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Characterizing Maize Production Environments in Nepal

A Synopsis of Proposed Research¹

1 Introduction

CIMMYT's recently adopted strategic plan calls for an increased emphasis on research, particularly strategic research² (CIMMYT, 1989). Expanded strategic research on crop management is a part of this new direction. To help set priorities for strategic research activities, an improved understanding is needed of the environments around the world in which CIMMYT's mandate crops are produced (Edmeades, 1989). Information on maize and wheat production environments also has obvious utility for NARS.

Some of the needed information may be obtained from published sources (e.g., De Leon, *et al*, 1990). However, available data may often suffer from severe problems of reliability (e.g., Balungon, forthcoming). In addition, much of

1. Developed by L. Harrington and M. Read (CIMMYT), K. Adhikary (NARC) and H. Gurung (LAC).

2. Strategic research is defined as research on problems that cross national boundaries, the output of which may be principles of crop production, generalizable input-output relationships, or research methods.

the required information is often simply unavailable -- especially at the level of the production environment -- and must be collected or estimated.

2 Objectives

A study is proposed that would feature the collaboration of CIMMYT, NARC, the Lumle Agricultural Center, and the National Maize Research Center (Rampur). The proposed study (described below) aims to define and characterize major maize producing environments in Nepal. Moreover, it aims to do this at the national level and achieve acceptable levels of quantification and precision while using low-cost methods of data collection. It should be possible to achieve all of these apparently conflicting objectives (low cost, acceptable precision, some quantification, systematic and consistent national coverage) by means of a properly designed survey, using extension workers as key informants.

The output of the proposed survey will be comparisons of maize production practices and problems, and the place of maize in the farming system (including issues of utilization) over environments. By means of this survey, it should be possible to obtain estimates of national maize area by production environment, and ascertain ways in which environments are similar and ways in which they are different.

3 Methodology: A Discussion

Key informant surveys are commonly used in Nepal, e.g., Upadhyaya, 1990; Chand and Gibbon, 1989. A key informant survey with national coverage, as proposed here, falls somewhere between an exploratory survey¹, a formal farm survey, and a national census. Like a census, it is intended to provide systematic national coverage. Like a formal farm survey, it will use random sampling techniques and a thoroughly tested questionnaire implemented by trained enumerators. Like an exploratory survey, it will focus on expert opinions -- especially regarding complex interactions -- offered by those in the best position to provide⁶ them. Unlike an exploratory survey, however, it will go far beyond describing and analyzing conditions found in only one small site.

Efforts will be made to control measurement error as well as sampling error. Group interview techniques will be used to elicit consensus estimates at the Ilaka level. Questions with obvious possibilities of enumerator bias (e.g., breakdowns of farmer use of improved varieties, fertilizer application rates, other questions where official recommendations might be viewed as "threatened") will be avoided. Rather, questions will tend to focus on "non-threatening" themes best addressed

1. There are many terms for "exploratory surveys", including "sondeo", "rapid site description", "RRA", "joint trek", "samuhik brahman", "informal surveys", etc.

by respondents with broad experience at the Ilaka level. Care will be taken to avoid presenting results at a greater level of precision than supported by the underlying data.

4 *Sampling and Data Collection*

Maize growing areas in Nepal may be distinguished by Development Region (5) and elevation (3 levels). In the proposed survey, one or two of the largest maize growing Districts will be selected within each of the resulting 15 (5x3) Development Region /elevation groupings.

Within each selected District, interviews will be conducted with key informants from all (usually 9) Ilaka. Interviews will be conducted Ilaka by Ilaka, not globally at the District level. Informants will be asked questions about maize environments, maize production practices and problems, maize utilization (including byproducts) and the place of maize in the farming system (see draft questionnaire).

Key informants will be composed largely of extension staff, including JT, JTA and AA. Other key informants may be interviewed as needed. A group interview of 4-6 of these extension staff will be held (normally at the District extension office) for each Ilaka.

Ilaka-level data will be aggregated to the District level (weighted by maize area within the Ilaka). District-level

data will be extrapolated to the national level (again, weighted by maize area). Where appropriate, results will be broken down by maize production environment, aggregated over Districts.

5 Environments

The following have been tentatively selected as major maize producing environments in Nepal. Survey results should allow comparisons of maize practices and problems, and the place of maize in farming systems, among and between environments. Note that environments 8 and 9 are expected to be by far the largest in the country.

No.	Elevation	Season	Land Type	Access-ability
1	Terai/ Inner Terai	Winter 1/	Khet 2/	Good 3/
2	Terai/ Inner Terai	Spring 4/	Khet	Good
3	Terai/ Inner Terai	Summer 5/	Bari 6/	Good
4	Foothill/ Valley 7/	Winter	Bari	Good
5	Foothill/ Valley	Spring	Khet	Good
6	Foothill/ Valley	Summer	Bari	Good/ poor
7	Midhills 8/	Spring	Khet	Good
8	Midhills	Summer	Bari	Good
9	Midhills	Summer	Bari	Poor
10	Upper hills 9/	Summer	Bari	Poor

- 1/ Rabi or cool season planting, usually with irrigation
 2/ Bunded area planted to flooded rice during the cropping pattern
 3/ Within a one day walk (round trip) to an input supply point
 4/ Pre-rainy season planting, usually with irrigation (?)
 5/ Rainy season planting. Exact dates depend on altitude
 6/ Unbunded land not used for flooded rice in the cropping pattern
 7/ Above the terai, but below below 1000 masl
 8/ 1000 - 2000 masl
 9/ Above 2000 masl

6 *Tentative Plans/ Calendar*

- Review of secondary data on agroecological zones in Nepal, focusing on those of possible relevance to maize.
- Review of secondary data on maize research in Nepal, stratified where possible by production environment. This should include information from FSR programs, e.g, exploratory survey reports.
- Review of policies, including those affecting input supply and markets, relevant to maize in Nepal.
- Pre-test questionnaire and train enumerators.
- Field test the proposed key informant survey method in one or two districts and make a final check of its feasibility. (This will require a test of analytical procedures and cross-checks on data quality.)
- Proceed with enumeration, editing, coding and analysis.
- Calendar: should begin in October 1991 and be finished by June 1992.

References

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- De Leon, C., G. Granados and M. Read, 1990. Proceedings of the Fourth Asian Regional Maize Workshop, Pakistan, September 21-28, 1990. Bangkok: CIMMYT.
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MAIZE PRODUCTION ENVIRONMENTS QUESTIONNAIRE: DISTRICT LEVEL

District _____
 Enumerator _____ Date _____

1. What is total cultivated area in this district? _____ ha
2. What is the total population in this district? _____ (lakh persons)
3. What is average farm size in this district? _____ ha
4. What are the major crops grown, and the area for each?

- | | | |
|---|-------|----------|
| 1 | _____ | _____ ha |
| 2 | _____ | _____ ha |
| 3 | _____ | _____ ha |
| 4 | _____ | _____ ha |
| 5 | _____ | _____ ha |
| 6 | _____ | _____ ha |

5. Estimate maize yield, harvested area and total production for the district.

Yield	_____	kg/ha
Harvested area	_____	000 ha
Production	_____	000 tons

6. What is the % of maize area found in each Ilaka?

Ilaka No.	% maize area	OR Actual area (ha)
1	_____ %	_____ ha
2	_____ %	_____ ha
3	_____ %	_____ ha
4	_____ %	_____ ha
5	_____ %	_____ ha
6	_____ %	_____ ha
7	_____ %	_____ ha
8	_____ %	_____ ha
9	_____ %	_____ ha
TOTAL		100% _____ ha

QUESTIONNAIRE, BY MAIZE PRODUCTION ENVIRONMENT: ILAKA LEVEL

District _____
Ilaka No. _____
Enumerator _____
Date _____

GENERAL QUESTIONS (FOR ALL ENVIRONMENTS)

1 Estimate the total cultivated area for this ilaka.
_____ ha

2 Estimate the % of total cultivated area in this ilaka planted to
maize. _____%

OR

Estimate the % of total maize area in the district
found in this ilaka. _____%

OR

actual maize area in this ilaka? _____ ha

3 What is the % of TOTAL MAIZE AREA found in each
of the following, in this ilaka?

terai/ inner terai	_____	%
foothill valley (< 1000 masl)	_____	%
midhills (1000-2000 masl)	_____	%
high hills (> 2000 masl)	_____	%
TOTAL		100 %

4 For TERA I AND INNER TERA I only, what is the %
of maize area found in each of the following:

winter	_____	%
spring	_____	%
summer	_____	%
TOTAL		100%

5 For FOOTHILL VALLEY only, what is the %
of maize area found in each of the following:

winter	_____	%
spring	_____	%
summer	_____	%
TOTAL		100%

6 For MIDHILLS only, what is the % of maize area found in each of the following:

spring	_____%
summer	_____%
TOTAL	100%

7 For MIDHILLS SUMMER MAIZE only, what is the % of maize area found in each of the following:

accessible areas	_____%
inaccessible areas	_____%
TOTAL	100%

("Inaccessible" means more than one normal day's round trip to the nearest input store/ market.)

8 Based on the information above, calculate the actual area for each maize production environment. Take further data only for environments where there is at least 100 ha of maize per ilaka.

- 1 _____ ha TW Winter maize in terai (khet)
- 2 _____ ha TSp Spring maize in terai (khet)
- 3 _____ ha TSu Summer maize in terai (bari)
- 4 _____ ha FW Winter maize in foothill valley (bari)
- 5 _____ ha FSp Spring maize in foothill valley (khet)
- 6 _____ ha FSu Summer maize in foothill valley (bari)
- 7 _____ ha MSp Spring maize in midhills (khet)
- 8 _____ ha MSuAC Summer maize in midhills (accessible) (bari)
- 9 _____ ha MSuNA Summer maize in midhills (not accessible) (bari)
- 10 _____ ha HHSu Summer maize in high hills (bari)

9 Estimate maize yield and harvested area in this ilaka for the selected environments

	Environments (Write in numbers)			
	_____	_____	_____	_____
Yield kg/ha	: _____	: _____	: _____	: _____
Harvested area 000 ha	: _____	: _____	: _____	: _____

10 On average, has maize area in this environment increased, decreased or remained stable during the last five years? Check one per environment

	Environments (Write in numbers)			
	_____	_____	_____	_____
Increased	: _____	: _____	: _____	: _____
Decreased	: _____	: _____	: _____	: _____
Stable	: _____	: _____	: _____	: _____

11 IF MAIZE AREA IS INCREASING OR DECREASING, what might be some reasons for this? (Specify environment in the answer.) _____

12 Have maize yields increased, decreased or remained stable over the last five years, for the different environments?

Environments (Write in numbers)

	:	:	:	:
Increased	:	:	:	:
Decreased	:	:	:	:
Stable	:	:	:	:

13 IF MAIZE YIELDS ARE INCREASING OR DECREASING, what might be some reasons for this? (Specify environment in the answer.) _____

QUESTIONS ON FARMING SYSTEMS

14 List the major maize-based cropping patterns for each environment. (Include monocropped maize if appropriate.) Include only three patterns per environment.

Environment	Pattern
1:	: _____ : _____ : _____
2	: _____ : _____ : _____
3	: _____ : _____ : _____
4	: _____ : _____ : _____

15 Estimate the % of maize area that is monocropped (no other crop in the field during the maize season) vs. intercropped or relay cropped, for each environment. HINT: Answers should be in percentages.

Environments (Write in numbers)				
	:	:	:	:
Monocropped	: _____	: _____	: _____	: _____
Intercropped/ relay cropped	: _____	: _____	: _____	: _____
TOTAL:	100%	100%	100%	100%

16 List the crops commonly intercropped or relayed with maize, and estimate the % of intercropped (or relayed) area corresponding to each, for each environment. HINT: Answers for each environment should be in percentages.

Environments (Write in numbers)				
	:	:	:	:
1 _____	: _____	: _____	: _____	: _____
2 _____	: _____	: _____	: _____	: _____
3 _____	: _____	: _____	: _____	: _____
4 _____	: _____	: _____	: _____	: _____
5 _____	: _____	: _____	: _____	: _____
6 _____	: _____	: _____	: _____	: _____
	100%	100%	100%	100%

17 Maize utilization: Estimate the % of maize grain used in the following way, for each environment.

Environments (Write in numbers)				
	:	:	:	:
Consumed by farm family	: _____	: _____	: _____	: _____
Fed to livestock	: _____	: _____	: _____	: _____
Sold/ traded/ bartered	: _____	: _____	: _____	: _____
	100%	100%	100%	100%

18 Maize utilization: Estimate the % of maize grain used in the following way, for each environment.

Environments (Write in numbers)				
	:	:	:	:
Green ears (sold or consumed)	: _____	: _____	: _____	: _____
Dry grain (any use)	: _____	: _____	: _____	: _____
	100%	100%	100%	100%

19 Estimate the % of maize stover used in the following ways, for each environment, regardless of timing of use (e.g., during vegetative stage, during grain filling, after harvest).

	Environments (Write in numbers)			
	:	:	:	:
Fed to animals	:	:	:	:
Not used	:	:	:	:
Other _____	:	:	:	:
	100%	100%	100%	100%

20 Maize varietal characteristics: estimate the percentage of maize area with the following characteristics, by environment. HINT: Answers should be in percentages and should sum to 100% within characteristics.

	Environments (Write in numbers)			
Characteristics	:	:	:	:
COLOR:	:	:	:	:
White	:	:	:	:
Yellow	:	:	:	:
Total	100%	100%	100%	100%
TEXTURE:	:	:	:	:
Dent	:	:	:	:
Flint	:	:	:	:
Total	100%	100%	100%	100%
GENETIC BACKGROUND	:	:	:	:
Local	:	:	:	:
Contaminated improved	:	:	:	:
Improved (purchased within last three years)	:	:	:	:
Total	100%	100%	100%	100%
MATURITY	:	:	:	:
Short season	:	:	:	:
Full season	:	:	:	:
Total	100%	100%	100%	100%
SEED SOURCE	:	:	:	:
Official sources 1/	:	:	:	:
Private seed company/ agent	:	:	:	:
Unofficial sources 2/	:	:	:	:
Own	:	:	:	:
Total	100%	100%	100%	100%

1/ AIC, JT, JTA, coop
2/ market, neighbor

QUESTIONS ON MAIZE MANAGEMENT

21 Estimate the % of maize area tilled by tractor, bullock or hand labor.

Environments (Write in numbers)				
	:	:	:	:
Tractor	:	:	:	:
Bullock	:	:	:	:
Hand labor	:	:	:	:
Total:	100%	100%	100%	100%

22 Estimate the % of maize area in which farmers practice stripping of leaves for fodder.

Environments (Write in numbers)				
	:	:	:	:
Leaf stripping	:	:	:	:
Leaf stripping	:	:	:	:
No leaf stripping	:	:	:	:
Total:	100%	100%	100%	100%

23 Estimate the % of maize area in which farmers practice detopping for fodder.

Environments (Write in numbers)				
	:	:	:	:
Detopping	:	:	:	:
Detopping	:	:	:	:
No detopping	:	:	:	:
Total:	100%	100%	100%	100%

24 Estimate the % of maize area on which farmers apply insecticides to maize.

Environments (Write in numbers)				
	:	:	:	:
Insecticide use	:	:	:	:
Apply insecticides	:	:	:	:
No insecticides	:	:	:	:
Total:	100%	100%	100%	100%

25 Estimate the % of maize area planted to terraced vs. unterraced land.

Environments (Write in numbers)

Terraced vs. unterraced:	:	:	:	:
Terraced land	:	:	:	:
Unterraced sloping land:	:	:	:	:
Flat land	:	:	:	:
Total:	100%	100%	100%	100%

26 Estimate the % of maize area sown in the following manner:

Environments (Write in numbers)

Sowing Practice	:	:	:	:
Behind the plow/ furrows	:	:	:	:
Broadcast/ planking	:	:	:	:
Dibbling	:	:	:	:
Line planting	:	:	:	:
Other _____	:	:	:	:
Total:	100%	100%	100%	100%

27 Estimate % of maize area which receives the following FYM, compost and fertilizer applications:

Environments (Write in numbers)

FYM/ Fertilizer	:	:	:	:
Compost/ FYM applied	:	:	:	:
Fertilizer applied	:	:	:	:

QUESTIONS ON PRODUCTIVITY PROBLEMS

28 List the major maize diseases that occur in each environment. Select the three most important for each environment.

Environments (Write in numbers)

Diseases	:	:	:	:
1 Downy mildew	:	:	:	:
2 Stalk rot	:	:	:	:
3 Leaf foliar blight	:	:	:	:
4 Head smut	:	:	:	:
5 Cob rot	:	:	:	:
6 Rust	:	:	:	:
7 Other _____	:	:	:	:

29

List the major insects that occur in each environment.
Select the two or three most important for each one.

Environments (Write in numbers)

Insects	:	:	:	:
1 Stem borer	:	:	:	:
2 Wireworm	:	:	:	:
3 White grub	:	:	:	:
4 Armyworm	:	:	:	:
6 Others _____	:	:	:	:

30

In every ten years, how many years is maize affected by drought?
HINT: Write in the number of years for each environment.

Environments (Write in numbers)

	:	:	:	:
No. of years	:	:	:	:

31

At what stage of crop growth does drought commonly occur,
by environment? HINT: Check off appropriate boxes

Environments (Write in numbers)

Drought/ crop stage	:	:	:	:
First 30 days	:	:	:	:
Vegetative stage	:	:	:	:
Around flowering	:	:	:	:
Grain filling stage	:	:	:	:
Any time	:	:	:	:
Other _____	:	:	:	:

32

When drought occurs, what is the average percentage yield loss
for maize, by environment?

Environments (Write in numbers)

	:	:	:	:
Yield loss (%)	:	:	:	:

QUESTIONS ON YIELD GAP

33

Do you feel that there is a difference between maize yields when the recommended package of production practices is used, compared to average farmers' practice in your ilaka?

If so, what are the factors that cause this yield gap for different environments?

Environments (Write in numbers)

Factors/ yield gap	:	:	:	:
Variety	:	:	:	:
Plant population	:	:	:	:
Soil fertility	:	:	:	:
Drought	:	:	:	:
Hail	:	:	:	:
Waterlogging	:	:	:	:
Insects	:	:	:	:
Disease	:	:	:	:
Weeds	:	:	:	:
Other _____	:	:	:	:
Other _____	:	:	:	:
Other _____	:	:	:	:
Total:		100%	100%	100%