"Hamabia" - Intercrop Integrated Pest Management in the Jordan Valley

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ABSTRACT

The "Hamabia" Project was created in 1994, to implement a multicrop integrated pest management in the Gilboa and Beit Shean Valleys. The project works in an area of 15,000 hectares that includes field crops, vegetables, winter and summer spices, greenhouses and orchards. Together with the Ministry of the Environment, the Division of Agro-Ecology and the help of the Government of the USA, contacts were made with The Kingdom of Jordan and the Palestinian Authority. The main objectives of "Hamabia" are effectively control common pests in the Jordan Valley while minimizing the use of toxic pesticides and encouraging the use of environmentally friendly alternatives through co-operation among agriculturists in Israel, Jordan and Palestine. This would be achieved through the implementation of the "pesticide usage policy" (window policy) which takes into account the different kinds of crops and pests that appears and establishes a careful step by step alternate pre-programmed usage policy for the different groups of products. Local pest scouts receive instruction and guidance so that a local pest control system can be implemented. This system would be under the control and guidance of regional supervisors and supported by a research and training organization. There would be- constant follow-up of changes in the resistance of key-pest as they occur, through a specific resistance monitoring laboratory. Changes in population levels would be monitored throughout the year by monitoring stations. Co-operation would be established among the different regional authorities to accomplish a more effective pest control policy over the pests that are common to the regions and to create a relationship of trust and understanding among all agriculturists involved. In this frame, a special course of Palestinian pest scouts was organized in the region in February 1998.

Introduction

Pest control in agriculture is currently based on spraying insecticides in order to exterminate various kinds of pests in the fields. Along with the benefits of these control measures, it has become clear that uncontrolled use of insecticides has harmful side effects, including insecticide residue on the crops themselves. Pollution of the environment through spray drift into populated areas and residues in the soil and aquifer, disturbance of the natural balance between the pests and their natural enemies (predators and various parasites), the development of resistance to the different insecticides and damage caused to international trade resulting from specific levels of insecticide residue

Integrated pest management (IPM) is known world-wide and assists in effective, sophisticated use of insecticides (Horowitz *et al.*, 1994). There is a growing awareness that pest management must include consideration of the pests developing resistance to various insecticides. Integrated resistance management (IRM) monitors pest resistance to insecticides and uses the results of this monitoring as a basis for a pesticide use policy. This policy is based on the controlled use of the specific insecticide groups for limited periods, with alternating use of different chemical groups. In this way, pests would be exposed to each group only once in a generation. Some pesticides would be used only once in a growing season, and if monitoring results showed a specific level of resistance to the pesticide, its use would be halted completely (Denholm and Rowland, 1992). Another element of this policy is the use of synergists n combination with insecticides (Horowitz *et al.*, 1992). These measures, taken in Israel and the rest of the world, would attain some success, primarily when they are taken against one specific pest (Forrester, 1990) or a number of pests in one specific crop (Forrester *et al.*, 1993; Horowitz *et al.*, 1992). In the past, efforts were made in Israel to reduce crop spraying and different methods are used to promote these approaches (Ausher, 1997).

Methods accepted to decrease use of chemical pesticides in agriculture are:

- Raising the economic threshold necessary for treatment
- Use of biological controls, such as the pest's natural enemies
- Use of substitutes for toxic substances, such as the use of pheromones in certain species
- Implementing a policy of insecticide use that would formalize improved use of existing substances by alternating different groups of insecticide to postpone

the development of resistance and prolong their "shelf-life."

In the past, these measures were taken with specific crops, but there has been no attempt until now, to unite an entire agricultural area around a central system that would manage all elements of pest control in all the area's crops.

The "Hamabia" project has been in effect in the Jordan Valley area since 1994. Its purpose is to realize these guidelines and to make them operative on a regional level. The overall purposes of the project are to:

- Create awareness in growers of the need for correct use of pesticides;
- Limit the use of toxic insecticides to the lowest level possible;
- Diminish contamination of crops by insecticide residue;
- Prolong the "shelf-life" of existing insecticides;
- Preserve the quality of the environment and public health; and
- Lower production costs.

Methods and materials

The "Hamabia" project is conducted on two parallel levels, organization and research.

Practical and organizational level

1. The setting-up of a "pesticide use policy" (the "windows policy") (Table 1). This policy determines the length of the period each insecticide is used. This framework applies to all growers in the area. (Note that there is no way to enforce these policies and the only way to carry them out is through explanation, guidance, example and persuasion.)

2. The formation of a pest control system. Supervision is based on local pest scouts in every growing area. Two regional scout advisers guide these pest scouts in conjunction with crop supervisors of the area.

3. Surveillance of air borne insecticide residue in populated areas, along roads and in cultivated areas by twenty surveillance stations spread throughout the area.

4. Perennial monitoring of six key pest population levels in ten regional stations.

5. Establishment of a computerized database for perennial pest level monitoring.

6. Regular weekly meetings of growers, scouts, supervisors, advisers, lab staff, and representatives of chemical companies.

7. A regular report, issued to the growers, guides, representatives of chemical companies and others interested in this information.

Research level

An Insecticide Resistance Monitoring Laboratory (IRM) has been established, where supervision and research on changing resistance levels of the area's key pests are carried out. Lab findings from previous years have already contributed directly to discontinuing use of substances to which resistance is proven.

Key pests monitored:
1. Egyptian cotton worm (*Spodoptera littoralis)* (Boisdeval);
2. Tobacco bollworm (*Helicoverpa [Heliothis] armigera)* (Hübner);
3. Spiny bollworm *(Earias insulana) (Boisduval);*
4. Pink bollworm (*Pectinophora gossypiella)* (Sunders);
5. Tuber moth (*Phthorimaea operculella)* (Zeller);
6. Whitefly (*Bemisia tabaci)* (Gennadius).

The IRM laboratory examines changes in resistance/sensitivity of key pests to insecticides commonly used against them. The results aid in formulating a pesticide use policy.

Examination of pest resistance to insecticides is based on comparative studies of resistance/sensitivity of pests gathered in a growing area with the resistance/sensitivity of a sensitive population of pests in the lab.

There are three methods of testing:

1. Topical application of the insecticide being tested to the larvae. This test is carried out on larvae whose age and weight have been predetermined, with different concentrations of the insecticide being tested. After a set time period (according to the characteristics of each insecticide) the death rate of the larvae is checked. This method is especially suitable for moth larvae and its advantage lies in checking the pest in the actual stage when it does damage (larvae). Its drawback is the need to grow the pest in the lab in order to acquire a sufficient number of larvae of the proper size.

2. Testing adult moth tolerance to different concentrations of insecticides spread on the walls of scintillation vials. The moths are trapped in the growing areas in pheromone traps and are put, one by one, into vials. The death rate is checked after 24 hours. The advantage of this test is in its speed and simplicity. The drawback is that moths are being tested. There is a connection between their sensitivity and that of the larvae, but the moths do not cause the damage. An additional problem is that the test is carried out on males only of indeterminate age (Figure 1).

3. Dipping potted test plants into different concentrations of the insecticide and exposing the pest to the insecticide on the plant. This system is especially suitable for sucking pests such as

aphids, whitefly, bugs, etc., as well as stomach-acting insecticides (Figure 2).

Discussion

Conventional pest control through the spraying of insecticides seemed to reach its end in the latter half of the 20th century. Such spraying caused contamination of food, water and air. Since publication of *Silent Spring* (Carson, 1962), there has been a revolution in methods of pest control and their cumulative effect on the environment. Today, alternative solutions are being sought to exterminate pests in a way that will cause minimal damage to the environment.

Uncontrolled use of insecticides has cause many cases of resistance in the pest population. This has caused a significant drop in the raising of certain crops, as well as to encourage the discovery of unconventional solutions.

Organic crops have become more prevalent in the past few years. This sort of farming stresses total abstention from synthetic insecticides, but allows the use of natural pest control. The result is that these crops are much more expensive than conventional crops, while a number of problems are not avoided. In addition, it is not possible to grow the entire range of known crops in this manner.

Thus, it is important to limit the use of chemicals, while stressing the use of user-friendly substances and sophisticated techniques that will enable the grower to raise residue-free crops with a minimum of harm by pests and a maximum of environmental protection.

In the past, there was rapid development of new insecticides. When pests developed resistance to an insecticide or group of insecticides, the chemical companies quickly replaced it on the shelf. Today, with growing awareness and enforcement of laws pertaining to the environment, this production has slowed and prices have skyrocketed. Therefore, it is most important to lengthen the effectiveness of existing products through correct and careful usage.

Our project includes the innovative comprehensive regional approach of a pest control system and includes all the area's crops. The project uses systems of explanation, examples, and guidance and integrates the insecticide resistance-monitoring laboratory. In addition, the lab functions in international regional co-operation between Israel, Jordan, Egypt, and the Palestinian Authority, in order to promote and co-ordinate a unified pest control policy in the area.

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Table 1. Annual scheduling of pesticide use on field and vegitables crops, Beit Shean valley area-wide IPM program.

	Period		
	III	II	I
Prohibited pesticides	Endopsulfan	Organo-phosphate Carbamates	Endosulfan
		Synthetic Pyrethroids	
Free use of pesticides	Synthetic Pyrethroids		Organophpsphates, Carbamates
	Chlorfluazuron, Buprofezin Lufeoron		

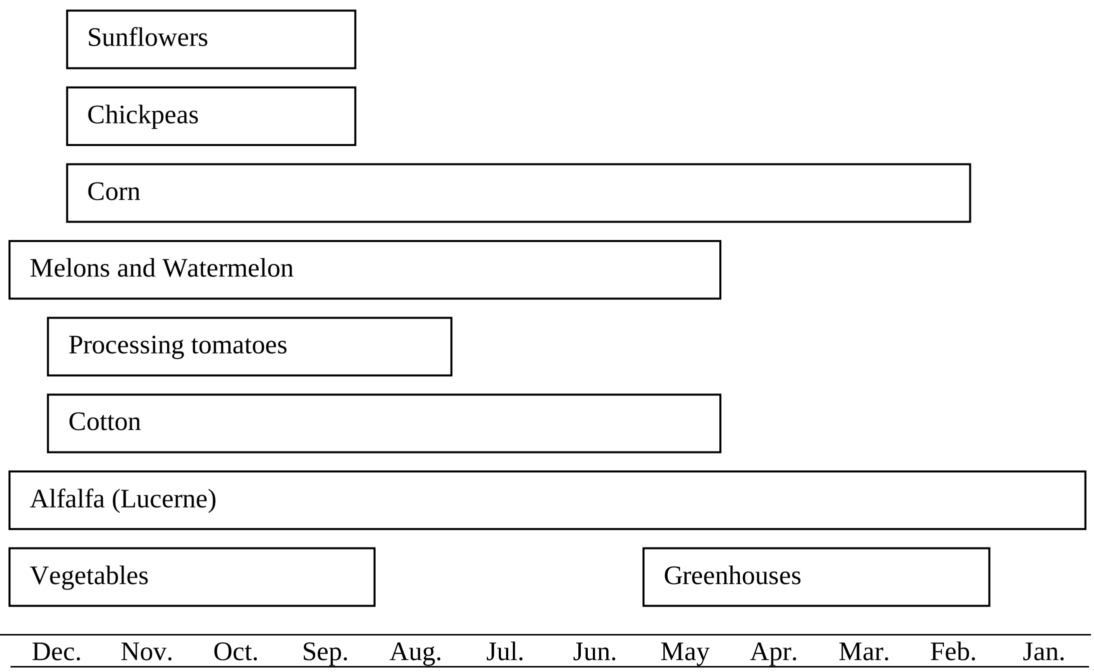

Figure 1. Changes in *Helicoverpa (Heliothis) armigera* resistance to endosulfan. Beit Shean 1994-97.

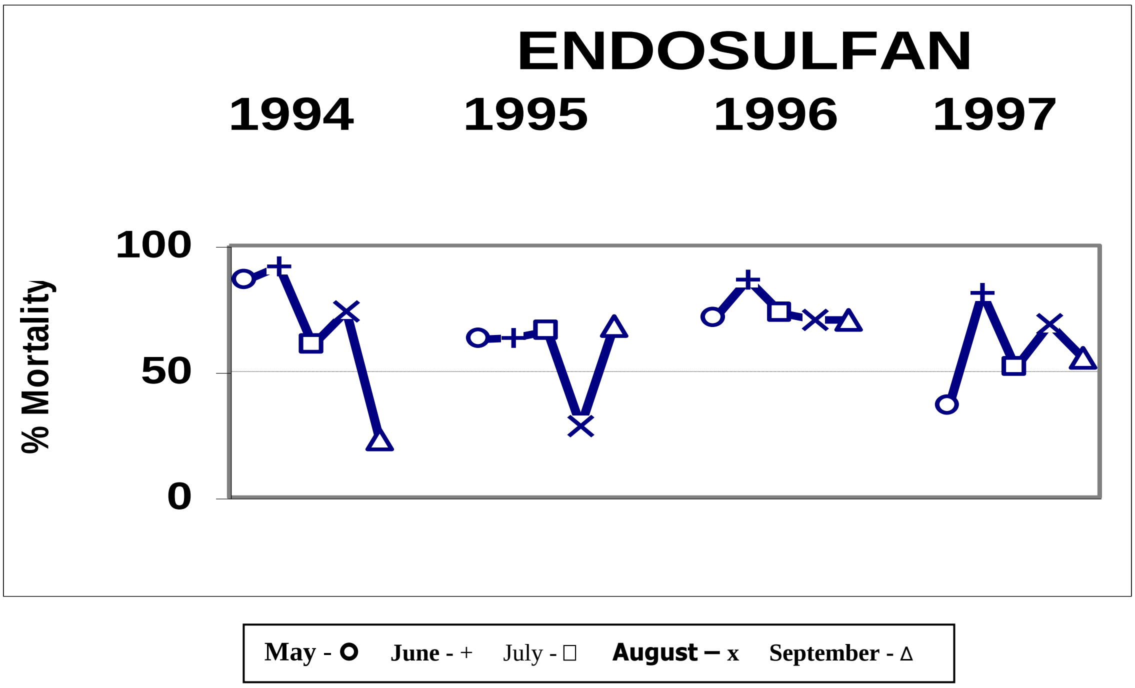

Figure 2. Concetration-response line (on probit scale) of the pyriproxyfen on *Bemisia tabaci* population (egg hatch suppression) collected in June and September 1995 in Beit Shean. Region after two treatments of the insecticide.