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IMPACT EVALUATION REPORT

ON

INTEGRATED PEST MANAGEMENT (IDRC PROJECT: 89 - 0318)

BY

HASSAN ABOU-BAKR, Ph. D.

**Biological control Research Laboratory
Department of Economic Entomology and Pesticides
Faculty of Agriculture - Cairo University
Giza - Egypt**

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Acknowledgement

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I. PROJECT PROFILE

Project Title: Integrated Pest Management (Egypt)

Project: IDRC/890318/01 **ISN:** 14150

Donor : IDRC

Funding Unit: AFNS- Crop Production Systems--Integrated Pest
Management

Amount of grant : 210,410 CAD

Fiscal year : 1989 / 1990

Date funds committed : 21 / 3 / 1990

Duration : 1990- 1994

Recipient: Department of Pesticide Chemistry, Faculty of
Agriculture, Alexandria University, Alexandria, EG

Project Leader : Dr. Nabil Mansour

Areas of Project Implementaton:

- Alexandria University
- El Beheira Governorate

II. BACKGROUND

Maize is the commonest summer cereal crop in Egypt, where up to 1.95 million feddans (one feddan = 4,200 m²) are cultivated throughout the country with a total production of about 4.5 million tons, valued at approximately LE 1740 million. Maize is used as human food and animal fodder, and the dry plant residues are used as a major source of fuel by rural households.

Maize has the advantage that its yield could be increased under the Egyptian conditions thanks to the development of new high yielding and pest - tolerant cultivars, and the introduction of improved agricultural practices.

However, maize plantations in Egypt are subject to infestations of a wide range of insect pests, plant diseases, and weeds. Maize pest control strategy has conventionally depended on chemical pesticides (insecticides, fungicides and herbicides). At the same time, chemical fertilization has been the major source to satisfy the plant growth needs.

With the increasing costs of agro- chemicals on one hand, and the increasing awareness of the hazards of these chemicals on the environment and human health, on the other hand, research efforts are directed to reduce the amounts of chemical pesticides and fertilizers used in crop production.

1- Corn Pest Problem

Stem borers, *Chilo agamemnon*, *Sesamia critica*, and *Ostrinia nubilalis* are the most dangerous lepidopterous insect pests of corn in Egypt. They are controlled mainly by the use of granular Carbamate and the organophosphorous Diazinone which have teratogenic effects on mammals. In addition, these compounds are known to have destructive effects on the populations of natural enemies and other non-target organisms.

Corn is also attacked by several fungal diseases, mainly the late wilt, *Cephalosporium maydis* and the common smut *Ustilago maydis* in addition to a recently emerged downey mildew. The control strategy of these diseases is mainly based on the cultivation of resistant varieties. However, there are reports on the decline of resistance of these varieties; crop losses due to fungal diseases ranged between 12-100 % in some areas of the country.

Weeds represent an additional problem in corn production, as weeds compete with the economic plants on nutrients in the soil, and cause yield reduction.

2- Integrated Pest Management (IPM)

Integrated Pest Management (IPM) is an environmentally sound approach which is based on the multidisciplinary and interdisciplinary involvement in agricultural pest problems. IPM recognises the presence of these " Pests " as part of the agro-ecosystems, provided that their populations are kept below economic threshold level. In other words, IPM could be defined as a crop protection system that is structured to use a variety of control procedures rather than relying on chemical pesticides as a sole control method. This system integrates cultural, biological, chemical, and other control methods in harmonised manner so that the eventual result is greater than the sum of all involved methods. In addition, IPM is an integral part of the Integrated Crop Management, which in turn , should be a part of Integrated Resource Management of a given ecosystem. Farmers' participation is a prerequisite to the success of IPM programs.

Although the National Campaign Program of Corn (NCPC), adopted by the Ministry of Agriculture (MOA) for more than 17 years, was based on the implementation of an integrated package of practices aiming at the

increase of maize yield in Egypt, little research efforts were made an IPM for the major crops cultivated in the country. This reflects the significance of the IPM project implemented by Alexandria University.

The IPM project was implemented in El Beheira Province (Governortate) north-west of the Nile Delta (see the map, Annex 6) where 180,000 - 200,000 feddans are currently cultivated with maize, representing 10 -12 % of the total maize- cultivated area in the country. In El Beheira, maize is cultivated in alluvial soil put down by the floods of River Nile over thousands of years. The surface flood irrigation is the dominant irrigation system followed there, using Nile water through a complicated irrigation and drainage network.

The delivery agent was the Faculty of Agriculture, University of Alexandria, the second biggest and oldest modern University in Egypt. Since the early 1960s the Department of Plant Protection in this faculty was strongly involved in research programs concerning integrated control, insect resistance to synthetic insecticides, microbial control, new natural pesticides, and the use of predators and parasites for the control of agricultural pests. The research team was headed by Dr. Nabil Mansour, professor of pesticide chemistry, and comprised of scientists and researchers of different disciplines, *i.e.* pest control, pesticides, soil and water science, economic entomology, plant pathology, agronomy, rural sociology and agricultural extension as well as administrative and financial officer. This diversity of the research team fits to the nature of the study problem and the planned objectives.

3- Project Objectives:

According to the project proposal (p. 3-4) the **planned general objective** of the project was:

" To develop and evaluate an integrated pest management (IPM) system for corn , in view of reducing pesticide use, decreasing health and environmental damage, and increasing the income of corn growers in Egypt"

In addition, the project had also the following **specific objectives**:

a) to develop a broad understanding of the range of farmers' pest management options, practices, knowledge and attitudes in corn production;

b) to generate corn IPM technologies that obviate the need for large quantities of pesticides, are environmentally sound and fit the conditions and needs of small farmers;

c) to evaluate and improve the developed IPM technology, technically and socio-economically, under farmers' conditions;

d) to establish a database for the subsequent development of an operational model for the prediction of seasonal occurrence of major pest species; and

e) to train village extension workers and farmers in IPM.

4- The Expected Results

The project proposal (p.4) defined the **expected results** as follow:

a) the development, and on-farm verifications, of methodologies and technology for corn IPM in Egypt;

b) the development of research experience in IPM for scientists and extension workers involved, and improvement of the understanding of farmers' strategies related to pest management;

c) the reduction of pesticide use and consequent decrease in environmental and health hazards, and increased income opportunities for corn growers in Egypt;

d) the development of IPM training materials targeted to extension workers and farmers; and

e) development of systems to organise information, and advising farmers on how to make decisions for managing their pest problems so as to optimise, on a long-term basis, returns to themselves in a way that recognises long- term environmental and social values.

III.Methodology

1- Review of Project Documents (Annex 1)

- 1.1. Project Proposal (1989)
- 1.2. Project Appraisal (1990)
- 1.3. Project Summary (1990)
- 1.4. Report on a Monitoring Visit (1991)
- 1.5. Second Annual Report (1992)
- 1.6. Final Report (1994)

2- Review of Project Puplications (Annex 2)

- 2.1. Crop Health Conference : Future of IPM in Crop Health and Sustainable Agriculture " IPM and Environment " First Announcement.

2.2. Crop Health Conference : Future of IPM in Crop Health and Sustainable Agriculture " IPM and Environment ", Programme (1994).

2.3. Crop Health Conference : Future of IPM in Crop Health and Sustainable Agriculture " IPM and Environment " , Abstracts (1995).

2.4. Pest Management and the Environment, (1995).

2.5. Extension Bulletins: Integrated Pest Management of Corn Pests (In Arabic):

2.5.1. Guidelines

2.5.2. Corn Insects

2.5.3. Corn Weeds

2.5.4. Corn Diseases

3. *Field Visits (Annex 3)*

3.1. Department of Pesticide Chemistry, Faculty of Agriculture,
University of Alexandria, Alexandria.

3.2. Abou Hommos, El Beheira Governorate.

4. *Interviews (Annex 4)*

4.1. Project Leader

4.2. Delivery Agent (Research Team in Alexandria University)

4.3. Agricultural Extension Staff in El Beheira.

4.4. Corn Growers in El Beheira.

4.5. IDRC regional director, Cairo.

5- Other Readings (Annex 5)

- 5.1. The Central Administration for Agricultural Extension, Ministry of Agriculture and Land Reclamation (1997). Extension bulletin on Corn. - In Arabic.
- 5.2. Dent, D. (1991). Insect Pest Management.
- 5.3. Youdeowei, A. and Service, M. W. (1983). Pest and Vector Management in the Tropics.
- 5.4. Framework for the Evaluation of Use and Impact of IDRC Projects. IDRC Evaluation Unit.

IV. EVALUATION RESULTS

1- Inputs / Activities

1.1. Inputs

- The IDRC offered a total amount of 210,410 CAD over four years (1990 - 1994) to the delivery agent. This grant represented the financial support given to the project.
- The recipient , the Faculty of Agriculture, Alexandria University, provided its laboratories, the physical and mental efforts and capacities of the research team.
- The beneficiaries, farmers in El Beheira Governorate, allowed the research team to use their own fields to carry out their experiments and small - scale field trials, on the basis that farmers participating in the trials will be compensated for any loss in revenue due to the

experiments. According to the PI, there were 27 collaborative farmers, increased later to 64. "Collaborative farmers" were those who offered their lands for experimentations, throughout the project activities. In addition, there were 264 co-operative farmers, who applied the IPM package in their fields by themselves with the advice of their neighbouring farmers and the extension workers.

- The agricultural extension department in El Beheira Governorate acted in close co-operation with the project team. There were 24 extension officers participating in the project activities. Meetings between research team and extension personnel were held in the agri-extension conference hall which was established in Abou Hommos using a fund offered by the National Agricultural Research Program (NARP).
- Political and moral support was given to the project by local senior officials and members of local and national parliaments in El Beheira Governorate.
- The project also made use of the publications and extension materials produced by the Central Administration for the Agricultural Extension, MOA.
- Moreover, the project has built on the accumulated findings of the National Campaign Program of Corn, MOA, which took place for 17 years and covered all maize-cultivated areas in Egypt.
- The project leader has good contacts with various research institutes as well as the MOA. The project has benefited from these contacts for the distribution of its extension materials (the technical bulletins) in different parts of the country.

1.2. Activities

Project activities were run by a triangle made up of scientists, extension workers, and collaborative farmers. This allowed a good interaction among the involved participants.

The project conducted a range of activities including:

- A questionnaire form was designed to recognise the farmers' attitudes, knowledge and practices towards corn cultivation and the different problems related to it in nine villages in El Beheira Governorate.
- An extensive survey was carried out in the same Governorate covering corn pests, corn infectious and non-infectious diseases, weeds associated with corn plantations and natural enemies associated with corn insect pests.
- A system of meetings was designed to secure direct and constant contacts between different parties participating in and collaborating with the project. The meetings were held at different levels: meetings with senior extension officers, meetings with extension workers, village meetings with the community leaders and farmers, and town hall meetings with local governors, senior officials in the agricultural department and members of local and national parliaments.
- A series of small - scale field trials were conducted in the farmers' fields in order to test and demonstrate a variety of cultural practices to achieve an appropriate technological package for corn production. The trials included: seed bed preparation, planting dates, planting spaces, irrigation intervals, type and rate of chemical fertilisation, manure application, weed control practices, cultivars, insect and disease control, detasseling and defoliation. (see project progressive reports)

- The project produced and distributed a series of 4 extension bulletins, mainly directed to extension workers and innovative farmers. The coloured- illustrated bulletins covered the following subjects: general guidelines, corn insects, corn diseases, and corn weeds. (Annex 2).
- Field data and experimental results are computerised and processed in order to establish a modelling system for the prediction of insect and disease infestations in corn fields.
- A video tape is currently produced as an additional tool to disseminate information to a wider range of corn growers throughout Egypt.
- In 1994, the project team organised an international conference, held in El Fayoum, on Pest Management and the Environment.

2- Outputs

The diversified inputs and the various activities of the IPM project have resulted in considerably rich outputs.

- Data and information resulted from the questionnaire constitute an important contribution to both scientific community, decision makers, extension workers and pest control people as well as provincial officials in El Beheira. It is noteworthy that such kind of studies which bring together socio-economic and ecological aspects are generally not common in Egypt. The accumulated knowledge drawn from the questionnaire would provide better understanding when a strategy of IPM for corn is to be set up.
- Field trials carried out in farmers' plots have resulted in a package of *agricultural practices for corn production*. In my meetings with the extension workers and farmers in Abou Hommos, they strongly

expressed the adoption of this package by corn growers. According to what they said, as well as what was mentioned in the project reports the technological package resulted in:

a- The best planting dates range between May 15th and June 1 st, to avoid the early infestation by the stem borer *S. critica* .

b- Cultivation in rows, instead of sowing the seeds in the plane field, at distances of 25-30 cm instead of 40 cm resulted in better plant growth and a reduction in seed amount from 30 kg to 12-15 kg / feddan.

c- The best corn cultivar is the single hybrid 10, followed by the triple hybrid 310, both are high yielding varieties (HYVs).

d- The use of pre-emergence herbicide application reduced the number and costs of tillage and hoeing from LE 240 to LE 80. According to the research team, this early herbicide application does not leave any residues in the plant tissues at the end of the season.

e- The improvement in planting methods (in rows) resulted in a reduction of irrigation time from 4-6 hours / Fed. to 2 hours / Feddan. That consequently reduced the amount of irrigation water from 400 m³ to 200 - 250 m³ / Fed.

f- Although the total amount of chemical fertilisers is greater now than before (because of the use of HYVs which are actually high responding varieties), the waste of fertilisers is less now because of changing the timing and technique of fertilisation.

g- Changing the thinning time from 35-45 days after planting to 18-19 days after planting reduced the waste of fertilisers and allowed the plants to better use of the added nutrients.

h- The introduction of insect growth regulators (IGR) and the entomopathogenic bacteria *Bacillus thuringiensis* (*B.t.*) for the control of stem borers resulted in the reduction of chemical insecticides which consequently resulted in less environmental pollution and allowed greater role of natural enemies in corn fields. The cost of pest control was reduced by 20 %.

- It seems that the production of four extension bulletins is highly appreciated by extension workers and farmers. According to PI, 25,000 copies were printed of each volume. The bulletins were distributed, for free, among farmers and extension workers in El Beheira, Alexandria, Fayoum, Ismaelia and Assuit. (see the map in Annex 6)

- In March 1994, the project team with the help of IDRC organised a conference on " Pest Management and the Environment". The conference discussed, over 4 days, the following main subjects:

- 1- IPM systems and modelling
- 2- Pesticides
- 3- Biotechnology and biocontrol
- 4- Crop-pest systems
- 5- Future research
- 6- Recommendations

The conference was attended by 71 scientists affiliated to different universities, research centres and agribusiness in 8 countries, *i.e.* Egypt, USA, UK, Canada, Hungary, Sudan, Germany, and Saudi Arabia.

A proceedings of 589 pages, containing 40 presentations and opening remarks, was published in 1995.

3- Context / Environment

- The project was run by a competent multidisciplinary research team in the Faculty of Agriculture, Alexandria University. From reviewing the project reports and documents it was obvious that the composition of the research team ensured a good coverage of the multi-dimensional aspects of IPM. During my interviews with the team members in Alexandria and El Beheira, they gave a good impression of a team spirit and harmony. It seemed that their work in close contacts with farmers and extension workers in the fields has acquired them a new vision of participatory and applied research. Now they believe that considering the farmers' knowledge, needs and priorities are when research plans are to be drawn. Noteworthy, most of the team members belong to almost the same generation of professionals in their mid career.
- The project leader, Dr. Nabil Mansour, is a man of pleasant and extrovert personality. It seemed to me that his way in leading his team has greatly contributed to the creation of the harmonised atmosphere there.
- The Department of Pesticide Chemistry, where the project was conducted, is fairly equipped. There are, for example, six computers, laser printer, slide image, as well as other audio-visual and research facilities.
- In the meeting with extension workers and farmers in Abou Hommos, both of them expressed their contentedness that the " university doctors" are working closely with them. The updating of the extension workers' knowledge, the practical advice's given to the farmers and the eagerness to solve the production problems were the main causes of this contentedness.

- On the other hand, members of the research team reported that their direct contacts with the farmers was a valuable addition to their experience.
- The project succeeded to gain political support of the MOA and local authorities in El Beheira. This was reflected in many occasions, *e.g.* the IPM conference was held under the auspices of the Minister of Agriculture. MOA also took part in the distribution of the project publications over its extension units in different corn-cultivated areas in the country (as mentioned before, 25,000 copies were printed of each of the 4 bulletins). The Agriculture Extension Department in El Beheira Government hosted the regular meetings held with farmers and extension workers.
- In the side of IDRC, the support of an IPM project was in itself a good choice.

However, there are two points to be discussed:

a- The planned Co-operation with Assiut University

According to the project proposal (p.11) a part of the project activities was planned to be executed by a team in Assiut University. The proposal presented some good justifications for the co-operation with Assiut. Moreover, the project appraisal, made by N. Mateo, reported that " Being more than 500 Km away from Cairo, the University of Assiut, in spite of its capability, **is far removed from donors' support.** Their participation in this project is important in exposing the research team to the challenge of multidisciplinary research in IPM, to linkages with colleagues in other institutions and to strengthening their links with farmers in their areas."

A report on a monitoring visit written by Dr. Michael Loevinsohn, during the early stages of the project implementation (in November, 1991) noted that: " I found both teams (in Alex. and Assiut) to be competent and energetic, committed to making a success". Yet he added

that " the current system of centralised financial management has given rise to considerable frustration at Assiut. A more flexible arrangement was agreed at my final meeting with Drs. Mansour and Kishk in Cairo". Dr. Loevinsohn mentioned some details concerning budget allocation and resource distribution among the two participating institutes.

However, it seems that all these attempts failed to ensure the continuity of Assiut participation in the project. When I raised this point with the PI in Alexandria, he pointed out to disagreement about the budget. In conclusion, because of the exclusion of Assiut team from the project, a part of the project objectives was unrealised, and Assiut University was deprived from a good opportunity of being exposed to such an experience. In the final analysis, Assiut University remained " far removed from donors' support ". Second, this deprived the project from from an opportunity to hold a comparison between the results of applying the recommended agricultural packages in two ecologically different areas of corn cultivation in Egypt. Third, although there are numerous institutes working in the field of agricultural research in Egypt, there are very little cases of co-operation between them. Thus, an opportunity of co-operation, as in the case of Alexandria and Assiut should have deserved stronger role played by the IDRC to keep the links planned in the proposal. The problem would have been settled if the recommendations of Dr. Loevinsohn were implemented.

b- The planned cooperation with the National Research Centre (NRC)

The project appraisal made by N. Mateo reported that " the project will benefit from the research results of the IDRC-supported project on

biological control of lepidopterous pests. Promising *Bacillus thuringiensis* strains and formulations developed and tested by the NRC project will be supplied to the IPM team to be tested in their program" (p. 12). But according to the project reports, the team has used commercial formulations of *B.t.* imported from the US. In my discussions with the PI, he said that the NRC did not provide them with the *B.t.* formulations. This fact was confirmed in another discussion with Dr. Kishk in Cairo.

This is another example of the failure of co-operation between research institutions in Egypt, which resulted in waste of resources and efforts. Although the NRC project on *B.t.* is not our subject here, but as far as I know it was one of the major projects on microbial insect control in Egypt so far. The project isolated, identified, multiplied and formulated strains of *B.t.* which can be used in the biological control of some economically important lepidopterous insect pests. It should have played a significant role in the advancement of microbial control based on national production of the microbial agents. However, the IPM team in Alexandria University still has the chance to benefit from the research findings of some other institutions such as the faculty of Agriculture in Cairo University, and the Plant Protection Research Institute if the Agricultural Research Center.

In my opinion, these two cases reveal that IDRC should play a stronger role, from the very beginning, to ensure the co-operation commitment among its partner institutions, especially in cases similar to the latter one (NRC) where considerable amounts of resources were invested in the *B.t.* project. Contractual agreements, with clear and well defined assignments, along with budget allocation agreed upon by the concerned parties, may help to avoid the rise of problems similar to what this project has encountered.

4- Reach

- The project outputs reached various direct and indirect beneficiaries. Among the **direct beneficiaries** are **farmers** in the villages of El Beheira Governorate where the project was initiated. The research team

started with 27 farmers (most of them are small holders), then the number increased to 64 collaborative farmers in addition to 264 co-operative farmers. The project now covers 4 districts (*Markaz*): Kafr El Dawar, Abou El Matameer, Abou Hommos, and Kom Hamada. (This may answer the question of " where de things stand today? "

- The **extension workers** in El Beheira were also among the direct beneficiaries of the project outputs (the IPM package which helped the extension workers to improve their work with the farmers.

- The **research team** members themselves are among the direct beneficiaries, through capacity building and through their direct contact with farmers where both sides shared information and experiences.

- There are also **indirect beneficiaries** whom the project outputs reach:

- The extension bulletins produced by the projects were distributed in 14 districts (*Markaz*) in El Behiera. This was achieved through an effective distribution network made of extension workers and active farmers.

- The bulletins were also disseminated in other four Governorates, *i.e.* Menofyia, Fayaum, Ismaelia and Assiut. (Again, 25,000 copies were printed of each bulletin).

- A large number of copies were sent to the MOA at its request.

- Farmers in El Beheira in general - even outside villages where the project took place - adopted many components of the recommended package. Although I could not know the actual numbers of farmers adopting the project package so far, there are some useful indicators which can reflect the changes that are taking place. For example, ten years ago, the amount of maize seeds of the cultivar single hybrid 10 supplied to El Beheira by the MOA did not exceed 2 tons. More than one half of the seeds of this variety used to return back to the MOA storehouses because farmers did not take it. Now, more than 40 tons of seeds of the same variety are not sufficient to satisfy the increasing demand by the farmers (interview with extension officers and farmers in Abou Hommos).

- It is noteworthy that the IPM package has benefited from the experience of the NCPC.

- However, planned and aware documentary efforts should have been exist throughout the whole course of the work. There are no deliberate measures of observations of farmers' participation, innovations or even resistance. Most success stories I knew have been told to me through meetings and interviews. In my opinion, this would belittle the magnitude of efforts exerted by people involved in this work.

The project outputs reached also the scientific community working in agriculture in the Egyptian universities and research centres. " The team of Nabil Mansour" enjoys good reputation among many circles of agricultural researchers. I have seen the proceedings of El Fayoum conference on the bookshelves of several colleagues in different agriculture research institutes.

5- Impact

5.1- Direct Impact on Farmers

a- The package of cultural practices provided by the project has led to increasing corn productivity which in turn resulted in more farm income.

{ The average yield in plots of the project-linked farmers ranged between 28-32 ardab / F. (ardab - 140 kg grains) compared to a general average of 18-22 ardab / F. in the surrounding fields }.

b- The reduction of pesticide amounts on corn has led to a reduction in production costs on one hand, and allowed safer fodder to farm animals, and corn grains with less pesticide residues.

c- The afore-mentioned statements mean a lot to small farmers, especially under the application of structural adjustment programs (SAP), according to which inputs' prices become higher. The designed cultural package is considered - in my opinion - a good step to the Low External Input Agriculture (LEIA).

d- Farmers working directly or indirectly with the project team have acquired higher awareness about environment, especially the role played by the natural enemies in the suppression of pest populations. Farmers now give local names to predacious insects in corn fields, and they recognise their role in decreasing the numbers of harmful insects

e- The working atmosphere created by the project has encouraged several farmers to take initiatives to solve problems in their fields. There are impressive innovations which should be followed and developed.

5.2- Impact on Extension

The project has played a considerable role in activation and enhancement of the role of agricultural extension and its relationship with farmers. This point is very important in view of the criticism directed to this sector by many authors concerned with the Egyptian agriculture. Factors helped this activation should be emphasised and subjected to thorough evaluation. Today, the project covers four *Markaz*, i.e. Kom Hamada (55 villages (, Abou Hommos (42 villages), Kafr el Dawar (36 villages), and Abou Matameer (27 villages).

5.3- Impact on Capacity Building

a- The composition of the research team of researchers from different disciplines allowed a good opportunity for the execution of multidisciplinary and interdisciplinary research, which is in itself not an easy task.

b- Facilities made available by the project enabled a number of younger researchers and research students to carry out their work in a better atmosphere.

c- The international conference held in 1994 constituted an extraordinary occasion for the concerned researchers to share experiences and information with other colleagues from different schools.

5.4- Impact on Policy Changes

a- It seems that there is an increasing trend among farmers in El Beheira to adopt the package provided by the IPM project for corn cultivation. That would change the strategy of pest control to be more dependent on biological and cultural methods rather than chemical pesticides. The

same might be said regarding corn varieties, planting dates, irrigation, and other farming practices.

b- At the national level, there is already a strong endeavour by the MOA to reduce pesticide application and encourage the use of environment - friendly pest control methods. The impact of the present project on this area is an indirect and long-term one. Policy change is a result of accumulative efforts made by different parties over the time.

c- More important is the possibility to increase productivity of the land unit through modification of farming practices and introduction of new appropriate technologies and techniques. This has significant implications to the Egyptian agriculture which suffer from scarcity of cultivable land.

5.5- Environmental Impact

The project has positive impact on the agro-ecosystem and the environment in general. According to the project reports and interviews with researches, extension workers and farmers, the following could be concluded.

a- Modification of planting methods (in rows) has resulted in a reduction in the amount of irrigation water from 400 m³ / f. to 200 -250 m³. The importance of reducing the consumed amount of water is vital under the Egyptian conditions.

b- There is a considerable increase in the populations of natural enemies in the fields where project package is applied. This is also a positive impact towards more balanced agro-ecosystem. Farmers now are able to recognise the beneficial insects in their fields and they know that these insects are " friends ".

c- The reduction of chemical pesticide applications on corn would lead to the production of corn grains and green fodder free of - or at least with less - pesticides. This is of great positive impact on human and animal health, non-target organisms and the rural environment in general.

5.6- Impact on Funding Agencies

- A new phase of the IPM project is planned (1997 - 2001). This phase will be financially supported by the European Union (EU) and IDRC. The IDRC support (LE 200,000) will concentrate on :

a- evaluation of the economic benefits and the technical, economic and social constrains to the adoption of IPM practices by the various types of corn producers in the study area, and examine those elements of regional and national agricultural policy which directly and indirectly influence corn production and its farming practices.

b- Transfer of the package for corn pest control to farmers and extension workers, through training and workshops.

This support by the IDRC would enhance the socio-economic aspects of the IPM and compensate the weakness of socio-economic considerations appeared in the first phase of the project.

6- Enhancement of Outcomes

There is a wide room for enhancement of the project outcomes:

1- The outcomes of the project would have been of more value if the problems regarding the co-operation with Assuit University were solved in time with a manner that ensured smooth relations between the two partners. (see section 3: context / environment).

2- It would have been better if the project used the *B.t.* formulations produced by the NRC instead of depending on imported products. (see section 3: context / environment).

3- Efforts should be made to link the Alexandria team with various research groups in the Egyptian universities and research centres working in similar areas. For example, there are promising attempts in Cairo University to produce biological fertilisers as well as predators, parasites, entomopathogenic bacteria, viruses, and nematodes that could be used in the biological control of corn pests. In my interview with Dr: Nabil Mansour, he expressed his readiness to co-operate with these groups. The IDRC can play a strong role in the enhancement and the sustainability of such co-operation.

4- Findings of the project activities should be made available and accessible to the widest groups of researchers, extension workers, farmers, as well as policy makers.

5- A distribution network should be developed to ensure a wider dissemination of the extension bulletins produced by the project.

6- It is of great importance to complete the part concerning building database, forecasting and modelling systems. That will better help setting strategies for corn pest control and allowing better understanding of the conditions and factors influencing corn production in the country. In this regard, the method by which the economic threshold is calculated should be developed so that it can be easier used by field workers, and to reflect the actual situation of insect infestations.

7- In spite of the awareness of the socio-economic aspects in the project, which was strongly expressed in the project documents, it seems that there is no intentioned or designed way to measure and evaluate the farmers' responses to the project activities and materials. In this regard,

more active involvement of extension, sociological, and communication specialists would be useful.

8- Again, in spite of the importance of meetings held with farmers in villages and towns, there is no regular records of these events. Summaries of issues raised, documentation of outstanding innovations and initiatives, as well as video records would help in evaluation of the ongoing work, and could be further used as extension materials.

9- Farmers' participation should be encouraged and developed towards a participatory research approach.

10- There is a complete absence of gender dimensions through the design and implementation of the project. The impact of the project activities on the livelihood, roles, needs and responsibilities of women and men in the villages, and their access to and control over resources was neglected.

Therefore, it would be important, from the developmental point of view, to give more emphasis on this point. The IDRC can play a role here, by stipulating the necessity of gender considerations in the projects it supports in the future.

V. RECOMMENDATIONS

1-In view of the importance of developing IPM programs in various major crops in Egypt, and in view of the multifarious nature of this kind of research which requires fairly big facilities, the IDRC is strongly requested to support such type of research.

2- The IDRC, and other donors, are invited to play more active role in order to make sure that conditions for good co-operation among its partners are satisfied. A workshop on co-operation mechanisms between IDRC partners may be a good step in this way.

3- It is important to ensure that conditions of active community participation are fulfilled throughout the different stages of the project life cycle. Training workshops for research teams may enhance this attitudes. Such trainings may be a part of any IDRC - supported program.

4- IDRC is invited to more active participation with the candidate recipients in writing project proposals so that the declared objectives would be suitable to the resources available, in terms of funds, capacities, and time frame.

5- Environmental considerations should be strongly emphasised in the choice, acceptance, and evaluation of the project.

6- Gender issues are usually of no priorities on the research agenda, especially among those working in the field of natural, biological, or applied sciences. Therefore, IDRC should give a greater consideration to this issue, and examine the ways that would raise gender awareness among its partners. Training workshops on gender sensitizations, and how to incorporate gender considerations in research activities may be helpful.

VI. MATERIALS FOR PUBLIC RELATIONS

This project has a good base to produce materials for public relations, provided that better efforts would be dedicated to gather and document the scattered and fragmented stories about farmers' initiatives and innovations.

Annex (1)

INTEGRATED PEST MANAGEMENT PROJECT DOCUMENTS

- 1- Project Proposal , (1989). 18 pp.
- 2- Project Summary, (1990). 2 pp.
- 3- Project Appraisal (by N. Mateo) , (1990). 4pp.
- 4- Report on a Monitoring Visit to Alexandria and Assiut in November 1991, by M. Loevinsohn, (1991). 7 pp.
- 5- Project Second Annual Report, (1992). 67 pp.
- 6- Project Final Report, (1994). 153 pp.

Annex (2)

PROJECT PUBLICATIONS

- 1- Crop Health Conference : Future of IPM in Crop Health and Sustainable Agriculture " IPM and Environment " , The First Announcement. March 21-24, (1994), Fayoum , Egypt (In English).
- 2- Crop Health Conference : Future of IPM in Crop Health and Sustainable Agriculture " IPM and Environment " . The programme Book , 32 pp. (In English).
- 3- Crop Health Conference : Future of IPM in Crop Health and Sustainable Agriculture " IPM and Environment " . The Abstracts Book , 153 pp. (In English).
- 4- Pest Management and the Environment: Proceedings of the Crop Health Conference, March 21-24 , (1994) , Fayoum, Egypt., editor Nabil Mansour, 589 pp. (1995) (In English).
- 5- Extension Bulletin of Corn IPM Project : (1) Guidelines, (1995) ,22pp. (In Arabic).
- 6- Extension Bulletin of Corn IPM Project : (2) Corn Insects, (1995), 20 pp. (In Arabic).
- 7- Extension Bulletin of Corn IPM Project : (3) Corn Weeds, (1995), 20 pp. (In Arabic).
- 8- Extension Bulletin of Corn IPM Project : Corn Diseases, (1995), 20 pp. (In Arabic).

Annex (3)

VISITS TO PROJECT SITES

- 1- Visit to the Department of Pesticide Chemistry, Faculty of Agriculture, Alexandria University, June 7-8, 1997.
- 2- Visit to the Village of Abou Hommos, Abou Hommos District, El Beheira Governorate, June 8 , 1997.

Annex (4)

INTERVIEWS AND MEETINGS

1- Meeting with Dr. Nabil Mansour, IPM Project Leader in the IDRC Office, Cairo, May 29, 1997.

2- Two interviews with Dr. Nabil Mansour, IPM Project Leader in the Pesticide Chemistry Department, Faculty of Agriculture, Alexandria University, Alexandria, June 7,8, 1997.

3- Meeting with the Research Team in the Faculty of Agriculture, Alexandria University, June 7 , 1997. The meeting was attended by:

Dr. Shibl Sherby	Pesticide Chemistry
Dr. Maher Saleh	Soil and Water Science
Dr. Mohamed Awad El Erian	Economic Entomology
Dr. Mohamed Salem Shaaweer	Pesticide Chemistry
Dr. Farid Soliman Sabra	Pesticide Chemistry
Dr. Fathallah Zaitoun	Plant Pathology
Dr. Mahmoud Al Morshidy Farag	Pesticide Chemistry
Dr. Samy Al-Tabbakh	Agronomy
Eng. Osama Helal	Director, Agricultural Extension Programmes, El Beheira Governorate
Eng. Essam Abdel Fattah	Project Financial & Executive officer
Mis. Salwa Mostafa	Ph. D. Student (Biochemistry)
Mr. Hamdy Kotb	M. Sc. student (Pest Control)
Mis. Jehan Fathi	M. Sc. student (Pest Control)

4- Meeting with the extension staff and farmers in the Agricultural Department, Abou Hommos (the meeting was held in the Agricultural Extension Conference Hall, Abou Hommos) and attended by:

Eng. Attallah M. Awad	Ext. Officer, Kafr el Dawar
Eng. Mohamed Al Shahawi	Ext. Sub director, Kafr el Dawar
Eng. Fahmy Esawi	Ext. Sub director, Abou Hommos
Eng. Lotfy Zalat	Ext. Officer, Abou Hommos
Eng. Khairi Abou Ammo	Head, Ext. dept., Abou Hommos
Eng. Osama Helal	Director, Ext. Services, El Beheira
Saad Toema	Farmer
Haj Mohamed	Farmer

- Individual interviews were done after the meeting with some of the above mentioned persons.

5- Meeting with Dr. Fawzy Kishk, IDRC, MERO, Cairo Office May 25, 1997, Cairo.

Annex (5)

OTHER READINGS

- 1- Corn. Extension Bulletin No. 324. The Central Administration for Agricultural Extension. Ministry of Agriculture and Land Reclamation, 24 pp., 1997 (In Arabic).
- 2- Dent, D. (1991). Insect Pest Management. C.A.B. International. 604 pp.
- 3- Youdeowei, A. and Service, M.W. (1983). Pest and Victor Management in the Tropics. Longman, 399 pp.
- 4- Framework for the Evaluation of Use and Impact of IDRC Project: IDRC Evaluation Unit.

Annex (7)

ACRONYMS AND ABBREVIATIONS

<i>B.t.</i>	<i>Bacillus thuringiensis</i>
<i>C. agamemnon</i>	<i>Chilo agamemnon</i>
ECB	European Corn Borer
HYVs	High Yielding Varieties
ICM	Integrated Crop Management
IDRC	International Development Research Centre
IGR	Insect Growth Regulators
IPM	Integrated Pest Management
IRM	Integrated Resource Management
LEIA	Low External Input Agriculture
MOA	Ministry of Agriculture
NARP	National Agricultural Research Program
NCPC	National Campaign Program of Corn
NRC	National Research Centre
<i>O. nubilalis</i>	<i>Ostrinia nubilalis</i>
PI	Principal Investigator
SAP	Structural Adjustment Programmes
<i>S. critica</i>	<i>Sesamia critica</i>

Annex (8)
Summary Table

Potential Beneficiary / User	How Benefit	Extent actually benefited/ affected	Factors helping(+) or hindering (-) impact	Potential for future benefit
1- Faculty of Agriculture , University of Alexandria	- Staff capacity building - better research facilities	High direct benefit. Department of Pesticide Chemistry is now better equipped to conduct research. Researchers accumulated information and experience	(+) inspiring leadership (+) established, experienced department (+) interdisciplinary research team (-) researchers have other obligations (e.g. teaching)	Medium. EU is ready to support an extension project. IDRC will support some objectives
2- Research students in Pesticide Chemistry Department	- information gathered by project work - participation in project experiments - make use of equipment and facilities made available through the project.	High direct benefit. They will be exposed to rich experience by working with the project team.	(+) they are supervised by the project research leaders (-) they have other obligations in the department (-) there may be contradictions of interest between the project objectives and the students'	low-medium. interest of the project extension are not necessarily the same of the research students
3-Extension workers in the villages where project is implemented	-capacity building -incentives -better working conditions	Medium. Updating their information through project publications and the direct contacts with the research team	(+) working in close contacts with the research team (+) regular meetings together and with farmers (+) they have access to project publications	low. No guarantee that the link with the research team will continue if the project terminated or phased out
4-Extension workers in El Behira Governorate and in other corn-cultivated areas	better information	Low. Project publications will help better work with farmers	(+) publications are available, illustrated, with up-to-date information (-) no feedback mechanisms for publication improvement (-) no enough copies of the bulletins	Low. The project does not represent an integral part of a sustained policy towards the improvement of working conditions of the extension workers

5- Farmers in the villages where the project is implemented	<ul style="list-style-type: none"> - higher yield - higher income - better farming practices 	High direct benefit, because of the use of improved farming package resulting in higher income	(+) assistance given by researchers and extension workers () participatory approach still needs to be strengthened	Medium. Knowledge acquired can lead to more sustainable production techniques, unless changes at the macro level would take place
6- Farmers in the neighbouring villages	<ul style="list-style-type: none"> - new, improved farming practices - higher yield, higher income 	indirect benefit through project bulletins, advises of the extension workers, and talks with their neighbours	(+) success stories told by the neighbouring farmers (+) demonstration fields are good prove () bulletins not always accessible, language not always simple () information may be distorted through poor communication means	as in (5)
7-Farmers in other corn-cultivated areas	as in (6)	low indirect benefit, through technical bulletins and extension workers	(+) success stories disseminated by media and extension workers () bulletins not available, not always understood	as in (5)
8- Researchers in the field of crop production	-information disseminated in the conference and via published papers, or through encounter with project staff	high indirect benefit : <ul style="list-style-type: none"> - promoting the concept of IPM among researchers - promoting the idea of multidisciplinary team working on one issue - better understanding of corn production problems 	(+) IPM is an emerging approach (+) there is potentiality to increase yields of other crops using similar approach () working in multidisciplinary team is not always easy	-Agricultural research institutions can raise funds for IPM projects -The necessity of multidisciplinary would encourage work-team formation
9- Plant- protection Professionals and decision makers in the country	-better understanding of the interacting factors influencing corn production and the components of integrated crop management in corn	information made available by project reports, the conference book , published papers, and other presentations in scientific fora would help plant protection people to set up plans and strategies of crop production based on IPM and ICM.	(+) available data, especially when data base is completed (+) close links between university and MOA () conflict of interests, on the part of agri-business (pesticides and chemical fertilisers companies)	possible new strategies for integrated management of the major crops in Egypt

10- NGOs concerned with rural health, environment, and development	project findings which prove that increasing crop yield is possible with less chemicals	information made available through technical bulletins, video tapes, conference book, seminars attended by project staff...etc. would give support to NGOs in their efforts to protect rural environment and improve rural livelihoods	(+) numbers of active NGOs are increasing (+) available information (-) poor understanding by researchers of the role of NGOs (-) lack of funds and skills among many NGOs working in rural areas at grassroots level	Low. Possible cooperation between research centers and NGOs in the field of rural development and environmental protection
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Acknowledgement

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