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Rural Labor Outmigration and Agricultural Productivity in Nepal

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Workshop on Integrating Social and Agriculture Science: Building the Foundation for Interdisciplinary Research in Nepal

30 November 2014
Hotel Himalaya, Lalitpur, Nepal

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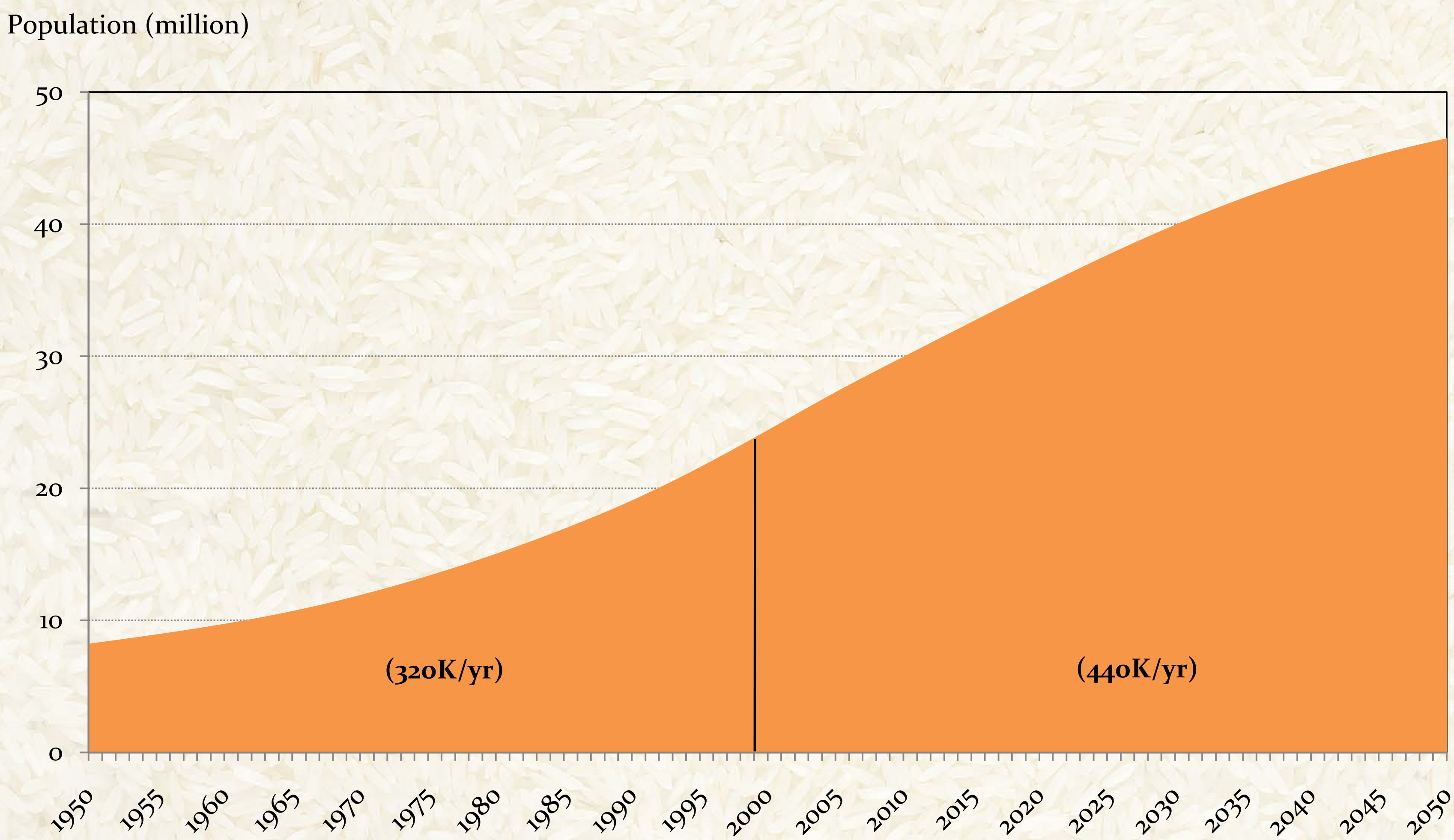
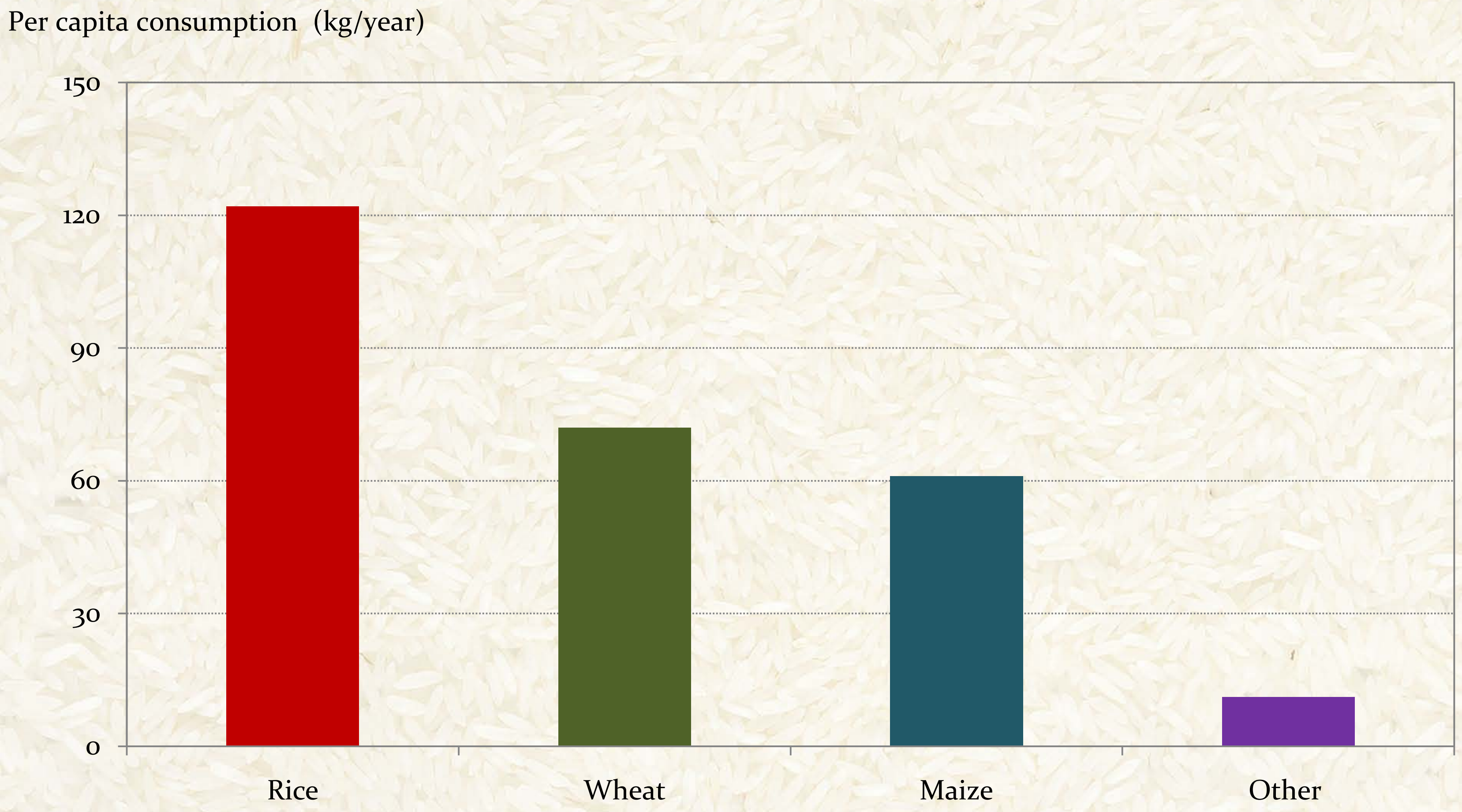
Presentation Outline

- Agricultural productivity
- Conceptual framework
- Sampling design
- Crop cutting techniques
- Analytical approach

Population growth trend in Nepal



Per capita consumption of cereals, Nepal, 2012



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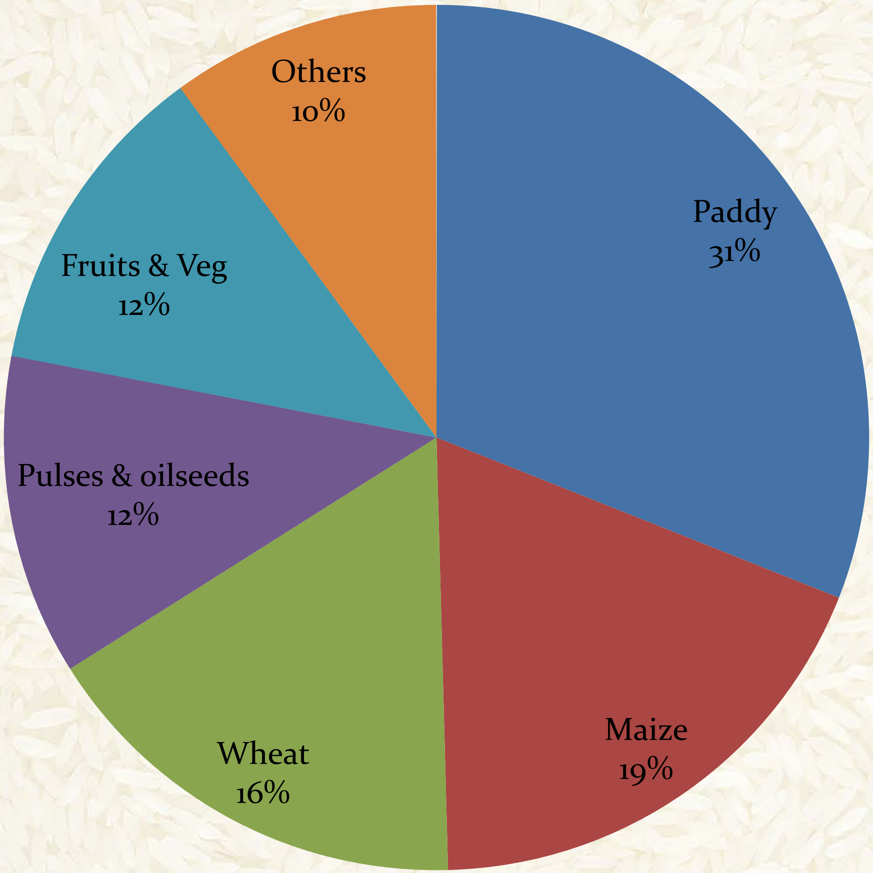
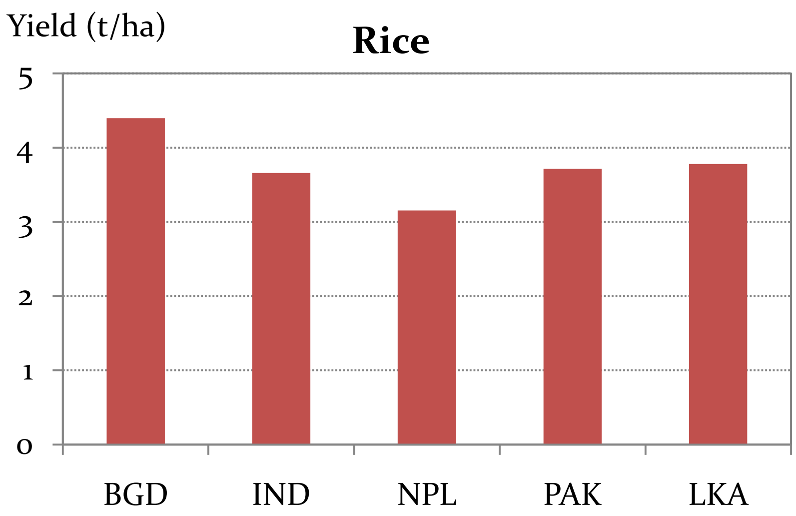
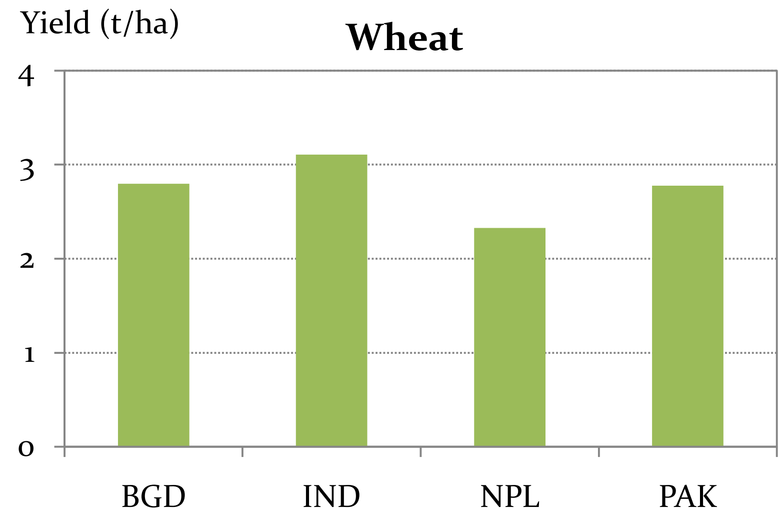
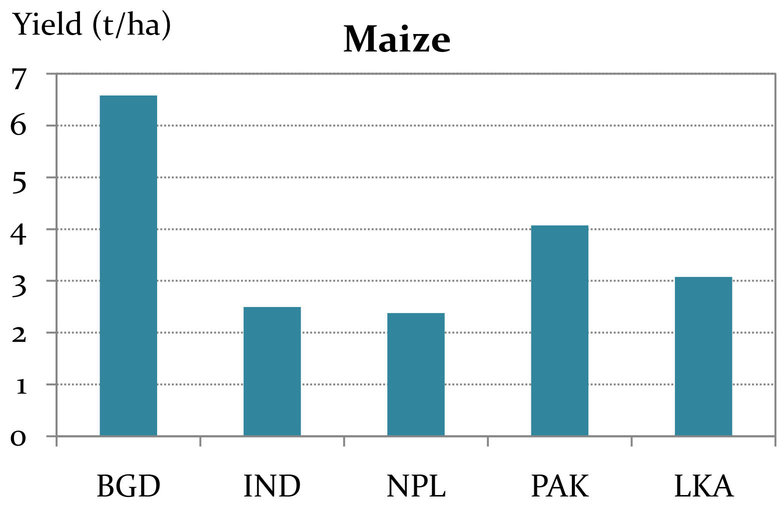
Share of crops in gross cropped area, Nepal, 2012-13



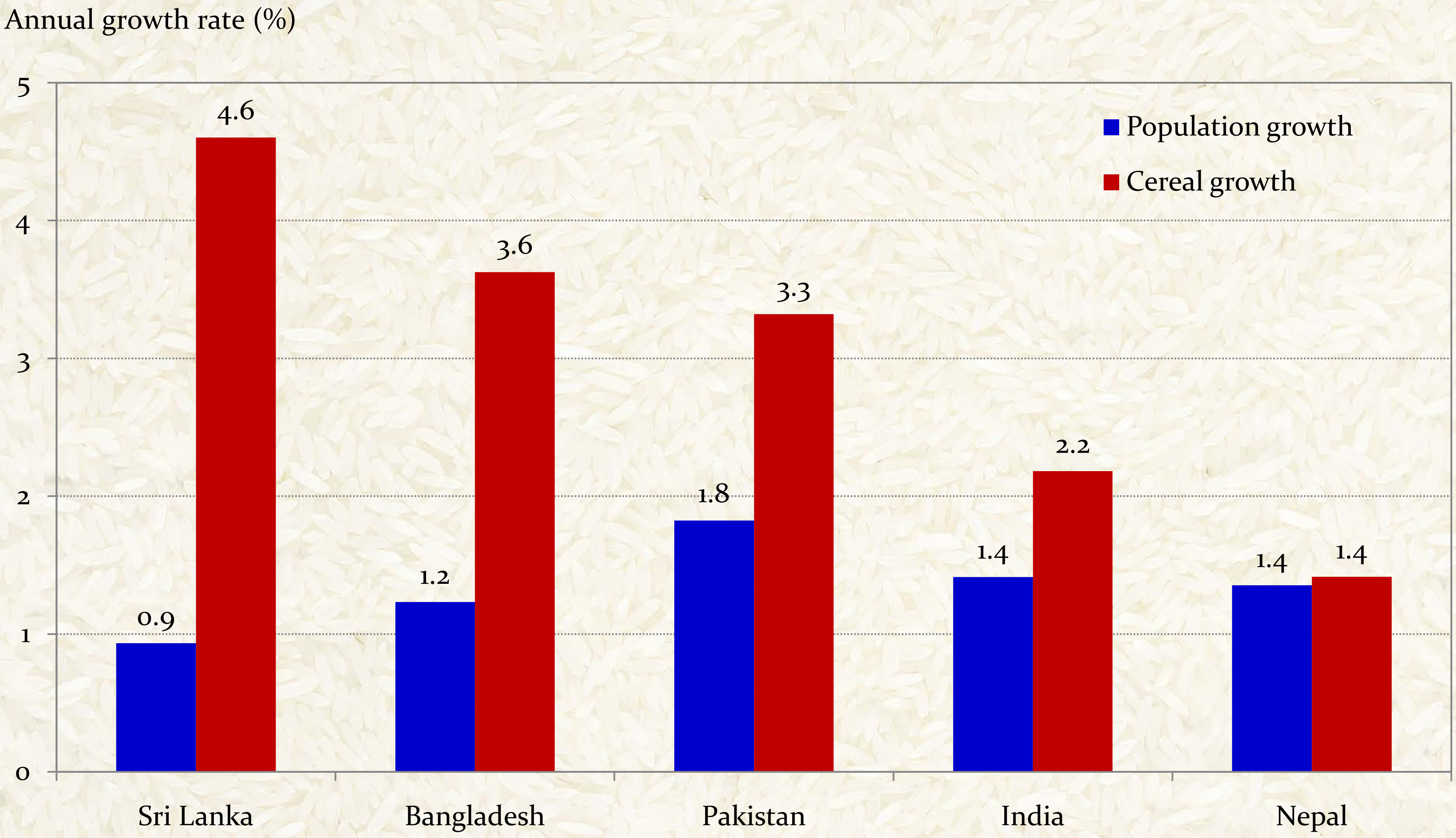
Cereal yields in South Asia, 2011-13







Growth rates of population and cereal production, South Asia, 2001-11



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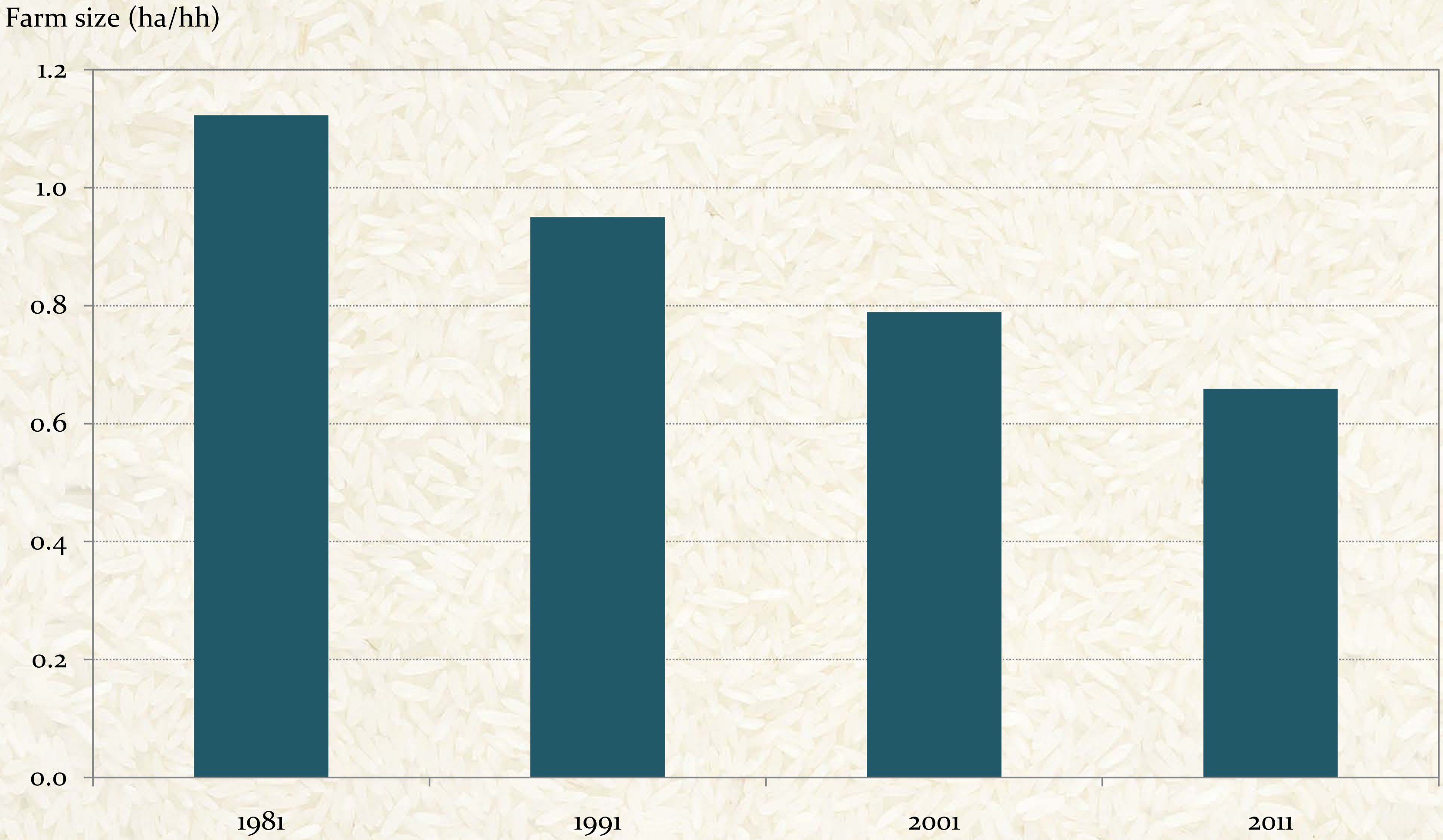
Trend in farm size in Nepal



Annual outflow of migrant workers to foreign countries, South Asia, 2006-08

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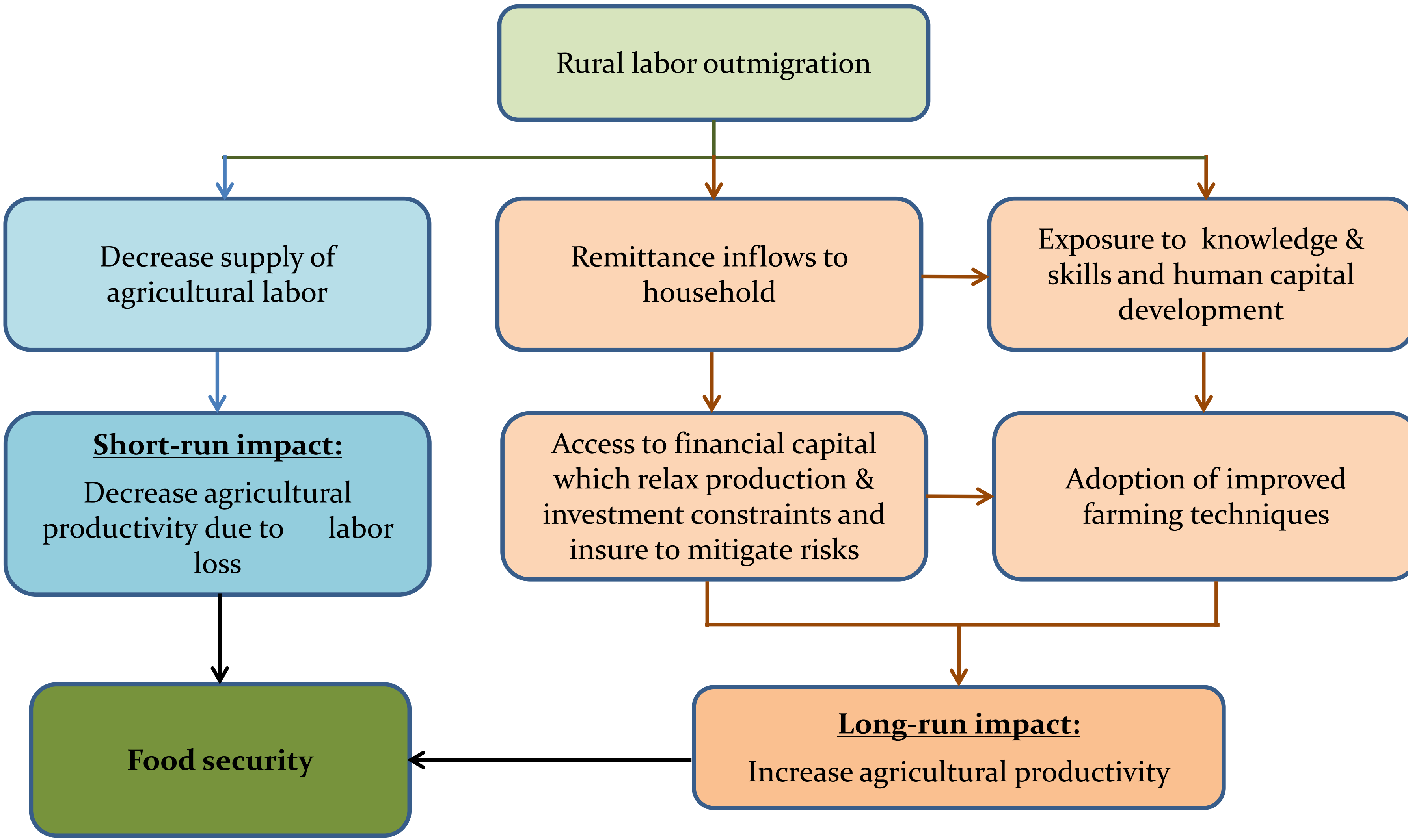
Migration and Agricultural Productivity Relationship

Conceptual framework:
Migration and agricultural productivity



Research Hypotheses

1. Migration decreases agricultural productivity through:
   - Decrease in labor quantity
   - Change in labor quality (from adult male to female, child, & elderly)
   - Decrease attention about appropriate use of technology

2. Migration increases adoption of improved farm technologies induced by farm labor scarcity and through access to information;

3. Migration does not affect crop production efficiency;

4. Remittance increases adoption of improved farm technologies by overcoming credit constraint, providing liquidity flexibility and insuring against the risk; and

5. Remittances increase crop diversification; and

6. Remittances and migration increases exit from farming

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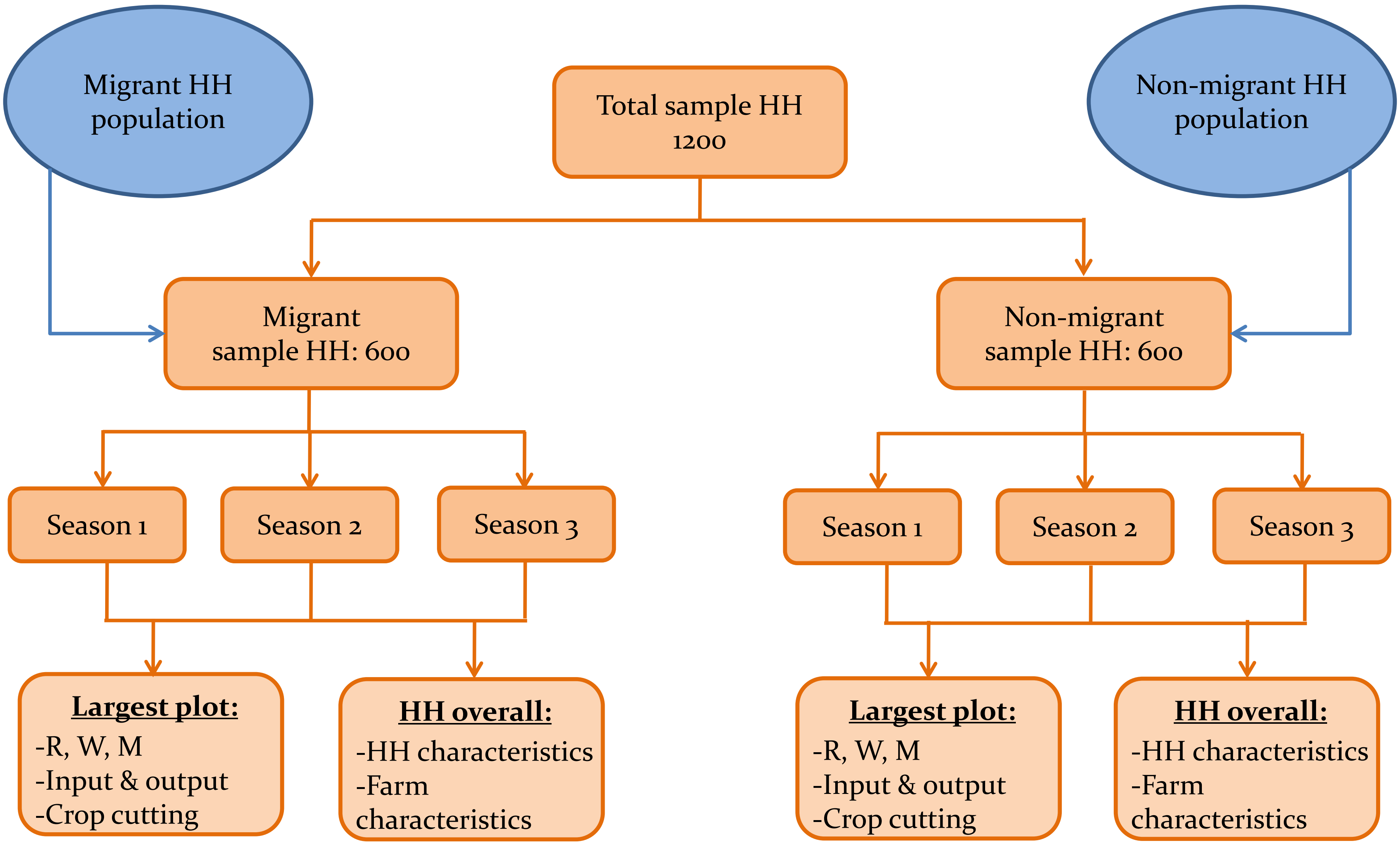
Analytical Framework:
How to measure agricultural productivity

- Household grow more than one crops
- Different crops have different yields
- Physical yield can't be used to measure overall agri. productivity
- **Option 1**: Measure agri. productivity in terms of gross value
    - Consider: main grain and cash crops
    - Exclude: perennial crops, livestock and fish.
- **Option 2**: Measure yield of 3 main cereals (rice, wheat, and maize)

Sampling Design for Farm Household Survey



Data Collection: 3 Seasons (by season)

- **Largest plot (Rice, Wheat, and Maize)**
  - ❖ Detail inputs and outputs
  - ❖ Technology adoption (fertilizer, pesticides, machine)
  - ❖ Crop cutting

- **Sample HH for crop cutting: 600 (*every alternate sample HH*)**
  - ❖ Need moisture meters

- **Overall farm and household characteristics**
  - ❖ Household demographic characteristics
  - ❖ Agricultural production including technology adoption (variety)
  - ❖ Income, consumption and expenditure
  - ❖ Wealth and assets
  - ❖ Migration as well as remittances and their use
  - ❖ Women's participation in farming and decision making

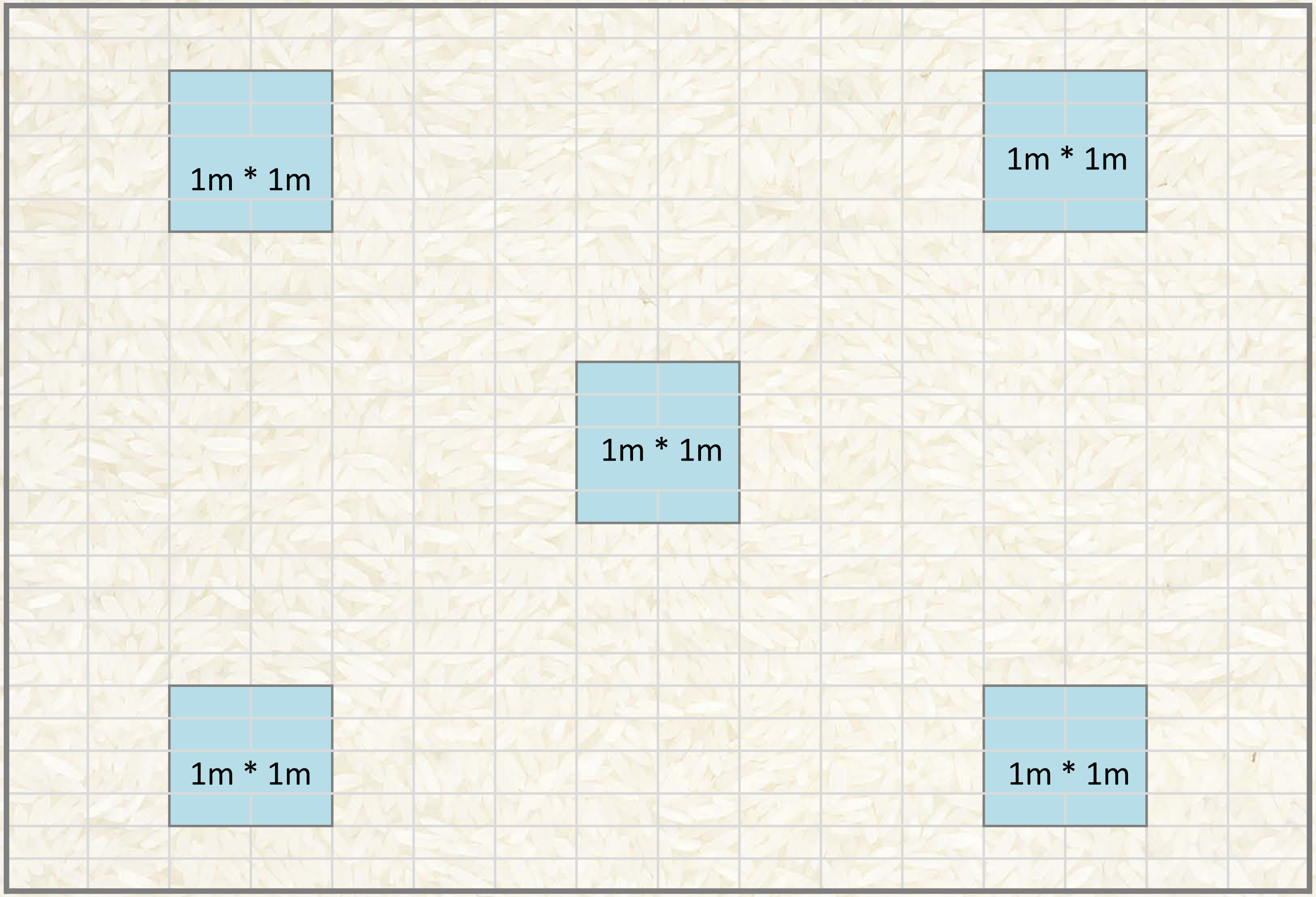
IRRI Crop Cutting Experiment (CCE) Method

1. **Selection of the field**
   - One CCE plot/crop/farmer (largest plot)
   - One farmer can have >1 CCE plots if he grow >1 crops
   - CCE plot represents the average farm management condition of HH

2. **Size and shape of the CCE plot**
   - Square plot
     - ❖ 1m * 1m (5 CCE plots per field)
     - ❖ 5m * 5m (1 CCE plot per field)
   - Rectangle plot
     - ❖ 5m * 2m (1 CCE plot per field)
     - ❖ 5m * 4m (1 CCE plot per field)

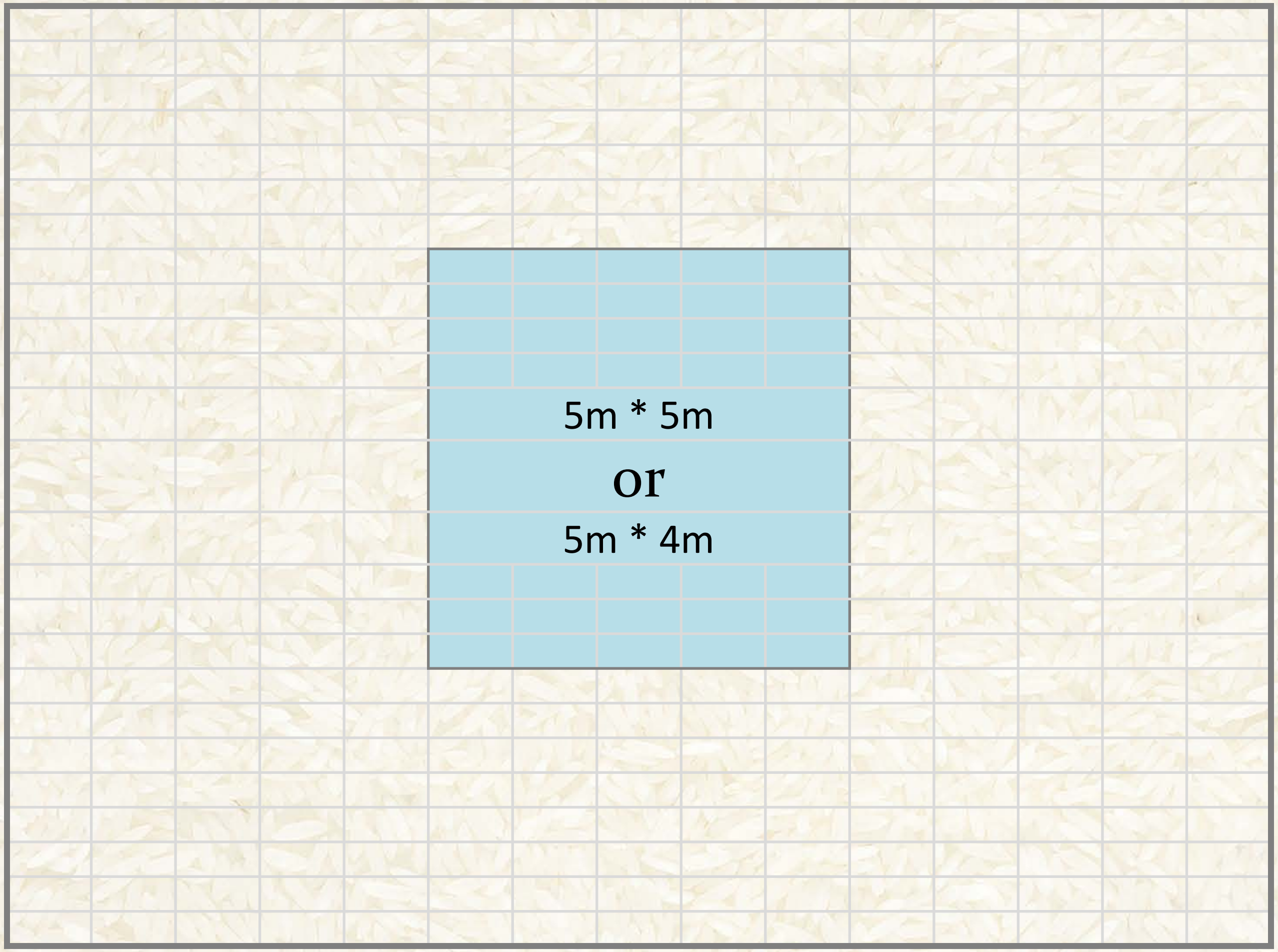
3. **Yield estimation**
   - Adjust yield for high moisture content at harvest

Crop Cutting Experiment (CCE) Method



- Suitable when production at the field varies across land gradient.

Crop Cutting Experiment (CCE) Method



- Suitable when production is uniform across land gradient.

IRRI Crop Cutting Experiment (CCE) Method

Estimation of actual crop yield from CCE plot yield

$$Yield\ \left(\frac{kg}{ha}\right)\ at\ 14\%\ m.c.\ = \frac{Plot\ yield\ (kg)}{Plot\ area\ (m^2)} * \frac{(100 - FMC)}{(100 - 14)} * \frac{10{,}000\ m^2}{1\ ha}$$

Example:

- CCE Plot size (5m*4m) = 20
- Rice yield from CCE plot (kg) = 10
- Field moisture content of the grain = 24%
- What is the rice yield at 14% moisture content:

$$= \frac{10\ kg}{20\ m^2} * \frac{(100-24)}{(100-14)} * \frac{10000 m^2}{1 ha}$$

= 4420 kg/ha

Analytical Approach:
A. Effect of migration on agricultural productivity

Estimation method:

- HH simultaneously decide migration, remittance and farm activities
- Need to eliminate endogeneity and simultaneity biases
- Solution:
  - ❖ Panel data: HH fixed effects to control fixed unobservable factors
  - ❖ Cross section data: Instrumental variable approach (3SLS)

Null Hypotheses:

- $\gamma_1 = 0$, Migration does not affect agricultural productivity
- $\gamma_2 = 0$, Remittances does not affect agricultural productivity

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Panel data:

1) $Y_{ijt} = \alpha_0 + \alpha_1 M_{ijt} + \alpha_2 X_{ijt} + \alpha_3 Z_{jt} + H_i + \varepsilon_{ijt}$

2) $Y_{ijt} = \beta_0 + \beta_2 R_{ijt} + \beta_2 X_{ijt} + \beta_3 Z_{jt} + H_i + \eta_{ijt}$

3) $Y_{ijt} = \gamma_0 + \gamma_1 M_{ijt} + \gamma_2 R_{ijt} + \gamma_3 X_{ijt} + \gamma_4 Z_{jt} + H_i + \zeta_{ijt}$

Cross section data:

1) $M_{ijt} = \theta_0 + \theta_1 X_{ijt} + \theta_2 Z_{jt} + \nu_{ijt}$

2) $R_{ijt} = \delta_0 + \delta_1 \hat{M}_{ijt} + \delta_2 X_{ijt} + \delta_3 Z_{jt} + \upsilon_{ijt}$

3) $Y_{ijt} = \lambda_0 + \lambda_1 \hat{M}_{ijt} + \lambda_2 \hat{R}_{ijt} + \lambda_3 X_{ijt} + \lambda_4 Z_{jt} + \tau_{ijt}$

- Y = Agricultural productivity (yield or value of production)
- M = Migration, R = Remittances
- X = A vector of observable farm and HH socioeconomic covariates
- Z = A vector of community-level covariates
- H = HH fixed effect, both observed & unobserved
- i = household, j = community, t = time

B. Effect of migration on adoption of improved farm technologies

(1) $Pr\ (A_i \neq 0 \mid M_i, R_{i,} X_i) = \phi\ (M_i\beta_1, R_i\beta_{2,}\ X_i\beta_3)$

A_i = Discrete var. representing adoption of technologies (A=0,1,2…)

M_i = Total number of migrants per HH

R_i = Remittances received by a HH

X_i = Vector of HH socioeconomic variables

ϕ = Standard CDF

If M and R are exogenous, a typical probit model can be used

(2) $A_i = \beta_0 + \beta_1 M_i + \beta_2 R_i + \beta_3 X_i + \varepsilon$

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If M & R are endogenous, 3SLS model can be used by identifying instrumental variables for M_i and R_i.

In 1st and 2nd stages, OLS model is estimated for each endogenous var.

(3) $M_i = \lambda_0 + \lambda_1 X_i + \lambda_2 Z_i + \varepsilon;$ Z_i is a vector of instruments for M_i

(4) $R_i = \gamma_0 + \gamma_1 X_i + \gamma_2 \hat{M}_i + \gamma_3 W_i + \varepsilon;$ W_i is a vector of instruments for R_i

In 3rd stage, predicted value of M_i and R_i are used as explanatory var.

(5) $A_i = \delta_0 + \delta_1 X_i + \delta_2 \hat{M}_i + \delta_3 \hat{R}_i + \eta$

C. Effect of migration on crop production efficiency

Stochastic Frontier Production Function

$$Y_{it} = f(X_{it}; \beta) \exp(V_{it} - U_{it})$$

Y_{it} = Grain output produced by HH i in year t,

X_{it} = A vector of inputs used by HH i in year t to produce output Y_{it},

V_{it} = Assumed to be *iid* $N(0, \sigma_v^2)$

U_{it} = Measure of technical inefficiency of HH i in year t

$f(X_{it}; \beta)$ = Have the general translog functional form.

Variables to measure impact of migration on efficiency

- Number of working members
- Share of old age workers (60+)
- Share of female workers
- Time spent on migration

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