# A SURVEY ON INSECT PESTS AND FARMERS' CONTROL MEASURES ON SNAP BEANS IN KIRINYAGA DISTRICT, KENYA

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**Occasional Publications Series, No. 23**

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September 1997

*Correct citation:*

J.H. Nderitu, J.J. Anyango and J.K.O. Ampofo. 1997. A survey on insect pests and farmers' control measures on snap beans in Kirinyaga District, Kenya. Network on Bean Research in Africa, Occasional Publications Series, No. 23. CIAT, Kampala, Uganda.

## PREFACE

This volume is the twenty-third in a working document series that serves research on common bean (*Phaseolus vulgaris*) in Africa. This publication reports the findings of a study proposed and carried out by the University of Nairobi in collaboration with the Kenya Agricultural Research Institute (KARI). A related study on snap bean seed production and dissemination chanels in Kenya was recently published as No. 22 in this series.

The research project reported here received partial financial support from the Eastern Africa Bean Research Network (EABRN), within its portfolio of research sub-projects selected by a regional steering committee as being of importance to the region as a whole. Besides Kenya, other member countries of EABRN were Ethiopia, Madagascar, Mauritius, Sudan, Tanzania and Uganda; this network has since merged with that for the Great Lakes region of Central Africa.

The Network on Bean Research in Africa serves to stimulate, focus and coordinate research efforts on common bean. The network is organized by CIAT in collaboration with two interdependent sub-regional networks of national programs: the Eastern and Central Africa Bean Research Network (ECABREN) under the auspices of the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), and the SADC Bean Research Network (SABRN) under the Southern African Centre for Cooperation in Agricultural and Natural Resources Research and Training (SACCAR).

Working documents include bibliographies, research reports and bean network discussion papers. These publications are intended to complement two associated series of Workshop Proceedings and Reprints.

Financial support for regional bean projects comes from the Canadian International Development Agency (CIDA), the Swiss Agency for Development and Cooperation (SDC) and the United States Agency for International Development (USAID). This publication was made possible through support provided to EABRN through a grant to CIAT by the Office of Agriculture, Bureau for Research and Development, U.S. Agency for International Development (under Grant No. LAG-4111-G-00-2025-0).

Further information on bean research in Africa is available from:

Pan-Africa Coordinator, CIAT, P.O. Box 6247, Kampala, Uganda.

Regional Coordinator, Eastern and Central Africa Bean Research Network, c/o CIAT, P.O. Box 6247, Kampala, Uganda.

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# A SURVEY ON INSECT PESTS AND FARMERS' CONTROL MEASURES ON SNAP BEANS IN KIRINYAGA DISTRICT, KENYA

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**ABSTRACT.** A survey was carried out in 99 out of about 1000 snap bean farms in Mwea Division, Kirinyaga District during January and February 1993 to identify pest and disease problems encountered in snap bean production and the management strategies adopted by farmers. The main pests on the farms were bean stem maggots (*Ophiomyia* spp), whiteflies (*Bemisia tabaci* [Gen]), thrips (*Megalurothrips sjostedti* [Trybom]), red spider mites (*Tetranychus* spp.) and spiny brown bugs (*Clavigralla* (*Acanthomia*) *horrida* [Germ] and *Clavigralla tomentosicollis* [Stal]). Angular leaf spot and bean rust are the main diseases on snap beans in the area. It was observed that farmers knew their pests and diseases well and were able to rank them fairly accurately for level of importance. Farmers were keen on achieving high yields of unblemished pods, and used high rates of external inputs to achieve this. They saw pesticides as an insurance for a "quality" produce and relied heavily on synthetic products to grow and protect their crops. Some 36 insecticides and fungicides were used regularly by farmers, who employed up to 15 foliar sprays during a single crop cycle. Some of the pesticides were ineffective as a result of adulteration or decay due to age. Farmer decisions on pesticide application often were not based on knowledge of the pest population density or control thresholds, but on planned calendars of operation. Farmers appeared to ignore or lack knowledge on how to spray, use of protective clothing, use of pesticides for specified pests, proper rates of application, formulations and concentrations.

## INTRODUCTION

Snap bean (French bean) is a major horticultural export crop in Kenya. National production levels are in the range of 20,000 tons with export earnings of US$ 20 million per annum (Ouko 1995 [personal communication], cited from Anyango and Nabwile 1995). While there is an increasing demand for snap beans by the processing industry, the local demand for the produce is relatively limited. Snap beans are normally grown by small scale growers with small land holdings. These growers seek to maximize their yields and satisfy the aesthetic values of the market through intensive management regimes with irrigation and rigid crop protection practices, which rely heavily on chemical pesticides. As a result, high levels of toxic pesticide residues on the produce and pollution of river systems have become a major concern of environmentalists.

The present study was conducted to describe and evaluate the extent of pesticide use in snap bean production and generate some baseline information for the development of IPM

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strategies that will reduce the number of pesticide applications and minimize pesticide residue on the final produce as well as pesticide pollution of the environment.

## MATERIALS AND METHODS

### *Area of study*

The area of study was Mwea Division in Kirinyaga District, central Kenya. The division has four locations namely, Tebere, Murinduko, Nyagathi and Mutithi and covers about 1161 square kilometres. The area is classified as a lower midlands ($LM_4$) zone with a mean temperature range of 22.0-21.2°C (Jaetzold and Schmidt, 1983). The soil is mainly black cotton type with moderate fertility. The agricultural land per household of 5.8 persons is about 3.8 hectares. The first rains normally start at the end of March and the second rains start at the end of October. Snap beans are grown throughout the year but peak production, aimed at the export market, is between September and April.

### *Survey methods*

A formal questionnaire survey was carried out during January and February 1993 in 99 out of about 1000 snap bean farms in Mwea Division. Farmers were selected systematically, with a distance of a quarter kilometre between farms. The survey was carried out primarily to determine the key pest problems and the strategies adopted by farmers for their management. This covered the types of pesticides used and their rates of application, as well as the frequency of application in snap bean farms. Other information collected related to pesticide application methods, safety precautions taken by farmers during pesticide application, use of appropriate or recommended pesticides for specified pests, proper rates of application, as well as formulations and concentrations used. Farmers were interviewed on these issues (see Appendix for the questionnaire form). The researchers also made direct observations on the farmers' fields to compare their findings with farmers' perceptions of pest and disease problems, as well as the pest control strategies they adopted.

## RESULTS

### *General observations on crop production in the study area*

Tebere, Mutithi and Nyagati locations of Mwea Division were the major snap bean producing areas in the district. The total farmland under snap bean production in the area was about 250 ha. with an average production of 6000 kg/ha. There were about 1000 snap bean farmers in the area with farm size ranging from a few square metres in the backyard to about 5 ha. The mean farm size was 0.2 ha. and the predominant snap bean variety grown was "Monel", a bush type with fine pods. The main crops grown in the area were maize, sorghum, dry beans, leafy vegetables and tomatoes. Cotton and rice were the main cash crops in the area; these crops as well as the snap beans were grown under irrigation.

### *General snap bean production practices*

Snap bean production during the main growing season (September - April) was normally under irrigation and the produce was exported. Most farmers also grew a crop during the

rainy season (April - June), although demand from the export market was low at that time. Forty-two percent of the farmers interviewed planted snap beans successively at two-weekly intervals, while 57.6% had a single planting each year. The farmers generally followed recommended husbandry practices provided by the National Extension Service and used fertilizer, certified seeds and rigid crop protection methods in the production of snap beans. Land preparation was mainly by animal traction but mechanized ploughs and harrows were often used on the larger farms. In general, the farmers grew snap beans as a monocrop. They commonly applied di-ammonium phosphate as a basal fertilizer during planting and supplemented it with frequent applications of foliar fertilizer during vegetative and flowering stages of crop growth.

*Farmers' perception of pest and disease problems and their management strategies*

Most of the farmers in the surveyed area were young and had basic primary education. Some had diplomas from agricultural colleges or had secondary school education. Such farmers generally had good knowledge about their production constraints and were able to describe them adequately (Table 1). They ranked pests and diseases as the principal constraints that restricted snap bean productivity and quality (Tables 2 & 3).

Farmers named bean stem maggot, white flies, spider mites, bollworms, thrips, spiny brown bugs, leafminers and aphids among the key pests; while rust, angular leaf spot, anthracnose, root rots and bean common mosaic virus were named as the principal diseases that constrained snap bean productivity. These either reduced pod yield *per se,* the length of the production period or the quality of the produce.

**Table 1. A rating of farmer knowledge about pests, diseases and weeds and their control by researchers (interviewers).**

| **Farmer category** | **Percent of farmers with knowledge about:** | | |
|---|---|---|---|
| | Pests | Diseases | Weeds |
| Highly knowledgeable | 18 | 11 | 12 |
| Moderately knowledgeable | 62 | 55 | 53 |
| Poorly knowledgeable | 18 | 30 | 25 |
| Ignorant | 2 | 4 | 10 |

About 90 % of the farmers felt they lost more than half their crop to pests if they applied no controls, while some 10 % felt they only lost 25-50 % of the crop to pests. With regard to diseases, 73 % of the farmers felt they lost more than half of their crops if they applied no disease controls, while 25 % of them felt they only lost between 25 and 50 % of the crop. Farmers' perception of and reaction to weeds were less pronounced than for pests and diseases. Fifty-seven percent felt they lost less than 25 % of their crop to competition with weeds.

**Table 2. Ranking of key pests attacking snap beans by farmers and by researchers (interviewers)**

| Pest group | Rank order of importance by: | |
|---|---|---|
| | Farmers | Researchers |
| Bean stem maggots (*Ophiomyia* spp.) | 1 | 1 |
| Whiteflies (*Bemisia tabaci)* | 2 | 1 |
| Spider mites (*Tetranychus* spp.) | 3 | 5 |
| Bollworm (*Helicoverpa armigera*) | 3 | 6 |
| Thrips (*Megalurothrips sjöstedti*) | 5 | 3 |
| Spiny brown bugs (*Clavigralla* spp.) | 5 | 4 |
| Leafminers (*Liriomyza trifolii*) | 5 | 6 |
| Aphids (*Aphis fabae)* | 5 | 8 |

Ranking on a 1-9 scale. (1 = highly important, 9 = unimportant)

**Table 3. A ranking of key diseases constraining snap bean productivity by farmers and by researchers (interviewers)**

| Disease | Rank order of importance by: | |
|---|---|---|
| | Farmers | Researchers |
| Rust | 1 | 1 |
| Angular leaf spot | 1 | 1 |
| Anthracnose | 3 | 1 |
| Root rots | 4 | 4 |
| Halo blight | 4 | 4 |
| Bean common mosaic virus | 4 | 4 |

Ranking on a 1-9 scale. (1 = highly important, 9 = unimportant)

Farmers were keen to control the pest and disease problems they encountered. They expressed sufficient knowledge of pest and diseases of beans and their control; they were able to identify their pest and disease problems, and actively protected their crops against these adversities to ensure good yield and meet the quality standards of unblemished pods. They were familiar with the available pesticides and their efficacy against target pests

and diseases and adopted these as their basic control strategy; but very few farmers monitored pest populations and used control thresholds as a guide for the application of pesticides.

Only about 20 % of the farmers obtained their crop protection recommendations from the village extension officer; 21% got advice from the shopkeepers who sold them the pesticides, while 55 % used their own knowledge or consulted a neighbour about what pesticide to use against a specific pest (Table 4). In addition, some contracted farmers were advised on appropriate pesticides and their spray schedules against specific pests by their agents, who also supplied them with the chemicals. However, there was no single or consistent spray programme followed by farmers in an area; each farmer followed his own practice.

**Table 4. Farmers' sources of advice on pesticide application**

| Source | Percent of farmers |
|---|---|
| Self | 35.4 |
| Neighbour | 18.2 |
| Extension officer | 20.2 |
| Shopkeeper | 21.2 |
| Agent | 5.1 |

All the farmers interviewed used insecticides as the primary control strategy while about 7% supplemented this strategy with cultural methods, such as frequent ridging to improve plant tolerance to bean stem maggot damage, ploughing in crop residue soon after harvest to reduce the carry over of pests between plantings, and the application of ash to the soil for the control of soil pests. Apart from the use of chemical fungicides, farmers did not express knowledge of other methods of disease control. Farmers used only hand tools for weed control.

Tables 5 and 6 list the pesticides used to control pests and diseases on snap beans. Most pesticides were used against a range of pests or diseases on the bean crop and farmers often mixed cocktails of pesticides for this purpose (Tables 7 and 8). However, Furadan was used mainly for bean stem maggot control and Selecron for mite control. Although Antracol, Dithane and Kocide were used by the farmers to control nearly all diseases, Antracol was emphasized for control of angular leaf spot, and Dithane and Kocide for the control of leaf rust. Pesticides such as Furadan, Ridomil and Benlate were considered efficient by the farmers, but they were used less extensively because of their high costs. Most farmers, however, indicated that the pesticides they were spraying were ineffective against such pests as white flies (*Bemisia tabaci*) and spiny brown bugs (*Clavigralla* spp.).

## Table 5: Insecticides/miticides used by farmers in the surveyed area

| Insecticide/Acaricide | | | Mode of action | No. of farmers using the chemical (n = 99) |
|---|---|---|---|---|
| Trade name | Common name | Type | | |
| Ambush | permethrin | (SP), insecticide | contact | 34 |
| Selecron | profenofos | (OP), insecticide + miticide | contact, ingestion | 30 |
| Furadan | carbofuran | (C), insecticide + acaricide + nematicide | systemic | 24 |
| Rogor E. | dimethoate | (OP), insecticide+ miticide | contact, systemic | 18 |
| Sumithion | fenitrothion | (OP), insecticide | contact | 14 |
| Karate | L-cyhalothrin | (SP), insecticide | contact | 12 |
| Diazinon (Basudin) | diazinon | (OP), insecticide | contact, non-systemic | 12 |
| Decis | deltamethrin | (SP), insecticide | contact, ingestion | 8 |
| Thiodan | endosulfan | (OP), insecticide + miticide | contact, stomach, non-systemic | 7 |
| Azocord | cypermethrin+ monocrotophos | (OP)+ SP), insecticide + miticide | systemic, contact, ingestion | 7 |
| Ripcord | cypermethrin | (SP), insecticide | ingestion, contact | 6 |
| Dursban | chlorpyrifos | (OP), insecticide | ingestion, contact, vapour action, non-systemic | 6 |
| Brigade | eefenthrin | (SP, insecticide + miticide | contact | 5 |
| Kelthane | dicofol | (OP), miticide | non-systemic | 4 |
| Lebaycid | fenthion | (OP), insecticide | contact, ingestion | 4 |
| Marshal | carbosulfan | (C), insecticide | systemic | 3 |
| Eralux | quinalphos | (OP), insecticide + miticide | contact, ingestion | 2 |
| Malathion | malathion | (OP), insecticide + miticide | non-systemic contact | 2 |
| Folimat | omethoate | (OP), insecticide + miticide | systemic | 2 |
| Omite | propargite | (S), miticide | systemic | 2 |
| Polytrin | cypermethrin | (SP), insecticide | ingestion, contact | 2 |
| Sherpa | cypermethrin | (SP), insecticide | ingestion, contact | 1 |
| Hostathion | Ttiazophos | (OP) insecticide+miticide, | ingestion, contact | 1 |
| Bancol | bensultap | (N) insecticide | contact | 1 |

OP = Organophosphorus insecticide SP = Synthetic pyrethroid C = Carbamate insecticide
S = Sulfite acaricide N = Nereistoxin analogue insecticide

**Table 6. Fungicides used by farmers in the surveyed area**

| Pesticide | | | Mode of action | No. of farmers using the chemical (n = 99) |
|---|---|---|---|---|
| Trade name | Common name | Type | | |
| Antracol | propineb | dithiocarbamate | Protective | 46 |
| Copper oxychloride | copper oxychloride | copper | Protective | 36 |
| Dithane M-45 | mancozeb | dithiocarbamate | Protective | 25 |
| Bayleton | triadimefon | conazole | Protective, curative, systemic | 11 |
| Ridomil | metalaxyl | acylalanine | Systemic | 2 |
| Kocide | copper hydroxide | copper | Protective, fungicide/ bactericide | 1 |
| 'Pencozeb' | penconazole | conazole | Systemic | 2 |
| Plantrav | oxycarboxin | anilide | Systemic | 1 |
| Nova | myclobutanil | conazole | Systemic | 1 |
| Rabcide | phthalide | phthalide | Specific action on rice disease | 1 |
| Polyram | metiram | dithiocarbamate | Non-systemic, preventative | 1 |

Several of these pesticides, e.g. Ambush, Selecron, Kocide, Furadan, are registered for use on other crops such as rice and cotton, but not on snap beans in Kenya. However, because they were easily available in the area, they were also used on snap beans. Furadan granules provided to farmers by the Kenya National Irrigation Board for rice production were applied on snap beans as foliar sprays, seed dressing or drenching the ground around bean seedlings immediately after plant emergence.

Farmers observed that by applying Furadan as a spray, rather than as a granular application to the soil, they were able to cover a wider area and reduce costs. This method of application, however, is not recommended as it may expose the farmer to toxic levels of the chemical. The price and ease of availability of a pesticide often influenced the level of adoption by farmers. Expensive pesticides were less likely to be adopted, irrespective of how effective they were.

Although it is illegal under the Pest Control Products Act to repackage a pesticide product, this was normally done by stockists in the area because farmers often want to buy smaller. As a result there was a high level of adulteration of pesticides during the repacking, by addition of non-active ingredients.

**Table 7. Farmer response to use of mixtures of chemicals**

| Frequency of using chemicals in mixtures | Percent of farmers |
|---|---|
| Always | 57.6 |
| Sometimes | 29.3 |
| Never | 13.1 |

**Table 8. Chemical mixes commonly used by farmers**

| Chemical mix | Percent of farmers |
|---|---|
| Insecticide + fungicide | 77.8 |
| Insecticide + fungicide + foliar feed | 22.8 |

*Farmer handling of chemical pesticides*

There were no pest scouting systems to advise farmers on what and when to spray; the complete eradication of pests seemed to be the aim of the farmers, and they tended to adopt prophylactic treatments. Most farmers (83%) had a spray schedule which they followed routinely through the crop cycle. Only a few farmers (17 %) assessed pest abundance or checked for pest damage before they applied insecticides. In many instances farmers (75 %) sprayed on a weekly schedule and made up to 12 pesticide applications in a cropping cycle over their beans (Table 9). Also, 58 % of the farmers admitted they always sprayed mixtures of chemicals on their crop; the most commonly mixed chemicals were insecticide and fungicide (78 % of farmers) and insecticide, fungicide and foliar fertiliser (22 % of farmers) as they felt appropriate, while 52% indicated that they applied the same products on snap beans when spraying other crops (Table 9). In most cases the farmer himself (59 %) applied the chemical; otherwise, he hired labour from outside the family (34 %) to do it. The use of other family labour was rare (6 %) (Table 10).

**Table 9. Number of spray applications used by farmers in a crop cycle**

| No. of applications | Percent of farmers |
|---|---|
| Less than 5 | 11.1 |
| 5 - 10 | 58.7 |
| More than 10 | 30.3 |

**Table 10. Decision-making on when and what pesticide to apply**

| Decision Maker | Percent of farmers |
|---|---|
| Farmer | 93.9 |
| Farmer's parent | 4.0 |
| Farmer's spouse | 1.0 |
| Other relatives | 1.0 |

Half the farmers interviewed responded that they sprayed snap beans when they sprayed other crops. Eighty-four percent of the farmers admitted they did not take any precautions during pesticide applications and 62 % indicated they had experienced "intoxication" after applying pesticides at least once previously. They also did not wear adequate protective clothing. Some farmers wore old clothes and only a few wore gumboots or overcoats for protection during the spray operations. Even though they were all aware of the need of protective clothing during the spray operation, the high cost made them unavailable. However, all the farmers interviewed said that they did not smoke, drink, or eat while applying pesticides, and that they washed themselves afterwards.

## DISCUSSION

Pests and diseases on snap beans in Kenya are controlled mainly with pesticides, as elsewhere in the world (Cardona and Corrales, 1992; Velasquez and Prada, 1992; Anyango *et al.*, 1989). This is because of farmers' desire to produce beans without blemish, as demanded by the market. The cost of pesticides is increasing and their proper use has to be emphasized to minimize the cost of production and residue levels on the final produce.

The wide variety of pesticides used in the Mwea Tebere area could cause a buildup of pest resistance to pesticides and pollution through the water canals in the area. It was therefore not unexpected that farmers reported encountering difficulty in the control of white flies and other pest species, which may already have developed resistance to the range of pesticides currently in use. The reported ineffectiveness of some pesticides may also be due to their inappropriateness against the specific pest, or to the high rate of adulteration of pesticides. These factors could also induce pest resistance to pesticides. The effect of the pesticides on farmers, who were normally not protected from them, should be of great concern. Currently there is a project to train farmers in the area on the safe and appropriate use of pesticides. This is in the right direction and should help alleviate the problem.

While the use of chemicals may not be abandoned entirely, it is necessary to reduce the high number of sprays used in snap bean production in the Mwea-Tebere area. There is also a need for the use of selective chemicals that will have the least effect on natural enemy populations. This can be achieved if farmers are made aware of the actual losses caused by the different pests and diseases and are convinced of effective alternatives to high doses of pesticides. They will need to be convinced also that such methods could be combined with pesticides to effectively control the pests, reduce the dangers to themselves and reduce the

populations. This can be achieved if farmers are made aware of the actual losses caused by the different pests and diseases and are convinced of effective alternatives to high doses of pesticides. They will need to be convinced also that such methods could be combined with pesticides to effectively control the pests, reduce the dangers to themselves and reduce the levels of pesticide residue on the produce. Strategies for effective integrated management of snap bean pests and diseases are currently lacking, even though some recommendations are available in local publications (e.g. Muruiki 1988, Anyango *et al.* 1989, Kibata 1990).

In cases where such options are not adequately developed, research should focus on their development. Emphasis should be given to cultural practices such as residue management, including burning of diseased or pest infested plants at the end of the season, crop rotation, a strict closed season to break the pest cycle, and trap cropping to control pests with minimum pesticide applications. In addition, suitable control thresholds for the key pests need to be determined by scientists and extensionists in collaboration with farmers, through demonstrations and participatory research approaches that enable them to understand and use safe and appropriate pesticide handling and application procedures. In combination, these measures should help reduce the chemical hazards to the environment.

## ACKNOWLEDGEMENT

This study was undertaken under a subproject of the Eastern Africa Bean Research Network (EABRN) and using funds allocated by the Network's regional steering committee. The KARI/ODA project administrators assisted us with transport to the areas of study.

## REFERENCES

**Anyango, J.J., Ochiel, G.R.S., Alembi,D.K., Pete, S.O.K. and Kimutai, D.C.(1989).** Survey, identification and control of French bean pests with major emphasis on bean thrips in Kenya. NARL Annual Report, KARI., Kenya, 1989. pp 109-113.

**Anyango, J.J. and S.M. Nabwile (1995).** A survey of french bean production by small-holders in Kenya: pest status, plant protection practices, economics and gender factors. KARI/ GTZ-IPM Horticulture Project, Nairobi. Kenya. 38pp.

**Cardona, C. and M.A.Pastor-Corrales (1992).** Strategies for management of pests and diseases of snap beans in Latin America. In: Henry, G. and Jansen, W. (eds) Snap Beans in the Developing World: Proceedings of an international conference held in Cali, Colombia,16-20 October 1989. CIAT, Cali, Colombia, 366 pp.

**Jaetzold, R. and Schmidt, H. (1983).** Farm Management Handbook of Kenya. Crop Development Division, Ministry of Agriculture, Kenya. pp. 179.

**Kibata, G. (1990).** Control of the *Ophiomyia* spp. (Diptera: Agromyzidae) on French beans (*Phaseolus vulgaris* L.).National Agricultural Research Laboratories, Kabete, Kenya. Annual Report, 1990. pp 87-90.

**Muruiki, S.J.N. (1988).** evaluation of pesticides in the control of bean flower thrips in the common bean (*Phaseolus vulgaris* L.) at Thika, Kenya. Acta Horticulture, 218:347-350.

**Velasquez, J.G. and P. Prada (1992)**. Snap bean pests and diseases in Sumapaz, Colombia: their present status and implications. In: Henry, G. and Jansen, W. (eds) Snap Beans in the Developing World: Proceedings of an international conference held in Cali, Colombia, 16-20 October 1989. CIAT, Cali, Colombia, 366 pp.

## APPENDIX

**Questionnaire administered**

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**DEVELOPMENT OF AN IPM PACKAGE FOR SNAP BEANS IN KENYA**

**Objectives:**

1. To describe and evaluate the current control methods in French bean production system.
2. To evaluate the current use of pesticide in snap bean production.

SURVEY NO:_____

1. Name of farmer_____

2. Location of farm:- District_____Division_____
   Location_____Sub-location_____

3. Crops grown in order of importance to the farmer:

| | (Enter priority 1-5) |
|---|---|
| Maize | _____ |
| Dry beans | _____ |
| Snap beans | _____ |
| Flowers | _____ |
| Vegetables | _____ |
| Others (specify) | _____ |

4. Number of plantings: _____

5. Planting interval: _____
   a. one week b. two weeks c. three weeks
   d. five weeks e. six weeks f. seven weeks
   g. eight weeks h. nine weeks i. other (specify)

6. Date of first planting:
   Month (enter 1 to 12) _____
   Day (enter 1 to 3) _____

7. Main insect pest problems and insecticidal control:

| Pests | (Enter priority 1-5) | insecticides |
|---|---|---|
| Bean aphid | _____ | _____ |
| Bean thrips | _____ | _____ |
| Mites | _____ | _____ |
| Podborers(specify) | _____ | _____ |
| others (specify) | _____ | _____ |

Mention insecticides not used for specific pests_____
_____

8. Farmers suggested solutions to insect pests:

| Solutions | (Enter priority 1-6) |
|---|---|
| Chemical control | _____ |
| Cultural control | _____ |
| Biological control | _____ |
| Physical/mechanical control | _____ |
| Varietal control | _____ |
| No control | _____ |
| Others (specify) | _____ |

9. What insecticides do you apply to control the pests?

| Product | Dosage | Farmer's appraisal of efficacy | | |
|---|---|---|---|---|
| | | Good | Moderate | Poor |
| a. | | | | |
| b. | | | | |
| c. | | | | |
| d. | | | | |
| e. | | | | |
| f. | | | | |

10. Main disease problem:

| Disease | Enter priority (1 to 6) | Fungicides/ bactericides |
|---|---|---|
| Rust | _____ | _____ |
| Anthracnose | _____ | _____ |
| Halo blight | _____ | _____ |
| Angular leaf spot | _____ | _____ |
| Bean root | _____ | _____ |
| Common bean mosaic | _____ | _____ |
| Others specify | _____ | _____ |

Mention fungicides/bactericides not used for specific diseases:

_____

11. Farmers suggested solution to disease pests:

| Solutions | (Enter priority 1-6) |
|---|---|
| Chemical control | _____ |
| Cultural | _____ |
| Physical/mechanical control | _____ |
| Varietal control | _____ |
| No control | _____ |
| Others specify | _____ |

12. What fungicides do you apply?

| | Product | Dosage | Efficacy | | |
|---|---|---|---|---|---|
| | | | Good | Moderate | poor |
| a. | | | | | |
| b. | | | | | |
| c. | | | | | |
| d. | | | | | |
| e. | | | | | |
| f. | | | | | |

13. Main weed problems:

| Weeds | Enter priority (1-3) | Herbicides |
|---|---|---|
| Broadleafed weeds | | |
| Grasses | | |
| Sedges | | |
| Others (specify) | | |

Mention herbicides not used for specific weeds_____

_____

14. Farmer's suggested solutions to weeds:

| Solutions | (Enter 1-4) |
|---|---|
| Herbicides | |
| Hand pull | |
| Hand tools | |
| Mechanical | |
| Others(specify) | |

15. Observer's comments on farmers' perceptions and actions on insect, disease and weed problems:

| | insects | diseases | weeds |
|---|---|---|---|
| knowledgeable | | | |
| some knowledge | | | |
| little knowledge | | | |
| no knowledge | | | |

16. How do you decide when to spray?_____

a. pest abundance
b. pest damage
c. scheduled treatment
d. others (specify)

17. After spraying, how do decide when to spray next?

a. monitoring
b. routine schedule
c. others (specify)

18. How often do you apply the chemicals?
    a. Once a week
    b. Twice a week
    c. Once every ten days
    d. Once every five days
    e. Other(specify)

19. How many times do you apply insecticides in a season?

| | | |
|---|---|---|
| a. once | d. four times | g. seven times |
| b. twice | e. five times | h. eight times |
| c. thrice | f. six times | i. nine times |
| j. ten times | k. eleven times | l. other (specify) |

2O. Who recommends the insecticides to you?
    a. An extension officer _____
    b. Farmer himself _____
    c. Neighbour or other farmer _____
    d. A salesman _____
    e. A shopkeeper _____
    f. Other (please specify) _____

21. Do you mix insecticides and other products?
    a. sometimes
    b. always
    c. never

22. What kind of mixture do you use?
    a. Insecticides and fungicides
    b. Insecticides,fungicides and foliar fertilizers
    c. Insecticides and foliar fertilizers
    d. Fungicides and foliar fertilizers
    e. Insecticides/fungicides and other products

23. Do you apply the same products on other crops? On which crops?
    Yes_____No_____
    _____

24. When you spray other crops do you also spray beans?
    Yes_____No_____

25. Who decides on date of application?
    a. Farmer himself/herself
    b. His/her father
    c. His/spouse
    d. Other relatives
    e. Other (please specify)

26. Who spray or applies the chemicals?
    a. Farmer himself/herself
    b. Farmer and relatives
    c. Hired labour
    d. Farmers and hired labour.

27. How much water do you use per ha?

| Pesticide | No. tanks | Tank size | Estimated area | Approx. volume/ha* |
|---|---|---|---|---|
| | | | | |

* a. 200 litres d. 800 litres
b. 400 litres e. 1000 litres
c. 600 litres f. 1200 litres

28. Do you take any precautions when you use chemicals?
    Yes_____No_____

29. Do you.....?
    a. smoke _____
    b. drink _____
    c. eat _____
    d. wear a mask _____
    e wear gloves _____
    f. wash yourself (shower) afterwards_____
    g. wash your hands afterwards_____
when you use chemicals {insecticide, fungicide, herbicide, etc.).

30 Have you ever been intoxicated (dizzy, sick, etc) after applying chemicals?
    Yes_____No_____

31. Interviewer's record of the main pests and insecticides:

| Pests | Insecticides |
|---|---|
| a._____ | f._____ |
| b._____ | g._____ |
| c._____ | h._____ |
| d._____ | i._____ |
| e._____ | j._____ |

32. Inteviewer's record of the main diseases:

| Diseases | Fungicides/bactericides |
|---|---|
| a._____ | f._____ |
| b._____ | g._____ |
| c._____ | h._____ |
| d._____ | i._____ |
| e._____ | j._____ |

33. Interviewer's record of the main weeds:

| Weeds | Herbicides |
|---|---|
| a._____ | f._____ |
| b._____ | g._____ |
| c._____ | h._____ |
| d._____ | i._____ |
| e._____ | j._____ |

34. At what stage of plant growth do pests cause serious damage?

| | Insect (specify pest) | disease (specify disease) | weeds (specify weeds) |
|---|---|---|---|
| a. Before emergence | _____ | _____ | _____ |
| b. Seedling stage | _____ | _____ | _____ |
| c. Before flowering | _____ | _____ | _____ |
| d. During flowering | _____ | _____ | _____ |
| e. After flowering | _____ | _____ | _____ |
| f. Near maturity | _____ | _____ | _____ |

35. If there is no control, how much of the yield do you think is affected?

| | For insects | For diseases | For weeds | total |
|---|---|---|---|---|
| a. None | _____ | _____ | _____ | _____ |
| b. 1-25% | _____ | _____ | _____ | _____ |
| c. 25-50% | _____ | _____ | _____ | _____ |
| d. over 50% | _____ | _____ | _____ | _____ |

36. Comments/observations (cropping systems, cropping pattern, fertilizer use, weeding, enviromental factors):

_____

_____