate for project extension.

Table 7.5. Selection of 24 best wheat lines/varieties across three irrigated/rainfed sites.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Yield, t/ha</th>
<th>Irrigation</th>
<th>Rainfed</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Terter</td>
<td>Saatly</td>
<td>Gobustan</td>
</tr>
<tr>
<td>Gyimatly 2-17</td>
<td>4.22</td>
<td>4.50</td>
<td>3.23</td>
<td>3.98</td>
</tr>
<tr>
<td>Lutecens 85</td>
<td>4.78</td>
<td>7.06</td>
<td>3.72</td>
<td>5.19</td>
</tr>
<tr>
<td>Grekum 330</td>
<td>5.22</td>
<td>5.28</td>
<td>3.28</td>
<td>4.59</td>
</tr>
<tr>
<td>Grekum 09290-3</td>
<td>5.56</td>
<td>6.75</td>
<td>4.05</td>
<td>5.45</td>
</tr>
<tr>
<td>Eritroleukon 01701/1-3-6</td>
<td>6.00</td>
<td>6.30</td>
<td>4.79</td>
<td>5.70</td>
</tr>
<tr>
<td>Lutecens 09209/4-2-3</td>
<td>5.22</td>
<td>5.80</td>
<td>4.30</td>
<td>5.11</td>
</tr>
<tr>
<td>Grekum (Shefek selection)</td>
<td>6.22</td>
<td>5.88</td>
<td>4.66</td>
<td>5.59</td>
</tr>
<tr>
<td>Lutecens 0215/5</td>
<td>5.89</td>
<td>5.39</td>
<td>4.67</td>
<td>5.32</td>
</tr>
<tr>
<td>Azametli 95</td>
<td>6.67</td>
<td>6.50</td>
<td>4.85</td>
<td>6.01</td>
</tr>
<tr>
<td>Bereketly 95</td>
<td>5.00</td>
<td>5.20</td>
<td>3.10</td>
<td>4.43</td>
</tr>
<tr>
<td>Laegatly selection/Derbent chernokolos</td>
<td>5.67</td>
<td>5.59</td>
<td>3.95</td>
<td>5.07</td>
</tr>
</tbody>
</table>

PROJECT: ON-FARM SELECTION AND DISTRIBUTION OF HIGH QUALITY MAIZE VARIETIES AND HYBRIDS

May 2002 Monitoring/Evaluation

This project consists of varietal selection at the Zagatala station and on-farm verification and demonstration plots at Shaki and Saatli. The team visited the on-farm verification and demonstration plots at Saatli. Trials and demonstrations occupy 4 ha at this site; they are very well managed.
August-September 2002 Monitoring/Evaluation

During August – September, we visited all the three locations (Saatli, Shaki, and Zagatala) where this trial/demonstration is being conducted. It is a very well managed project and should yield useful information. Had the plot size been smaller, we could have accommodated a few more demonstration sites, and the usefulness of the project would have increased.

December 2002 Monitoring/Evaluation

The objectives and the work plan for 2002 were well implemented. The data on varieties tested across locations are shown in the table below. It appears that the variety Mirvari and some new populations have high yields. The farmers involved in the project were very happy with the high yield and being able to keep the seed. In 2003 the project will concentrate on the best varieties identified but will also introduce new varieties identified at the on-station experiment at Zakatala.

Table 7.6. Production data on maize varieties and hybrids tested across two sites.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Yield, t/ha</th>
<th>Expenses AZM/ha</th>
<th>Cost of product/ha</th>
<th>Net profit, AZM</th>
<th>Profit Center</th>
<th>Profitability, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheki site</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mirvari</td>
<td>8.5</td>
<td>2248395</td>
<td>6800000</td>
<td>4551605</td>
<td>26.5</td>
<td>202.0</td>
</tr>
<tr>
<td>Perspektivli-1 F522 x Yu V 274</td>
<td>7.6</td>
<td>2248395</td>
<td>6080000</td>
<td>4151605</td>
<td>29.6</td>
<td>170.0</td>
</tr>
<tr>
<td>Perspektivli-2 F522 x Yu V 274</td>
<td>8.5</td>
<td>2248395</td>
<td>6800000</td>
<td>4551605</td>
<td>26.5</td>
<td>202.0</td>
</tr>
<tr>
<td>Perspektivli-3 PV236 x W23</td>
<td>8.0</td>
<td>2248395</td>
<td>6400000</td>
<td>4151605</td>
<td>28.1</td>
<td>184.0</td>
</tr>
<tr>
<td>Perspektivli-4 Yu V 273 x W23</td>
<td>9.1</td>
<td>2248395</td>
<td>7280000</td>
<td>5031605</td>
<td>24.7</td>
<td>223.0</td>
</tr>
<tr>
<td>Zakatala 68</td>
<td>10.0</td>
<td>2248395</td>
<td>7984400</td>
<td>5736005</td>
<td>22.5</td>
<td>255.0</td>
</tr>
<tr>
<td>Saatly site</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mirvari</td>
<td>8.8</td>
<td>2580123</td>
<td>7040000</td>
<td>4459877</td>
<td>29.3</td>
<td>173.0</td>
</tr>
<tr>
<td>Perspektivli-1 F522 x Yu V 274</td>
<td>7.8</td>
<td>2580123</td>
<td>6560000</td>
<td>3979877</td>
<td>31.5</td>
<td>154.0</td>
</tr>
<tr>
<td>Perspektivli-1 F522 x Yu V 274</td>
<td>8.0</td>
<td>2580123</td>
<td>6240000</td>
<td>3659877</td>
<td>33.0</td>
<td>142.0</td>
</tr>
<tr>
<td>Perspektivli-3 PV236 x W23</td>
<td>7.6</td>
<td>2580123</td>
<td>6400000</td>
<td>3819877</td>
<td>32.2</td>
<td>148.0</td>
</tr>
<tr>
<td>Perspektivli-4 Yu V 273 x W23</td>
<td>8.6</td>
<td>2580123</td>
<td>6080000</td>
<td>3499877</td>
<td>33.9</td>
<td>136.0</td>
</tr>
<tr>
<td>Perspektivli-5</td>
<td>8.2</td>
<td>2580123</td>
<td>6880000</td>
<td>4299877</td>
<td>30.0</td>
<td>167.0</td>
</tr>
<tr>
<td>Zakatala 68</td>
<td>7.9</td>
<td>2580123</td>
<td>6320000</td>
<td>3739877</td>
<td>32.6</td>
<td>145.0</td>
</tr>
<tr>
<td>Umumi ekin sahesi</td>
<td>7.7</td>
<td>2580123</td>
<td>6160000</td>
<td>3579877</td>
<td>33.5</td>
<td>139.0</td>
</tr>
</tbody>
</table>

Since the demand for maize is on the rise in Azerbaijan, it is worth expanding the activity of this project, which is certainly a candidate for extension. However, taking into account the commercial nature of the maize crop and the profitability demonstrated, it is
important that the project find a way to recuperate the expenses and gradually move towards a self supporting operation.

**PROJECT: SELECTION AND PROMOTION OF CHICKPEA VARIETIES WITH HIGH YIELD AND DISEASE RESISTANCE IN RAINFED AREAS OF AZERBAIJAN**

**May 2002 Monitoring/Evaluation**

This project has made excellent progress in regard the selection of new varieties with disease resistance and these should be promoted. Due to the rainy weather, the local varieties grown in Jelalabad region were highly diseased while the lines selected from the ICARDA nurseries were indeed very resistant. If their grain quality meets the requirements, they may very soon spread to many farmers in the region. The on-station trails to identify superior lines were good though they would benefit from one more replication. The on-farm trials met most of the evaluation criteria but lacked a treatment with the farmers' practice (local variety).

**June 2002 Monitoring/Evaluation**

On this trip the consultant was able to visit experimental plots and visit with project scientists of a number of different projects and in different regions during travel from Baku to the Ganja and Tovus regions. On June 7, the consultant visited the Absheron Experiment Station of the Research Institute of Agriculture. Chickpea variety trials were evaluated and project progress was briefly discussed with the CGS project leader. Small farmer chickpea demonstrations were visited in the Gobastan region. These plots were the least developed of any of the farmer plots visited during this entire trip of the consultant. However, the farmer and his wife were actively working in the plots. In addition these plots were at the most remote location visited. Thus, these demonstrations are likely to be successful at reaching the farmers needing the most help. Chickpea trials were also visited at the Gobacay Experiment Station of the Research Institute for Agriculture. Again these trials were well established and maintained.

**December 2002 Monitoring/Evaluation**

The project implemented the work plan, and the data obtained from the on-farm trials is shown below. The crop suffered tremendous losses due to disease in Jelalabad and as a result the local varieties yielded nothing. The new breeding lines turned out to be resistant and gave good yields. The farmers in the regions are demanding the seed of new varieties to multiply them. The breeding line F 95-45 selected from ICARDA international nurseries seems superior to all and will be submitted for the official testing as planned. The project will proceed in 2003 as planned. If funds are available this project can be expanded and extended since the varieties promoted are so much superior to the local germplasm. The crop also provided needed cash to the private farmers.
Table 7.7. Production data from on-farm trials comparing improved and local chickpea varieties.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Jalilabad</th>
<th>Gorubstan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yield, t/ha</td>
<td>Cost/ha</td>
</tr>
<tr>
<td>Astrahanbazar LC</td>
<td>0</td>
<td>500000</td>
</tr>
<tr>
<td>F.95-45</td>
<td>15.7</td>
<td>1654000</td>
</tr>
<tr>
<td>F.95-54</td>
<td>14.2</td>
<td>1654000</td>
</tr>
<tr>
<td>F.94-25</td>
<td>14.8</td>
<td>1654000</td>
</tr>
<tr>
<td>Narmin local</td>
<td>12.5</td>
<td>1654000</td>
</tr>
<tr>
<td>F.93-174</td>
<td>8.1</td>
<td>1654000</td>
</tr>
<tr>
<td>Average</td>
<td>13.1</td>
<td>1654000</td>
</tr>
</tbody>
</table>

PROJECT: A FARMER PARTICIPATORY APPROACH TO INCREASE THE USE OF EFFICIENT TECHNOLOGY FOR POTATO PRODUCTION BY SMALL-SCALE FARMERS

May 2002 Monitoring/Evaluation

On-farm verification of technology and demonstrations were conducted at three different farms in the Tovuz district. The team visited two locations. These were probably the most impressive demonstrations and at both these locations the plots were excellent. However, there was a minor problem of plot randomization for the variety demonstration, where all three replications for each of the varieties were accommodated on the same strip and the leader of the project agreed to rectify this problem in the second year.

June 2002 Monitoring/Evaluation

The consultant visited the Research Institute for Vegetable Growing and met with the Principal Investigator for the potato project. The project was modified for the first year and research was implemented only in the Tovus region. Experiments could not be initiated in the Jalilabad region (early production) due to the late approval of the project and release of funds. Significant progress had been made in this project and the experimental plots in Tovus were visited by the consultant later in this trip. Workshops have been planned and the project should be successful in completing the planned work. The consultant and PI also discussed how to ensure that the second year of the project move forward with appropriate treatments and experimental design based on the results from the first year. Initial plans for limiting the number of treatments were made – but a final decision will be made after harvest.

Two sites of the potato project were visited in the Tovus region. Both sites were in excellent condition and included both the variety trials and technology demonstrations. The P.I. for the project met with the consultant at the Ibrahimhajili village location. Examination of a few plants indicated that good tuber initiation had occurred and yields should be high. Various levels of poor weed and disease (Phytophthora) control were
obvious in neighboring fields. Again these fields could be used as direct comparison during future workshops. In one replication, the experimental fields were treated under wet conditions and significant plant damage could be observed. The P.I. discussed how this would be used to demonstrate poor timing of fieldwork during workshops.

A part of the Tovus-Baltiya LTD Company is located at this site. This company is conducting its own trials and providing training for local farmers. The company is involved in a wide range of other activities that support farmers, including contract field preparation, pesticide application, harvesting, seed cleaning and storage. The company is the national distributor for many pest control products and is considering developing a credit system for farmers. Mr. Mammadhanazanov Naiq, Company Director, expressed a commitment to helping farmers throughout the republic. This company appears to have the capacity to participate in a number of future projects of the CGS.

December 2002 Monitoring/Evaluation

Data obtained in the first year of the project on variety experiment are presented in the table below. By shifting from the farmer’s practice to the recommended technology the yield was doubled and further yield increase in the magnitude of 50-120% was obtained by using new varieties. The highest yield was obtained from the Dutch varieties Primura and Amingo.

Table 7.8. First-year data from experiments comparing different potato varieties at three sites.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Duz Gyrygli T/ha</th>
<th>%</th>
<th>Ibrahim Hadjili T/ha</th>
<th>%</th>
<th>Ala Kol T/ha</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmer variety &amp; technology</td>
<td>18.4</td>
<td>21.6</td>
<td>22.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmer variety + recommended technology</td>
<td>37.9</td>
<td>+106</td>
<td>49.9</td>
<td>+131</td>
<td>49.6</td>
<td>+118</td>
</tr>
<tr>
<td>Emiri 600 + recommended technology</td>
<td>48.8</td>
<td>+165</td>
<td>59.6</td>
<td>+176</td>
<td>54.4</td>
<td>+139</td>
</tr>
<tr>
<td>Sevinj + recommended technology</td>
<td>50.2</td>
<td>+173</td>
<td>55.8</td>
<td>+158</td>
<td>59.4</td>
<td>+161</td>
</tr>
<tr>
<td>Primura + recommended technology</td>
<td>59.5</td>
<td>+223</td>
<td>68.1</td>
<td>+215</td>
<td>66.8</td>
<td>+194</td>
</tr>
<tr>
<td>Amingo + recommended technology</td>
<td>58.2</td>
<td>+216</td>
<td>64.9</td>
<td>+200</td>
<td>63.7</td>
<td>+181</td>
</tr>
</tbody>
</table>

The data from the experiment with different technology components (see table below) suggest that single technology components such as variety, disease or pest control, or organic fertilizer improve yield by 20-50% and can be recommended to farmers. Unfortunately there is again a lack of economic analysis.

The potato project achieved excellent results. It is suggested that for 2003 it should concentrate on the best varieties and treatments identified in the first year.
Table 7.9. Yield improvement achieved using different combinations of technology components at three sites.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Duz Gyrgili Fertilizer</th>
<th>Ibrahim Hadjili Fertilizer</th>
<th>Ala Kol Fertilizer</th>
<th>Average Fertilizer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No T/ha</td>
<td>Yes T/ha</td>
<td>No T/ha</td>
<td>Yes T/ha</td>
</tr>
<tr>
<td>Farmer variety &amp; technology</td>
<td>17.2</td>
<td>18.5</td>
<td>21.4</td>
<td>23.3</td>
</tr>
<tr>
<td>Farmer technology + recom. variety</td>
<td>22.4</td>
<td>23.1</td>
<td>34.0</td>
<td>37.3</td>
</tr>
<tr>
<td>Farmer technology + irrigation</td>
<td>21.9</td>
<td>22.7</td>
<td>31.7</td>
<td>35.8</td>
</tr>
<tr>
<td>Farmer technology + organic fertilizer</td>
<td>18.6</td>
<td>19.2</td>
<td>27.6</td>
<td>33.2</td>
</tr>
<tr>
<td>Farmer technology + weed control</td>
<td>17.7</td>
<td>19.3</td>
<td>22.1</td>
<td>25.5</td>
</tr>
<tr>
<td>Farmer technology + disease control</td>
<td>20.8</td>
<td>21.4</td>
<td>28.5</td>
<td>31.6</td>
</tr>
<tr>
<td>Farmer technology + pest control</td>
<td>19.3</td>
<td>20.1</td>
<td>27.8</td>
<td>32.1</td>
</tr>
<tr>
<td>Optimal technology</td>
<td>32.4</td>
<td>38.0</td>
<td>43.6</td>
<td>50.7</td>
</tr>
</tbody>
</table>

**PROJECT: APPLICATION AND DEMONSTRATION OF TECHNOLOGY TO INCREASE COTTON PRODUCTIVITY**

**May 2002 Monitoring/Evaluation**

This project is being implemented by the Cotton Research Institute at two locations each at Saatli, Beylagan and Ujar districts. The team visited the on farm trials and demonstration at the Garajalar farm in the Saatli district. The plots looked excellent and we should expect good results from these trials.

Two aspects are covered under this project: verification/demonstration of improved cotton varieties and verification/demonstration of improved production technology. During the second visit in August-September we made observations at two locations each at Saatli and Beylagan. The same trials are repeated at two more locations in Ujar. Trials in general were excellent and the collaborating farmers were very pleased with the outcome. Most of the plots should yield over 4 t/ha and some of them may even reach 5 t/ha. The yield in farmer fields in this region will be around 2.5 t/ha at best.

Like most other trials, these did not include any randomization. It is suggested that next year each replication should be planted in a different farmer's field at each location. This year there were six farmer collaborators and with the recommended change in strategy during the second year there will be 18 farmer collaborators.

**December 2002 Monitoring/Evaluation**

The cotton project made good progress in 2002, and preliminary data are reported in the table below. Data on the technology trials are not presented since the complete data are not available. However, the technology applied in the project also doubled the yield. For 2003 the project plans to change some of the varieties tested and add one more
technology – dense planting of cotton which saves labor and requires less mechanization. The main challenge of the project remains establishment of working relations with the processing industry and private companies which are monopolizing the cotton production sector in Azerbaijan.

Table 7.10. Comparing yield data for farmers’ and improved cotton varieties in two regions.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Yield after 1st picking T/ha</th>
<th>% of farmer’s variety</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Saatly region (2 farms)</td>
<td></td>
</tr>
<tr>
<td>Abdas- 3 (farmer’s variety)</td>
<td>25.8</td>
<td>-</td>
</tr>
<tr>
<td>Gence-2</td>
<td>29.3</td>
<td>+13</td>
</tr>
<tr>
<td>Gence-8</td>
<td>29.5</td>
<td>+14</td>
</tr>
<tr>
<td>AzNIXI-170</td>
<td>28.8</td>
<td>+11</td>
</tr>
<tr>
<td>AzNIXI-104</td>
<td>28.4</td>
<td>+10</td>
</tr>
<tr>
<td>Gence-80</td>
<td>28.9</td>
<td>+12</td>
</tr>
<tr>
<td>Karmen</td>
<td>22.3</td>
<td>-14</td>
</tr>
<tr>
<td>Cukuroba</td>
<td>21.4</td>
<td>-17</td>
</tr>
<tr>
<td></td>
<td>Beylagas region (2 farms)</td>
<td></td>
</tr>
<tr>
<td>AzNIXI-33 (farmer’s variety)</td>
<td>25.1</td>
<td>-</td>
</tr>
<tr>
<td>Karmen</td>
<td>16.7</td>
<td>-34</td>
</tr>
<tr>
<td>Cukuroba</td>
<td>13.3</td>
<td>-48</td>
</tr>
<tr>
<td>Mugan-395</td>
<td>21.1</td>
<td>-16</td>
</tr>
<tr>
<td>3038.00</td>
<td>22.9</td>
<td>-9</td>
</tr>
<tr>
<td>Gence-78</td>
<td>27.0</td>
<td>+7</td>
</tr>
<tr>
<td>AzNIXI-195</td>
<td>30.6</td>
<td>+22</td>
</tr>
</tbody>
</table>

PROJECT: APPLICATION AND DISSEMINATION OF NEW TECHNOLOGY TO INCREASE APPLE, POMEGRANATE, HAZELNUT, AND WALNUT PRODUCTIVITY

June 2002 Monitoring/Evaluation

Pomegranate seedling beds were visited in the Goychay region. The success rate for seedling establishment was very high (> 80%). These plots clearly demonstrated differences in establishment between varieties. This information should be useful in planning future production of sufficient numbers of seedlings to meet experimental or commercial requirements.

The consultant visited the Research Institute for Horticulture and Subtropical Crops in Guba. Two projects, “Application and Dissemination of New Technology to Increase Apple, Pomegranate and Hazelnut Productivity” and “Propagation and Dissemination of Tea Clones and Application of Methods to Increase Tea Productivity” were discussed with the Director of the Institute. Originally a small effort was planned for walnut in
addition to the three major fruit and nut crops. After evaluation of the resources available for this project, the investigators elected not to include walnut. The consultant fully supported this decision.

Production of seedlings or grafted seedlings for pomegranate, apple and hazelnut was in progress. A visit of the seedling bed for apple rootstocks showed vigorous growth and high survival. Grafting will occur in approximately three months and planting next year. For hazelnut and pomegranate, seedlings have been rooted and will be planted in approximately 6 months. A technology demonstration plot for apples was also visited and the plots were in excellent shape. As in other regions of the Republic, the Guba region has received an unusually high amount of spring rain that has favored disease development. Given the location of the demonstration plots among many other farmers’ orchards with different management methods, the demonstration plots will be useful for comparing a variety of practices including tillage, mowing, fertilization, irrigation and pest control. Recommendations were made to include training of farmers on maintaining record books of field activities as a learning tool. In addition, the plots would benefit from more signs describing the field layout and various aspects of treatments. The project leader was asked to add these to the on-farm trials.

August-September 2002 Monitoring/Evaluation

This project aims at producing saplings of three fruit species (apple, pomegranate, and hazelnut) and also demonstrates production technology to the farmers. The project is being implemented in the regions of Zagatala, near Shaki, and Guba. All activities are undertaken in collaboration with farmers. This project is well conceived and the activities so far would indicate that it should produce good results.

The tree fruit and nut project continued to make progress. Grafting of apples was in progress. Hazelnut seedlings were ready for orchard establishment. Given the perennial nature of these crops, I would like to see some means to ensure commitment to the project by scientists beyond the funding period for the project.

Concerning the seedling production, it would be useful to clarify that the aim of the project is to provide technical assistance to the farmer to produce quality seedlings and also help the farmer in obtaining a certification to the effect that these are quality seedlings. During the project phase the project should pay the cost of technical help and certification and after the project the institute should be willing to provide the same services to the farmer, provided the cost of such services is born by the farmer. This should be viewed as an initiative in establishing private enterprise.
PROJECT: CULTIVATION AND DISTRIBUTION OF HIGH QUALITY TABLE GRAPE SEEDLINGS RESISTANT TO PHYLOXERA

June 2002 Monitoring/Evaluation

The consultant visited the Research Institute for Viticulture and Wine Making. During this visit the implementation of the project for grape production was discussed with the P.I. While it is early in the project, significant progress has been made. As proposed, 5000 grafted seedlings have been produced. These included the 7 varieties and 6 rootstocks that were proposed for the two regions where the project is being implemented. A workshop for training farmers on grafting techniques has been planned. Farmer cooperators have been identified and the fields are being prepared to plant the seedlings produced in the first year in December 2002.

The Ganja Experiment Station of the Research Institute for Viticulture and Wine Making was also visited. This station had produced a number of grafted seedlings for use in the project. The success rate in general was high, but varietal differences had been noted. The visits to the on-farm and experiment station seedbeds confirm the progress of this project. A site for on-farm production of grafted grape seedlings was visited in the Shamakhi region. The success rate for seedling establishment was very high (> 80%). These plots clearly demonstrated difference in success among varieties. This information should be useful in planning future production of sufficient numbers of seedlings to meet experimental or commercial requirements.

August-September 2002 Monitoring/Evaluation

This project is based at the Grape Research Institute at Ganja. The only aim of this project is to multiply appropriate table grape varieties and make them available to smallholder farmers. A very modest attempt is underway to graft table grapes on to root stocks having resistance to wilt disease. The nursery is very small and the success rate of grafting is only around 60%. To be successful the project must make this a much bigger effort and get some private nurseries involved. Some means to ensure commitment of scientists beyond the funding period for the projects on perennial crops needs to be developed.

PROJECT: PROPAGATION AND DISSEMINATION OF TEA CLONES, AND APPLICATION OF METHODS TO INCREASE PRODUCTIVITY

August-September 2002 Monitoring/Evaluation

This project had two objectives. The part of the project directed at seedling production was excellent. Farmers were involved and it was clear that they had been actively engaged in the project and acquired the knowledge needed to be successful in the future. In contrast, a demonstration plot for appropriate production technology was poorly implemented. In fact, these demonstration plots were more complex than proposed in the
original proposal. The size and scope of the plots are not justified: such an effort is not needed nor is the project budget sufficient. It was recommended that technology be demonstrated on several farms in small unreplicated plots. The different farms would serve as replicates for statistical purposes. The work should be limited to two treatments, farmer practices and a full technology package.

This project is being implemented at a location very close to the Lankaran tea research station. The objectives of this project are very similar to that of the fruit project. The seedling production of tea is much more complicated than the fruit crops, but the scientist has done a great job in placing the technology in the hands of the farmers. The comments made for the fruit crops are equally applicable to tea also. **The execution of the technology part of this project is very poor and is not likely to produce any tangible results. It is suggested that it should be abandoned and in its place a production package demonstrated in three farmer fields. One of these should be on a hillside, the second on level ground and the third on the experiment station.**

**PROJECT: CONTROL MEASURES AGAINST DISEASES AND PESTS THROUGH APPLICATION OF EFFECTIVE PESTICIDES WITH SMALL SPRAYERS IN FARMER HOLDINGS**

**June 2002 Monitoring/Evaluation**

The consultant visited a number of sites of the project on pest management. The participants in the project “Control measures against diseases and pest through application of effective pesticides with small sprayers in farm holdings” and the consultant met at the Research Institute of Plant Protection in Ganja. Demonstration experiments have been initiated at three vineyards. The high rainfall and humidity together with warm temperature were favorable for both mildew and grape worm development. At the experimental sites the researchers were able to provide effective control with two well-timed sprays. Other farmers in the surrounding vineyards, had applied 0 – 4 treatments and had not effectively controlled mildew or worm. This was confirmed by visiting all three on-farm sites in the area surrounding Ganja. As individual farmer holdings had been taken directly out of the large collective vineyards that existed under Soviet control, direct side-by-side comparisons can be made with a number of different farmer practices during the workshops that are planned for the future. The tomato part of the pest control project is just being initiated: two farmer holdings had been identified and the seedlings are being grown for planting. The consultant will evaluate these experiments in the fall. Other notable aspects of the projects are training of the farmers in effective record keeping of all cultural and pest control measures and the preparation of a catalogue of recommended chemicals (approximately 80) for pest control in different crops for the Republic. In addition, a computer has been purchased for project use. Computer purchases had occurred in a number of different projects and again have enabled scientists to increase their activities in general.
August-September 2002 Monitoring/Evaluation

This project aims at demonstrating optimum control measures against pests and diseases of grapes and tomato and also demonstrates the usefulness of small sprayers.

In the case of tomatoes, the variety used was too susceptible and as a result too much application of chemicals was needed. The farmer stated that the technology is too complicated for him and that he will not adopt the technology. It is suggested that the technology package of this project should include a resistant variety and appropriate agronomic practices to reduce pest and disease incidence, with chemicals used only as a last resort.

With respect to the grape project all the farmers were extremely happy with the project and have stated that they would follow the practices even if the technical help is withdrawn. Attempts should be made to extend this project to cover more representative, poor farmers.

Review of this project identified both excellent and poor aspects. The two parts of the project, grapes and tomatoes, differed widely in their effectiveness at demonstrating technology. It was evident that the two grape growers were engaged in the research, learning new technology and sharing this knowledge with neighboring farmers. They indicated a high degree of confidence in continued use of the technology in the future. In contrast the tomato grower seemed poorly informed about the research/demonstration and more interested in temporary free input. Among the grape growers, the two participants seemed well selected and were obviously accessible to surrounding farmers. These growers also seemed to be engaged in a learning process. The third grower had academic training and experience in grape growing. Though he should have been already knowledgeable, his background in fact seemed to impede his willingness to learn (already being an expert). In addition, a critical review of his farm indicated that he was not controlling mildew and other diseases in his nursery area. Finally his farm was not conveniently located relative to other vineyards. These problems point to the requirements for proper selection of farmers. All project leaders should be encouraged to share their experiences with farmer cooperators so that they can learn from success as well as failures.

PROJECT: ESTABLISHMENT OF CONTINUOUS YEAR-ROUND GREEN FORAGE PRODUCTION IN IRRIGATED ENVIRONMENTS OF AZERBAIJAN

December 2002 Discussion

The on-farm trial/demonstration was established at a private farm of the Ziya village, Mollaullyumer, Berde region. The total area of the big plots is 3 ha including 1 ha of barley and vetch, 2 ha of triticale and vetch. In spring 1 ha of maize will be planted. The experiment with small plots (10 m²) includes winter, facultative and spring varieties of triticale, barley and oats both alone and in mixtures with vetch. The biomass is being harvested regularly and yield estimated. Planting was conducted on September 18 and the stand establishment was good.
NEW PROJECTS (STARTED IN 2002)

PROJECT: FARMER PARTICIPATORY SELECTION AND DISTRIBUTION OF WHEAT VARIETIES FOR THE DRYLAND REGIONS OF AZERBAIJAN

December 2002 Monitoring/Evaluation

Three regions were selected: Sheki, Zakatala and Gobustan. The trials at each site involve five new drought tolerant varieties either submitted for official testing already (Azametly, Gobustan, Nurlu) or in the process of submission. The area at each site is 3 ha and the area under each variety is 0.6 ha.

PROJECT: APPLICATION OF EFFICIENT CONTROL MEASURES AGAINST WIDESPREAD WHEAT WEEDS IN DIVERSE REGIONS OF AZERBAIJAN

December 2002 Monitoring/Evaluation

The projects first goal is to collect and analyze the data on the spread of weed species in different regions of the country. The preliminary results show that the most widespread weeds are wild oats, *Vicia arvensis* and *Barbarene*. Three regions were selected for the on-farm trials and demonstrations including irrigated condition, areas with sufficient rainfall and the region with insufficient rainfall. The trials under irrigated conditions follow two preceding crops: winter wheat and cotton. The rainfed trials will follow wheat and fallow. The treatments include:

- Farmer’s practice (no control)
- Herbicide application against monocotyledonous species.
- Herbicide application (50% rate) against monocotyledonous species
- Herbicide application against dicotyledonous species
- Herbicide application (50% rate) against dicotyledonous species

The trials were established at four sites with a total area of 16 ha. The field activities of the project have been initiated on time and according to the work plan.

PROJECT: PROMOTION OF EFFICIENT PLANTING TECHNOLOGY TO IMPROVE IRRIGATION EFFICIENCY AND REDUCE SEED RATE

December 2002 Monitoring/Evaluation

The projects compares progressive bed-planting technology for wheat with regular solid planting. The new technology allows savings of water and seed. Three farmers were selected in Karabakh valley. The trails are established on a total area of 15 ha. The regular planter normally used for cereals seed multiplication (SN-16) was modified to plant and make beds at the same time. At the same time the project leader was sent to CIMMYT headquarters in Mexico for specific training on bed planting for five weeks. Three planters designed for bed planting were ordered from Turkey with the help of the GTZ project in Azerbaijan.
PROJECT: PROMOTION OF WHEAT PRODUCTION IN NAKHCHIVAN AUTONOMOUS REPUBLIC THROUGH THE USE OF NEW HIGH YIELDING WHEAT VARIETIES AND APPLICATION OF CULTIVATION TECHNOLOGY IN FARMER HOLDINGS

December 2002 Monitoring/Evaluation

Wheat is the dominant crop in Nachichevan Republic occupying 20,000 ha. Since the republic is isolated – it needs to produce sufficient amounts of grain and is approaching self-sufficiency. In 2002, 57,000 t of grain was produced. Wheat research is limited to variety testing and seed production by a Department of Breeding and Seed Production of Nakhichevan Agric. Res. Inst. The institute is not part of the national network of wheat breeding, nor does it participate in international collaboration. Efforts will be made in 2003 to incorporate this program into the overall cooperative arrangements with CIMMYT and ICARDA. The other important crop is sugar beet occupying 7,000 ha. It is processed either in Turkey or Iran and the sugar returned to the producers as payment. Alfalfa occupies 5,000 ha and is an important crop for livestock feed.

The new project is similar to the Technology project but has a focus on the specific geographic area of Nakhichevan. The field activities started in the fall of 2002. On-farm trials/demonstrations were planted at four sites in two rayons: Babek and Sharora. An area of around 2 ha is planted at each site with 10 varieties of winter wheat and barley. Two seeding rates and different technologies are applied. The project communicates with the regional consulting centers. More emphasis/attention should be given to this project since the project personnel did not participate in the previous CGS program activities.

PROJECT: TO ACHIEVE SUSTAINABLE CROP PRODUCTION IN FARMER HOLDINGS THROUGH IMPROVEMENT OF STRUCTURE AND FILTRATION CAPACITY OF WEAK AND MEDIUM SALINE SOILS

December 2002 Monitoring/Evaluation

The project involves three research institutes. Soil analysis was conducted at two selected sites in the Shirvan and Udjar regions. The area at each site is 1.5 ha divided into two: 1 ha subjected to deep drainage tillage and 0.5 ha with regular soil tillage and irrigation. A variety trial consisting of 10 wheat varieties, 6 barley varieties and 3 triticale has been planted under both treatments. The planting was a little delayed but the germination is expected to be good. During summer, sorghum will be planted to reduce evaporation. An effort should be made to prepare a detailed report on the type of salinity of different regions if the data is available. If not, soil analysis should be conducted.
General Observations

May 2002 monitoring/evaluation
In general, a very good start was made in implementing the CGS projects. Given the fact that it is the first time that many of the scientists are implementing a project of this kind and also given the fact that the machinery available for conducting the trials is inadequate and inappropriate, the project scientists have done an excellent job. It was agreed that some modifications may be made in the work plan for the second year in order to rectify the problems encountered during the execution of the project in the first year.

Meeting with project leaders
Subsequent to the visit, the team met with some of the project leaders on the 21st of May to discuss the findings of the evaluation mission and also to respond to some of their concerns.
1. It was found essential to make some modifications to the current work plan of some of the components to make the project more effective. A modified work plan, approved by the Secretariat, should be added to the project contract.
2. Also it was found essential to make some modifications to the budget. Again, modified budget tables approved by the Secretariat should be added to the project contract.
3. Projects are unable to make use of the overhead line item in the budget because the accounting department insists of having documentary evidence. Dr. George Varughese agreed to contact the concerned people at the World Bank and seek their assistance in resolving this problem.
4. Also, the accounting department insists on having three quotations for all procurements irrespective of the size of the item. Once again it was agreed that we will seek help from the Bank.
5. Farmer collaboration and cost/benefit sharing. There are differences in the contractual agreements between projects and it is suggested that the Secretariat should develop a standard set of regulations for the cost/benefit sharing to be used by all new projects, or when the current contracts are renegotiated. For perennial crops the terms and conditions should be different from that of the annual crops.
6. Can additional activities be added to the project? Yes, as long as it does not divert the basic objective of the project and if the added activity strengthens the project.
7. Can we change the field sites from one place to another to facilitate better conduct of the project? Yes.

By the time of the visit, eleven projects were being implemented and there were 41 project field sites established in the country. Specifically with respect to field crops there were 6 projects underway and 29 field sites across the country. Twelve sites were visited and reviewed during the trip in May. The review and evaluation of the projects concentrated on two major aspects: evaluation of the field activities per se and evaluation of the projects based on the field and other activities taking into account the work plan and the project objectives.
Evaluation of the project field sites was based on eight criteria summarized in Table 1(?). The general comments across the projects are:

- The on-farm demonstrations and trials are mainly conducted on big plots and are good for demonstration of the technologies. They are relevant taking into account the project objectives.
- The involvement of the farmers is very good. Most of them understand the objectives of the trials and actively participate in the implementation: they do not just give land for the projects.
- The general agronomy of the demonstrations/trials is very good and the farmers participating in the project will benefit greatly.
- Presentation of the trials/demonstrations to visitors is poor. Though the general signboards are in place and of good quality, it is difficult to see the field layout and maps were not available.

The general conclusion of the team visiting the sites was that within a limited period of time tremendous progress has been made in the work directly with farmers and communities in promotion of better technologies. However, it was also noted that the field activities alone are not the objective of the grant project but rather a mechanism for reaching the project goal and the importance of other activities should not be underestimated.

At the final meeting with the Project Secretariat it was once again emphasized that the second phase of the project should follow the guidelines drafted during the National Consultancy Workshop in November, 2001.

**December 2002 monitoring/evaluation**

1. As far as can be judged from the project reports in the Azeri language, there is no uniform requirement for the yearly technical report or they are not followed. The requirements or the templates should be developed, following the objectives or activities of the project. There is no need for big reports but they should be uniform and follow a defined pattern.
2. The system of project evaluation has not been developed yet. It cannot be limited to the evaluation of field activities only and should be based on achieving the project objectives.
3. Economic analysis of the trials and cost/benefit calculations of different technology components should be presented in great detail, and should be one of the main criteria for defining recommendations of technologies. So far no project has reported sufficient economic analysis. Special training of project participants in this respect is well justified.
4. The capacity of the Secretariat to conduct monitoring and evaluation of projects is limited, especially taking into account the need for translation of the report, summary and data. It is suggested, therefore, the issue of employing an additional individual in the Secretariat to conduct this activity should be raised.
8. Suggestions for the Future

Results of the first stage projects would indicate that CGS is a very successful project and it has made a very good beginning. The staff of the Secretariat are highly qualified, motivated, dedicated and are very hard working. CGS receives very good support from the concerned organs of the Government and the Board. The following observations and suggestions are made in order to make the CGS even better.

KEY OBSERVATIONS ABOUT PROJECT EXECUTION

• In general the quality of project proposals were very poor and this trend continues to be true even for the second stage. This is manifested through the inability of the scientists to clearly define the problems that the Azeri farmers face, to develop logical conclusions concerning each of these problems, and suggest specific solutions other than general statements. Lack of exposure to modern scientific literature due to their inability to read and write English, lack of active involvement in research for many years, lack of opportunities to know what is happening in the outside scientific world and pride about their past could be reasons for this poor performance. Thus the most important assumption on which the CGS was based - that there is plenty of scientific talent available and it is possible to jump-start the CGS - proved to be incorrect. Hence the Secretariat staff and the consultants had to be heavily involved in helping the scientists in revising the project proposals various times before they were acceptable. The only long-term solution to this is through training. Training should be treated as an integral part of the CGS and it should be given the highest priority in the second phase, so that Azeri scientists will be better prepared to serve the nation.

• Lack of time: CGS is a great idea and has potential to help the Azeri farmers in resolving some of their constraints in improving productivity and profitability. However, the total time available to implement the first phase of this project was only three and a half years. Given the fact that this is the first time a project of this kind is being implemented in Azerbaijan and that there is a general lack of preparedness of the scientists to develop and execute on-farm research, the need to develop ground rules and educate the scientific community on the mission and vision of the CGS, meant that a greater gestation period than envisaged was necessary. Thus the first projects were awarded only in September, 2001, a year and three months after the initiation of CGS. Thus the total effective time available to execute two or three rounds of project submissions was only two years and three months. This is too short a time taking into account the need for two or three revisions of the project proposals before they were of acceptable standard. It was inevitable, therefore, that there would be some delays in accomplishing all the initially conceived goals and objectives of the CGS. It is important to recognize the commitment, enthusiasm, and dedication of the staff of the CGS Secretariat towards the cause of CGS: the delays were inevitable and not of their making.

• Lack of proper institutional structure to address the needs of the resource poor farmers. Current institutions were built many years ago to address the needs of a
much larger republic having large-scale socialized farming. Since independence almost all the arable land was privatized and Azerbaijan has adopted policies that encourage a free market economy. However, the research institutions continue to function as highly specialized institutions, with little cooperation between institutions and with small operational budgets. All activities of the CGS are undertaken in this very difficult institutional structure and there is urgent need for change: this should be a top priority in the second phase of the CGS.

• Lack of proper equipment and infrastructure to undertake research, especially on-farm research. All equipment and machinery available to the researchers are out-dated and mostly non-functional. There had been no investment in infrastructure development for agricultural research for more than a decade. For the CGS to be effective, some investment towards infrastructure development is essential and urgent. This aspect should receive higher priority in the second phase.

• The current staff of the Secretariat will not be able to handle efficiently the increased number of the projects once the second phase starts, as evaluation/monitoring of the on-going projects as well as the selection process of the new projects will be required. It is recommended that either CGS staff be increased or short-term local consultants be contracted for project evaluation/monitoring.

• Lack of technical expertise for evaluation and monitoring of livestock projects at the CGS Secretariat. The current staff of the Secretariat are highly qualified, motivated and dedicated. However there is no one in the group with adequate technical background in handling livestock issues. Hence, it is strongly suggested that if one of the current technical advisors leaves the service of the Secretariat, that vacancy should be filled with an individual having expertise in livestock.

• The overall economic component of the project can be strengthened through better economic analysis of the technologies and technology components; and the formulation of specific economic projects.

ADDITIONAL OBSERVATIONS ON PROJECT IMPLEMENTATION

• In general in most cases the selection of collaborating farmers and their location were done in a hurry and as result there were deficiencies in this respect. Care should be taken to make sure that the farmers are representative of the farming community and also that the locations have easy access.

• Lack of participation in the CGS projects by private enterprises and non-governmental organizations. There is some collaboration in some of the projects, but there is need to encourage more participation of private companies and NGOs in future CGS projects.

• Most of the on-farm verification/demonstration trials had three replications, but there was no randomization in any of the locations. In addition, plots were too big and in many cases occupied the entire farm. It is suggested that replications be established on different farms, with only one set of treatment plots (one replication) on any one farm. This will allow an increase in the number of demonstration sites, as well as statistical analysis of the data across farms, as well as avoiding turning the whole of any farm into an experimental site.
• A number of projects have negotiated independent contracts with farmers and, as a result, there are differences in the terms of the contract from one project to the next. An attempt should be made to bring uniformity to these contracts.

• The projects need to develop a clear model of relationships with the farmers which will eventually lead to a mutually beneficial contract. Technologies which double yield on the farmers’ fields bring tremendous benefits to the farmers, who in turn should share these benefits with those who developed and delivered the technologies. Possibly a special short-term economics contract/project is justified to develop such models. The sustainability of the project lies in the farmer/researcher/extensionist relations.

• CGS projects should adopt uniform field display signs. Each of these should show at the top the name of the organization conducting the trial/demonstration, followed with the title of the project and the funding agency (i.e. ADCP) and the World Bank.

**Potential External Project Evaluators**

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ACKNOWLEDGMENTS

The consultants wish to acknowledge the following organizations and individuals for contributing to the project implementation and assisting the team in completing the tasks assigned under the contract.

- Ministry of Agriculture and HE the Minister Mr. I. Aliev for constructive dialog and guidance throughout the project.
- Agency for the Support of the Development of the Agricultural Private Sector and the Head of the Agency, Mr. V. Huseynov, for his excellent working relations, good support of the team and responsive attitude towards the Competitive Grant System.
- The Competitive Grant System Secretariat and the Head, Dr. M. Nabiev, for their most sincere attitude towards the goals of the project and its implementation, and for making the missions of the team productive and enjoyable. Special thanks go to Mr. Yagub for his communicative skills, translation, and personal attention to various needs of the consultant team.
- Prof. Jelal Aliev as Chairman of the CGS Board, a scientist and a citizen, for his wisdom, guidance and support while designing and implementing the project.
- The Azeri Center of Agricultural Research, and its Director General, Dr. A. Musayev, for open cooperation with the research institutions of the center, productive discussions and support.
- The World Bank staff: J. Srivastava, R. Southworth, D. Lugg and R. Chragzade for their responsive, constructive and supportive attitude.
- The numerous scientists and research administrators involved in regional and national meetings, preparation and implementation of the CGS projects: without their contribution and efforts the project would never have reached its objectives.
- Numerous farmers and local administrators for frank discussion and guidance of the project as well as for accepting the risk of providing their fields and resources for the on-farm activities.
- The devoted support staff, especially drivers and interpreters, for making the travel and work in Azerbaijan meaningful and productive.
- Our parent institutions, CIMMYT, Oregon State University, and Cornell University, for supporting us while working on this project.

REFERENCE

## Appendix 1: List of Surveyed Villages

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Source: RRA and PRA Survey Data, 2001
Appendix 2. Evaluation of the CGS project field sites, May, 2002.

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<th>Project</th>
<th>District/ Farm</th>
<th>Location accessibility</th>
<th>Location suitability</th>
<th>General agronomy</th>
<th>Layout to meet the objective</th>
<th>Demonstrativeness of the trial</th>
<th>Farmer involvement</th>
<th>Presence of the farmer technology</th>
<th>Scheme availability</th>
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Score 1-5: 1 - very poor, 2 - poor, 3 - satisfactory, 4 - good, 5 - very good.
### Appendix 3: Participatory Variety Selection Form

**Site**
**Date**
**Plant stage**
**Evaluator**

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<th>Crop traits</th>
<th>Evaluation (score 1-5)</th>
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<td>Not suitable at all</td>
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<tr>
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<td>Suitable but has</td>
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<td>deficiencies</td>
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<tr>
<td></td>
<td>Ideal</td>
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<td>Plant height (relevance to the environment tolerance to lodging)</td>
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<tr>
<td>Spike productivity (spike length and number of grains)</td>
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<td>Uniformity (even height of the plants and spike type)</td>
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