Summarized Survey of
Local Plant Health Knowledge

Project:
Plant Health Services *initiative* (PHS*i*) in Bangladesh

Prepared by:
Md. Harun-Ar-Rashid
AKM Murshedur Rahman

Funded by:
CABI Bioscience
Bakeham Lane, Egham
Surry TW20 9TY, U.K.

Implemented by:
Agricultural Advisory Society (AAS)
House # 8/7 (Ground Floor), Block-B
Lalmatia, Dhaka-1207
Phone: 880-2-8113645, E-mail: aas@bdcom.com

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Brief on the survey

A participatory survey of farmer's knowledge about plant health problems has been completed by Agricultural Advisory Society (AAS) on behalf of CABI Bio-science, UK. AAS conducted the survey over the course of three successive cropping seasons; i.e., Summer-I (Kharif-I), Summer-II (Kharif-II) and Winter (Rabi). The survey in Summer-I, Summer-II and Winter cropping seasons of 2004 was completed according to a carefully defined methodology. Accordingly, this report summarizes the objectives, methods and stages of the survey undertaken at 35 villages in 6 upazilas of Natore (Boraigram and Sadar upazilas), Norsingdi (Raipura and Shibpur upazilas) and Moulvibazar (Srimangal and Sadar upazilas) districts. The survey was conducted to better understand the extent of farmer's knowledge about plant health problems and their remedies.

A total of 1591 farmers including 334 female farmers participated in the survey. According to farmer's opinion, the status of insect, disease and soil problems for each of the crops surveyed were recorded (on a scale of 0 to 5) to identify the major plant health problems. Farmers were divided into small groups for the purpose of collecting representative samples of major plant health problems from the adjacent crop fields. In 'Focused Group Discussions (FGD)', farmers were asked to give their understandings regarding: local names, identifying characters, nature of damage or symptoms, favorable conditions and to cite the pest management practices most commonly applied to resolve a particular problem.

Farmers identified about 130 crops in three districts, which had major plant health problems. Out of these, farmers identified 49, 30 and 51 crops during 2004 Summer-I, Summer-II and Winter crop seasons respectively. The highest number of crops identified was in Natore district (85) followed in order by Norsingdi district (54) and Moulvibazar district (49). Farmers identified 214 plant health problems during the survey, of which 97 were insect related and 117 were disease problems.

The Seasonal orientation of Pests and Diseases

During 2004 Summer-I (Karif I) season, it was found that (i) the frequency of some damaging insects was comparatively greater. These included the cucurbit fruit fly, brinjal shoot and fruit borer, rice stem borer, sugarcane stem borer, pumpkin caterpiller and epilachna beetle; and (ii) the frequency of some damaging diseases was also comparatively greater during the same period. This included heavier concentrations of bud rot in coconut, nutritional deficiency of coconut, clove separation of garlic, leaf curl of teasle gourd, virus of cucurbit and anthracnose of mango. During the Summer-II (Karif II) season, it was also found that (i) the frequency of some damaging insects was comparatively greater; such as rice stem borer, hispa, rice gall midge, cucurbit fruit fly, bean aphid and brinjal shoot and fruit borer. (ii) The frequency of some damaging diseases was also comparatively greater. This, such diseases as die-back of brinjal, sheath blight of rice, foot rot of brinjal, leaf blight of turmeric, leaf curl of chilli and root knot of brinjal. During the 2004 Winter (Rabi) season, it was found that (i) the frequency of some damaging insects was comparatively greater. For example, there were greater infestations of bean aphid, brinjal shoot and fruit borer, bean pod borer, cucurbit fruit fly, potato cutworm and mustard aphid; (ii) the frequency of some damaging diseases such as leaf curl of chilli, anthracnose of bean, stem rot of brinjal, Riceyness of Cauliflower, foot rot of wheat, Leaf curl of brinjal, die back of brinjal, foot rot of tomato and foot root of Cole was also comparatively greater during that period.

How Farmers Name the Pest and Diseases they deal with

Farmers used one or more local names to identify their plant health problems where some of the common names were found that had no specific meaning. In most of the cases, the local names were found to have a translatable or literal meaning. Farmers used different local names on the basis of morphological characters, infestation characteristics or symptoms. Some of the local names were found to be unique to specific localities. Whereas some of the local names of insects such as “Jab Poka”, “Leda poka”, ‘Mazra poka’, ‘Machi poka’ etc. were found to be in common use in all survey areas. Most of the disease problems had no specific common or local names. Rather farmers were inclined to use terms such as ‘Gura pocha’, ‘Pocha rog’, ‘Kukra rog’, ‘Mora rog’ etc. as these names described the observed symptoms of particular diseases. Farmers of three districts identified by name or description 250 plant health problems (165 without duplication). For this they used some 435 local names (287 without duplication) or descriptions to describe the various pests and diseases they encountered during the three successive seasons surveyed.

Extent of Damage Caused by Various Pests and Diseases

In Natore district, some crops were found to be severely damaged by insects such as, Rice (Stem borer), Sugarcane (Stem borer), pointed gourd and cucumber (Lepidopteran larvae), Mango (stem borer and hopper), Jack fruit (Stem borer), Country bean (Bean aphid and Bean pod borer), Cabbage and Cauliflower (Larva of cabbage butterfly), Brinjal (Brinjal shoot and fruit borer), Bitter gourd, Bottle gourd and Sweet gourd (Cucurbit fruit fly), Banana (Banana leaf and fruit beetle), Teasle gourd (Epilachna beetle), Pomegranate (Pomegranate fruit borer), Rice (Earthworm) etc. In Norsingdi district, Rice (hispa, case worm), Cucumber and brinjal (Red mite), gourds (Epilachna beetle), Banana (Leaf and fruit beetle), Cabbage and Cauliflower (Cabbage butterfly and Cutworm), Brinjal (Brinjal shoot and fruit borer), Country bean and Yard long bean (Aphid and Pod borer), Bitter gourd, Sweet gourd and Bottle gourd (Cucurbit fruit fly), Potato (Cutworm), Lemon (Lemon butterfly) etc. crops were damaged seriously by insects. In Moulvibazar district, some crops were found susceptible to insect damage such as, Potato and Chilli (Cutworm), Country bean (Bean pod borer), Yard long bean (Aphid), Cabbage (Cabbage butterfly), Brinjal (Brinjal shoot and fruit borer), Rice (hispa, and stem borer), Taro (Hairy caterpillars), Country bean (Aphid) etc.

Overall more disease than pest problems were identified by the survey. In Natore district, for example, farmers identified some disease problems which cause serious damage to crops such as, Purple blotch of onion and garlic, Foot rot of vegetables, Leaf curl of chilli, tomato, cucurbit and papaya, Die back and Wilt of brinjal, Rhizome rot of turmeric, Foot rot of wheat, Bud rot of coconut and betel nut etc. In Norsingdi district, Anthracnose of bean, Wilt, Leaf curl and Anthracnose of cucurbits, Leaf curl of chilli, Foot rot of vegetables, Late blight of potato, Sigatoga of banana, Gummosis and Scab of lemon, Dieback and Wilt of brinjal etc. caused serious damage to crops. In Moulvibazar district, several disease problems caused considerable damage to crops. These included the problems of Late blight and mosaic of potato, Foot rot of vegetables, Leaf curl and Foot rot of tomato, Scab of lemon, Bud rot of coconut and betel nut etc.

How Pesticides are Used by the Farmers Surveyed

To know the actual situation of pesticide application, farmers were asked to give the trade name of chemicals applied, number of doses used and the frequency of application. They were also asked to comment on the overall effectiveness of the chemicals used. Farmers used some pesticides such as Basudin, Furadan, Curaterr, Diazinon, Biesterin, Phaddy, Malathion, Dursban, Basathrin, Decis, Fenfen, Fyfanon, Tafgor, Fenitox, Fastac, Ripcord,

Cymbush, Marshal, Schincyper, Karate, Aktara, Sevin, Kartap, etc. to protect their crops from a variety of pest. In most cases, farmers used these chemicals on the basis of the recommendation of pesticide dealers.

Farmers were more interested to protect the insects by pesticides in comparison to disease problems. Some chemicals such as Tilt, Dithane M-45, Ridomil, Rovral, Indofil, Bavistin, Antracol, Topsin, Folicur, Thiovit, Cupravit, Ronovit, Knowin, Champion, etc. are used to protect the diseases. Farmers were found to use insecticides for disease problems when they failed to identify the problem.

Farmers used common as well as some unauthorized pesticides to control the destructive effect of known pests. Farmers made frequent use of chemicals to control the Bean aphid, Bean pod borer, Cabbage butterfly, Brinjal shoot and fruit borer, Cucurbit fruit fly, Cutworm, Banana leaf and fruit beetle etc. In Natore district, farmers made 40-50 pesticide applications on average to protect a single Bean Crop from Bean pod borer. To protect the Brinjal shoot and fruit borer, farmers used the pesticides almost everyday and in some cases, 150-200 times in a single crop season. Farmers of Norsingdi district applied pesticides at least 1-3 times in a week to protect their vulnerable vegetable crops. In Norsingdi district, the unauthorized ‘Indian bish’ (comes from India whose trade name is ‘Kripcord’) becomes very popular to protect Bean pod borer and Brinjal shoot and fruit borer, which is same in Natore district. Some farmers in Natore and Norsingdi district are known to frequently apply chemicals to their crops intended for "sale" in the market, but do not spray that part of the crop intended for their own consumption.

Indiscriminate use of both authorized and unauthorized pesticides at very high concentrations and at very frequent intervals was found to be exceedingly common within the survey areas. Farmers of the survey area were inclined to apply some unauthorized highly toxic pesticides as few insects have already gained resistance to the authorized and safer chemicals. Some vegetable crop required spraying almost everyday in order to control the infesting insects. Due to excessive application of pesticides and some tendency to use the wrong chemicals, as much as one third of some farmer’s vegetable crop revenue is spent on buying pesticides. Moreover excessive and indiscriminate use of pesticides in crop protection has been creating hazards in many ways, as result farmers noticed several consequences such as extinction of fishes, frogs, birds etc and physical sufferings and deterioration of human health within the survey areas.

Innovative Methods of Pest and Disease Control

In the 3 districts, about 35 innovative methods were identified in the survey. In Natore district, about 20 innovative methods are identified where 5-6 methods gave considerable result in controlling adult moth of rice, jute, fruit flies, cut worm, rats, aphids etc. In Norsingdi district, about 15 innovative methods are identified where 3-4 methods gave good results to reduce to attack of red mite, cucurbit fruit fly, banana leaf and fruit beetle, aphids etc. In Moulvibazar district about 10 innovative methods were identified where 2-3 methods showed considerable results against rice hispa, cutworm, rice stem borer etc.

In most of the cases, farmers are dependent on the local pesticide dealers for recommended crop protection practices. Accordingly, most farmers are advised to apply high doses of the recommended pesticides; perhaps with the aim of selling chemicals in greater volumes. Farmers expressed much interest in receiving training on pest management and they wanted to know the appropriate recommendation of pesticide use. Moreover, farmers expressed an interest in growing crops with safe and effective pesticides or even without pesticide use.

Background

Agricultural production accounts for about one third of Bangladesh's gross domestic product and makes up more than 30% of the country's export earnings. Nearly two thirds of the country's population is employed, one way or another, in agriculture; the majority in rice production. Approximately 80% of the country's 140 million people depend on agriculture for their subsistence. Bangladesh now deems itself to be self-sufficient in food grain production. This is a significant accomplishment as "food security" has long been a major tenant of national policy. Accordingly, there is ample evidence to support the notion that "Agriculture is, indeed, the economic backbone of Bangladesh".

The major crops of the country are rice, wheat, pulses, jute, oilseed, vegetables, potatoes, fruits, sugarcane, spices and cotton. Achieving substantial crop production increases is a major challenge to the nation. The challenge is extremely complex and is made more so due to the existence of several, well understood, well entrenched constraints. Of these, resilient insect pests and diseases (a global concern) are particularly serious threats to Bangladesh's continued improvement in its overall agricultural productivity.

Estimates of crop losses due to pests vary from year to year according to location and kinds of crops. Available reports show losses caused by insect pests, diseases and rodents in rice at 16%, 10% and 1.5% respectively. Under farmers' field conditions, in certain years and in certain places, crop losses reach more than 30% and on rare occasions even up to 80-100%. Similar estimates apply to wheat, jute, sugarcane, pulses, oilseeds, vegetables and fruits. An estimate of annual loss due to insect pests alone has been reported as 16% for rice, 11% for wheat, 20% for sugarcane, 25% for vegetables, 15% for jute and 25% for pulses. Thus weaknesses in Bangladesh's plant health management regime are known barriers to the achievement of high levels of increased agricultural production. Unfortunately the country is lagging behind in the development and implementation of efficient, eco-friendly plant-health management practices. It is an irony that in spite of the known serious consequences,, pesticides, in most cases, still serve as the only method used in protecting crops from massive insect/pest-born losses. Pesticides are often used indiscriminately and at very high rates of application and very frequently without knowing the actual purpose of the pesticide being applied. At present about 22 thousand metric tons of pesticides are used every year in our country.

About 75% of the total cropped area is under rice cultivation in Bangladesh. The remaining 25% is devoted to the production of more than 50 non-rice crops, of which more than 50% are high value cash crops such as vegetables, fruits, spices etc. High value cash cropping has increased tremendously due to favorable market conditions during last 20 years. The marketing of the high value cash crops now faces a new problem; i.e., unduly high production costs in relation to selling prices. It is reported that the production costs of the crops in Bangladesh are among the highest in the South Asia region. This is due, in part, to excessive input costs in relation to "farm-gate" market values.

Moreover, the scenario is further complicated by increases in the level of pest and disease infestation. In general farmers are failing to harvest the high yields of good quality of non-rice and rice crops they deserve due to increasingly heavy damage caused by the number of pests and diseases suffered during the cropping cycle. Such damage, especially that which is done to high value non-rice crops has become an area of increased concern among the

country's extension and farming communities. In order to protect high value non-rice crops from pest and disease damage, farmers are becoming increasingly dependent on the frequent use/abuse of dangerous and highly toxic pesticides. Moreover, pesticide adulteration by wholesalers and retailers is an increasing being concern of many farmers. In most cases, farmers use pesticides in their fields on the basis of recommendations and advice from their local pesticide dealers. In general, the dealers, themselves are not professional crop/soil/pest specialists and thus we have a situation of the 'blind leading the blind" with certain incentives for both farmers and dealers to advocate the use of inappropriate and/or excessive pesticide levels. Monitoring and supervision of pesticide use by DAE is very minimum at field level. Agricultural research institutes have no role in such monitoring and/or supervision at any level. Regrettably, the agro-chemical industry has done little or nothing to police them selves; having left the field open to misuse and abuse.

Preliminary information indicates, overall, that farmer's knowledge about crop health relating to insects, diseases and soil problems is minimum. Traditionally farmers want to protect their crop with chemicals; this is the result of motivation on plant health management (i.e. crop protection) by DAE, BADC, agricultural research institutes and pesticide companies for the last four decades. By global standards, the plant protection (chemical application) practices of farmers in the country are extremely hazardous. This is an important national issue, because the current low-level of plant protection safety, if left unattended, will cause increased human health risks to both consumers and applicators. Moreover, pesticide use in the current crop protection scenario is almost wholly top-down and gives little consideration to the farmer's role and perception in the overall production/consumption/human health and environmental equation. Presently, the consuming civil society is blindly hopeful that chemical usage in crop production will be kept at "Safe and effective" levels. However, on the production side of the equation, farmers are inclined to make maximum and excessive use in order to bring to market the largest quantity of unblemished product possible in the shortest time with the least loss due to insect and disease damage. Thus there are incentives for farmers to use excessive levels of chemicals and disincentives for them to look out for the overall heath interests of their customers.

To know the actual situation of plant health problems, Agricultural Advisory Society (AAS) with the funding support of CABI Bioscience, UK, conducted a participatory survey over the course of three different crop seasons, i.e., Summer-I (Kharif-I), Summer-II (Kharif-II) and Winter (Rabi) in 2004. The survey was conducted at 30, 12 and 17 villages during Summer-I, Summer-II and Winter seasons respectively in 6 upazilas of 3 districts namely Natore, Norsingdi and Moulvibazar. Findings of the initial survey form a baseline for measuring the progress of AAS/CABI Bioscience project on "Plant Health Services *initiative* (PHS*i*)" in Bangladesh.

Purpose

The project intended to establish a better flow of information about plant diseases and pests to scientists, extensionists, research facilities and private sector players; enabling them to respond more quickly to farmers about plant disease and pest control needs through establishment of the beginnings of a comprehensive Plant Health Services System (PHSS) within and outside of the project areas.

Objectives

i) To know more about the local knowledge of plant health problems.
ii) To identify major insects, diseases and soil problems of different crops.
iii) To know the level of infestation of the major pests and diseases of different crops and the farmers concept about the plant health problems.
iv) To know more about the developing health problems of different crops.
v) To know the pest management practices used by the farmers.
vi) To know how and why farmers are inclined over use pesticides and how farmers innovated various methods of pest management.

Location and Participants

The participatory qualitative survey of local knowledge on plant health problems was conducted in 3 different crop-growing seasions i.e. Summer-I (Kharif-I), Summer-II (Kharif-II) and Winter (Rabi) during 13 March 2004 to 31 December 2004. These surveys were conducted at 35 villages in 6 upazilas of Natore (Boraigram and Sadar upazilas), Norsingdi (Raipura and Shibpur upazilas) and Moulvibazar (Srimangal and Sadar upazilas) districts. A total of 1591 farmers (1257 males and 334 females) participated in the participatory surveys in three crop-growing seasons in six upazilas of Natore, Norsingdi and Moulvibazar districts is provided in the following Table.1:

Table. 1: Participants and locations of survey during 3 crop seasons

District	Upazila	Village (Nr)			Participated farmers								
		Sum-I	Sum-II	Win	2004 Summer-I			2004 Summer-II			2004 Winter		
					M	F	Total	M	F	Total	M	F	Total
Natore	Boraigram	10	4	5	238	16	254	102	-	102	125	-	125
	Sadar	8	4	5	61	179	240	78	43	121	48	69	117
Norsingdi	Raipura	4	1	3	85	4	89	24	-	24	90	9	99
	Shibpur	2	1	2	70	-	70	21	-	21	56	-	56
Moulvibazar	Srimangal	4	1	1	96	14	110	35	-	35	23	-	23
	Sadar	2	1	1	57	-	57	27	-	27	21	-	21
Total	**6**	**30**	**12**	**17**	**607**	**213**	**820**	**287**	**43**	**330**	**363**	**78**	**441**

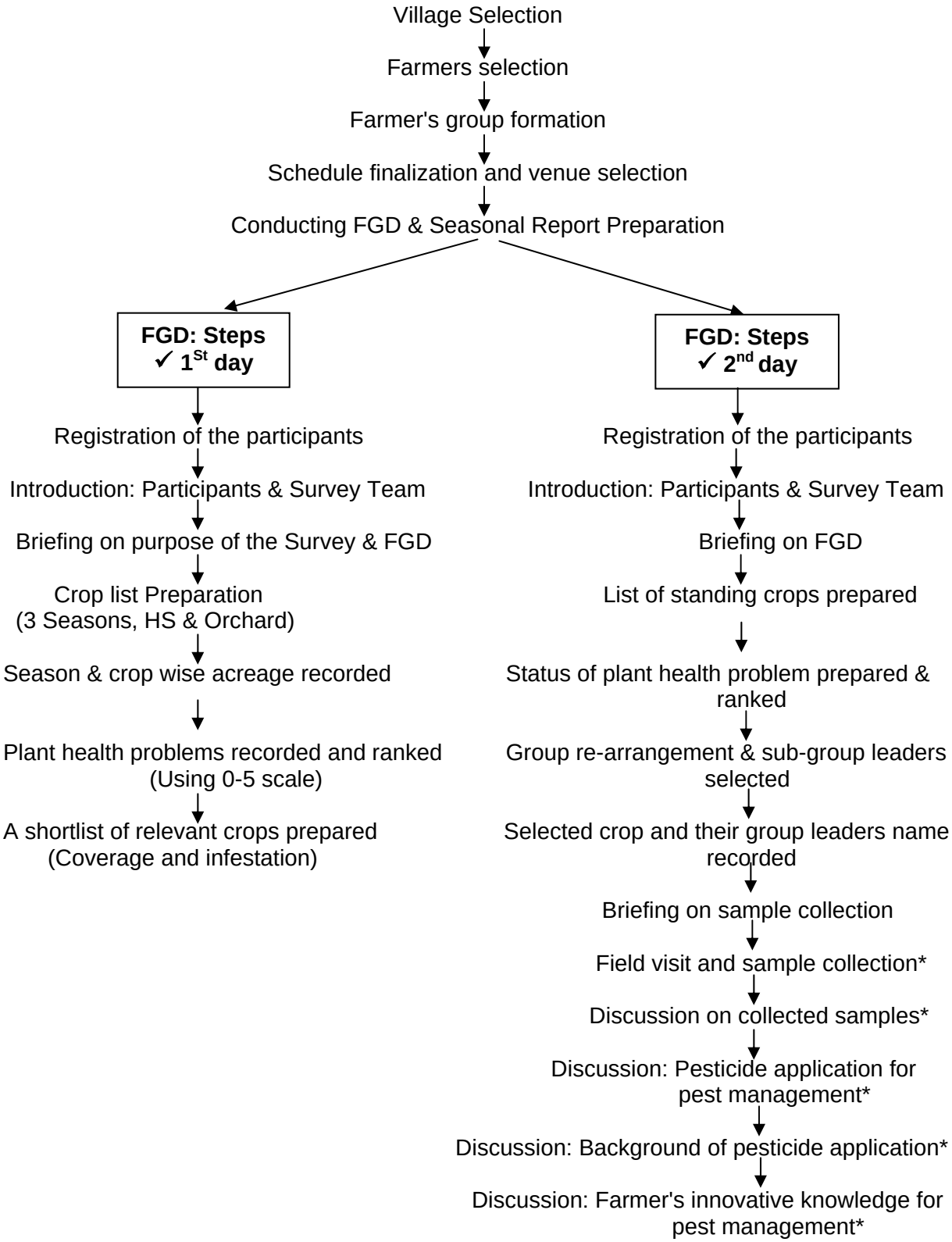
Sum-I = 2004 Summer -I, Sum-II = 2004 Summer-II, Win = 2004 Winter, M = Male, F = Female

Project location (districts) is shown in map in Annex. I:

Methodology

The survey was conducted in Summer-I (Kharif-I), Summar-II (Kharif-II) and Winter (Rabi), 2004 crop seasons at 35 villages in 6 upazilas of 3 districts namely Natore, Norsingdi and Moulvibazar districts. A.K.M, Murshedur Rahman, Entomologist, AAS was the principal surveyor. Initially a survey guideline was prepared and it was finalized after field-testing at the beginning of the survey period. Overall supervision and guidance for the survey was provided by Mr. Harun-Ar-Rashid, Executive Director, AAS. According to guideline, the following process/steps were followed during implementation of the survey:

Process:
Participatory Qualitative Survey (PQS)



★ Field Visit and Sample Collection: Steps

Sub-group discussion
(Group leaders & facilitators)
↓
Sample identification at field
↓
Sample collection of the assigned crop(s)
↓
Sample preservation at field
(Polythene/Petridish)
↓
Briefing on presentation
(Facilitators & Group leaders)

★ Participatory discussion on collected Samples of plant health problems

Presentation on Collected Samples
(By group leaders)
↓
Open discussion

During participatory discussion the farmers' conceptions of the following events were recorded:

- ✓ Local name of the plant health problems and its meaning;
- ✓ Identifying character or key character of the pest and disease;
- ✓ Nature of damage or symptoms of the problems;
- ✓ Growth stage of the plant that is initially affected;
- ✓ Stage of the pest that causes serious damage;
- ✓ Initial time of pest infestation and severe infestation period;
- ✓ Favourable condition of the infestation; and
- ✓ Severity of infestation or approximate status of crop damage.

★ Discussion on pesticide application for pest management

Discussion was conducted in the following areas:

- ✓ Commercial name of the applied pesticide;
- ✓ Time of application (on the basis of crop stage, time of infestation etc.);
- ✓ Rate of application;
- ✓ Frequency of application in a crop season and total time (if necessary) and
- ✓ Effectiveness of these pesticides.
  - → Findings recorded

★ Discussion on Background of pesticide application

Farmers were asked to provide the following information:

- ✓ Starting period of the use of pesticide;
- ✓ Starting use of pesticide on a large scale;
- ✓ After using pesticide, the condition or infestation level of the pest;
- ✓ Application of pesticide is now beneficial or not; and
- ✓ Concepts on the bad effect of the use of pesticide.

★ Discussion of innovative methods for pest management

To know the effective modification of traditional methods or the effective use of low-level safe chemicals with the association of other methods, the participatory discussion was made in this session. Farmers were asked to inform the following information.

- ✓ To recite innovative methods with which they may be familiar;
- ✓ Local name of the method;
- ✓ By whom and when this method is started;
- ✓ Description of the method;
  - Necessary equipment, materials and elements
  - Application technique
  - Time of application
  - Rate and frequency of application
- ✓ Comparative effectiveness in relation to pesticides; and
- ✓ Amount of cost and benefit.
- ✓ Other related methods used to control the same pests
  - Any method of pest management such as physical, mechanical and biological adopted by farmers was recorded on the flip chart.

Information collected during the survey from different villages was compiled separately. After compilation, the village wise reports were prepared. Final report of a crop season was prepared based on the compilation of the village reports.

Findings

I. Status of plant health problems

At the **first day** of focus group discussion (FGD) in each village, farmers were asked to discuss the crops grown in the different crop seasons. Area covered by each crop at different crop growing seasons was recorded. According to farmers' opinion, status of insect, disease and soil problems were recorded to make a short list of major plant health problems.

At the **second day** of focused group discussion (FGD), farmers were asked to express their opinion about plant health problems of the existing field crops, homestead crops, fruit trees and orchards. According to farmer's opinion, status of insects, diseases and soil problems of existing crops were recorded to make an overall idea of about the major plant health problems in Summer-I, Summer-II and Winter crop seasons.

Farmers identified about 49 crops in Summer-I crop season, in three districts, which have health problems. Among them 27 crops in Natore district, 21 crops in Norsingdi district and 20 crops in Moulvibazar district were identified as sources of major health problems.

Farmers identified 30 crops in Summer-II crop season in three districts, which have health problems. Among them 23 crops in Natore district, 11 crops in Norsingdi district and 11 crops in Moulvibazar district were identified to have major health problems.

Farmers identified 51 crops in Winter crop season in three districts, which have health problems. Among them 35 crops in Natore district, 22 crops in Norsingdi district and 18 crops in Moulvibazar district were identified as having major health problems.

Farmer's identified crops which have health problems during Summer-I, Summer-II and Winter crop seasons of 2004 in Natore, Norsingdi and Moulvibazar districts is provided in the following Table 2.

Table. 2: Farmer's identified crops those have health problems in 3 districts during 3 crop seasons

Season	Nr of crops identified			
	Natore[1]	Norsingdi[1]	Moulvibazar[1]	Total[1]
2004 Summer-I	27	21	20	49
2004 Summer-II	23	11	11	30
2004 Winter	35	22	18	51
Total	**85**	**54**	**49**	**130**

[1] Duplication of several crops in districts during the same season.

In general, farmers of three district reported crops such as rice, brinjal, lady's finger, cucumber, Teasle gourd, white gourd, coconut, jack fruit, pomegranate, banana etc. to be highly vulnerable to damage by insects and diseases during Summer-I season; some crops such as rice, brinjal, chilli, country bean, bottle gourd, white gourd, turmeric, banana, coconut etc. were seen to be highly vulnerable to damage by insects and diseases during Summer-II season; and some crops such as country bean, brinjal, chilli, potato, cabbage, cauliflower, bottle gourd, sweet gourd, banana, coconut etc. were also seen to be highly vulnerable to damage by insects and diseases during Winter season.

During survey in three crop seasons in three districts were identified 214 plant health problems, of which 97 were insect problems and 117 were disease problems. Farmer's identified plant health problems during 2004 Summer-I, Summer-II and Winter crop seasons is provided in the following Table 3.

Table. 3: Farmer's identified plant health problems during 3 crop seasons

Season	Identified plant health problems (Nr.)[1]		
	Insects	**Diseases[2]**	**Total**
2004 Summer-I	39	35	74
2004 Summer-II	24	31	55
2004 Winter	34	51	85
Total	**97**	**117**	**214**

[1] Duplication of several plant health problems under each category

[2] Including very few soil and physiological disorders

From the participatory survey at 30 villages in three districts during 2004 Summer-I crop season, it was found that (i) the frequency of some damaging insects was comparatively higher such as cucurbit fruit fly, brinjal shoot and fruit borer, rice stem borer, sugarcane stem borer, pumpkin caterpiller and epilachna beetle; and (ii) the frequency of some damaging diseases was comparatively higher such as bud rot of coconut, nutritional deficiency of coconut, clove separation of garlic, leaf curl of teasle gourd, virus of cucurbit and anthracnose of mango (Figures 1 a & b).

From the participatory survey at 12 villages in three districts during 2004 Summer-II crop season, it was found that (i) the frequency of some damaging insects was comparatively higher such as rice stem borer, hispa, rice gall midge, cucurbit fruit fly, bean aphid and brinjal shoot and fruit borer; and (ii) the frequency of some damaging diseases was comparatively higher such as die back of brinjal, shealth blight of rice, foot rot of brinjal, leaf blight of turmeric, leaf curl of chilli and root knot of brinjal (Figures 2a & b).

Similarly, from the participatory survey at 17 villages in three districts during 2004 Winter crop season, it was found that (i) the frequency of some damaging insects was comparatively higher such as bean aphid, brinjal shoot and fruit borer, bean pod borer, cucurbit fruit fly, potato cutworm and mustard aphid; (ii) the frequency of some damaging diseases such as leaf curl of chilli, anthracnose of bean, stem rot of brinjal, Riceyness of Cauliflower, foot rot of wheat, Leaf curl of brinjal, die back of brinjal, foot rot of tomato and foot root of Cole was comparatively higher (Figures 3a & b).

II. Local name of the plant health problems and their meanings

Each of the plant health problems bears one or more local names at the same community. Farmers used different local names of plant health problems on the basis of morphologic characteristics, nature of damage or symptoms. In the participatory survey, farmers were asked to inform the local name of the insects, diseases and soil problems. Farmers were also asked to describe the meaning of the local names. Farmers tried to give the meaning of the local names where some of the local names were identified that to have no definite translatable meaning. Farmers of three districts identified 250 plan health problems (165 without duplication) and their local names were about 435 (287 without duplication) during 2004 Summer-I, Summer-II and Winter crop seasons.

In the Summer-I crop season, farmers of the three districts identified about 45 plant health problems, which contain more than 85 local names. In Natore district, about 40 plant health problems were identified and found to have more than 80 local names. In Norsingdi district, about 18 plant health problems were identified as serious problems. These had more than 30 local names. In Moulvibazar district, about 20 major plant health problems were identified which bears about 32 local names.

In the Summer-II crop season, farmers of three districts identified about 55 plant health problems, which were locally known by more than 90 different names. In Natore district, about 39 plant health problems were identified which had more than 60 local names. In Norsingdi district, about 14 plant health problems were identified and found to have more than 20 local names. In Moulvibazar district, about 14 major plant health problems were identified and found to have more than 21 local names.

In the Winter crop season, farmers of the three districts identified about 65 plant health problems, which contain more than 112 local names. In Natore district about 55 plant health problems, were identified and found to have more than 90 local names. In Norsingdi district, about 32 plant health problems were identified and found to have more than 64 local names. In Moulvibazar district, about 18 major plant health problems were identified and found to have more than 32 local names.

Farmer's identified plant health problems and their local names of three districts for three crops seasons are provided in the following Table 4.

Table.4: Farmer's identified plant health problems and their local names of 3 districts for 3 seasons

Season	Natore[1]		Norsingdi[1]		Moulvibazar[1]		Total (+ duplication)		Total (-duplication)	
	PHP	LN	PHP	LN	PHP	LN	PHP	LN	PHP	LN
2004 Summer-I	40	80	18	30	20	32	78	142	45	85
2004 Summer-II	39	66	14	20	14	21	67	107	55	90
2004 Winter	55	90	32	64	18	32	105	186	65	112
Total	**134**	**236**	**64**	**114**	**52**	**85**	**250**	**435**	**165**	**287**

[1] Duplication of plant health problem in districts during the same season;

PHP = Plant health problems; LN = Local name

Most of the disease problems had no specific common local names, where farmers generally used some terms such as “Pochon rog”; ‘Gura pocha rog’ ‘ Mora rog’, Jhora rog’, etc as these names characterized the observed symptoms of a particular disease or the ultimate result of particular disease.

In the Summer-I crop season, farmers were identified slight higher damaging insects in comparison to diseases. In the Summer-II crop season, it was found that crop are more damaged by diseases in comparison to insects. In the Winter crop season, farmers identified more diseases in comparison to insects.

A few examples of farmer’s identified plant health problems and their local names of three districts is provided in Annex. II:

III. Farmer's conceptual knowledge of major plant health problems

In the participatory survey, farmers were asked to collect representative samples of major plant health problems in order to demonstrate their "plant health ideas" more clearly. Farmers collected insects, infested plant parts and diseased samples from the adjacent fields. After sample collection, the discussion was held on the basis of the prevailing local name of plant health problem, its identifying characteristics, the nature of damage caused, infestation rate, favorable conditions for infestation and their management practices.

Findings of the participatory discussion were recorded; including management techniques to control the harmful insects and diseases, traditional methods, pesticide use and innovative methods for pests and diseases management for the crops.

Farmer’s concept on major plant health problems summarized as crop wise local name, description and management practices along with its identification in three crop seasons. Farmers of three districts listed 130 crops (232 with duplication) during 2004 Summer-I, Summer-II and Winter crop seasons. Farmer’s listed crops due to their health problems of three districts for three crop seasons are provided in the following Table 5.

Table.5: Farmer’s listed number of crops due to their health problems in 3 districts of 3 crop seasons.

Season	Number of crops due to their health problem				
	Natore	Norsingdi	Moulvibazar	Total	
				+ Duplication	- Duplication
2004 Summer-I	43	38	32	113	49
2004 Summer-II	22	11	11	44	30
2004 Winter	35	22	18	75	51
Total	**100**	**71**	**61**	**232**	**130**

A total of 49 crops including fruits were recorded for crops grown in Summer-I season. In Natore district, about 43 crops were listed including some winter crops. About 27 crops including fruit crops were identified which suffered seriously from pests and diseases. In Norsingdi district, a total of 38 crops including fruits trees were listed that grown in Summer-I season. More than 21 crops were highly damaged by insects and diseases. In Moulvibazar

district, 32 crops including fruit trees were identified where 20 crops are found more infested by insects and diseases.

In Summer-II crop season, a total of 30 crops including fruits were recorded in three district;s including those that suffered seriously from insects and diseases. In Natore district, farmers identified about 22 crops including fruits, which were highly vulnerable to insects and diseases. In Norsingdi district, farmers identified about 11 crops, which were most infested by insects and diseases. In Moulvibazar district, 11 vulnerable crops were identified.

In Winter crop season, a total of 51 crops including fruits were identified in three districts as being seriously vulnerable to insects and diseases. In Natore district, farmers identified 35 crops including fruits, which were highly vulnerable to attacks by insects and diseases. In Norsingdi district, farmers identified about 22 crops, which are more infested by insects and diseases. In Moulvibazar district, about 18 crops were found highly damaged by insects and diseases.

Farmers of all districts were able to explain their major plant health problems including their preferred pest management practices. Farmer's concept about some of the major plant health problems and their management practices are presented in three separate reports. A few examples of the farmer's concept about plant health problems, their description, management practices and identification are provided in Annex. III

IV. Use of pesticides for pest management

Farmers used pesticides when the infestation rate of insects or diseases is high. Most of the farmers of the country have no clear concept about the appropriate use of pesticides. For this reason, the harmful as well as the beneficial insects are killed by excessive use of pesticides that have the harmful effect on human health, environment and biodiversity. At present about 22 thousand metric ton pesticides are uses every year in our country. According to dealers suggestions, farmers used authorized as well as some unauthorized pesticides those are available in the local market to protect their crops from pests.

To know the actual situation about the use of pesticides, farmers were asked to inform the trade name of pesticide, rate of application, frequency of pesticide spraying and their effectiveness. Farmers of three districts frequently used some insecticides such as Basudin, Furadan, Curaterr, Diazinon, Biesterin, Phaddy, Malathion, Dursban, Basathrin, Admair, Duraban, Decis, Fenfen, Fyfanon, Tafgor, Fenitox, Fastac, Ripcord, Cymbush, Marshal, Sunfuran, Schincyper, Karate, Aktara, Sevin, Kartap, etc. to protect their crops and fruits from a variety of insects. In some cases, farmers used some unlabelled and unauthorized pesticides. In most cases, farmers used pesticides on the basis of recommendations from their local pesticide dealers. Farmers used some fungicides such as Tilt, Dithane M-45, Ridomil, Rovral, Indofil, Bavistin, Antracol, Topsin, Folicur, Thiovit, Cupravit, Ronovit, Knowin, Champion, etc. to protect their crops from diseases. In general, farmers are found more interested to use pesticide to protect insects in comparison to diseases.

In Natore district, farmers frequently apply insecticides to rice stem borer, country bean aphid, bean pod borer, brinjal shoot and fruit borer, Okra shoot and fruit borer, cabbage butterfly, sugarcane stem borer, leaf folder of cucurbits, epilachna beetle, cucurbit fruit fly, red pumpkin beetle, cutworm, banana leaf and fruit beetle etc. Farmers frequently use fungicides to control purple blotch of onion or garlic, late blight of potato, foot rot of vegetables, foot/stem rot of betel vine, sheath blight of rice etc. In some cases, farmers applied pesticides almost

everyday to control certain destructive pests. Farmers use pesticides average 40-50 times to control bean pod borer. To control brinjal shoot and fruit borer, it was found to apply pesticides up to 180-200 times in a crop season.

In Norsingdi district, farmers used excess pesticide to control bean pod borer, bean aphid, brinjal shoot and fruit borer, cucurbit fruit fly, cabbage butterfly etc. Farmers generally applied pesticides at least 1-3 times in a week in all most all kinds of vegetables and it may rise up to 6-7 times in a week on the basis of pest severity. Farmers used pesticides almost everyday to control bean pod borer. Fungicides are frequently used to control late blight of potato, foot rot of vegetables, die back or wilt of cucurbits and brinjal.

In Moulvibazar district, farmers frequently applied pesticides to control rice hispa, rice case worm, cutworm, bean pod borer, cabbage butterfly, brinjal shoot and fruit borer, bean aphid, late blight of potato, foot rot of vegetables etc.

Some of the unauthorized and unlabelled pesticides are found to be used to control few major pests. The ‘Indian oil’/ ‘Indian bish’ (Comes from India whose chemical name is Kripcord) became very popular for the last 1-3 years to control some of the destructive pests in Natore and Norsingdi districts.

Use of pesticides to control some of the major pests in three districts is explained in the three separate seasonal reports. Few examples on use of pesticides for pest management of three districts are presented in Annex. IV

V. Back ground of pesticides application

To know the background of pesticide application and to know the actual situation of the use of pesticides, the participatory discussion was made on the following events.

- Starting period of the use of pesticides;
- Starting use of pesticides on a large scale;
- After using pesticides on a large scale, the condition or infestation level of pest;
- Application of pesticides for pest management is now effective or not;
- Bad effect of the use of pesticide; and
- Information about beneficial insects.

The information collected on pesticides use in crop production scenario are summarized separately for three districts and presented in the following Table 6.

Table. 6: Pesticide use in crop production scenario of 3 districts.

Natore district	Norsingdi district	Moulvibazar district
✓ Use of pesticides starts from 20-30 years ago, and frequent application starts from the last 8-10 years.	✓ Use of pesticides starts from 20-30 years ago and frequent application starts from the last 10-15 years.	✓ Use of pesticides starts from 15-25 years ago and frequent application of pesticides starts from the last 5-6 years.
✓ About one third of the farmer's revenue from selling vegetables is spending against buying pesticides.	✓ About one third of the farmer's income by selling the vegetables is spending against buying pesticides.	✓ About one third of the farmer's revenue from selling vegetables is spending against buying pesticides.
✓ To control the brinjal shoot and fruit borer, the 'Indian oil' (comes from India whose trade name is 'Kripcord') is frequently used as it can protect the pest for 3-4 days.	✓ The unauthorized 'Indian bish" become popular from the last 1-2 years as it can be used to protect the pest of majority vegetables.	✓ Farmers are interested to grow crops by using proper pesticides.
✓ Few farmers produce brinjal only for selling in the market, not for their own consumption	✓ Some farmers frequently used pesticides for selling their attractive vegetable where they routinely grow few vegetables without using pesticide for their own consumption.	✓ Farmers identified the excessive pest attack as the natural calamity
✓ Farmers identified birds, frogs and spiders as the beneficial for their crops.	✓ Few farmers identified the spider, frogs, 'Dail poka' (lady bird beetle), birds as the beneficial agent for crop protection.	✓ Only birds and frogs are identified by the farmers as the beneficial agents for crop production.
✓ Considerable farmers were unable to diagnose the problem and thus they used broad-spectrum pesticides.	✓ Few trained farmers identified the spider, ladybird beetle etc. as the beneficial insect, but they had no interest to protect/preserve them.	✓ Farmers are unable to control the 'Rice hispa' and 'Rice case worm' by using chemicals for the last 3-4 years. For this reason they claimed for low quality pesticides.
✓ Farmers are unable to grow some crops (e.g. brinjal, sugarcane, country bean) without frequent application of chemicals.	✓ Almost all the farmers have minimum knowledge about the pest and their management.	✓ Most of the farmers have no idea about the pest and their management.
✓ Farmer's identified the excess pest attack, extinction of fishes, birds and frog and physical sufferings and disorder of human body as the results of excess application of pesticides.	✓ Physical sufferings of human, extinction of birds, severe pest attack etc. problems were mentioned as the results of excess application of pesticides.	✓ Farmer's identified the extinction of fishes, physical sufferings of human as the results of excess application of pesticides.
✓ Only few farmers know about beneficial insects, those who have received training.	✓ Some farmers noticed their physical suffering caused by handling and spraying pesticides with their own hands.	✓ Only few pests make problem to control them by pesticides.

✓ Increasing pesticide application resulted the increasing role of pest attack, e.g. Bean aphid could be successfully controlled by the application of ash at 5-7 years ago. But present time it is quite impossible to grow bean without pesticide application.	✓ Increasing pesticide application resulting increasing infestation of pest. Farmers claimed the low quality pesticides responsible for this situation.	✓ Farmers identified about 10 innovative methods where 2-3 methods gave considerable results in controlling major pests.
✓ To grow sugarcane they used some unauthorized pesticides from the border country (e.g. heptachlor is used to control termites in sugarcane).	✓ Most of the farmers used pesticides in their vegetable fields at least 2-3 times in a week.	
✓ Most of the farmers used pesticides in their vegetable fields at least 2-3 times in a week.	✓ In some cases, they used pesticides everyday in the same field to protect the crops from destructive pest (e.g. Bean pod borer, Brinjal shoot and fruit borer).	
✓ In some cases, they used pesticides everyday in the same field to protect the crops from destructive pest (e.g. Bean pod borer, Brinjal shoot and fruit borer).	✓ Almost all the farmers have minimum knowledge about the pest and their management.	
✓ Farmers identified about 20 innovative methods for controlling pests where 5-6 methods gave considerable results in controlling major pests.	✓ Farmers identified about 15 innovative methods where 3-4 methods gave considerable results in controlling major pests.	
	✓ Farmers always depend on pesticides to grow maximum crops.	
	✓ All the farmers realized the bad effect of hazardous chemical application, but there is no alternative way in their hand.	
	✓ Farmers identified about 15 innovative methods for controlling pest where 3-4 methods gave considerable results in controlling major pests	

VI. Farmers innovative knowledge on pest management

Farmers generally use some traditional method (e.g. application of ash, cow dung, neem extract, putting stick in the field for birds etc.) to protect their crops from the infestation of insects and diseases. From last decade, farmers were being interested about pesticides as they got considerable instant results against the pest and easy to application. Due to frequent application of pesticides with excessive doses; some of the pests have already gained high resistance against pesticides. For this reason, farmers are now often failed to control some of the destructive pests by chemicals. On the other hand, farmers have to spend a large amount of money for buying chemicals to protect their crops from pest attack.

When farmers failed to protect their crops by the traditional methods or by using frequent application of pesticides, they try to find an alternative way to control the pest. As farmers have long time experience in crop production, they try to control the pests by some innovative techniques on the basis of nature of damage or the behavior of pests. Sometimes farmers use some traditional methods and chemicals with some effective modification with their own intelligence. Skilled farmers always try to find the most effective, economical and easiest process to control the pests.

From the survey in three different crop-growing seasons, it was found that few farmers were able to successfully control a wide variety of major pests. To know the effective, alternative way of pests control action, farmers were asked about their adaptive innovative methods for pest management. Most of the innovative methods were found economical, readily available and helpful to conserve biodiversity. It will also be helpful to suggest the farmers of another region where it is difficult to control the pest by suitable way.

Farmers of three districts identified 69 innovative methods for plant health management (82 with duplication) during 2004 Summer-I, Summer-II and Winter crop seasons. Out of 69 identified innovative methods, the highest methods were identified in Summer-I (35), followed in order by Summer-II (20) and Winter (14). Farmer's identified innovative methods for plant health management of three districts for three crop seasons are provided in the following Table 7.

Table. 7: Farmer's identified innovative methods for plant health management of 3 crop seasons in 3 districts.

Season	Innovative Method (Nr.)							
	Natore		Norsingdi		Moulvibazar		Total	
	Total	Effective	Total	Effective	Total	Effective	+ Duplication	- Duplication
2004 Summer-I [1]	20	5-6	15	3-4	10	2-3	45	35
2004 Summer-II[1]	15	5-6	3	1	1	1	19	20
2004 Winter[1]	14	3-4	2	1	2	1	18	14
Total	**49**	**-**	**20**	**-**	**13**	**-**	**82**	**69**

[1] Duplication of innovative methods in districts during the same season.

In the 3 districts, about 35 innovative methods were identified from the survey of Summer-I crop season. In Natore district, about 20 innovative methods are identified where 5-6 methods gave considerable result in controlling adult moth of rice, jute, fruit flies, cut worm, rats, aphids etc. In Norsingdi region, about 15 methods are identified where 3-4 methods gave good results to reduce to attack of red mite, cucurbit fruit fly, banana leaf and fruit beetle, aphids etc. In Moulvibazar region about 10 innovative methods were identified where 2-3 methods showed considerable results against rice hispa, cutworm, rice stem borer etc.

About 20 methods were identified from the survey of Summer-II crop season in three districts. Among them, 15 methods in Natore district, 3 methods in Norsingdi district and 1 method in Moulvibazar district were identified where 7-8 methods showed considerable results against rice stem borer, rice hispa, bean aphid, bean pod borer, cutworm, pomegranate fruit borer etc.

In winter crop season, about 18 methods were identified from the survey in three districts. Among them, 14 methods in Natore district, 2 methods in Norsingdi district and 2 methods in Moulvibazar district were identified where 5-6 methods showed considerable results against bean aphid, bean pod borer, foot rot of brinjal, purple blotch of onion or garlic etc.

From the survey in three different crop seasons, it was found that most of the innovative methods were found to be used by the affluent farmers as they are able to take risk by innovating and applying this methods on their own initiative in their field for crop protection.

Some of the representative innovative methods identified in three districts are described in Annex. V

Lessons Learned

- ✓ Farmers used the local name of the plant health problems on the basis of nature of damage, symptoms, major pest characteristics and ultimate result of the plant health problems, where some local names bear no specific meaning.

- ✓ Farmers are most interested to know about effective innovative method that are being used by other farmers, as these are cost effective, readily available and effective in situations where it has become difficult to achieve control with pesticides.

- ✓ Some of the farmer's innovative methods to protect pest infestation give considerable results. Most of the innovative methods are used in the specific areas.

- ✓ Some of the effective innovative methods were the modification of some indigenous methods or the association of common chemicals with some traditional techniques.

- ✓ Most of the innovative methods were found to be used by the elite farmers as they are able to take risk by innovating and applying these methods in their field for crop protection.

- ✓ In the survey it was found that farmers frequently used pesticides to protect some vegetables like country bean and brinjal. In a crop growing season, farmers sprayed pesticides for about 40-60 times to protect the country bean and 60-80 times to protect brinjal. In some cases, application of pesticides in a brinjal field may raise up to 180-200 times whereas few farmers sprayed pesticides almost every day to protect their vegetables from pest.

- ✓ Farmers identified intensive cultivation of crops and vegetables, frequent application of pesticides and the extinction of frogs, fishes and birds as the main causes for increasing rate of pest attack.

- ✓ Most of the farmers claimed that it is not cost effective to use pesticides for major pest management at present time. About one third of their crop revenue is spent on buying pesticides for use in their fields.

- ✓ The unauthorized pesticide 'Indian oil'/ 'Indian bish' (comes from India whose chemical name is 'Kripcord') becomes popular in Natore and Norsingdi districts for the last 1-3 years to control the destructive pests (e.g. Bean pod borer, Brinjal shoot and fruit borer).

- ✓ Few farmers were found to apply the pesticides frequently in their vegetables only for selling their products in market at a high rate where they grown few vegetables without using pesticides for their own consumption.

- ✓ In general, farmers of three districts identified more diseases than the insects in survey.

- ✓ Most of the farmers are depended upon the local pesticide dealers for pest management where they advise to apply high doses of their selected pesticides with the aim of selling their chemicals.

- ✓ In most of the cases, farmers are dependent to the local pesticide dealers to take suggestion for crop protection

- ✓ Farmers, who produce vegetables for commercial purpose, give more emphasis to use chemicals, instead of other methods, as it is easier and instant result can be obtained.

- ✓ In most cases, farmers used fungicides to control viral diseases and gave their opinion that this disease is spread by contaminated soil.

- ✓ In comparison to insects, farmers have little concept about disease and their management, the symptoms of disease infection and the symptoms of nutritional deficiency. Some insects, which are not visible and produce infestation system is identified as diseases.

- ✓ Only few trained farmers have concept about the beneficial insects. Maximum farmers believed that any kind of insect present in the crop field is harmful.

- ✓ Farmers were found less interested to use chemicals to protect against diseases and were more inclined to protect against insect pests. Even farmers used broad-spectrum insecticides when they failed to control some diseases.

- ✓ Some pesticides banned by the government that contains high toxicity and residual effects are available in the market.

- ✓ It was found that farmers sprayed pesticides in their vegetable fields prior to harvesting or selling if the pest attack observed.

- ✓ Female farmers expressed more interest about fruit problems and the crops grown in the homestead.

- ✓ Few farmers were not interested to explain their effective innovative methods in a group discussion, as they believed that it's a secret technique and his own valuable innovation for better crop production.

- ✓ Farmers expressed their much interest to receive training on pest management and they want to know the appropriate recommendation of pesticide use.

- ✓ Few farmers identified the spiders, lady bird beetle, frogs, bees etc as beneficial but expressed no interest to preserve them.

- ✓ Some superstitions also noticed to protect diseases (e.g. to protect bud dropping and empty water symptom (waterless fruit), water prayed by religious person is sprayed or hung the bone of cow to protect evil eyes. Soil made broken pot with few pictures is placed in the field to protect vegetables from the evil eyes.

Conclusion

The Participatory survey was undertaken to know the consensus opinion of the farmers about the plant health problems and their management practices. Necessary information related to plant health problems was collected in a participatory manner. Thus AAS/CABI Bioscience conducted the survey in 2004 Summer-I, Summer-II and Winter crop seasons at 35 villages in Natore, Norsingdi and Moulvibazar districts. In the survey, farmers were asked to express their opinion on existing plant health problems, status of the pest infestation, pest identifying characters, nature of damage or symptoms, favourable conditions of pest attack, period of pest severity and the existing pest management practices. In the survey gathered huge local knowledge on plant health problems and their management, which can be useful information for plant health problems and their management strategy. Indiscriminate use of authorized and unauthorized pesticides at very higher rates of application and very frequent in crop protection was found very common in survey areas. Farmers of the survey area were inclined to apply some unauthorized highly toxic pesticides as few insects have already gained greater resistance against chemicals. Some vegetables were found to spray pesticides almost everyday to control their infestation. Few farmers were found to spray pesticides frequently only for selling their vegetables in the market and uninterested to consume themselves. Due to application of pesticides excessively or using the wrong chemicals, about one third of the farmer's vegetable crops revenue is spent on buying pesticides. Moreover excessive and indiscriminate use of pesticides in crop protection has been creating hazards in many ways, as result farmers noticed several consequences such as extinction of fishes, frogs, birds etc and physical sufferings/disorders of human body in the survey areas.

In most of the cases, farmers are dependent to the local pesticide dealers to take suggestion for crop protection. Most of the farmers are depended upon the local pesticide dealers for pest management where they advise to apply high doses of their selected pesticides with the aim of selling their chemicals. Farmers expressed their much interest to receive training on pest management and they want to know the appropriate recommendation of pesticide use. Moreover, farmers expressed their interest to grow crop with safe and effective pesticides or without pesticides application.

Besides the frequent pesticide application, few farmers were found to successfully control some major pests through the used of some innovative methods. In the survey of three crop seasons, a total of 35 innovative methods were identified in three districts where about 10-13 methods were found to be highly effective to control the pest. Some innovative methods were found to be cost effective, readily available and very effective against the pest where it has become difficult to achieve control by pesticides.

Some superstitions also noticed to protect plant health problems with spraying of water prayed by religious person, hang the bone of cow and placing soil made pot with picture in the field to protect vegetables from the evil eyes.

The survey in three different crop-growing seasons (Summer-I, Summer-II and Winter) has already completed and their report has prepared. The seasonal report summarizes the information of the survey undertaken in 2004 Summer-I, Summer-II and Winter crop-growing seasons. This summarized paper compiling the necessary information of the survey in three different crop growing seasons could be act as a generalized conclusion about the overall plant health situation in the survey areas.

Recommendations

i) The participatory qualitative survey areas should be expanded in future to other regions in order to give a comprehensive 'plant health' view of the entire country.

ii) To support the identification of the more confused plant health problems and proven innovative methods for pest management, sufficient digital photographs should be used.

iii) More emphasis should be given to those insect pests that are known to have acquired high level of pesticide resistance so that safe and effective control measures can be developed without using frequent application of pesticides.

iv) The survey gathered huge farmer's knowledge on plant health problems and their management. This can be incorporated into safe plant protection measures to produce safe and health hazard free crops for national and international consumers.

v) Proper emphasis should be given to know more about farmer's innovative method for pest management across the country. Details information and source of each identified innovative method for pest management should be documented for its future use on the basis of farmers demand. Suitable innovative methods for pest management should be pre-selected through using participatory selection process.

vi) Potential innovative methods for pest management should be selected through farmer's participatory validation for large-scale dissemination on demand driven basis.

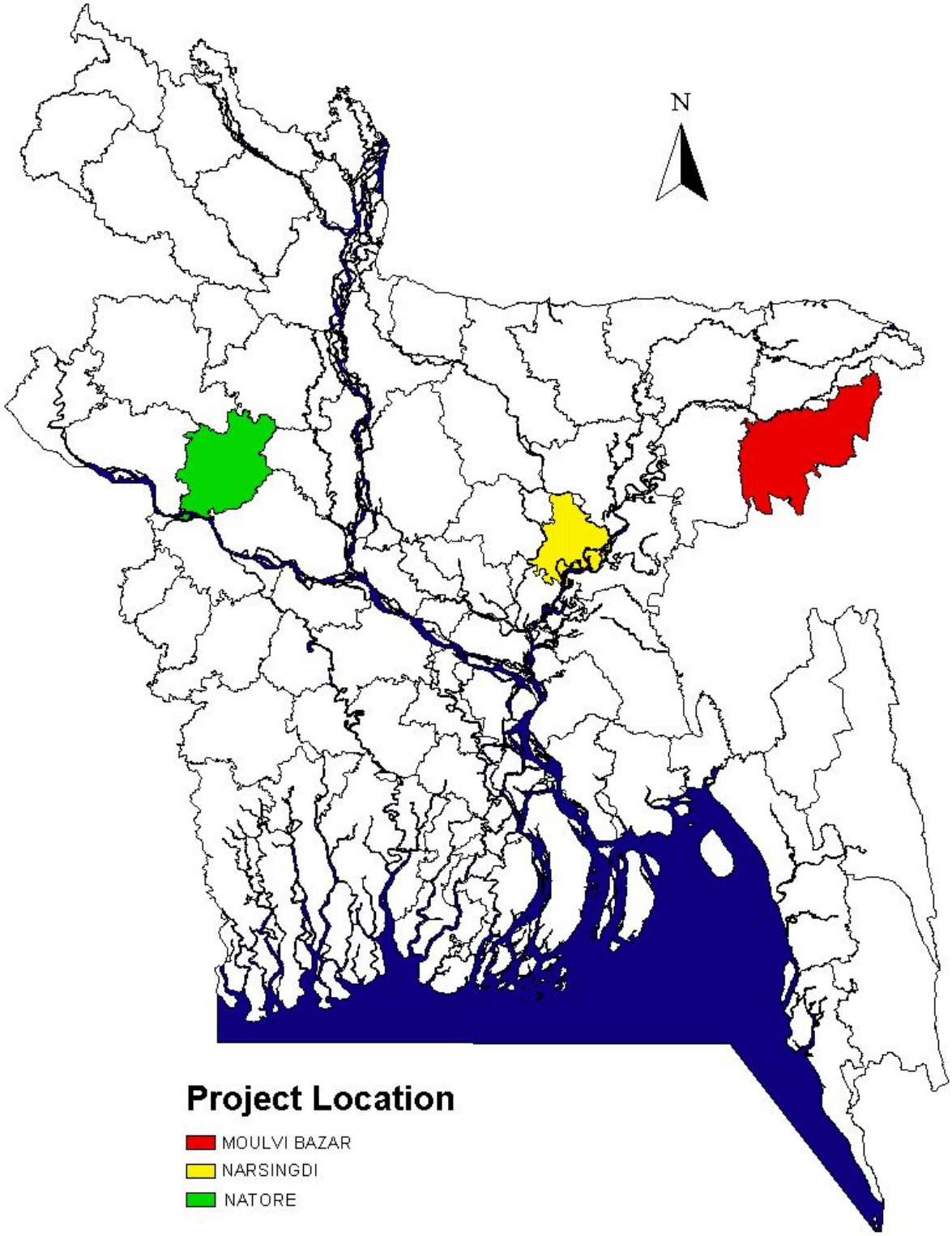
vii) Video on innovative methods for pest management should be prepared for large scale dissemination by arranging video shows at community gatherings, using audio-video-multimedia presentations together with live sample presentation.

viii) Videos can also be developed on the excessive use of authorized and unauthorized pesticides and their harmful effects in many ways along with safe and effective use of pesticides in crop production for developing awareness of farmers and consumers through audio-video-multimedia presentation with live sample presentation.

ix) Video on safe and health hazard free crop production for consumption can be telecasted in national TV channels for nationwide awareness development.

x) AAS can facilitate to produce safe and health hazard free crop products (Specially vegetables and fruits) for national and international consumers through establishing incentive based commercial linkage for production and marketing of such products.

Annex. I: Project Location Map



Annex. II: Meaning of the local name of plant health problems

Crop*	Local name of the problem	Meaning of the local name	Common name
Rice (Dhan)	Chera	Earthworm	Earthworm
	Mazra poka/ Mazkata poka	Central stem insect/ central stem cutting insect	Rice stem borer
	Chatka poka	Jumping insect	Grass hopper
	Gura pocha rog	Base rot disease	Sheath blight
	Checur	One kind of weed (Pipe like)	Rice gall midge
Brinjal (Begun)	Mazra poka/ Beguner kirra/Doga chidrokari/Machi poka	Central stem insect/ Insect of brinjal/Shoot boring / Fly insect	Brinjal shoot and fruit borer
	Leda poka	Cow dung like (soft) insect	Cut worm
	Fula rog/ Virus rog/Kukra rog	Bushy disease/ Virus disease/ Curl disease	Little leaf of brinjal
	Gura sukna rog/ Saifty rog/ Gura mora rog	Foot dry disease/ Rot disease/ Base die disease	Foot rot disease
	Dul mora rog/ Kalo pocha rog/ Aga mora rog	Branch die disease/ Black rot disease/ Tip die disease	Die back of brinjal
	Guti rog	Knot disease	Root knot of brinjal
Onion (Peaz)	Aga mora/ Aga sukna rog	Tip die / Tip dry disease	Purple blotch of onion
Betel vine (Pan)	Tela laga	Rot disease	Leaf spot of betel vine
Bottle gourd (Lau)	Machi poka/ Bhomra poka	Fly insect/ Wasp like insect	Cucurbit fruit fly
Chilli (Moris)	Kukra laga/ Thupa dhora	Being curled/ Turning bunchy	Leaf curl of chilli.
Country bean (Sim)	Pachi poka/ Echi poka/ Menda poka/ Jaua poka	Wrapping insect/ Close sitting insect	Bean aphid
	Mazra poka/ Simer kirra/ Machi poka/ Sada kirra	Central part insect/ Worm of bean/ Fly insect/ White worm	Bean pod borer
	Kando pocha/ Pocha rog/ Pata pocha/ Cancer	Stem rot/ Rot disease/ Leaf rot	Anthracnose of bean
Sugarcane (Kushar/ Akh)	Mazra Poka/ Sada kirra	Central stem insect/ white worm	Sugar cane stem borer
	Kala pata rog/ Virus	Black leaf disease/ virus	Smut of sugar cane
Turmeric (Halud)	Pocha rog	Rot disease	Leaf blight of turmeric
Bitter gourd (Korola)	Leda poka	Cow dung like (soft) insect	Fruit fly
Hog palm (Amra)	Pata Khaua poka	Leaf eating insect	Hog palm caterpillar
Cabbage (Badha copy)	Gura pocha	Foot rot	Foot rot
Banana (Kola)	Dauda poka	Scar insect	Banana leaf and fruit beetle

* Local name of the crop is within parenthesis.

Annex. III: Farmer's concept about the major plant health problems

Crop	Local name	Description of the problem	Management practices	Identification
Rice	Mazra poka	✓ It is a worm like insect that cut the central stem ✓ The central leaf is dried and can be easily pulled out ✓ It infest the rice plant after 30-40 days of transplanting ✓ It comes from one kind of flying insect known as 'Futi poka' ✓ It is the main damaging insect of transplanted Aman rice ✓ Its infestation starts from the tillering stage and remains up to harvesting	✓ Application of pesticides such as Kuraterr, Briffer, Basudin, Furadan, Regent, Cymbush ✓ Put on stick ✓ Application of 'wheel power' (washing powder), 'Fitkari', 'Gul' by mixing with fertilizer or spray the solution	Rice stem borer
	Pocha rog/ Gura pocha/ Pocha kana	✓ It starts from two months after transplanting and remains up to panicle initiation stage ✓ Severe infestation is found during rainy season and hot weather and maximum damage is found during panicle initiation stage ✓ The rot symptom is found from the middle to lower portion of rice plant and unpleasant odour comes out from the infested field ✓ It is appeared from 10-12 years ago. 'Shorna dhan' (var. comes from India) is highly affected and BR-11 is moderately affected	✓ Chemicals such as Folicur, Tilt etc. are applied ✓ Tute ($CuSO_4$) mixing with boric powder is applied	Sheath blight of rice
-Do-	Checur/ Pipe houa	✓ The leaf turned into pipe like structure (round & like an onion leaf) instead of flattened ✓ It is appeared at tillering stage and the infested tillers cannot bear panicle ✓ It may be caused by one kind of disease ✓ In case of severe infestation, 10-20% tillers are damaged ✓ It is first appeared 8-10 years ago but maximum damage is appeared for last 2-3 years ✓ In every hill, 5-12 tillers are affected and the affected tillers bear no panicle ✓ In Aman rice season, this disease is appeared seriously and it favours in dry weather	✓ Control measures are not adopted ✓ Sometimes fungicides are used but give no result	Rice gall midge
Sugarcane	Mazra poka	✓ After one month of transplanting, its infestation is started and remains up to harvesting ✓ It bore the soft tender central portion and eats inside the cane. ✓ In hot weather, its infestation is high	✓ Chemicals such as Kuraterr, Vriper, Furadan etc. are used ✓ Cutting and removing the	Sugarcane stem borer

Crop	Local name	Description of the problem	Management practices	Identification
		✓ Fertilizer application favours its infestation ✓ The middle leaf of the infested cane can be pulled out easily ✓ If a cane is splitted several 'kirra' (worm) are found and the middle portion generally turned into reddish coloured	infested plant parts	
Garlic	Matha lal houa	✓ The tip portion of the plant is died ✓ It starts from the seedling stage and remains up to harvesting ✓ Initially the top portion is died and then gradually enlarged downwardly ✓ In most cases, the garlic field is seriously damaged where rice is frequently cultivated ✓ Maximum damage is observed from the last 4-5 years	Application of pesticides such as Thiovit, Ridomil, Folicur etc Application of ash	Purple blotch of garlic/onion
Potato	Morok rog	✓ Initially few plants of the field are affected and the tender leaves of the affected plant are rotted ✓ Rapidly this disease is spread and within 2-3 days the whole field is destroyed ✓ Unpleasant odour comes out from the seriously affected fields ✓ The foot region and the roots are also rotted ✓ Deep fog favours the disease ✓ From the last 4-5 years, it has become quite impossible to grow the crop without pesticides	Application of Dithane M-45, Indofil, Ridomil, etc	Late blight of potato
Cauli flower	Ful mela rog/ Ful futa rog	✓ The affected curd contains loosed bindings ✓ The colour of the curd turned into brown to purple colour ✓ Sometimes the top portion of the curd is rotted and it gradually enlarged downwardly ✓ Sometimes the root region is also rotted ✓ These symptoms are appeared at the early stage of the curd and the curd cannot grow large and the plants can bear early flower ✓ This disease is appeared from the last 10-15 years ✓ Hot weather and late transplanting favours the disease	✓ Application of Dithane M-45, Indofil, Tafgor etc ✓ Uprooting the infected plant	✓ Riceyness/Buttoning of Cauliflower

Annex. IV: Use of pesticides for pest management

Crop	Pest	Commercial name of the chemicals	Application technique	Effectiveness
Rice	Earthworm (chera)	✓ 'Indian oil' (Comes from India whose chemical name is Kripcord) ✓ Furadan, Basudin etc.	✓ After 15-30 days of transplanting, application of this chemical starts and sprayed for 1-2 times @ 1 Bottle/ Bigha ✓ These are used for 1-2 times @ 12- 16 Kg/Acre	✓ Good result is obtained ✓ Satisfactory results are not obtained
	Rice stem borer	✓ Basudin, Furadan, Sunfuran ✓ Malathion, Diazinon	✓ After one month of transplanting these chemicals are used @ 1-1.25 kg/ Bigha for 1-2 times ✓ When the plants grow enough (e.g. panicle initiation stage). These are applied for 1 times @ 10-15 ml/ 10 L water	Pest can be controlled by using these pesticides
Brinjal	Brinjal shoot and fruit borer	✓ Ripcord, Cymbush, Ekalux, Fenfen, 'Indian oil' (Comes from India), Marshal, Kartap, Suntap, Rider etc	✓ These chemicals are used for 10-20 days in a moth @ 10-20 ml/ 10 L water ✓ On an average, these chemicals are applied for 50-70 times in a crop season but in some case it may raise up to 180-200 times ✓ During rainy season, severe infestation, pesticides are applied almost every day	It is quite impossible to grow brinjal without frequent pesticide application Pesticide application can stop the infestation of this pest only for 1-2 days
Country bean	Bean pod borer	Fenfen, Milfen, Basathrin, Tafgor, Relothrin, Fentox, Karate, 'Indian oil'	✓ These are applied from fruiting stage for 2-3 times in a week @ 2-4 cork/ 10 L water ✓ In a crop season about 25-50 sprays are made	Frequent application can give results
Chilli	Leaf curl	Zinc, Agro grow (vitamin)	These are applied for 1-2 times @ 5-10 ml/ 10 L of water	These chemicals give no results
Sugarcane	Sugarcane stem borer	Brifur, Curaterr (from sugar mill) Furadan	After rain, these are applied for 1-2 times @ 16 kg/ Acre as the infestation starts	Effective results are not found
Bitter gourd	Lepidopteran larvae/ Fruit fly	Cymbush, Fifanon, Decis	Soon after flowering stage, it is applied for 10-15 times in a season at 7-10 days interval @ 10 ml/ 10 L of water	Effective results are found
Country bean, Yard long bean	Bean pod borer	Fenfen, Milfen, Basathrin, Tafgor, Relothrin, Fentox, Karate, 'Indian bish'	✓ These are applied from fruiting stage for 2-3 times in a week @ 2-4 cork-10 L water ✓ In a crop season average 15-45 sprays are made	Frequent application can give results

Crop	Pest	Commercial name of the chemicals	Application technique	Effectiveness
Bottle gourd/ Sweet gourd	Cucurbit fruit fly	Fenfen Dursban, Sevin, Cymbush, Fifanon, Tafgor	✓ These are sprayed for 1-3 times in a week @ 2-3 cork / 10 L water ✓ In a crop-growing season, about 15-20 sprays are made	✓ This pest cannot be controlled effectively After 1-2 days of application, the pest attack again ✓ Comparatively Tafgor gives better result
Cauliflower	Riceyness/ Buttoning	Dithane M-45, Indofil, Tafgor	✓ These are applied before the flowering stage for 1-2 times in a week @ 25-50g / 10 L water ✓ In a crop season about 8-10 sprays are made	Effective results are not obtained
Chilli	Leaf curl	Bavistin, Indofil	As the infestation starts, these are used for 1-2 times @ 2-3 spoons/ 10 L of water	Effective results are not obtained
Potato	Cutworm	Tafgor, Basudin, Dursban, Furadan, Cymbush	These are applied for 2-3 times at 5-7 days interval during the seedling stage @ 2-3 Cork/ 10 L of water	Considerable results are not found
	Late blight of potato	Dithane, Mencozeb, Milfen, Indofil	✓ These are applied for 3-4 times in a crop season at 10-15 days interval @ 40-50 g/ 15 L of water ✓ When the field bears few infected plants, spraying is started	These chemicals can reduce the rapid damage
Cauliflower / Cabbage	Foot rot	Dithane M-45, Bavistin	These are applied for 1-3 times at seedling stage @ 1.5-2.5 spoons/ 10 L of water	Considerable results are not found
Bottle gourd/ Sweet gourd	Cucurbit fruit fly	Fenfen Dursban, Sevin, Cymbush, Fifanon, Tafgor	✓ These are sprayed for 1-3 times in a week @ 2-3 cork / 10 L water ✓ In a crop-growing season, about 15-20 sprays are made	✓ This pest cannot be controlled effectively. After 1-2 days of application, the pest attack again ✓ Comparatively Tafgor gives better result
Onion	Purple blotch of onion	Rovral, Antracol	As the infestation starts, these chemicals are applied for 2-6 times @ 30 g / 10 L of water at 15-20 days interval	Desirable results are found
Tomato	Foot rot	Ridomil, Dithane M-45, Champion	When the infestation starts, these are used for 3-7 times @ 15-20 ml/10 L water at 7-10 days interval	Considerable results are not found

Annex. V: Farmers innovative knowledge on pest management

Crop	Pest	Description of the method	Effectiveness	Cost
Rice	Earth worm (Chera)	✓ Application of crushed naphthalene mixing with urea fertilizer. It is only done when urea fertilizer is applied in the field.	Reasonably effective	25-30 Tk/ Bigha
	Rice stem borer	✓ 'Wheel powder' (Cloth washing Rowder), 'Gul' (Dust tobacco leaf), and 'Fitkari' is mixed together with urea fertilizer and then applied to the field as the pest is appeared. ✓ 4 packets of 'gul' (1 taka per pile), 4 packets 'wheal powder' (2 taka per packet) and 250 g 'fitkari' (white vitriol) are applied in one bigha (33 decimal) of land for one time and this mixture is applied for 1-2 times.	This pest can be controlled effectively	20-30 Tk/ Bigha
	All insects	✓ The seeds of 'deshi pat' (white variety of jute) is to dried in sunlight and crushed to make dust by traditional equipment and sprayed in the rice field @ 3 kg/Bigha.	Insects can not attack the rice plant	Negligible
	Sheath blight/ Sheath rot	✓ 'Tute' (Copper sulphate) and Boric powder is mixed and then applied in the rice field for two times. ✓ 500 gm 'Tute' (42 Taka), 200 gm boric powder (14 Taka) is mixed and applied per Bigha.	If these are applied before the infestation, it gives good result,	56 Tk/ Bigha
	All kinds of insects	✓ 1 kg neem leaf and 100 gm of tobacco leaf (Ala pata) or 4 packets *Gul* ('Dust tobacco leaf) is boiled in 4 L water. When the boiled mixture turned into 2 L, the mixture should be cold. After cooling, the mixture is filtered. The filtered solution is applied by a spray Machine mixing with additional water. ✓ 2 kg liquid mixture is mixed with 4 drum of water (1 drum=10 L) and can be sprayed for 1 Bigha of land. ✓ Spraying is made for 3 times in a season.	It gives very good result and not need to apply pesticides.	20-30 Tk/Bigha
Wheat	Rat	✓ 'Soas gura' (an irritable substance found in the local market) is applied on the way of their movement. When a rat comes to contact with that substance, it feels anxiety. The other rats can feel the setback and they run off from the field. ✓ A large aluminum pot (straight walled) is placed inside the field and near the burrow system. It should be placed at the same level of the field by making a large hole. Inside the pot, some attractive fruits which have good smell (e.g. Banana, Mango, coconut) should be placed. In this method, the trapped rat cannot up lift, as the wall of the pot is very smooth. At a time 3-5 rats can be trapped. Foods are removed every day.	Effective result is obtained	Negligible

Crop	Pest	Description of the method	Effectiveness	Cost
White gourd	Red pumpkin beetle, Epilachna beetle	Application of ashes with crushed naphthalene at early morning that gives good result	Effective	Negligible
Cucurbits	Red pumpkin beetle	Crushed Naphthalene and ashes are mixed and sprayed at morning when the plant parts bear little moisture.	Effective	Negligible
Brinjal	Foot rot/ Stem rot	✓ 100 g Dithane M- 45 and 50 g 'Aqua wint' (one kind of glue collected from the poultry dealer) is mixed properly in 1-1.5 L water. ✓ A rough cloth is used to apply the solution on the infected plant part by a layer. Within few hours, the solution becomes dry and persistent and cannot be removed by water. ✓ It is used for 2-3 times when the infestation starts or before the infestation. ✓ This method is used when the basal portion is dried and broken by cracking.	60-70% disease infestation can be controlled	60 Taka / Bigha
	Brinjal shoot and fruit borer, Epilachna beetle	✓ Application of 'Gul' (powdered tobacco leaf), crust dry chilli and neem leaf extract mixing with water. ✓ Spraying is done for 1-2 times in a week.	It can protect the infestation for 2-4 days	25-30 Tk/ Bigha
Country bean	Bean pod borer	✓ 'Gul' (dust tobacco leaf) mixing with water is sprayed on the infested plant. ✓ 4-5 packed 'Gul' is mixed with 10 L water and sprayed for 1-3 times. ✓ 100 g tobacco leaf (Ala pata) dipped into 1 L water for a night. The extract of tobacco leaf is mixed with 40 L water and then sprayed on the infested plant parts. ✓ It can be used against the bean aphid as well as bean pod borer.	Effective	20-30 Taka/ Bigha
Tomato	Tomato aphid	Application of tobacco leaf extract dipping into water for 24 hours. 100-150 g tobacco leaf (Ala pata) is needed for one Bigha of land	It gives good results	20-30Tk/ Bigha
Garlic, Onion	Purple blotch disease	✓ 1 kg 'Tute' (Copper sulphate) and 1 kg 'Fitkari' is mixed with 4 drum of water (1 drum= 10 L water) and sprayed for 1 Bigha of land. ✓ Spraying is done for 1-2 times as soon as the disease symptom appeared.	Very effective to control this disease	145 Tk/ Bigha (Tute=80Tk/ Kg, Fitkari = 65 Tk/ Kg)
Lemon	Foot rot, Gummosis	✓ Application of lime mixing with water. ✓ The mixture is applied for 1-2 days in a week. ✓ 150-200 g lime is mixed with 10 L of water. ✓ The limewater is applied before the disease infestation.	If limewater is applied before the disease infestation, the plant is not generally affected by this disease.	15-20Tk / Spray

Crop	Pest	Description of the method	Effectiveness	Cost
All fruits	Fruit borer	✓ Application of tobacco leaf extract dipping into water for 24 hours. ✓ 100 g tobacco leaf (Ala pata) is needed for one Bigha of land.	It can be used in fruits where it is difficult to use pesticides.	20-25 Tk / Bigha
Cabbage cauliflower	Cutworm	✓ The both side open polythene is used to cover the basal portion of the plant up to 2-3 inches depth from the ground level, so that the pest cannot reach to the plant. When the pest feels the hard barrier, it moves backward.	Although it is time consuming and costly, it gives very good result.	100-150 Tk/ Bigha (Re useable)
Seedlings	Cut worm	✓ Making small channel around the seedling on seedbed. The channel is sometimes opened or sometimes filled with kerosene water. ✓ Covering the seedling by polythene up to 2-3 inches depth of the surface of the soil so that it can not reach to the plant (when it found the hard barrier, it moves backward).	Effective	Negligible
Brinjal, Cabbage	Cutworm	Kerosene oil is applied at the basal part of the plant.	Effective	Negligible
All vegetables	All pests	Neem leaf, soap (cloth washing), Tute (copper sulphate) and water are boiled for half-hour. Then it is sprayed in all kinds of vegetables to protect them from insect and diseases. Sometimes Sohaga (borax) is added.	Effective	Negligible
Gourds	Cucurbit fruit fly	✓ Cooked rice by product is mixed with bright yellow cloth pieces (it attracts the fruit fly) and hanged with a stick. The fruit fly is arrested by this method. ✓ The spike of ripen jackfruit is mixed with liquid pesticide (such as Malathion) and then hanged in the crop field.	Effective	Negligible

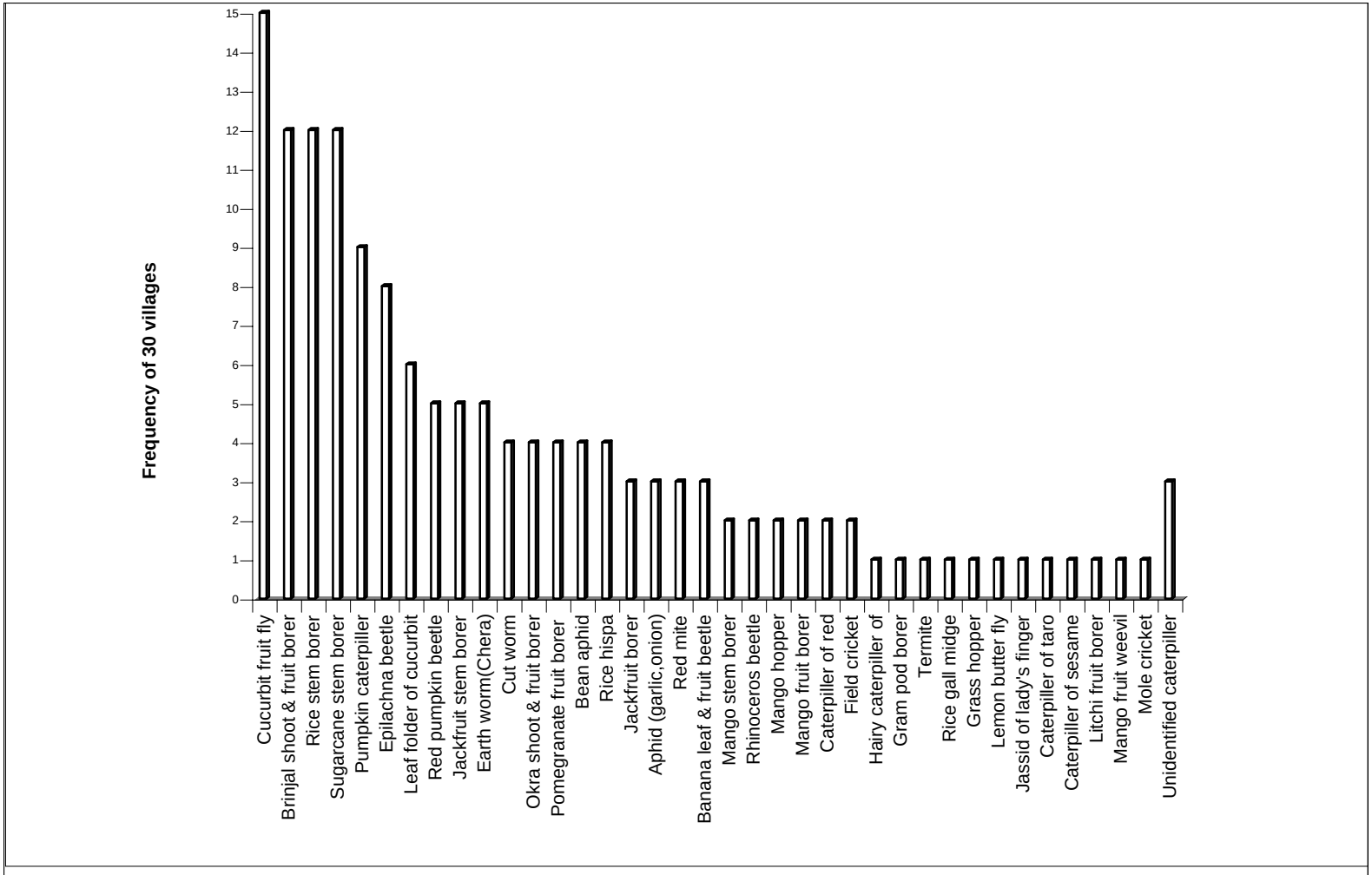


Figure 1a: Frequency of plant health problems (insects) at 30 villages in 3 districts (2004 Summer-I)

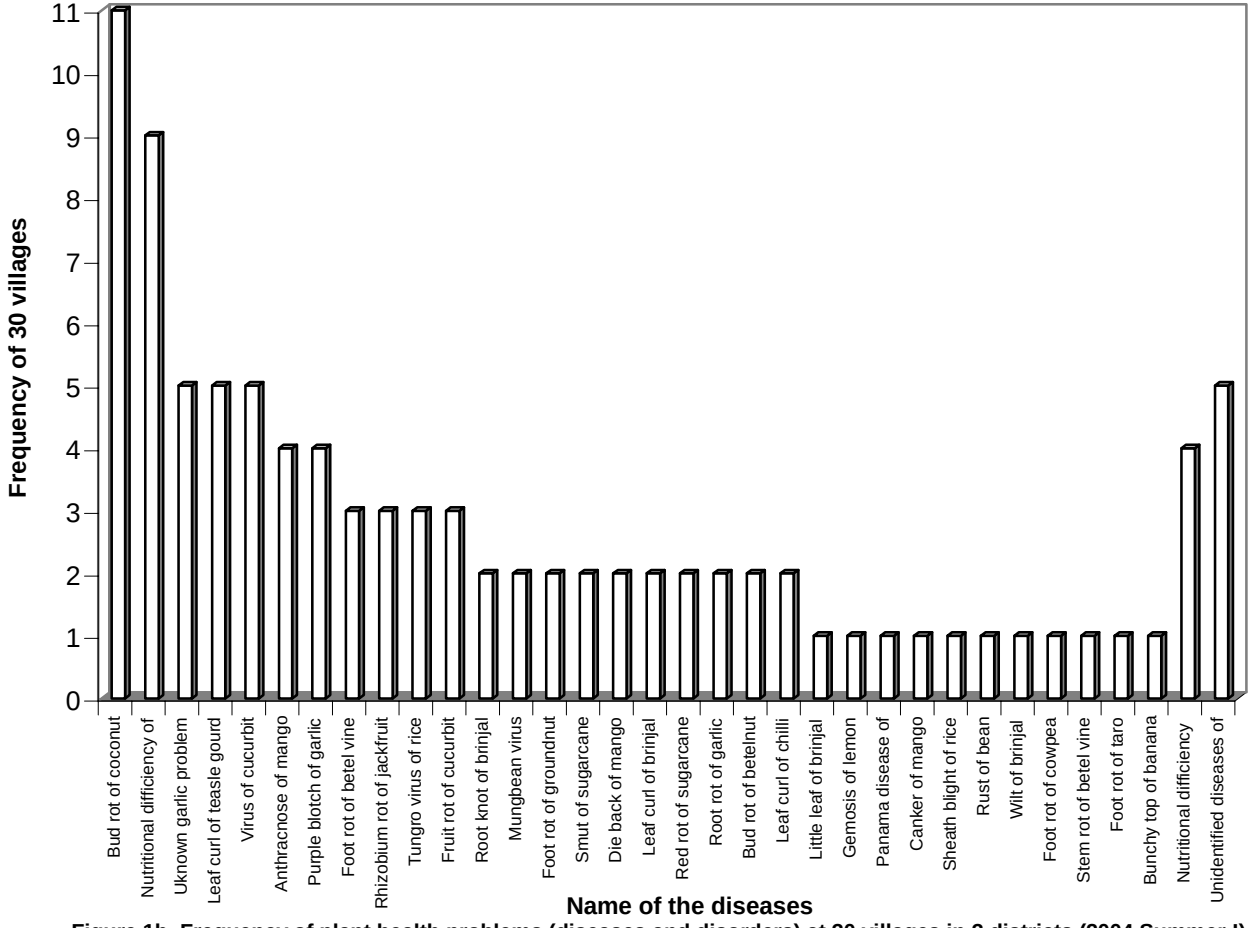


Figure 1b. Frequency of plant health problems (diseases and disorders) at 30 villages in 3 districts (2004 Summer-I)

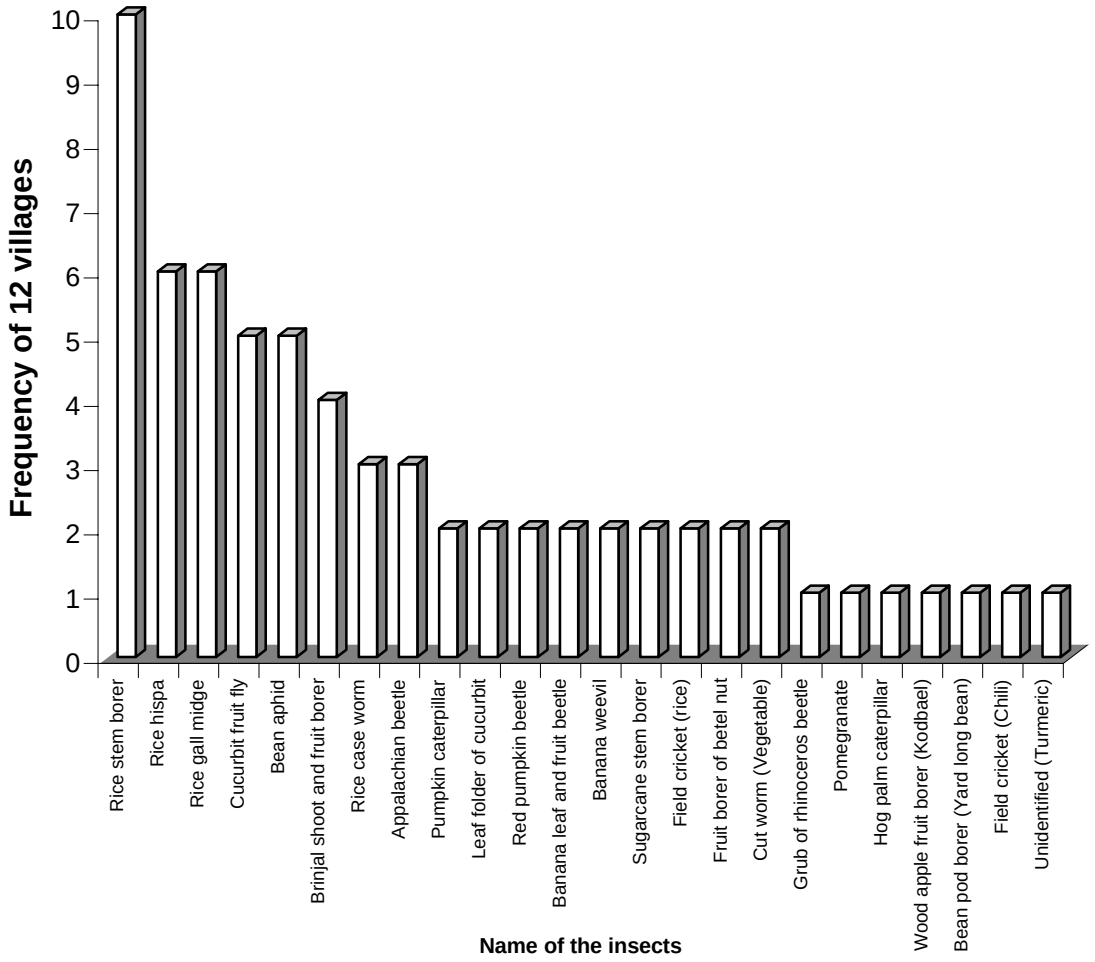


Fig 2a. Frequency of plant health problems (insects) at 12 villages in 3 districts (2004 Summer-II)

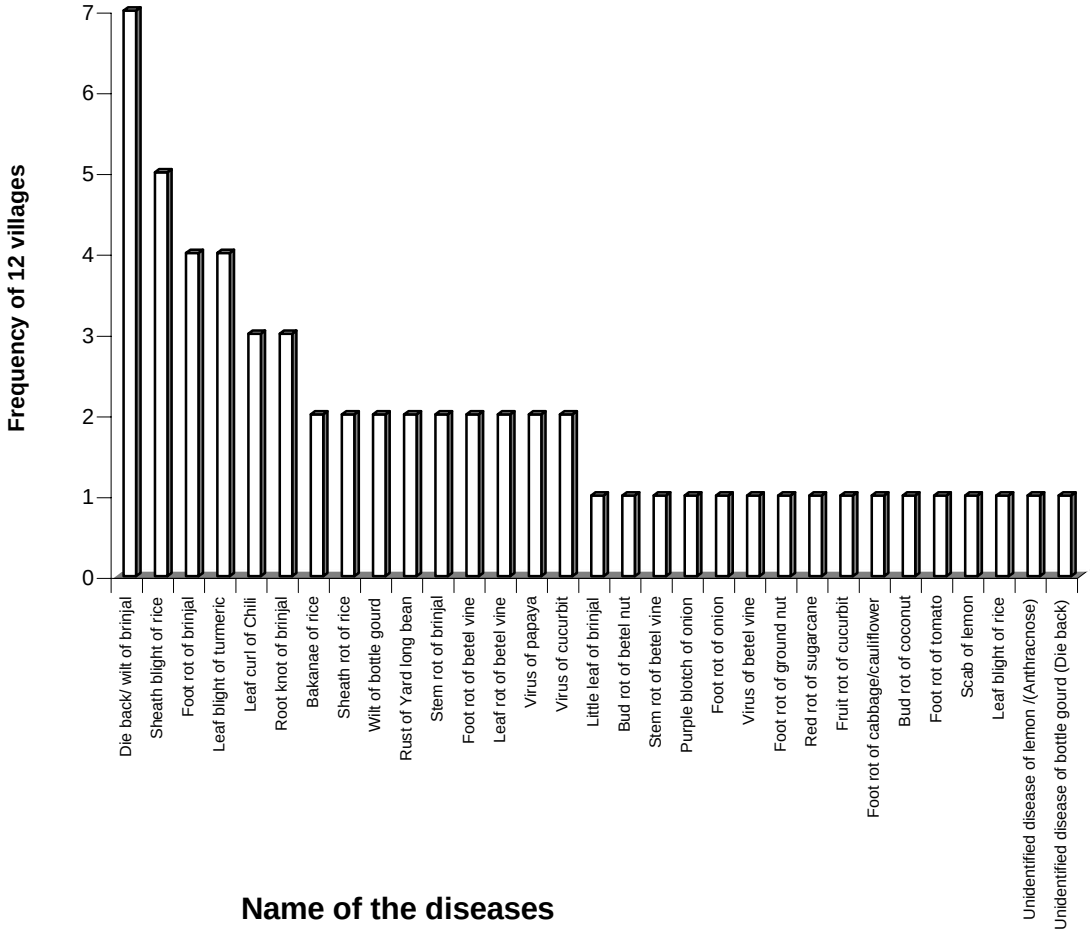


Fig 2b. Frequency of plant health problems (diseases and disorders) at 12 villages in 3 districts (2004 Summer-II)

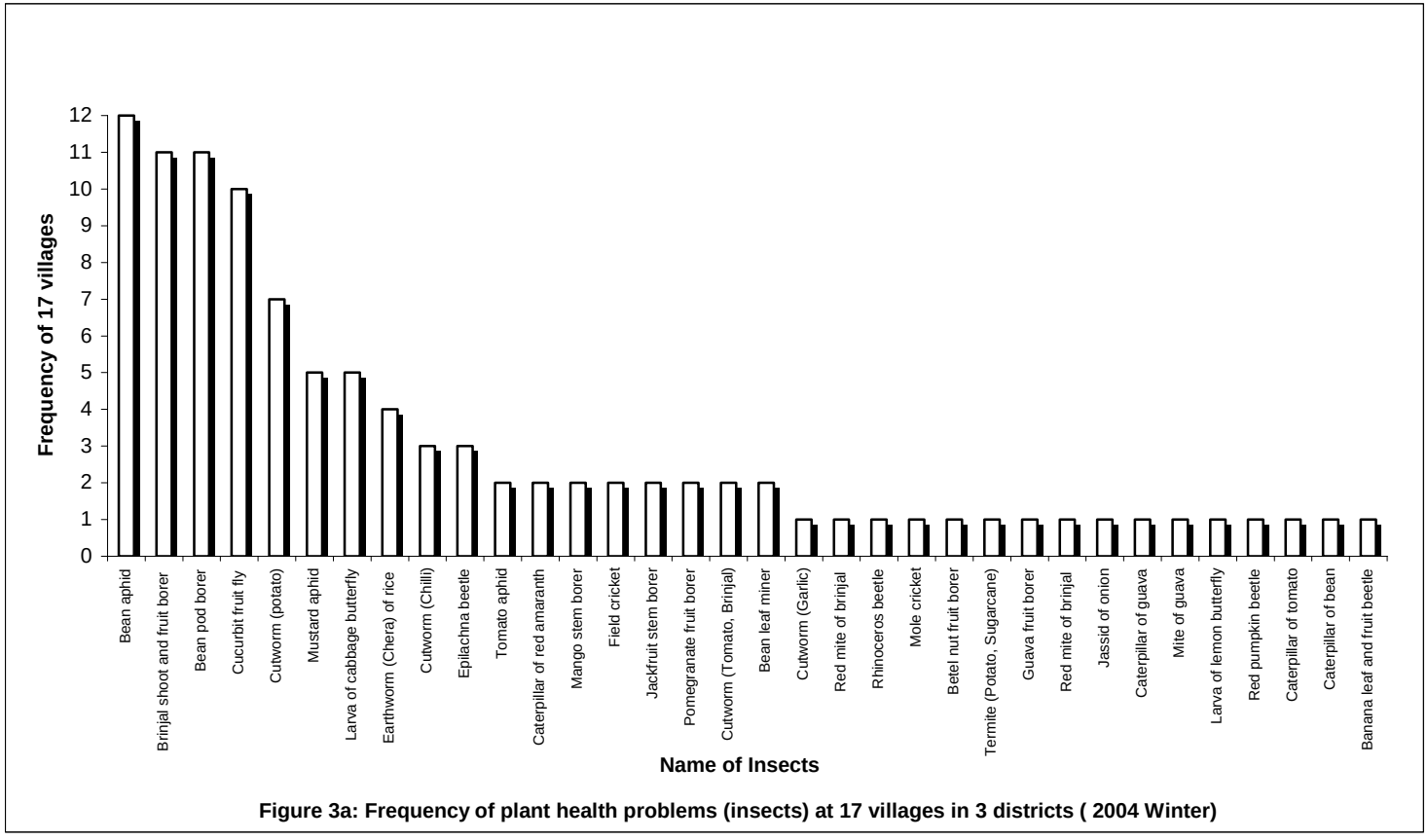


Figure 3a: Frequency of plant health problems (insects) at 17 villages in 3 districts (2004 Winter)

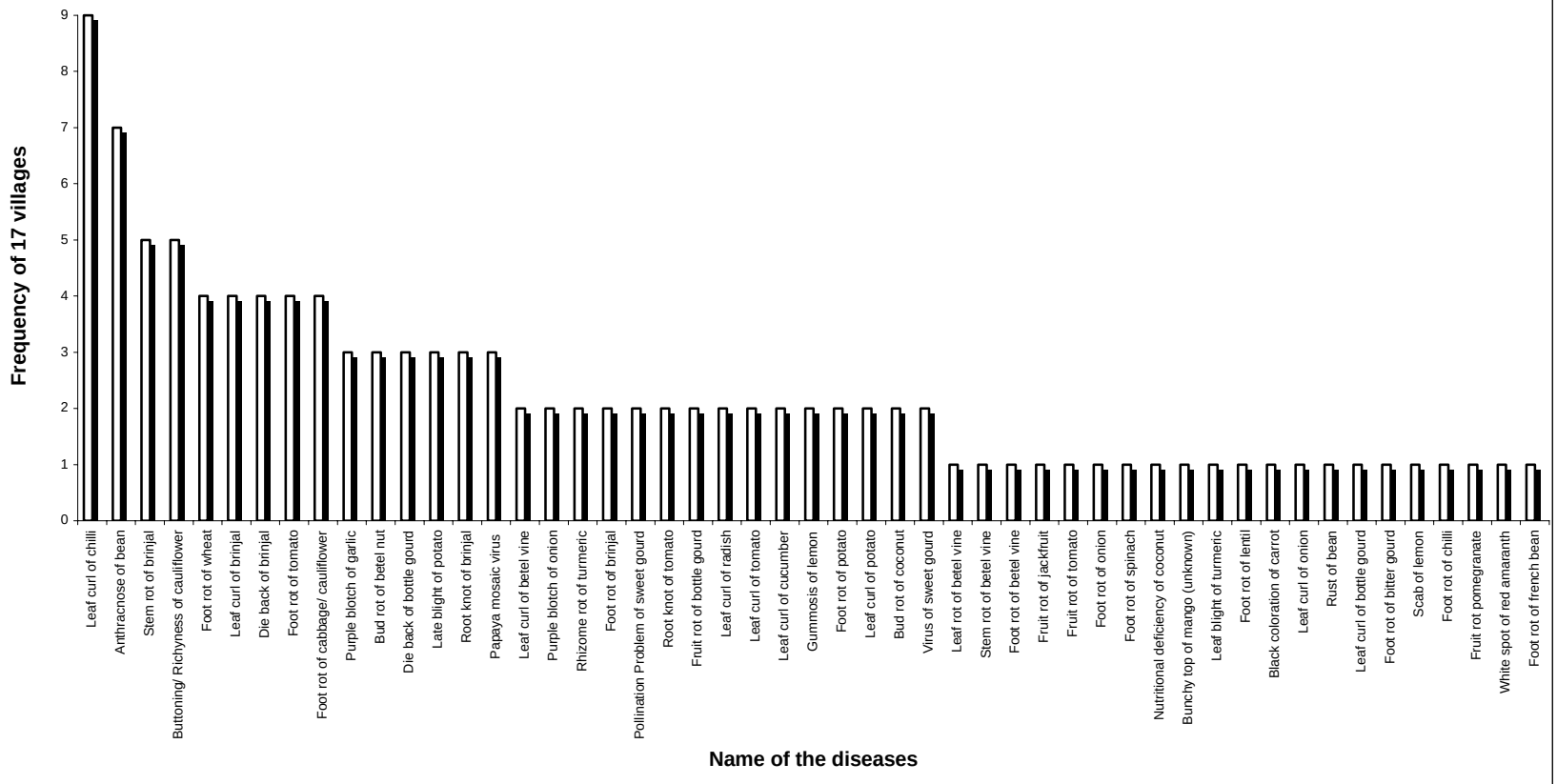


Figure 3b: Frequency of plant health problems (diseases and disorders) at 17 villages in 3 districts (2004 Winter)