

Appendices

Appendix 1: Experimental data set used for model calibration.

Variety	Year/Observation
Variety (IR64)	2001
Date of Transplanting	2nd June (153)
Anthesis Date (DAP)	83 (236)
Physiological Maturity(DAP)	115 (268)
Grain Yield (kg/ha)	6490
Variety (BajoMaap2)	
Date of Transplanting	2nd June (153)
Anthesis Date (DAP)	73 (226)
Physiological Maturity(DAP)	110 (263)
Grain Yield (kg/ha)	6400
Variety (BajoKaap2)	
Date of Transplanting	2nd June (153)
Anthesis Date (DAP)	85 (238)
Physiological Maturity(DAP)	117 (270)
Grain Yield (kg/ha)	6800

Appendix 2: Experimental data set used for model validation.

Variety	Year/Observation	
Variety (IR64)	2000	2002
Date of Transplanting	2nd June (153)	2nd June (153)
Anthesis Date (DAP)	85 (238)	85 (238)
Physiological Maturity(DAP)	117 (270)	118 (271)
Grain Yield (kg/ha)	6900	7000
Variety (BajoMaap2)		
Date of Transplanting	2nd June (153)	2nd June (153)
Anthesis Date (DAP)	75 (228)	80 (233)
Physiological Maturity(DAP)	109 (262)	113 (266)
Grain Yield (kg/ha)	6000	6450
Variety (BajoKaap2)		
Date of Transplanting	2nd June (153)	2nd June (153)
Anthesis Date (DAP)	91 (244)	86 (239)
Physiological Maturity(DAP)	121 (274)	119 (272)
Grain Yield (kg/ha)	6400	7250

Appendix 3: Field survey questionnaires set.**Survey on Rice Production and Resource Use****Format information**

1. Household name				
2. Date of interview				
3. Dzongkhag of respondent				
4. Geog of respondent				
5. Chewog of respondent				
6. Educational Qualification	1. Primary	2. High School	3. Secondary	4. College
7. Number of family members	1-10 yrs	11-17 yrs	18-45 yrs	45 & above
8. Household category <i>Tick one category</i>	1	2	3	
9. Respondent's age and sex <i>Tick one type only</i>	1. Elderly (>50 yr) female	2. Elderly (>50 yr) male	3. Female	4. Female

Household land-use information

10. Do you own land? <i>Tick yes or no</i> 1. Yes 2. No			
10.1 What is the total land area (i.e. of all crops) cultivated or owned by your household by land use and tenancy type? <i>(Complete all the cells in the table and enter 0 if no land is cultivated for any cell).</i>			
Land use type	Tenancy type	Land area	Unit of land area (e.g. langdo)
Wetland	Owner managed		
	Shared in		
	Shared out		
Dryland	Owner managed		
	Shared in		
	Shared out		

11. What is the means of repayment for the leased land? <i>(Please tick)</i>		
Repayment for leased land	Land use type	
	Wetland	Dryland
Labour exchange		
Cash		
Kind		
Others (specify)		

12. What was the cultivated area under different crops last year? <i>(Please specify unit)</i>			
Crops	Area (Unit)	Total Production (Unit)	Rank

13. Why do you grow these crops? List down the reasons			
Crops	Reason 1	Reason 2	Reason 3

14. Do you own farm machineries? <i>If Yes, list them.</i>	
Machine	Year of purchase/acquisition

15. Which are the important crops and livestock for the household livelihood? <i>Please list them.</i>	
Crops	Livestock
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.

Information on household livestock

16. What type of livestock do you own and ho many? <i>(Enter 0 in the cell if the household do not have any type of livestock)</i>				
Type of livestock	Young	Adult	Total	Rank
Cattle				
Pigs				
Horses				
Poultry birds				

Rice Production Information

17. What were the varieties of rice grown and area under each variety last year? <i>List down the varieties and reasons out for the variety choice</i>		
Rice Varieties	Area	Reason for the variety choice
1.		
2.		
3.		
4.		
5.		

18. What was the rice varieties and time of planting last year?					
Varieties	Seed Rate	Nursery Time	Time (days after sowing)		
			Emergence	Transplanting	Harvesting
1					
2					
3					
4					
5					

Soil Fertility

19. How fertile is your rice field? (Farmers perception of soil fertility status) <i>Please tick and note down the criteria for their judgment</i>	
Category	Criteria
Rab (Good)	
Ding (Moderate)	
Tha (Poor)	
Other (Specify)	

Crop Rotation

20. Do you practice crop rotation? <i>Tick answer Yes or No</i>	
1. Yes	2. No
20.1 If yes, what crop do you grow before and after rice?	
Before	After
20.2. If no, for how long is the land left fallow?	

FYM Use

21. How much farm yard manure (organic manure) do you apply in one langdo of land? <i>Please record the unit</i>	
	Amount applied per langdo (basket)
FYM	
Forest litter	

Fertilizer Application

22. What type of chemical fertilizer do you use? <i>Tick option only</i>				
1. Urea	2. Suphala	3. SSP	4. MoP	5. Others
22.1 When do you apply the fertilizers?				
Fertilizers	1 st application and quantity	2 nd application and quantity	3 rd application and quantity	
1. Urea				
2. Suphala				
3. SSP				
4. MoP				
5. Others				

Plant Protection

23. Do you apply chemicals for pest and disease control? <i>Please tick Yes or No</i>		
1. Yes	2. No	
23.1 If yes, What chemicals and when do you use them? <i>Please specify</i>		
Chemicals	When	Reasons

Irrigation

24. At what stage is the irrigation water applied days after transplanting			
Application	Days after transplanting	Frequency of water application/flooding	Crop Stages
Application 1			
Application 2			
Application 3			
Application 4			
Application 5			

24.1 Is getting irrigation water difficult? <i>Tick answer Yes or No</i>	
1. Yes	2. No
24.1.1.If Yes, specify the reasons	
Reason 1	
Reason 2	
Reason 3	
Reason 4	

25. What is the harvested rice grain for the last 5 years?					
Rice varieties	Total production (Unit)				
	2003	2002	2001	2000	1999

26. What was the quantity of straw you obtained last season? <i>(Please convert the straw unit into kgs)</i>	
Varieties	Straw Yield (Bundles)

1 bundle = Kgs

32. If your rice production is not enough then how you do meet the deficit? (Tick)	
<ol style="list-style-type: none"> 1. Buy from the market 2. Borrow from neighbor 3. Others (specify) 	
32.1 If you buy from the market, how much do you buy in a year for your family?	
32.2 If you borrow from your neighbors, how much do you borrow in a year for your family?	
32.3. Are there any problems in getting inputs for rice production? (e.g. fertilizers, seeds for improved rice varieties, credit, labor etc). <i>Tick Yes or No</i>	
<ol style="list-style-type: none"> 1. Yes 2. No 	
32.3.1. If Yes, which inputs and why?	
<u>Inputs</u>	<u>Reasons</u>
1.	
2.	
3.	
4.	
32.3.2. If No, which inputs and why?	
<u>Inputs</u>	<u>Reasons</u>
1.	
2.	
3.	
4.	
33. What are the major constraints for rice production for your family? List the constraints and rank them by importance.	
1.	
2.	
3.	
4.	
5.	

Curriculum Vitae

Name:	Kailash Pradhan
Date of birth:	January 17, 1967
Educational background:	
1988-1993	B.S. Agricultural Science, College of Agriculture, Indore, Jawarlal Nehru Agricultural University, Jabalpur, Madhya Pradesh, India.
2003-2005	M.S. Agriculture (Agricultural System) Chiang Mai University, Chiang Mai, Thailand.
Scholarships:	RNR-Extension Support Project, Ministry of Agriculture, Thimphu.
Work Experiences:	
2002-present	Program Officer, Training and Skill Development, Council for RNR Research of Bhutan, Ministry of Agriculture, Thimphu.
1999-2002	Program Officer, Field Crops Section, Council for Research and Extension, Ministry of Agriculture, Thimphu.
1997-1999	District Agriculture Officer, Dzongkhag Administration, Ministry of Agriculture, Trashigang
1995-1997	District Agriculture Officer, Dzongkhag Administration, Ministry of Agriculture, Punakha
1993-1995	Lecturer, Natural Resources Training Institute, Ministry of Agriculture, Lobesa.