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Government of Azerbaijan

Ministry of Agriculture

State Agency of Agricultural Credits

AGRICULTURAL DEVELOPMENT AND CREDIT PROJECT III (ADCP - 3)

RECOMMNEDATIONS FOR THE DEVELOPMENT OF THE NATIONAL INTERGRATED PEST MANAGEMENT PROGRAM (IPM) AND PEST MANAGEMENT PLAN (PMP) FOR THE PROJECT

June 2012

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List of acronyms

ADCP	Agricultural Development and Credit Project
APL	Adaptive Program Lending
CAC	Codex Alimentarius Commission
CGIAR	Consultative Group on International Agricultural Research
CPS	Country Partnership Strategy (of the World Bank)
EMP	Environmental Management Plans
EMPRES	Emergency Prevention System for Trans-boundary Animal and Plant Pests and Diseases
EPPO	European and Mediterranean Plant Protection Organization
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FFS	Farmer Field School
GOA	Government of Azerbaijan
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
M&E	Monitoring and Evaluation
MOA	Ministry of Agriculture
MOU	Memorandum of Understanding
MRL	Maximum Residue Limits
NMTPF	National Medium Term Priority Framework
NPPO	National Plant Protection Office
PAC	Private Advisory Centers
PMP	Pest Management Plan
PMU	Project Management Unit
POPs	Persistent Organic Pollutants
RASSC	Republican Agrarian Sciences Service Centers
SPCS	State Phitosanitary Control Service
SPS	Sanitary and Phytosanitary Measures
WTO	World Trade Organization

Executive Summary

Azerbaijan blessed with nine distinct climatic zones is a highly diversified agricultural production system, producing high value fruits (apple, grapes and pomegranate), nuts and vegetables, along with a variety of field crops including grains and cotton, etc. and has the potential of becoming a center for high value-added food processing industries. Improvement in the production methodology is necessary for enhancing production, which will generate off-farm economy and high wage labor opportunities. However, optimizing yields can only be insured with highly professional research and advisory support to farming sector, and unless farmers can meet the highest production standards, the goal of meeting international quality standards will remain unachievable.

This had challenged farmers with an array of pests and diseases specific for different crops, as well as for the cropping systems. While apple, a horticultural crop, and cotton a field crop, are severely affected by several insect pests and diseases, requiring an array of crop protection tools, wheat is mostly damaged by fungal diseases (rusts and smuts), which can be controlled largely by building disease resistance (long-term control strategy), biological control (rust mite) and seed treatment with fungicides. Several viral diseases and weeds further add to this challenge. At the same time, there is an ever present danger of introduction of new pests and diseases.

Since the 1950s DDT 5% was the choice pesticide applied against pests in cotton plantations, both by ground (20-25 kg/Ha) and aerial (15-20 kg/Ha), 4-5 sprays and sometime 8-10 sprays during the season. An exception to its use was made for Azerbaijan even when it was banned in the rest of the Soviet Union, and about 500 thousand tons of 5% DDT was used into early 1980s. Some obsolete stocks of DDT still exist and FAO is preparing an intervention to address obsolete pesticides.

Azerbaijan is also affected by several locust pests including the Moroccan Locust, which is one of the most serious agricultural pests in the region and has a relatively high outbreak occurrence. All these efforts are indicative of GOA's efforts to develop mechanism to address agricultural and livestock production and protection against pests and diseases on scientific and sustainable basis.

Azerbaijan aims to join WTO, which requires application of principles of WTO Agreement on Application of Sanitary and Phyto-Sanitary Measures (SPS) and reaching equivalence of food control system with other WTO members. Azerbaijan produce was rejected at various ports, especially hazelnuts because of contamination with aflatoxins. To overcome these hurdles, government aims to strengthen the national sanitary and epidemiology control, veterinary control, phyto-sanitary control, and compliance with minimum quality parameters through ecologically sustainable agriculture focusing on environmentally sound farming practices, reducing reliance on synthetic chemicals, thus pursuing IPM. Thus without any anticipated pesticide procurement in the under preparation ADCP-3, the GOA had pursued the preparation of this PMP to show its intent to improve compliance not only with World Bank's Safeguard on Pest Management (O.P. 4.09), but to reaffirm its commitment to the general safety of producers and consumers: both domestic and for export; and the improvement of environmental quality, since

improved resources for agricultural production may lead to increase in the use of agrochemicals including chemical pesticides.

Government does not procure chemical pesticides for distribution or sale in the country. The private sector is active in importing and marketing pesticides as well as pesticide application equipment. All marketing outfits emphasize their responsibility in creating awareness of the risks associated with chemical pesticides. There are training session held periodically, and in addition to selection of appropriate products – which usually are what the firms itself sells, proper application methodology, and safety practices are also highlighted, and safety gear is displayed prominently and is easily available, along with an acknowledgement that more needs to be done by the Ministry of Agriculture (MOA).

Usually, the pest control strategies in use were developed by the crop-based research institutes, some decades ago, and there is some revival in research even though many scientists work for private sector, usually working for pesticide and other input marketing companies, promoting pesticide sales instead of focusing on their research programs, IPM or otherwise, full time. There were pest thresholds against apple pests, cultural and mechanical control initiatives for cotton and fruit crops, and biological and microbial control programs against major pests. There is a pest forecast and warning group which continued to operate throughout this transition from the former Soviet centralized command system to the current on 'the road to free market' setup, and can play an effective role in forecasting pest infestation, thus enabling of rationalization of pest control decisions, as well as assist quarantine services in monitoring accidental introduction of pests and diseases in the country. All these would warrant enhanced coordination and the ADCP-3 would be ideal by virtue of its being centrally located within the MOA.

More recently, the State Phytosanitary Control Service (SPCS) was established under the MOA in 2004 to regulate all pesticide related issues. This Law defines legal basis for tests, registration, use of pesticides and agrochemical substances and organization of agrochemical service in agriculture which includes regulations/rules for production, import and export, packing and labeling, storage and transportation, use, removal of expired and prohibited substances, clean-up and elimination of pesticides and agrochemical substances, and there is no reference to adoption of IPM principles, however, even the full compliance of the provisions of the said law in regard to registration may also be questionable.

The procedure calls for pesticides to be approved by a 15-member Pesticide Approval Committee (specialists/experts chosen from various government agencies – MOA, Ministries of Health, Natural Emergencies, Environment, etc.) on the basis of field data obtained during two years of field trials at research institutions. Products are registered for a period of five years, after which it must be re-registered. There are no subsidies for crop protection products, but they are exempt from import duties and taxes, which may play a role in promoting pesticide use by business. The toxicological labs at SPCS need equipment, up gradation and staff training without which modern equipment remains unused, and above all, there is a need for more transparency, including release of approved pesticide lists on a regular basis as well as product approval and import authorization processes. ADCP-3 can strengthen the functions of this service to enable it in the discharge of its duties, however, the service has to adopt transparency and accept the coordination role of ADCP-3.

Ministry of Natural Emergencies also maintains pesticide stocks and capacity for control of Locust, a periodic occurrence. A specialized agency is responsible for incineration of obsolete pesticides, but there are several thousand tons of obsolete pesticides at various sites in the country.

At one time, Azerbaijan had many biological control labs, producing egg parasite *Trichogramma* mostly for control of cotton bollworms. Most of these facilities were abandoned and many serve as shelters for internally displaced persons at present. ADCP-3 will support Plant Protection Institute with the revival and establishment of biological control program as well as in establishing the rearing lines for major bio-control agents. Biological control can be effective in pest control in green house cultivation, an increasing trend. There is some interest in the use of biological control by some field crop promoters as well, especially cotton.

The ADCP-1 and -2 have already supported and piloted individual initiatives which are necessarily elements of a comprehensive technology development (like rehabilitation of Crops Husbandry Research Institute) and knowledge transfer practices Private Advisory Centers (PAC). ADCP-3 can not only pursue this approach, it will broaden it as well to start laying a framework which would address needs and provide imperatives to move to next higher level by developing a national IPM Program with the Plant Protection Institute as the lead institution and other institutes participating in developing IPM methods for their crops in the various ecological regions in the country. At this stage, ADCP-3 foresees the participation of Cotton Research Institute, Horticulture Research Institute, Crop Sciences Research Institute and Vegetable Research Institute to focus on biological control of Green house pests.

The purpose of this entire document is to (i) identify strategic approach for the development of the Integrated Pest Management Program, which the Government of Azerbaijan can decide to proceed with, and (ii) propose actions for the Pest Management Plan for ADCP-3, for consideration by the MOA PMU. The latter are summarized below in the section 'Pest Management Plan for ADCP-3'.

Recommendations:

There is a keen awareness that without agricultural chemicals (fertilizers, crop protection chemicals), there will be no agriculture sufficient to feed the population. Thus proper handling and use of these chemicals is very critical for human and environmental health. Transport and storage of pesticides is as critical as is their field application methods. With a large number of small farmers, it is not possible to reach all, especially if the private sector is relied upon to educate. This is further compounded by the shortage of properly qualified specialists in the country. The GOA is therefore advised to support/develop the following:

(1): Availability of appropriate technologies to farmers, for which an effective extension methodology is the most important need for agricultural development. Without technical knowhow, there is little likelihood of efficient use of good seed and other production technologies. This must be a State Function as private sector cannot and will not be able to provide unbiased and objective input use advice, especially by the chemical input providers. Extension is therefore listed before research in importance

for Azeri farmers, because it is possible several research methodologies may already be available with research institutions that can be transferred to farmers after proper adaptive trials and demonstrations. Furthermore, as attitudes change slowly, there always is the likelihood that after observing a successful demonstration, most farmers may not adopt a new technology, unless an extension agent in whom farmers have developed trust emphasizes the imperatives of such adoption. Usually, a one off visit by a research expert or a sales person is not sufficient for technology adoption. Thus ADCP-3 will play its role in advocating establishment of a more responsive extension service to adequately meet the needs of small holder farmers with capacities far lower than the collectives of yore, by identifying and packaging available IPM technology packages, adapting on-shelf research findings which never reached the field and promoting research in areas of priority for newer crops and cropping patterns in key farming areas. A large number of first time farmers is an opportunity to introduce the best agricultural practices with an efficient extension service

(2): Investment in identifying research methodologies developed and tested at various institutes that may be ready for adoption and preparing dissemination packages would be ideal under the circumstances. At present many institutions are unable to properly package their research outcomes by designing appropriate message that can be disseminated effectively both through electronic and print mass media. ADCP-3 will provide this support through hiring IPM and Communication Specialists at the PMU with the mandate to coordinate IPM Program of different institutes with extension services and marketing interests as well as with farmers of different cropping systems in the case of the former, and in developing extension materials for wider dissemination by the latter.

(3): Many of the research institution suffer from a shortage of qualified staff, and need help with upgrading labs with newer equipment and lab reagents. However, material help is insufficient without proper training in use of modern equipment. Like ADCP-1 & -2, ADCP-3 will support research institutions with the procurement/provision of their laboratory equipment and chemicals/reagents needs, especially for research in IPM methods, and will develop a comprehensive capacity building training needs of these institutions within one year of the hiring of an IPM Specialist. The ADCP-3 will ensure development of certain capabilities at more than one institution - developing sufficient pesticide and residue analytical capacity – pesticide analysis at Plant Protection Institute and pesticide residue analysis at the Horticulture Institute, in addition to the pesticide analysis at SPCS labs. This will incentivize proper analysis rather than reliance on good faith and trust in test results from elsewhere.

(4): ADCP-3 will support Plant Protection Institute to lead the development of IPM in Azerbaijan. This Institute had retained sufficient capacity – knowledge base; laboratory facilities; programs and experience to initiate and up-scale the program, but will need support to build its facilities which are for the most part equipped with out dated equipment. Pest warning and forecasting group and biological control program can be started immediately. Pest warning group will be facilitated to disseminate their pest situation reports widely through electronic and print media and biological control program will be supported with the provision of material support to demonstrate effective rearing methods. At the same time, Plant Protection Institute will start releasing regular pest warning and forecast reports along with the best practice of pest control within an IPM Framework, proposing most appropriate chemicals for pest control when all else fails. All modes of information dissemination will be used. Improved

research environment would require availability of sufficient young researchers, a commodity in short supply. ADCP-3 will also support Horticulture Institute to prepare a limited number of multi-year demonstrations in farmer's orchards to introduce best agricultural practices and show case important research findings for important fruits. Vegetable research institute can focus on greenhouse pests initially.

(5): ADCP-3 will further incentivize improvement in the institutional imperatives – from rationalizing phytosanitary staff capacity to that of other institutions ranging from republican agrarian centers to crop protection staff of research institutions in their ability to sample plant protection products randomly, and most importantly of Plant Protection Institute to have the capability of analyzing both the products as well as the pesticide residues, so as to guarantee the safety of products for export, as well as their safety for consumers in the country. This is important also because while import of most product into Azerbaijan in small packing for direct retail eliminates the possibility of contamination during re-packaging, but there are chances of sub-standard products, or even expired and obsolete products being offered to growers at cheaper rates, mostly because of lack of awareness on part of farmers and the shortage of sufficient staff to regulate market.

(6): ADCP-3 will ensure that every business and/or farming entity receiving support under ADCP-3 while preparing EMP will clearly define potential pesticide use issues and their proposed mitigation measures, which will be cleared by the environmental specialist at the PMU.

The SPCS must standardize the product information and safety to remove any gaps when they are identified or add concise safety information. The GOA's phytosanitary development strategy may suffer on account of shortage of trained manpower, mostly a lack of strategic plan and strategic planning and skills development. Major effort is required to make this SPCS effective. ADCP-3 will assist the Service in improving its operations by equipment and training (staff development) and ensure SPCS becomes more transparent and more answerable. One good indicator would be an open access to all pesticide import licenses issued, to eliminate any prospects of allowing products with environmental or health impacts, ensure transparency in testing of new products before registration/approval for use in the country in a transparent manner, improving coordination with various interests within the public and private sector actors and making the approved pesticide lists public and widely available.

(6): While the afore-mentioned recommendations would need time and resources to produce results, an immediate "awareness campaign" on mass media (TV, Radio, Print media) to disseminate good practices will be immensely useful. A carefully crafted, non-product-centric campaign may educate farming community in best practice; guide them to seek appropriate knowledge resources; and prepare them for adopting full IPM program when they become available.

(7): The various government departments, agencies and programs involved in agricultural production, processing and trade sectors suffer from compartmentalization and lack of coordination, which is detrimental especially, given their over-lapping mandates. ADCP-3 will work towards enhancing this coordination at policy and institutional levels through workshops, trainings and awareness raising media campaigns on policy implications, especially IPM and its human and environmental impacts. And,

(8) Advocate agricultural education. Presently, the only Agricultural University in the country is unable to attract and admit sufficient numbers of students in its agricultural degree programs. Coupled with the aging agricultural workers, many on verge of retirements, unless this situation is addressed, the country may face serious shortage of qualified agriculturists in coming years.

Introduction

Azerbaijan, located in the south of Caucuses, is 58% mountains and 42% flatlands and plains; is blessed with nine distinct climatic zones which had enabled it to become a highly diversified agricultural production system, producing high value fruits, vegetables and nuts, along with a variety of field crops including grains and cotton, etc. In spite of having an arid climate, with supplemental irrigation, these climatic zones confer Azerbaijan the potential of becoming a center for high value-added food processing industries moving up the value chain. However, improvements in the performance of agriculture are necessary for significantly enhancing production potential of the food processing sector, which will generate off-farm economy and high wage labor opportunities. While this diversified agriculture enables Azerbaijan to produce a wider variety of fruit, vegetable, grain and other field crops, it also creates a complex of challenges: starting with the development of water logging and salinity in many areas, to optimizing yields; and can be met only with a highly professional research and advisory support to farming sector.

Unless the farmers can meet the highest production standards, the goal of meeting international quality standards will remain unachievable.

After independence, agriculture in Azerbaijan was in a state of flux. While area and production under grains increased tremendously as the traditional export markets disappeared overnight with the collapse of former Soviet Union, many new farmers that emerged after land privatization switched to crops ensuring food security - grains and vegetables, which were of paramount importance in difficult economic times that followed after the total system collapse. Besides, vegetables and other horticultural crops being highly labor intensive, this created many employment opportunities, when none other seemed available and viable. Crops like cotton and grapes were abandoned on a large scale, with grains, vegetables and potatoes taking their place. Thus, agriculture was seen, and has remained a priority, particularly, not only in the context of food security but also in helping with increasing employment and creating trade opportunities, even when they were mostly informal. This is reflected by the close to 40 percent of labor force's involvement in agriculture sector which contributes only about 5 % of the Gross Domestic Product (GDP), when compared with extractive sector producing more than 90 % of GDP, but employing about one percent of the labor force.

According to a paper by Eldar Kosayev and Yagub Guliev, there was some empirical evidence of Azerbaijan having a comparative advantage in the production of perennial crops such as oranges, apples, pomegranates and olives; in vegetable crops such as tomatoes, cabbage, and chickpeas; in oilseeds like sunflower; and less of this comparative advantage for crops like wheat, barley, and maize, and in cash crops like cotton and tea. Potato, a relatively new crop in the country, was seen important for food security, was adopted widely in spite of its being neutral essentially neutral in terms of comparative advantage.

The State Program for Agriculture (2008-2015) recognizes the importance of rehabilitation of irrigation networks, (some of it with the Islamic Development Bank (IDB) as a potential donor); development of food processing enterprises; private sector involvement in meat and milk processing; expansion of lending resources; and creation of a research center. Furthermore, EU-Azerbaijan Agreement on Neighborhood Policy and continuous efforts of the Government and private sector to access European food market call for harmonization of norms, procedures and practices applicable to planning, management and implementation of national food control with EU requirement.

Strategic goal of Azerbaijan Republic is to join the World Trade Organization (WTO), which requires application of principles of WTO Agreement on Application of Sanitary and Phyto-Sanitary Measures (SPS) and reaching equivalence of food control system with other WTO members. Azerbaijan has faced rejection of shipment at various ports because of disease and/or aflatoxin, especially hazelnuts were rejected in Italy because of contamination with aflatoxins. Thus:

The goal of the national food control system to be created through this Strategy is to contribute to a higher level of public (national) health and safety, and better protection of consumers' interests, including fair food trade practices, taking into account, where appropriate, of the protection of animal health, plant health and essentially the environment. The national food control activities should include sanitary and epidemiology control, veterinary control, phyto-sanitary control, and compliance with minimum quality parameters where necessary, with a support by public and private laboratory activities. At all stages of food chain, traceability of food, feed and ingredients, and transparency of processes, steps and operations should be ensured.

This may include:

1. Institutional reforms to establish clear leadership functions and administrative structures with clearly defined accountability, with transparent decision-making;
2. Harmonization of laws and implementation through bringing national policies and practices to internationally accepted requirements, especially in development of international food safety standards which comply with the requirements of The Codex Alimentarius Commission (CAC) including for residues of veterinary drugs and pesticides;
3. Ecologically sustainable agriculture focusing on environmentally sound farming practices, reducing reliance on synthetic chemicals offer a healthy choice for consumers as well as producers, even though it might have an impact on the pricing structure of such commodities;
4. There may be a need of additional studies on marketing potential and cost-and-benefit analysis of ecologically sound agri-food products; a mapping of inventory of land resources suitable for ecologically sound agriculture; finding alternative use of marginal lands, preferably for environmental enhancement; development of a system of support and incentives for farmers who opt for such production; training of farmers on the uses of pesticides, traditional and biological agri-techniques , as well as on selecting and using the most appropriate, pesticides by the most appropriate application methods (IPM) should be introduced and enhanced where these are already in use; and create and facilitate awareness and promotional activities among consumers on ecological agri-food products. This is essentially making investments in an appropriate technology generation and enhancement (research) and building a technology

transfer (extension) system in the public sector, which is responds to public needs, rather than the needs of a marketing organization.

As had been highlighted in the World Bank's Country Partnership Strategy (CPS) build on the Government of Azerbaijan's adopted sector specific frameworks, focusing on strengthening the non-oil economy, primarily through an improved business environment, better infrastructure and agriculture improvements. The second pillar of this Strategy focuses on improving the effectiveness of social and community services, including health, education, social protection and water supply. All of these efforts will need to be accompanied by capacity building and improved governance in order to improve results.

Thus After the successful completion of Phases-1 and -2 of ADCP, an adaptive program lending (APL) first approved in 1999, the Bank and Government of Azerbaijan (GOA) are in the process of preparing its third Phase. The main objective of the project would be to contribute to strengthening competitiveness of Azerbaijan agri-food sector, build upon the lessons learned during implementation of the current project and would further promote agribusiness/food processing through a line of credit to improve their technologies and increase production; further strengthen agricultural support services; and upgrade and modernize the plant protection service and veterinary services; facilitate development of selected high-value chains and interventions targeted at key constraints in functioning of marketing chains of agricultural commodities; and contribute to improving a regulatory and institutional basis for food quality and safety system. By adding value to agricultural commodities, the project interventions would ultimately increase rural productivity. The proposed objectives are in line with the Government's food security program and regional development strategies. Furthermore, Coordination with other donors and partners will be maintained and enhanced, to ensure that the ADCP-3 activities synergize initiatives and investments striving to enhance food safety and agricultural competitiveness.

Evidence of GOA's commitment to improving environment is shown by the adoption of various international protocols and agreements not only to mitigate the environmentally poisonous legacy of former Soviet production system, but also to improve quality of environment. This PMP fits in with this objective as it aims to rationalize agrochemical use to bring it in compliance with integrated pest management (IPM) principles in general, but specifically in enhancing safety and improvement of food quality for local population as well as to comply with maximum residue limits (MRLs) for expanding export to high value western consumer markets. Government's vision expects to broaden the country's export market, now mainly limited to Russia and Turkey, to the rest of Europe and beyond. This will further support the GOAs National Food Safety and Control Strategy (Draft) as well, which states:

> EU-Azerbaijan Agreement on Neighborhood Policy and continuous efforts of the Government and private sector to access European food market call for harmonization of norms, procedures and practices applicable to planning, management and implementation of national food control with EU requirement.
>
> Strategic goal of Azerbaijan Republic to join WTO requires application of principles of WTO Agreement on Application of Sanitary and Phyto-Sanitary Measures (SPS) and reaching equivalence of food control system with other WTO members…

The goal of the national food control system to be created through this Strategy is to contribute to a higher level of public (national) health and safety, and better protection of consumers' interests, including fair food trade practices, taking account, where appropriate, the protection of animal health, plant health and the environment. The national food control activities should include traceability, sanitary and epidemiology control, veterinary control, phyto-sanitary control, and compliance with minimum quality parameters where necessary, with a support by public and private laboratory activities. This strategy document is in advanced stage of its approval process.

It is also important that institutional reform to be carried out in Azerbaijan Republic shall include the establishment of a leadership function and administrative structures with clearly defined accountability. The confidence of consumers in the safety and quality of the food supply depends on their perception of the integrity and effectiveness of food control operations and activities; therefore it is important that all decision-making processes are transparent, allow all stakeholders in the food chain to make effective contributions, and explain the basis for all decisions.

The CAC as an intergovernmental body that coordinates food standards at the international level with the main objectives to protect the health of consumers and ensure fair practices in food trade, is the best mechanism for Azerbaijan to reach the objective of harmonization.

Assess and bring food safety technical requirements into compliance with those of Codex Alimentarius, (e,g, residues of veterinary drugs and pesticides), in the priority sequence, as identified by assessment;

It will be unreasonable to assert that this whole document will serve as an over-arching framework for the entire agriculture sector throughout the country. The purpose of the document has not been to produce a comprehensive analysis but rather address certain important aspect. It highlights GOA current policy initiatives, practices that constitute or converges towards, and can form the firm foundation of IPM methods; the future directions viz-a-viz the important needs in pursuit of developing and adopting IPM methods; building upon the achievements under ADCP-2 that may have laid a foundation for the promotion of IPM; and chart a road-map which will be initiated under ADCP-3, or from which the ADCP-3 will draw, to support and further enhance this goal.

Like its predecessor ADCP-2, the ADCP-3 will not procure any pesticides categorically, neither directly nor finance procurement of pesticides through interventions funded through various components. However, improved resources for agricultural production may lead to increase in the use of agrochemicals as well, including chemical pesticides, as has happened over the last several years. This might necessarily not suggest indiscriminate or over-use of pesticides, as increased pesticide use may also reflect increase in cropped area and/or increase in cropping intensity. Yet, there may be opportunities to enhance effectiveness of current application practices. This however warrants development of coherent guidelines (which may be missing at present), that ensures per unit area chemical use is rationalized with the cropped area and/or cropping intensity increases! Thus without any

anticipated pesticide procurement in the ADCP-3, the GOA had pursued the preparation of this PMP to show its intent to improve compliance not only with World Bank's Safeguard on Pest Management (O.P. 4.09); in not only meeting the Bank's requirement, but to reaffirm its commitment to the general safety of producers and consumers: both domestic and for export; and the improvement of environmental quality. Every business and/or farming entity receiving support under ADCP-3 while preparing EMP will clearly define potential pesticide use issues and their proposed mitigation measures, which will be cleared by the environmental specialist at the PMU.

This PMP for ADCP-3 will adopt the World Bank's Operational Policy OP 4.09's definition of integrated pest management which states:

> "Integrated pest management refers to a mix of farmer-driven, ecologically based pest control practices that seeks to reduce reliance on synthetic chemical pesticides. It involves:
>
> - Managing pests (keeping them below economically damaging levels) rather than seeking to eradicate them;
> - Relying, to the extent possible, on nonchemical measures to keep pest populations low; and
> - Selecting and applying pesticides, when they have to be used, in a way that minimizes adverse effects on beneficial organisms, humans, and the environment."

At this stage of project preparation/development, ADCP-3 will likely have the following Components:

Component A: Food Safety and Sanitary and Phytosanitary System Modernization. This component would support the enhancement of food quality and safety systems through these three sub-components:

(i) National Food Safety Strategy and Capacity Building;
(ii) Upgrading Plant Health and Phytosanitary System; and
(iii) Animal Health and Veterinary Services.

Component B: Agri-Food Value Chain Development and Support Services. The immediate objective of the Component B is to increase the competitiveness of selected supply chains by raising productivity and the quality of output along the supply chain through the following sub-components:

(i) Sub-component B1: Supply Chain Sub Projects;
(ii) Sub-component B2: Rural Advisory Services Development:
    i. Capacity Building for Supply Chain Development through technical assistance to advisory services (RACs or other service providers) to develop extension packages to support the target supply chains and to advise them during the initial stage of the Project; and
    ii. Public Awareness. And
(iii) Sub-component B3: Seeds Sector Development.

Component C: Access to Finance. The objective is to enhance access to financial services for agribusinesses operating in Azerbaijan's agrifood sector, in particular towards enhanced competitiveness of the agribusiness sector, achievement of food product quality and safety standards, new products development, and establishment of market linkages through the following sub-components:

(i) A credit line through commercial banks and leasing companies;
(ii) Capacity building of the Participating Financial Institutions (PFIs); and
(iii) Agricultural Insurance; and

Component D: Project Management. In addition to the approved staff strength under ADCP-2, PMU may hire a full time IPM Specialist to assist with the development of IPM Program at various research institutions, and develop a coordination mechanism where all IPM elements are integrated into a nationwide system. The decision of involving the IPM Specialist under the project will be guided by GOA's commitment and readiness to initiate the development of the National IPM Program aiming at medium and long-term goals.

Historical Perspective/Background

Before independence, Azerbaijan had become a major cotton growing area producing close to one million tons of cotton. In the process, Azerbaijan used very high quantities of inputs, including chemical pesticides, with close to half a million tons of DDT alone used up to the early 1980s, before the collapse of Soviet Union. There were significant pesticide related issues – from pest resistance to most pesticides and environmental concerns that led the country to adopt biological control, especially for cotton bollworms. Up to sixteen (19 by other accounts) biological control laboratories produced *Trichogramma* species, an egg parasite. After the collapse of the former Soviet Union, the loss of trade, coupled with the regional conflicts, there was a general system collapse, and these labs suffered neglect and there total collapse when most of these facilities were used for other purposes. However, there is already renewed interest in reviving some of these initiatives and biological control program may return as at least one of the rearing facilities has been marked for renovation and/or refurbishing. The emphasis though, may change from primarily cotton to other crops, especially vegetables and green house crops, targeted for export markets.

While cotton, which is a big consumer of agrochemicals, has been in a continuous decline in Azerbaijan, agrochemical use, after a period of decline, is noticing an increase again. Thus the reduction of cotton area did not translate into reduction of crop protection chemical use. It is important to acknowledge that cotton is a unique crop which can aid in the diversification of Azeri economy, and create significant employment opportunities for workforce, if the marketing chain is rationalized. This is of some significance as after losing market to synthetic fibers for years, cotton, as natural fiber has seen an increase in demand globally in recent years. Furthermore, cotton by virtue of the crop area can also help accelerate development of alternative methods of pest control (cultural control, biological control, microbial control, etc) with scales of economy that other crops may not be able to generate. There is

evidence some cotton producing companies may use biological control if there was revival of the bio-control agents production system. Additionally, bio-control agents are highly effective pest control method in greenhouse production systems which are on the increase. Besides being environmentally benign, such methods improve the product quality and safety for consumers by reducing chemical pesticides use significantly.

At the same time, and over a short period of time, a little over 2000 collective farms with more than forty thousand agricultural specialists have been transformed into more than 800,000 small private farms, where many of the new farmers were not even agriculturalists, thus creating a need for extra advice and support, which was not built into this evolving farming system. With the collapse of collective farms, the specialists dispersed and while the eight Republican Agrarian Sciences Service Centers (RASSC) with small teams of experts who were effective in transfer of technology to 2000 farms with teams of specialists, but were not, and are not capable of reaching the large number of new farmers. Even though reaching farmers was neither their primary mandate, nor part of the technology transfer culture of the RASSCs, these centers made effort to prepare extension materials, including on handling pesticides and spraying methodology, even without an effective and efficient technology dissemination capacity. For instance, the RASSC in Ganja covers nine Raions which grow many vegetable, fruit trees and field crops, but with only three full time specialists, with little access to, or no transportation at all. Even if the Center can call upon the research Institutes for appropriate expertise, which it does (there are at least three research institutes and the Agricultural University in Ganja, and the centre can access expertise from other research institutes), it had too few staff, and too ill-equipped to reach the large number of farmers. Thus, even the beneficial research results that may be readily available for transfer to farmers for adoption could not reach the farming communities, unless some farmer made an effort to reach the sources of information and knowledge. While this has created a need for more qualified extension specialists, it is also an opportunity to help start the new farmers with the best sustainable agricultural practices based on science before they adopt traditional farming practices of the past.

To address this and other technology transfer imperatives, ten Private Advisory Centers (PAC) were set up under ADCP-1 and -2. These were better equipped for transferring technology through hired private advisory agents, who were provided appropriate training for extension outreach. There was an understanding between the project and the MOA on completion of the project, these centers will be transferred under administrative and budgetary control of the MOA, which will support their farmer outreach activities until they became self-sustaining and self-sufficient (which is an unreasonable aim at least at this stage of Azerbaijan's agricultural development, as even in advanced free market economies like USA, agriculture research and extension support are public sector functions). Unfortunately, this has not happened so far, thus ADCP-3 will continue lobbing GoA for playing a more effective role in empowering the new farmers adopt best practice.

Since technology generation and transfer in agriculture are a slow process, public support for basic and adaptive research and extension support would be required for considerable period of time; and to spread the technologies widely, both RASSC and Private Advisory Centers would need scaling up. It is very unlikely that Private Advisory Centers will became self sufficient and sustainable in short or even in

the medium-term. Ideally, if these centers were taken over by MOA, while ADCP-3 may still contribute towards some facilitation of the existing centers, ADCP-3 may support the establishment of additional five to ten centers to increase their coverage of the country.

Various government initiatives, some with donor support, have identified critical issues faced by Azerbaijan agriculture, especially in crop production and protection areas that need to be addressed. Some of the issues identified and need to be addressed are:

1. Pesticide residues (mostly POPs) may still be significantly higher than permissible limits – as evidenced by rejected export shipments;
2. Though much of obsolete pesticides were destroyed by incineration, stocks of obsolete pesticides still exist, and there is a great likelihood some of these are still being used even;
3. Legislation on pest management , though mostly confined to pesticide management, is reasonable and may meet international standards however, compliance is questionable, especially because of inadequate capacity to monitor compliance;
4. Many products with potential hazards are officially imported even though there is literature on their proper use, there is little evidence of the capacity to train the users in proper handling and use. At the same time, though officially, many products may not be imported and sold in the country, there is some evidence of presence and use of such products. There is a need for a cadre of trained pesticide applicators as well as developing the capacity for proper monitoring of field use of various plant protection products and practices;
5. There is a list of approved pesticides. All new products undergo an approval process, and the list of approved pesticides is circulated to the concerned ministries twice a year. However, there is a shortage of skills as well as laboratories for testing chemicals and residues and field monitoring. Plant Protection Institute can play an effective role in testing new products before their approval, developing and delivering training for proper pesticide use methods and monitoring both the quality of products in the field as well as residues on products, especially for export.
6. Government has approved and is on the process of approving several laws and necessary regulations – there is an environmental law, a Phytosanitary law, with some laws (livestock and extension) are in parliament as well as legislative acts. Specifically, plant protection chemicals have been banned (DDT, methyl parathion, DNOC, etc.), a list of dangerous chemicals issued to acknowledge dangerous products that may be eliminated. Azerbaijan had signed Stockholm Convention, thus committing to ban persistent organic pollutants before 2020 (POPs), nine of which (out of a total of 12 chemicals) are insecticides, some of which were used widely (for instance about 25,000 tons of DDT was used annually for decades).
7. New pesticide goes through an approval process, which is very effective, at least on paper. While, government is trying to prevent misuse, use of sub-standard products, etc. by establishing specialized laboratories for testing products and detecting residues, these efforts are dispersed, with some areas receiving overlapping treatment and others not covered at all, and are not sufficient. Ultimately, a coordinated approach will ensure all stakeholders receive appropriate message. Most importantly, the farmers who have to use these methodologies.

During the ADCP-1 & -2 pesticide use precautions were taken very seriously by the PMU. ADSP-3 can play an even more proactive role in ensuring that pest and disease related issues receive sufficient attention, both at policy and institutional levels. While policy imperatives are under consideration, the Project will initiate the enhancement of capacity building and human resources development for this specialized discipline. The Project will enhance the monitoring of pesticide use as well as the efforts dedicated to developing integrated pest management concepts and methods, and transferring these to the farming population. Building upon the earlier efforts under ADCP 1 and 2, ADCP-3 will continue addressing the issue of improper use of pesticides and develop approaches and methodologies to enhance appropriate pest control practices, whether biological, cultural, mechanical or chemical.

ADCP had developed environmental management plans (EMP) for Phase I and II, and the plan for Phase III is updated, as well as will be further enhanced with the addition of this Pest Management Plan (PMP). ADCP-3 will enhance the monitoring both directly and indirectly through the national research institutes supported by the Project. ADCP-3 will support the revival of biological control program both as a basic research program and for application in areas with the highest potential for success, particularly export oriented high value horticultural field and green house crops. ADCP-3 will enhance transparency in the pesticide registration process at the PC commission, to ensure the list of approved pesticides is updated frequently, at least once a year, and the list not only provides the trade names and active ingredients of approved pesticides and herbicides but also of those whose registration had been cancelled, or were dropped from the list of approved products. This will improve the environment of trust.

Maximum residue levels followed were still old former Soviet standards. The Government is developing new stands to match EU standards to exploit western export markets. This is part of the harmonization process with the EU. However to remove the quality constraints due to outdated labs and equipment, ADCP-3 will upgrade and develop capacity with appropriate trainings to ensure reliable testing for safe food supply. These labs will meet the highest international standards. And finally, when Azerbaijan joins some international treaty, the requirements under the Treaty take precedence over the Azeri law/standard.

The Government's Environment State Program (2006-2010) is committed to improving the environment, including investing in a large number of environmental cleanup operations given the huge legacy of environmental degradation, land rehabilitation activities and protection of environmental resources – though implementation has lagged. Promotion of IPM approaches will ensure chemical pesticide use is rationalized to a degree that environmentally hazardous chemical use is further decreased, if not eliminated immediately. Institutional Capacity Building within individual agencies will be an essential element in achieving results --- through building legal and regulatory framework, budgeting and accounting systems, information systems, adequate staffing, staff training and study tours.

Pest Management Issues and Current Control Practices

The pest management issue will be incomplete without referring to the DDT use (specially in cotton) episode in Azerbaijan. In the 1950s the expansion of croplands (cotton, cereals – wheat, rice, barley, vegetable, tobacco plantations, grapes, tea, forestry and fruit growing) had brought about the growth in the amount of pesticides against pests and diseases. DDT 5% was the choice pesticide applied against pests in cotton plantations. DDT being, poorly degradable in natural conditions, highly insoluble in water and with its bio-accumulation properties, accumulated in humans as well as environment. The use of DDT was prohibited in 1970 in the former USSR. In spite of this its use, as an exception, continued in Azerbaijan until 1985 officially, and may still be continuing in certain regions of the country either with the existing obsolete stocks, or imports of an informal nature. DDT was sprayed by ground sprayer in the amount of 20-25 kg per hectare and by airplane in the amount of 15-20 kg per hectare to combat cotton pests. In most cases the procedure was repeated 4-5 times and sometimes even 8-10 times. Initial analyses show that about 500 thousand tons of DDT was used in Azerbaijan through the 1950-1982 Period. Some obsolete stocks of DDT still exist: “currently there are 4286.37 tons of stockpiled pesticides in the country”, as reported by POPs National Implementation Plan’s Report.

Nature has bestowed Azerbaijan with nine distinct climatic zones, which support its complex farming system, ranging from diverse horticultural crops – apple, grapes and pomegranate and vegetables, to field crops like wheat and cotton in its several environmental zones. This had challenged farmers with an array of pests and diseases specific for different crops, as well as for cropping systems. While apple, a horticultural crop, and cotton a field crop, are severely affected by several insect pests and diseases, requiring an array of crop protection tools, wheat is mostly damaged by fungal diseases (rusts and smuts), which can be controlled largely by building disease resistance (long-term control strategy) and seed treatment with fungicides. Several viral diseases and weeds further add to this challenge. At the same time, there is an ever present danger of introduction of new pests and diseases. The GOA had already issued a list 45 insect pests, 11 bacterial species, 18 fungal disease organism, one virus, 8 weed species, 13 introduced pests, four parasitic plant, and one potato potential pest and disease organism for quarantine on December 29, 2006. This list is presented in Annex II.

However, in spite of the this professed vigilance by SPCS (customs service does not allow phytosanitary inspectors at ports of entry) , a new leaf mining moth *Tuta absoluta* with strong preference for tomato has already made a foothold in tomato growing areas of the country. While in the field, this pest may undergo diapauses as egg, pupa or adult to overwinter, in greenhouse environment, it may remain active year round with up to eight or more over-lapping generations. The pest had developed resistance to organophosphates and some pyrethroids, in its original habitat (South America) and may require insect resistance management approach for its effective suppression.

GOA had been proactive in this area, addressing agricultural chemical issues especially in relation to food security, and has taken several initiatives to develop policy and institutional reform by revising laws and framing updated regulatory regimes, usually in collaboration with one or more donors,as evidenced by the enactment of Phyto-Sanitary Law, (which may have weakened the pest control imperatives contained in the earlier Laws that were superseded). This however, seems to be an ongoing process for

some time to come. Several bilateral and multilateral donors, including the Food and Agriculture Organization of the United Nations (FAO) are assisting the Government. A Regional Program for Food Security for the Economic Cooperation Organization member states, (which includes Azerbaijan), was completed and revised in 2008; The Highly Pathogenic Avian Influenza crisis in Asia caused by several highly pathogenic strains including the H5N1 virus that had a disastrous impact in several countries was addressed through the creation of a regional network as an Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES) system since 2006. The regional network addresses several issues, among them the improvement of surveillance (including wildlife issues), laboratory diagnostics and the development of contingency plans; Assistance is provided to the government on the Assessment of African Swine Fever (ASF) and to provide urgent assistance in assessing the current situation of ASF in domestic pigs and wild boars, and to strengthen the capacity for immediate epidemiological interventions and laboratory diagnosis.

Azerbaijan is affected by several locust pests including the Moroccan Locust, which is one of the most serious agricultural pests in the region and has a relatively high outbreak occurrence. A regional Technical Cooperation Program (TCP) that covers Afghanistan, Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan was approved in late February 2009. The immediate objective of this project is to improve national and regional locust management (currently, mostly by chemical application, with some mechanical/physical means, with all operations outside of MOA's control) in the Caucasus region and Central Asia through regional cooperation and capacity-building.

A regional workshop on prevention and disposal of obsolete pesticides in central Asia was organized in Turkey, in November 2007, benefiting seven countries: Azerbaijan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan and Uzbekistan. The workshop recommended the development of a regional program on sound pesticide management and the drafting of a regional proposal for capacity building in the field of pesticide management and obsolete pesticide disposal (prepared by FAO), with a follow-up regional workshop organized in Azerbaijan, in December 2008, to further the process.

The National Medium Term Priority Framework (NMTPF) formulation was initiated in January 2009 with a first workshop involving all relevant stakeholders. The workshop resulted in a preliminary identification of priorities for FAO-government collaboration and served as a basis for the preparation of a first draft of the NMTPF. Currently FAO is preparing an intervention to address obsolete pesticides with the aim of contributing towards better protection of environment and public health in the region through reducing the risks posed by hazardous waste in the region, placing specific emphasis on pesticides as a model group of hazardous chemicals. These efforts are indicative of GOA's efforts to develop mechanism to address agricultural and livestock production and protection against pests and diseases on scientific and sustainable basis.

The ADCP has supported and piloted individual initiatives, mostly in designing and delivering training programs in pest management and control which are necessarily elements of a comprehensive technology development and knowledge transfer practices. ADCP III will not only pursue this approach,

it will broaden it as well to start laying a framework which will address needs and provide imperatives to move to next higher levels – laying foundations for a comprehensive IPM Program.

Government does not procure chemical pesticides for distribution or sale in the country. The private sector is active in importing and marketing pesticides as well as pesticide application equipment. All marketing outfits emphasize their responsibility in creating awareness of the risks associated with chemical pesticides. There are training session held periodically, and in addition to selection of appropriate products – which usually are what the firm in question itself sells, proper application methodology, and safety practices are also highlighted. Safety gear is available with most pesticide marketing outfits. However, there is also an acknowledgement of the fact that more needs to be done, and that it falls under the responsibility of MOA.

Usually, the pest control strategies in use were developed by the crop-based research institutes, some of them decades ago. The research establishment is active after a considerable period of inactivity. However, some confusion persists. While it is necessary to have clear demarcation of responsibilities, there is an ever increasing need for coordination as more than one agency of the MOA and more than one ministries of the GOA as well as international donors and most importantly, the public of Azerbaijan are affected by these policies, as in case of food safety, for instance, eight agencies from seven ministries are involved in policy implementation.

Pesticide Management

Azerbaijan had inherited a sophisticated agricultural research system at the time of independence but the country was faced with serious emergencies and some of the capacities were either lost or degraded, while others had to be adapted to meet the requirements of a fluid evolving land tenure and farming system. These research institutions were well equipped with sophisticated labs housing amino acid analyzers and transmission electron microscopes. However, closer look at the research institutions reveals many research initiatives and outputs at various stages of development, with many of these complying with and/or were constituents of the basic elements of IPM. There were pest thresholds against apple pests, cultural and mechanical control initiatives for cotton and fruit crops (inter-culture for weed control and exposing hibernating pests in soil to elements), and biological and microbial control programs against Lepidopterous pests. There is a pest forecast and warning group (at Plant Protection Institute, Ganja) which continued to operate throughout this transition, and can play an effective role in forecasting pest infestation, thus enabling of rationalization of pest control decisions, as well as assist quarantine services in monitoring accidental introduction of pests and diseases in the country. All these would warrant more coordination and ADCP III will be ideal by virtue of its being centrally located in the MOA, as well its role in providing capacity building support to several of these agencies.

The State Phytosanitary Control Service was established under the MOA in 2004. All pesticide related issues are regulated by the "Law of the Republic of Azerbaijan on Phytosanitary Control" signed into Law on May 12, 2006 by the President of the Republic. This Law superseded all earlier legislation on "Plant Quarantine": The Compilation of Legislation of the Republic of Azerbaijan, 1997, No. 2, Article 103; 1998, No.2, Article 83; 2002, No.5, Article 241, No.12, Article 706; 2004, No.2, Article 57; "On Plant Protection", The Compilation of Legislation of the Republic of Azerbaijan, 1997, No.4, Article 274; 2002, No.5, 241; and "On Pesticides and Agrochemical Substances" The Compilation of Legislation of the Republic of Azerbaijan, 1997, No.5, Article 396; 2003, No.1, Article 7.

This Law defines legal basis for tests, registration, use of pesticides and agrochemical substances and organization of agrochemical service in agriculture which includes regulations/rules for production, import and export, packing and labeling, storage and transportation, use, removal of expired and prohibited substances, clean-up and elimination of pesticides and agrochemical substances. In addition to the Law, SPCS also oversees the implementation 26 Guidelines on various subjects covered under this Law.

The procedure calls for pesticides to be approved by a 15-member Pesticide Approval Committee (specialists/experts chosen from various government agencies – MOA, Ministries of Health, Natural Emergencies, Environment, etc.) on the basis of field data obtained during two years of field trials for efficacy against specific pests on specific crops, in specific regions. Products are registered for a period of five years, after which it must be re-registered. Crop protection products are exempt from import

duties and taxes, but there are no subsidies for pesticide import, and in absence of official IPM policy imperatives, may indirectly promote chemical pesticide use.

The toxicological labs at SPCS need equipment, up gradation and above all, the staff needs training to discharge their duties effectively. Some modern equipment could not be used because of shortage of trained manpower. ADCP-3 will strengthen the functions of this service to enable it in the discharge of its duties.

Ministry of Natural Emergencies maintains pesticide stocks and capacity for control of Locust, a periodic occurrence. A specialized agency is responsible for incineration of obsolete pesticides, but there are several thousand tons of obsolete pesticides at various sites in the country.

At one time, Azerbaijan had ten (16 and 19 in other accounts) biological control labs, producing egg parasite *Trichogramma* mostly for control of cotton bollworms. There is a move to rehabilitate some of these labs for the production of bio-control agents with emphasis on green house pest control for vegetable pests in the first phase. There is a likelihood of demand of these against cotton pests in some areas. There is an emerging movement of producing "certified organic crops", which may grow to take advantage of niche export markets. Azeri specialists have already received training from their Turkish counterparts in organic agriculture.

The SPCS, in coordination with International Plant Protection Convention (IPPC) has prepared an exhaustive national phytosanitary development strategy, which covers mostly pesticide trade and management issues but not from an IPM perspective. With further improvements in the institutional capacity, the SPCS will streamline its operations and more importantly, improve upon its record of transparency. SPCS's coordination as well as coordination in general between all the state agencies and institutions with a role in agriculture sector, among themselves and with all the stake holders in a more systematic manner will be of critical importance. Currently, there is a serious lack of even basic information exchange. However, development of IPM technology and dissemination will be pursued under the MOA's research and extension institutional set-up.

Key problems in pesticides and pesticide residues areas are:

(i): Accessing pesticide registration list is hard, if not impossible. Several new pesticides were registered and added to the new registration list (adopted since 2007), some, even on the basis of their registration in neighboring countries (that may or may not meet environmental or safety criteria in Azerbaijan), but updated pesticide lists have not been made public.

(ii): Maximum residue limits are based on a relevant Russian regulation but may not comply with those of Codex or EU. Furthermore, MRLs are set only for those commodities for which application of a pesticide is approved. If a pesticide is not approved for use on a certain commodity, no MRL is set and no further tests are performed. For all pesticides registered after 2007, MRLs have never been established at all, thus serious gaps remain.

(iii) Current practice also includes certification in accordance with the old Soviet "Rules of Receiving, Sampling, Packaging, Labeling and Storage of Pesticides" of 1981.

(iv) Finally, there is little evidence to show that the registration of pesticides is conducted according to established procedure including the conduct of efficacy trials.

The research establishment under the MOA with Crop Protection mandate, especially in relation to IPM is organized as under:

Plant Protection Institute: Established in 1959, had the mandate to conduct research and transfer technology. One instance of success of plant protection research was to reduce the potential spraying on cotton from fifteen sprays over the growing season to up to one spray for achieving perfect pest control In the state-owned collective farms that employed more than 40,000 specialists. This source of expertise has disappeared over the years, and chemical spray is the predominant control method.

This Institute has research sub-stations in Absheron and Khasmash, and field trial bases/stations in Jar and Saatli; is currently working with 12 scientists (including one Academician) but has 17 vacancies for scientists which cannot be filled because suitably qualified experts are either not available or are not interested in these positions on account of poor remunerations. The Institute is organized into two Departments – (1) Entomology and Biological Control; and (2) Phyto-pathology Department; and four labs – (1) weed control and residues; (2) mechanization of control (researching on chemical application equipment); (3) pest/disease warning and forecast; and (4) pesticide lab. All labs were operational in spite of their ancient equipment, mostly because of the Institute's dynamic leadership. Two of the ongoing operations at the institute are perfect examples of an operational IPM program, and have been successful in addressing practical constraints with the use of best practice. These are: (i) Biological control lab, which still maintains a lab culture for parasites and predators, and (ii) Pest warning and forecast had forecasted the arrival of new pests as well as developed a methodology of survey and forecast of pest infestations for various crops in different climatic zones. This assessment of the operational capability of biological labs refers to this institute but not necessarily the case for similar lab facilities country-wide.

However, unless personnel issue is addressed appropriately, there may be significant shortages of skilled research hands within a decade as older research staff, most from Soviet time are not being added to and/or replaced by younger scientists. Unfortunately, there just aren't enough students at the University even, and this will cause serious shortages of agricultural scientists in due course!

ADCP-3 can provide necessary support to enable bio control lab to function as a technology generating and disseminating facility, facilitate pest forewarning and forecast and pesticide testing and residue analysis lab. This can help to ensure at least a second facility for pesticide and residue analysis it is imperative that the ongoing programs at Plant Protection Institute are upgraded, and ADCP-3 can support with this upgrade.

Cotton Research Institute: One of the first research Institutes in the country was established in 1925, received a pride of performance award in 1977, has developed 39 cotton varieties, and has had the mandate to conduct research on cotton pest control. Pest and disease control is of critical importance in

cotton production, therefore cotton was the primary user of plant protection chemicals in the country. However, cotton as a crop is in decline, with 2011 production a mere 53,000 tons against close to a million tons in cotton heyday, mostly for policy reasons. This should have reflected major reduction in pesticide usage, and the associated imperatives! However, this is not the case.

This Institute has had a history of testing host plant resistance against major pests and diseases; has recorded resistance to pesticides (DDT was mostly used in cotton fields); and had used important elements of IPM program for pest control to offset resistance by using cultural and biological control methods. Although less studied if at all, weeds may also have developed resistance against most herbicides.

The institute has 24 PhDs, but only four under 60 years of age, with one researcher over 86 years old. Availability of younger staff for agriculture research and extension may become a serious constraint in Azerbaijan if not addressed appropriately, on an urgent basis. While addressing personnel issue of this nature is beyond the writ of ADCP III, the Project can help institute revive the biological control program and refurbishing crop protection related laboratories and general laboratory reagents required. This is a recommendation which will be further considered by MOA and decided upon. Some time, it may become necessary to test improved spraying technology to enhance effectiveness of pesticides used and to prevent dispersal beyond crop. Cotton pest control program can be coordinated with the Plant Protection Institute research initiatives to enhance synergies. At the same time, collaboration between these institutions and the Agrarian University may serve a useful function of attracting students for crop protection discipline by highlighting research and professional growth potential.

The importance of cotton as an industrial crop for agrarian economy as well as in off-farm manufacturing should not be underestimated. Cotton chain can create significant employment opportunities in cotton processing and textile sector.

Horticulture Research Institute: established in 1926, was moved to its current 350 Hectare location in 1964 and has been conducting research and demonstrations on pome and stone fruits and nuts. Horticultural crops suffer from many fungal and bacterial diseases, viruses, mites and insects mostly – leaf miners and curlers, weevils, mealy bugs, aphids which also act as disease vectors, thrips, wooly apple moth, and most importantly codling moth in the field; as well as storage pests. Many fruit producing areas have high humidity during part of the year, which creates ideal conditions for high disease incidence, followed by attacks by various pests. Thus plant protection section at the Institute has tested more than a hundred pesticides, herbicides and even pheromones traps for several pests. While use of chemical pesticides may have become necessary against pests and diseases when thresholds were crossed, the pest management package developed for fruit tress also includes:

1. Deep plowing after application of soil insecticide to kill soil insects;
2. Pruning;
3. Winter irrigation to kill rodents;
4. Spraying mineral oils on fresh vegetation (prophylactic – physical barrier against sucking insects);
5. Spraying fungicide/insecticide/micro nutrients before flowering;

6. Spraying fungicide to control apple scab a week after flowering;
7. Periodic monitoring/scouting to check pest prevalence and recommending spraying once thresholds are crossed.

These practices led to better yields with seven or less chemical applications than the usual fourteen calendar-based spray operations. Farmers using this pest control approach can double (or more) their production in addition to the cost savings with fewer chemical applications. While the Institute practices demonstrations, and has prepared information materials/booklets for farmers who attend these demonstrations, there is a need for a more systematic demonstration program and preparation of effective extension material as well as extensive use of audio-visual aids. An awareness campaign on mass media (TV, Radio, Print media) to disseminate good practices will be immensely useful, but is constrained by lack of sufficient resources.

ADCP-3 can work with this Institute to prepare a limited number of multi-year demonstrations on farmer fields to show case important research findings.

Crop Sciences Research Institute: established in 1950, the Institute had gone through changes and reforms, most recently under ADCP-2, when the research mandate of the Institute was decreased to five more focused research areas than the original fifteen crops. This Institute collaborated and collaborates with the Consultative Group on International Agricultural Research international (CGIAR), and has developed about 80% of all the crop varieties registered in the country. The Institute produces elite seed for seed multiplication; conducts thirty to forty demonstrations in farmers field annually, holds field days and develops extension materials (booklets, pamphlets, etc.); and collaborated with the advisory centers developed by the ADCP.

This institute received significant support from ADCP-2 in refurbishing the laboratories; improvement of physical facilities and staff training. Presently, the main focus is on wheat, barley, maize, food legumes and sustainable agriculture programs. The research program is centered on breeding, seed production and cultivation; biotechnology for disease and pest control; biological stress and crop quality.

This Institute is organized into three Departments: (1) Plant Breeding; (2) Plant Physiology and Biotechnology; and (3) Sustainable Agriculture and crop diversification; four Labs: (1) grain quality; (2) primary seed production and quality; (3) soil and plant analysis; and (4) disease and pest control; and one extension and training group serving as a link between the Institute and farmers. This Institute with a total staff strength of 304, with 101 research staff (53 PhDs, four doctoral candidates and 1 Academician), has five research sub-stations in different ecological regions (reflecting climate and soil types) of the country, with two in irrigated and four in high/low rainfall areas.

The Institute's crop protection focus is pest/disease identification, area of distribution, development of host resistance strategies for various crops under its research mandate, cultural control methods and establishment of economic thresholds for chemical control. Crop protection team consisting of six researchers, and focuses on pests and diseases of economic importance of all cereal crops in the

country. These complex crop based studies usually start with evaluation of resistance beginning at germplasm stage, followed by tolerance level and finally pest susceptibility and control imperatives. The institute has 200 germplasms resistant to nine new rust races, and had identified fifteen genes that are resistant to rusts.

Presently, there is no biological or microbial control research at this Institute.

There is a tradition or research and excellence which developed technologies, including those constituting fundamentals of IPM; Practices like developing thresholds for pesticide use, employing cultural and/or mechanical and biological and/or microbial pest controls methods, and were effective in disseminating these results to the over two thousand collectives – with their over forty thousand crop production and protection specialists, but the system was not designed to reach efficiently and effectively more than 800,000 small farmers, many of them with non-farming background. For instance, some of these institutes had labs equipped with Automatic Amino Acid Analyzer and Transmission Electron Microscope, which were in continuous use, indicating advanced basic research and issue oriented research. While modern equipment may not address all the deficiencies, since man power is equally in short supply, support for upgrading facilities (research equipment and reagents/laboratory chemicals) and capacities (staff training) is very important and will be extended to Plant Protection Institute especially to strengthen Pest warning and forecasting system, biological control system, and to Horticulture Institute in arranging effective demonstrations and support will make the research results available to grower community as effective technology package.

There is a keen awareness of the fact that without agricultural chemicals (fertilizers, crop protection chemicals), there will be no agriculture. At the same time, proper handling and use of these chemicals is very critical for human and environmental health. Transport and storage of pesticides is as critical as their field application method. With a large number of small farmers, it is not possible to reach all. This is further compounded by the shortage of properly qualified specialists in the country. The GOA, at suitable occasion will therefore consider the possibilities for ensuring that:

1. To ensure availability of appropriate technologies to farmers, an effective extension methodology is the most important need of agricultural development. Without technical knowhow, there is little likelihood of efficient use of good seed and other production technologies. This must be a state function as private sector cannot and will not be able to provide unbiased and objective input use advice to the farmers.
2. Extension is being listed before research because it is possible several research methodologies may be available with research institutions that can be transferred to farmers after proper adaptive trials and demonstrations. As attitudes change slowly, there always is the likelihood that after observing a successful demonstration, most farmers may not adopt a new technology, unless an extension agent in whom farmers have developed trust emphasizes the imperatives of such adoption. Usually, a one off visit by a research expert is not sufficient for technology adoption.

3. Even small investments in identifying research methodologies developed and tested at various institutes and preparing dissemination packages would go a long way. At present many institutions are unable to properly package their research outcomes by designing attractive message, disseminated in an effective manner, both through electronic and print mass media. ADCP-3 may provide this support centrally through a communication specialist at the PMU.
4. Many of the research institution suffer from a shortage of qualified staff, and need help with upgrading labs with newer equipment and lab reagents. Staff training is another potential area for improving research outcomes. Some of the institution that can be supported by ADCP-3 and their immediate material needs are provided in. The Project will develop and deliver a comprehensive capacity building training sessions for these institutions.

In addition to the Agroleasing Corporation, an autonomous corporation, which imports/procures equipment and some inputs and leases them for both short and long term lease to farmers throughout the country, Azerbaijan has a vibrant private sector providing crop production and protection services to farmers. While fertilizers are subsidized, crop protection chemicals are not. A wide range of crop protection chemicals are imported from several countries, and marketed in the various specialized markets – from vegetable inputs, to fruit crop protection chemicals to field crop pest control. Formulated products are imported in small containers for marketing without further repackaging. Some outlets do sell highly toxic products (e.g. Methyl parathion), but at the same time, they also carry safety kits (goggles, aprons, gloves, masks), with instructions on how to use them. Most of these outfits are either headed by or have hired the senior experts, or retain specialists as consultants in this area.

Even though almost all product imported into Azerbaijan are in small packing for direct retail, eliminating possibility of contamination during re-packaging, there are chances of sub-standard products, or even expired and obsolete products being offered at cheaper rates, mostly because of lack of awareness on part of farmers and the shortage of sufficient staff to regulate market. Trusting private sector to police itself is less than perfect in the best of times and places, and should not be ideal in a developing country environment.

Developing Phytosanitary's capacity at the borders and entry points is important by and of itself, it will not be enough therefore to ensure adoption of environmentally sound IPM. Therefore, ADCP-3 may further incentivize improvement in the institutional imperatives – from rationalizing phytosanitary staff capacity to that of other institutions ranging from republican agrarian centers to crop protection staff of research institutions in their ability to sample plant protection products randomly, and most importantly of Crop Protection Institute to have the capability of analyzing both the products as well as the residues, so as to guarantee the safety of products for export, as well as their safety for consumers in the country.

The Project is aware of constraints in the smooth operation of this industry, and government has various initiatives for the facilitation and enhancements for further improvements. Thus with the passage of time, there is every likelihood of improvement in the efficiency of use of plant protection chemicals and their safety both for both the environment and the consumers. The ADCP-3 will initiate development of these capabilities at more than one institution - developing sufficient pesticide and residue analytical

capacity at more than one points – like at pesticide analysis at Plant Protection Institute and pesticide residue analysis at the Horticulture Institute, in addition to the pesticide analysis at Phytosanitary Commission labs will incentivize proper analysis rather on good faith and trust in test results from elsewhere, furnished and shared by the importers.

The ADCP-3 can look into the issues of convergence in application laws of the GOA in standardizing the nomenclature of agro-chemicals so it is easy to identify products and their properties to remove confusion that is possible as some of the active ingredients are marketed under many trade names. It is essential to standardize the product information and safety to remove any gaps when they are identified or add safety information more clearly. ADCP-3 can also play its role in advocating establishment of a more responsive extension service.

Policy Imperatives, Regulatory Framework and Institutional Capacity

The GOA has joined/signed the following international agreements/protocols/conventions relating to plant protection with environmental imperatives:

1. International Plant Protection Convention (IPPC) since March 2000
2. Basel Convention on "Trans- boundary Movement of Hazardous Wastes and their Disposal" in February 2001;
3. Stockholm Convention on Persistent Organic Pollutants December 2003;
4. Convention "For the establishment of the European and Mediterranean Plant Protection Organization (EPPO) in February 2007; and
5. In the process of joining Codex Alimentarius Commission

Environmental Laws:

Annex A (targeting elimination of production and use) Section 2 of the Stockholm Convention sets forth a requirement to phase out the use of Polychlorinated biphenyls (PCB), one of the three non-pesticide POPs, widely used as dielectric and coolants fluids in electric equipment, and their wastes by 2025 year. The Republic of Azerbaijan plans to phase out the use of PCB containing equipment by 2020. By signing POPs, the Government is committed to phase out/eliminate the use of all POPs, where nine of the original twelve POPs were insecticides, (with subsequent additions made to this list, including Endosulphan in Annex A); eliminating the use of these insecticides is essential. Similarly, according to a protocol of the Board of Experts #21 dated April 22, 2009 import of DNOK and its utilization in the Republic was banned, and with the exhaustion of existing stock, no new imports will be allowed, in spite of some evidence to the contrary.

National Physanotary Law and Development Strategy:

This is the Program for Ecologically Sustainable Social – Economic Development.

One of the strategic targets in this sphere is

- Bringing the environmental legislation of Azerbaijan to conformity with legislation of European Community. It is a long – term (strategic) aim, and as a result of implementation of this item, great results in the sphere of environment management in Azerbaijan may be achieved.

According to the Decree of President of Azerbaijan Republic № 467 of October 23, 2004 the State Phitosanitary Control Service under the Ministry of Agriculture has been established. This service conducts state control on protection and quarantine of plants, on use of pesticides, biological preparations and other plant protecting substances as well as gives permission for import, export, production, repackage, distribution and selling of pesticides.

Before the import of pesticides the initial examples are tested on special plants. The list of pesticides import of which permitted is submitted to the State Customs Committee and State Phitosanitary Control Service (SPCS). However, there are too many gaps. SPCS has little or no control of shipments arriving at the border. According to National Phytosanitary Development Strategy, SPCS lacks most skills to function properly and with some degree of its opacity, it fails to take advantage of expertise and skills present elsewhere in the country. The gaps identified in this document are:

1. Some functions to enhance National Plant Protection Office (NPPO) are not reflected in the national phytosanitary legislation;
2. Strategic framework for phytosanitary policy NPPO clearly not reflected in a single document;
3. Based on the principle of “single window” adopted by the country, Service has no control of imported consignments at the border;
4. Insufficient awareness of the population, employers and administrators in other areas on phytosanitary issues;
5. Absence of a strategic plan;
6. Lack of internal technical audit procedures;
7. The absence of units responsible for strategic planning and skills development;
8. The absence of unit responsible for planning and conducting technical audits, lack of procedures for internal quality audits;
9. The absence of a manager responsible for system of operational manuals and procedures, no written procedure for developing and storing the updated operational manuals;
10. Lack of training in inspection and diagnostics activity;
11. Lack of access to scientific and international sources of information;
12. Lack of equipment on entomology, herbology, mycology, nematology, bacteriology, virology, fumigation;
13. Do not have training in management, entomology, herbology, mycology, nematology, bacteriology, virology, fumigation;
14. Lack of methodological materials such as diagnostic protocols, sampling and standard operational procedures for laboratories;
15. Lack of biological and information reference materials for pest diagnosis;

16. Lack of phytosanitary strategic plan;
17. There is no computerized database for collecting, storing and use of pest information;
18. And the list of the deficiencies can go on! And on!

In a nut shell, perusing the National Phytosanitary Development Strategy reveals there is a significant need for developing procedures and capacities of SPCS in several areas: in legislation and policy; in operations; technical capacity; and in addressing the factors hindering improvement of the SPCS to have the desired impact. While the service must be enabled to work with Customs at the border control points – not only for verification of pesticide shipments, but also in monitoring agricultural imports that may become the cause of introduction of pest or disease organism, export to assure compliance with MRLs, the service will have to become more transparent in itself in conduct and discharge of duties; as well as improve its coordination with other stake holders by identifying not only their strengths, but building upon them. The Country had significant capabilities at one time, and some of the expertise may still be available, but major effort is required to make this Service effective. In addition to equipping the labs, there is a need for training personnel with a wide array of skills to build the institutional capacity to deliver its mandate. ADCP-3 can assist the Service in improving its operations by facilitating facilities improvement and staff development to ensure SPCS becomes efficient and more transparent service delivery institution. One SPCS Good Practice would be its opening up the access to all pesticide import licenses issued, to decrease prospects of allowing products with environmental or health impacts.

Strategic Directions: National IPM Program (Proposed) for consideration by the Ministry of Agriculture A

For successful implementation, a national IPM Program is proposed. To enhance effectiveness, this program must be based centrally preferably directly under the ADCP-3 Project Management Unit (PMU), under an international IPM Specialist who would ensure coordination with all the program stakeholders – the research institutes, field staff and the growers of economically important crops in various regions of the country, as well as with the environment ministry. In addition of the IPM activities, IPM Specialist would also assist with the development of analytical capacity in country, preferably at more than one institution to ensure quality control of agrochemicals imported for use in the country, and residue analysis to meet MRL compliance requirements. One of these facilities can be developed at the SPCS and a second facility can be either based at the Plant Protection Institute or Horticulture Research Institute, since fruits are important for export development. Since there is an urgent need to inject fresh blood in the research system, IPM Specialist would also develop a short- and medium-term human resources development program in consultation with all stakeholders, and assist the PMU with identification of resources. And, finally, the IPM Specialist would assist with the M & E of IPM Program.

Several research institutions in Azerbaijan have been, and are involved with crop protection research. Most elements of IPM program can be found in more than one of these institutes. Plant Protection Institute is found to be an institution with most elements of IPM in its research mandate is ideally located being close to the University and Cotton Research Institute. While cotton was the main user of

chemical insecticides, it is a crop in decline. Yet, with improved policy environment and pest control it can rebound, and due to the nature of crop production (larger crop areas) and crop value, it is well placed to revive IPM methods.

The Project – ADCP-3 can support this Institute in reviving IPM in holistic sense for field and horticultural crops, as well as building its testing of pesticides and pesticide residues capability to enhance in-country analytical capacity. The Plant Protection Institute already has a pest survey and forecast group which should be strengthened. The Institute also has the necessary knowledge and cultures for producing bio-control agents and the project will assist the institute in establishing rearing lines for parasites and predators that can be adopted for pest control of economically important crops. The institute has pesticide analytical facilities which are out dated, and would need to be upgraded, as this institute is better placed to ensure quality control for the chemical insecticides imported into the country. Since the SPCS is has the mandate to register and issue import licenses of all pesticides imported in the country, conducting quality control may cause conflict of interest. Thus relieving SPCS from quality control could help ensure the robustness of pesticide registration and approval process. However, to enhance the monitoring function of Plant Protection Institute, it will have to enhance its working relationship with the field staff of MOA, and may have to be delegated with the authority to collect samples of plant protection chemicals in the Republic for onward transmission to the Institute for analysis.

Plant Protection Institute will pursue IPM development in close coordination with Cotton Research Institute, Horticulture and Vegetables Research Institutes and Field Crops Research Institute; assist the Agrarian University in improving the crop protection academic and research program; and develop information dissemination/extension materials in coordination with communication specialist of ADCP-3 (as proposed) as well as the RASSC and PAC in Ganja and in coordination with Horticulture Institute in Guba, Field Crops Research Institute and Vegetable Research Institute in Baku, the last one to specially focus on biological control of pests of greenhouse crops.

The Institutes that may be involved in developing IPM Program initially are:

1. Plant Protection Institute as the lead institutions with a senior scientist assigned full time for the development and coordination of IPM Program in Azerbaijan. Elements of the old paradigm that need revival are:

- Basic research in pest bionomics; ecosystem analysis; etc. to:
    - Revalidating Economic Thresholds;
    - Develop new thresholds for new pests; new crops; in different eco-zones;
    - Basic research in pest population dynamics and host plant resistance.
- Strengthening and Operationalizing Pest Warning and Forecasting Program using all resources for pest population monitoring: light traps; pheromone traps; surveys; etc – with capacity to disseminate pest situation reports with print and electronic media during the season;
- Alternative Pest Control Methods: (A):

    - Legislative Control Methods – prevention of new pests from entering or establishing in the country – the most important function of SPCS
    - Cultural control methods
    - Mechanical Control Methods
- Alternative Pest Control Methods: (B): Biological Control with parasites and Predators:
    - Survey for identification of indigenous parasite and predators for control of important pest species;
    - Multiplication of parasites and predators cultures for trials and testing;
    - Development of a full scale biological pest control facility – with individual lines for production of parasites and predators; and
    - Research on developing artificial diets for culturing biological control agents.
- Microbial Control of Insect Pests (with bacteria, viruses, etc.)
- Potential of pheromones and other behavioral chemicals
- Control of pests with plant formulations
- Greenhouse pest control – with emerging trend of greenhouse production, and controlled green house environment, cultural and biological control methods may be standardized with parasites and predators for greenhouse pests and diseases.
- Improving effectiveness of the "last-resort" pest control method – chemical control with highly selective insecticides approved for use against the pest in question, on the crop it is approved for, using the most effective spray methodology. This component must ensure only the most appropriate pesticides are tested and approval of any pesticide with deleterious environmental or human health implications is not allowed.
- Development of pesticide delivery mechanism to ensure efficient targeting of pest with selective chemicals with little or no adverse impact on non-target and beneficial organism. This will involve both research in improvement of spray instruments; and improvement of spray methodology. And,
- Pesticide and pesticide residue laboratory.

2. Cotton Research Institute Ganja for Cotton IPM Program focusing cotton pests, their Economic Injury Thresholds, parasites and predators, formulating an effective cotton IPM program in addition to host plant resistance.
3. Horticulture Research Institute, Guba can serve as the node for developing IPM Program for major fruits in the country. This institute may also be assisted with the development of a facility to detect pesticide residues as this would become the most important determinant in export of fruit crops as the country aims to tap into high value markets.
4. Crop Husbandry Research Institute, Baku: In addition to testing for host plant resistance, cereal pests like cutworms, wheat bulb fly, corn ground beetle, cereal ground beetle, western corn root worm, cereal leaf beetle, click beetle, fruit flies, aphids and borers as well as pests of lentils, this Institute will be tasked to develop thresholds of the serious pests of food crops, identify biological control agents and under the leadership of plant protection institute, develop extension materials for farming community. The institute can also develop a program to identify

biological control options for other pests and diseases including rust mite against rusts for cereals and potentially for fruits. This institute had received significant support from ADCP-2 and may be supported with the acquisition of a green house.

5. Vegetable Research Institute, Baku may also be invited to initiate research on vegetable crops IPM by coordinating with Crop Husbandry Research Institute under the overall technical guidance of Plant Protection Institute. It is likely that this institute will focus more on greenhouse pests and their eradication using environmentally benign methods under IPM.
6. RASSC under the MOA and PAC developed under the ADCP II may become useful in terms of adapting the research results from these institutes into adaptive research packages to be demonstrated at the farmers' field. They can become an important node for the dissemination of pest forecast and warning system and can also assist the research institution in the design of extension materials both for print and electronic media. However, while ADCP may establish new PACs, the existing PACs must be transferred to MOA.
7. Development of print and electronic resources for dissemination of IPM related knowledge to all stake holders – field workers, farmers and as well as input marketing sector to ensure uniform knowledge.
8. Agrarian University was supported by ADCP-2 in improving its teaching departments. However, the university has not been successful in recruiting/admitting sufficient student numbers that may be required by the Agriculture sector once existing staff starts retiring. Unless an appropriate human resource policy is formulated, there is an ever increasing likelihood agriculture sector will suffer human resource shortages in the near to medium term. The university may consider improving student enrollment, especially in crop production and protection sphere.

This is a comprehensive approach to initiating an IPM Program at national level and its implementation may not be possible in immediate terms. Furthermore, since some aspects like the bionomics of newer pests and validation of economic injury levels in different regions to determine thresholds may require multi-year data; other actions can be started with relatively very small lead time. Depending on the state of preparedness of the Institutes, some may be in a position to initiate effort in pursuit of IPM development even before their promised capacity building is delivered by the ADCP-3. Some of these activities may be:

1. Pest survey and forecast:
2. Biological control program:
3. Adapting any of the old IPM approaches/practices where possible

The impact of ADCP-3 on agricultural will be increase in yields and production as well as the development of value chains ensuring higher profits to the more enterprising amongst the farmers. This may lead to an increase in the use of chemical inputs as well, through non-project sources. However, this cohort of farmers is easily approachable for adoption of good practices, which generally yield to lower costs as well as efficient use of resources. Most of these farmers can be provided with best

practice literature by the value chains that they may be associated with, but others may benefit by project supported initiates.

The ADCP-3 may support the development of new print and electronic resources as well as updating existing extension materials for dissemination of best practices, emphasizing IPM related knowledge to all stake holders – field workers, farmers and as well as input marketing sector to ensure uniform knowledge through the RASSCs and PACs as well as by making them available to the private sector for distribution.

ADCP-3 may also pilot the village level, season long Farmer Field Schools (FFS), an experiential-learning approach to extension emphasizing IPM, developed and promoted by FAO in many parts of the world. This tool is as much a human resource developmental tool as it is an extension method. This approach may be piloted especially in areas which have a high concentration of small holder farmers especially in areas close to these institutions – Plant Protection Institute in Ganja and Vegetable Research Institute in Baku, as these institutions may have necessary technical manpower to provide the leadership for this program. These FFS may initially focus on IPM of specific crops, but may later be adapted "integrated crop management" (ICM). It is pertinent to note that FFS method is a community based participatory approach to learning by doing, which may be useful at later stage in organizing producers groups for specialized production of field crops/vegetables/fruits!

Institutional Support for Research System: Like preceding ADCP-2, the ADCP-3 can support research institutes with their capacity building needs. ADCP-3 can procure specialized rearing lines for various bio-control agents for Plant Protection Institute and facilitate operationalization of biological control program. The Project can also procure specialized pesticide and pesticide residue analysis equipment for SPCS, Plant Protection Institute and Horticulture Institute. In addition to these specialized equipments, all these institutions are in need of basic lab equipment and chemical reagents, for which the project will make an appropriation of resources as indicated in the budget. Most of these institutions lack even the basic laboratory equipment – namely binocular, simple and complex microscopes, electronic balances, climatic control chambers, water distillation units, etc.

Initially, the Project Staff (M & E and Technical Specialists) can monitor the delivery of equipment. However, for a successful coordinated program, PMU must acquire an in-house capability to develop and monitor the program. Thus a provision of an international IPM specialist initially for two years is made. The PMU must also have an in-house capacity to inventory researches in various institutes that may form the basis of a national IPM program. While this is being established, any research findings with potential of benefiting production systems as well as IPM must be demonstrated and extension materials prepared with special emphasis on good practices leading to the adoption of IPM.

Human Resource Development for IPM: While the academic program at undergraduate and graduate levels is the mandate of the Agrarian University, specialized training in various specialties of IPM would be essential for the successful development of IPM in Azerbaijan. This assumes even greater significance since most researchers are approaching their retirements and qualified staff for replacement is not

readily available. Fresh college graduates may require international exposure as well as training in modern research methodology. These training programs may vary between short term trainings of one to several weeks to masters and doctorates for younger scientists.

Indicative Costs of a National IPM Program (US$)

Biological Control Rearing Facilities:	
3 Rearing Lines for major Parasites and Predators	500,000
Refurbishing Biological Control Program labs	200,000
Laboratory Equipment for Plant Protection Institute	100,000
Insecticide/residue Analysis Lab – equipment/rehabilitation of infrastructure	250,000
Laboratory Equipment for Horticulture Institute	200,000
State Phytosanitary Control Service	
Insecticide/residue Analysis Lab: upgrading equipment at SPCS facilities	250,000
Training and capacity building needs of SPCS and research institute	2,500,000
Institutional Capacity Building	
Laboratory Equipment Chemicals/Reagents for research institutes	300,000
Preparation of publications/audio/visual aids and dissemination campaigns	200,000
Demonstrations of good practices (Demonstrations and FFS)	1,000,000
Training and capacity building needs of research institutes	3,500,000
International IPM Specialist (2 Calendar years)	500,000
Contingencies	950,000
Total:	**10,450,000**

ADCP 1 and 2 were instrumental in upgrading agricultural production in Azerbaijan and has supported several research institutions in improving the research environment. ADCP-3 intends to continue this practice but with emphasis on revival of pest management techniques to conform to IPM principles. While the ultimate objective will be the identification of local/donor resources for this proposed national IPM Program, it will be a medium-term priority. On a more immediate basis, ADCP-3 may take the following steps to initiate the mainstreaming of IPM in the Project areas:

Inventory of research at key institutes that fit the IPM paradigm – namely economic injury thresholds of keypests in key field and horticultural crops; non-chemical control; biological control; chemical control with non-persistent, environmentally benign insecticides; appropriate chemical handling and application methods; applicator and environmental safety.

If the PMU chooses to hire the IPM Specialist, s(he) can undertake the above tasks within one year after being hired by the PMU. In such case, s(he) will be responsible to facilitate coordination ing between all

the agricultural research institutions as well as all government agencies with a mandate in agricultural production, processing and trade, public and environmental health, etc.

Identified IPM methods (or components, thereof) will be reviewed and selected messages will immediately be converted into best practice notes, which would be processed by the Project in-coordination with Project authorities.

ADCP-3 can run concerted campaigns with the ministry of environmental to create awareness of human and environmental health hazards and with the MOA to increase awareness of IPM methods and their benefits.

Organize trainings and workshops with other stakeholders, including private sector and nongovernmental organizations to improve awareness and beneficial effects of IPM. Several training modules with IPM messages were prepared under ADCP-1 and 2, while others would be developed on the basis of perceived needs during stakeholder discussions. ADCP-3 can assist with their development and delivery. Any support to SPCS will be contingent upon streamlining and ensuring transparency in the pesticide registration and import licensing processes as well as utilizing existing resources efficiently before further up-gradation of facilities.

The most important IPM messages disseminated as campaign would be:

- Avoidance of calendar spraying at all cost;
- Cultural control methods (pre- and post- sowing);
- Mechanical control;
- Delaying first spray for as long as possible to allow population of natural enemies (parasites and predators) to suppress pest populations;
- Biological (and microbial) controls as the key elements of IPM in Azerbaijan;
- Developing and encouraging adoption of Pest Scouting culture by the farmers;
- Designing appropriate pest forecast and pest warning model and messages;
- Use of light and pheromone traps for monitoring pest activity and for trapping adults for pest control;
- In the event chemical control is necessitated, use of only selective insecticides with minimal environmental footprint; emphasizing product quality, timing and method of application and use of safety gear for applicator safety;
- Demonstrations of IPM approaches listed above in every ecological zone;
- Publicizing IPM both as government policy (which it is not at the present, but, ADCP-3 will lead its advocacy) and environmentally benign and sustainable tool for production and quality enhancement of agricultural produce; and
- Addressing human and environmental health dimensions.

Advocacy of IPM as a public policy as well as efficiency enhancing agricultural production component of farming system, with health and environmental benefits assumes an even greater role in an environment when there is competition for limited public budgetary resources on the one hand and

continuous donor insistence on government's withdrawal from provision of basic agricultural research and technology transfer (extension). Advocacy for increased allocation of resources for education in IPM at the Agriculture University will also be rigorously pursued.

PEST MANAGEMENT PLAN FOR ADCP - 3

Below are the key areas proposed for intervention under the ADCP-3. They are subject of further consideration by the MoA and PMU. The final choice of the activities will depend on the commitment and readiness of GOA (MOA) for broader interventions:

1. During year one, the Project will recruit a local IPM Specialist with appropriate qualification and experience – Ph.D/M.Sc in Entomology/Plant Protection/Plant Pathology with national and regional/international experience. One of the important responsibilities of IPM Specialist will be to develop an effective coordination mechanism between various GOA agencies as well as other stakeholders – farmers, value chains, and consumer groups, when necessary.
2. ADCP-3 will sign a memorandum of understanding (MOU) with Plant Protection Institute for providing necessary support in developing/institutionalizing an appropriate IPM Program in lieu of any support provided to the institute by the Project. Plant Protection Institute will provide support in validating existing and developing fresh economic injury levels and thresholds, pest monitoring program, biological control program, pesticide management in field and store conditions and pesticide residue management.
3. ADCP-3 will also sign an MOU with SPCS for greater transparency in issuing pesticide import licenses, ensuring only the most environmentally benign pesticides are allowed to be imported.
4. Within the first twelve months, the IPM Specialist will inventory all IPM related knowledge with the research institutions, as well as determine training needs for the staff of research institutions, PASSC, PAC and SPCS, as well as for the farmers of major crops of different ecological regions with ADCP-3 interventions.
5. IPM Specialist in coordination with the environmental/social safeguard specialist will prepare a check list for sub-project/value chain sponsors/promoters/investors.
6. Based on inventory of IPM knowledge, develop a program to promote IPM and reduce reliance on chemical pesticides by promoting cultural control before planting crops and during their growth cycle; establishing economic injury levels of major pests of major crops. Pest scouting will be promoted for pest monitoring on a regular basis, to ensure first spray is delayed as long as possible to enable natural control agents (parasites and predators, etc) to suppress pest populations. The Plant Protection Institute will provide the cultures and methodology for production of bio-control agents.
7. These thresholds will be promoted as basis for pest control decisions. Only the most appropriate – selective pesticides will be used to target pest, once thresholds are crossed. This will be initially pursued for fruit trees and greenhouse crops. For fruit trees Horticulture Institute will arrange multi-year demonstrations for major fruit crops in fruit growing areas. For vegetables and other greenhouse crops, biological control program will be instituted under supervision of Plant Protection Institute.
8. These is considerable understanding of safety in pesticide use. Most pesticide outlets have some safety gear readily available. All awareness creating campaigns and training materials will emphasize safe use practices.

9. To reduce environmental and health risks associated with pesticide use, the Project will encourage SPCS will only allow the import and use of approved pesticides which meet strict environmental and health safety criteria. While building capacity of SPCS, the role of various agencies involved will be defined and mechanism for coordination developed. Safety messages will be designed in consultation with Environment Commission and health authorities to create awareness among the consumers as well as practitioners. These messages will be disseminated widely using electronic and print media. Training modules may be revised to emphasize these aspects. Project will ensure this through IPM Specialist who will work closely on this subject with the environmental specialist.
10. The Project will develop an extensive training program using training modules prepared under ADCP 2 and developing new modules when need is identified. The Project will coordinate with FAO Program being designed for pesticide handling, especially applicator's safety and assist Environment Commission in the disposal of some of the obsolete pesticides (especially POPs) as provided in the Environment Strategy.
11. MOA field staff, RASSC and PAC staff will be co-opted to sample pesticides in the field for testing for quality to ensure sub-standard and unsafe products use is discouraged. The Project will develop, publish and provide appropriate literature on this subject. This activity will be responsibility of IPM Specialist, who will prepare all training and extension materials with Communication Specialist. All training, publicity and extension literature will be prepared during the second year of Specialists appointment.

In addition to the direct monitoring by ADCP-3 M & E Specialist, the Project will acquire/use third party monitoring in the third year of the Project, either through hiring of an NGO with experience/expertise in pest management related issues or an academic/research institution which had not and will not benefit from ADCP-3 resources.

To accomplish the above, ADCP-3 should make a minimum allocation of the following expenditure in its budget:

IPM Specialist (36 months)	54,000
Communication Specialist (18 months)	27,000
Design of messages/development of modules	20,000
Publication of IPM messages and publicity campaigns	150,000
Field Demonstrations	150,000
Transport and office support	30,000
Independent M & E	20,000
Contingencies	29,000
TOTAL	**480,000**

Monitoring and Evaluation of PMP Implementation

Monitoring and supervision plan, implementation responsibilities, required expertise and cost coverage.

ADCP-2 had developed an in-house M&E capacity. Monitoring PMP implementation is contingent upon the selection of an appropriate set of indicators or an indicator that is easily measureable. An indicative indicator for M & E of IPM is given in Annex III.

However, given the current environment, to be effective, in addition to M & E, there will be a need for advocacy at all levels, for acceptance of IPM principles in totality, as a coherent whole. This will warrant coordination between the stakeholders, from the highest policy formulation level to the field level where IPM principles are applied not by the experts only, but more significantly, by the farmers also. Thus ADCP III may choose to hire a full-time IPM Coordinator who would ensure different institutions, with interest in crop protection, institutions with interest in approving and authorizing imports of crop protection products, service providers in the public and private sectors are effectively working as a team for the benefit of farmers, ensuring food security without compromising human and environmental health. Dialogue with research institutions, as well as the associations developed between these institutions and ADCP 1 & 2 is indicative of their level of comfort with such an approach as in the long run as these institutions had an interest in IPM in the past and will benefit from capacity building support in various forms in due course. This would warrant developing a suitable advocacy environment for enhancing service structure for professionals, expected to serve away from major urban centers, with very important mandate of enabling improved agriculture production to ensure food security, poverty alleviation as well as creating environment in rural space which will prevent further migration to Baku.

The culture of “Turf-Management”, where every organization protects its prerogatives and monopolizes information will be nudged towards a culture of responsiveness, transparency and better coordination between various organization implementing activities that fall under IPM. ADCP-3 can be in a position to move in this direction because of the support it intends to provide various stakeholders (government agencies) for building their capacities and improving their operational capabilities.

There is an identified need for more coordination between Agriculture University at Ganja which produces crop protection specialists, where these specialists must be given sufficient skills that are required in spear-heading effective crop protection strategies for different crops in distinct ecological zones of the country; Plant Protection Institute and various crop-based research institutions in the country; private sector entities involved in crop protection product import and marketing; and most importantly, growers of different crops in all the ecological zones. It must be emphasized this is a lofty goal, and will take resources, efforts and time to achieve a reasonable balance, given that the university cannot even attract sufficient students for admission to the Faculty of Agriculture.

Annex I: List of Pestisides Approved for Import in Azerbaijan

1.	2,4 D Acid dimetylamine
2.	2,4 D+ Dicamba
3.	Abamectin
4.	Acetamiprid
5.	Alphacypermethrin
6.	Aluminium Phosphide
7.	Amitraz
8.	Azoksistrobin
9.	Bentazone
10.	Bentazone+ terbuthylazine
11.	Beta Cyfluthrin
12.	Bifenthrin
13.	Bordeaux + mancozeb
14.	Bordeaux mixture+ Copper
15.	Brodifacoum
16.	Buprofezin
17.	Captan
18.	Carbendazim
19.	Carboxin + thiram
20.	Carbosulphan
21.	Chloridazon
22.	Chlorothalonil
23.	Chlorothalonil+ Carbendazim
24.	Chlorpyrifos + bifenthrin
25.	Chlorpyrifos + cypermetrin
26.	Clodinofop propargyl + antidote

27.	Clopyralid
28.	Copper Hidroxide
29.	Copper hydrochloride
30.	Copper oxychloride
31.	Copper oxychloride + zineb
32.	Copper oxychloride+cymoxalin
33.	Copper sulphate
34.	Coumatetralyl
35.	Cyhexatin
36.	Cypermethrin
37.	Cyprodinil
38.	Cyprodinil +fludioxonil
39.	Cyromazine
40.	Deltamethrin
41.	Deltamethrin + dimethoate
42.	Desmedipham + phenmedipham + etofumesate
43.	Diafenthiuron
44.	Diazinon
45.	Dicamba
46.	Dicamba + chlorsulfuron
47.	Dicamba +triasulfuron
48.	Dicloran
49.	Dicofol
50.	Difeconazole+ propiconazole
51.	Difeneconazole
52.	Difeneconazole + propiconazole
53.	Diflubenzuron

54.	Dimethenamid
55.	Dimethoate
56.	Dimetimorf + Mankazeb
57.	Dimetomorf+ Ditianon
58.	Dithianon
59.	Dithianon+ pyraclostrobin
60.	Emamectin benzoate
61.	Esfenvalerate
62.	Ethephon
63.	Ethephon+ cyclanilide
64.	Ethoprop
65.	Ethoprophos
66.	Ethylphenacine
67.	Famoxadone+ simoksanil
68.	Fenarimol
69.	Fenazaquin
70.	Fenbutation Oxide
71.	Fenoxaprop-P-ethyl
72.	Fenoxaprop-p-ethyl + antidote
73.	Fenoxycarb
74.	Fenphropathrin
75.	Flocumafen
76.	Fluazifop-p-butyl
77.	Fludioxonil+ cyproconazole
78.	Fluronoset
79.	Flusilazole
80.	Flutriafol

81.	Glyphosate
82.	Hexythiazox
83.	Helimacide-laktobakter
84.	Humic Acid
85.	Hymexazol
86.	İmazamox
87.	Imidacloprid + lambda cyhalothrin
88.	Imidacloprid+ mineral oil
89.	Indoxacarb
90.	Iprodione
91.	Klopiralid
92.	Klotianidin
93.	Kresoxim-methyl
94.	Qaloxifop-P- methyl
95.	Quizalofop-p-ethyl
96.	Quizalofop-P-tefuryl
97.	Laktobakteriyalar
98.	Lambda cyhalothrin
99.	Linuron
100.	Lyufenuron
101.	Lyufenuron+ Fenoxycarb
102.	Magnesium phosphide
103.	Malathion
104.	Mancozeb
105.	Mancozeb + carbendazim
106.	Mancozeb + copper
107.	Mancozeb +dimetomorf

108.	Mancozeb +metalaxyl
109.	Mancozeb+Cymoxanil
110.	Mancozeb+famoxadon
111.	Mancozeb+mefenoxam
112.	Mandipropamid
113.	Mandipropamid+ Mancozeb
114.	Maneb
115.	Mepiquat chloride
116.	Metalaxyl
117.	Metaldehyde
118.	Metallic copper
119.	Metam Sodium
120.	Metamitron
121.	Methidathion
122.	Methomyl
123.	Metiram
124.	Metiram+ copper hydroxide
125.	Metolachlor
126.	Metrafenone
127.	Metribuzin
128.	Metsulfuron-methyl
129.	Mineral oil
130.	Mitallik mis+misxlor oksid
131.	Modifiye Hint Yağı
132.	Myclobutanil
133.	Nicosulfuron
134.	Oxamyl

135.	Oxyfluorfen
136.	Parafinic mineral oil
137.	Paraquat
138.	Pendimethalin
139.	Phosmet
140.	Piridaben
141.	Pirimiphos methyl
142.	Polret+triadimenol
143.	Profenofos + cypermetrin
144.	Proquinazid
145.	Prometrin
146.	Propargite
147.	Propargite+tefradfion
148.	Propiconazole
149.	Propiconazole+cyproconazole
150.	Propiconazole+tebuconazole
151.	Propineb
152.	Propineb+Cymoxanil
153.	Pyraclostrobin+ metiram
154.	Pyridaben
155.	Pyrimethanil
156.	Rebound
157.	Sulphur
158.	Tebuconazole + sulphur
159.	Texnik Bordo Bulamacı
160.	Tepraloxydim
161.	Thiabendazole + tebuconazole

162.	Thidiazuron + diuron
163.	Thiodicarb
164.	Thiophanate-methyl
165.	Thiophonate methyl +epoxikonazol
166.	Thiram
167.	Triadimefon
168.	Triadimefon + tebuconazole
169.	Triadimenol
170.	Triasulfuron
171.	Tribenuron methyl
172.	Trifloxystrobin
173.	Trifluralin
174.	Triticonazole+ pyraclostrobin
175.	Zetacypermethrin
176.	Zinc Phosphide
177.	Zineb
178.	Etofymezam+phenmedipham+ desmedipham
179.	Tiomethaxam

Annex II:

LIST of quarantine pests that have not been recorded or have limited spread and represent potential danger in the territory of the Republic of Azerbaijan

A1. Quarantine pests that have not been recorded in the territory of the Republic of Azerbaijan
Insects (A)

Agrilus mali Mats
Aleurocanthus woglumi Ashby
Aleurothrixus floccosus Mask
Anarsia lineatella Zeller
Anguina tritici (Steinb)
Anthonomus grandis Baheman
Aphelenchoides besseyi Christie
Bactrocera cucurbitae (Coguillet)
Bemisia tabaci (Gennadius)
Bursaphelenchus xylophilus (Steiner et Buhrer) Nickle
Cacoecimorpha pronubana Hubner
Callosobruchus chinensis L.
Carposina niponensis Wlsghm.
Caryedon gonara Ol.
Caulophilus oryzae Gyll
Ceratitis capitata Wied.
Ceroplastes rusci L.
Conotrachelus nenuphar (Herbst)
Dacus ciliatus Loew
Diabrotica virgifera virgifera le Conte
Ditylenchus destructor Thorne
Ditylenchus dipsaci (Kuhn) Filipjev
Earias insulana Boisduval
Globodera pallida (Stone) Behrens
Globodera rostochiensis (Woll.) Behrens
Liriomyza trifolii (Burgess)
Lymantria dispar L (asian race)
Meloidogyne chitwoodi Golden et al.
Numonia pyrivorella Mats.
Pantomorus leucoloma Boh.
Parasaissetia nigra (Hietner)
Pectinophora gossypiella Saund.
Pectinophora malvella Hb.
Phthorimaea operculella Zell.
Popillia japonica Newm.
Pseudococcus citriculus Green
Pseudococcus gahani Green
Rhagoletis pomonella Walsh.
Saissetia oleae Bern.

Spodoptera littoralis Boisd.
Spodoptera litura Fabr.
Tetradacus citri Chen.
Thrips palmi Karny
Trogoderma granarium Everts
Unaspis citri Comst.
Unaspis yaponensis Kuw.
Zabrotes subfasciatus Boh

Bacteria (B)

Xanthomonas campestris pv. citri Dye
Xanthomonas campectris pv. corylina Dye
Xanthomonas campectris pv. phaseoli Dye
Xanthomonas campestris pv. vesicatoria Dye
Xanthomonas oryzae Scurngs et al. pv. oryzae (Ishiyama) Swings et al.
Xanthomonas oryzae Scurngs et al. pv. oryzicola (Fang et al.) Swings et al.
Clavibacter michiganensis subsp sepedonicus (Spieckermann and Kotthoff) Davis et al.
Erwinia sтewartii (Smith) Dye.
Erwinia amylovora (Burrill) Winslow et al.
Ralstonia solanacearum (Smith) Yabuuchi et al.
Pseudomonas caryophylli Burkholder

Fungi (F)

Anqiosorus solani Thirumulachar et O'Brien
Cochliobolus carbonum R.R. Nelson
Cochliobolus heterostrophus (Drechsler) Drechsler(Rase T) (Helminthosporium maydis Nisiĸado et Miyaĸe)
Deuterophoma tracheiphila Petri
Didymella chrysanthemi (Tassi) Garibaldi et. Gullino
Elsinoe fawcettii Bitancourt et A.E. Jenkins
Glomerella qossypii (South) Edgerton.
Cryphonectria parasitica (Murrill) Borr
Phialophora cinerescens (Wollenweber) van Beyma
Phoma exigua var. foveata (Foister) Bolrema
Phomopsis helianthi Munt – Cvet et al.
Phymatotrichopsis omnivora (Duggar) Hennebert
Puccinia horiana P. Hennings
Stenocarpella macrospora Sutton (Stenocarpella maydis Sutton)
Synchytrium endobioticum (Schilb.) Percival
Tilletia controversa Kuhn
Tilletia indica Mitra
Uromyces transversalis (Thümen)Winter

Virus, mycoplazma və viroids (B)

Tristeza virus

Weeds and parasite plants (W)

Ambrosia psilostachya D.C.
Ambrosia trifida L.
Cenchrus payciflorus Benth .
Iva axillaris Pursh.
Solanum carolinense L.
Solanum elaeagnifolium Cav.
Solanum triflorum Nutt.
Striga (spp.)

A.2. Quarantine pests that have limited spread in the territory of the Republic of Azerbaijan

Insects (A)

Icerya purchasi Maskell
Hyphantria cunea Drury
Grapholita molesta (Busck)
Cuadraspidiotus perniciosus (Comstocк)
Leptinotarsa decemlineata Say
Pseudoulacaspis pentagona (Targioni- Tozzetti)
Pseudococcus comstocki Kuwana
Callosobruchus maculatus Fabricius
Viteus vitifoliae (Fitch)
Dialeurodes citri (Ashmead)
Phyllocnistis citrella Stainton
Ceroplastes japonicus Green
Lopholeucaspis japonica (Cockerell)

Weeds and parasite plants (W)

Ambrosia artemisiifolia Linnaeus
Acroptilon repens (Linnaeus) De Candolle
Solanum cornutum Dunal
Cuscuta sp.

B1. Pests that represent potential danger in the territory of the Republic of Azerbaijan Insect (A)

Phthorimaea operculella (Zeller)

Annex: III

IPM INDICATORS (Indicative – must be adapted for individual crop)

Performance Indicator # 1 (i): Reduction in average pesticide usage among smallholder [**crop**] producers due to adoption of IPM practices in test area(s).

a) Definition of the indicator: Integrated Pest Management (IPM) methods lead to reduction in the **number of chemical sprays for effective pest control** during the crop's pest cycle, usually beginning in the [?] week after planting up to the [?] week, when most of the fruits/flowers/ bolls/vegetation have matured and are no longer susceptible to pest damage.

Since small holder farmers growing [crop] in [area] and elsewhere have low level of technical skills and effective technology transfer methods are inadequate, they use calendar-based spraying for pest control. Usually, the period beginning around [?] weeks after crop's planting and continuing up to week [?] – the critical time for pest infestation. It is during this period when farmers generally apply chemical insecticides every week/two weeks even when there are no pests/or with very low pest population in the fields, mostly because they are usually told (by pesticide sellers) not doing this will cause economic damage. This increases production costs for farmers, sometime unnecessarily and may more likely create environmental pollution and health problems for the farmer, his family or livestock. Early spray also eliminates the population of beneficial, which usually takes much longer to re-establish their presence.

IPM educates farmers to use chemical spray only when it is necessary – that is, when there is a significant population of pests in the [crop] field. This is when the damage caused by the pest will be more than the cost of chemical spray: "economic threshold", which can be determined by regular crop inspection or survey and is called Pest Scouting.

b) Parameter to be measured:

Number of chemical sprays applied during pest control cycle that is between week 8 and week 16 of the crop production cycle. Cotton farmers in Azerbaijan have usually applied six to eight sprays based on a calendar spray program. Thus with IPM adoption, the number of sprays will decrease while the efficacy of pest control will increase.

The parameters to be measured for this indicator are:

- Pest infestation levels (sucking, bollworms, etc. determined with pest scouting at least once every week and maybe more than once a week depending on the season/pest pressure.)
- Number of sprays
- Pesticide used

c) Sampling method:

Initially under the IPM program, the contact group of farmers consists of smallholders within a radius of several kilometers around (a Research Institute/Advisory Service Center). This could be a relatively small group of farmers (30 to 35 farmers), and the entire group can be used as a sample. If there are more

than one farmer groups in an area, a representative sample from among these groups will be selected for data collection.

d) Data Collection Method:

Data will be collected by interviewing the head of the household. M and E questionnaire will contain the following general and IPM related questions:

Farmers Number/code:
Farmers Name:
Gender of household head:
Age of household head:
Education of household head:
Total Number of Household Members:
Address:
    Village:
    Block/District

Farm area:
Other crops: crops/area

Target Crop area:
Target Crop variety:
Date of planting:
Fertilizer applied:
    Basal:
    Top dressing:
Gap filling/thinning:
Pest scouting:

Date						
Sucking Pests:						
Aphids						
Jassids						
Whiteflies						
Bollworms:						
American						
Spiny						
Other pests						
Beneficial						
Spray Yes/No						
Pesticide/Qty						
Pesticide cost						
Spray method						
Other costs						

[N.B. This is an indicative List. The Pests will vary depending upon the crop, region and season]

e) Data collection period and Frequency:

Data will be collected once every year at the end of pest control cycle = the end of the crop cycle.

f) Method of Data Analysis:

The data collected from all samples will be entered into an Excel database. Data analysis will follow the following steps:

Step 1: Calculate the area under the target crop
Step 2: Calculate the inputs applied
Step 3: Record pest scouting activity
Step 4: Record pesticide application
Step 5: Records the pest control chemicals used and control costs incurred

g) Data entry and analysis template for the indicator:

An excel data template will be designed for recording and analyzing data

h) Verification of the indicator: The field/trial logbook records all relevant data. These are analyzed and presented as results in the annual report of the IPM. These results and logbooks can be corroborated with the survey data and further verified by field visits if necessary.

Performance Indicator # 1 (ii): increase of crop yield/Ha of smallholder producers due to adoption of IPM practices in test area(s).

a) Definition: Farmers adopting IPM will achieve higher yields because of the improved management of their crop. The yield in – tons/kilogram/hectare of crop, as well as quality, which could lead to higher price/quality premium.

Adoption of IPM will improve farmers understanding of crop production technology – from land preparation to planting, to pest management, harvesting and post harvest sanitation of crop's fields. Improved management and optimum pest control leads to improvement in yield and quality of crop produced, thus improving profitability directly and food security of crop producers in general.

b) Parameter to be measured:

Yield of crop calculated on the basis of kg or tons/hectare.

c) Sampling Method:

Initially under the IPM program, the contact group of farmers consists of smallholders within a radius of several kilometers around (a Research Institute/Advisory Service Center). This could be a relatively small group of farmers (30 to 35 farmers), and the entire group can be used as a sample. If there are more than one farmer groups in an area, a representative sample from among these groups will be selected for data collection.

A sample of twenty plants in an average row, away from the boundary of the cotton field will be selected and marked so the farmer will not pick the cotton from these plants. Crop will be picked/harvested by researcher/advisor personnel or the farmers themselves to estimate the yield/hectare. The plant sample will be selected as under:

- Select an average row of crop – five rows from the edge of the field.
- Walk one fifth the length of selected row.
- Count twenty plants marking the first and the twentieth plant.

All the farmers of the farmer contact group will be included in the sample at this stage. But once the program is expanded, a sample of farmers will be selected from each of the intervention area for data collection. One sample will be sufficient for the collection of Data for both of these indicators.

d) Data Collection Method:

M and E questionnaire will contain the following cotton yield related questions for IPM indicators.

Crop yield/hectare:

Pick/harvest the crop carefully.
Record the number of unripe fruits etc. if any.
Weight the sample.
Calculate the yield – kilograms/hectare.

e) Data Collection Period and Frequency:

Data will be collected once every year during harvesting: at the end of crop production cycle.

f) Method of Data Analysis:

The data collected from all samples will be entered into an Excel database. Data analysis will follow the following steps:

Step 1: Calculate the area under crop
Step 2: Calculate the inputs applied
Step 3: Record pest scouting activity
Step 4: Records the pest control costs
Step 5: Determine the cost of crop management (cost of production)
Step 6: Record yields and calculate net profit

g) Data entry and analysis template for the indicator:

An excel data template will be designed

h) Verification of the indicator: The yield data are recorded in the trial log books and presented as results in the annual report of the IPM. This can be corroborated with the survey data and further verified by field visits if necessary.