CROP PROTECTION PROGRAMME

Ecology and management of rice hispa (*Dicladispa armigera*) in Bangladesh

R No 7891 (ZA 0445)

FINAL TECHNICAL REPORT – PART 2

APPENDICES

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Appendix 1.1. Wealth categorisations from PETRRA (2000). "Acres" is the area of family farmland standardised to acres - bighas were assumed to be 0.33 acres wherever this was not specified. Rice Provisional Ability ("RPA") is the length of time the family can live from its own rice harvest, and is in months. "%" is the percentage of sample families in each class. In Comilla the RPA and farm area categories did not fully correspond for the two poorer classes.

Zone	Category	"Rich"	"Medium-rich"	"Medium-poor"	"Poor"	"Very Poor" / Landless
South West Coast	No categorisation - "Resource-poor" households all have RPA of 3-8 months					
South Central Coast A	Farm area (acres)	>1		0.5-1	0.4-0.5	0
	RPA (months)	12		8-9	4-6	0
	Cattle (head)	10-20		5-7	0	0
	Pond (sqft)	90x75		75x60	45x40	0
	%	13		13	28	46
South Central Coast B	RPA (months)	>12		>6	>3	0
	Characteristics	Bank account		2 or 3 daily meals	Usually 2 daily meals	Sometimes starve/beg
	%	16		16	38	30
Central West	Farm area (acres)	2.31-3.30		0.66-2.31	0-0.66	0
	Income (tk/month)	2500-4000		1500-2500	800-1500	700-800
	RPA (months)	>12		9	6	0
	Characteristics	Have business, power machinery		Sharecrop	Sell labour	Sell labour
	%	18		26	44	12
Chua-danga	Farm area (acres)	>1.65		0.66-1		<3
	RPA (months)	12		6		0
	Characteristics	Have business		Farm, small trade, power tiller and pump		Sell labour, large households
	%	2.5		60		37.5
Comilla	Farm area (acres)	2.8-3.2	1.6-2.8	0.4-1.6	<0.4	0
	RPA (months)	12	12	6-12	3-5	0-3
	Characteristics	Have other income source	Some have other job	Livestock	Have homestead only, sharecrop, sell labour	Sell labour
	%	10	20	20	15-25	25-35

Faridpur	Farm area (acres)	>2	1.21-2	0.81-1.2	0.41-0.8	0-0.4
	RPA (months)	12	12	>5	<12	1
	Characteristics	Business, education, some family abroad	Full meal every day, power machinery	Power machinery, sharecrop, small business	Tin roof on house	Sell labour, shabby house
	%	23	23	14	23	18
High Barind	Farm area (acres)	>6.6	3.3-6.6	1-3.3		<1
	RPA (months)	>12	8-12	6-8		0
	Characteristics	Have business, service	Small business, cattle, tenants	Tenants, have cattle		Day labour, buy all food
	%	5	35	40		20
Hobiganj	Farm area (acres)	>8.25	4-8.25	0.33-4		<0.33
	RPA (months)	>12	12	9-10		<9
	Characteristics	Off-farm business, livestock, cement house	Off-farm income, Livestock, tin roof	Tin or straw roof, sharecrop, few livestock		Labour, sharecrop
	%	10	30	50		10
Rangpur Men	Farm area (acres)	5-10		1-5		0
	Characteristics	Savings, farm or business		Farm or seasonal business		Only two meals a day, labour, fish, rickshaw, beg
	%	10		30		60
Rangpur Women	Farm area (acres)	1.68-2.4	0.96-1.68	0.48-0.96		0
	Characteristics	Large business, farm machinery	Farm, service	Farm, labour, small business		No land or leased, labour, sharecrop, beg
	%	20	40	20		20
Maijdi	Farm area (acres)	>16	5-16	<5	0	0
	RPA (months)	>12	>12	8-9	4	0
	Characteristics	Sell surplus, have implements, business, education, lease out land	Some surplus, implements, tin sheet houses, education	Cattle, access to loans from bank or NGO	Own homestead only, loans from moneylender, sharecrop, children work, sell labour	Some beg, sometimes starve

	%	5	10	70	10	5

Appendix 1.2. Formal Survey Questionnaire

B.R.R.I. FARM RICE PEST STUDY 2004

DISTRICT:_____ UPAZILLA: _____

VILLAGE:_____ INTERVIEWER: _____

DATE: _____/_____/2004 TIME: _____

We are researchers at the Bangladesh Rice Research Institute doing a study of the problems rice farmers face and what they do about them, in order to develop ways to help farmers to overcome their problems. We will use the things you tell us to work on ways to make the solutions we develop more practical and useful to farmers like yourself. My name is …….

To start with, I would like to ask you about YOURSELF AND YOUR FARM

1. What is your name [_____]

2. How old are you? [____ years]

3. For how many years were you in school or college? [____ years]

4. How many years have you been farming rice? [____ years]
(IF "FOR EVER":- AGE MINUS TEN)

5. What is the main rice variety you grow:
   - Aus? [_____]
   - Aman? [_____]
   - Boro? [_____]

6. How large is the area that you farm?
   - The whole area? [____ …… *(LOCAL UNIT OF AREA)*]
   - How many decimals are there in a [LOCAL UNIT OF AREA]? [____ decimals]
   - How much of the total area you farm is rice crop land which you own?
     [____ ……..…….]
   - And how much of the total area you farm is not rice crop land you own, for example rented, mortgaged, sharecropped, managed for somebody else, or beel, haor or fallow land? [____ ……..…….]
   - *(IF ANY LAND IN THIS CATEGORY:-)* Which is it, mostly:-
   - Rented? [__]
   - Mortgaged? [__]
   - Sharecropped? [__]
   - Managed for someone else? [__]
   - Beel, haor or fallow? [__]

7. How many family members does the farm have to feed? [____ people]

8. Does the rice that you grow feed the family all year [12 months] or for how many months? [____ months]

9. Have you any other economic activity other than the farm? [YES / NO]
(IF YES:-) Is the other, non-farm activity more or less important than farming?
   - Non-farm activity more important [__]
   - Non-farm activity less important [__]

10. How many times in the last year did you meet with extensionists? [____ times] *(IF ONE OR MORE - TICK OR FILL ONE)* Who were they? DAE [__] / NGO [__] / other [_____]

We want to ask about the PROBLEMS & LOSSES YOU FACE IN RICE FARMING

11. In the last 3 years, have you always obtained the best possible rice yield? [YES / NO] *(IF YES:- END INTERVIEW; OTHERWISE:-)* What caused the most serious losses to your rice crop over the last 3 years, and how do you rate each one as very serious [score 3 points], middlingly serious [score 2 points] or a bit serious [score 1 point]?

Worst loss	[_____]?	Score [____ points]
2nd worst	[_____]?	Score [____ points]
3rd worst	[_____]?	Score [____ points]
4th worst	[_____]?	Score [____ points]
5th worst	[_____]?	Score [____ points]

12. For managing pest losses, have you ever attended an IPM training course? [YES / NO] *(IF YES: TICK ONE OR TWO)* Farmer Field School [__] / class [__] / demonstration [__] / field day [__] / other [_____]
- Who was it run by? *(TICK ONE OR TWO)* DAE [__] / NGO [__] / SPPS [__] / other [_____]

13. Where principally do you get the information for pest management? *(TICK ONE)* Dealer [__] / DAE [__] / NGO [__] / IPM course [__] / neighbours [__] / your own experience [__] / Don't know [__]?

14. Overall, how do you rate the pest management advice you have received: very good [score 3 points], middlingly good [2 points], a bit good [1 point] or no good [0 points]? [____ points]

We are principally concerned about the LOSSES CAUSED BY RICE HISPA. This is the hispa - you probably recognise it (photo of HISPA ADULT INFESTATION [Figure 1.1: Left])

15. In how many years has hispa caused serious losses since 1996? *(IF FARMER STRUGGLES TO REMEMBER)* – that was the first year Sheik Hashina became Prime Minister. [____ years] *(IF ZERO:- END INTERVIEW; OTHERWISE:-)*

16. In which year did hispa last cause serious losses? [year ____]
In that year, how serious was it - very serious [score 3 points], middlingly serious [score 2 points] or a bit serious [score 1 point]? [____ points]

17. In that year, when it last caused serious losses, how much was the yield?
[____ maunds of rice for an area of ____ …….……]

18. For comparison, how much was the yield in a good year, without this or other losses? [____ maunds of rice for the same area]

So by my calculation the loss to hispa is *(ANSWER 18 MINUS ANSWER 17:)*……..

19. What is the price of the harvest if and when you sell it? [_____ taka per maund]

20. Does the hispa ever cause lesser losses - more than no-loss but less than this serious loss? [YES / NO] *(IF YES:)*
- In which year did hispa last cause these middling losses? [year ____]
- In that year, how much was the yield? [____ maunds for the same area]
- in how many years since 1996 has it caused these middling losses? [____ years]

We are also trying to find out about the NATURE & BEHAVIOUR OF HISPA

21. When there is a hispa attack, how does it arrive? *(TICK / FILL ONE)*
- from the field [__] / from the air [__] / other [_____] / don't know [__]

Where does it come from? *(TICK / FILL ONE)*
- from close by [__] / or where [_____]? / don't know [__]

22. Do you ever see hispa reproducing, for example laying eggs, or young ones?
[YES / NO] *(IF YES:)* what do you see?
[_____]

23. In which season is hispa worst? *(TICK ONE)*
- Aus [__] / Aman [__] / Boro [__]

24. When does hispa attack? *(TICK ONE OR TWO)*
- early tillering? (1) [__]
- mid tillering? (2) [__]
- late tillering? (3) [__]
- booting? (4) [__]
- flowering? (5) [__]
- grain formation? (6) [__]
- grain filling (7) [__]
- grain maturing? (8) [__]
- don't know [__]

25. Does hispa attack in a certain type or kind of weather? *(TICK ONE OR TWO:)*
sunny [__] / light rain [__] / heavy rain [__] / cloudy [__] / don't know [__]

26. Does hispa attack when the wind is coming from any particular direction?
[YES / NO] *(IF YES:)* From where? [_____]

27. Does hispa attack on any particular type of land? *(TICK ONE)*
- dry [__] / wet [__] / damp [__] / other [_____] / don't know [__]

28. Are any rice varieties particularly susceptible to hispa? [YES / NO]
(IF YES:) Which particular one, or two? [_____]

29. Are any rice varieties particularly resistant to hispa? [YES / NO]
(IF YES:) Which particular one, or two? [_____]

Additionally, do you recognise this?
(photo of HISPA LARVA INFESTATION [Figure 1.1: Right])
(IF NOT RECOGNIZED:) This is the damage done by the immature form of the same animal, a little grub which hollows out leaves from the inside, then turns into a black adult and tunnels out.

30. Which is more serious *(TICK ONE)*? - larvae [__], adults [__], don't know [__]

31. When hispa attacks, how does it begin and develop *(TICK ONE)*
- a smooth increase in numbers? [__]
- or none at all, and then all of a sudden large numbers of them? [__]
  - *(IF SUDDENLY:-)* before they suddenly become abundant,
    do you see a few first? [YES / NO]
    - *(IF YES:)* how many days before? [____ days]

32. Do you ever see just a small population of hispa, that does no harm? [YES / NO]

33. Can you predict when hispa will attack? [YES / NO]
- *(IF YES:)* How long before? [____ days]

We want your views on GOVERNMENT SUPPORT for hispa control

34. Have you knowledge of these supports for hispa control by the Government, even if you have not yourself benefited from them, and if so do you think they are very helpful [score 3 points], middlingly helpful [2 points], a bit helpful [1 point] or not helpful [0 points]?
- Aerial spraying? Knowledge [YES / NO] *(IF YES:)* [____ points]
- Bounty paid for hispa caught? Knowledge [YES / NO] *(IF YES:)* [____ points]

- Loan of a sprayer? Knowledge [YES / NO] *(IF YES:)* [____ points]
- Donation of a sweepnet? Knowledge [YES / NO] *(IF YES:)* [____ points]
- Donation of pesticide? Knowledge [YES / NO] *(IF YES:)* [____ points]
- Other? [_____] [____ points]

35. How do you rate the advice you have received for hispa control: very good [score 3 points], middlingly good [2 points], a bit good [1 point] or no good [0 points]? [____ points]

36. If the Government were to provide a warning system of hispa alerts, how useful would this be: very useful [score 3 points], middlingly useful [2 points], a bit useful [1 point] or not useful [0 points]? [____ points] *(IF ANY USE:-)* How many days before the hispa attack would it be useful to receive a warning? [____ days]

We want to find out what you use as CONTROLS AGAINST HISPA
First, I would like to ask about CHEMICAL SPRAYS against hispa
Do you have knowledge or experience of chemical sprays against hispa? [YES / NO]
(IF NO:- GO TO NEXT BOX; IF YES:-)

37. In how many years since 1996 have you sprayed against hispa on your farm?
[____ years]
OR have you knowledge of it without having used it on your farm? *(PUT ZERO IN BOX)*

38. How good is the spray at controlling hispa: very good [score 3 points], middlingly good [2 points], a bit good [1 point] or no good [0 points]? [____ points]

39. Do these cause problems or difficulties with sprays against hispa? If so, are these very serious [score 3 points], middlingly serious [2 points], a bit serious [1 point]?
- It costs a lot of money? Problem [YES / NO] *(IF YES:)* [____ points]
- It is hard to get a sprayer? Problem [YES / NO] *(IF YES:)* [____ points]
- It takes a lot of labour time? Problem [YES / NO] *(IF YES:)* [____ points]
- It is hard, tiresome or boring work? Problem [YES / NO] *(IF YES:)* [____ points]
- A danger to personal health? Problem [YES / NO] *(IF YES:)* [____ points]
- A danger to the rice plants? Problem [YES / NO] *(IF YES:)* [____ points]
- Any other problem? [_____] [____ points]

40. In a season when you have to spray against hispa, how many times in the season do you spray it? [____ times]

41. Which chemical or chemicals do you use (including kerosene)?
[_____]

42. When you have to spray against hispa, how much does the insecticide cost?
[____ taka per bottle or packet of ____ CCs or Grams]
How much area of rice will this amount of insecticide treat, and how many times?
[____ ……. by ____ times]

43. Is the sprayer *(TICK OR FILL ONE:)*
- owned [__] / borrowed (from whom? [_____])
/ hired (at what price? [_____ taka/day])

44. How many people does a spray take? [____ people]
- How long does it take them? [____ hours for the field of ____ …….]
- Are they family members [__], hired labourers [__] or a mix of both [__]? *(TICK ONE)*
- *(IF HIRED)* how much are they paid per day? [____ taka per day]

45. By how much does the spray reduce the hispa losses given above,
EITHER as the yield restored up to what level? [____ maunds for the field of ____ …….]
OR as what mortality of hispa? [____ percent of hispa killed]

46. When you have to spray against hispa: *(TICK ONE)*
- is it every year, regularly? [__]
- or not every year, but only when it reaches a certain level or threshold? [__]

(IF EVERY YEAR:- NEXT BOX; IF AT THRESHOLD:-)

- What do you look at to decide whether to spray? *(TICK ONE:)*
  - numbers of insects? [__]
  - or damage to rice plants? [__]
- What infestation level do you spray at? *(TICK OR FILL ONE:)*
  - Any at all, no matter how few? [__]
  - A few? [__] *(IF SO:)* such as a count of about [____ hispa] per hill?
  - A large amount, more than can be easily counted? [__]
- Is the decision to spray *(TICK ONE:)*
  - Very easy? [__] (1)
  - Quite easy? [__] (2)
  - Neither easy nor difficult? [__] (3)
  - Quite difficult? [__] (4)
  - Very difficult? [__] (5)
- In particular, is there a risk that you may spray, and then later realize it was not necessary? [YES / NO] *(IF YES:)* Is this a very serious risk [score 3 points], middlingly serious [2 points], a bit serious [1 point] or not a problem [0 points]? [____ points]
- On the other hand, is there a risk that you may decide not to spray, and then later realize that it was necessary after all and it would have been better to have sprayed? [YES / NO] *(IF YES:)* Is this a very serious risk [score 3 points], middlingly serious [2 points], a bit serious [1 point] or not a problem [0 points]? [____ points]
- Do you usually make the spray decision *(TICK ONE:)*
  - alone? [__]
  - with an extensionist? [__]
  - with neighbours? [__]
- After you decide a spray is necessary, in how many days is it necessary to spray? [____ days]
- And how many days does it take to prepare the spray? [___ days]
- Is it a problem to be sure the spray will be on time and not too late? [YES / NO] *(IF YES:-)* is it a very serious problem [score 3 points], middlingly serious [2 points] or a bit serious [1 point]? [____ points]

Second, do you know about SWEEPNETTING against hispa? [YES / NO]
(IF NO:- NEXT BOX; IF YES:-)

A1. In how many years have you used sweepnetting against hispa on your farm since 1996? [____ years] OR have you knowledge of it without having used it on your farm? *(PUT ZERO IN BOX)*

A2. How good is sweepnetting at controlling hispa: very good [score 3 points], middlingly good [2 points], a bit good [1 point] or no good [0 points]? [____ points]

A3. Do these cause problems or difficulties with sweepnetting against hispa? If so, are these very serious [score 3 points], middlingly serious [2 points], a bit serious [1 point]?
- It costs a lot of money? Problem [YES / NO] *(IF YES:)* [____ points]
- It takes a lot of labour time? Problem [YES / NO] *(IF YES:)* [____ points]
- It is hard, tiresome or boring work? Problem [YES / NO] *(IF YES:)* [____ points]
- A danger to personal health? Problem [YES / NO] *(IF YES:)* [____ points]
- A danger to the rice plants? Problem [YES / NO] *(IF YES:)* [____ points]
- Any other problem? [_____] [____ points]

A4. In a season when you have to sweepnet against hispa, how many times in the season do you do it? [____ times]

A5. Is the net *(TICK OR FILL ONE:)*

- bought [__] / provided by DAE [__] / hired [__]
/ borrowed - from whom? [_____]

A6. How many people does a sweepnet take? [____ people]
- How long does it take them? [____ hours for the field of ____ …….…….]
- Are they family members [__], hired labourers [__] or a mix of both [__]? *(TICK ONE)*

A7. By how much does the sweepnetting reduce the hispa losses given above,
EITHER as the yield restored up to what level?
[____ maunds for the field of ____ …….…….]
OR as what mortality of hispa? [____ percent of hispa killed]

A8. When you have to sweepnet against hispa: *(TICK ONE)*
- is it every year, regularly? [__]
- or not every year, but only when it reaches a certain level or threshold? [__]

(IF AT THRESHOLD:-)

- What infestation level do you sweepnet at? *(TICK OR FILL ONE:)*
  - Any at all, no matter how few? [__]
  - A few? [__]
  - A large amount? [__]
  - Don't know [__]
- Is the decision to sweepnet *(TICK ONE:)*
  - Very easy? [__] (1)
  - Quite easy? [__] (2)
  - Neither easy nor difficult? [__] (3)
  - Quite difficult? [__] (4)
  - Very difficult? [__] (5)
  - Is it a problem to be sure the sweepnet will be on time and not too late? [YES / NO] *(IF YES:-)* is it a very serious problem [score 3 points], middlingly serious [2 points] or a bit serious [1 point]? [____ points]

Third, do you know about the use of LEAF-CLIPPING against hispa? [YES / NO]
(IF NO:- NEXT BOX; IF YES:-)

B1. In how many years since 1996 have you clipped leaves against hispa on your farm? [____ years]
OR have you knowledge of it without having used it on your farm? *(PUT ZERO IN BOX)*

B2. How good is leaf-clipping at controlling hispa: very good [score 3 points], middlingly good [2 points], a bit good [1 point] or no good [0 points]? [____ points]

B3. Do these cause problems or difficulties with leaf-clipping against hispa? If so, are these very serious [score 3 points], middlingly serious [2 points], a bit serious [1 point]?
- It costs a lot of money? Problem [YES / NO] *(IF YES:)* [____ points]
- It takes a lot of labour time? Problem [YES / NO] *(IF YES:)* [____ points]
- It is hard, tiresome or boring work? Problem [YES / NO] *(IF YES:)* [____ points]
- A danger to personal health? Problem [YES / NO] *(IF YES:)* [____ points]
- A danger to the rice plants? Problem [YES / NO] *(IF YES:)* [____ points]
- Any other problem? [_____] [____ points]

B4. In a season when you have to leaf-clip against hispa, how many times in the season do you do it? [____ times]

B5. How many people does leaf-clipping take? [____ people]
- How long does it take them? [____ hours for the field of ____ …….…….]
- Are they family members [__], hired labourers [__] or a mix of both [__]? *(TICK ONE)*

B6. By how much does the leaf-clipping reduce the hispa losses given above,

EITHER as the yield restored up to what level? [____ maunds for the field of ____ ……..……]
OR as what mortality of hispa? [____ percent of hispa killed]

B7. When you have to leaf-clip against hispa: *(TICK ONE)*
- is it every year, regularly? [__]
- or not every year, but only when it reaches a certain level or threshold? [__]

(IF AT THRESHOLD:-)

- What infestation level do you leaf-clip at? *(TICK OR FILL ONE:)*
  - Any at all, no matter how few? [__]
  - A few? [__]
  - A large amount? [__]
  - Don't know [__]
- Is the decision to leaf-clip *(TICK ONE:)*
  - Very easy? [__] (1)
  - Quite easy? [__] (2)
  - Neither easy nor difficult? [__] (3)
  - Quite difficult? [__] (4)
  - Very difficult? [__] (5)
  - Is it a problem to be sure the leaf-clipping will be on time and not too late? [YES / NO] *(IF YES:-)* is it a very serious problem [score 3 points], middlingly serious [2 points] or a bit serious [1 point]? [____ points]

Do you know about ANY OTHER CONTROL METHOD against hispa (including against larvae)? [YES / NO]
(IF NO:- NEXT BOX; IF YES:-)

C1. What is it? [_____]

C2. In how many years since 1996 have you used it against hispa on your farm?
[____ years]
OR have you knowledge of it without having used it on your farm? *(PUT ZERO IN BOX)*

C3. How good is it at controlling hispa: very good [score 3 points], middlingly good [2 points], a bit good [1 point] or no good [0 points]? [____ points]

C4. Do these cause problems or difficulties using this control against hispa? If so, are these very serious [score 3 points], middlingly serious [2 points], a bit serious [1 point]?
- It costs a lot of money? Problem [YES / NO] *(IF YES:)* [____ points]
- It takes a lot of labour time? Problem [YES / NO] *(IF YES:)* [____ points]
- It is hard, tiresome or boring work? Problem [YES / NO] *(IF YES:)* [____ points]
- A danger to personal health? Problem [YES / NO] *(IF YES:)* [____ points]
- A danger to the rice plants? Problem [YES / NO] *(IF YES:)* [____ points]
- Any other problem? [_____] [____ points]

C5. In a season when you have to do this against hispa, how many times in the season do you do it? [____ times]

C6. How many people does it take? [____ people]
- How long does it take them? [____ hours for the field of ____ ……..……]
- Are they family members [__], hired labourers [__] or a mix of both [__]? *(TICK ONE)*

C7. By how much does it reduce the hispa losses given above,
EITHER as the yield restored up to what level? [____ maunds for the field of ____ ……..……]
OR as what mortality of hispa? [____ percent of hispa killed]

C8. When you have to do this against hispa: *(TICK ONE)*

- is it every year, regularly? [__]
- or not every year, but only when it reaches a certain level or threshold? [__]
(IF AT THRESHOLD:-)
    - What infestation level do you do it at? *(TICK OR FILL ONE:)*
        - Any at all, no matter how few? [__]
        - A few? [__]
        - A large amount? [__]
        - Don't know [__]
    - Is the decision to do this control *(TICK ONE:)*
        - Very easy? [__] (1)
        - Quite easy? [__] (2)
        - Neither easy nor difficult? [__] (3)
        - Quite difficult? [__] (4)
        - Very difficult? [__] (5)
        - Is it a problem to be sure the control will be on time and not too late? [YES / NO] *(IF YES:-)* is it a very serious problem [score 3 points], middlingly serious [2 points] or a bit serious [1 point]? [____ points]

Do you know about ANY OTHER CONTROL METHOD against hispa (including against larvae)? [YES / NO]
(IF NO:- NEXT BOX; IF YES:-)

D1. What is it? [_____]

D2. In how many years since 1996 have you used it against hispa on your farm?
[____ years]
OR have you knowledge of it without having used it on your farm? *(PUT ZERO IN BOX)*

D3. How good is it at controlling hispa: very good [score 3 points], middlingly good [2 points], a bit good [1 point] or no good [0 points]? [____ points]

D4. Do these cause problems or difficulties using this control against hispa? If so, are these very serious [score 3 points], middlingly serious [2 points], a bit serious [1 point]?
- It costs a lot of money? Problem [YES / NO] *(IF YES:)* [____ points]
- It takes a lot of labour time? Problem [YES / NO] *(IF YES:)* [____ points]
- It is hard, tiresome or boring work? Problem [YES / NO] *(IF YES:)* [____ points]
- A danger to personal health? Problem [YES / NO] *(IF YES:)* [____ points]
- A danger to the rice plants? Problem [YES / NO] *(IF YES:)* [____ points]
- Any other problem? [_____] [____ points]

D5. In a season when you have to do this against hispa, how many times in the season do you do it? [____ times]

D6. How many people does it take? [____ people]
- How long does it take them? [____ hours for the field of ____ ……..…….]
- Are they family members [__], hired labourers [__] or a mix of both [__]? *(TICK ONE)*

D7. By how much does it reduce the hispa losses given above,
EITHER as the yield restored up to what level? [____ maunds for the field of ____ ……..…….]
OR as what mortality of hispa? [____ percent of hispa killed]

D8. When you have to do this against hispa: *(TICK ONE)*
- is it every year, regularly? [__]
- or not every year, but only when it reaches a certain level or threshold? [__]
(IF AT THRESHOLD:-)
    - What infestation level do you do it at? *(TICK OR FILL ONE:)*
        - Any at all, no matter how few? [__]
        - A few? [__]

- A large amount? [__]
- Don't know [__]

- Is the decision to do this control *(TICK ONE:)*
  - Very easy? [__] (1)
  - Quite easy? [__] (2)
  - Neither easy nor difficult? [__] (3)
  - Quite difficult? [__] (4)
  - Very difficult? [__] (5)
  - Is it a problem to be sure the control will be on time and not too late? [YES / NO] *(IF YES:-)* is it a very serious problem [score 3 points], middlingly serious [2 points] or a bit serious [1 point]? [____ points]

We are also concerned about the LOSSES CAUSED BY MASRA

E1. Has masra caused serious losses since 1996 (the first year Sheik Hashina became Prime Minister) and if so, in how many years since then:
- very serious losses? [YES / NO] *(IF YES:-)* In how many years? [____ years]
- middling serious losses? [YES / NO] *(IF YES:-)* In how many years? [____ years]

(IF SERIOUS IN NO YEARS:- END THE INTERVIEW; OTHERWISE:-)

We are also trying to find out about the NATURE & LIFE-CYCLE OF MASRA

E2. When there is a masra attack, how does it arrive? *(TICK / FILL ONE:)*
- from the field [__] / from the air [__] / other [_____] / don't know [__]

Where does it come from? *(TICK / FILL ONE:)*
- from close by [__] / or where [_____]? / don't know [__]

E3. Do you ever see masra reproducing, for example laying eggs, or young ones?
[YES / NO] *(IF YES:)* what do you see?
[_____]

E4. Are any rice varieties particularly susceptible to masra? [YES / NO]
(IF YES:) Which particular one or two? [_____]

E5. Are any rice varieties particularly resistant to masra? [YES / NO]
(IF YES:) Which particular one or two? [_____]

E6. When masra attacks, how does it begin and develop *(TICK ONE:)*
- a smooth increase in numbers? [__]
- or none at all, and then all of a sudden large numbers of them? [__]
  - *(IF ALL OF A SUDDEN:)* before they suddenly become abundant, do you see a few first? [YES / NO]
    - *(IF YES:)* how many days before? [____ days]

E7. Do you ever see just a small population of masra, that does no harm? [YES / NO]

E8. Can you predict when masra will attack? [YES / NO]
(IF YES:-) How long before? [____ days]

E9. How do you rate the advice you have received for masra control: very good [score 3 points], middlingly good [2 points], a bit good [1 point] or no good [0 points]? [____ points]

We want to find out what you use as CONTROLS AGAINST MASRA

First, I want to ask about CHEMICAL GRANULES to the soil against masra
Do you have knowledge or experience of chemical granules against masra? [YES / NO]
(IF NO:- NEXT BOX; IF YES:-)

E10. In how many years since 1996 have you used granules against masra on your farm? [____ years]
OR have you knowledge of it without having used it on your farm? *(PUT ZERO IN BOX)*

E11. How good are the granules at controlling masra: very good [score 3 points], middlingly good [2 points], a bit good [1 point] or no good [0 points]? [____ points]

E12. Do these cause problems or difficulties with using granules against masra? If so, are these very serious [score 3 points], middlingly serious [2 points], a bit serious [1 point]?
- It costs a lot of money? Problem [YES / NO] *(IF YES:)* [____ points]
- It takes a lot of labour time? Problem [YES / NO] *(IF YES:)* [____ points]
- It is hard, tiresome or boring work? Problem [YES / NO] *(IF YES:)* [____ points]
- A danger to personal health? Problem [YES / NO] *(IF YES:)* [____ points]
- A danger to the rice plants? Problem [YES / NO] *(IF YES:)* [____ points]
- Any other problem? [_____] [____ points]

E13. When you have to use granules against masra: *(TICK ONE)*
- is it every year, regularly? [__]
- or not every year, but only when it reaches a certain level or threshold? [__]

(IF AT THRESHOLD:-)
- What infestation level do you do it at? *(TICK OR FILL ONE:)*
  - Any at all, no matter how few? [__]
  - A few? [__]
  - A large amount? [__]
  - Don't know [__]
- Is the decision to apply the granules *(TICK ONE:)*
  - Very easy? [__] (1)
  - Quite easy? [__] (2)
  - Neither easy nor difficult? [__] (3)
  - Quite difficult? [__] (4)
  - Very difficult? [__] (5)
  - Is it a problem to be sure the granule application will be on time and not too late? [YES / NO] *(IF YES:-)* is it a very serious problem [score 3 points], middlingly serious [2 points] or a bit serious [1 point]? [____ points]

Second, I would like to ask about CHEMICAL SPRAYS against masra
Do you have knowledge or experience of chemical sprays against masra? [YES / NO]
(IF NO:- NEXT BOX; IF YES:-)

F1. In how many years since 1996 have you sprayed against masra on your farm?
[____ years]
OR have you knowledge of it without having used it on your farm? *(PUT ZERO IN BOX)*

F2. How good is the spray at controlling masra: very good [score 3 points], middlingly good [2 points], a bit good [1 point] or no good [0 points]? [____ points]

F3. Do these cause problems or difficulties with sprays against masra? If so, are these very serious [score 3 points], middlingly serious [2 points], a bit serious [1 point]?
- It costs a lot of money? Problem [YES / NO] *(IF YES:)* [____ points]
- It is hard to get a sprayer? Problem [YES / NO] *(IF YES:)* [____ points]
- It takes a lot of labour time? Problem [YES / NO] *(IF YES:)* [____ points]
- It is hard, tiresome or boring work? Problem [YES / NO] *(IF YES:)* [____ points]
- A danger to personal health? Problem [YES / NO] *(IF YES:)* [____ points]
- A danger to the rice plants? Problem [YES / NO] *(IF YES:)* [____ points]
- Any other problem? [_____] [____ points]

F8. When you have to use sprays against masra: *(TICK ONE)*

- is it every year, regularly? [__]
- or not every year, but only when it reaches a certain level or threshold? [__]

(IF AT THRESHOLD:-)

- What infestation level do you do it at? *(TICK OR FILL ONE:)*
  - Any at all, no matter how few? [__]
  - A few? [__]
  - A large amount? [__]
  - Don't know [__]
- Is the decision to spray *(TICK ONE:)*
  - Very easy? [__] (1)
  - Quite easy? [__] (2)
  - Neither easy nor difficult? [__] (3)
  - Quite difficult? [__] (4)
  - Very difficult? [__] (5)
  - Is it a problem to be sure the spray will be on time and not too late? [YES / NO] *(IF YES:-)* is it a very serious problem [score 3 points], middlingly serious [2 points] or a bit serious [1 point]? [____ points]

Third, do you know about DESTROYING EGG-MASSES against masra? [YES / NO]
(IF NO:- NEXT BOX; IF YES:-)

G1. In how many years since 1996 have you destroyed masra egg-masses on your farm? [____ years] OR have you knowledge of it without having used it on your farm? *(PUT ZERO IN BOX)*

G2. How good is the egg-mass destruction at controlling masra: very good [score 3 points], middlingly good [2 points], a bit good [1 point] or no good [0 points]? [____ points]

G3. Do these cause problems or difficulties with destroying masra egg masses? If so, are these very serious [score 3 points], middlingly serious [2 points], a bit serious [1 point]?

- It costs a lot of money? Problem [YES / NO] *(IF YES:)* [____ points]
- It takes a lot of labour time? Problem [YES / NO] *(IF YES:)* [____ points]
- It is hard, tiresome or boring work? Problem [YES / NO] *(IF YES:)* [____ points]
- A danger to personal health? Problem [YES / NO] *(IF YES:)* [____ points]
- A danger to the rice plants? Problem [YES / NO] *(IF YES:)* [____ points]
- Any other problem? [_____] [____ points]

G4. When you have to destroy masra egg-masses: *(TICK ONE)*
- is it every year, regularly? [__]
- or not every year, but only when it reaches a certain level or threshold? [__]

(IF AT THRESHOLD:-)

- What infestation level do you do it at? *(TICK OR FILL ONE:)*
  - Any at all, no matter how few? [__]
  - A few? [__]
  - A large amount? [__]
  - Don't know [__]
- Is the decision to destroy the egg-masses *(TICK ONE:)*
  - Very easy? [__] (1)
  - Quite easy? [__] (2)
  - Neither easy nor difficult? [__] (3)
  - Quite difficult? [__] (4)
  - Very difficult? [__] (5)
  - Is it a problem to be sure the egg-mass destruction will be on time and not too late? [YES / NO] *(IF YES:-)* is it a very serious problem [score 3 points], middlingly serious [2 points] or a bit serious [1 point]? [____ points]

Fourth, do you know about the use of SWEEPNETTING against masra? [YES / NO] *(IF NO:- NEXT BOX; IF YES:-)*

H1. In how many years since 1996 have you sweepnetted masra on your farm? [____ years]
OR have you knowledge of it without having used it on your farm? *(PUT ZERO IN BOX)*

H2. How good is sweepnetting at masra control: very good [score 3 points], middlingly good [2 points], a bit good [1 point] or no good [0 points]? [____ points]

H3. Do these cause problems or difficulties with sweepnetting against masra? If so, are these very serious [score 3 points], middlingly serious [2 points], a bit serious [1 point]?
- It costs a lot of money? Problem [YES / NO] *(IF YES:)* [____ points]
- It takes a lot of labour time? Problem [YES / NO] *(IF YES:)* [____ points]
- It is hard, tiresome or boring work? Problem [YES / NO] *(IF YES:)* [____ points]
- A danger to personal health? Problem [YES / NO] *(IF YES:)* [____ points]
- A danger to the rice plants? Problem [YES / NO] *(IF YES:)* [____ points]
- Any other problem? [_____] [____ points]

H4. When you have to sweepnet against masra: *(TICK ONE)*
- is it every year, regularly? [__]
- or not every year, but only when it reaches a certain level or threshold? [__]

(IF AT THRESHOLD:-)
- What infestation level do you do it at? *(TICK OR FILL ONE:)*
  - Any at all, no matter how few? [__]
  - A few? [__]
  - A large amount? [__]
  - Don't know [__]
- Is the decision to sweepnet *(TICK ONE:)*
  - Very easy? [__] (1)
  - Quite easy? [__] (2)
  - Neither easy nor difficult? [__] (3)
  - Quite difficult? [__] (4)
  - Very difficult? [__] (5)
  - Is it a problem to be sure the sweepnetting will be on time and not too late? [YES / NO] *(IF YES:-)* is it a very serious problem [score 3 points], middlingly serious [2 points] or a bit serious [1 point]? [____ points]

Do you know of ANY OTHER CONTROL that can be used against masra?
[YES / NO]
(IF NO:- END INTERVIEW; IF YES:-)

I1. What is it? [_____]

I2. In how many years since 1996 have you used it against masra on your farm? [____ years]
OR have you knowledge of it without having used it on your farm? *(PUT ZERO IN BOX)*

I3. How good is it at controlling masra: very good [score 3 points], middlingly good [2 points], a bit good [1 point] or no good [0 points]? [____ points]

I4. Do these cause problems or difficulties with this control against masra? If so, are these very serious [score 3 points], middlingly serious [2 points], a bit serious [1 point]?
- It costs a lot of money? Problem [YES / NO] *(IF YES:)* [____ points]
- It takes a lot of labour time? Problem [YES / NO] *(IF YES:)* [____ points]
- It is hard, tiresome or boring work? Problem [YES / NO] *(IF YES:)* [____ points]
- A danger to personal health? Problem [YES / NO] *(IF YES:)* [____ points]
- A danger to the rice plants? Problem [YES / NO] *(IF YES:)* [____ points]
- Any other problem? [_____] [____ points]

15. When you have to do this against masra: *(TICK ONE)*
- is it every year, regularly? [__]
- or not every year, but only when it reaches a certain level or threshold? [__]

(IF AT THRESHOLD:-)

- What infestation level do you do it at? *(TICK OR FILL ONE:)*
  - Any at all, no matter how few? [__]
  - A few? [__]
  - A large amount? [__]
  - Don't know [__]
- Is the decision to do it *(TICK ONE:)*
  - Very easy? [__] (1)
  - Quite easy? [__] (2)
  - Neither easy nor difficult? [__] (3)
  - Quite difficult? [__] (4)
  - Very difficult? [__] (5)
  - Is it a problem to be sure the control will be on time and not too late? [YES / NO] *(IF YES:-)* is it a very serious problem [score 3 points], middlingly serious [2 points] or a bit serious [1 point]? [____ points]

THAT'S ALL. YOUR TIME AND YOUR ANSWERS HAVE BEEN VERY HELPFUL TO US. THANK-YOU VERY MUCH.

Appendix 1.3. Informal Survey Interview Records.

As these are "raw data" they are traditionally in courier font and without formatting such as italics or bold text. Asides and conjectures are in {curled brackets}. Due to variation in the local value of the bigha, these are specified in decimals: 1 decimal = 0.01acres = 40.5sqm = 1/247ha.

#: Farm stop number
A: Khulna/Barisal tour 2001; B: Habiganj/Sylhet tour 2002; C: Barisal meeting 2004
=: Date, time and GPS coordinates
~: Interviewer
JS: John Stonehouse
FR: M Fazle Rabi
MH: Mosaddeque Hossain

H=hispa; SB=stem borer; BPH=brown planthopper; DAE=Department of Agricultural Extension; LOK=lever-operated knapsack sprayer; HYV=high-yielding variety; IRRI=International Rice Research Institute.

A#1. =28.2.01 0910. N23.44.36, E90.12.14. By busy roadside and market. Ten years ago this was all fields. The road and bridge are only 2 years old; before that you crossed by boat. A new road's being built and soon there will be an intersection here. It has been farmed by the same family for generations, but no one thinks people will still be growing rice here in 10 years' time. No farmer to be seen.

A#2. =28.2.01 0930. N23.33.34, E90.7.37. Late 20s. Respondent is a long-term field worker, not a farmer.

~JS. PESTS Stem borer is worst problem. Against SB is one (preventative) application of granular insecticide mixed with fertiliser. H was bad 3-4 years ago, making white areas in patches

PESTICIDE In last H attack granular insecticide was used. Nobody round here owns a sprayer, but can rent one for 50 taka to spray one bigha (3 decimals {??}). Pesticide is paid for by the farmer. Sprays used against stem borer or rice bug, and hispa too on seeing white patches. Granular application is preventative/prophylactic, with first top dressing; generally basudrin granules. This one dress is every year on every crop. Sprays are irregular, but over the whole field - not just on infested patches. The last spray needed was 3-4 years ago, but he's not sure if it was hispa - probably rice bug. Most farmers here use herbicide once a year - mixed with fertiliser and applied to the soil broadcast just before transplanting

A#3. =28.2.01 0945. N23.22.33, E90.03.10. ~JS. CROPS He also has 2 bighas of "kalizira" as a cash crop, a sort of special luxury spice. He studied up to Grade 8 but then his father died and he took over the farm. A bigha here is 42 decimals, and he has 1/4 bigha of coriander, 2 bighas of kalizira and 2 of boro {a total of 84 decimals of boro and of kalizira and 10.5 of coriander}. Farmers round here used to grow a lot of spices and lentils in rabi, along with deepwater rice, but now grow boro instead. Many grow only the one (boro) crop - deepwater rice is still grown but a lot less than before.

In a neighbour's field is onion grown for seed {JS gets the impression the switch from deepwater rice has made farmers here quite resourceful and enterprising}.

PESTS Before the last hispa attack there was routinely one every roughly 2-3 years, often associated with more rainfall. SB also occurs roughly every 2-3 years, often with rain. Hispa has been around and a problem for as long as he can remember.

PESTICIDE He sprayed against hispa 4 or 5 years ago. Sprayer was a locally-made tin piston one, now broken. Information source for controls is usually the dealer. Hispa is controlled with liquid sprays, SB with granular, e.g. 2-3 years ago applied to standing water in fields. Against both SB and hispa sprays work; he's satisfied with the advice he gets from the dealer (which is why he goes back to him). He has close to 1 ha, uses no herbicide, but does use fertiliser - urea, potash, "TSV". When he started farming in the early 70s free pesticide was available and this is remembered as a bit of a Golden Age - in those days a litre bottle treated a whole field; nowadays a big one is needed {apparently because this was endrin, no longer available - although as endrin used to make the water milky, unscrupulous dealers peddle other stuff which milkies the water, passing it off as endrin}.

A#4. =28.2.01 1100. N23.11.13, E90.05.48. c early 60s. Primarily a schoolteacher who also farms. ~JS. CROPS He has 5 bighas (here 1=50 decimals), 3 bigha of rice and the rest rented out to others who grow tomatoes on them {or jute?}.

PESTS Stem borer and rice hopper are bad here, but hispa the worst; it can damage the whole plant, and is bad pretty much every year, especially when there's been a lot of rain.

PESTICIDE If hispa attacks he seeks advice from the Agriculture Department. He went on a training course at the DAE. He uses liquid insecticide applied with a knapsack sprayer, which he scrounges off the DAE because he's friendly with them - sometimes he pays them, sometimes not. Not all farmers have this advantage. The chemical itself he gets from a dealer. The last time he sprayed against hispa was 3 years ago, on aus crop, which was attacked in May and June (he grows little boro) while plants were still growing and in vegetative stage. He sprayed 2 or 3 times at intervals of 20-30 days. It didn't really work and he's not really satisfied. He thinks maybe the product was adulterated, recalling (though he didn't give it much mind at the time) that the seal on the product bottle was broken when he bought it. It was being applied against the adults only. He's been a farmer for 35-40 years. Hispa was not much of a problem until about 15 years ago - the DAE supplied power sprayers and free pesticide, and these chemicals worked better than the ones available today.

A#5. =28.2.01 1200. N23.07.30, E90.10.30. ~JS. CROPS He has 10 decimals of his own, and sharecrops another 90 for a landlord in Dhaka. Almost all is rice.

PESTS Worst pest is SB because it attacks the main stem and the whole plant dies. Controls are pesticides bought from the fertiliser dealer, from whom comes advice also. Hispa attacks almost every year, but not in winter; it's a bit of a problem but not serious on boro, severe in aus and not really bad on aman.

(A younger more assertive farmer muscles in at this point). Mid 30s. Worst problem for him in rice is BPH; sprays don't work against it. 2 years ago was a bad hispa attack. Insecticide was applied, with a knapsack sprayer (LOK) hired from another farmer, also identified {?} as the dealer from whom he buys pesticide. He paid 10 taka for sprayer hire for 20 decimals (sprayed himself). He sprayed twice but it didn't kill all of them or really work. Some insecticides are better than others - some are good, some bad. Hispa attacks in "rainy season" - May/June. Hispa has been a similar problem on back into the past as long as they can remember. He's not heard of any other controls. 3 years ago DAE gave away a small amount of insecticide, which worked much better than the bought stuff but was not in quantities enough to spray a whole field.

A#6. 28.2.01 1400. N23.02.33, E90.12.61. ~JS. CROPS He usually farms 10 jeshtos (1=20 decimals); 8 he owns, 2 he rents in. This year he's cultivating 12, all in rice.

PESTS Worst problem is SB. Hispa is also bad, but not every year. Hispa has always been a problem when the sky is cloudy. BPH is not so bad these days.

PESTICIDE Against SB he applies endrin granules {?} - applied when they see insects but always necessary. Against hispa he sprays endrin liquid {?}. Some farmers spray liquid against SB too. Most suitable time for application is late sowing - there is less water but the insect attack is quite high. BPH is another problem. Both chemicals and information come from the dealer; the sprayer is hired from another farmer, for a fee of 10 taka to spray 20 decimals. (JS tries to ask why sprayers are hired out per unit area treated instead of per unit time out, but doesn't get an answer he can make sense of). Treatment rate possible is about 300-350 decimals per day. Granular insecticide is good against stemborer. Applied every year but in boro only. Hispa is bad in boro. 2 years ago it attacked, in April-May, and endrin was applied. Last year, BPH attacked at ripening stage, and again endrin was the response. Did it work? - yes - "good" result. Against SB attacking boro furadan granules worked well. He knows of no other controls useable against hispa. He has little contact with DAE, most farmers mainly go to dealers for advice.

A#7. =28.2.01 1500. N22.53.02, E90.13.55. ~JS. CROPS 3 bighas (each 33 decimals), all of rice.

PESTS Worst pest is stemborer, hispa number 2. Both attack in almost every season but not necessarily together. Hispa is worst when the west wind blows, during February-March in the monsoon. SB also attacks boro, in the early stages when the fertiliser is in and plant is fresh green.

PESTICIDE Controls:- Against stemborer furadan/basudrin granules - applied preventatively and in fact already applied, 7 or 8 days ago; applied to soil after transplanting when plants are rooted, but not with fertiliser: things are better if both fertiliser and insecticide are applied, but not at the same time - fertiliser at transplanting, insecticide later. Against hispa liquid dimecron, sprays when insects are visible - last year but not so far this year. Last year it was applied just once and did work; the sprayer he hired from the dealer, though some farmers own their own; information he gets from the dealer or from the label on the container; hispa isn't always a problem, and really started to do damage 5-7 years ago.

A#8. 1.3.01 0730. N22.33.87, E90.20.08. Early-mid 40s. ~JS. CROPS Used to grow aus, aman and rabi vegetables; now a bit of boro instead of the rabi, but it's still largely vegetables, particularly okra. 12 bighas (each 32-33 decimals).

PESTS Worst is stemborer, hispa second. SB bad because it causes the death of the whole plant; this plot right here is particularly badly affected. Hispa and Sb both come in the rainy monsoon, May/June attacking aus, both often come at the same time. Hispa was bad 2 years ago, with the west wind, last year the SB much worse than hispa. He's known hispa as a pest since childhood.

PESTICIDE He buys chemicals, and gets advice, from the dealer. Chemicals are the only controls he knows. When he was 12 or 15 insecticides were supplied by the Government and better than today's; these are not so good. They were so powerful that "even the fish died," he reminisces approvingly. He owns his own LOK sprayer, and has had it 4 years. Before that he borrowed from DAE, or some made their own piston sprayers from bamboo. In the even older days they applied chemicals with cloths dipped in liquid and swept over the plants (this is vividly and entertainingly mimed with a wrap about 4'x6'). So chemicals are less good than in the old days, but application better.

A#9. =1.3.01 0840. N22.28.05, E90.20.45. Farmer walking down the road, interviewed standing outside the home of a landless labourer making thatch by the roadside, who shows great interest in the ensuing conversation. ~JS. CROPS 3 acres. He grows rice mostly, but none right now - he will plant a late boro later, and also aus.

PESTS Does he think that in an area with no boro hispa problems may be less? - well, possibly but not very taken by the idea. Hispa was devastating 4-5 years ago. It comes a bit every year, not always very bad. Stem borer is worst, hispa 2nd.

PESTICIDE Against hispa they don't do anything at all - don't know of a chemical which will control. Used furadan and endrin against SB, but neither was much use. Did they try it against hispa? - no; the DAE, their usual source of information, said it couldn't recommend anything. Hispa has always been here but was particularly bad 3-4 years ago. Endrin sprayed against SB is with a sprayer hired for cash from a dealer. Not very effective. Furadan soil-applied against SB is when attack comes, after transplanting, of aus and to a lesser extent amun; granules are applied after transplanting to flooded fields.

A#10. =1.3.01 0915. N22.25.09, E90.19.79. Late 20s. ~JS. CROPS 10 bigha each of 30 decimals. He has no rice now; aus will be next. Now he has rabi vegetables - chilli, lentil, potato, moong bean, sweet potato, mustard. In aus and amun seasons he has all his land under rice. Aus in March-April; amun in June-July.

PEST BIOLOGY & CONTROL Stem borer is worst because the whole plant dies. Hispa 2nd but also serious. It attacks amun too, but primarily aus, in April/May, where it is worse than SB, the other way round in amun. Why is that? - the west wind, also high humidity. (The full monsoon is in May-June, so hispa apparently worst when it's cloudy but before the full monsoon). Chemical doesn't work very well. Both SB and

hispa are hard to control. He went to the dealer and bought what he recommended but it was no good - he suspects it may be poor quality.

(Somebody else, older, drifts into the conversation). SB is bad every year, hispa not. Boro is not much grown round here because no irrigation water - people grow rabi vegetables instead because of lesser water demand.

A#11. =1.3.01. 1100. N22.16.75, E90.19.47. 35ish. Bearded barefoot farmer - sharecropper. ~JS. CROPS Grows aus, amun and small-scale vegetables. Has 6 jeshto of his own, sharecrops 10 jeshto (1 jeshto=20 decimals). Does other jobs too. His rice harvest lasts 11 months.

PESTS SB is worst pest, hispa too but less so. This year so far no problems. Stemborer attacks in September and October on amun; hispa in May or June in aus - e.g. last year.

CONTROLS What did he do about it? - nothing. Why not? - it was only in a little area. 2 years ago he sprayed against hispa. He has used spiny sticks too, used after spraying, only once, 2-3 years ago; he was told about it by someone from outside, but not DAE. {Implication is that spine punctures facilitate entry of chemical inside leaves/mines, so facilitate insecticide reach to endophages in absence of systemics}. (In the gathered group of 5-8 farmers, 2 tried the spiny branches, and only this once, when recommended by DAE. Will they try it again? - this will depend on the next attack, when they'll probably again follow the DAE's advice). Pesticides are hard to afford - "Who will get pesticides for the farmers if not the DAE?" 2 years ago some farmers could afford them, other not; those who could were on the whole satisfied. There is little point in protecting a small area such as your own little plot, as pests will rapidly reinvade from neighbouring fields.

A#12. =1.3.01. 1200. N22.10.55, E90.15.87. ~JS. CROPS Here there will be an April sowing of fodder crop, then a sort of boro {?}, then they let the animals back in after the rice harvest to feed on the stubble. 2 farmers talked to here - one (late 30s, with an umbrella) has 40-50 decimals, the other (30ish) has 7 acres but it's held jointly and he shares it with 2 brothers and 4 sisters.

PESTICIDE Hispa control was needed 2 years ago - one used endrin but it didn't work, the other used a sprayed liquid whose name he can't remember, which was not effective. The DAE block supervisor had said that endrin was effective but it wasn't. Hispa comes largely on aus, with west wind and the rain. If a field is cleared of hispa it comes back and reinvades. How do they know? - they've seen it - once one field was cleared and hispa came back after 2-3 days. The Government gives advice but no material help.

A#13. =1.3.01 1330. N22.45.45, E90.18.17. Mid 20s. ~JS. CROPS Owns 1.5acres - 1 acre of rice, 0.5 of dhal rabi right now, rice later. Aus and amun will be over the whole 1.5. Feeds family over the whole year.

PESTS SB is worst, comes every year, hispa only bad when west wind blows.

PESTICIDE Against stem borer dimecron is sprayed with sprayer, after the top dressing of urea. Sprayer is hired from dealer or someone else in the village, for 40 taka/day. Granulars are used too, "disteren" {dipterex?} but if put on too early it "hardens" the plants and stops them tillering. How did he learn this? - he found out for himself, he applied it to the water and this happened. So he'll apply to soil later. Also "at least 4 or 5 sprays" - some preventative, some when pests are observed. The dealer says that different insects need different chemicals, so lots of products are needed. One insect is controlled, another arrives. How does he figure out the need to spray when pests observed? - he knows the stem borer moth adult is the same as the larvae doing damage, and splashes off and snatches and brings back two adult moths in a few seconds, to justify the fact that he is about to spray. Hispa too will come - it is worst in boro, which is what this is. No aus here, so next is amun. A few have aus too, but most just boro and amun.

PEST BIOLOGY An older guy (40?) evidently a more substantial farmer, turns up with more clothes on and under an umbrella. JS fears he will muscle in on the conversation but he seems happy to let respondent 1 keep talking, mostly, and after a few minutes sidles unobtrusively round JS to shade respondent 1 (who is wearing only a lunghi) under his umbrella, which is rather touching. He says that hispa is not a problem in amun, and in aus less than boro, and this is because it's less wet. He knows about beneficial natural enemies but not of any particular effect on them of wet/dry weather thus influencing hispa.

A#14. =1.3.01 1630. N22.42.48, E90.22.78. BRRI station; nobody to interview.

A#15. =2.3.01 0715. N22.40.34, E90.16.73. Mid 50s. ~JS. CROPS Sharecropper with 95 decimals of rice. SB is worst pest; H less so. Both insects come almost every year. In what year was hispa last a serious problem? - It already is this year. There was a bad attack 2 years ago.

PESTICIDE Control is by powder with water, sprayed with a tin piston sprayer. These sprayers cost 35 taka and last only one year, so are replaced every year. Dimecron is sprayed v stemborer. 8-10 days ago he sprayed his boro against SB - pest was not visible, this was preventative and he does it regularly every year. This preventative spray is only in boro, the pest is not bad enough to warrant it in aus or amun. On boro he has to spray 2-4 times, mainly against SB. Hispa is not killed by dimecron but by powder. He gets it from the dealer who also provides information about pest control. Sprays against hispa are done on sighting the insects but even so he does it every year. Either 1 or 2 sprays, on boro but not amun or aus. The threshold is by observing black insects, not damage marks.

A#16. =2.3.01 0815. N22.34.90, E90.08.86. 45ish. ~JS. CROPS 50 bighas of 62 decimals each, all in rice.

PESTS H was bad in last amun - 1/2 the yield lost. H is a problem in both amun and aus. The government sprayed from the air in a plane once, about 3 years ago; it worked. H bad in the beginning of amun - August & Septemberish. Malathion is used against H, when he sees the black insects. How many sprays? “Only one” but last year twice. Hispa is never seen as just one - either a huge crowd or none. Spray is with LOK - the

DAE will lend one in an emergency if you're lucky, but he has his own. For information he consults the DAE before spraying. This year a little bit of pesticide has been given free by DAE but most had to be bought from the dealer. The chemicals aren't the same; that from the DAE is better than from the dealer. The quality is very variable, and he doesn't trust the dealer to get quality as good. DAE stuff is malathion or a relative; the dealer's also malathion but not as good. V SB use dimecron. H comes with the west wind, and he explicitly assumes this is blowing it from the Sunderbans.

A#17. =2.3.01 0915. N22.34.42, E90.02.26. 60ish. ~JS. CROPS A sharecropper with no land of his own - farms 5 bighas of 64 decimals each. No boro - aus and amun only.

PESTS SB is worst problem. Last year both SB and H were bad. They tend to be bad together - both appear almost every year, but are worse in some years than others. Abundance varies between years. H comes in the rainy season - most in amun, less in aus. Attacks about 30-50 (30 most likely) days after transplanting, onto mature rice plants but before booting. An old guy looking about 70 reminisces that in "British times" (pre-1947) Hispa was not a problem. H comes with the west wind, blows from the Sunderbans. JS floats the idea H is not coming from Sunderbans but somewhere else nearer, and arrives with the west wind because that's when the weather suits it; this idea is rejected because if H was overwintering elsewhere it would be seen, and isn't.

PESTICIDE H control is by spraying endrin with water. Can also be killed by furadan applied together with fertiliser. Granule application is safe for plants when water is 4 or 5 fingers' width deep. If deeper the chemical is wasted. This information comes from the DAE but from using it he can confirm it's good pest management information. Some farmers borrow a sprayer from DAE; others rent. Not all can always afford pesticide.

SB & H are managed differently - SB with granules, H with endrin. Sometimes there are only a few hispa, and then not worth controlling. Density is not estimated by counting - there are thousands and millions. SB is bad because if it attacks it destroys everything. Ducks definitely eat SB, as to whether they eat H there is a bit of an argument & no consensus.

A#18. =2.3.01 1000. N22.32.67, E90.07.40. 30ish. ~JS. PESTS SB is worst. H comes when aus is transplanted; tranplanting starts in March & April - H turns up about 6 weeks after. So attacks aus plants when smallish - about 18" high. In terms of hispa attack some areas do much better or worse than others - but which do well or badly is not consistent from year to year. This is because of their arrival by air - with the west wind. Losses - if attacked and not controlled 2/3 of the crop may be lost; sprays work - they can recover most but not all of this loss if used. SB is worse, and comes regularly every year. Without it they get 25 maun; with it only 5-7 maun. So do stem-borer attacks vary between years? Yes - a lot. But their severity does not vary between areas - when it's bad in one place it's bad everywhere. H so far this year is down, less than last year.

CONTROLS Dimecron is used against hispa. No knowledge of sweepnetting or any other non-pesticidal control. Advice source is DAE. Sprayer is rented. Sprays once in

aus, once in amun, but numbers of sprays vary - can be up to 3 times on one crop, for example 2 or 3 years ago when attack was v. bad. They consult pest management decision with DAE but buy inputs from the dealer. Chemicals are high-priced. Ducks eat SB but not H. Do they eat enough SB to make a difference in losses? No. Has anybody ever given out free pesticide here? - no.

PEST ATTACK Up until 10-12 years ago hispa populations weren't that big. Why is it different now? - it's all up to God. What has changed about the production system in the last 20 years? - pest attacks are sometimes so bad they don't harvest any aus at all, only amun. In the old days aus cropping was more common than nowadays, so since then aus production has declined - because of pests, largely SB and also hispa. BPH features too - if it comes, as it did last year, it's bad. So last year BPH was bad, H OK: do they come either one or the other? - no, some years you definitely get both.

A#19. =2.3.01 1115. N22.29.17, E90.03.08. Very large and well-off family farm. 1st thing seen is an employee actually sweepnetting. Influential and capable people - a son, in his 40s, is "member" for the ward - the lowest level of local political organisation. They are well connected to local agricultural officials and get advice from them more than from anyone else. The research team is given fresh coconut milk to drink and generally feted. The chap sweepnetting easily leads to the conversation opening with this.

~JS. NONPESTICIDE They've done sweeping for a good few years, mostly against stemborer. Sweeping is done daily from transplanting through to booting. They reckon that with a thorough sweep programme of this kind you don't need to spray.

CROPS Altogether they have rice-&-fish on 3 bigha (about 2 acres=3 bigha {?}); total farm size = 4 or 5 acres, family is 25 people, some here, some in Dhaka etc etc. They've been cultivating the rice/fish mix for 8 years, with intensive sweeping their main insect control - they don't spray at all because of the fish.

A#20. =2.3.01 1250. N22.33.68, E89.58.34. c45. Not many people around because everyone is in the mosque. ~JS. PEST BIOLOGY This plot is 1/3 acre, surrounded by trees - its small size and tree hedge apparently, he says, protect it from both H and SB {clearly implying aerial arrival each crop?}. Right now there is no rice in the field {so these observations can't be tested}. Aus will be planted in March-April. 2-3 km to the West of here is boro in the ground right now. At this time of year insects are to be found in boro wherever it is found. Insects arrive in a big way in May or June, onto plants when standing about 1.5 inches above the soil surface. Arrivals are not uniformly distributed. Why this pattern? - late rice plantings are susceptible to hispa much more than early, possibly because of the softness of the plants at an earlier stage. {GH points out at this point that this corresponds with Zahir's opinion that late-planted rice is particularly susceptible to H}.

(These farmers appear distinctly cagey and suspicious - they may think we are from pesticide companies - we ask if they have had company people coming round asking questions and they say no; we ask if they have much contact with DAE here, they say no - this is technically part of a municipality so part of a town and strictly outside DAE's purview.)

A#21. =2.3.01 1315. N22.37.02, E89.57.97. late 20s. Interviewed with a buffalo pair smoothing a plot of mud for broadcast aus, in a big treeless plain or basin between distant trees. {JS estimates at least a treeless square km of plain}. His buffalo have never seen anything half as weird as JS and are very jumpy, messing up his work a lot, for which JS apologises but he seems genuinely not to mind.

~JS. CROPS He's a sharecropper, with 1.5 bigha (each here 63 decimals). He splits the yield 50:50 with the landlord, yielding about 11 maunds per bigha. From this plot he gets about 385 maunds {?}.

PEST BIOLOGY In this expanse of treeless boro {>10ha?} SB has already arrived - it comes just pre-booting and almost every year comes in huge numbers. Last year was very bad for hispa hitting t.amun. Hit in "ashin" {Bangali language month?}. H arrives during booting but before flower or panicle formation. Is this usual? - Well, it can come at any time in the three Bangla months called Ashar, Sharon and Hadro. Why? - when the Westerly wind comes, then H comes 3 days later, and a week later "this whole area is covered". But it is not uniformly spread over the area but is only on the young plants {JS observes the whole area is a patchwork - with rice plots at all stages from fallow to in preparation to wee seedlings to knee-high plants}. Why is the area such a patchwork of plots at such different stages? - Although it looks flat, some areas are higher or lower than others by tiny amounts, which affect crop development as it's tidally flooded. How long have they farmed here? - his father & grandfather before him. Before last t amun there had not been a hispa problem for 2 years. 3 years ago it was serious. SB won't attack very big and old rice plants, but is less picky than hispa. Both in general like young plants. SB doesn't appear suddenly.

PESTICIDE Last t amun he sprayed against hispa 3 times, but it didn't do much good. The pesticide came from a dealer. DAE supplied a few chemicals too but these didn't work either - these were tried first so he went to the dealer later. DAE's was "Esudrin" - some but not all of the dealer's were better than DAE's. 65 taka per 100g. Ripcord is good v. hispa, sb and other insects. Spray technology is largely their own ideas, more than DAE - they've taken to making up their own minds. He owns his own LOK. Has non-insecticidal control ever been recommended? - No. Farmers who don't have sprayers use furadan. Spray thresholds are chosen by looking at adults, not the whitening of plants by damage - because the whitening is the damage, and so when you see it it's already too late. Do you count the adults to figure when it's worth spraying? - This isn't possible because there are either none or too many to count.

A#22. =2.3.01 1455. N22.35.94, E89.54.06. 2 men in their 30s. ~JS. CROPS 2 bighas at 63 decimals per bigha. This is boro. Plants are about 2.5" high.

PESTICIDE It was sprayed a few days back. The 1st spray is before booting. How is the spray decision made? - by looking for symptoms, not insects themselves. Stemborer is worst problem & worse than hispa. Insecticide is most often applied as a preventive measure against SB. Overall they prefer granules to sprays here, because they have some residual toxicity in standing water. A powersprayer is available for hire. It's good for knocking down adults on the wing, and gets good knockdown. V. Yellow SB and then hispa. Specifically against hispa, how do you decide whether to use granules or a

sprayer? Liquids when adults (of H or SB) are clearly visible and evident; granules when the plants just have things that look like mines or general white patches. If you see insects and spray you get instant knockdown at once. Are fertiliser and pesticide ever applied at the same time? Not general practice, but one farmer round here does a bit - a top dressing of urea with a spray, and from time to time in with granules too. He gets a good result from both.

PESTS BPH is also a problem {but last to be mentioned}. Was bad in last amun. The last harvest was a disaster - ony 30kg from 6 bighas (63 decimals). Amun plant round here is local varieties - low yielders but no particular problems. Overall, yield fails, from all causes together, on a cycle of about every 2 or 3 years.

HISPA BIOLOGY Hispa comes every year, but some years more than others. Up and down on a 2-year cycle. What drives it? - he thinks the weather but doesn't really know. SB is resident (not his word), H comes in from outside. West wind is in March, April, May. Could it be that H attacks a certain stage, and this explains the pattern? Well, thinks H comes in mid-tillering, not earlier nor later. Why might that be? Probably that earlier there's just not enough to eat and later it's less tasty and succulent. {JS has been a bit mischievous in his questioning here, leading on with specific suggestions, but the precision of his reply suggests to me that he really thinks this, c.f. parroting extension-speak}.

A#23. =2.3.01 1415. N22.34.88, E89.51.02. No individual respondent, but a bunch of men, probably mostly in their 40s. ~JS. CROPS Boro rice, IRRI improved varieties.

PESTS Masra is the worst - it comes every year and every season; hispa not so much. Rats are bad in boro: less bad than SB but worse than hispa. There are also problems with salinity here - the fields are tidal and there's a lack of salt-tolerant varieties.

PEST BIOLOGY SB in boro is worse than in amun. 1st week of March is worst. H too is worse in boro. Hispa starts in February. Why the difference? - wind blow; end of February, wind is in the west, and h comes from thence. Isn't it also overcast at the time the w wind is blowing? Yes - this could be a factor in combination. Hispa is dependent on weather. How is the decision to treat Hispa taken? When you see the black adults. How many? You don't have time to count because suddenly overnight there are hundreds. The last big outbreak was in 1998-9, with a long duration of the west wind.

PESTICIDE What did the farmers do? Most used liquid pesticides, he used granules because he believes in persistence - liquid gives a good knockdown but then straight after you get immigration from other fields. Is this the same with stemborer? No. With SB people use 50:50 granules and liquid - it's not the same. {i.e. other people tend to use liquid v H, more likely to use granules v SB, but he is the other way?} Why are they different? Lots of reasons:- (1) When SB arrives there is more water in the fields and it's flowing when SB arrives but not hispa. When the water is this way granules are no good. When this is not the problem and water can be controlled this way suits H better than SB. (2) Granules cost more than liquids. Why not then use granules more against SB as well as H? He thinks granules overall are to be preferred to liquids because more reliable, but also granules are more trustworthy because the risk of

adulteration with granules is less than with liquids {note that JS has not quite followed the logic here, but the arguments seem so clear that this is probably my fault and not the farmer's; at the time of the interview this seemed entirely clear and logical, but on transposition of notes slightly less so}. But aren't liquids in sealed bottles? Yes, but the person we don't trust is the manufacturer just as much as the dealer, so even with an unbroken seal you are not safe from adulteration. Couldn't granules be adulterated as easily? Well, yes, but in fact these opinions come less from ideas about general trustworthiness of dealers than from actual observations about effectiveness {to an extent - JS isn't too sure that this isn't rather put into their mouths}. Most years there are 5 or 6 applications against SB, 3 each in boro and in amun. Against H there are 3 to 6, in boro much more than in amun. But some in amun.

A#24. =2.3.01 1530. N22.29.57, E89.51.97. Mid-30s. ~JS. CROPS Here there's only amun - no boro etc because of salinity. Some upland areas have chilli and vegetables. Coconut and betel nut. He survives on his own harvest 3 to 8 months - say 6. 75% of the family they have to support on sources other than farming. 30 years ago the family's rice lasted 12 months for the whole family. Now: 2 crops, of boro and amun. Boro is declining because salinity's rising with the construction of a canal nearby, built 30 years ago. 1 bigha=66 decimals. They have 12 bighas. 7-8 years back no fertiliser was used; now it's obligatory.

PESTS Masra attacks at tillering but before booting. Hispa comes just after planting (Aug and Sept). Rats are a problem, but not as bad as SB or H.

CONTROLS: v. H 1st is sweepnet, 2nd insecticide
v. SB 1st is light trap, 2nd insecticide
Do these work? Yes. Why? 5 people for 2 bighas {JS at 1st thinks he's saying labour abundance is the key}. How often do you sweep? 2 or 3 times in all of amun. Where did the information about netting come from? DAE but they themselves tried it and it works. Putting up bird perches also works against SB. Where do the nets come from? They make their own when they see attack. When a net is needed, the 1st step is to ask the DAE to loan one, if not they buy the mesh and make one. It all only takes a day. Can I see one? No. The number of sweeps is 2. Do they own a sprayer? Yes.

PEST THRESHOLDS The threshold for control decisions is by seeing insects outside the plants. Do they go out into the field specifically to look for them? Yes. How often? Twice a week. Are the insects hard to see? No - it's easy. When was the last bad hispa attack? 1998. Was it so bad they had to spray? It was so bad they thought the spray wouldn't work so they just ploughed the crop back in. When did they last have to spray against H? 1999 - they swept twice and sprayed twice. Did it work? "OK". In 2000 there was no hispa. 1996 attack was moderate. When you go into the field to look, can you tell if sweeping will do or if it will need a spray? Yes. How did you figure this out? DAE, as expressed as threshold. How is this threshold expressed? If the field actually looks black {!} spray; if not, sweeping will do.

A#25. =2.3.01 1600. N22.38.35, E89.49.11. About 30. Last of the day. ~JS. CROPS 25 bighas of land, each 21 decimals. 5 bighas of boro at the moment; the other 20 are saline and useable only for amun {WPA=315}. 4 family members - the rice harvest lasts for all 12 months with some left over for sale {MCP=48}. Rice and fish and

shrimp. Now is boro, with no fish, fish go in after the end of the boro harvest. Fish can go in with the amun, not boro {does fish make a difference to pest management - do they eat insects?}.

PESTS In both boro and amun you get both SB (worst) and H. SB is worst because "more persistent". SB attacks in the last week of Feb or 1st of March, H at almost the same time.

PESTICIDE Has it come this year? Yes, and he'll spray soon and has already bought the insecticide. He'll spray tomorrow or the day after. The chemical has in fact been bought for use against SB but will do for H as well. In 1995 there were very few insects and he sprayed nothing at all; in every year since then he's sprayed. Which of each of these against which pest? - all of them were against both. Both have attacked in both boro and amun in every year since 1995. Doesn't this hurt the fish? No he uses such low doses the fish are not affected. Dimecron (phosphamidon) as liquid; mainly some granules - furadan, basudrin. When do you use granules and when liquid? Depending on the water situation. Granules can be used only when water is in the fields, but no more than 2.5cm deep or it dilutes it too much. And also no fish. Does he know of any non-chemical controls? No. Another farmer chips in that he was given chemicals by the SAE last year but it didn't work Against both hispa and SB. There were a lot of them. The field was white with stem borer and black with hispa. If the population is smaller will he sweepnet? No. He's lost confidence in the DAE people: they are now avoiding his place, excusing themselves if pressed, saying they've been assigned elsewhere.

DUCKS The ducks go into the fields, and eat stemborer, hispa a bit but much less. Ducks avoid hispa because of the spines. Do the ducks eat enough SB to get some control? Yes. He has his own ducks, and those of a neighbour too. Sometimes ducks are put in specifically for pest control. They don't obtain control, all by themselves, but they make a difference.

THRESHOLDS For all the farmers gathered around hispa comes every year. Are some years worse than others? Yes. So in some years do you spray more than in others? Yes, between 3 and 5 sprays on each of boro and amun. How is the decision made? Seeing insects. How did they learn how to tell bad from not-so-bad insect densities? Just by eye estimation, learnt by experience. This guy has 3.5 bighas. Does he have his own sprayer? No but he can hire one.

A#26. =3.3.01 0725. N22.38.35, E89.31.58. 30ish. ~JS. CROPS 5 bighas each of 33 decimals {WPA=165}. Does the harvest last all year? 3 months, then other employment. 12 people in the family {MCP=36}.

PESTS "Chapipoka" {?} is hispa; "Pambri" {?} is stem borer (the worst). {JS is told by the team that pambri means hispa elsewhere, so be careful with language}. He is standing by his stand of boro. It's nearly booting. SB has already arrived. There's a small caterpillar with a dark head {apparently probably a skipper}.

CONTROLS Control is beating with sticks, so that the adults fall in the water. Not special or modified sticks. If it doesn't work - ripcord. He has a piston sprayer that cost him 170 taka. He's had it 2 years and it only just still works. What happens in an

attack? You see insects or symptoms. 1st thing in is the stick - in fact date palm leaves. You dip them in water with insecticide, then beat. Why do controls differ? If you use a sprayer you hurt fish in the field. Date leaf is good because the chemical stays on the leaves, and so you can use a lower dose. Usually ripcord, sometimes powder. Differences between SB and H? SB is more effectively controlled by leaves; for h control sprayer is likelier to be necessary. Why? Hispa is under the leaves, and so needs a better penetration; you get this with a sprayer. Is there a period when fish are OK to spray? In March & April the water is low, and there are fewer fish, so it's not so bad. Fish are small. Released March-April. Released just after the harvest of boro. Timing: Boro then aus then amun. The fish are in 10 months. At the changeover between rice crops there is never a full drain of the field. Water is always there over aus-amun, March-January. Are there different strains of rice for each of the seasons? Yes.

PESTS' BEHAVIOUR Hispa is mostly seasonal, prefers amun, August-September, then boro, then aus. SB is the same in all 3. When H attacks boro when does it come? January-February, just after transplanting. When plants about 6" high. H comes almost every year but not always serious. It doesn't follow any order. Outbreak every 2 to 4 years. What happens when it is not bad enough to spray? Sometimes they just go. How do you know? We monitor day by day and see if density is going up. If not the adults just go, probably because a neighbour's field is more appetising rice, younger. The population grows by additional adults flying in to join those already there. When they fly off to a neighbour's field they don't lay eggs first. H's favourite time to attack rice is in mid-life-cycle. SB has no favourite time. Why is H less bad in aus? Because the field is dry in April-May, then 10 months of water. Why then is H in amun more than in boro. Because there's more water - up to date. Why does the depth of the water make a difference? H likes it really wet. {JS reflects how readily the farmers answer all this stuff - the conceptual questions of why things are as they are are answered coherently, articulately and quickly}.

A#27. =3.3.01 0805. N22.48.25, E89.25.88. Seems >70. ~JS. CROPS Sharecropper. 1 crop of boro, then fish only. Release fish in March, then in for 7-8 months. Vegetables on the dykes, but no plants in the water. Why not? It's low here, and after June or so the water is man-high, so high that nothing will grow. Fish prefer water which is a little bit saline, but rice doesn't. The sluice gate opens only once a year. What are fish fed? Fishmeal, rice bran, snail shells, wheat and commercial fishmeal. Fish are more important than rice for him. 4 bighas each of 50 decimals {WPA=100}. How much is paid to the landlord? 3-4000 taka/bigha/year. The same division deal covers rice as well as fish. He gets about half, the landlord half. How many people are there in the family to be fed? 16. The rice harvest lasts 6 months, then he sells fish to buy rice for the rest {MCP=96}.

PESTS Worst pest is SB. No severe problem with H. Hispa. H comes only sometimes not always and not a major problem. Why not? H uses this field as a temporary shelter only for a few days, then moves on. To the East. It comes in boro, then moves off East. When? Early February. What stage is the rice at then? Early tillering. Don't they lay eggs? Yes - sometimes they do, and then control is needed. Why are eggs laid sometimes and not others? {No coherent answer}. How do you know they go East? It's when the wind is blowing into the east and they go with it. Wind is going East or South. He assumes they go with it. Can you see them in the air in flight? No.

PESTICIDE Actually they do control just after seeing insects. What control? Spray pesticide. So do you have to use controls every year? Yes. But not all of them need controlling - some do go off to the east. When you spray some are killed and the rest leave - apparently the spray makes them leave. What's sprayed? Carbofuran. Applied with a piston sprayer. It cost 200-250 taka. It's still working after 2 years. Is he satisfied with the level of control? Yes. Are controls different for H & SB? Carbosulfan for SB, monocrotophos for H. You apply both with a piston sprayer in the same way. But you have to be careful for the fish. Are there differences between the 2 in terms of fish risks? No. At the moment the fish are in the canal down the side of the field. They aren't let in until after the harvest. In fact fish and rice are never mixed {i.e. so insecticide fish risks minimised}. The risk is of cross-contamination, by spray drift and by leaks through bunds and barriers. So keep the bunds tight and spray holding the nozzle low down. He hasn't a sprayer but has seen them available for 135 taka. One will last a good many years. An old guy confirms this - he has one and it's the same.

INFORMATION Where does pest management information come from? Their own experience. Well, and some suggestions from DAE and dealers too. The recommendation of carbosulfan for SB and monocrotophos for H specifically came from a dealer. Has he been able to confirm this is good advice? Yes - it works. He's been following this regime of these 2 for 3 years and he's happy with it. At this point JS, who has been leaning nonchalantly against a tree, has a chunk bitten out of his thumb by a large and aggressive ant, drawing quite a lot of blood to general amusement for everybody but JS.

A#28. =3.3.01 0835. N22.49.62, E89.19.34. 40ish. A farmer walking along the road carrying his sprayer. ~JS. CROPS He's on his way to his beel - a plot of marsh where he's planted rice. He has an upland plot as well. His beel plot is 4 bighas, each of 33 decimals, but he's only planted 2 bighas this year. His upland plot is 1 bigha {WPA=99}. On the beel he plants amun, which is not irrigated, when the water is knee-deep, and boro which is irrigated. On the upland area amun and boro. Does the rice harvest feed the family all the year? Pretty much - there are 6 people in the family and it lasts about 11.5 months {MCP=69}. Why this year are only 2 of the 4 bighas of beel cultivated? The other 2 are a little bit more upland, and so need more irrigation, which he can't afford this year.

PESTS SB is some problem almost every year. It comes in mid-tillering. Is SB the same in upland and beel? Well, the upland plots are higher and not always cultivated, because it's more expensive to get the water further uphill. So boro is not always cultivated, but amun is. Worst pest is stemborer. Also is hopper {?}, dark-headed caterpillar {skipper?}. Hispa is "schrappi" {??}. It's a problem in July and August. In the whole year it is number 2 pest, but right now not too bad and it's only SB. Do pests differ between beel and upland fields? In beel you get more hispa. More sb too but less pronounced. The difference is because hispa likes water.

PESTICIDE He's going to spray dimecron. He'll buy it along the way. Mostly against stem borer. Right now almost everybody is spraying. SB is a problem here just now. Sprayer. He bought it nearly 5 years ago. He mended it with a weld. It will last another 3 years. Is this sprayer the 1st one he's owned? Yes. Why? Before this he didn't need to

spray because local varieties were still grown and not susceptible to pests. About 7-10 years ago they switched from the locals to HYVs, but pests came 2-3 years after the HYVs were introduced. Were local varieties less susceptible to all pests? Yes. The transition was with technical assistance from the DAE. Do you still get advice from the DAE on what to do? Not a lot of communication. Now most information comes from the dealer. Is dimecron used against hispa too? No - against schrappi use monocrotophos. How do they feel about pesticide technology in general? It works? They are aware of bad effects. But on balance they're good. Do they know of any beneficial insects? Spiders, carabids, ladybirds. Impressive - how so? IPM training from DAE. No NGO.

NONPESTICIDAL DAE advises IPM by perch-building and sweepnetting. This works in some cases but not others. What's the critical difference between when it does and when it doesn't? When there's an outbreak it doesn't. So is the first step to try non-pesticidal controls? What then? Monitor the field 2 or 3 times a week, looking for a population increase specifically not an absolute level or count, but an increase {recommended by DAE or other extensionists to circumvent farmer dislikes of counting?}.

PERCHES Tell us about perch-building. You put wooden perches in the fields specifically for insectivorous birds to sit on to help them hunt. Against grasshoppers and stemborer it's particularly effective. {they may also eat large numbers of dragonflies}. Spodoptera {littura?} was the worst pest in the 40s, 50s and 60s, but went down when perches introduced. No longer a pest, although largely that in-soil pupation sites are now flooded, which has smitten spodoptera and also ear-cutting caterpillar, which used to be so bad it was largely what the old pesticide buffer stocks were against - all gone now.

A#29. =3.3.01 0900. N22.48.08, E89.13.91. Two men in their late 20s. ~JS. CROPS 30 bighas, of 42 decimals. 10 bighas of rice, 10 of sugar cane, 10 of other crops {WPA=1260. This feeds a family total of 60 people for the whole year {MCP=720}. On the rice land they get 2 crops, and 3 in some areas too small to be significant. What explains the difference? Irrigation - some areas are more easily irrigable. Some bits are more upland, others more lowland, and their properties mean they aren't interexchangeable. When there are 2 crops they're boro and amun. This is probably a hindu community - the women come out and join in the discussions.

PESTS Stemborer is worst, then hispa. H is worst in amun, from just after planting up to mid-tillering. Is hispa attack different in the 2-crop and 3-crop plots? Yes, 3-crop plots have more hispa, because they have more water. They don't have more stemborer.

NONPESTICIDE Are there differences in controls between h and sb? SB you can pick the egg masses and even adults by hand when density is low. When H is low you beat with a stick. Not a special stick. Branches of trees. The aim is to knock them into the water.

PESTICIDE When density is high you spray. How estimate the population size to distinguish high and low densities? Look for insects, not damage. They were told all this by the DAE. No NGOs. For how many years have they used this regime? 5. Does it

work well? Yes, with low populations. What before 5 years ago? Ash dusting and other traditional methods. They did use pesticide back then but not often or organised. There was also a CARE project, which targetted natural pest control. Has he a sprayer? Yes - a manufactured one with a tank, not a home-made tinplate one. No big difference in the active ingredients of insecticides used against SB or H.

NONPESTICIDE Sweepnetting they used to use, until 4 years ago. Were recommended by DAE and CARE, but lately weren't effective any more. Hand catching and sticks are effective only at low pest densities. Are perches used too? Yes. Birds eat stem borer in particular, hispa less. Any source of advice on which particular chemicals to use? DAE. Dealers too but secondary.

PEST BIOLOGY Why have the pests got worse in the last 4 years? Climatic factors. More rain has led to pests getting worse. Have there been any changes in varieties grown? Well, even 5 years ago they were growing predominantly HYVs. But some changes. Any particular ones you can think of? No specifics. When last were traditional varieties grown? 10 years ago. Do old & new varieties differ in pest resistence? Not sure.

A#30. =3.3.01 1005. N22.45.28, E89.06.62. Late 20s. A man interrupted weeding. The field he's weeding adjoins his own - he's doing it for a neighbour.

~JS. CROPS His own rice area is 3 bighas at 33 decimals each {WPA=99}. He now has an "IRRI" boro {apparently a generic term for improved rices like IRs}. It's now in maximum tillering to booting.

PESTS Worst pest is masra; 2nd is BPH. H is not so serious. 5 years ago h was a big problem. Less so now. Why not? Use of pesticide. Until 5 years ago it was bad in 4 consecutive years, but hasn't returned for 4. So was it living locally? No, it comes from outside. So {the reason why it doesn't come back is because} farmers are using insecticide all over, including wherever it is that it comes from. Where does it come from? West. Here we're 70km from the Sunderbans, but these are to the South, not West, so it could be coming from agricultural land, not forest. SB is local.

CROPS Another man buts in, evidently more self-important. Most fields here have 3 crops. But some can't afford the water all the time so only have 2. Last year there was a severe flood. Very unnatural - though to be the Farraka dam up in India. It occurred in November, normally a dry month. Both boro and amun failed. So this late boro is the 1st since. The original respondent is asked if his plot feeds the family all year. Yes - three crops feed 4 people all year {MCP=48}.

PESTS H has been around since the boyhood of the butting-in man {late 1930s?}.

NONPESTICIDE They used insecticide in the past more than since 1995. DAE block supervisor advised sweepnetting, and it is effective. Leaf dipping was done but not as large-scale as sweepnetting. Sweepnetting was not too popular because laborious. He never tried it because it seemed like hard work. One man interjects he thought it not promising - it seemed unlikely to work, with H just attacking the leaves lower down. When clipping is raised, another man says it will just reduce yields. Nobody has tried

it. Sweepnetting probably works with promising conditions. Could be used 2 or 3 times. Maybe insecticide if conditions are severe.

PEST BIOLOGY Can they tell if h is likely to be bad by the weather etc? Yes - if overcast and wet. SB also likes rainfall and overcast. So if SB and H like the same weather conditions, do they arrive together? Largely together. So which season is worst? July-August, amun. Pest attack varies but now, in March, if it rains for 2-3 days both SB and H appear.

PESTICIDE Most farmers own sprayers. Most have piston sprayers, a few LOKs, one a motorised. Is the LOK better than the piston? Yes - it's more effective but costs more. A lot of them have and like piston sprayers - in comparison with LOK they are easier, cheaper, faster and more accurate, but also more tiring. {Overall piston is apparently preferred - possibly to denigrate something they can't afford?} LOKs are on sale at 1000 taka but nobody buys them. So why does anybody at all use an LOK rather than a piston? The piston's only been on the market 7-8 years; there were only LOKs before that. So the LOKs in use are all at least 7-8 years old.

A#31. =3.3.01 1125. N22.44.44, E89.15.62. Interrupted ploughing, for vegetables, on a raised area. ~JS. CROPS Has 2 bighas of rice (each 33 decimals) some distance away {WPA=66}.

PESTS SB is worst. H - 3-4 years ago it was severe. BPH was bad once; not as bad as hispa. H - there are never at all just a few. SB yes. At present he has "IRRI" rice in. He also has amun - 2 harvests a year. SB is bad in "both IRRI and amun". Why no H since the last attack? He doesn't know but it is sometimes seen. What information source re pest management? Dealers. DAE or NGO here? No.

PESTICIDE Does he know any non-pesticidal controls? {Question missed}. He borrows a sprayer. SB gets insecticided 2-3 times in each of boro and amun. He decides it's time to spray when he sees 1 or 2 or 3 dead hearts in the field.

PEST BIOLOGY H was in a big way 4 years ago. A huge "swarm" arrived overnight. So many of them. He sprayed twice. It arrived in June/July/August. Swarm arrived all at once in 1 lump. His 2 sprays were 1 week apart. It was effective - eventually. He applied "Marshall" {?} carbosulfan both times. H has always been common in the past. Family has 6 people; rice subsistence lasts 6 months {MCP=36}. For the other 6 months he works in the fields of others. Here he's just had potato, to get a diversity of vegetables. Does he use insecticide on the vegetables? No, it's not really bad - you don't have to spray.

A#32. =3.3.01 1200. N22.38.43, E89.18.09. Late 20s. ~JS. CROPS Amun only - no boro. 3 bighas, 33 decimals in each {99}. In rabi largely vegetables, mostly potatoes, instead of rice. He has 15 bighas too in the beel area {247.5} {WPA=346.5}. Harvest lasts all year, to feed 4 in the family {MCP=48}. Both his plots are on upland and so not irrigated and so he has only amun on both.

PESTS Worst pest is masra, then BPH, then hispa. H comes only in June and July. About every other year H is a problem, particularly when "rainy season". Usually

arrives in June. It's usually rainy in June-August. So H is worst from when it starts being rainy on into September. H is favoured by what? By rain in a smooth distribution - a series of days each a bit wet favour H more than 7 v wet days interspersed with 7 dry ones. Wind favours H when in the East: if wind is in East for 2-3 days then H comes; if this wind continues then it goes off again, towards the West, without having laid eggs. When was there last a bad H attack? 3 years ago. Since then it has been present but not serious. But it's sprayed even if it's little - sometimes they see just a few and spray anyway.

PESTICIDE Dimecron. Recommendation comes from DAE. They think that if they don't spray, even if only a few insects, the harvest will be at risk. There are usually 3 sprays, maximum 4. Sprays do work. Did DAE recommend non-pesticidal controls? No - sprays only. "Nogus" {DDVP?} is an alternative to spray against SB; it has knockdown effect only - not systemic. The dealer recommends whatever he has in the store at the time. Do you ever spray against both SB and H at the same time? There's no real difference between them in terms of suitable a.i.s. Most farmers have non-tin piston sprayers. They've been available in the shops for 7-8 years. Before that? Used public health sprayers (pump-pressurised cylinders back-carried, c.f. the continually-pressurised LOK). They were for sale in the shops and people bought them or rented. LOK is expensive, but people do still buy them. What advantages has LOK over the piston sprayer? Less tiring. No other big difference {except cost?}. What about the old bounty system paid for catching hispa? They've never heard of it.

RATS Are rats a problem? Yes. DAE has given rat bounties - 3 years ago for 1000 severed rat-tails you got a radio or a bicycle. Nobody here took it up because catching rats is very hard. Was it maybe a success from the DAE's point of view? They don't think so (general laughter).

A#33.=4.3.01 0715. N22.38.36, E89.28.26. Late 20s. His land is 2 miles to the SSW from here. ~JS. CROPS Has 2 bighas of 52 decimals (for both, not each) {WPA=52}. Now he has boro, othertimes amun. Feeds his family of 6 people for 6 months {MCP=36}.

PESTS Pests (apparently ranked by continuousness of presence through the year, more than gravity - masra is always there, hispa less so):-

1 masra
2 caterpillar with dark head
3 cutworm
4 hispa ("peira" {?})
5 BPH

When do they attack? H attacks boro just after transplanting.

PESTICIDE Controls? Insecticide 5-7 times per season in boro; in amun it's usually low, so spray 1-2 times. In fact these are against all pests, not just H. A new man, at the edge of whose field we are standing, comes up; 1st respondent defers to him. In his 30s. Uses "kayodine" {thiodan?} against SB. Does he ever tank-mix? "Marshall" {?} carbosulfan v. H, thiodan v. SB. {JS is unsure if this is one-for-each or tank-mixed - probably the former}.

NONPESTICIDE We look at his field. In 7 bighas there are 8 bird perches {WPA=182}. How long has he had them? 5-7 years ago; he learnt it from the DAE people. Is he happy with them? He thinks they are good but can't estimate or quantify. He sees the birds on them and sees them eat pests - stemborers, mostly. He doesn't think they eat hispa (laughter). He puts the perches out every year. Getting them isn't hard. What is the "application rate" - density per acre - of perches? The more the better - finding branches is the problem, this number isn't really enough, the ideal number would be 50 {!} for this 7 bighas. There are four in his family. The harvest lasts all 12 months, fed from this one plot {MCP=48}.

BOUNTY 2-3 years ago there was a bounty on hispa. He never heard the going rate - just heard about the principle. Why didn't he try it? (Vague answer). Does he know of any other non-pesticidal control? No.

PESTICIDE DAE are quite effective. If there's a problem you have to go to them. Their man is supposed to come to you but he doesn't. Where does information about chemicals come from? From neighbours. He heard that DAE used to give free pesticide, but he never got any. Does he ever tank-mix? No. But he does a top dressing of urea. Wouldn't mixing fertiliser and insecticide save time and energy? He can't afford them both at the same time. He buys whichever is most important at the time. Fertiliser he applies 3 or 3 times to both boro and amun. Urea and gypsum are applied together, phosphate on its own. Why separate? He can't afford both - urea and gypsum are the most important, so applied as soon as he can afford them, then if there's more money phosphate too. The fertiliser recommendation came from dealers. He applies insecticide with a piston sprayer. It's loaned by a kind neighbour. Basic phosphate fertiliser is applied at transplanting, for both boro and amun. Urea attracts pests. Stemborer. The plants become "Succulent" {not the 1st time this word used?}. {Apparently no fertilisers ever applied with sprayers - urea and other top dressings are broadcast, sometimes mixed with furadan}.

A#34. =4.3.01 0830. N22.38.29, E89.38.46. A man in his early 20s, with his father. ~JS. CROPS 5 bighas, all 5 in rice in amun, 1 of rice in boro {if 1 bigha=26 decimals} {WPA=130}. He farms with his father, for 7 in the family. Harvest lasts 8-9 months {MCP=59.5}.

PESTS Hispa is not very common in amun. In boro but at low populations. Masra is more serious. Hispa: there was an epidemic outbreak about 3 years back. {GH opines that the fact that some farmers say H is endemic and others epidemic need not mean contradiction - it could well be real differences in incidence with geography and with luck we will be able to detect them}.

PESTICIDE Sometimes they do spray hispa. Yesterday they sprayed against mostly stemborer but a bit hispa too. So are both controlled in the same way? Sprayed but he can't remember the name of the chemical. One chemical only. He follows the recommendation of his father, who took an IPM course with the DAE, so knows a bit. He himself knows very little.

NONPESTICIDE Does he know of any non-pesticidal controls? Sweepnetting. Anything else? Beneficial natural enemies. Sweepnetting is the only actual practice.

Doesn't sweepnetting hurt the natural enemies? They are picked out of the net and released again. We sweepnet after 3-4 weeks over the whole of boro and amun. 300 sweeps in the field. The net came from the DAE, 3 years ago. This net they got last year. They have 2 nets, one is torn (the older one). Net is 1.5 feet across. You sweep 6 times in boro and amun. The pests caught are squashed. So how often do you have to stop to empty the net? Each 100 steps you stop, sort and squash. Mostly catches SB but some hispa too. Is it effective? Yes. Is it hard work? 4-5 hours to sweep 5 bighas with one net. Usually 2 people taking turns. Has he heard of the bounty system? No. How many sprays are needed? If net collection fails, up to 5 maximum. 1-2 is minimum. Is sweepnetting more effective against some pests more than others? Yes - it controls relatively rare pests better than common ones, so works against Hispa better than stemborer.

12 ducks arrive. They are his neighbour's ducks. He thinks they damage the rice. He doesn't like them. He sometimes warns the neighbour that if he doesn't contain them he'll eat them. He's never heard they can be a good thing, and never seen them eating insects. Does he put out bird perches? Yes. How many? Every 5 to 10 of a local unit of measurement of about 1.5 feet. Effective? "More or less." He learnt this from "ancestors" - an old practice.

A#35. =4.3.01 1005. N22.48.79, E89.44.38. Mid 20s. ~JS. CROPS Boro is in now. 1 bigha of 52 decimals. Also 3 bighas in beel {WPA=130}. Shrimp. It moved from rice to shrimp 5 years ago, because of rise in salinity. Would he rather have been able to stay with rice? Shrimp cultivation is more profitable. The beels are under water.

NONPESTICIDE - ENTER THE DRONGO 4 or 5 perches in the field. 20 would be the right number. Is there any problem getting the branches for the perches? No. How long has he been putting them up? 10 years. The idea came from the DAE. A bird arrives: a black drongo. The birds spend the night in the trees, and take up station on the perches 1st thing in the morning. He sees them eat stemborers and grasshoppers, but they don't eat hispa. The perches are not a source of friction between neighbouring farms.

PEST BIOLOGY They are expecting hispa within a few days. The numbers are quite few but even so controls are beneficial. How does he know that hispa will come soon? Weather; after winter temperature rises. H's arrival is sudden. Thousands of them. H comes mainly at night but some by day. They can see the direction they're coming from and it's the South. Can he see how high they fly? About 25 feet up in the air.

CONTROLS Control methods: sweep (rec by DAE); then pesticide (rec by DAE). Only one of the assembled crowd thinks that sweepnetting is any good. A certain amount of arguing.

BOUNTY SYSTEM Do people know about the bounty system? One man used it: 7 years ago he got 400 taka for 250g of hispa. He got this in 2-3 hours of sweeping on his plot of 5 bighas. The population was very big. This was in late February or very early March of 1994. Did they ever offer a bounty but nobody take it up? Yes - 5 years ago, in late February, they offered a bounty at the same rate, but the hispa population went down and so it wasn't worth the hard work to gather them and so nobody could be

bothered. Old farmers did it less than the younger ones {implicitly because of the hard work involved}. The kill was taken to the DAE office in a plastic bag. The DAE weighed it and gave him his money. He doesn't know what the DAE did with them. How long was the journey to the DAE office? Only 10 minutes - he went just for the insects, not combining it with other errands. It was worth it for the money involved. Later that same year he sprayed. He can't remember if it was the same year that the Government did the aerial sprays.

NETS His net he made himself. It's bought net mesh on a bamboo frame. It's 2.5 feet in diameter {bigger than ours}. A younger man points out that he uses a DAE net which is smaller - about 1.5 feet diameter {about the same as ours}.

VERTEBRATES They complain about the frog population. It used to be high, but since exports of frogs' legs started the population has gone down and pest management has suffered. People catch frogs, sell the legs, and feed the rest to fish. Now frogs are so rare they're not worth collecting. Fish do eat pests. They doubt if fish eat hispa; they think it would be bad for the fish - partly the spines but also possibly poisonous. Frogs do eat hispa. Fish and birds don't. Rats are always a problem. Lots of things eat them, such as foxes and owls, which live in trees. Rats are too big for snakes to eat, except when small. Does rice harvest last all year? The initial respondent says yes, with a family of 3 {MCP=36}; the second says yes for 6 people {MCP=72}, with 5 bighas of rice, 5 fallow and 8 of shrimp {WPA=468}.

SHRIMP He started shrimp farming 8 years ago - again because of rising salinity. A particular shrimp species he calls "bagda" will tolerate saltiness. Are shrimp more profitable than rice? "Undoubtedly." Rice he now grows only for subsistence. Do people farm fish as well, or only shrimp? Local freshwater fish too, in with the rice, moved from canals into fields after harvesting. So fish is miscible with rice, but only after harvest - why? Now (late tillering before booting) the water isn't deep enough for the fish.

PESTICIDE Will sweepnetting ever control hispa without insecticide? No, but it can delay the point when pesticide is needed, so you need one less application over the whole season. Sweep 1 or 2 times. Another man has a motorsprayer, and makes 10 000 taka a year in renting it out. Nobody wears protective clothing while spraying {and we've seen at least 6-7 guys carrying or using sprayers, with no protection at all). Zahir says BRRI did a study on frogs and found their pest control so effective that it asked for a ban on exports from rice and its environment; this was imposed in the mid-80s but populations haven't recovered - possibly because as exports from non-rice areas are still legal, they are being falsely declared.

AERIAL SPRAYS AND SHRIMP 4-5 years ago DAE did aerial spraying. Now shrimp cultivation has increased farmers don't want aerial sprays because of risk to shrimp.

A#36. =4.3.01 1130. N22.57.60, E89.47.10. Late 20s. ~FR. CROPS Has 0.5 bigha; 1 bigha=52 decimals {WPA=26}. Only boro. Production can support a family of 5 for 6 months. {MCP=30} A 2nd man (about 50) has 2 bighas {WPA=104}, with boro and amun, can support 8 family members 8 months {MCP=64}. {GH asks if the nuclear, western family implied by the "mouth.month" unit of measurement is really realistic. In

fact yes more or less - families do split into smallish “western” households, though some do have huge families (and areas)}.

PESTS & CONTROLS Stemborer and hispa both occur every year. They apply granules due to lack of sprayer. Some farmers apply liquid mixed with fertilisers. “Perching” is used for controlling stemborer but not hispa. Sweepnetting and kerosene rope pulling are practised and advised by the DAE. Hispa comes in March. Population becomes high within 2-3 days of first appearance. Sweeping reduces the frequency of pesticide applications. But sweeping alone is not sufficient to control. Sweeping is laborious and farmers are reluctant to do it. Perches are used by dragonflies as well as birds. A farmer trained by the DAE says yes, they are beneficial, they do eat pests, particularly stemborer, but he knows of no role for perches in helping dragonflies to control pests. Most farmers round here have money for pesticides, but sprayers themselves are simply not available. They mix liquid insecticide with urea and broadcast. 4 years ago there were LOKs to rent, but since they have all broken down and so no more hiring. Piston sprayers (manufactured, not the tin ones) are available in the market, but they are hard work and time-consuming and tedious. The kerosene rope? It does work and can reduce the number of sprays needed by 1. Why is the rope soaked in kerosene rather than insecticide? They don’t know. Kerosene is cheaper. Maybe the rope is absorbent and so if insecticide were soaked into it it would be lost in the application process; kerosene’s not so bad. Has anybody ever tried application with brushes or branches? Never. 6-9 perches in 1 bigha is what BRRI recommends, here are that many in a square 20 feet across.

A#37. =4.3.01 1200. N23.03.36, E89.49.45. Mid 30s. ~JS. CROPS 2.25 bighas, of 55 decimals {WPA=137.5}. All under boro and amun. 8 people in the family. The land supports them all year {MCP=96}. We can see 2 labourers weeding, who are working for him. It’s mid-late tillering, plants about 2 feet high.

PERCHES His bird perches are of two sorts - branched, forking branches, or tied-wood “goalposts” - two uprights of about 4' and a crossbar of about 6'. These two designs give a horizontal timber for the birds to sit on, much superior to his neighbour’s, which are just spindly sticks. Masra is the worst pest, then hispa. Loss levels - he can’t say for sure, but estimates stemborer uncontrolled causes losses of 40%, hispa of 50% - sb is worse because this is pretty regular, whereas the hispa figure is for outbreak years. Both are reduced to 0% by controls. He once tried light traps, recommended by DAE. Electric light? No - a lamp; DAE said that “Any kind of light will work.” Did it? No - no good. And not at all cheap. So what controls does he use? Perches and insecticide. Against stemborer. DAE recommend perches. 2 of his perches are equivalent to 25 of the less-good sort. He has 10 per bigha, for SB control. 1 of his goalpost perches can fit 5 drongoes. Don’t the drongoes fight and squabble? Yes, they argue a lot. Are there problems getting the materials for the perches? No. So why doesn’t his neighbour use the goalpost design? Because of the work involved in building them. Too idle. The joints are tied and knotted with jute. (Drongo is “Ducrilis adsimilis” {?}).

PESTICIDE He sprays twice in boro and twice in amun, and “1 additional if hispa comes”. The 2 sprays v. masra are at regular points in the plants’ development - mid-tillering and then the second if there is a lot of masra whenever needed - most often at maximum tillering. Does he ever not spray at all? Well, the 1st spray is used 95% of the

time, but even so is not preventative/prophylactic but is applied on a threshold - you wait and see if there are moths in the fields.

PEST BIOLOGY Hispa comes later, when it is rainy and the wind's in the South. When is this? Early March - mid March. On boro. It does attack amun too, but in smaller numbers. It does not come less frequently to amun than to boro, but in lesser numbers when it does come. Why? Because in amun there is not fertiliser; boro has fertiliser applied to the soil and this attracts hispa. BPH is not frequent, but when it comes you can lose the whole crop. There have been outbreaks twice in 10 years. Why is fertiliser applied to boro and not to amun? DAE advice - he's not quite sure why.

PESTICIDE Against both SB and H you spray. Are the sprays the same or different? The same against both - either granules or liquids, used against either. Sometimes both come together and are sprayed together. The recommendations came from DAE. In general DAE gives good advice and is very useful. 5 or 10 years ago, before DAE gave advice, we didn't have beautiful fields of crops like this one we're looking at. DAE advice is followed for both fertiliser and insecticide, regarding both selection and timing. BPH is very hard to control with insecticide. Also it's often too late when they realise it's come. Use the same insecticide as the other 2 - pyrethroids, karate, furadan. He rents a sprayer. 12 years ago it became possible to rent them. Before that? There was only amun, no boro; local varieties. Insect populations were much smaller. (Local DAE extensionists here are controlled directly from Dhaka; their salaries and so on are all set nationally). Certified seed is available, but less than 5% of the total; the rest is local and kept over.

A#38. =4.3.01 1310. N23.11.63, E89.57.53. Mid 20s. ~JS. CROPS 7 bighas, each of 52 decimals {364}. He now has IRRI boro. He grows t amun too. 10 people in the family. Harvest feeds all year with a bit left over {MCP=120}. He has 10 bighas of upland as well {520} {WPA=884} - vegetables, onions, spices.

PESTS Main pest - stemborer larvae; 2nd pest - stemborer adults. Hispa sometimes comes but is not a major pest. Sometimes when wind is in the south. He builds perches, and the birds feed on stemborer adults. Larvae are controlled with granules. How are the adults a pest? They suck the sap from leaves. He sprays against hispa.

NGO SUPPORT Where does advice come from? BRAC (Bangladesh's biggest NGO) visit more often than the DAE. What is the best thing that BRAC does to help? Provides seeds and microloans - these are more help than technical advice. Overall, is he happy with BRAC? Yes - they're helpful. Where does the actual chemical come from? From the dealer, but when buying he specifies the brand recommended by BRAC. There are no other non-pesticidal controls he knows of. The perch idea came from BRAC. Most other farmers round here follow BRAC advice too. What fertiliser do you use? None at all in amun. In boro: first, at planting, furadan is mixed in with TSP {urea?} and MP (the furadan is always applied); second, urea (or MP) is applied twice, once mixed with furadan (the furadan is always added - preventatively - apparently another of BRAC's ideas); third, one month after transplanting urea (or MP) is applied as at first. {JS is not quite sure he's got this right}. Amun has no furadan, it is all a bit traditional, with local varieties. BRAC is only interested in boro. Why does he follow BRAC's advice on all these prophylactic applications - if they're

preventative how does he know they work? He knows from experience that without controls pests attack. (They obviously have a high opinion of BRAC's advice). BRAC provides the seed, and so if the farmers don't protect it thoroughly BARC comes round and gives them a scolding.

A#39. =4.3.01 1425. N23.23.88, E89.58.71. Early 40s. ~JS. CROPS 2.5 bighas each of 42 decimals {WPA=105}. All now under IRRI boro. This is a deepwater area - boro is the only choice. Harvest feeds 6 people for 9-10 months {MCP=57}. How long have they grown the IRRI var? 15-20 years? What did they grow before IRRI? Deepwater amun. Why isn't deepwater amun grown any more? Big labour demands and relatively low yields. The hard work was largely because there was a very short time gap to get the rice harvested before the tide came in, and sometimes it was under water before it could be harvested.

PESTS The worst pest? Hispa. 2nd? Stemborer. Hispa comes on a cycle of every 2-3 years. The last bad outbreak was in the mid 1980s, then there was an aerial spray. There was another 2 years ago but not a real outbreak. Around now is the time that hispa comes. H starts off in the East side of the sort of bowl which forms this area, then moves westwards. Can he tell if H is going to come? No - it's chance, not climate or anything. In the old deepwater days Hispa and SB both still came, but not as bad as now.

CONTROLS v. hispa. He uses insecticide and nothing else. Uses LOK, rents it. Advice source? Neighbours, particularly one good farmer; DAE only very rarely, their suggestions are general and not specific. BRAC give microloans, not really agricultural advice. Some general advice. There are also small, local NGOs who give loans. Has he a loan? Yes - from BRAC and a local cooperative society/NGO. What was it for? Both farming and household costs, fertiliser and irrigation costs. Does anybody else use non-pesticidal controls? No. (There are no bird-perches visible anywhere).

PESTICIDES Pesticides are applied once or twice, and work. Are there difficulties in application? Getting a sprayer is the hard bit - he has to walk a mile looking for one for rent. Labour - he sprays himself, his 2 bighas take 3 hours.

PEST BIOLOGY How is the decision made as to whether 1 or 2 is necessary? When he sees insects on the East side. {He's not really worried about SB}. 1 or 2 sprays against hispa. If there are only small numbers he still sprays. Why does it start off in the East? The plots over on the E are richer in organic material, so the crop is more luxurious there. Adults fly at a height of 8-10 feet. What stage are we at now? Mid-tillering. Over in the East does rice develop faster too? Yes. Does it seem plausible to him that h likes a particular stage or stages of rice, and so goes 1st to the places where rice is developing soonest? He thinks it's luxuriousness, not developmental stage. Why is hispa worse than stemborer? It can spread more quickly. Without the sprays, what would be the hispa losses? At least 25%. With sprays control is 100%. You get 40 mounds (local measurement unit?) with controls, but about 25-30 without it. Another pest is storks. People put scarecrows to deter them.

A#40. =4.3.01 1515. N23.30.43, E89.52.86. 40s. ~JS. CROPS 1.5 bighas of 52 decimals is all he has {WPA=78}. 2 crops. This is late boro. Early tillering. 10" high.

Amun has to be harvested late (these are the smallest plants JS has seen so far). Amun always has to be harvested late. Transplant is of 50-70-day-old amun. Why is it harvested late? It's their custom. Hmmm. Are these traditional or modern varieties? Amun is an HYV, boro an IRRI. Why is his plot later than his neighbours? He doesn't like to work too hard.

PESTS The worst pest is SB. Hispa not a major pest. Furadan and dimecron are applied, but he doesn't know why or against what - just when the plants look a bit weak. Applies fertilise - TSP, MP, urea, furadan (Is the pesticide always applied? Yes. Why? "It's my fate.") - during planting of both boro and amun. 1.5 months later urea. If he sees any damage at all he sprays liquid. Whose advice does he follow? Nobody - this is his own experience. Always everything is from his own idea: he doesn't listen to anyone but always does what he wants; if it's no good he changes it next year. 4 family members. Harvest lasts all year {MCP=48}. (The others are worried about hispa, and worried that he isn't worried). He applies with a broomstick. "If he sees a problem, he buys some stuff." He splashes it on with a broomstick and "doesn't care if the insects are controlled or not."

B#1. =24.3.2. 1515. N24.03.36, E91.14.70. Approximately 40 years old.

~JS. HISPA DAMAGE Hispa problem is the worst, no other pests. Every year. Four to five years ago it got bad. Why did it get bad? Can't say. An old man gets pulled in. He is about 60. At present the rice will be lost: hispa will take it all. T. Amun is the worst. Boro is bad in lowland, but not so in upland. Lowland boro is soft. Why is lowland boro soft more than upland? It is earlier planted, so worse on earlier planted more than upland rice. It comes in 22 to 25 days after planting. In both boro and T. Amun? Yes.

HISPA DYNAMICS It flies in as adults. Where does it comes from? Don't know. Do you see it fly? No. It is night time. So are you sure it flies in? Yes. Why does it come when it does? Is it the weather? The sky is cloudy. Does it come in small numbers? Yes. Small numbers to start, then more come in. We don't see them go.

HISPA HISTORY Before 25 years ago hispa was not present. Why did it come? He doesn't know, it just turned up.

HISPA CONTROL He uses pesticide but it is unsatisfactory. When he sees hispa he sprays. The d.a.e. officer is the source of information. And the sprayer too? No. He bought his own. L.O.K. is described with some laughter. He bought it eight to ten years ago. It is foreign but he doesn't know where it came from. Can you apply pesticide without a sprayer? Yes - like a brush. Liquid with brush, powder too.

PESTICIDES & DEPENDENCE Another man. The local educated bean with thick glasses like the bottom of a milk bottle. Pesticides are less good than they were, but they don't know why. They blame the dealer. No non-pesticidal controls are known. Have the pesticides always been the same? No. They have been different over the years, but they do not know why.

HISPA HISTORY 25 years ago hispa was not so bad. So when did it become a serious problem? There is a big argument about this: people can't agree on when it became a

problem. Five to seven years. Is it all over the area, or in patches? Patches. Why? We don't know. Young leaves and soft and succulent. The timing of development of the plants.

B#2. =24.3.2. 1600. N24.04.48, E91.15.76. JS is sat regally on a wooden chair. There are pylons and road construction. The whole family. The main man is in his 30s.

~JS. HISPA AS PEST Hispa is the worst problem. They have sprayed the field already so we hope the sweepnetting won't find anything (it doesn't).

HISPA INSECTICIDING Spraying for five to six years. Fifteen to 30 days after planting. Only once. Every year. But it is also when they see the insects: so are the same thing. They see hispa fifteen to 30 days after transplanting. Plants young and green.

IMMIGRATION FROM THE FALLOW They see it fly in. Both day and night. Where does it come from? Some sort of weed. Durbah. A grassy weed along the sides of the fields. Mosadeq suggests _Sinodon dactilon. Ah yes, says the farmer to some general amusement, _Sinodon dactilon. Graminaceous.

HISPA HISTORY Hispa a problem for a long time? Six to seven years. What was it like before that? It was around, but not bad. Why did it get worse? Don't know. Stem borer is about the same as hispa. Masra also got worse, but three years ago. Why? No idea.

BIRDS Masra is eaten by birds, but not hispa. Drongo, but won't eat hispa.

WEALTH AND FARM How many family members? (He looks around to count) 8. 330 decimals. 3.3 acres. {WPA=330}. Feeds all 12 months. {MCP=12*8=96}(Quite a literate and well-off farmer). All rice paddy. Vegetables too. Spinach-type vegetable ("data"? "denga"?). Red spinach. Jute too. This area floods. Deepwater rice too. Fish too? Yes. Pesticide kills fish. In the rainy season you don't spray, so not a problem. Because of fish or because pests are not so serious? It's because they can't get in to spray, in deep. You can't spray from a boat. So it can be bad but they can't do anything. So insects in wet season worse than this season because they can't spray. Do you know of an area where hispa is not bad? No.

B#3. =24.3.2 1640. N24.08.43, E91.19.57. Overall there seem to be more ducks here than in the South.

~JS. Hispa is the worst pest, masra second. For fifteen to 20 years affected. So before 20 years ago were not so bad. Why? Expansion of boro. He's seen hispa in boro. Deepwater amun is less badly affected. Why are some affected more than others? He doesn't know.

Hispa is bad every year. First there are a few, and then more and more. Are they natives or flying in? Natives - developing on the land. He knows he's in a minority in holding this opinion. Only on a rice plants - no alternate host.

Does hispa survive in rice residues? They don't think so: none ever seen in rice ricks or anywhere. He thinks it's in the soil, and miraculously and spontaneously generated in the soil. At the end of the season they die and fall in the soil and regenerate in the soil. Ten years ago. Damage increased from masra too. They use pesticide, but damage is low i.e. not all insects are killed. Used pesticide to be better than it is now? Partially. How long has pesticide being used for? 20 years. At that time what was the problem? He can't remember. Could it be that pesticide made the problem worse? He can't say.

Do the ducks eat insects? Yes. Masra, but not hispa. You said you know you are in a minority view: so have you talked this over with other farmers? Yes: he and a few others all think it is spontaneous. Not all. A farmer butts in who does not agree. He thinks it immigrates to some, spontaneous in others. (I.e. trying to smooth disagreement by saying both views possibly true) . What are the characteristics of the areas where the arrival is spontaneous? Fertiliser overdose.

Boro. T. amun. Vegetables in the boro season, then broadcast amun. Do you ever see hispa anywhere other than in rice? No (quite emphatic).

Are there any non-pesticidal controls of hispa? No. So 30 years ago what did they do? Biological control: neem oil. But no neem any more? No. Why not? Neem doesn't work any more. Does hispa attack at characteristic times? Cloudy weather (relative humidity?). Not rainfall.

Does it move around a patchwork of fields in each area? Yes, because of soft leaves. Are they emerging in this pattern, or moving? Moving. So they start in emergence, then move. So are heavily fertilised plots earlier than the others? No: heavily fertilised plots are not the first to develop.

The timing of arrival is not dependent on fertiliser. Do they ever see hispa mating, eggs, or larvae? No. Adults are all they see and know. Is there any relationship between hispa and irrigation? No relationship.

B#4. =24.3.2. 1740. N24.07.76, E91.22.32.

~JS. 25 kani, each 30 decimals. The worst pest is hispa, then masra. For how long has it been bad? One says seven to eight years in the high land. Another says fifteen years in the low land. Why? Water. Stem borer too is bad in both high land and low land. More than 15 years ago it attacked only seedbed, now the crop. Why did it do that? Intensive use of fertiliser and pesticide. Reduction in beneficial insects. And reduction of frogs and toads: ate stem borer and hispa. Did they see them eat them? Yes. When used cowdung was better than fertiliser. Fertiliser and pesticide have ruined the land, cowdung was better. Pesticide kills good insects. Does hispa fly in or is it native? Flies in, first a few, then more and more. From which direction? Don't know. Day or night? Night. Does it go away again, leave? After seeing adults they spray, so don't know about going. Because they kill the adults as soon as they see them. Insects are worst in the rainy season. Hispa and stem borer both. Do all farmers spray? Yes. We don't kill time. One or two or three times. Do large farmers spray more than small farmers? Small farmers sometimes use neem. He believes sprays should be done on Saturday and Tuesday. Because his father did this.

B#5. =25.3.2 1130. N24.25.68, East 91.23.72. MH looked here in the survey in February and found no hispa.

~JS. Masra is the worst pest, brown plant hopper second. A new problem is rotting of the stem, below ground, very similar to that at Madabpur.

In the monocrop area: boro-fallow-fallow; or vegetables-fallow-fallow. 5 percent of area is broadcast amun, but not here. In nearby areas. Why not here? Too deep and it can't keep up with rising water level. In "haor" area (very wet floody land) hispa is completely absent. Before ten years ago it was present. But sometimes you see one or two.

We are all sitting comfortably in the tea house. Mostly we talk with one man, who others watch talking but doesn't seem richer or posher than the others. Hispa is not quite completely absent. Why is it not here are any more? Impact of integrated pest management. Over ten years ago there were no pesticides, when pesticides came it's now gone. (In the conversation the English words "spray machine" and "dealer" are very audible) (& JS suspects "IPM" is in fact "spraying"). No problem with the rental of spray machine from other farmers. Is boro the only crop? Yes. It is sprayed once, one or two times, it depends on the damage. He investigates his farm with the DAE people and follows their advice. Everybody sprays. His farm is 40 kairs, each of twenty eight decimals {WPA=40*0.28=1120}. Quite a big farmer, for here (yes). Do people with small farms do the same pesticide use? Yes. Use the same amount. The small farmers sometimes use higher doses than the large farmers. Because the small farms are cultivated more intensively. There are 12 in his family. His harvest lasts all year {MCP=12*12=144}.

What are non-pesticidal controls? Sweepnetting. Neem. Birds against masra. But we've no experience. Do the birds eat hispa as well? No - only masra. Where does he know about I.P.M. from? DAE. And training from B.R.R.I. too - quite close. And an N.G.O. called "heart" {?}. To ask about neem: has he tried it himself? Yes. Is it effective? Yes. Does he sweep too? Yes. Every year? Yes - one to three sweeps.

What other differences are there from ten years ago? BR 9 has been replaced by BR 28 and 29. Is fertiliser any different? Ten years ago it was one heavy dose of fertiliser, now he uses a more balanced dose two to three times. This changed ten years ago.

B#6. =25.3.2 1200. N24.26.34, E91.23.06. A solitary farmer with wife and two children. Apparently Hindu: red spot on wife's forehead.

~JS. The worst problem is masra, hispa is second. His farm is just here. It is ten "kair" (= "kani"), each twenty eight decimals. (We are in a large big flood plain, villages are islands and roads on causeways - very different from yesterday.) He has one boro - the only crop in the year. There was heavy weather last night, hailstones have damaged his crop. Hispa has been present for 12 years. And before? No hispa. Why did get worst 12 years ago? Expansion of boro.

The bus comes and the first farmer gets on. We are left with another farmer, also perhaps Hindu (he wears a little necklace). What are the differences between areas with different hispa populations? He doesn't know. Before boro there was no hispa. The rice was the local Deepwater amun, broadcast. "Lakki". Is it still grown any more? No: replaced by boro. Why? Higher yield.

Another man walks up. He has no farm of his own. He knows nothing. All the people here are reluctant to talk and not chatty - they are depressed by the hail damage last night.

B#7. =25.3.2 1240. N24.27.62, E91.22.33. Three men in their mid 30s to Forties, walking down the road. More people turn up all the time.

~JS. Worst pest is masra. When it is a problem with you go to the dealer. Fertiliser seller. Second is rice leaf roller. (This is from a smarter man with an umbrella). Third: Hispa also. In Deepwater rice and amun. (Masra is worse than hispa in boro).

The amun is a small area, so the insects go there and are bad. {The implication is that the amun area is small, but the entire hispa population from other crops migrate to it and have to fit in, so result in a high pest density (note the assumption here of a population of static size which is moving about)}.

Hispa is particularly bad in late planted boro. Why is it bad on the late boro? The plants are tender, also because there are fewer of them. So are the hispa reproducing? No. Where do they come from? From grass, and then flies into fields. Stem borer comes from stubble, hispa from grasses. At the end of boro, there is some ratooning from cut stubble. The water rises and you can see the hispa climbing up the ratoon. Is the hispa in the cut stubble or only the ratoon? Now it is only in the ratoon, not the stubble or dead plants. Only when green and tender and young. Stem borer _is in the stubble. Stem borer is also in grass and migrates; at the end of the season stem borer resides in the grass. When the water level rises above the ratoon where does the hispa go? To grasses on higher land, and water hyacinth.

Hispa has been a problem for five to ten years, not before. It is getting worse. Why? Because of fertiliser: makes plants succulent and soft. Urea makes plants succulent and have a vigorous growth. Almost all areas are covered by hispa - they know of no areas with different situations. The weather makes a difference.

Controls: pesticide mixed with potash. Basudrin. Used as a granular mixed with potash. It works against hispa and stem borer. Only granular is used. It is put into both boro and amun. Grains are better than sprays because this is the rainy season and sprays will wash off (this is probably right). Are applications prophylactic or when you see the damage? When you see one or two insects. The same rule for both stem borer and hispa. The application is one time only in both boro and amun.

Crop patterns:
1: boro - fallow - fallow
2: broadcast amun - boro - fallow
3: (in some places) broadcast amun - fallow - fallow

Are there are differences among the three in pests? No: the pests are the same. The pests can be worse when boro follows amun.

Which birds eat stem borer? Drongo. Unknown birds. Ducks also. No bird eats hispa.

There are 10 in the family. The harvest feeds all year {MCP=10*12=120}. 17 kairs (1 kair = twenty eight decimals): ten kair in boro {1}; four kair in amun {0.5}; three kair in amun with boro {1} {WPA=0.28*(10+3+4/2=420}. Why are some areas cropped differently from others? Differences in the topography of the land. They tried to grow tomato and potato. No success. Insects and diseases. He alone tried. If all farmers grew them he could do it as well. Do frogs and toads eat insects? He's not seen them. Toads eat insects but he's not seen them.

In the fields we see bags on stakes looking a bit like scarecrows - they are not scarecrows but to warn other farmers that the plot has been sprayed. Out to the north the ground seems to rise slightly.

B#8. =25.3.2 1400. Late Forties. N24.30.58, E91.22.29.

~JS. Masra is the worst pest. Then there is a new problem - the rotting of stems below ground. He has no knowledge at all of hispa. Once only: in his life: two years ago hispa got bad. Why? He doesn't know. What crops are grown? There are two systems: boro - T. amun - fallow; or T. amun. Have these changed? No, but the varieties have. T. amun is a local variety - no changes. But the boro has changed - B. R. 8 has given way to modern B.R.s.

What are the differences between the two crop systems? Lack of irrigation. Does he ever see a small number of hispa - anywhere at all? No.

There are 14 in the family - four daughters, five sons, three sons work outside. He is landless. Sharecrops: 13 Kair. The harvest does not last all year. "He is a poor farmer." What controls are used? Pesticide: he and the landlord share the cost, he does the work. Do pest control methods differ between the rich and poor? No. (M. catches two adults in twenty sweeps).

B#9. =25.3.2 1500. N24.31.23, E91.29.69. Two men - one in his 20s, one in his 40s. They are landlords, not farmers. With them are 2 thin young men. They call over the farmer a bit peremptorily. He has a moustache and muddy feet. In his late twenties. A large crowd gathers.

~JS. Hispa is present. It is the worst pest in seedbed; attacks the crop too. Hispa is the only bad pest here. Serious. It got bad three to four years ago. It was last bad two years ago. Why is it bad only sometimes? Don't know. What happens when it attacks? He thinks it flies in. From where he doesn't know. The worst season is T. amun. The cropping patterns are either T. amun or T. amun and then boro. Are there any differences between them in hispa behaviour? No difference they can see. Is hispa different in different areas or is it as bad ball over? The damage in some areas is worse than others. Why? Greenness and softness of leaf.

Are any areas always better or worse than others? Yes, in terms of rat damage.

Is hispa usually in a big crowd, or just a few? First a few and then more and more. Do they _ever see just a few? No. Is it ever seen outside the rice fields? No. When it is in the crop what is it that it does - Do you ever see them mate? Lay eggs? Babies? No. How do they do their damage? The adults eat leaves and the leaves go white: some know this but others don't. The rat is worse than hispa. {Hispa apparently is not too bad a problem}. There are 10 people in his family. He sharecrops off these men.

Last year he farmed 12 kair. The amun season can be bad. But not in the last two years. Rice leaf roller is a problem worse than hispa now. Why is hispa in some years different from others? Don't know. It attacks the worst in the late planting and seedling stage. What controls? "Medicine". Spray with machine. And prayer to Allah for remedy. For how long has he used the spray? Ten years ago. Why was it first introduced? Don't know. In fact nobody here had anything to do with it: this is a very young crowd. Are there any other non-pesticidal controls? In some areas they catch by net but not here. And you can lower the immigration to the fields and this helps the problem. Do they do this? No, but they've heard about it. Why no use of a net? No net. If the DAE gave a net they'd try it, but not on their own initiative.

We produce a hispa in a jar and they don't recognise it; M. thinks they can recognise a mass of hispa, not one individual in a jar.

B#10. =25.3.2 1625. N24.34.40, E91.32.38. A man a with one eye missing and a very old man.

~JS. The younger man is the owner of three kair (each twenty-eight decimal) {WPA=0.28*3=84}. He doesn't distinguish any insects. Amun is the worst. Two crop systems: T. amun and Boro, and T. amun only. Do they differ in insect pest attack? Boro is more affected by insects. Why? The younger man doesn't know, but the old man says that in the Boro it is worse because the Boro stays on as stubble and ratoon and both can be hosts of insects. He hasn't seen them but this is what he thinks.

Control is by pesticide spray. No other methods are known. Pesticides came in 15 to 16 years ago. Before this there were no insects. Why is that; why did they get worse? Impact of fertiliser: its use led to increases in production. New varieties and fertiliser altogether: susceptibility increased so pesticide use increased too.

How many in the family? 3. Does the harvest feed all year? Six months, than six months in another job - rickshaw driving. {MCP=6*3=18}

B#11. =25.3.2 1635. N24.35.46, E91.35.93. ~JS. A bunch of children produce a plastic bus to show JS. It is still in its box which says "Protect the environmental" and it plays a terrible tune. They recognise the hispa in the tube but they don't know its name. It is the worst pest and they know it well. More so than stem borer. T.amun is worst.

Here is T.A. only, but Boro too - close by. Why is the additional Boro over there? Water. Is hispa different over there and over here? Yes - it's all over and everywhere, so it is the same, but not now {apparently differences in timings of appearances}.

Pesticide use: (a lot of animation) Is it used every year? Yes - in all years in T. amun. Are there differences between years? A bit. Why is it in some more than others? Don't know.

Hispa has been here for 30 to 35 years. There has been no change. It has been the same over the years. There is more hispa if rain. If storms then hispa is less abundant. Do you ever see just a few? At first a few, then more and more. Or do you ever see them outside the rice fields? You only see them in the rice field. Where does it comes from? He doesn't know. If they did know they would destroy it. It arrives from outside. Do the sprays work? Yes - up to a point. If after spraying it's windy or rainy the numbers go down; if not hispa comes back and you have to spray a second time. Many times for scarcity of money they can't afford to spray. Nobody ever sprays more than twice. Large farmers use pesticide more than small ones. The information comes from the dealer. Does it ever come from an N.G.O. or the DAE? No - you go to the "pharmacy of insecticide".

What happens at the end of the season if hispa is not controlled and is abundant? They don't know. Possibly they fly away somewhere else.

He has 4 kair. {WPA=0.28*4=112}. 5 family members. The harvest feeds all 12 months. {MCP=12*5=60}.

Do you ever see hispa breed or lay eggs? No - you can't see. Maybe it breeds in the soil - you can't see. When plants are young and soft it eats the leaves and the plants go white. Once the hispa was killed by a net, but not like ours (which M. is carrying) - by fishing nets with a fine mesh, two people dragging it through the field. They did it once but the population was not reduced by much so it stayed large. This was two years ago. They won't do it again. It didn't work enough. This was his own idea and initiative.

B#12. =25.3.2 1745. N24.31.67, E91.29.94. A man of about 40, and another of about 50 with a white beard and one eye.

~JS. Masra is worst but hispa is second worst. Are they both present in every year? Yes - both in every year. Hispa when the leaf is young and soft, after 30 days after planting. In boro - boro only. Broadcast amun is not attacked by hispa. It arrives from the air. One other man says that amun too is attacked by hispa, a short brainy-looking fellow and everybody starts to defer to him. And attacks the seedbeds. The short man holds forth. He says that hispa is worst.

Do they ever see hispa anywhere else, outside the rice fields? No. Is the damage more in some years than others? Yes - damage differs year to year but they don't know why. Others say when there is rainfall the damage is worse. Does it differ from area to area? Yes, but they don't know why. Is it always in large numbers or sometimes just a few? Sometimes just a few, it varies between place to place.

Sometimes the pesticide fails to work, but he doesn't know why. He sprayed it on the hispa but it didn't kill it. Any non-pesticidal controls? No. Sometimes you plant a

banana tree on Saturday or Wednesday; this came from grandfather (says old man) - he believes it does good. It is not used but some people believe it is useful also.

Hispa has increased over the years, but they don't know why. How many years ago did it become a big problem? Eight to ten years. Have there been any changes in the farming system at the same time - associations? Varieties changed at the same time. Now there is ploughing by a little tractor, three to four years ago they used cows.

There is only boro - a monocropped area. New varieties now produce well. The most common one is {BR}29. But might it be more susceptible? Yes, they think so.

When he sees hispa he uses pesticide. Any hispa at all, or lot of them? Only when he sees a lot. There was only one time he used it. It didn't work so he hasn't used it since. Big farmers use pesticide more than small farmers. Hispa is seen on bison grass too. Has he seen it on grass? Yes. Do you see it out of the rice season on plants other than rice? Yes. He is emphatic. On weeds or grass in marshy fields. In lowland waterlogged areas.

There are 24 family members. 30 kair of land, each of 30 decimals {WPA=0.3*30=1000}. The harvest lasts 12 months exactly if a good harvest, a normal year - it is just balanced {MCP=24*12=288}.

An old white-haired man starts grandstanding. A big bird flies past. This is "Paskanda". It eats hispa. It is a good bird. (It looks bigger than a drongo). Do they put out perches for the birds? No. There are too few birds to make a difference. Fewer birds than they used to be. They don't know why. The drongo eats them too. Frogs and toads too? Yes. Seen them eat masra. All eat both hispa and masra.

B#13. =26.3.2 0810. N24.18.07, E91.39.74. Interview in a local house - a bit crowded and rowdy. We are up in the hills; the surrounding is a mosaic of rice and tea. They say the nearest tea garden is 2 km away. A man with quite exceptionally sticking out ears.

~JS. The worst pest is hispa, then masra, brown plant hopper is third.

The first man goes off. Four men in their Twenties and Thirties. Three crop systems:
- (on the higher land) vegetables and then T. amun
- T. amun is also grown
- boro and T. amun

Hispa is the same in all three. When does hispa attack? In November is attack. T. amun. Boro is attacked too. Does hispa emerge as a native or does it immigrate? From outside. But they don't know where. The see it fly in in the daytime but they can't see the direction of arrival.

It is sprayed with kerosene mixed with insecticide. Why is it mixed? Because the mix works better than pesticide by itself. Kerosene is also what you can drown hispa in when you catch it. Where was this learnt? Our experience: native farmer knowledge. How is it caught? By hand, then drowned in kerosene. JS draws a sketch of a sweep net: they have no knowledge of nets. Have they access to information? No - no DAE or

NGO. All learnt themselves. So if you drown them in kerosene do you not have to spray? Sometimes. Does this work with masra to? No: all this is just about hispa.

Hispa comes in at different times to different plots. Why? They don't know. Do they see hispa mating, laying eggs or reproducing? No. No idea. Do they see masra reproducing? No. Do they sometimes see hispa in the fields but not masra? Yes. Hispa turns the leaf from green to white. What does masra do? Turns the leaves red. Do they see hispa outside the rice fields? Sometimes on grass. Including in the fallow, when there is no rice? Yes.

Grass is also damaged by hispa - it can go white with hispa damage. Do you ever see masra outside the rice fields? No. The insecticide was introduced first from 20 years ago. Kerosene at seven years ago: added later. Because pesticide alone did not get good control. Are both the uses of kerosene at the same time? {No answer}. How long have you been catching hispa by hand? Usually they don't, only for test or trial, it is not done as crop protection. DTT is banned now. Why is hand catching not used? There is no profit: it is hard work and not good control. A jute rope soaked in kerosene and dragged through the field works. Useful. They used one pesticide in tea gardens {Thiodan, apparently}, they don't use kerosene in tea gardens. Are any of the same pests in rice and tea? No. Have there been any trends in time over the years, including hispa? Some years more, some years less: hispa and masra both. If it rains a lot you get a lot of stem borer. Do you ever get just a few hispa? Yes. So do you not need to spray every year? Usually he uses it: preventatively.

Some farmers spray on sight, he doesn't - preventative. Have things been getting better or worse as a trend over the last 30 years? He can't tell because of differences from year to year. He has four kair of land, each of 30 decimals {WPA=4*0.3=120}. Eight family members. If you irrigate, and get a good yield, it lasts five to six months {MCP=5.5*8=44}. If not, it lasts less. Irrigation is needed. The boro needs irrigation. A fresh source of irrigation - a deep tube well (or river).

B#14. =26.3.2 0920. N24.20.21, E91.49.26. Altitude 130 ft (all until now have been below 80 feet). Near the forest reserve. N. talks to a single man of about 30 by the side of the road. J and M talk to a very chatty man and woman by the side of the road.

~JS. Ratoons are visible in the field - what are these? Ratoons of T. amun - ended in December; it is big for volunteer ratoons. Less so in aus, coming up next. Two adult hispa and some damage are visible: hispa is very bad here, it makes the whole plot white. Sometimes it is so bad they apply Endrin. (Leeches are also abundant, JS observes apprehensively).

Why is hispa so bad? It is always bad but varies from year to year. It is bad when it rains heavily. (JS asks does this mean it comes in the rainy season or is it worst when there is a lot of rain? Not understood.) Sometimes they broadcast potash or cowdung to try to control it. Basudrin is okay: Mix it with potash and scatter by hand. They don't see hispa outside the paddy fields but they do see it on volunteers and on _grasses volunteering in the paddy. They even see hispa _damage on grasses. They have 4 kair of land, each of 30 decimals. Why is hispa so bad here? Abundant in hilly and bushy

region; here is very near the forest region. So hispa comes in from the forest?. They don't go to the forest so they don't know. A calf stands on JS's foot.
The characteristics of the weather. In the jungle and hilly area there can be a lot of rain at any time. Hispa is not associated with a particular weather pattern. Do they get advice from the DAE? No - this is all their own experience. But they do look at what other farmers do and do that. Is there always a T. amun ratoon like this? Yes. Does it always have hispa in it? Yes. Aus will go in in two months time.

There is stem borer too: the second pest. Stem borer is bad every year, hispa not every year. Why is this difference? Don't know. As the wife is very chatty and does the talking JS and M ask if they are Muslims or Hindus - Moslems. There is a lot of immigration here of people from the plains into the less populated areas.

B#15. =26.3.2 1015. N24.21.55, E91.52.04. Alt 130 feet. (Photograph taken of late paddy by fallow). JS sweepnets (drawing a huge crowd of fascinated villagers). N. and M. interview a (much smaller) group.

~MH. Farmer used Thiodan (farmer called "thirtin") for hispa, and works well. Hispa is available in the month of Srabon (rainy season). All field infested. Doesn't know the source. Ralothrin, Shoficron control well. Get advice from Block supervisor of DAE. Last year damaged seriously. Need 2-3 spray for hispa control. Hispa came by flying. Problem since 4-5 years but not before. Sharecropper of approx. 1.5 acre land. Harvest feed all year. Cropping pattern (CP): Boro-T.Aman and Aus-T.Aman-vegetable (cauliflower, tomato, sweet gourd, bitter gourd, cowpea). Do sweepnetting if they got from DAE. Never use sweepnet before. Only three months ago got sweep net from DAE.

B#16. =26.3.2 1045. N24.24.39, E91.55.55. 102 feet. 2 men in early 20s. JS takes a picture of N & M with the net.

~JS. Worst pest is masra (here "manjara"). No it isn't - worst is hispa, 2nd rice bug, 3rd masra. Hispa attack so bad that nothing is left.

When does hispa attack? Worst is in T. amun.

One cropping system here is T. amun to Boro. Some have T. amun to aus. Where does hispa comes from? It comes in from hilly regions. Does he see them arrive? Yes. Does he see them in hilly areas? Yes. What kind of plants are they found on? A wild flowering bush. Purple flowers. JS takes two photographs. He's definitely seen hispa inside the flowers of this out of season. He's sure it's hispa? Yes. He says hispa can also cause shrivelling of rice seeds, but M. says this is something else {“Rice abundant”?}. He does confirm from a drawing of hispa by JS that this is hispa. Masra kills the plant, feeding off it. Hispa in some seasons is bad, sometimes more or less. It also varies from place to place. Masra: he produces a stem with a larva inside. (Note he knows exactly how it causes damage and how to identify plants suffering from it and to take and dissect them). Is hispa worst near the wild hilly areas? Not sure.

When he sees a few hispa he sprays them. Are there ever just a few? No: you start with a few, you know that more are coming. How long has he been using pesticide? Five to

seven years. Year by year both hispa and stem borer get worse. Why is that? The medicine doesn't work as well. He's tried different chemicals before now, but can't remember. Furadan is okay. Some are better than others, others worse. Before he started using pesticide seven years ago, was hispa worse? No. Before 4 to 5 years ago the government sprayed from the air. For how many years before that? Two years. It was effective. So they started using their own pesticide when the government quit. So before the government started did they apply pesticide? Don't know. He's too young, but he's _heard that back then Endrin was used. Has he used Endrin? No. It's very dangerous, he knows. Now he gets from the market. Furadan is okay. DDT powder is okay.

How many times does he apply? One to three times in both T. amun and boro. Why does ait differ? It depends on the damage. Not everybody uses pesticide. Why is this? Large farmers don't care, have a lot of land. The small farmer cares more.

He has 5 kani, each 30 decimals {WPA=5*0.3=150}. 5 family members. The harvest lasts all year {MCP=12*5=60}. In a good year a surplus: 30 to 40 months {?}. There are lots of drongoes: do they eat hispa? Yes. Do they eat masra? No. Do people put up perches? Yes - people do. He also does. So why are there are none now? Not a lot of insects just now. Does he know of any other controls? No. Is he in touch with the local DAE? No. No N.G.O. either. So where does information come from? The dealer suggests products, and the label of product on the container.

B#17. =26.3.2 1155. N24.30.88, E91.58.64. JS sweeps. One hispa in 30 sweeps. The farmer seems about 50, with sticking-out front teeth.

~MH. Stem borer is the worst, then hispa. 11 family members. Surplus paddy goes to sale. Last T. Aman serious damage occurred due to hispa (called Zia pok). Don't know the source. Sprayed 2-3 times but did not work well. Within 3-4 days population increased much. Collected insecticide called 'holland' from the Duncan tea garden and applied it by broom or bamboo leaf stick and it worked. Knows the stages of hispa. Furadan/Basudin don't work.

~JS. The first farmer we've found who knows the life cycle of hispa. Does he know where it goes in the fallow season? No. Neither do we. M. asks his age and he says 60. (Laughter).

B#18. =26.3.2 1305. N24.34.33, E92.04.62. Farmers gathered in a little tea house. Smell of woodsmoke. All are farmers. A dozen men, from teenagers to their sixties.

~JS. Hispa is worst, then masra. Huge enthusiasm for a photograph of hispa. Now masra is doing damage. So when does hispa attack? 15 to 30 days after planting. Amun is attacked, and so are seedlings.

They have amun, boro and aus. Two cropping systems, both monocultures:
1. Boro - fallow - fallow
2. Amun - fallow - fallow
Boro suffers more than amun. Why is that? Doesn't know. A lot of arguing. How does hispa come? A few at first, then more and more. They fly in from outside. Where

from? They don't know. You see them in grass. Grass is also damaged. In the fallow period. Is hispa bad every year, or some less than others? It is bad every year since 10 years ago. What happened 10 years ago? Don't know. The big man says the expansion of boro led to it. High yielding varieties, not irrigation. Since then irrigation has increased, but there is no relationship between hispa and irrigation. Others disagree and say the increase in irrigation led to increases in hispa. Why? When the water drains out, the hispa goes. At the end of irrigation, you drain out and hispa goes. Does it die? No: it flies off. Hispa migrates around a cycle of crops, from boro to amun to seedlings and back to boro. About 10 years ago there was no hispa until this change. They agree the closing of the fallow cycle is quite likely the culprit. Do they see hispa reproducing? A minority: 1 says yes. Lays eggs on leaves of rice; then hispa emerge (possibly seen because there are little and big hispa). On amun or boro? Both. The whole population goes up year-on-year. It is always going up, not fluctuating up and down. Masra is also a problem. Increases year after year. Do you see masra reproducing? No. How does masra do damage? It turns the rice red. They don't know the masra life cycle. "Masra can't fly." {Oh dear - clearly for them "masra" is a larva, not adult - this is confirmed by asking}. Is masra seen outside the rice fields? No. Masra is getting worse. It started being very bad about 10 years ago, _along _with hispa; and probably for the same reason - boro. Pesticides are used against masra. Are they the same pesticides against masra and hispa? "Marshall" or something against masra: can't remember the name of that against hispa but they were different - one for each. Granular against masra, liquid against hispa.

So do they use both in every crop? No: they look at the damage of the two insects separately. How many times are insecticides used on each crop? Liquid 1 to 5 times. Granular is only once - you can only put them once. So granules are used preventatively. (Agitated discussion). Liquid insecticide is used in boro more than amun. Amun has fish, boro does not. Very small, wild fish. Are they eaten? Yes. Do you worry about pesticide and fish? No. They do eat fish, and fish are killed by insecticide, but they don't worry or do anything. Have the forests any effect on pests? They don't know of any.

Do they know of any non-pesticidal controls? No. They are in touch with DAE. There is no N.G.O. Where does the information about pest management come from? DAE training. They trained them and gave them sweepnets. But the nets didn't reduce hispa populations last year, so they gave up. How many times were the fields swept? One or two times. Apparently only one farmer actually bothered. There were so many they just re invaded. Everybody thinks they are useless from apparently one man - a younger farmer, about 15. It was not hard work but you could see it was leaving hispa behind in droves.
Have you ever heard of the hispa bounty? No. Aerial sprays? No.

One farmer is asked. Farm is 5 kani of 30 decimals each {WPA=5*0.3=150}. How many family members? To universal laughter he asks around and tries to tally from neighbours' replies. 16 (eventually). His harvest lasts six {MCP=6*16=96}. Most of the time. He has a diversified crop.

B#19. =26.3.2 1450. N24.39.42, E92.12.34. Doxinbugh, Baralekha Altitude 84 feet. There is no rice left standing, but in a field of fallow volunteer ratoons are traces of

adult hispa attack on leaves of rice. JS takes two photos of this farmer gesticulating, and M&N respectfully paying attention. Near here is the only waterfall in Bangladesh.

~MH. CP: Pattern: Aus-Aman. SB (Khatra) is the worst then hispa (Mainjara) followed by Mohua. Hispa attacks in the late part of rainy season (Srabon). Found in low land with water. Don't know the source. Attack in the young stage and more in wetland. Used Endrin by seeing neighbours and dealers. Insecticide works if spray. See hispa from time immemorial. Spraying since 20 years ago. Hispa becomes less if the shoot of 'Gurus' perch in the field. Don't use Granular. Attack is increasing over time. Hispa comes from Hakaluki Haor and live there in murali dhan/durba grass. Last year hispa seriously damaged. Owner of 10 acre land. 14 family member. No idea about life cycle of hispa. Hispa come from east and go to west (to haor). Advice from Allah.

B#20. =26.3.2 1600. N24.43.76, E92.09.71.

~JS. 55ish. Hispa is the worst, then masra. For two years it has been very bad - last year and this year. Before two years ago it was not really bad. Why? Natural disaster: scattered hispa over a whole area. Why is this - what are the characteristics of the area hit first? Lowland areas first, then upland areas. Lowland area is first because the moisture in the soil is higher. It comes in from the air. It comes from the East - India. He doesn't really know. We ask an old geezer (looks about 70) how far back he remembers. Thirty or 35 years. 1971. Was there hispa then? No - none in 70s. First seen in 1980s - one isolated time before. 10 years ago. Not a slow buildup until 1990, just suddenly. Since then. {i.e. if JS understands correctly, one isolated outbreak in the 1980s, and a sudden and largely permanent deterioration in around 1990}.

Two rice systems - aus followed by T. amun, or boro. There are no differences in hispa density. No: aus/amun has hispa more than boro. Eight to 10 years ago boro was introduced. They also have vegetables, and B. amun. Hispa is never seen outside of paddy on grasses.

His problem is lack of irrigation. Why is hispa worse in aus/T.amun than other areas? Hispa here is worse than other districts. No - Silhet is also bad - as bad as here. The hill area has less hispa then here. Why is that? Don't know. Is there less rice there? Yes - but don't know.

At the end of the season does hispa die or what? It emigrates back out: not back to India but West (indicates setting sun) to haor area - lowlands.

Controls. Insecticide, but it doesn't work. Tried for the first time last year but didn't work. Will you use it again this year? No - because it didn't work. Are there any other controls? No. Has he talked to the DAE? For information, yes. No NGO. What did the DAE recommend? One kind of pesticide - I can't remember. It didn't work. It was sprayed with a machine. The local government lent the sprayer; I didn't have to buy it. I used insecticide before e.g. on vegetables. For 10 to 15 years on vegetables - tomato and potato.

Are there controls against masra too? Masra was bad five to seven years ago - but less bad than hispa. There are no controls against it. Masra was present in the 1970s,

confirms the old man. Masra has _decreased since 1971. Why? I don't know: Allah is doing us a favour. The old man says that the improvement in masra is constant and the man who says it was bad five to seven years ago is wrong. The old man has 100 bighas of aus/amun, each of 31 decimals {WPA=100*0.31=3100}. 15 family members. It feeds all year, with a surplus {MCP=15*12=180}.

B#21. =26.3.2 1600. N24.50.95, E92.09.74. Beanibazar. JS sweeps with another large crowd of spectators. (12 hispa in 30 sweeps).
~MH. Caused serious damage. During 80s sprayed from helicopter. Last two years did severe damage. Come from southeast (probably India). CP:1. Boro-fallow. 2. T.Aman-fallow. Hispa was severe in previous T. Aman crop. Five times sprayed but did not work. Advice from God. Sweepnet is not enough to reduce the population. Sweeping is effective in morning. Got sweepnet from DAE two years ago . Hispa feed on grass also. Light trapping (recommended by DAE) is not effective. Owns 3.5 acre of land. 12 family members. Meet the demand of a year. Contact DAE people.

B#22. =27.3.2 1315. N24.52.58, E91.52.18. This interview is dominated by the extensionist.

~JS. (Farmer: An oldish man - 55 to 65). Worst is hispa then masra. There was a trial on his land against hispa with the DAE. The only crop is this boro season. What treatment? Pesticide when you see hispa. Sprayed twice. Swept once but didn't really work.

(From here on the extensionist answers all the questions). Is hispa attack very heavy? Yes. Do controls work? Yes. Dimecron {?} also usually used in vegetables. Were the neighbours spraying too? Yes. For how long have you been a farmer? 15 to 20 years. Were you born here? No: migrated from the hills. Forty years ago he came with his family. So how did he get his farm? He share crops, doesn't own his farm. How is the crop divided: half and half? No: he gets two-thirds of the harvest but he pays all the input costs. Where does the landlord live? London. Who is the landlord's local contact? A family member - his brother. Where does the brother live? Here. What has changed in farming in the last 15 to 20 years? Before 15 to 20 years ago there was only one crop of B. amun all year. Now there are two crops of rice and one of vegetables. Now there is T. amun, then boro and vegetables irrigated from the pond. Does he grow his own seedbed for T. amun? Yes. Any other changes? Local varieties have been replaced by modern. In another plot he has T. amun followed by vegetables followed by aus. He has a third plot as well. Have there been changes in the pests? (0 is). Masra is always present but hispa three years ago. Was hispa present before three years ago? Yes - in small numbers and not outbreaks. Is hispa is seen outside the rice fields? Yes - in grass. Is it seen in the grass in the fallow season? Yes. When there is heavy rain hispa is not seen. Does the hispa come to the rice fields from outside? Yes. Where does it come from? Areas of _grass. Are these areas of grass distant or close? Some large areas of grassland, also bunds etc. Does he see hispa reproduce - lay eggs etc? Yes he's in seen it. Laying eggs? Yes. What happens then? Adults appear after a certain time (the extensionist is prompting heavily, he doesn't know about larvae). He has 60 decimals (2 kair) {WPA=60}. Six family members. The harvest feeds exactly {MCP=6*12=72}. Do farmer-owners use controls differently? No: the same.

B#23. =27.3.2. 1405. N24.49.89, E91.51.79. A very plump, rich farmer. He is the chairman of a local Company and local political leader. Leaves as soon as we arrive. The extensionist drags over a patently reluctant and resentful farmer.

~JS. In his 40s. The worst problem is hispa. What are the changes in hispa in the last ten years, and what does he think is causing them? He doesn't know. (The extensionist is not very nice to him). When the hispa arrives in the field, how does it come, and when? It comes into the seedbed, and into transplanting. T. amun, boro, and aus seedbed as well. Here is low land and only boro, on the other side of T. amun and T. aus. The worst hit is T. amun. Why do you think this is? Amun is grown over a bigger area, greater than boro or aus, so it is more extensively and less carefully cultivated. Aus > boro. Here all is rice - aus-amun only or boro only. Where does the hispa come from? Outside (implicitly quite far away) but no knowledge. Could it be moving between the aus -amun area and the boro area? Yes - it could be. The boro land is lower, like haor, Aus-Amun is higher. What controls are used? First he trying sweeping but not useful: some insects were caught, and some population reduction, but not all of them - some outside the net. Second our pesticides. 8 bighas, each of 30 decimals, he owns {WPA=8*0.3=240}. Seven family members, surplus harvest {MCP=7*12=84}. What changes in the last ten years? Local varieties gave way to high yielding. Have there been changes in the cropping pattern? No.

B#24. =27.3.2 1520. N24.46.52, E91.50.78. A man who also has a shop with biscuits, cigarettes and sweets.

~JS. He is about 55 and has been a farmer for 20 to 25 years. No 1 pest is hispa, 2 is masra, 3 is rice bug. The pests are increasing all the time. Getting worse. Hispa is getting worse more than the others. Why? I don't know. What controls are used? Insecticide. Do you know of others? No. There is the shop as well - is it yours? No - the building is rented out. He has run the business for 2 1/2 years. Why did you decide to branch out into shopkeeping? Improve financial condition. He doesn't sell farm inputs. He sells food, fuel and fags.

There are three cropping patterns.
1. Aus - amun - boro (this is in now)
2. Boro alone (in haor area)
3. Amun - aus (twice in the year)
In all three cropping systems hispa is the same. It is worst in T. amun. How many times do you have to spray? Once or twice? How do you make the decision? When I see the hispa. Seedling also is badly affected. Is the number of sprays the same in boro amun and aus? Yes - the same in this regard. Do you spray whenever you see hispa? More. So not when just a few. How? Just looking at the field, eye observation: not hard and fast. How? When leaves start to whiten: hispa alone is not a problem, only whitening. Is the rule the same for all varieties of rice? Yes: the same for all of them. How is this decision made for masra and rice bug? The same way, by estimates by eye. How do you know this? All my own experience.

B#25. =28.3.2 1515. N24.59.18, E91.51.34. Altitude 110 feet. We are still with the extensionist, after the field day. 2 men, both about 50.

~JS. The worst is the rice bug, second is hispa. Masra just a few. (To extensionist) why does hispa here seem less bad than other parts of Silhet? No idea. Control is by granular insecticide Basudrin mixed with urea. If he sweeps it gets more and more. Against rice bug he sprays malathion. Why granular against hispa, spray against rice bug? Advice of dealer and DAE people. Does hispa come every year? The last three years. For how many years have you used granular pesticide? We started many years (five years) Basudrin to reduce stem borer. But we know it's good against hispa too. Cropping systems are boro then T. amun, or just boro. Hispa is worst in boro. Granules are used only in boro, not T. amun. Why? No infestation in T. amun. So how does he know the granules control hispa if he was using them before hispa got bad? Basudrin is added as a top dressing with urea. So he puts the granules on after he sees the hispa. Does he apply the granules only once? Yes. If he saw no hispa, would he add granules to the urea? No. Can he tell early on if the hispa will be bad? No idea. Where does it come from? He doesn't know. Was hispa a problem before three years ago? No. Were there small numbers - any at all? No. Do the granules work? Yes. How many sprays are there against the rice bug? One.

B#26. =28.3.2 1550. N24.58.13, E91.51.31. JS sweeps.

~MH. Rice bug is the worst, then hispa followed by stem borer. Sharecropper. One acre own and 1.5 acre tenured. Hispa becoming serious since last 3-4 years. Rice leaves become white. Shoficron sprayed by spray machine and bamboo made sprayer. CP: 1. T.Aman-fallow. 2. Boro-T.Aman. Damage is patchy. Knows the H. life cycle. Use own made sweepnet.

B#27. =28.3.2 1715. N24.54.64, E91.45.26. Chanpur, Mughalgaon (on the road to Chhatak). JS sweeps.

~MH. Hispa (Mainjara, Zia poka) attacks in the month of Ashin in seedling. Becoming serious since five years ago. Depend on God. Sprayed 1-2 times (Basudin) but did not work. CP: 1. Aus-Aman/fallow. 2. Boro-fallow 3. Aman- fallow. Damage in Aus and Aman. Last Aman damaged more. Advice from God. Attack in young leaves. Never used sweepnet. No idea about LC. Birds don't eat hispa.

B#28. =29.3.02 1130. N24.30.52, E91.50.16. ~JS. A young man in his 30s. A share cropper. The only pest is hispa. 3 systems:
- T amun
- Aus - T amun
- Aus - T amun - boro

T. amun is affected worse than aus or boro. Another man, the same age but more thrusting, rather takes over. Why so? Don't know. Last year was particularly bad. It was bad in the T. amun seedbeds. Masra came too. If the land's flat immigration is easier. Invasion of hispa: from outside. Do you see it outside the field? Yes - in the grass. All the year round? No - sometimes. When? When there is no rice in the field. So could it invade the rice field from the grassland? It could. But early and you said "outside": how? It came from far away. Why far away, rather than the grass nearby? The first time - it came from outside the first time. When was this first time? Three to four years ago. Any idea where it came from? Don't know. (A man of about 50 starts to dominate). Before three to four years ago, did you ever see any hispa at all? Yes, you used to see a

few. Where? Rice. Do you think it is moving about between crops? Definitely. Has the number of different crops increased? Yes. In what way? A big and good difference is boro - only. No real increase in the others. The varieties have changed too. They volunteer. Could changes in the varieties have led to changes in pests? No.

Controls: they spray. A liquid "Relothrin" {?}. Are there any nonpesticidal controls? No. Pesticide granules? Basudrin. What is each for: the difference between granules and sprays? The granules are preventative. Sprays are not - when you see the insects. This is not hard and fast, but discussed with the dealer, DAE too. He follows advice. The decision is not different between insects and controls. How can you tell to spray? When he sees the damage. Not the insects? No - damage. What does damage look like? The leaf goes white (the team agrees he seems to be talking about hispa). What does masra damage look like? The main headache is hispa. It can take the whole field. Life cycle? He knows, for hispa. How does he know? Other farmers told him, then he confirmed by watching for himself. Is hispa in the ratoon? Yes - he's seen it. He saw hispa in the grass too. Is there a lot of ratoon, and is it particularly abundant in particular crops? Particularly in aus and boro, not amun because that's dry. Do people eat ratoon - does it have a good aspect? Or is it just there? It's just there. No gain and people don't eat it, but they do let the cattle in to eat the leaves. Do you ever see hispa in or around crop residues e.g. straw? You see it in the green part but not in straw, in when green but not when dry.

B#29. =29.3.02 1230. N24.08.02, E91.21.11. A group of eight people weeding. The one we mostly talk to is participating but apparently their employer.

~JS. In his twenties. They are weeding boro. Worst is masra, second is hispa. Here is a whole plain of boro: from tiny seedlings to set seed ready to harvest to stubble with grazing cows. The boro started ten years ago, so it has been like this for ten years. Hispa came five years ago. At another time of the year of this would all be fallow. Three cropping systems:
- aus - T amun - boro (biggest)
- boro - T amun
- boro
Hispa is the same in all of them. Here are all three, as far as you can see, but in the distance is beel. Where does hispa come from? Outside. Hispa is worst in amun, then aus, then boro. Why? Don't know. Does it come from outside in every year or in the first year? Both - it always comes from outside. Is there always rice here? No - there is a fallow period. When is the fallow period? In the aus - sometimes he omits the aus crop: the plants grow badly and the land is tired. Does he think hispa moves around the field from crop to crop and across fields? He thinks yes, but also it comes in from outside. Does he see hispa reproducing, laying eggs, or young ones? No. Does he see hispa outside the rice fields? No. Is there much ratooning rice here? They get ratoon but see no hispa in it. When is the most ratooning? At the end of T. amun. Is it used for anything? No. The cows we can see are eating stubble. (You can also see in the fields no ratoon). He has seven cows. Is it better for the cows to have ratoon, rather than stubble on its own? Yes.

Insect controls."fenfen" {?}. Liquid. Sprayed. Used against only hispa. Dimecron granules against masra. Sometimes perches for the drongo. No others. Where are does

information come from? DAE. How many times does the hispa have to be sprayed? One to three times. When you see the hispa, not the damage.

B#30. =29.3.02 1305. N24.05.04, E91.16.93. Chanpur, Mughalgaon, Two men with big baskets on yokes on their shoulders.

~JS. Worst is masra, second is hispa. (A hard-faced younger man in a long shirt and cap comes and muscles in, standing between us and the first people).You have:
- boro
- boro - T amun
- aus - T amun - boro
with no difference in hispa. Hispa is worst in boro. And masra? Also worst in boro.

Where does hispa come from when it invades the crop? It comes from the soil. Do you see hispa in the fallow? No. Do you see it outside rice fields? No. Do you see it reproduce, laying eggs, young? No. The two original men leave. Ratoons? They have Ratoons but no hispa is seen in it. After which the season are the most Ratoons? After boro. Is the Ratoon used for anything? Sometimes as feed for cows. Mostly you take the cow into the field, or sometimes you cut it and take it to the cow. Do goats eat the ratoon? Yes. Do sheep? Yes. You take them all in to eat. (JS has seen goats in a paddy field and wondered if they eat weeds but not rice). Goats eat rice (the goats we have seen in the field are probably there by mistake). He doesn't know the hispa life cycle. Pest controls: Dimecron liquid, answers a slightly older man. And Basudrin granules. Are they both for all pests or each for different pests? When the problem is small, use Basudrin, when bad you spray. Basudrin is used in all three seasons. Any fish in the paddy they eat. Wild fish. Basudrin and Dimecron don't hurt fish. They don't use Basudrin in the rainy season. Why not? When there is heavy rain there is no need for pesticide, because the pest is less bad. Meaning masra or a hispa or both? Both. Which is sprayed most - masra or hispa? Mostly masra. Are they controlled in the same way? Yes. How many sprays are against masra? One. And how many against hispa? One. Which arrives first? Masra comes first, then hispa. This is now in boro. In T. amun it is flooded, deep. So they can't spray. In aus they can. (The team want to explore all this and more deeply, but everybody goes off to the mosque to pray).

~MH. Ralothrin sprayed. Sometimes spray Basudin but expensive. Attack in young plant. Spray after see insect. Don't get good advice from BS. Aerial spray during 80s. Know life cycle. Hispa live in grasses and ratoons.

C#1. =25.1.04 1215. Seventeen farmers around a circle of tables in Sardar-Upazilla (general word for the main, central upazilla in each district), Barisal, local government hall. Distressingly, they have been waiting since before 9 and it is now after 12 - they seem remarkably gracious about this. The group is pretty vociferous, all apparently wanting to talk, though a few tend to dominate. Present are JS, FR, MH, and several DAE local and national officers.

Is hispa the worst pest? No - stemborer is worst; second are two leafrollers - one which fold the leaf after which it becomes dry, and one which folds the leaf but it doesn’t dry; third is BPH. One farmer observes “I see a little butterfly flying about; after that there is masra.”

Hispa used to be second-worst pest, but now is not on the list. Hispa is now found in chaor area by rivers, not around here. When was hispa last bad? 1997. So how many bad years? 1995,6,7. Is it ever at intermediate levels, present as opposed to absent? We say none at all last 2 years 2002 and 2003. A different farmer says he saw a little bit in 1990.

H comes when wind is in the west - it blows in from western side. It can't be predicted.

When in the year is it bad? June, July, August - T amun.

Do you see hispa reproducing? We see it laying eggs on leaves. The adults arrive first, from the air, then lay eggs. Then they go away. What happens to the eggs? Hispa emerges. Black spikey adults? Yes.

Are there any predictors? Water condition. What - humidity or rain? Cloudy; humidity. Light rain.

Why was h bad in 3 years consecutively? 1990,1,2,3 weather was bad {i.e. suitable} but no hispa. Why not? You need the west wind as well as bad weather. So was there a west wind in 1995,6&7 more than in 2002,3&4? The wind blows from the same direction every year.

By how much does hispa attack reduce the harvest (the English word "percentage" is used in the Bangla sentence as the question is translated)? 90%. Normal production is 60 mounds per acre; with hispa 10 to 12 mounds per acre. Does anybody remember if it reduced yield at all in 1990, when just small populations were seen? One farmer says he lost his whole crop - local boro was infested and totally damaged.

Varieties infested. HYV and local are both affected. In torrential riverside area local boro is infested, elsewhere HYV too. T amun is also infested.

If in early stages we kill hispa, it comes back, but we get 20% loss if it recovers.

Is the build-up gradual or sudden? Sudden. Overnight. Before the build-up do you see just a few? Inundation. 2 or 3 days before the big idundation some come. If they see 2o r 32 they think h is coming - this is the advance party. Big explosion after 2 days.

They think development egg-larva-adult is not possible in their fields. We say we think it is. They say no, it can't be.

Sometimes hispa arrives in such numbers they feel them hit their bodies, they also hit trees and water.

4 people have IPM training. So what about natural enemies - ladybirds, damseflies, lacewings etc? Light trap technology. A handful of insects come in and are killed. What sort of insects? Masra, rice bug. Hispa? We don't know because hispa attack was before IPM training.

Most people spray. Has everybody here sprayed against hispa? All have sprayed. 1 used kerosene. Is this when h attacks, or every year? When h attacks. If you spray a big hispa attack does it work or is it too late? It works. 75% of them die. Sometimes adults die but eggs survive and hatch again. So how many sprays are needed? 1 or 2. Has anyone sprayed h when just a few, as a warning? No.

Any experience of non-pesticidal control? Kerosene rope - a little bit of hispa reduction but not much. Beating against larvae and adults: leaves got torn, larvae fell down, then we sprayed and killed them. Has he done it more than once or once only? Once only. Where did he hear about the technology? Learnt from senior farmers locally. Use sweepnet, but cannot fully control. But they still use it. “When we see hispa we get a headache. So we’ve no time to catch it, we want to kill it, so buy pesticide.” So why sweepnet? This is not for hispa - other pests.

At what stage is hispa bad? Early tillering.

How much does the pesticide cost? 500 taka for an acre {Observe there is here difficulty in clarifying the unit area of rice the specified volume will treat - it will need treating with care}. Where do the sprayers come from? Mostly borrowed from neighbours or the DAE office.

Appendix 1.4. Calculation and comparison of wealth indicators in the informal survey. Given are the interview number (A = first, southern tour; B = second, northern tour); location as coordinates (D=degrees, M=minutes, C=hundredths of minutes); Production areas in acres and WPA and MCP values.

	North			East						Months		
No	D	M	C	D	M	C	Full PA (acres)	Half PA (acres)	WPA	Harvest Lasts	Number in Family	MCP
A25	22	38	35	89	49	11	1.05	4.2	3.15	12	4	48
A26	22	38	35	89	31	58	1.65	0	1.65	3	12	36
A27	22	48	25	89	25	88	0	2	1	6	16	96
A28	22	49	62	89	19	34	0.99	0	0.99	11.5	6	69
A29	22	48	8	89	13	91	12.6	0	12.6	12	60	720
A30	22	45	28	89	6	62	0.99	0	0.99	12	4	48
A31	22	44	44	89	15	62	0.66	0	0.66	6	6	36
A32	22	38	43	89	18	9	0.99	4.95	3.465	12	4	48
A33A	22	38	36	89	28	26	0.52	0	0.52	6	6	36
A33B	22	38	36	89	28	26	1.82	0	1.82	12	4	48
A34	22	38	29	89	38	46	1.3	0	1.3	8.5	7	59.5
A35A	22	48	79	89	44	38	0.52	1.56	1.3	12	3	36
A35B	22	48	79	89	44	38	2.6	4.16	4.68	12	6	72
A36A	22	57	60	89	47	10	0.26	0	0.26	6	5	30
A36B	22	57	60	89	47	10	1.04	0	1.04	8	8	64
A37	23	3	36	89	49	45	1.375	0	1.375	12	8	96
A38	23	11	63	89	57	53	8.84	0	8.84	12	10	120
A39	23	23	88	89	58	71	1.05	0	1.05	9.5	6	57
A40	23	30	43	89	52	86	0.78	0	0.78	12	4	48
B2	24	4	48	91	15	761	3.3	0	3.3	12	8	96
B5	24	25	68	91	23	719	11.2	0	11.2	12	12	144
B7	24	27	62	91	22	331	3.64	1.12	4.2	12	10	120
B10	24	34	40	91	32	385	0.84	0	0.84	6	3	18
B11	24	35	46	91	35	927	1.12	0	1.12	12	4	48
B12	24	31	67	91	29	936	10	0	10	12	24	288
B13	24	18	73	91	39	741	1.2	0	1.2	5.5	8	44
B16	24	24	39	91	55	546	1.5	0	1.5	12	9	108
B18	24	34	33	92	4	622	1.5	0	1.5	6	16	96
B20	24	43	76	92	9	709	31	0	31	12	15	180
B22	24	52	58	91	52	185	0.6	0	0.6	12	6	72
B23	24	49	89	91	51	795	2.4	0	2.4	12	7	84

Appendix 1.5. Tabulations of Formal Survey Responses by Zone and Village.

Table A1.5.1. Costs and benefits of hispa control options, as in the main text, given separately for wealth categories and zones.

Upazilla	Golapganj			Balaganj			Sadar			Rajnagar		
Wealth category	A	B	C	A	B	C	A	B	C	A	B	C
Spray - chemical	4.0	4.1	3.7	3.9	3.5	3.6	3.9	3.6	2.5	2.9	3.3	2.1
Spray – labour	2.6	0.7	0.4	0.4	0.5	0.7	0.7	0.5	0.5	0.4	0.7	0.4
Spray – sprayer	0.0	0.0	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.2	0.1	0.1
Spray - total cost	6.6	4.9	4.3	4.4	4.1	4.3	4.5	4.1	3.0	3.5	4.2	2.5
Spray – benefit	59.6	51.3	40.0	54.9	59.5	56.3	62.0	60.7	82.0	62.3	62.9	64.6
Sweep – cost	5.3	3.3	1.3	1.0	1.3	2.5	1.9	2.6	1.7	1.8	1.8	1.6
Sweep – benefit	19.9	19.3	30.0	16.8	9.4	36.0	14.5	12.7	12.4	14.0	14.2	10.3
Clip – cost	3.4	6.5		1.9	4.2		2.6	1.7	1.7	1.5	1.5	
Clip – benefit	19.2	24.0		66.7	18.7		31.6	29.3	30.0	27.0	30.6	

Table A1.5.2A. Scoring matrix of attributes of control practices, of numbers answering (N) and mean scores, as in the main text, given separately for different zones and wealth categories. A: Hispa values.

Zone	Golapganj			Balaganj			Sadar			Rajnagar		
Wealth category	A	B	C	A	B	C	A	B	C	A	B	C
Sprays	(17)	(8)	(1)	(16)	(11)	(3)	(14)	(13)	(3)	(9)	(18)	(3)
Number since 1996	2.7	3.6	2.0	2.9	2.2	2.0	2.5	2.2	1.3	2.7	1.8	2.7
Good at control	2.6	2.9	3.0	2.8	2.6	3.0	2.7	2.6	2.0	2.8	2.7	2.3
Money problem	1.7	0.4	2.0	1.0	0.5	1.7	0.9	1.2	1.3	1.7	2.8	3.0
Sprayer problem	1.8	1.4	0.0	1.5	1.1	3.0	2.1	1.9	2.7	2.3	2.4	2.3
Labour problem	0.8	0.4	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tiresomeness problem	0.4	0.5	0.0	0.1	0.4	0.0	0.1	0.6	0.0	0.4	0.1	0.0
Health risk problem	2.0	1.5	3.0	1.8	1.5	1.3	2.1	1.1	1.7	2.3	2.1	2.3
Crop damage problem	0.0	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Sweepnetting	(9)	(2)	(1)	(5)	(3)	(1)	(5)	(9)	(3)	(5)	(15)	(2)
Number since 1996	1.8	2.5	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0
Good at control	1.3	2.0	2.0	1.0	1.0	1.0	0.8	1.4	1.3	1.2	1.0	0.5
Money problem	1.7	0.0	0.0	0.4	0.3	3.0	0.4	0.6	2.0	1.8	1.3	2.5
Net problem	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Labour problem	1.8	0.0	3.0	1.8	2.7	0.0	2.8	1.2	0.7	0.8	0.8	0.0
Tiresomeness problem	2.2	3.0	3.0	0.8	2.0	3.0	1.8	1.8	2.0	2.0	2.3	3.0
Health risk problem	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crop damage problem	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
Leafclipping	(7)	(2)	(0)	(1)	(1)	(0)	(5)	(4)	(1)	(1)	(6)	(0)
Number since 1996	1.6	1.0		1.0	1.0		1.0	1.3	1.0	1.0	1.0	
Good at control	1.1	1.5		2.0	1.0		1.8	2.0	1.0	2.0	2.0	
Money problem	1.9	1.5		0.0	0.0		1.2	2.0	3.0	3.0	2.0	
Labour problem	2.3	3.0		3.0	3.0		2.6	2.5	0.0	3.0	1.8	
Tiresomeness problem	1.1	1.0		3.0	1.0		0.8	1.5	2.0	0.0	0.3	
Health risk problem	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Crop damage problem	1.1	0.5		0.0	2.0		1.0	0.3	0.0	2.0	2.0	

Table A1.5.2B. Scoring matrix of attributes of control practices, by zone and wealth category. B: Masra values.

Zone	Golapganj			Balaganj			Sadar			Rajnagar		
Wealth category	A	B	C	A	B	C	A	B	C	A	B	C
Granules	(2)	(0)	(0)	(12)	(8)	(2)	(11)	(9)	(3)	(9)	(17)	(2)
Number since 1996	3.0			4.3	4.0	4.0	4.7	4.2	3.7	3.6	2.6	1.5
Good at control	3.0			2.7	2.6	3.0	2.5	2.3	2.3	2.4	2.3	2.0

Money problem	2.0			1.0	0.9	3.0	1.3	1.4	2.0	2.3	2.1	1.5
Labour problem	0.0			0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Tiresomeness problem	1.0			0.1	0.3	0.5	0.2	0.0	0.7	0.0	0.0	0.0
Health risk problem	1.0			1.3	1.3	2.0	1.2	1.0	1.3	1.8	1.4	1.0
Plant damage problem	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0
Sprays	(1)	(0)	(0)	(1)	(0)	(0)	(2)	(1)	(0)	(0)	(0)	(0)
Number since 1996	1.0			1.0			2.0	2.0				
Good at control	2.0			2.0			3.0	2.0				
Money problem	0.0			0.0			0.0	0.0				
Sprayer problem	3.0			3.0			3.0	3.0				
Labour problem	0.0			0.0			0.0	0.0				
Tiresomeness problem	0.0			0.0			0.0	0.0				
Health risk problem	0.0			3.0			2.0	2.0				
Plant damage problem	0.0			0.0			0.0	0.0				
Sweepnetting	(0)	(0)	(0)	(1)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Number since 1996				1.0								
Good at control				1.0								
Money problem				0.0								
Labour problem				0.0								
Tiresomeness problem				3.0								
Health risk problem				0.0								
Plant damage problem				3.0								

Appendix 2.1. Explanatory Document for Research Partners

BRRI/DAE Rice Hispa Management Trial

The aim of this trial is to quantify the economic returns to the management of hispa by the two options commonly available to and used by farmers - pesticide sprays and sweepnetting. Farmers generally resort to both techniques - typically sweepnetting first and then spraying as a last resort - on a simple threshold rule, when hispa infestation is observed in the field.

Controls will be assessed on farmers' fields. The main comparison will be of fields in each locality treated with either sprays or sweepnetting. Assessment will be (A) of inputs in terms of man-hours of labour - both family and hired - and money and (B) of yield and rice prices to quantify income, and (C) of populations of hispa, stem-borer (masra) and brown planthopper (BPH) to allow differences in yield to be attributed to different pests. It is hoped that data (A) and (B) will be provided by farmers being asked. (C) will be assessed by BRRI researchers visiting the fields.

Each group of plots will include (1) one protected with insecticide (2) one protected with sweepnetting and (3) one unprotected.

It is a number one priority that the trials do not expose farmers' crops to risk. As a result, both the unprotected plot and the sweepnetted plot will be treated the following way. (1) If either contains a population of pests (hispa or other insects) which threatens losses to its own yield, the Hispa Project will compensate the farmer for the difference between its yield and that of the sprayed plot nearby. (2) If either contains an insect pest population which threatens other plots around it, the farmer will be allowed to spray it with insecticide. In such a case, the farmer will be asked for an estimate of what he believes the yield would have been had the spray not been started. In this way the security of the farmers' crops will be guaranteed.

In general, the rice area made available by each farmer will be divided into two more-or-less equal plots, one of which will be sprayed and one sweepnetted. The unprotected plot will be selected as a small (4-10sqm) area taken out of the area to be sprayed, to be monitored for infestation and yield, in an area away from the other rice plots to minimize the risk of hispa moving into other plots nearby.

Farms have been selected in different areas, varying vary widely in size, and infestation density, which will allow the comparison of the controls over a variety of circumstances.

BRRI/DAE Insect Pest Control Trial YIELD AND COST Farm Data Sheet

District, Upazilla, Season, Year	**Sylhet, Sardar-Upazilla, Aus 2004 (DUMMY)**
Farm(er) name	**Yusuf Islam**

Treatment	**Insecticide**	Sweepnet	Un-protected
Plot size (decimals)	**21**	**17**	**4.5**
Variety	**BR1**	**BR23**	**BR1**
Transplant date	**31/5/4**	**30/5/4**	**31/5/4**
Hill spacing and units	**10" x 8"**	**10" x 8.5"**	**10" x 8"**
Date of the first spray / sweep	**10/6/4**	**8/6/4**	
Date of the last spray / sweep	**10/7/4**	**14/7/4**	
Number of sprays / sweeps	**2**	**9**	
Number of people each spray / sweep – family	**1**	**1**	
Number of people each spray / sweep – hired	**0**	**2**	
Number of minutes for each spray / sweep	**30**	**20**	
Daily wage of worker to spray / sweep (without food)	**50**	**40**	
Harvest date	**18/7/4**	**17/7/4**	**18/7/4**
KG of harvest per plot OR sqm (add "E" if estimated)	**1225/pt**	**1010/pt**	**25/pt(E)**

Sale price of 1KG of rice	**12.5**
Daily hire of a sprayer (tk)	**100**
Type of insecticide used	**Cypermethrin**
Quantity and units of insecticide in the bottle or packet bought	**125ml**
Price of the bottle of insecticide (tk)	**250**
Fraction ("F") or quantity ("Q") of the bottle to spray the field once	**3/4 (F)**

Notes:-
Harvests should be given either per unit area (e.g. per square metre) or for the whole plot.
If the plot treatment is changed, give the estimate of what the yield would have been if the plot had not been altered, with "E" to show that it is an estimate.
For insecticide use for each spray, for the area of the sprayed plot, give either the fraction of the bottle or packet used (e.g. 3/4, 1/2) or the volume used (e.g. 50ml or 35gm).

BRRI/DAE Insect Pest Control Trial PEST INFESTATION farm data sheet

FARM IDENTIFICATION:- **Yusuf Islam, Sylhet Sardar-Upazilla (DUMMY)**

DATE:- **9 July 2004** PLOT TREATMENT:- **sweepnetted**

HLL	ADH	BPH	TLS	D/WH	STG	Leaves / tiller			Score of hispa damage							
						A	B	C	a	B	c	d	e	F	g	h
1	**7**	**0**	**5**	**0**	**3**	**5**	**4**	**3**	**1**	**1**	**0**	**1**	**0**	**0**	**1**	**0**
2	**21**	**3**	**4**	**0**	**2**	**6**	**5**	**3**	**1**	**0**	**3**	**4**	**2**	**5**	**1**	**0**
3	**12**	**0**	**5**	**0**	**4**	**5**	**4**	**2**	**1**	**0**	**0**	**2**	**2**	**2**	**3**	**2**
4	**11**	**0**	**6**	**1**	**3**	**12**	**11**	**2**	**1**	**2**	**1**	**0**	**0**	**0**	**0**	**2**
5	**10**	**0**	**4**	**1**	**2**	**3**	**12**	**3**	**0**	**2**	**0**	**1**	**1**	**0**	**1**	**0**
6	**3**	**0**	**5**	**2**	**1**	**4**	**11**	**4**	**3**	**2**	**0**	**0**	**0**	**5**	**4**	**0**
7	**0**	**1**	**5**	**0**	**1**	**3**	**9**	**8**	**1**	**0**	**0**	**0**	**1**	**1**	**1**	**0**
8	**0**	**0**	**8**	**0**	**2**	**3**	**9**	**9**	**1**	**1**	**1**	**0**	**0**	**0**	**1**	**1**
9	**1**	**0**	**5**	**1**	**3**	**6**	**3**	**7**	**1**	**0**	**0**	**1**	**1**	**0**	**0**	**0**
10	**E4**	**0**	**4**	**0**	**3**	**7**	**3**	**6**	**0**	**1**	**1**	**2**	**0**	**1**	**1**	**1**
11	**19**	**0**	**5**	**1**	**3**	**4**	**3**	**4**	**3**	**3**	**2**	**5**	**2**	**3**	**4**	**0**
12	**28**	**1**	**6**	**3**	**3**	**4**	**3**	**6**	**0**	**3**	**3**	**3**	**3**	**3**	**2**	**2**
13	**E2**	**2**	**6**	**1**	**3**	**5**	**2**	**6**	**1**	**0**	**4**	**5**	**5**	**5**	**5**	**2**
14	**E1**	**0**	**4**	**0**	**1**	**5**	**3**	**11**	**5**	**2**	**0**	**2**	**1**	**1**	**2**	**4**
15	**21**	**0**	**3**	**1**	**2**	**3**	**3**	**10**	**2**	**3**	**1**	**0**	**5**	**3**	**4**	**4**
16	**8**	**0**	**5**	**1**	**3**	**12**	**17**	**12**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**
17	**0**	**0**	**5**	**0**	**3**	**16**	**3**	**7**	**3**	**0**	**0**	**0**	**3**	**0**	**0**	**1**
18	**18**	**0**	**4**	**0**	**4**	**5**	**13**	**8**	**1**	**3**	**4**	**2**	**1**	**0**	**1**	**1**
19	**20**	**0**	**4**	**2**	**1**	**4**	**6**	**4**	**1**	**5**	**2**	**3**	**4**	**1**	**2**	**3**
20	**E1**	**0**	**5**	**0**	**3**	**4**	**5**	**5**	**4**	**5**	**4**	**3**	**2**	**3**	**4**	**4**

For each of 20 hills:-

ADH - Number/score of adult hispa - count 0 to 30, then score “E1” to “E6” (see pictogram)

BPH - Number of adult BPH on the hill

TLS - Total number of tillers on the hill

D/WH - Number of dead hearts and/or white heads on the hill

STG - Most common growth stage on the hill (“1” early tillering; “2” mid-tillering; “3” late tillering; “4” booting; “5” flowering; “6” grain formation; “7” grain filling; “8” grain maturing)

ON 3 TILLERS count of number of leaves per tiller

ON 8 LEAVES score for area loss to hispa - score “0”, “1”, “2” .. “5” (see pictogram)

Appendix 2.2. Full Data Reports from Farm Field Hispa Control Trial

Results Farm A

District, Upazilla, Season, Year	**Moulvibazar, Rajnagar, Aus 2004**
Farm(er) name	**Abdur Rahim**

Treatment	**Insecticide**	**Sweepnet**	**Unprotected**
Plot size (decimals)	**20**	**20**	**5**
Variety	**BR 1**	**BR 1**	**BR 1**
Transplant date	**2 June 04**	**2 June 04**	**2 June 04**
Hill spacing and units	**8''x6''**	**8''x6''**	**8''x6''**
Date of the first spray / sweep	**26 June 04**	**26 June 04**	
Date of the last spray / sweep	**-**	**2 July 04**	
Number of sprays / sweeps	**01**	**04**	
Number of people each spray / sweep - family	**01**	**01**	
Number of people each spray / sweep - hired	**-**	**-**	
Number of minutes for each spray / sweep	**45**	**80**	
Daily wage of worker to spray / sweep (without food)	**100**	**100**	
Harvest date	**18 Aug 04**	**18 Aug 04**	**18 Aug 04**
KG harvest/plot (“P”) / sqm (“M”) (“E” if estimated)	**340(P)**	**364(P)**	**88(P)(E)**

Sale price of 1KG of rice (TK)	**8.00**
Daily hire of a sprayer (tk)	**30.00**
Type of insecticide used	**Cypermethrin**
Quantity and units of insecticide in the bottle or packet bought	**100**
Price of the bottle of insecticide (tk)	**120.0**
Fraction (“F”) or quantity (“Q”) of the bottle to spray the field once	**80 (Q)**

Results Farm B

District, Upazilla, Season, Year	**Moulvibazar, Rajnagar, Aman 2004**
Farm(er) name	**Md. Tofael Miah**

Treatment	**Insecticide**	**Sweepnet**	**Unprotected**
Plot size (decimals)	**10**	**10**	**6**
Variety	**BR 11**	**BR 11**	**BR 11**
Transplant date	**12 Aug 04**	**12 Aug 04**	**12 Aug 04**
Hill spacing and units	**8''x6''**	**8''x6''**	**8''x6''**
Date of the first spray / sweep	**12 Sep 04**	**12 Sep 04**	
Date of the last spray / sweep	**15 Oct 04**	**15 Oct 04**	
Number of sprays / sweeps	**03**	**06**	
Number of people each spray / sweep – family	**01**	**01**	
Number of people each spray / sweep – hired	**-**	**-**	
Number of minutes for each spray / sweep	**40**	**30**	
Daily wage of worker to spray / sweep (without food)	**100**	**100**	
Harvest date	**05 Dec 04**	**05 Dec 04**	**05 Dec 04**
KG harvest/plot (“P”) / sqm (“M”) (“E” if estimated)	**0.430(M)**	**0.365(M)**	**0.290(M)**

Sale price of 1KG of rice (TK)	**9.00**
Daily hire of a sprayer (tk)	**50.00**
Type of insecticide used	**Ralothrin**
Quantity and units of insecticide in the bottle or packet bought	**100 ml**
Price of the bottle of insecticide (tk)	**116**
Fraction (“F”) or quantity (“Q”) of the bottle to spray the field once	**1/5 (F)**

Results Farm C

District, Upazilla, Season, Year	**Moulvibazar, Rajnagar, Aman 2004**
Farm(er) name	**Md. Mokhles Miah**

Treatment	**Insecticide**	**Sweepnet**	**Unprotected**
Plot size (decimals)	**8**	**8**	**6**
Variety	**BR 11**	**BR 11**	**BR 11**
Transplant date	**10 Aug 04**	**10 Aug 04**	**10 Aug 04**
Hill spacing and units	**8''x6''**	**8''x6''**	**8''x6''**
Date of the first spray / sweep	**12 Sep 04**	**12 Sep 04**	
Date of the last spray / sweep	**15 Oct 04**	**17 Oct 04**	
Number of sprays / sweeps	**02**	**04**	
Number of people each spray / sweep – family	**01**	**01**	
Number of people each spray / sweep – hired	**-**	**-**	
Number of minutes for each spray / sweep	**40**	**30**	
Daily wage of worker to spray / sweep (without food)	**100**	**100**	
Harvest date	**05 Dec 04**	**05 Dec 04**	**05 Dec 04**
KG harvest/plot (“P”) / sqm (“M”) (“E” if estimated)	**0.320(M)**	**0.258(M)**	**0.140(M)**

Sale price of 1KG of rice (TK)	**9.00**
Daily hire of a sprayer (tk)	**50.00**
Type of insecticide used	**Cypermethrin**
Quantity and units of insecticide in the bottle or packet bought	**50 ml**
Price of the bottle of insecticide (tk)	**60**
Fraction (“F”) or quantity (“Q”) of the bottle to spray the field once	**2/5 (F)**

Results Farm D

District, Upazilla, Season, Year	**Moulvibazar, Moulvibazar Sadar, Aman 2004**
Farm(er) name	**Md. Abdul Karim**

Treatment	**Insecticide**	**Sweepnet**	**Unprotected**
Plot size (decimals)	**7**	**7**	**7**
Variety	**BR 11**	**BR 11**	**BR 11**
Transplant date	**30 July 04**	**30 July 04**	**30 July 04**
Hill spacing and units	**5''x6''**	**5''x6''**	**5''x6'' (E)**
Date of the first spray / sweep	**19 Sep 04**	**19 Sep 04**	
Date of the last spray / sweep	**05 Oct 04**	**05 Oct 04**	
Number of sprays / sweeps	**02**	**05**	
Number of people each spray / sweep – family	**-**	**-**	
Number of people each spray / sweep – hired	**1**	**1**	
Number of minutes for each spray / sweep	**30**	**30**	
Daily wage of worker to spray / sweep (without food)	**100**	**100**	
Harvest date	**10 Nov 04**	**10 Nov 04**	**10 Nov 04**
KG harvest/plot (“P”) / sqm (“M”) (“E” if estimated)	**115(P)**	**112(P)**	**80(P)**

Sale price of 1KG of rice (TK)	**9.50**
Daily hire of a sprayer (tk)	
Type of insecticide used	**Sobicron**
Quantity and units of insecticide in the bottle or packet bought	**125 ml**
Price of the bottle of insecticide (tk)	**145**
Fraction (“F”) or quantity (“Q”) of the bottle to spray the field once	**30 (Q)**

Appendix 2.3. Rationale for the cost/benefit assessment of plant protection training in increasing returns to hispa control.

This is an analysis of information available from the Programme *Strengthening Plant Protection Services (SPPS),* presented in Publicity Posters presenting results and allowing an estimation of returns to investment.

Poster: "Strengthening PP Services Project, DAE/DANIDA"
- Budget 285 million taka; GoB contribution 68 million taka.
- Train 812 DAE & 120 NGO extensionists in IPM.
- Set up 3320 FFSs, train 83 000 rice farmers and 15 000 vegetable farmers
- Expose 830 000 rice and 150 000 vegetable farmers to IPM

(This is additional to other objectives of the Programme, such as to develop National IPM Policy, capacity, quarantine etc.)

Undated SPPS publicity posters give summaries of performance in farms with and without IPM training, which allow calculations of returns to training per unit area:-

	Boro 2002		T Aman 2001		Brinjal	
FFS population	287		606		727	
FFS sample	84		107		64	
N farmers	2100		2675		6800	
Comparison	Un-trained	Trained	Before training	After training	Un-trained	Trained
Insecticide cost Tk/Ha	1000	58	860	63	8229	2252
Yield Kg/Ha	4410	4931	3550	4037	16229	20326
From the above the following values may be calculated						
IPM benefit – cost (Tk/Ha)	1000-58 = 942		860-63 = 797		8229-2252 = 5977	
IPM benefit - cost (%)	942/1000 = 94%		797/860 = 93%		5977/8229 = 73%	
IPM benefit – yield (KG/Ha)	4931-4410 = 521		4037-3550 = 487		20326-16229 = 4097	
IPM benefit - yield (%)	521/4410 = 12		487/3550 = 14		4097/16229 = 25	
IPM benefit – yield (Tk/Ha)	521x10 = 5210		487x10 = 4870		4097x5 = 20485	
IPM benefit - total	942+5210 = 6152		797+4870 = 5667		5977+20485 = 26462	
% of benefit to savings	942/6152 = 15%		797/5667 = 14%		5977/26462 = 23%	

SPPS Phase II cost - DANIDA 297millTaka, GoB 46millTaka.
Numbers of farmers reached (targets) - 117000 rice farmers 78000 vegetable farmers.
IPM is only extended in "IPM Upazillas", which are 201 of the total 465, in only 64 districts.
Of these improvements, allocation to hispa has been about 15-20%.

Additional estimated data obtained from informants:
- Rice price: 10 Tk/KG
(typical prices are estimated as 10-12; Government "declared price" is 200Tk/maund (40kg) = 5Tk/KG)
- Brinjal price: 5Tk/KG

- Mean farm size per farmer. Farm size varies, and may be estimated as 0.5 decimal = 0.002Ha (1 decimal=0.01acres = 40.5sqm = c.0.004Ha) [with this figure: Number of Ha affected = 117000x0.002 = 234Ha]; [with figure of mean farm size per farmer of 0.01Ha: Number of Ha affected = 117000x0.01 = 1170]

Cost = 297+46 = 343MillionTk
Percentage spent on rice farmers = 117000/(117000+78000) = 60%
Total spent on rice farmers = 343x0.6 = 206MTk (million Taka)
Cost per hectare if over 1170 Hectares = 206/1170 = 0.176MTk = 176000Tk
Annual benefit from Boro + T Aman = 6152 + 5667 = 11819
So SPPS will pay for itself in 176000/11819 = 15 years, or pays an annual return on investment of 11819/176000 = 6.7%

This may be summarized as a percentage increase in yield attributable to training of 12% in boro and 14% in Aman, with a mean of 13%. This is the increase to improved management of all pests, rather than hispa alone, and the improvement due to hispa management may be estimated as 5%, though the value of 12% will be used for comparison; it is assumed that financial benefits in pesticide uses saved are largely not accrued by hispa, but by other pests. If training in hispa as opposed to other pests represents 20% of the total, this obtains expenditure on hispa of 206MTk.0.2=Tk41MTk, for a target population of 830000 rice farmers a cost of approximately Tk50/farmer.

(Repeated for Vegetables, as if all vegetables were able to be considered as brinjal:-)
Cost per hectare is the same as for rice farmers = 176000Tk
Benefit from one brinjal harvest = 26462
So SPPS will pay for itself in 176000/26462 = 6.5 years, or pays an annual return on investment of 26462/176000 = 15%

Appendix 3.1. Full Text of Newspaper Articles

Articles are labelled as "B" for Bangla-language (in translation) and "E" for English-language (in facsimile).

A: Bangla-language articles, translated

B1. 10.10.1999: *Daily Ittefaque* pages 3 & 9

Hispa and Masra Attack in the Amun Fields of Moulvibazar and Narayal (Khulna) District

Severe infestation of hispa and masra in the amun fields in 5 out of 6 thanas has been observed in Moulvibazar. On the other hand, masra attack has been noticed in the 11 unions of Loha Gara and Sadar Thanas of Narayal district.

Moulvibazar

In 5 thanas out of 6 of this district hispa and masra attack has been observed. The insect cannot be controlled by any means. Local DAE did not give any attention for insect control. The most severely infested area is Sadar Thana of Moulvibazar. One farmer of Kamalpur Union of this Thana reported that he bought a spray machine for 2800 taka and sprayed insecticide on his 6 acres of land. But the insect cannot be controlled. The rice on 4 acres out of 6 turned grey-brown and died. The remaining 2 acres is being attacked further by the hispa. Another farmer named Abdul Hye reported that his 13.1 acres of land have been infested by insects. Insecticides failed to control the pest. Yield from 85300ha of amun paddy was expected this year but unfortunately half of the target has not been fulfilled.

Narayal

Masra attack in the HYV T-amun has been noticed in 5000 acres of land in different Unions of Sadar Thana. Farmers reported that they found the insecticide dimecron effective against masra. But the price is too high. 90% of the farmers are not able to buy dimecron. Other insecticides are found ineffective.

B2. 30.10.2000: *Daily Jugantor* page 7

Insecticides found Ineffective against Hispa Attack/Invasion of Aman Paddy Fields

The aman paddy of Sylhet, Jalokhati, Rupgonj and Chapainababgonj are turning yellow due to invasion of rice hispa. Insecticide sprays proved a failure against the hispa. Farmers have become disheartened.

The Sylhet office reported that the hispa outbreak has spread everywhere. Farmers had been hoping for bumper production due to favourable rainfall and weather. But there is a possibility of severe yield loss because of insect invasion. Hispa infestation has been observed in 85oooHa of land of 7 upazillas of Sylhet district.

Farmers have not yet received the necessary insecticides, spray machines and other materials. The local DAE office distributed 200L of BTMC and Palitoprion, which was much less than the requirement.

Jhalokhati (Barisal) representative: Aman paddy of 4 upazillas of Jhalokhati has been attacked by hispa and masra (stemborer). About 428Ha of Sardar upazilla, Nolchiti and Khatalia upazilla have been attacked by masra, and 185Ha of Rajapur upazilla have been attacked by hispa.

DAE has announced that it is mounting a control programme with IPM-trained farmers. Spray machines, however, are inadequate. In spite of this DAE is controlling hispa and masra by mechanical means and by spraying insecticides.

B3. 16.9.2001: *Daily Jugantor* page 5

Hispa Attack in the Rice Fields of Moulvibazar: Insecticide Sprays have become Ineffective

Scattered infestation of rice hispa has been observed in different locations of Moulvibazar district. Rice plants in affected fields become white. Farmers are frustrated. Whitened rice plants have been observed in Islampur and Rayoshmry unions of Sardar upazilla, Maholal, Gobindobati and Tengra unions of Rajnagar upazilla, and Bhramonbazar, Kadirpur and Rathgao of Kulaura upazilla. Additionally, attack by the same pest has been noted in Komolgonj and Borolekha upazilla. Farmers reported that insecticide are not giving effective results. Hispa come in groups, attack then fly from one area to another.

B4. 07.10.2001

Daily Ittefaque page 10

Pest Attack in Aman Field

Outbreak of hispa has spread in different upazillas of Moulvibazar district. Severe infestation has been recorded in Komolgonj upazilla.

Hispa attack was recorded as higher in Munshibazar union of Komolgonj upazilla, Sundarnagar union of Rajnagar upazilla, Brahmanbazar of Kulaura and Kalapur of Shrimongol upazilla.

DAE sources stated that hispa control is being carried out in infested areas.

B5. 04.10.2003: *Daily Jugantor* page 9

Hispa Infestation in the Rice Fields of Rajnagar (Moulvibazar)

About 50acres of rice fields have been turned brown in colour due to hispa attack. Due to adverse climatic conditions and hispa attack the rice fields of some unions of Rajnagar have become bare earth. Insecticides were found ineffective against hispa. Farmers of Munshibazar union have reported that 3.35 acres of rice fields of Khalagao, Balagao and Gyaspur localities have been attacked by hispa. Additionally, farmers of Uttarpur union have reported that 50 acres of rice fields of Indershmar, Uttarbhag, Lalpur, Haipur, Holdigul, Rajapur, Shurikhal, Shuprakandhi and Kalarbazar localities have also been attacked by hispa.

B6. 22.10.2003: *Daily Prothomalo* page 5

Rice Fields of Moulvibazar Attacked by Hispa: Farmers are Frustrated

Outbreaks of hispa and dried-up rice plants have been noted in different localities of Moulvibazar. Owners of the hispa-affected rice fields have become fed up. The Agricultural Office is continuing its control activities.

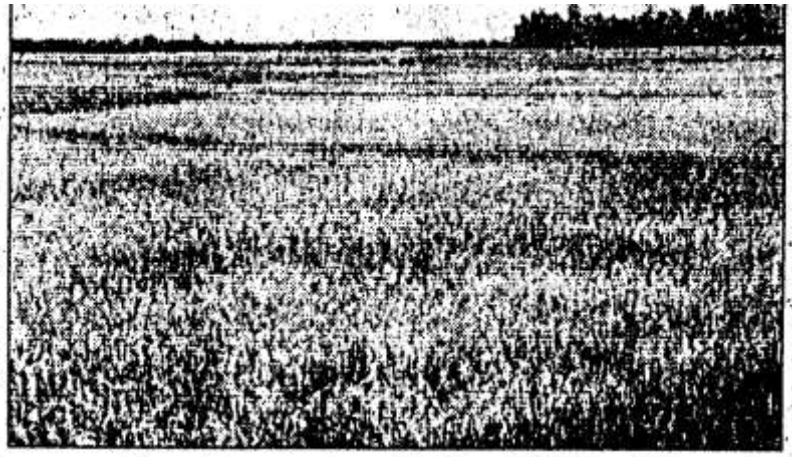
The green rice fields of different upazillas of Moulvibazar have become dried up, giving the appearance of ripening. Farmers have reported that hispa come in groups and attack.

It has been reported that severe hispa infestation was due to the cultivation of a local, late-sowing variety. Hispa infestation was recorded in Rajnagar and Kamalgonj upazillas. The District Agricultural Officer stated that about 600Ha of fields have been attacked by hispa.

DD of DAE reported that drizzle, high temperatures and cloudy skies favour the multiplication of hispa. DAE organised 34 squads for hispa control. Hispa in 390Ha of land has been controlled, and leaves of 60Ha of land have been cut. 1200 handnets and 135L of insecticides have been distributed among farmers. He also stated that Sardar upazilla parishad supplied 16 spray machines and insecticide worth Tk50ooo.
The Agricultural Officer of Rajanagar reported than 150KG of hispa have been caught and burned.

B7. 01.11.2003: *Daily Jugantor* page 9
Hispa Attack in Rice Fields of Khoyanghat (Sylhet): Farmers are Frustrated
Hispa infestation has been noted everywhere in Khoyanghat upazilla in Sylhet district. As a result farmers have become frustrated. Severe infestation has occurred on aman paddy of 8 unions of Khoyanghat. Hispa suck juice from the green stem and leaf of rice plants and as a result the lower part of the plant becomes desiccated. Rice plants are therefore being attacked before panicle initiation.

B: English-language articles, in facsimile.



SRIMANGAL: A view of an Aman Field at Chadnighat Union under Moulvibazar Thana which is worst affected by pests. —OBSERVER

Agri-Deptt inactive

Pests attack Aman Crop in Moulvibazar

Economic Reporter

SRIMANGAL, Sept 26:–Pests attack on the standing Aman crop has spread throughout Moulvibazar district. In absence of an active pest control measure by "Spraying Insecticides in the field, the farmers are in danger. To save their crop from the attack of pest special prayer has been offered and sweets were distributed.

It is learnt that Pest attack has spread in almost all the thanas of the district. In the last month pest invasion from Srimangal to Kamalganj thana took place and ultimately it spread over Moulvibazar thana. Almost all the unions of Moulvibazar excepting Kagabola and Nazirabad have gone under pest attack and the Chadnighat Union is the worst affected. On September 20 about 2000 farmers arranged a "Special Prayer" for the safety of their Aman crop.

Agriculture Department informs that due to non-supply of Spray Machine from the department and for the high price of insecticides and pesticides, the traditional pest control measures of the farmers have become tuff. But the Agriculture Department is advising the farmers to avoid insecticides spray due to its injurious effect and prescribing natural methods of pest control. Those methods are destroying pest physically and keeping the surrounding area clear.

The Agricultural Department has no assessment of crop loss yet but the department informed that the pest attack is still under control.

Aman crops under pest attack in Moulvibazar dist

From Rajat Kanti Goswami

MOULVIBAZAR, Oct 17: Standing *Aman* crops on vast areas of land are under pest attack in six thanas here.

The pests are locally known as *Pumri Poka, Mazra Poka, Leda Poka, Kalo Poka*. The pests have attacked the *Aman* paddy fields in various parts of the districts. The badly affected areas are Moulvibazar Sadar, Rajnagar and Kulaura.

About two thousand farmers at Mumrujpur village in the sadar thana arranged a *doa mahfil* for blessings of Allah for the protection of standing crops from pest attack.

Affected farmers of different areas informed that the green paddy plants had turned yellowish. The farmers said that the spray machines distributed by the Agriculture Extension Department are too ineffective to control the situation. The farmers of the affected areas cannot afford to purchase the required quantity of pesticides which are being sold in the local markets at an exorbitant price.

Moulvibazar District Agriculture Extension Department (AED) source said a total of 104 hectares of land under *Aman* paddy have been affected by *Pumri* and *Mazra* insects. They claimed that Moulvibazar district AED officials had been monitoring the situation. Necessary steps have been taken in this regards, the sources informed.

In the meantime, 69 acres of land have been protected from the pest attack.

AED sources added that this year a total of one lakh three thousand hectares of land had been brought under *Aman* cultivation.

About 52 thousand 155 hectares are high yielding variety and 16 thousand 941 hectares are local variety. However, they claimed that the situation was now under control.

The farmers have urged the concerned authorities to take immediate measures to save the standing crops from destruction immediately.

225 field workers working in Faridpur

Pests likely to affect *Aman* production in Moulvibazar

From Rajat Kanti Goswami

MOULVI BAZAR, Nov 2: *Aman* cultivation is likely to fall short of target due to massive pest-attack on paddy field.

Aman paddy on 1,000 hectares have been affected by *Pumri* and *Mazra* insects. However, the district Agriculture Extension Department (AED) claimed to have taken adequate measures to protect crops from massive damage.

About two lakh one thousand 480 metric tons of *Aman* is likely to be produced in the district, according to local AED. The production target has been fixed at 35,320 metric tons in the Sadar thana, 26,940 metric tons in Srimongal thana, 26,092 metric tons in Rajnagar thana, 45,956 metric tons in Kamalgonj thana, 49,071 metric tons in Kulaura thana and 18,081 metric tons in Baralekha thana, AED sources said.

A total of one lakh 12 thousand 900 hectares of land was brought under Transplanted *Aman* cultivation in the six thanas here.

Out of the total land, High Yielding Variety (HYV) of *Aman* was cultivated on 66 thousand hectares and local variety on 46 thousand 900 hectares of land.

The thana-wise break-up of land under T-*Aman* cultivation was as follows: In Moulvibazar sadar thana a total of 19,850 hectares land was brought under cultivation. Of this, 11,500 hectares under HYV and 8,350 hectares under local variety of cultivation.

In Srimongal thana, the total land under *Aman* cultivation was 15,975 hectares. Of this 7,770 hectares under HYV and 8,205 hectares under local variety.

In Rajnagar thana, the total cultivated land was 15,785 hectares. Of this 7,150 hectars under HYV and 8,635 hectares under local variety.

In Kamalgonj thana the total cultivated land was 22,880 hectares. Of this 18,500 hectares under HYV and 4,380 hectares under local variety.

In Kulaura thana, a total of 26,530 hectares of land was brought under cultivation. Of which 17,255 hectares under HYV and 9,275 hectares under local variety.

In Baralekha thana a total of 11,880 hectares was brought under T-*Aman* cultivation. Of the total figure 3,825 was brought under HYV and 8,055 hectares under local variety.

However, the official source said, 23,074 metric tons of urea fertiliser were allocated for Moulvibazar district though demand of urea was 12,950 metrict tons. Later on this allotment was reduced, according to the demand.

On the other hand, SSP fertiliser was yet to be allocated according to the demand. So farmers here are purchasing SSP fertiliser from the market at high price.

Our Faridpur Correspondent reports: A total of 7,653 hectares of land has been brought under Transplanted *Aman* paddy cultivation in eight thanas during the current season.

Of the total 7,653 hectares of land, 6,790 hectares have been brought under HYV and the rest 863 hectares under local variety.

Thana-wise break-up is as follows. A total of 3,267 hectares of land has been brought under T-*Aman* cultivation in Sadarpur, 23 hectares in Char Bhadrasan, 251 hectares in Nagarkanda, 195 hectares in Sadar, 253 hectares in Bhanga, 1415 hectares in Madhukhali, 1,851 hectares in Boalmari and 398 hectares in Alfadanga thanas.

The production of paddy (HYV) is expected to be 2.5 tons per hectare while that of local variety is 1.1 tons per hectare.

According to the District Agriculture Extension Department (AED) sources, 225 field workers have already been engaged across the district to supervise and make the programme a success.

Pests attack Aman paddy in Barisal

from Our Correspondent

BARISAL, Oct 16: Pests have attacked Aman paddy in different parts of Barisal region causing grave concern among the farmers.

A total of 8,21,380 hectares of land have been brought under Aman cultivation in the six districts of Barisal division in the current season. The districts are Barisal, Barguna, Bhola, Patuakhali, Pirojpur and Jhalakathi. The farmers of the region are apprehending that the production target of Aman paddy will not be achieved due to massive pest attack.

Sources in the Barisal Agriculture Extension Department (AED) told this correspondent that Aman paddy on vast tracts of land in Barisal region, including Jhalakathi district have been attacked by 'pamri' and 'majra' pests. The worst affected areas are in Jhalakathi district.

On the other hand, Aman paddy on 100 hectares of land came under 'ufra' disease and have been badly damaged during the last one week at Chakar, Madarkathi and Salia Bakpur areas of Banaripara upazila of the district. The sources, however, claimed that the situation is under control.

But a large number of farmers alleged that the new crop-fields are being attacked by pests and diseases in the absence of timely spraying of pesticides by the authority concerned. It is not possible for the farmers to combat the menace due to shortage of pesticides and spray machines, the farmers added.

On the other hand, farmers of Satospur and Khasherhat villages in Muladi upazila and Charbaria village in Sadar upazila of Barisal district and Tuskhali in Mathbaria upazila of Pirojpur district disclosed that thousands of rats have damaged crops on over 100 hectares of land during the last two weeks.

AED sources said, after getting the information, the department started a special drive to control the situation within a short time.

Pests affect Aman paddy on 539 hectares

HABIGANJ, Oct 29:– Pests have affected Aman paddy on 539 hectares of land in eight upazilas of the district, disheartening the growers. Agriculture officials said some 86 hectares of land in Sadar, 40 hectares in Madhabpur, 106 hectares in Churarughat, 60 hectares in Bahubal, 190 hectares in Nabiganj, 12 hectares in Baniachong, 25 hectares in Laghai and 20 hectares in Azmiriganj upazila came under attack by Majra, Chungi and grasshoppers. It is to be mentioned that AED has brought 50,100 hectares of land under Aman farming in the district in the current season. Of the total, 11,700 hectares were cultivated in Sadar, 880 hectares in Madhabpur, 16,795 hectares in Churarughat, 10,730 hectares in Bahubal, 7,254 hectares in Nabiganj, 406 hectars in Baniachong, 1,860 hectares in Laghai and 475 hectares in Azmiriganj upazilas. Meanwhile, scarcity of pesticides has been prevailing in the district. Due to abnormal price hike of the insecticides the poor farmers cannot afford to buy it, says UNB.

Pest attack may hamper Aman yield in Satkhira

Our Correspondent, Satkhira

Sept 30 :Massive pest attack may hamper Aman production in Satkhira district, some farmers of the district told this correspondent recently.

Pests have attacked Aman crop on vast tracts of land in the district, triggering grave concern among the farmers. The local Agriculture Extension Department office has taken no step to spray insecticide to combat the menace, some farmers alleged. The poor farmers of the district are extremely worried due to pest attack. Many farmers of the district are burdened with debt. Under the circumstances they cannot think of repaying their debt. The farmers of the district had cultivated their lands with great expectations, but they are now steeped in utter despair. About 23,170 hectares of land have been brought under Aman paddy cultivation in the district in the current season. The farmers apprehend that the production target would not be achieved due to pest attack.

Most of the farmers of the district are not in a position to buy pesticide to combat pest attack. They urge the relevant authority to take necessary measures in this connection.

Gurpukur mela begins

The month-long historical Gurpukur mela (fair) began in the district town with much enthusiasm recently.

On the eve of Sree Sree Biswa Karma Puja and Manosha Puja of the Hindu community, this fair is held every year in the district.Temporary shops have been set up on both sides of the main road. Thousands of people from across the country are visiting the fair being held at Polashol area in the town.

Flute, s balloons, dolls and toys are the attraction of the temporary shops. Besides, circus, 'nagardola', puppet show have also been arranged to mark the occasion.

The nurseries are adding to the attraction of the fair. Furniture, varieties of handicrafts and cottage industries are also attractions of the fair.

Not only that in order to make the fair a success, many sweetmeat shops have also been set up in the fair. No untoward incidents have been reported.

Standing T-Aman crops attacked by pests in Sylhet

UNB, Sylhet

Oct 1 : Standing Transplanted Aman crops on vast tracts of land in Fenchuganj upazila have been attacked by pests causing concern among the farmers.

Crops on about ,1000 acres of land have been damaged in the last few days due to the attack.

"Pest invasion is going on in massive scale day by day in the absence of coordinated efforts of the authority concerned," farmers said. AED has been spraying insecticides in the crop fields since September 25 with no fruitful results. Meanwhile, the stock of insecticides and spray machines is quite inadequate to check the pest menace.

Besides, the net used to catch the pests is not available in the market. Small and marginal farmers cannot use insecticides due to its high price in the market.

The affected farmers urged the authority concerned to take effective measures to save their crops from the unabated pest attack. Another report from Joypurhat adds : A young man was killed and 39 others were injured in a bus accident on Akkelpur-Santahar road in Akkelpur upazila here Saturday.

Witnesses said the driver lost control and the Shantahar-bound bus fell into a roadside ditch near Bhalkir bridge leaving 40 people injured.

Nine of the injured were admitted to Joypurhat Modern Hospital in critical condition. Of them, Parameshwar Rabidash, 37, of Kumpur village in Akkelpur upazila, died in the afternoon.

The other injured people were admitted to Akkelpur upazila Health Complex. A case was filed.

Another report from Sunamganj adds: A man was killed and another injured in a road accident on Sunamganj-Sylhet road near Nilpur bazaar Sunday.

Witnesses said the accident occurred when a motorbike collided with a Sylhet-bound coaster killing motorbike rider Shamsuddin Ahmed Chowdhury Babul on the spot. Co-rider of the bike Azizur Rahman was admitted to Sadar Hospital in critical condition from where he was shifted to Osmani Medical College Hospital.

Police seized the coaster but the driver managed to escape. A case was filed.

Yet another report from Patuakhali adds : A woman injured in the attack of her insane husband Saturday died at Barisal Medical College Hospital Wednesday.

Police said Abdus Sattar Bepari who was mentally sick beat up his wife Holdi Begum and his three daughters with an iron rod Saturday.

His 4-month old daughter Farzana died on the spot while others were rushed to the hospital in critical condition. Holdi Begum succumbed to her injuries after three days. Police arrested Sattar and a case was filed.

Crisis of insecticides hampers *boro* farming in Habiganj

BSS, *Habiganj*

Acute crisis of Furadon brand insecticides has been hampering the cultivation of high yielding Boro paddy in Habiganj.

The current Boro cultivation has already been affected and delayed due to recent severe cold wave, according to farmers.

The farmers who are now very busy in planting Boro seedling have been hard-hit by the price-hike of TSP and Potash fertilisers and diesel.

Non-availability of Furadon granules insecticide has further aggravated the plights of the farmers.

Furadon granules insecticide is very much effective to control mazra and other insects harmful to Boro paddy, the farmers said.

It also helps increase production, they said.

The farmers complain that there is no insecticide in the markets for the last few months. Some insecticide traders told BSS that Padma Oil Company which is the distributor of Furadon has been failing to supply insecticides to meet the demand of farmers.

Pest attack may hit Aman yield in Barisal

OUR CORRESPONDENT, BARISAL

Oct 29 : Pest attack may affect production of Aman paddy in all the 10 upazilas of the district in the current season.

About 4,000 hectares of land are now under serious pest attack in Bakergang, Babuganj, Mehendiganj and Hizla upazilas.

According to the Agriculture Extension Department (AED) sources, about 1,25,500 hectares of land have been brought under Aman cultivation this year in 10 upazilas of the district.

The upazilas are Barisal Sadar, Gournadi, Aguiljhara, Babuganj, Uzirpur, Banaripara, Hizla, Muladi, Mehendiganj, and Bakergang. Pests namely tungra, Majra, Sabujpata, Faring and others attacked about 4000 hectares of Aman of the pest affected land.

Of the pest affected lands, 480 hectares in Sadar, 881 hectares in Babuganj, 121 hectares in Uzirpur, 815 hectares in Bakerganj, 127 hectares in Gournadi, 24 hectares in Agoiljhara, 672 hectares in Muladi, 100 hectares in Hizla, 640 hectares in Mehendiganj and 135 hectares in Banaripara upazilas of the district.

AED sources however claimed that pest attacked about 3000 hectares of land and the situation is now under their control.

Ignoring the claim of AED officials, farmers told this correspondent that no official visited the affected areas.

3.2. Full Interview Study Notes

This appendix contains the original conversation notes made during the interview study of Government-Level hispa control options. They are presented in courier font as “raw data”.

#1 Regional DAE Office

Here now is in boro season. Some of their people are sweepnetting. Do it 100 times. Catch over 100 hispa - more than one per sweep. They're not too worried - now in late tiller stage to early flowering, probably not a particularly susceptible period so hispa does no harm. Last T Amun, 100 ha of paddy were affected in the whole district, out of a total of 58000 ha.

They divide the district on a hand-drawn map into 3 zones as broad stripes:
- Lowest area, with broadcast amun (deepwater amun) and boro, and no hispa
- A bit higher, is transplant amun, boro and aus, and hispa is a problem
- Highest, hilly area where hispa is bad sometimes. This has forest and tea, and in valley bottoms of hilly bits vegetables followed by t amun.

Some of here are sporadically affected; Sylhet and Moulvi Bazar have it worst.

T amun is particularly susceptible to hispa. And b. amun (deepwater rice) when it is a seedling. These are the 2 most susceptible rices. Hispa is also present in boro, but here does less damage than in t. amun.

#2 DAE Extensionist

The extensionist makes the good point that the hispa population can come from farmers' inattention or lack of care. Haor plots, beel etc are neglected, so the hispa population increases; this is a question of degree, and so plots next to surfaced roads will have lesser hispa problems, and so a completely wrong sample.

#3 DAE Office

Hispa was very bad in the early Eighties, in the days of Zia (the politician) is and therefore is called "Zia Phoket" ("Zia insect"). Now it is in northern India (directly to the north of Sylhet). He's heard Indian broadcasts warning people. It will come here because "you know it is migratory". DAE is fighting - has handed out free 8000 sweepnets to meet the menace.

One fieldworker has a theory – that the surge in hispa populations in the 1980s, from which we have yet to recover, came from a period of unusually good farm years in that decade, which produced a long period of lush rice and let hispa build up. This bonanza was due to the huge deposition of silt in those years by uncontrolled deforestation in the Himalayan headwaters of the Ganges and other rivers. All very productive. He’s

not sure why the population did not subside back to earlier levels when this bonanza ended.

#4. Senior Office, Dhaka

Poster on the wall: "Strengthening PP Services Project, DAE/DANIDA" Budget 285 million taka; GoB contribution 68 million taka.
- Develop National IPM Policy, capacity, quarantine etc.
- Train 812 DAE & 120 NGO extensionists in IPM.
- Set up 3320 FFSs, train 83 000 rice farmers and 15 000 vegetable farmers
- Expose 830 000 rice and 150 000 vegetable farmers to IPM
- Reduce pesticide use on IPM farms by 80%

Duration 5 years starting July 1997.

Posters on the wall: presentation of example cases to show the benefit of SPPS IPM training:
- Pesticide spending reductions are 80-90%, yields increase by 5% or so.
- Sex participation is 85.6% males for rice training, 50.1% males for vegetable.
- Cost of SPPS Phase II - DANIDA 297millTaka, GoB 46millTaka.
- Numbers of farmers reached (targets 117000 rice farmers 78000 vegetable farmers).
- Phase II is to last 3 years.

DANIDA is still going on. There have been 2 funding projects - FAO ended 2 years ago; SPSS is still running - Phase II to 2005. IPM is only extended in "IPM Upazillas", which are 201 of the national total of 465. And in only 64 districts.

In Bangladesh 65-70% of population is in agriculture.

Now it is dry & sunny. Transplanting is in different times in the 64 districts of the country. 464 thanna in the country. In each Upazilla DAE has three people - Agricultural Officer, and 2 others. Tha AEO (PP) can report a pest problem, and then DAE responds - technology and support people, organise a meeting

The supply of pesticides for sale on the market (not donated) is no longer part of DAE work - handed to the private sector in 1979. DAE supervises manufacture and so on and controls quality.

Support apart from pesticidal supply includes equipment eg sprayers loaned and hired. DAE did give out sweepnets, following a surveillance report from AEO-PP. If a problem is reported, a meeting is organised.

DAE recommends:- biological control; sweepnet; etc; insecticide as last resort.

1995-6 was a bad hispa outbreak and sprays were needed. Last Amun it was bad in Sylhet. The pest is bad because it builds up in wild areas - Sunderban in south, Assam in north.

The last aerial sprays were in 1997 - on wild reservoir hosts. 10oooHa were covered by infestation. Spray if minimum of 5000Ha affected - this is thought to be beyond ground

control and so an aerial spray is suggested. DAE has 5 planes - 3 Cresco and 2 Viva. If less than 5KHa are infested no aerial spray.

Officers do surveillance - get farmers to visit fields - some do and some don't - then report. Farmers often leave it too late, and go to DAE only when farm is completely attacked.

SPSS recommends: sweep, don't spray, threshold spray, leaf clipping and beating of leaves to knock adults into water. A big emphasis on good seeds, healthy seeds and seedlings, clean cultivation.

FFSs focus on all this - monitor fields daily etc.

Bounty system not in use at the moment, but he quite likes it. Pay Tk20/KG and people bring in hispa they've collected.

Before 1985 h was in SW - Kulna, Barisal. 1985 extended all over the country; then receded but it stayed in Sylhet.

Some flexibility is now coming in for fencing of sectors in the DAE budget. Under the last two governments it was rigid, now DG is allows discretion to reallocate.

Budget is all broken down. By district level. We have no current budget for a buffer stock of pesticide. There is a budget for allocation to buffer.

Surveillance: Reports go all up the chain from all districts to national level, then "We take the necessary steps to control the infestation." Information comes in on crop areas and infestation.

Pheromones and light traps are used against stemborer;

Research is through BRRI - a bit of validation e.g. of pesticide/no-pesticide may be on demonstration plots (there is big use of demonstration plots in the DAE system).

Hispa was bad for 1992 to 97, since then not present and bumper crops

#5. Senior Office, Dhaka

FFS concept is the big thing (on the Indonesia model). Demo plots a bit less. 25 farmers attend one FFS, with 3 or 4 trained people train these. We think it the best model for technology transfer to farmers. Extensionists meet 25 farmers weekly for 14 weeks. Now the idea is a move to ICM (integrated crop management). Help farmers to take decisions - agro ecosystem analysis. Monitor/followup activities. IPM clubs - part of the follow-up to keep information flowing. They have requested BRRI to evaluate the impact of this project (in rice - and BARI in vegetables). BRRI economics division is doing this now, have developed questionnaire. SPSS has monitoring to assess impact of training - interview farmers before (Benchmark survey) and after training. These surveys are done by the extension trainer.

What is or may be the role of a warning/alert system? Monitoring is done fortnightly by block supervisors. Surveillance linkage from field to HQ. "We have to send information to control this pest."

GoB has approved National IPM Policy, we are now developing National IPM Programme.

There are 10000 block supervisors in Bangladesh.

Survey form - focuses on HYV, because used to be for traditional varieties as well, but now HYVs are so popular we can fill the FFSs with people growing them, and these are the varieties which need IPM and benefit from it. Similarly Aus is not covered because not grown all over the country. The vegetable form is very similar.

Pesticide data is available- Pesticide Association of Bangladesh, now Crop Protection Association of Bangladesh.

SPPS project reaches only 200 Upazillas. Also trains NGO people as trainers. Both big and small NGOs. E.g. BRAC, Proshika. NGOs interested mainly in IPM training, more than in forecasting or similar.

Block monitoring forms (loose sheets, no holes). In each upazilla the officer selects five 20Ha blocks to be representative of the whole upazilla. This form is for this, filled in weekly, merged together to derive a map of Bangladesh showing the 64 Districts. Explained in Ramaswamy, S, Kazi Shafiq Uddin (eds) "New Pest Surveillance, Forecasting and Early Warning System for Bangladesh" (DAE-DANIDA SPPS Project SPPS 49, April 2001) 58pp.

There is no agreed and sure economic threshold for hispa.

The timing of hispa attack - the main attack is 65 days after transplanting, up to 95 days; but hispa is also found infesting seedbeds.

In operations terms, what Government operations other than SPPS? This section keeps track of pests all over Bangladesh, and take whatever action is necessary.

#6 Senior Office, Dhaka

The new system works well. Now in 200 upazillas in 64 districts. Funded by DANIDA in Phase II of SPPS.

Policy formulation is a major activity. National IPM policy was approved 2002, to implement it will take time. It's not just the DAE - NGOs, rural development agencies, economic development, all will need to be allowed to make input.

"Operations" may consist of: The bounty system has been used, though not currently, and is quite satisfactory. 20taka per kg is offered, and people bring in large quantities caught with sweepnets.

In 1988 a spray team was being operated out of Barisal airport in a major and serious hispa outbreak. After operations they boarded the aeroplane to leave, but "thousands of farmers" blocked the runway to demand that they stay and extend operations. More fuel and insecticide were sent for and operations were prolonged for two days.

Barisal and one other were DAE airfields, dating from the period of union with Pakistan. In 1995 they were handed to the CAA to become airports, but as part of the agreement MoU DAE pays no landing or parking charges on any of the CAA's 8 airfields.

The aeroplanes are kept in Dhaka, fuel and insecticide are taken to regional airfields by road.

NGO #1. Regional

This is a little local NGO. It works in 5 districts. Finance is from a foundation, PKSF, which under the Ministry of Finance. They provide microcredit, for income-generating activities, such as nursery, trading. There are about 200 cooperatives in this area. Each group has 15-30 families. Give credit of 4-25ooo. DAE "Smallholder Support Project". They are now not working on agriculture any more. "Sunderban Biodiversity Project" is one they do. No agricultural specialisation. Recently were in specialised projects in Barisal Sardar. Select farmers through Block Supervisor. Credit is given, a bit in the style of Grameen Bank, and also training, with the DAE technical support from the Agricultural Officer. The NGO provides organisational support.

#7 Local DAE Office

South-west - everybody believes hispa comes from Sunderban - three adjoining regions.

Last year the hispa population declined. The last aerial sprays were in 1996 - none since.

In 2003 aus there was some hispa attack. DAE came and did a farmer rally in 3 districts.

Hispa is mostly in aus and t amun, boro not much. Has the introduction of boro cultivation made hispa worse? Hispa was prevalent before boro was introduced.

Role of water - hispa likes the wet. Major here because it is always wet. Sylhet is also a wet area. Flat and wet - Magalaya, Assam, western Myanmar, inland of Cox's Bazaar.

Hispa likes local varieties of rice. HYV attack is less.

Most of the DAE work here is farmer training.

What are the advantages you would hope to gain from the hispa project? Farm-level training, field staff & block supervisors, equipment & material, resistance, forecasting (a bit less emphatic).

Aerial spray is very important. There is interest in Trichogramma - looked at by SPPS.

(Aerial fungal sprays may avoid problems of chemical insecticide, particularly for fish, prawns. Village-level fish cultivation is large and growing in Bangladesh, including at least one DFID project which JS saw a report about on the Discovery Channel.)

Fieldworker - "sometimes there are 200 hispa on one hill, but still the farmer will not clip."

One suggests hispa may travel by water too - this is why it infests river banks first and then moves in land.

Studying the sheet of hispa-affected and pest-managed areas; coding for data collection:
- "Area with pesticide" is farmer-treated with his own pesticide and spray
- "Area without pesticide" is farmer-treated with sweepnets, clipping
All are by farmers' own reports.

The best place to control is in the seedbed.

Aerial sprays. There is a lot of work to do on the ground. Farmers are asked to put up red flags in affected fields. The pilot drops only on affected fields. There is a report to fill in for before spray and after spray insect population density in all red-flagged fields.

There are 12000 blocks in Bangladesh, so the block supervisors are the people who do the work on the ground. Each field is pre-counted, flagged and post-counted, all on the ground.

The DAE do loan sprayers. This is important and DAE Operations is trying to increase the stock of machines.

Each Upazilla has:
- agricultural officer
- additional agricultural officer
- agricultural extension officer (responsible for plant protection)
Each Upazilla will also have sprayers for loan to farmers - right here are 2 motorised sprayers which don't always work, and 8-10 lever-operated ones which do. If problems arise they are mended. They are needed when infestation is heavy. The District Office also has stock, so there is additional reserve of lever-operated sprayers to be drawn on when needed.

Knapsack sprayers now available are not lever-operated-knapsack sprayers (LOK) but compression sprayers. In the 1980s and 1990s LOKs were imported from eastern European countries such as Bulgaria, but the supply dried up. Five or so local companies make compression sprayers, which are easier and cheaper to manufacturer, and so are used. A compression sprayer costs about Tk2500 - an LOK would be about the same, but are not easily available. Farmers cannot afford these costs. The DAE does not really have enough money for a satisfactory supply of these.

LOKs are not manufactured in Bangladesh. The manufacturers of compression sprayers have been authorised by DAE and standardised the designs to conform to standards.

Links between research and extension are important. There is a National Agricultural Policy, and now a National Agricultural Extension Policy (NAEP). The NAEP is to restructure the Agricultural Extension Department, to be better than the old Training and Visit system, by 2006. There is a strategic 5-year plan for 2002-6. There is a Working Group to see to it.

DAE operations. Function is to monitor and surveille - then take "necessary steps" e.g. severe hispa/BPH/masra in one place, goes or sends an officer, report, then report to to D(PP) the position, "take necessary steps to control".
1 - farmer training/workshop
2 - give net
3 - loan sprayer
4 - give farmers buffer stock - pesticide provided to poor farmers - it is donated, not sold, but only a small stock for emergency.1L 500 taka
5 - arial options
Also - bounty, advise and request, but not require, pesticide companies to maintain stocks in risk zones. "They follow our advice." we have good relations because they need us to register & approve pesticides. Also a continuous programme of training, a training officer in every district.

The bounty - there is still provision, but at present no funds from the Government. 10ooo taka SPPS gave to Habiganj and Bandigaraya. 5ooo each in October 2003. PP has discretion over the budget - allocation to different options. Govt sets totals of money in categories as totals, you can't move money from one category to another without permission of Ministry of Finance as well as Min of Ag. So these categories are set hard; PP has discretion in each individual case, but not overall. So now there is no possibility of bounty because this budget is empty. 2003 there was a budget for pesticide, we said we wanted machines, not pesticide, but Ministry of Finance (passed to Finance by Agriculture) said no. 2-3 months go by. June-July important time. Min of Ag passes requests to Min of Fin. Submitted 50 lakh proposal for machines to be provided to farmers. Still in the pipeline. He wants machines per upazilla - 3 hand sprayers and 2 motorised.

Also a district-level reserve - would like 5,6,or 8 hand sprayers, 4 power sprayers (which go to the big farmers with the fuel and large areas). Only the machine is loaned - not the fuel or pesticide. Emergency provision of pesticide to farmers is separate from sprayers. They have to try to meet demands from farmers. Of 20 farmers in Barisal one had a sprayer. 2500 taka for a sprayer. Even emergency requests have to go from ag min to fin min and it takes too long. Too slow. So for hispa we ask govt for money for sweepnets; by the time it arrives its moved beyond the sweepnet stage to the stage needing insecticide; if we ask for insecticide by the time it arrives its all too late. 2-3 months. Aerial application has no standing budget - at moment no aerial budget at all. Outbreaks need to go to Min of Ag and Min of Finance.

There are never aerial sprays against masra or PBH - only hispa gets aeroplane treatment. Masra can be controlled from the ground. BPH maximum attack it at ripening stage, so an aerial spray will expose consumers (& to a less extent harvesters) to residue.

After an aerial spray records are taken at 24, 48 and 72 hours. Leaf-folder is a bit of a pest, not much. Sporadic and isolated.

Table @1. Scoring matrix of the importance of intervention options against four major rice pests - hispa, stemborer (masra), brown planthopper (BPH) and leaf-folder - as perceived by personnel at DAE Operations. Personnel were asked to score for "Importance" the roles of the different actions available to the Operations Unit in response to the various pests. Scores are 2 for maximum, 0 for no-use and '-' for not applicable:-

Operation	Hispa	Masra	BPH	Leaf-folder
IPM Training	2	1	1	0
Sweep-Net Donation	2	1	0	0
Bounty Payment	1	0	0	0
Sprayer Loan	2	1	2	1
Pesticide Donation	2	0	1	0
Aerial Spray	1	-	-	-
Sum	10	3	3	1

NGO #2 National Office in Dhaka

Vice-president is an ex-entomologist in the Government. Organise farmers. Run pest and management training courses. Thana level people and come and talk. They mediate between farmers and the Government. Pesticide comes from Government. NGO uses organisational skill to help farmers get pesticide from the Government.

Microtraining programmes are a large part of their work, with a part as credit, basic education, social welfare, orphans, widows, and poor. People help with building houses and dowry-less marriages. In villages people can't marry without a dowry. They marry people here in Dhaka from the countryside. 100 weddings this year.

Services:
- Organisation
- Credit programme and training in using money use.
- Farm training programme. This may include different subjects e.g. pest management, sugarcane cultivation. Expertise and training is from in-house experts, or thanna-level officers - government people, most from min of agriculture, also fishery and livestock, health and sanitation. The government has its own programme, and we gather our farmers. Is any farmer training not from the Government? Eg universities? "In some places we find some friends."

Is hispa treated as a particular problem? Not really - give training and pesticide. In the market are pesticides. They lend sprayers as well as donate pesticide.

IPM is in training, not, for example, sweepnet provision. But a farmer could use credit provided by use to fund hispa control as a productive input.

Hispa is less when it is sunny. Sunshine hours are important for hispa.

Chairman says priority in education is moral training, or one farmer will get a good crop and another will steal it. When he started in Barisal farmers didn't do anything to control pests - it's from God, it's natural, why interfere? He had to say When you are sick take medicine - pesticide is medicine for plants. Farmers came to call him the "Insect doctor".

NGO#3: National Office, Dhaka

It was established in 1986. He joined in 1997 - it's grown since. 6 divisions, including:
- microfinance
- agriculture
- street children programme (special programme)
- education
- health
- finance and administration

1100 staff - "medium-sized organisation" 40 districts. "Our strong father is IFAD" "Strong relationship with DAE" and project of diversification. Smallholder farming improvement project, SAIP. Links with BRRI, BARI, BARC. PKS foundation - links for microfinance. Shonali Bank. Department of Nonformal Education in Ministry of Education - no degree or certificate, in gap time in peoples' lives - 2-3 hours inserted. It's hard to reach children. UNDP. Ministry of Social Welfare. Aim for changes with street children and disabled people too. In agriculture, trying to link extension services, technology, finance (particularly financial services). 2 goals - development in itself, and institutional development.

NGOs have proved essential - in development a pusher of the government, as are donors. Institutional sustainability is a concern. How can we sustain? Try to introduce a cost approach in everything - nothing is free of cost.

Agricultural division. IPM concept. We use no pesticide. Mechanical. Organic. A lot of learning what farmers need and what society needs. Production, information & technology, marketing and extension must all be integrated. Urea supergranules - where we have no expertise we build links to get it - gov, nongov or private sector. We have experts in seeds, soil testing, water management. 1 agriculturist, programme expert, 1 adviser, another expert. Field services director is ex-DAE. Livestock, poultry, fisheries, agricultural credit. Send specimens to BARI etc.

Insect control we go out of house: largely from government. For NGOs maintenance of specialists is hard. DAE is used a good deal here. NGOs are for organisation, mobilisation, links to expertise elsewhere. We need helps - have an agriculturist, even entomologist, but not at that level. Technical inputs to IPM project from SPPS, DAE.

Had an IPM project, May 98 - Dec 01. Training, workshop, field-level activities eg field visits, demonstrations, field day. ADB and DANIDA. Not all over. Connected with SPPS; supported by SPPS. It contained no pesticides at all - hispa caught by

netting. JS observes this may be seen as risky - possibly lucky there was no bad hispa outbreak in that period. In fact, it turns out “no-pesticide” is “low-pesticide” - minimal use.

Also pest management integrated with rice fish culture. Their sun-dried fish is DDT-free. Hitherto farmers put DDT in fish culture to control lice. They had a livestock for Winrock, with no medicine or antibiotics. PM and rice fish culture - took knowledge from IPM project, for no-pesticide. In lowland, with 6 months H2), motivate to stock with fingerlings. Control by hand or net. Any pesticide would kill fish so IPM important to get it to work. (PM & fish culture is not yet a project as such, but they intend to use in future projects what they’ve learnt - pesticide is a constraint to pisciculture.

#8 A group of current and ex-agricultural pilots.

One has left and is now GMG airline captain. I work against hispa. Chemical, not IPM ha ha. 17 years - 1984-90 I flew, then it stopped so I left. 1990-2000 no operational flying. Could do surveillance, cloud-seeding, VIP transport. Thus bought 3 - 1 for spray only, 2 for passengers and spray. 1990 bought 3 Crescoes - 1 sprayer, 2 adaptable. Now in VIP role but never used. The dual role capability was a special order, not standard - added 30-40% ($300ooo) to the cost. The option was added after the initial order was agreed. Bought in 1995-6. Order was 3 million dollars. ADB money. Cresco 600 turboprops. The others are Canadair beavers, obsolete and now being sold. Since the purchase only one plane (the not-dual-use one) has been used - 40 hours of operations. The planes have not been maintained to instant readiness for 5 years, and could not be made to fly straight away, would need to be overhauled to fly again. There is now only one pilot. “If there is a hispa attack in thin short time you will be in thick soup.”

Hispa used to breed in the few islands left above water when the whole of Bangladesh is flooded. Spray the ratoon. Identify areas for breeding. If I’d known I wouldn’t have done it - we put ourselves out of a job by precision controls. Put us out of food. We called it Suicide squad flying.

The flags are 3 feet high or so. A number of flags. Used to spray down the Indian border and the Indians used to put up red flags in their fields hoping to get a free spray. Which border areas? Bagehat, Sundarban, not Assam.

They sprayed Sylhet a few times. Last sprayed Sylhet in 88. It was havoc in 84. Canada government helped - sent 3 pilots, 2 engineers, to help spray all over.

Spray is hard as field boundaries aren’t clear, particularly in beel.

Do the flags go at the corners? No. 3 thousand Ha. 100 flags to show the whole area -a big field will have many flags to show the area. Is there a risk of spraying in the wrong place? Small. Spraying outside the right area is not a problem because people are happy for pesticide. And also it didn’t happen. Maps show the areas - 1" to 4 miles, some 1" to 2 miles. Not spraying individual fields, minimum requirement for an aerial spray is 1000 acres (300Ha). Area 1/2Km x 1/2Km is 250Ha - minimum area. Altitude. ULV concentrate. 10 feet, 15 feet. Oil-based ULV.2 Micronair nozzles, 1 on each wing. If

spraying high volume, with water, you need your wheels in the vegetation. 90-100mph. It's not dangerous.

Weather is bad from mid-March to mid-May. Most hispa sprays are September - March; avoid bad weather.

So you need other jobs. 5 years with no spray - bad for costs, bad for planes, bad for morale. Do nothing for 5 years. Need alternative jobs. Basic pay is increased by operations - one day of operations is equivalent to 1 month of basic pay. We get really fed up. Airline flying is exactly like sitting in the office. Procedural. Programmed. All taken care of - no risk. Crop flying is a lot more fun.

Went to NZ to get his Cresco rating.

Pilots think hispa can be controlled in ratoons. They did spray on farms to manage for farmers, also ratoons. (Dec) Jan & Feb is the time to spray ratoons. So 2 sorts of mission - mostly on crops in September & October; suicide missions on ratoons in Jan & Feb. Round Bagehat and the Sunderbans. 30K acres. Ratoon a problem in very marshy land - bagehat and sunderban fringe - where it descends to the swamp. Ratoons are particularly likely in these wet areas. So why is hispa a problem in Sylhet? A vast area of boro.
Hispa is "Luha poka" - "iron insect" - hard and like a tank. Birds don't eat it. Ladybirds avoid it.

There is always some rice -round borders of tea gardens in Sylhet are damp bits where rice can be, and is, planted.

They were present at the blocked-runway episode in 1990. Farmers in Barisal have a lower threshold to complain to the DAE, compared with those in Sylhet. "In Sylhet they are pest-loving people." Sylhet is very London-oriented - they are all around Aldgate and Brick Lane. Not such serious farmers.

#9 Senior Office, Dhaka

The SPPS system is impressive but how wide does it reach? IPM is only extended in "IPM Upazillas", which are 201 of the national total of 465. And in only 64 districts.

Of these improvements, how much are probably due to hispa? About 15-20%.

Budgets for different controls at DAE Ops level. Why is there no money in the budget for buying sprayers for stock? The govt gives the money to seed/fertiliser subsidy instead. The Ministry of Ag allocates to "Headwise demands" - submissions made under heads such as "employee salary" or "aerial spray". A headwise demand for sprayers was not made for 2004. Without a headwise demand it is impossible to allocate any money - even with one there is no guarantee. "You demand a crore and get 5 lakh." The loans of sprayers declined because although they were needed, the government has more urgent priorities. Requests for sprayers for loan were submitted but the Government said No.

Do we have statistics of crop loss to hispa? Yes - they will be there. DAE should have pest loss statistics. Bangladesh Bureau of Statistics will also have loss data, perhaps. Without control the farm-level loss can be 50-60%.

Have there been economic evaluations of the returns to investments in different state antihispa interventions e.g. sweepnet donation. Probably not.

What are the advantages to the farmer of a forecast/warning system? Alert the farmer - he can clean his field; he can raise money which will be needed (borrow, scrounge); he can look for a sprayer.

Table @2. Plots by office personnel of the fluctuations in investments in the six options of the state for hispa control over 20 years from 1984 to 2003. This shows importance as scores from 1 for "minimum" to 5 for "maximum"

Decade	1980s						1990s										2000s			
Year	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3
Training	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5
Net	1	1	2	2	3	3	4	4	4	4	4	5	5	5	5	5	5	5	5	5
Bounty	1	2	3	4	5	5	4	3	2	3	4	5	4	3	3	2	2	1	1	1
Sprayer	1	2	3	4	5	5	5	5	5	5	5	4	4	3	3	2	2	1	1	1
Chemical	1	3	5	5	5	5	5	5	5	4	4	3	3	2	2	1	1	1	1	1
Aerial	1	3	5	5	5	5	5	3	1	1	1	1	1	1	1	1	1	1	1	1

Observable from this:-
Training has always and steadily increased in importance.
The donation of nets increased consistently and has been steady since about the early-mid 1990s.
Bounty payment has had two surges with the big infestations.
Sprayer loans went up, then down.
Pesticide subsidies went up faster than sprayer loans, then declined faster.
Aerial applications, after the last emergency in the late-80s/early-90s, declined most sharply of all.

Sprayer loan budget is now empty. So in fact is the pesticide donation budget - there is money in the budget called "pesticide donation" but this is all in fumigation for export, so the field allocation budget is effectively zero.

There are other uses for advance warning - it may help management of seedlings and nurseries; in a drought, aircraft can seed rainclouds.

Nets are used for other pests as well as hispa.

Documents show the Government does donate nets in response to outbreaks.

Squad organization. A discussion of the time needed to organise a squad of technical people - local DAE, local officials, and some farmers and local political leaders. Squads give training support and technical support. Local governments have special funds - may buy nets, insecticides for spraying. It takes a week to set up a squad - liaison with upazilla officers.

Table @3. Lead times and duration times for control operations, estimated by office personnel:-

Operation	Lead time	Duration time
Training	No time	7 days
Net donation	7 days	10 days
Bounty payment	7 days	7 days
Loan sprayer	7 days	7 days
Donate pesticide	7 days	10 days
Aerial sprays	21 days*	21-28 days

* - 21 days would be ideal; 2 or 3 months now; 24 hours if on a hair-trigger.

The time it takes to rise the people and get a sprayer to spray, for typical farmers:-

Small	1-2 weeks
Medium	1 week
Large	No time

Scale of area where management is most efficient for different operations. All are best at national level. Management would be best at Upazilla level with backups at District and National levels - at the moment we don't have a national reserve of equipment, which would be useful. Sweepnets are procured at national level.

There is a political hue & cry in newspapers, television - this is what drives the intensification of response - political and social pressure.

There is a tripartite agreement with India and Nepal to share aircraft for spraying - good for all, because with migratory species it comes over the border. In India there was a big outbreak of locusts in 1988; we had 3 planes with pilots ready, at 10 days' notice, then the Indians said No more - we have control now.

Of the country's 465 upazillas, the 201 selected to be "IPM upazillas" were those with the highest agricultural intensity. IPM training is only in these.

Surveillance is by FS and sent up to HQ. SPPS used to support monitoring (Phase I), to redesign the data sheet, but doesn't any more. Plant Protection Wing no longer supports the monitoring. The surveillance system still needs improvement, and it would be nice to have a project specifically for this.

There are 9 regions. Each has Additional Director, 64 Districts, with DD, 678 Upazillas, with Upazilla Agricultural Officer.

The squad does not carry out control itself. Supervises and does technical support. The same squad may hire people to spray. Once the squad is together the sprayer loan is quick, apart from the odd repair.

There seems to be no data quantifying the protection obtained by sweeping. Probably never been a formal quantitative analysis. The practice developed by evolution - farmers had ideas, block supervisors had ideas, these spread, farmers tried them out, and either continued or didn't, then validated by looking at the satisfaction levels of IPM-trained c.f. non-IPM-trained farmers.

#10 Senior Office, Dhaka

Leaf-clipping is effective in early stages if attack is limited. If the scale is vast it can be detrimental. Sweepnetting is more effective, but you can't net in flowering. Even from "PI" (panicle initiation) you cannot use. It's effective if on a community basis in a whole area. Timing is also important.

Hispa is migratory, and perennial. A problem for 365 days.

You cannot push farmers to do the same operation. Community control will be a problem - if you need 100 farmers to cooperate, 95 is not effective. The nature of the community is key. Has community control been tried? In coastal areas it was common. Now gone. They mobilised the farmers. To do what - Spray? Sweep? Ask the coastal people - they know. Any examples of community control working. There are some success stories. We can find some areas where farmers control communally. There are some. How large an area? 20-30acres. One area only (it turns out). A stimulating factor - SPPS set up a farmer field school. They stimulated the farmers to organize. He doesn't know if they still do. (Laughs and seems to doubt it).

Village-level coordinated control would need to be thorough - if all farmers except 3 or 4 spray, then they will be everywhere.

Boro seedbed control. The only gap in the life-cycle - in end-November. Control it here - spray the seedbed, not so bad for ecology either.

People write in newspapers; people say DAE Do something; SPPS Do something. SPPS says We are doing a workshop. Hah. We have a hundred workshops here.

Hispa can go as easily as it comes.

Fungus DAE should develop it under strict supervision. Farmers will produce it if it is found good. If good then we can develop some mechanism. Best would be under supervision of DAE. NGOs might, but not a lot of technically suitable people.

Farmers don't clip. The don't like it. DAE bangs on and on but farmers wont. Don't like it. Don't like to be bothered to take the effort to harvest rice, never mind hispa. And it makes hispa worse because after clipping come more tender green shoots and hispa like these.

#11 DAE Office

In this district every upazilla was hit last year in T Aman. They tried sweepnets, pesticide and clipping. Most farmers like to spray - not interested in clipping or sweeping. 20-30 farmers live abroad - not interested in control without pesticide. We give them nets and they use them for fishing - "to catch small fish and so on".

Farmers don't do IPM, don't understand, not dynamic.

Clipping is the best method. Is effective. But farmers not interested. Labour mostly comes from outside the district. Labour problem is a district problem.

T aman is particularly hit in late tillering - veg and flowering stages. Particularly in t amun. A bit in aus - less, and patchy, but here and there. After t amun fields don't get ploughed, so "so many grasses". Starts in B (traditional) aus, builds up in aus, clobbers amun.

Lots of absentee landlords with 200 bighas - sharecroppers, so farmers unwilling to invest. A long moan about farmers' unwillingness to invest - you go with a new technology and the farmers say "You do it". Education level and outlook are important.

Several workshops were here.

Sweeping works against adults, but after a short while the grubs emerge and are a problem. Spiny sticks are much better against grubs. Make the pesticide more effective against grubs. Pesticide is not effective against larvae inside dead leaves without chlorophyll. Beating with spiny sticks first dramatically improves the effects of pesticide. Last week a spray was done by DAE officers. Most farmers have already sprayed.

Last year in one upazilla a bad attack in t amun. At least 5000Ha. DAE handed out 200L of pesticide, and 500 sweepnets. And taught farmers to clip. Farmers bought a lot of their own pesticide and in the end it worked - there was no yield loss. This was not as "IPM upazilla" but IPM training was given in this case.

Farmers hate clipping.

He doesn't know a lot about hispa ecology - came here only a couple of years ago, and it's so localised he's no experience. He thinks no relation between boro cultivation and hispa.

Fungus production possibilities - centralised to Dhaka would not be enough for such large areas as needed. DAE best organisation to produce fungus, but at upazilla level. Block supervisors would be obvious people. Ag officer or PP officer could do it. At District level there's little contact with farmers, but lots at upazilla level. Would a forecasting system help? I don't know.

#12 International Agency

Sometimes fields are white with hispa damage, but in passages.

Fish people make a lot of noise, but when pesticides are approved for particular pest fisheries scientists too make an input. It looks as though fish die and the fish people blame the pesticide.

Beauvaria is much, much easier to rear than Trichogramma.

In-migration will happen with most pests unless there's cooperative control, farmers sweeping together at village level.

#13 International Agency

Formulation of entomopathogenic fungi you must pay attention to quality control - "You can mess it up." Key is separation of the spores from the food substrate and, connected with this, getting the water content down. We now have machines for separation for this. Getting partners to appreciate the importance of quality assurance can be a long road. Properly prepared spores can be stored, with refrigeration, a good long time. You can get paper strips now to attach to batches so that if they are exposed to temperatures outside a specified range the paper changes colour. Organisation is best done on a national, not devolved level - "All our experience points towards doing it centrally."

#14. Central Agency, Dhaka.

DAE keeps pesticide in their buffer stock and supplies to the farmers if there is only an outbreak of a pest. For example, last year DAE supplied 600 litres of pesticides in total in the districts of Moulvibazar, Bagerhat and Rangpur against hispa and other pests.

DAE does not supply sprayers to the farmers. Rather they form squads in case of emergency and spray under supervision of these squads. A squad is constituted by Plant Protection Specialist (PPS), Assistant Extension Officer, Plant Protection Inspector (PPI) and Block Supervisors (BS). They also include lead farmers in the team. The leader of the squad for a particular district (more than 1000 ha infestation) PPS is the squad leader, AEO for Upazilla (500-1000 ha infestation) and PPI for a block (about 200-500 ha infestation).

Table.7.1 Schedule of survival of rice hispa immature stages, 2002-03-04, Barisal

Rice hispa stage	Percentage survival in relation to rice season															
	Boro						Aus						T.aman			
	Date of cohort															
	2002		2003		2004		2002		2003		2004		2002		2003	
	15/4	2/5	22/2	27/3	4/3	20/3	13/8	25/8	27/5	17/6	7/6	19/6	19/10	16/11	8/7	30/9
(Size of cohort)	*663*	*229*	*668*	*884*	*1,303*	*Undetermined**	*1,224*	*533*	*661*	*1,782*	*1,836*	*1,623*	*870*	*123*	*2,829*	*1,062*
Egg	24	2.6	45.7	58	73.1	0	4.6	7.9	37.5	64.5	10.8	23.9	12.8	70.7	49.3	52.2
Larvae	0	0	32.1	30.1	13.2	0	16.3	11.9	70.0	62.1	6.6	11.3	24.3	55.2	9.7	10.7
Pupae	0	0	61.2	21.7	95.2	0	58.7	80	83.1	89.3	92.3	100	85.2	41.7	71.1	96.6
Overall ** % Survival	0	0	9	3.8	9.2	0	4.4	0.8	22.1	35.8	0.7	2.7	2.6	16.3	3.4	5.4

* cohort destroyed by storm

** Between season values: F =0.4355, p. 0.10

Table.7.2 Schedule of survival of rice hispa immature stages, 2002-03, Gazipur

Rice hispa stage	Percentage survival in relation to rice season							
	Boro			Aus			T. aman	
	Date of cohort							
	2002		2003	2002		2003	2002	2003
	01/4	16/4	9/4	28/6	13/7	20/7	30/9	1/10
(Size of cohort)	*587*	*535*	*1,282*	*1,233*	*166*	*1,336*	*728*	*2,269*
Egg	35.3	17.9	15.2	36.3	36.7	10.9	37.6	24.8
Larvae	15	39.6	0	26.4	4.9	13	19.7	8.2
Pupae	100	0	0	82.2	100	42	75.9	80.4
Overall % Survival	5.3	0	0	7.9	1.8	0.6	5.6	1.6

Table. 7.3 Schedule of survival of rice hispa cohorts (in rice mono cultures) , 2004, Habiganj.

Rice hispa stage	Percentage survival in relation to rice seasons	
	Boro	**Aus**
	Date of cohort	
	23/3	**3/6**
(Size of cohort)	*391*	*80*
Egg	47.8	5.0
Larvae	1.6	0
Pupae	66.7	0
Overall % survival	0.5	0