



College of Tropical Agriculture and Human Resources
University of Hawai'i at Mānoa

Sustainable Management of Agro-ecological Resources for Tribal Societies (SMARTS) in India & Nepal

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19th May 2014



Conservation Agriculture Production Systems

(CAPS)

- CAPS concept developed by USAID Sustainable Agriculture and Natural Resource Management (SANREM) Feed the Future Innovation Lab program
- Based on principles of CA practices
 - Minimum soil disturbance
 - Continuous organic soil cover
 - Appropriate crop rotation

Goals

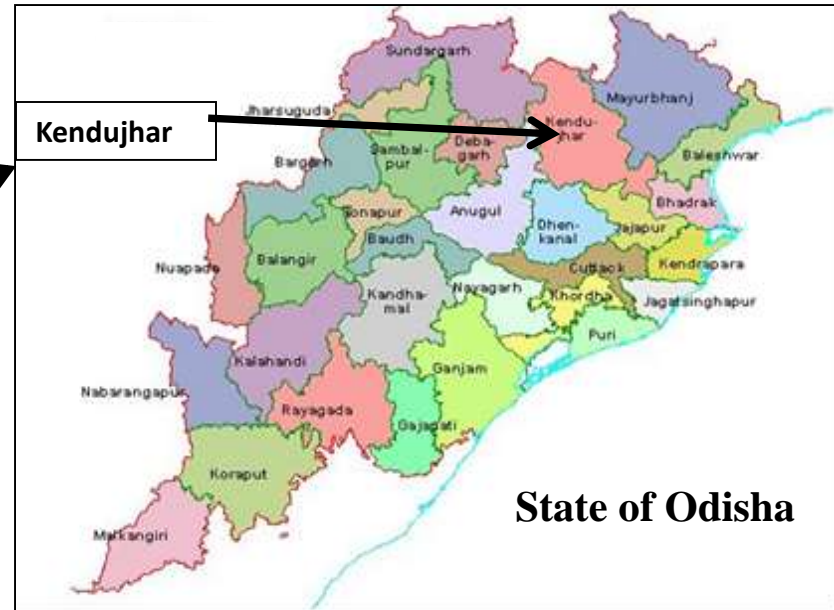
- The overall goals are to improve:
 - Crop yield
 - System productivity
 - Soil quality
 - Probability of adoption
 - Capacity building (among students, farmers, Institutions and NGOs)
 - Social networking
- Also to evaluate effects of CAPS on gender, & nutrition.

India

OBJECTIVES

- To evaluate short-term effects of CAPS on crop yields, system productivity, labor requirements and soil quality and,
- To provide recommendations to the decision makers to promote CAPS

The Study Area: District of Kendujhar, Odisha, India



- Resource poor tribal people
- Predominantly smallholder, subsistence farmers with <2 ha land per household
- Rely on low input, rain-fed maize based cropping systems



On Station Trials



a) **1st season (June-October):**

4 Treatments, 3 replications and randomized block design

T₁: Conventional tillage with sole maize,

T₂: Conventional tillage with maize + cowpea,

T₃: Minimum tillage with sole maize,

T₄: Minimum tillage with maize + cowpea

- Improved varieties of maize and cowpea

b) **2nd season (November-January):**

Residual effect of 4 treatments (main plot) and direct effect of cover crop treatments (sub plot); split plot design.

NCC: no cover crop (fallow)

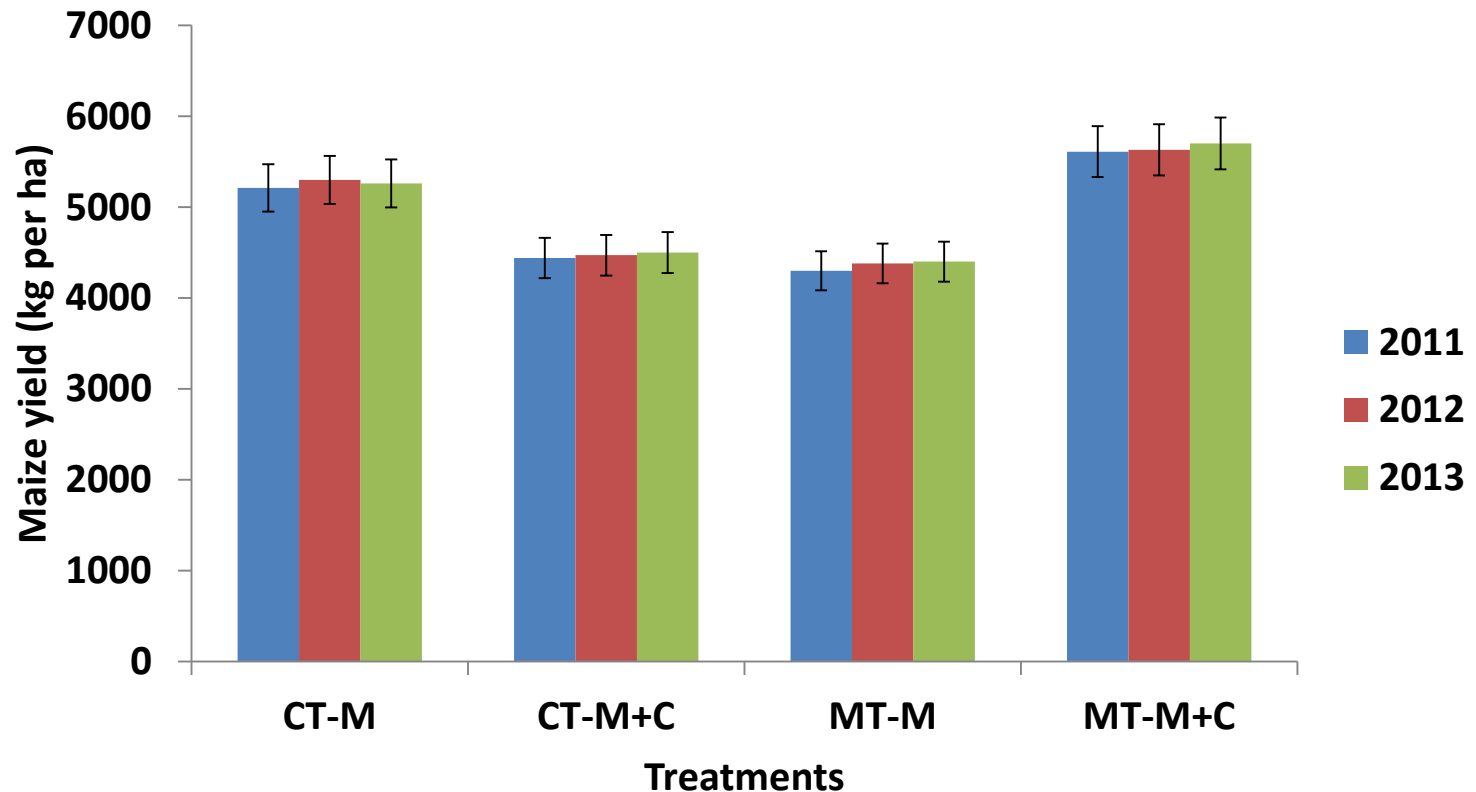
CC1: Mustard as a cover crop

CC2: Horse gram as a cover crop

Results

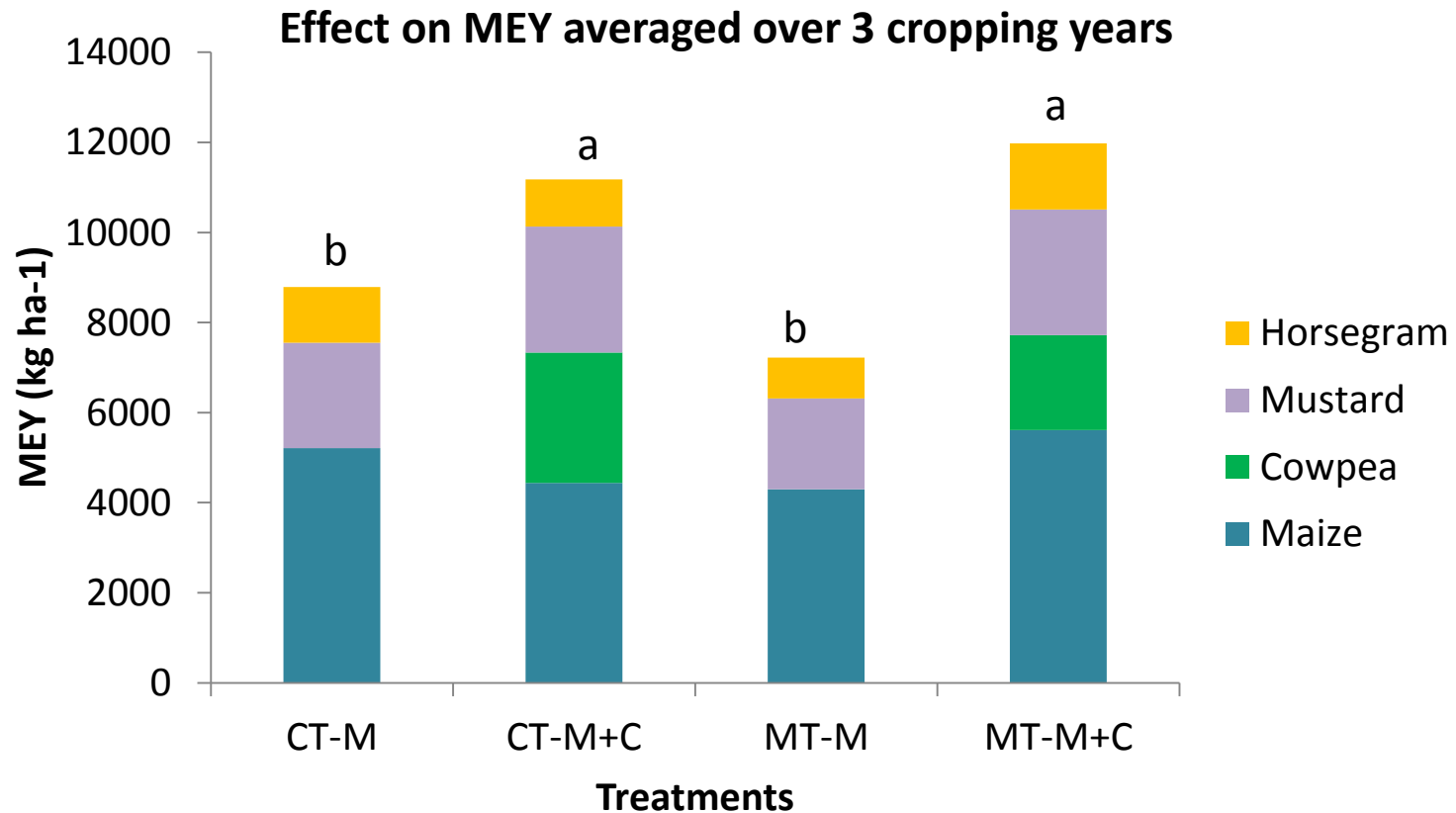
- Treatments and year had no effect on maize yield but had an increasing trend in all except CT-M.
- Cowpea was an additional gain in intercropping plots.

Maize yield (kg ha⁻¹) by treatments and year



Effect on maize equivalent yield (MEY, kg ha⁻¹)

- There was a significant effect of intercropping on MEY due to gain from cowpea and a better horsegram yield.

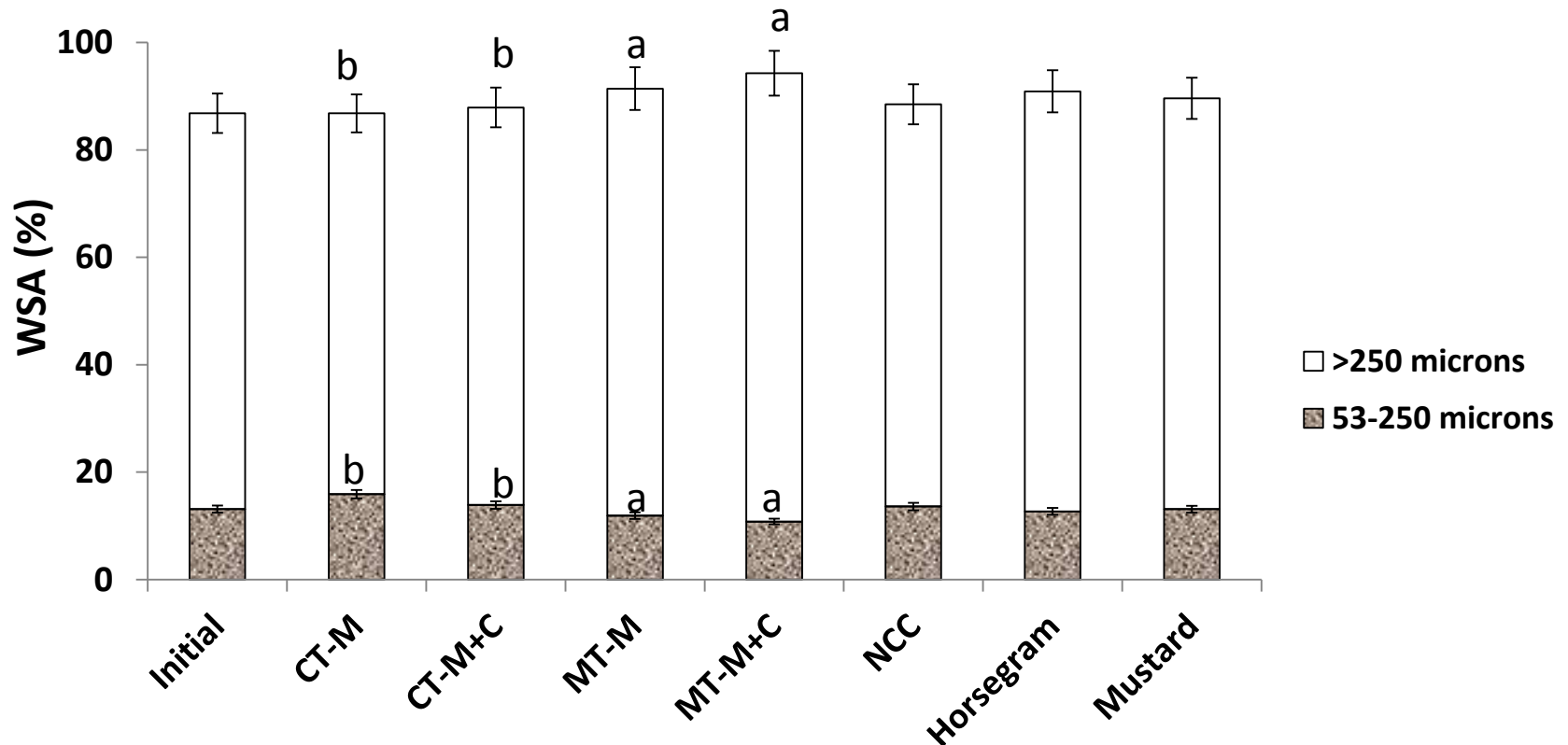


Soil



- No significant effect of treatments on many soil Properties.
- Tillage had significant effect on water stable aggregates (WSA).
- CT had more significant impact on micro-aggregates while MT had significance on macro-aggregates (resistant to dispersion).

WSA by treatment (0-10) cm



Economics

- 27% of labor saving in minimum tillage over conventional tillage mainly due to reduction in no. of plowings.
- Minimum tillage along with intercropping had higher profitability of \$403 ha⁻¹ yr⁻¹ where as conventional tillage with sole maize had less profitability of \$311 ha⁻¹ yr⁻¹.



On farm trials



No. of participating farmers:

Year\Village	Tentuli	Talachampe	Bayakumutia
2011	20		
2012	26	10	
2013	30	26	20

- 4 treatments, randomized block design
- Improved varieties of maize and cowpea.

Treatments	Season		Tillage
	1 st season (June-October)	2 nd season, cover crop (November-January)	
T1 (control)	Maize	Mustard	Conventional
T2	Maize + cowpea	Mustard	Conventional
T3	Maize	Mustard	Minimum
T4	Maize + cowpea	Mustard	Minimum



On-farm (Rainy season)





On farm (Post-rainy season)





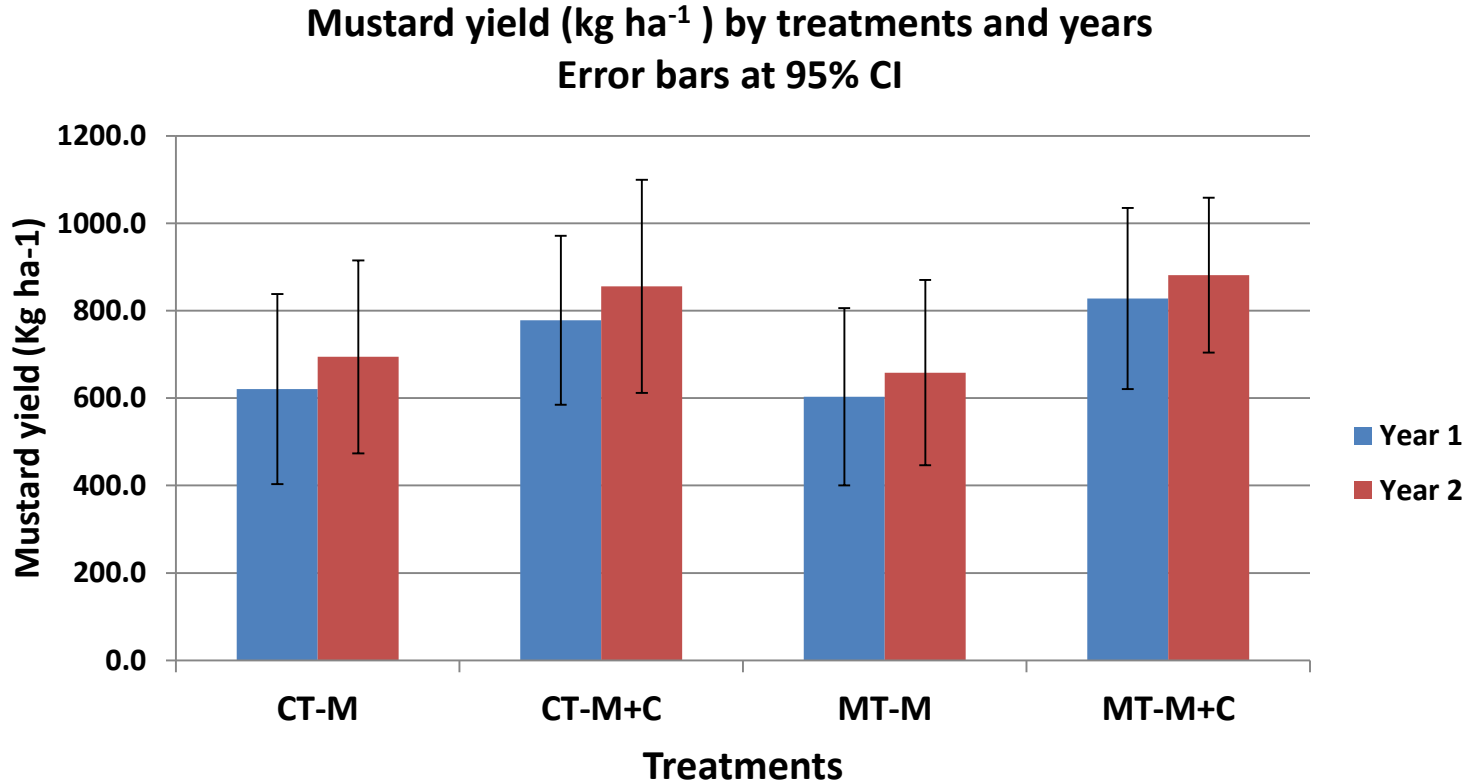
Market View



Officials visit to on farm trials

Results

- Tillage and intercropping had no significant effect on maize yield.
- Intercropping had a significant effect on mustard yield.



- Higher profitability of minimum tillage with intercropping (9.69%) over conventional tillage with sole maize (\$386 ha^{-1} yr^{-1}).

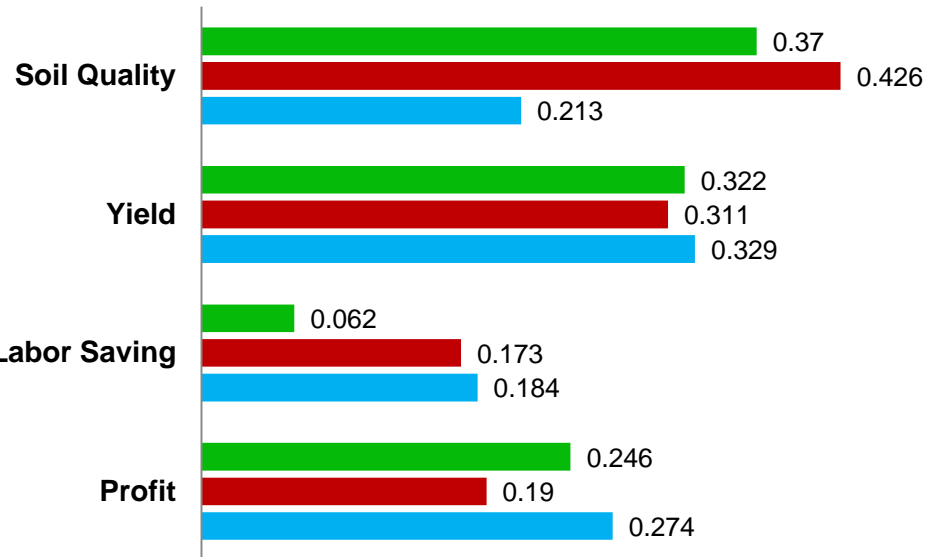
Stakeholder preference mapping



Farmers' preference mapping (AHP)

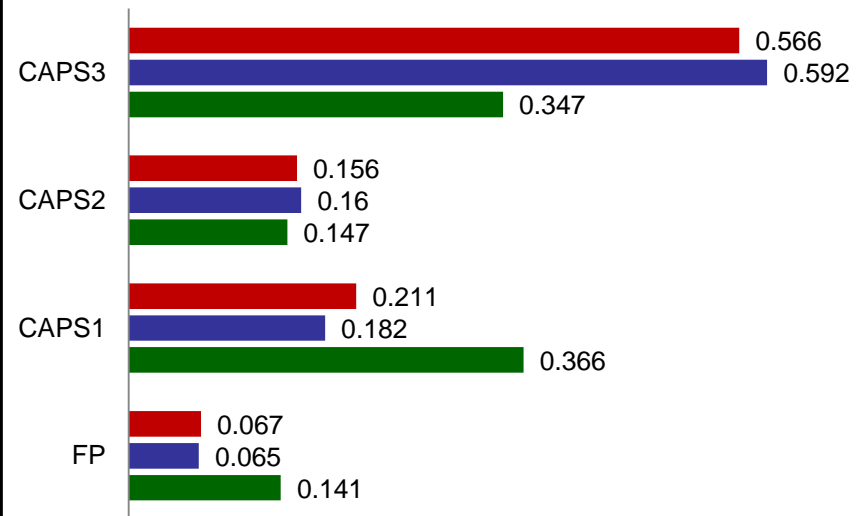
Farmers' priorities (weights) of objectives with respect to the goal of improved income

■ Talachampe, 2013 ■ Tentuli, 2013 ■ Initial AHP survey, 2011



Farmers' priorities (weights) of treatments with respect to the goal of improved income

■ Talachampe, 2013 ■ Tentuli, 2013 ■ Initial AHP survey, 2011



- High preference for soil quality over profit and yield
- Preference for CAPS 3 (maize + cowpea - MT) indicates perceived advantages of intercropping and minimum tillage.

Nutritional Security to tribal Farm families



Dioscorea Sp.
plantation
in backyards



Capacity building

- Training to 66 farmers (42 male and 24 female) on tillage, harvesting, post-harvest and crop residue management.
- 44 participants (26 male and 18 female) were exposed with tools of water stable aggregate, technology network, and fuzzy cognitive mapping.
- One District level workshop on maize-based conservation agriculture involving 80 participants (30 female, 50 male) *viz.* farmers and extension personnel was organized to deliver effect of maize-cowpea CAPS for sustainable tribal farming.
- 300 participants involving faculties & students, scientists, and Government of Odisha officials attended the workshop on conservation agriculture.
- 600 farmers from different districts of Odisha attended the farmer-scientist interaction section on "Soil health management through conservation agriculture".
- 1 student (PhD) from India in UH and 9 students (MS) in India



Focus group discussions



Networking

- Inclusion of SANREM FtF Innovation Lab in Cereals Systems Initiative for South Asia (CSISA) stakeholder consultation.
- a write up about SMARTS educational component will be featured on US India Education Foundation (USIEF) website.
- Kendujhar district department of agriculture and Agricultural Technology Management Agency (ATMA) approved a proposal to replicate minimum tillage and maize-cowpea intercropping in 500 ha of potential maize area.
- Mayurbhanj district has adopted in 1000ha with govt. funding.
- 3 leaflets (including 2 in local language) had been published.
- 7 abstracts and 16 presentations in different conferences, workshops and symposiums.

MEDIA COVERAGE

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୪ ଜାନୁଆରୀ ୨୦୧୨

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THE TIMES OF INDIA, BHUBANESWAR
MONDAY, SEPTEMBER 17, 2012

ବାଂଶପାଳ: ତେନ୍ତୁଳି ଗ୍ରାମରେ କୃଷକ ତାଲିମ ଶିବିର

କେନ୍ଦୁଝର, ୩୧ (ଇମିସ): ବାଂଶପାଳ ବ୍ଲକ୍ ତେନ୍ତୁଳି ଗ୍ରାମରେ ଉଡ଼ିଆ ଚାଷ ଓ ବୈଷୟିକ ବିଶ୍ୱବିଦ୍ୟାଳୟ କେନ୍ଦ୍ରରେ ଓ ଆମେରିକା ହାସ୍ତୀୟ ବିଶ୍ୱବିଦ୍ୟାଳୟର ମିଳିତ ସହଯୋଗରେ ଏକ କୃଷକ ତାଲିମ ଶିବିର ଆୟୋଜିତ ହୋଇଯାଇଛି । କୃଷି ବିଶ୍ୱବିଦ୍ୟାଳୟର କେନ୍ଦ୍ରୀୟ ଗବେଷଣା କେନ୍ଦ୍ରର ସହଯୋଗୀ ନିର୍ଦ୍ଦେଶକ ଡ. ପ୍ରକାଶ କୁମାର ଜାଇନଙ୍କ ଅଧ୍ୟକ୍ଷତାରେ ଆୟୋଜିତ ତାଲିମ କାର୍ଯ୍ୟକ୍ରମରେ କୃଷି ପ୍ରଦର୍ଶନୀୟତା ଅଧ୍ୟାୟ ଓ ବିଭାଗର ନିର୍ଦ୍ଦେଶକ ଡ. ସତ୍ୟନାରାୟଣ ବିଶ୍ୱବିଦ୍ୟାଳୟର ପରିଷ୍ଟ ବୈଜ୍ଞାନିକ ଡ. ବ୍ରାଜେଶ ଆଇଚଲ ସମ୍ମାନିତ ଅତିଥି ଭାବେ ଯୋଗଦେଇ ରବିପ୍ରାଦନ ଭଣିକରେ । ଏହି ପ୍ରକଳ୍ପ ବିଶ୍ୱବିଦ୍ୟାଳୟ ପକ୍ଷରୁ କାର୍ଯ୍ୟକ୍ରମ ହୋଇଥିବା ସ୍ୱାର୍ଥ ସୂଚକ ସହାୟତାରେ ଆୟୋଜନ କରାଯାଇଛି ।

ସହଯୋଗୀ ପଦକ୍ଷେପ ଗ୍ରହଣକାରୀ ଡ. ବ୍ରାଜେଶ ଆଇଚଲଙ୍କ ଅଧ୍ୟକ୍ଷତାରେ ଆୟୋଜିତ ତାଲିମ ପ୍ରତିଭାଗର ନିର୍ଦ୍ଦେଶକ ଡ. ସତ୍ୟନାରାୟଣ ବିଶ୍ୱବିଦ୍ୟାଳୟର ପରିଷ୍ଟ ବୈଜ୍ଞାନିକ ଡ. ବ୍ରାଜେଶ ଆଇଚଲ ସମ୍ମାନିତ ଅତିଥି ଭାବେ ଯୋଗଦେଇ ରବିପ୍ରାଦନ ଭଣିକରେ । ଏହି ପ୍ରକଳ୍ପ ବିଶ୍ୱବିଦ୍ୟାଳୟ ପକ୍ଷରୁ କାର୍ଯ୍ୟକ୍ରମ ହୋଇଥିବା ସ୍ୱାର୍ଥ ସୂଚକ ସହାୟତାରେ ଆୟୋଜନ କରାଯାଇଛି ।

New Farm System Popular With Ryots

Express News Service

Bhubaneswar: A sustainable conservation agriculture system, being jointly implemented by Orissa University of Agriculture and Technology (OUAT) and University of Hawaii, the USA, has evoked encouraging response from farmers in Keonjhar where it is being piloted.

ଓୟୁଏଟି-ହାୱାଉର୍ସ ପ୍ରକଳ୍ପ କୃଷକ ତାଲିମ ଶିବିର



କେନ୍ଦୁଝର, ୩୧ (ଇମିସ): ବାଂଶପାଳ ବ୍ଲକ୍ ତେନ୍ତୁଳି ଗ୍ରାମରେ ଓୟୁଏଟି-ହାୱାଉର୍ସ ପ୍ରକଳ୍ପର ଅନ୍ତର୍ଗତ କୃଷକ ତାଲିମ ଶିବିର ଆୟୋଜିତ ହୋଇଛି । ଏହି ପ୍ରକଳ୍ପର ଅନ୍ତର୍ଗତ କୃଷକ ତାଲିମ ଶିବିର ଆୟୋଜିତ ହୋଇଛି ।

NEWS

ସମ୍ବାଦ 92 1919-2011

THE NEW INDIAN EXPRESS
BHUBANESWAR MONDAY 17 SEPTEMBER 2012

BHUBANESWAR

Farmers' Training Camp Held

Express News Service
Bhubaneswar: A farmers' training camp was organized in Tentuli village of Banspal block of Keonjhar to showcase the usefulness of Conservation Agriculture Production System (CAPS) in the tribal pockets of the district. It was organized jointly by OUAT and University of Hawaii, the USA.
The camp was part of the Sustainable Management of Agro-ecological Resources (SMARTS) project, a collaborative research of the two universities. It is in operation in Keonjhar for improving farm income of tribal farmers with maintenance of soil health.
During the camp, project officers highlighted maize-based cropping system involving vegetable cowpea as inter-crop in rainy season followed by mustard under residual soil in post-rainy season. The mustard crop residue on incorporation in soil improves its health.
Fifty farmer families from two selected villages - Tentuli and Talachangal - are participating as beneficiaries in the ongoing project activities to realise multifarious advantages of different CAPS. Nearly hundred interested farmers from both these vil-

ages attended the programme and visited the experimental crop fields. They also listened to experiences of fellow farmers.
The camp was conducted by Dr Prakash Kumar Rout, Principal Investigator of the project and head of OUAT Research Station at Keonjhar; Dr S.V. Dada, Horticultural Scientist, Dr K.N. Mishra, Soil Scientist from OUAT, and Dr Sunil Mohapatra, Programme Coordinator, Krishi Vigyan Kendra, Keonjhar, attended.
The SMARTS project has been in operation in the district since February, 2011, and will continue till September, 2014.
At the training camp, the local farmers were informed about the harvesting and post-harvest management processes of mustard grown as cover crop after maize by agro scientists. The farmers practising the crops shared their experience with the experts.

ବାଂଶପାଳରେ କୃଷକ ତାଲିମ ଶିବିର

କେନ୍ଦୁଝର (ଓ.ପ୍ର.): ଉଡ଼ିଆ ଚାଷ ଓ ବୈଷୟିକ ବିଶ୍ୱବିଦ୍ୟାଳୟ, କେନ୍ଦୁଝର ଏବଂ ଆମେରିକା ହାୱାଉର୍ସ ବିଶ୍ୱବିଦ୍ୟାଳୟର ମିଳିତ ସହଯୋଗରେ ବାଂଶପାଳ ବ୍ଲକ୍ ତେନ୍ତୁଳି ଗ୍ରାମରେ ଓୟୁଏଟି-ହାୱାଉର୍ସ ପ୍ରକଳ୍ପର ଅନ୍ତର୍ଗତ କୃଷକ ତାଲିମ ଶିବିର ଆୟୋଜିତ ହୋଇଛି । ଏହି ପ୍ରକଳ୍ପର ଅନ୍ତର୍ଗତ କୃଷକ ତାଲିମ ଶିବିର ଆୟୋଜିତ ହୋଇଛି ।

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ODISHA

Training camp for farmers in Keonjhar: A one-day training camp for farmers was organized in Tentuli village of Banspal block in Keonjhar district to highlight the usefulness of conservation agriculture production system (CAPS) in the tribal pockets of the district. The camp was organized as part of the sustainable management of agro ecological resources project, a collaborative research of OUAT and University of Hawaii (USA) for improving the farm income of tribal farmers with maintenance of soil health. The project emphasizes on Maize-based cropping system involving vegetable cowpea as intercrop in rainy season followed by mustard under residual soil in post-rainy season.



Workshop



Inauguration of CAPS leaflet



Presentations



Threats



Earthen check dams



High runoff



Elephant invade



Farmer groups to protect crops from elephant



Elephant watch tower

Challenges

- Cowpea damage due to closer spacing in case of on farm trials.
- Early season drought during maize sowing.
- Only cover cropping is not acceptable to farmers
- Cover crop (Mustard) crop was badly affected by Cyclone- 'Phailin'
- Farmers have no preference for Crop residue recycling

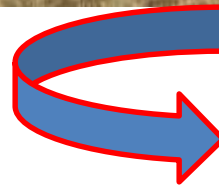
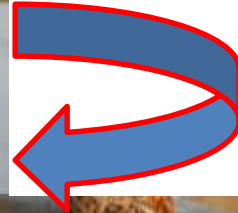
Actions

- On station experiment to find out optimum spacing options
- Change of cowpea variety
- Re-sowing and gap filling to maintain the plant population.
- Dual purpose (Economic yield + Cover crop) mustard was suggested
- On-farm threshing of mustard for residue recycling

Crop Residue Handling



Polythene sheet for on field
mustard threshing



Development impacts

- Technologies being tested have potential for increasing profitability of the tribal farmers
- CAPS research started by OUAT is sole government owned institute for formal agriculture training
- Tools to bridge the gap in understanding about CAPS among the stakeholders
- Gradual adoption of CAPS technologies both at local farmers and district administrative level

PROJECT ON MAIZE + COWPEA INTERCROPPING DEMONSTRATION TO BE CONDUCTED IN KEONJHAR DISTRICT DURING KHARIF 2012 UNDER EXTENSION REFORMS (ATMA), GOVT. OF ODISHA

Field experiments on Maize + Cowpea intercropping under minimum tillage was conducted at RKITS, Keonjhar and farmers' field in Bampur block by OAUAT-University of Hawaii collaborative research project "SMARTS" during 2011-12. Viewing the success of the practice, the matter was discussed in the District Agricultural Strategy Meeting held on 1st April, 2012 under the Chairmanship of Collector & District Magistrate, Keonjhar. Considering the higher yield, economics, soil health and nutritional benefits for the tribal farmers, the Chairman suggested to disseminate the technology to the other farmers of the Keonjhar district in different blocks through demonstration and training programmes.

It is proposed to conduct the demonstration in pilot project basis in 5 Acres. of patches (either continuous or contiguous) in different locations of different blocks of Keonjhar district as per the programme given below. Prior to the demonstration, it is felt that farmers training on technology have to be organized involving 25 farmers @ 4 training per block for quick and easy dissemination of the technology to the beneficiaries of the demonstration programme.

Viewing the successfulness of the programme and acceptance by the farmers of pilot tested project area, the demonstration programme can be replicated to larger area in subsequent years. However, indicative cost structure for both demonstration and farmers training programme is given herewith for reference.

Block wise programme for demonstration:

Sl No.	Name of the Block	Area Programmed (Acres)
1	Kerchuhar	50
2	Bisupal	100
3	Talka	50
4	Saharada	50
5	Patna	50
6	Hanchandrapur	50
7	Changana	50
8	Jhangana	50
9	Chermana	50
	Total	500

Cost structure for Farmers training

No. of Participants	Duration	1 Day	
1	Training materials (printing paid with printed literature material & 250) @ Rs 25/- for 25 farmers		Rs 625/-
2	Scouting tractor/allowance @ Rs 95/- for 25 farmers		Rs 2375/-
3	Household charges for insurance person @ Rs 250/- for 2 resource persons		Rs 500/-
4	Hiring of vehicle / POL charges for movement of resource person		Rs 1000/-
5	Stationery, photograph & misc. contingencies		Rs 250/-
	Total		Rs 4000/-

N.B:- Cost structure is indicative. Details in case components can be utilized in other as per requirement.

Cost structure for demonstration

Sl No.	Item / material	Quantity	Indicative cost in Rs.	Scheme share in Rs.	Farmers share in Rs.
1	Hybrid Maize seeds	4.3 Kg.	400	450	0
2	Cowpea seeds	4 Kg.	1600	1600	0
3	PYM	2 Tons	800	0	800
4	PDS	2 qnts.	40	0	40
5	PDS	20 qts.	80	0	80
6	Chemical fertilizer @48:34:24 per Ac. for hybrid Maize and 10:20:25 per Ac. for Cowpea				
	1. Urea (for Maize crop)	100 Kg.	1750	1750	0
	2. DAP (for Maize crop)	40 Kg.	250	0	250
	3. Urea (for Cowpea crop)	100 Kg.	1750	1750	0
	4. DAP (for Cowpea crop)	40 Kg.	250	0	250
7	Seed treatment chemicals				
8	PP Chloroxone wood based application				
	1. Chloroxone	250	0	250	0
9	Misc. Contingencies				
	1. Misc.	250	150	0	150
	2. Misc.	5420	4000	0	1420
	Total				

N.B:- Cost structure is indicative. Details in case components can be utilized in other as per requirement.

ALLOCATION REQUIREMENT

1	Farmers meeting @ Rs 4000/- per training X 4 trainings / per block X 9 blocks	Rs 1,44,000/-
2	Demonstration @ Rs 4000/- per 1 Ac. demonstration over 500 Acs.	Rs 20,00,000/-
	Total	Rs 21,44,000/-

(Rupees twenty one lakh forty four thousand) only
It is proposed to conduct the demonstration as well as farmers training with full assistance from ATMA funds as per guideline of Extension Reform (ATMA).

(Signature)
Project Director, ATMA
Keonjhar

(Signature)
Collector & District Magistrate
-cum- Chairman, ATMA
Keonjhar

CA Adoption in other areas of Kendujhar

Adoption in another district Mayurbhanj

PROCEEDINGS OF THE 12TH GOVERNING BOARD MEETING OF ATMA, MAYURBHANJ HELD ON 28.04.2013

The 12th Governing Board Meeting of ATMA, Mayurbhanj was held in the Conference Hall of OPDA under the Chairmanship of Sh. Rajesh Prasthakar Patil, IAS, Collector, Mayurbhanj. All the members of the Project Director, ATMA and other members and visitors on the occasion. The list of the members present in the meeting was as follows:-

During the meeting the Project Director, ATMA requested the Governing Board to consider the proceeding of the 11th Governing Board Meeting. As no suggestions were received from any quarters, the proceeding was confirmed.

Then, the Project Director informed the house that, during the period from November to April 2013, the following activities were undertaken in the district and requested approval of the Governing Board:

Sl. No.	Understand activities	Est.	Est. cost in Rs.	Total expenditure in Rs.
1	Demonstration of hybrid maize intercropping in mango orchards	11.5 hect.	4000	128000
2	Popularization of Beehive	120 units	3,000/-	240000
3	Popularization of seedling	1500 nos.	200/-	300000
4	Training on tree fruiting	100 participants		30000
5	Support to "Popularization of new varieties of Mustard / Fenar under PDS"	800 ha	1250/-	1000000
6	Dissemination of information through print media	270 fully service/ Sampurna Advt. in Sampurna	Preparation of RIC material 5000 On ATMA activities 5000	
		Source of China Mobile Publisher	400	10000
		State April May 2013		150000
		Bamanghosh Mahanagar		20000
		Collector's Mess.		25000
		Exhibition during Kharif Mela on PDS collection at KVK		5000
		Exhibition cum Kharif mela by KVK, Sunabhadra		10000
				410

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Then the Project Director proposed before the Governing Board to undertake the following farmer oriented activities during Kharif 2013-14. The details were placed for discussion and approval.

Sl. No.	Proposed activities	Area	Est. cost in Rs.	Total cost in Rs.
1	Farm School	52 nos.	23,914/-	1243028
2	Seed Treatment Campaign for Kharif, 2013	8 DAO circles	50,000/-	440000
3	Awareness on hybrid Maize (Funds to be used from available interest money & Farmer's share with FIACs with approval of FIAC)	As per requirement	2500/- per acre/ha	2000000
4	Intercropping of Cowpea in Maize (for non tribal farmers)	100 acre	4000 per acre	2000000
5	Popularization of Aromatic Paddy	20 trainings	3000/-	150000
6	Popularization of Hybrid Paddy	52 trainings	3000/-	315000
7	Mini Demo. cum Training on Groundnut	13 trainings	8000/-	104000
8	Trichocasts for Control of Stem Borer	20 demonstration in 10 acre	4500/-	110000
9	Demo. on Poly-culture of Fish with Prawn	20 demonstration	4000	104000
10	Health Camp of Goats	302 nos. area in each G.P.	2000	704000
11	Training of Krushak Sahitya on Vaccination	100 K. Sahitya	30,000/- for 20 K. Sahitya for 6 days	1800000
12	Introduction of New Cultures of Yams	200 nos demonstration	10000/-	200000
13	Growth Regulator demo in Cucurbita	200 nos demonstration	10000/-	200000
14	IPM Demo. cum Training in Solanaceous Crop	26 nos demonstration	7200/-	187200
		20 nos training	7200/-	144000

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- As per request of the DAOs, the Governing Board approved to provide one printer-cum-copier machine and one inverter to each DAO.
- The Chairman, ATMA-cum Collector & District Magistrate, Mayurbhanj suggested some valuable proposals for implementation through ATMA.
- Fertilizer recommendation of important crops, based on soil test result of the GP, should be displayed in the wall of the Grama Panchayat for awareness of the farmers.
- As intercropping of Cowpea in maize crop is to be taken up through ITDA for tribal farmers, the similar type of benefits from ATMA may be provided to non tribal farmers.
- More health camp for Goats may be organized in Saripal Area.
- The Honey Bee farmers should be provided adequate training. Exposure visit of bee farmers to successful units may be organized.

The meeting was ended with vote of thanks to the participants and the chair.

(Signature)
Project Director, ATMA
Mayurbhanj, Balipada

(Signature)
Collector & District Magistrate
-cum- Chairman, ATMA
Mayurbhanj, Balipada



CAPS Presentation before state level officials

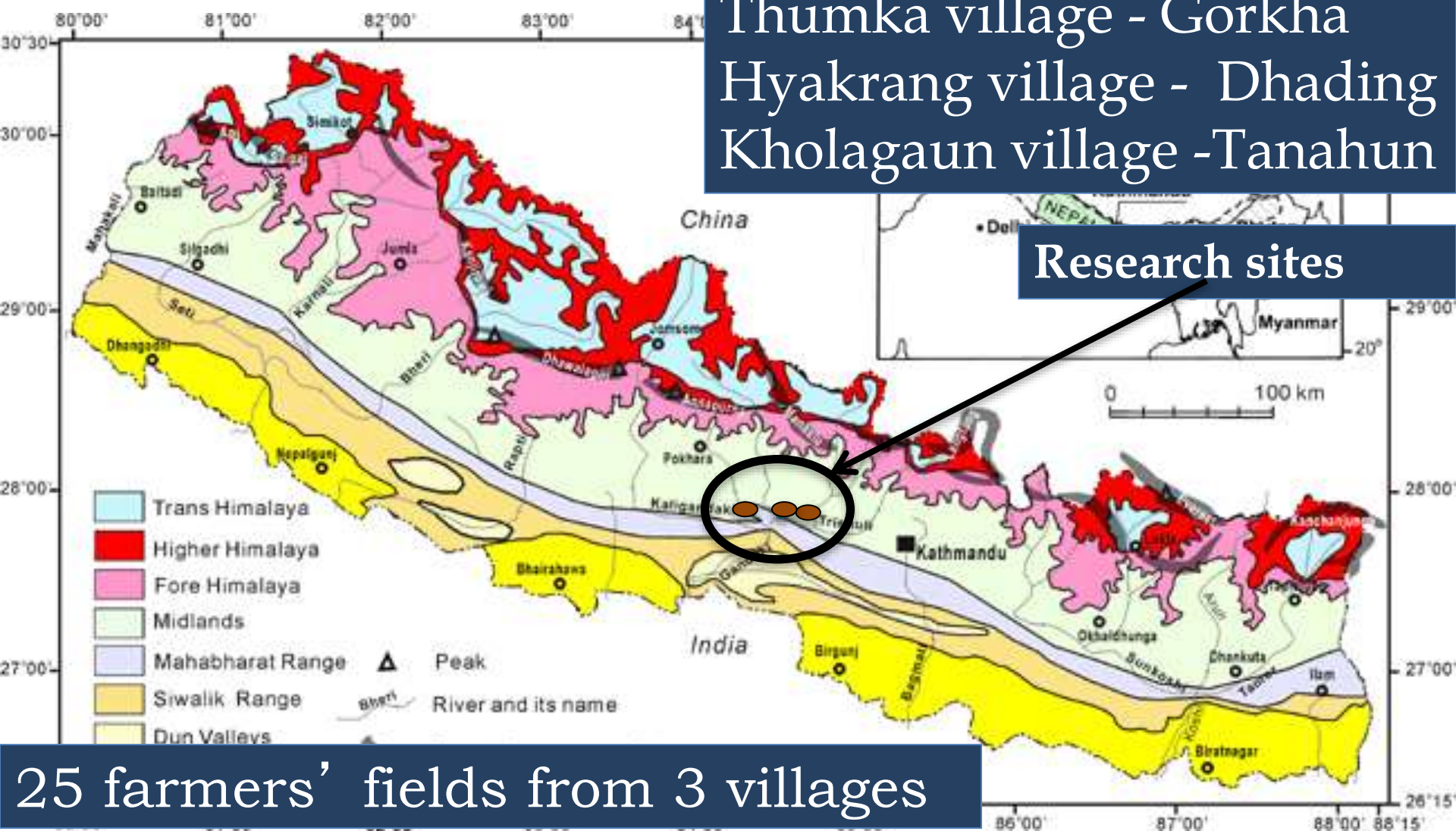
Nepal



Nepal: study sites

Thumka village - Gorkha
Hyakrang village - Dhading
Kholagaun village - Tanahun

Research sites



25 farmers' fields from 3 villages

Situation analysis

- **Problems of poverty and food insecurity**

- + 90% hill districts are in food shortage

- **Push for Intensification**

- + high food demand (about 2% pop. growth)

- + limited arable land (per capital 0.09 ha)

- + low crop yields (\approx half of world average)

- **High land degradation and challenges for sustainability**

- + intensification

- + sloping land

- + no conservation practices

- **Climate change**

- increased climatic variations, increased challenges



OBJECTIVES

- To evaluate short-term effects of CAPS on crop yields, system productivity, labor requirements, soil quality, gender and nutrition.
- To provide recommendations to the decision makers to promote CAPS

METHODOLOGY

□ On-farm evaluation

1. Selection of CAPS through focus groups

X Two tillage type: strip tillage (ST) & full tillage (FT)

X Two crop rotation {summer-post rainy season}

CAPS1: FT maize-legume

CAPS2: FT maize-millet+legume

CAPS3: ST maize-millet+legume

Legume crop for CAPS:

2011- cowpea; 2012 & 2013 – black gram

2. Traditional system: FT maize-millet



Farmers at on-farm trials in Hyakrang and Kholagaun VDC, photo – Durga Shrestha, LI-BIRD

Other studies

- Gender impacts of CAPS using gender survey
- Information network of CAPS using Social Network analysis
- Farmers preference for CAPS using Analytical Hierarchy Process (2 times)
- Mental mapping of farmers using cognitive survey
- Economic modeling study to estimate the impacts

Crop yields significantly different by CAPS

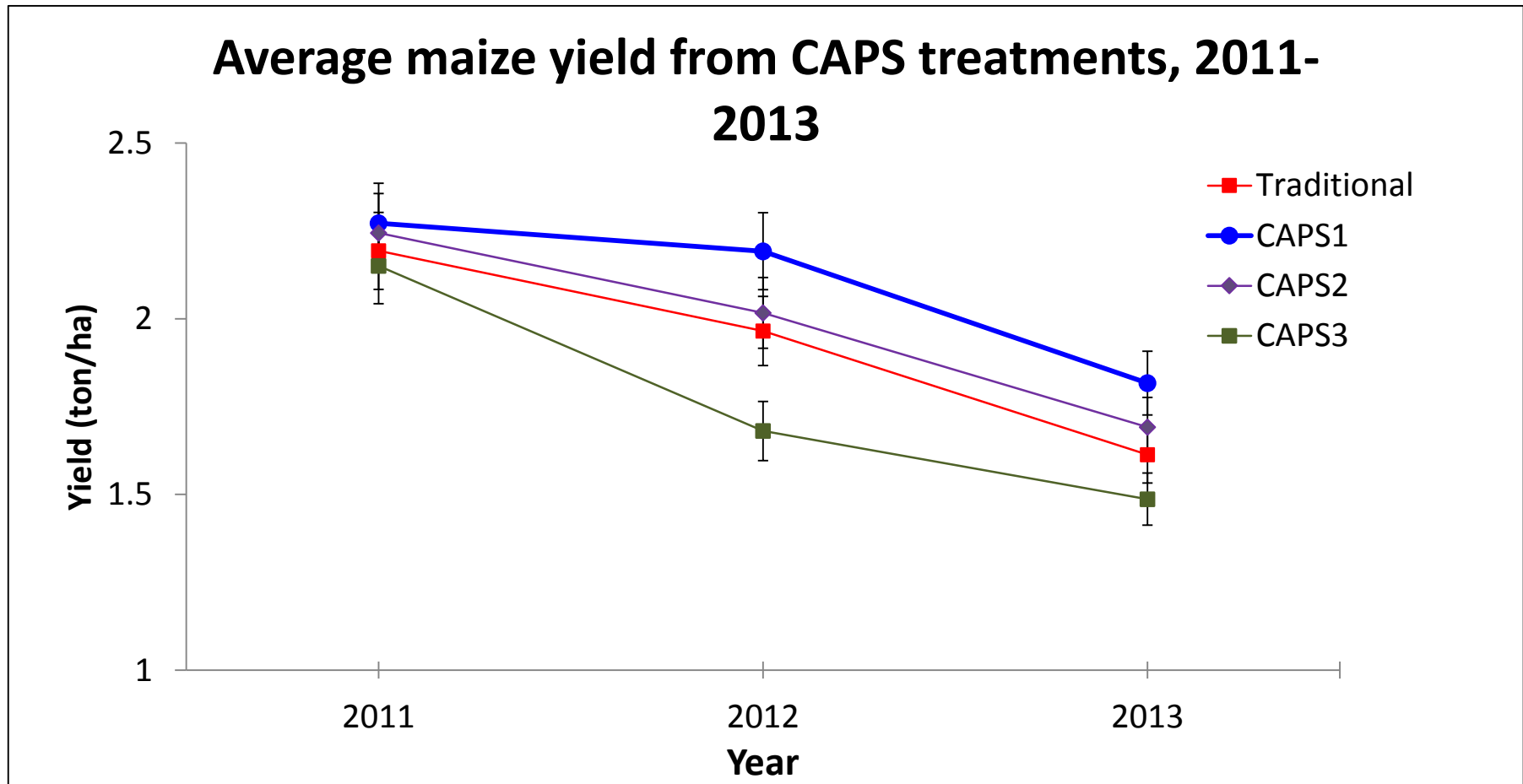
ANOVA

Source of variation	Maize (ton/ha)	Millet (ton/ha)	Black gram (ton/ha)	Cowpea (ton/ha)
Year (Y)	***	***	***	-
Village (V)	NS	**	NS	NS
CAPS (T)	**	***	***	**
Y x T	NS	NS	NS	-
V x T	NS	NS	NS	NS
Y x V	***	***	*	-
Field (village)	**	**	*	**

***, **, * indicate the factor were significant at $P < 0.001$, $P < 0.01$, $P < 0.05$; NS indicate factor was not significant at $p < 0.05$

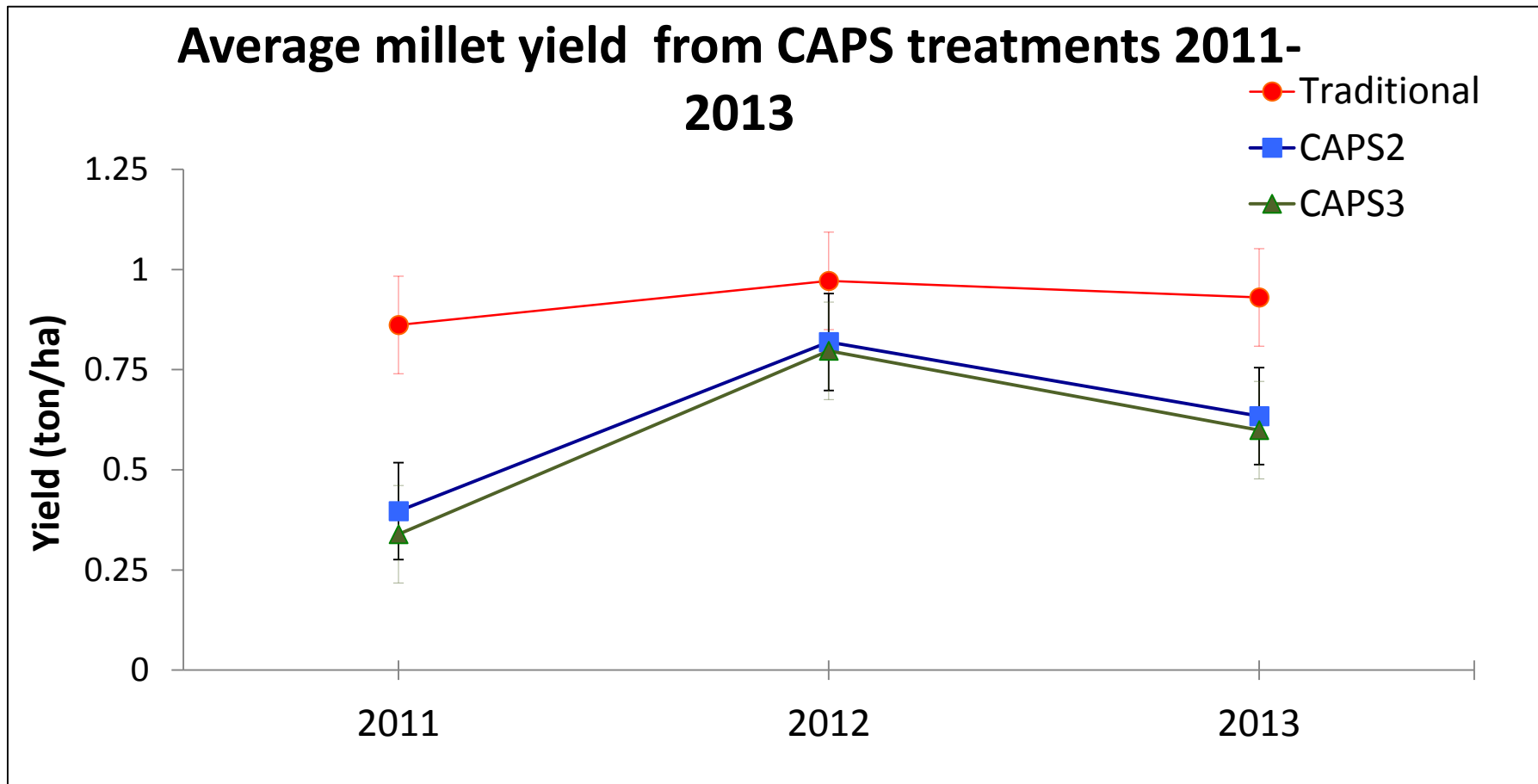
Higher maize yield in CAPS

Maize yield from CAPS1 was higher than traditional system and CAPS3 over three years



Lower millet production in CAPS

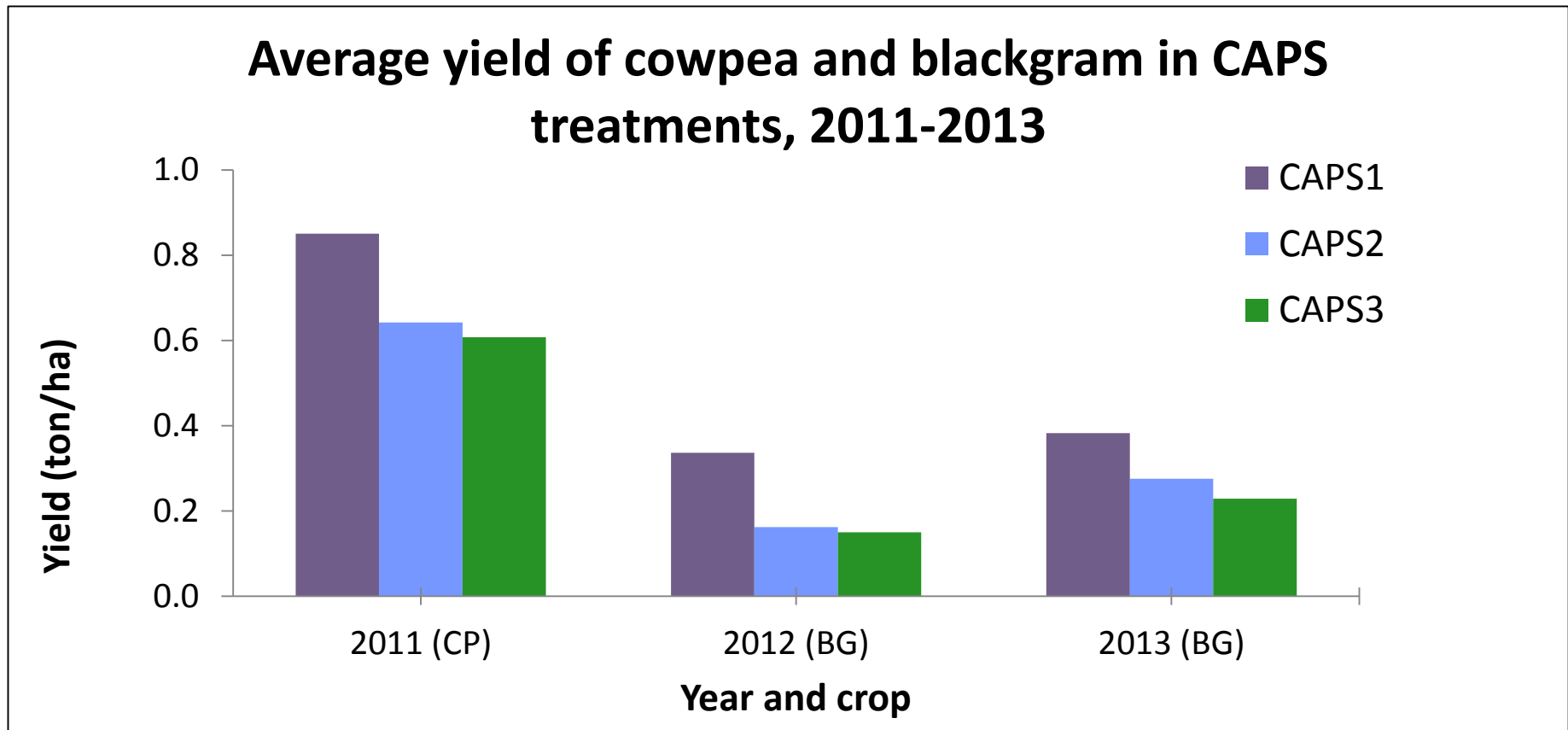
Millet production in traditional system was higher than CAPS2 & CAPS3 b/c of sole cropping



Higher legume production in CAPS

Black gram and cowpea yields in -

- CAPS1 was higher than CAPS2 and CAPS3 because of sole cropping



System productivity significantly different by CAPS

ANOVA

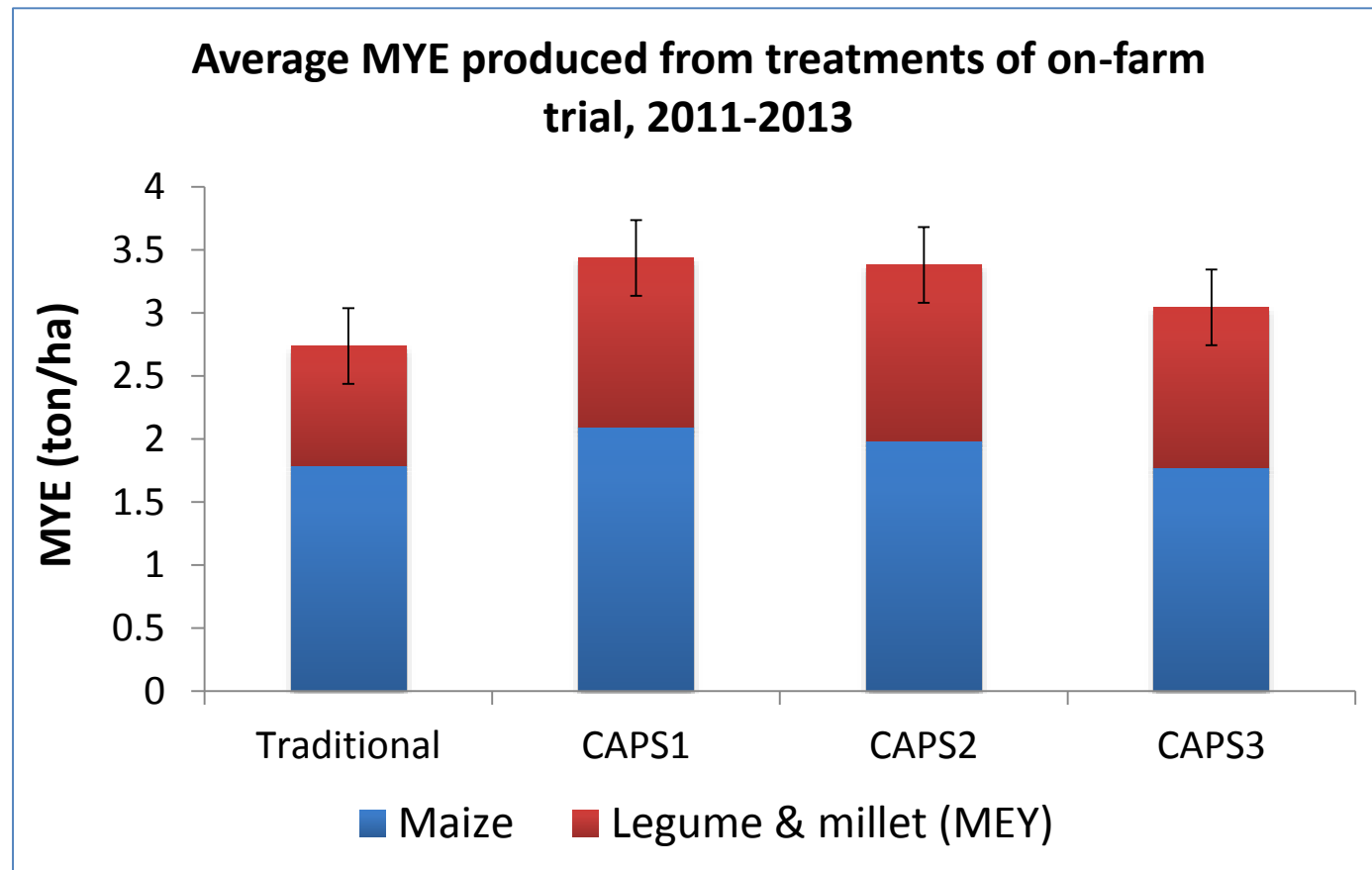
Source of variation	Maize Yield Equivalent (maize ton/ha)	Annual Revenue (\$)
Year (Y) ^c	***	***
Village (V)	NS	NS
CAPS (T)	***	***
Y x T	NS	NS
V x T	NS	NS
Y x V	***	***
Field (village)	**	**

***, **, * indicate the factor were significant at $P < 0.001$, $P < 0.01$, $P < 0.05$; NS indicate factor was not significant at $p < 0.05$

Higher MYE from CAPS

- ❑ CAPS1 and CAPS2 was higher than traditional system
- ❑ CAPS3 was was not different from all other treatments

➤ CAPS with ST system did not produced significant yield advantage

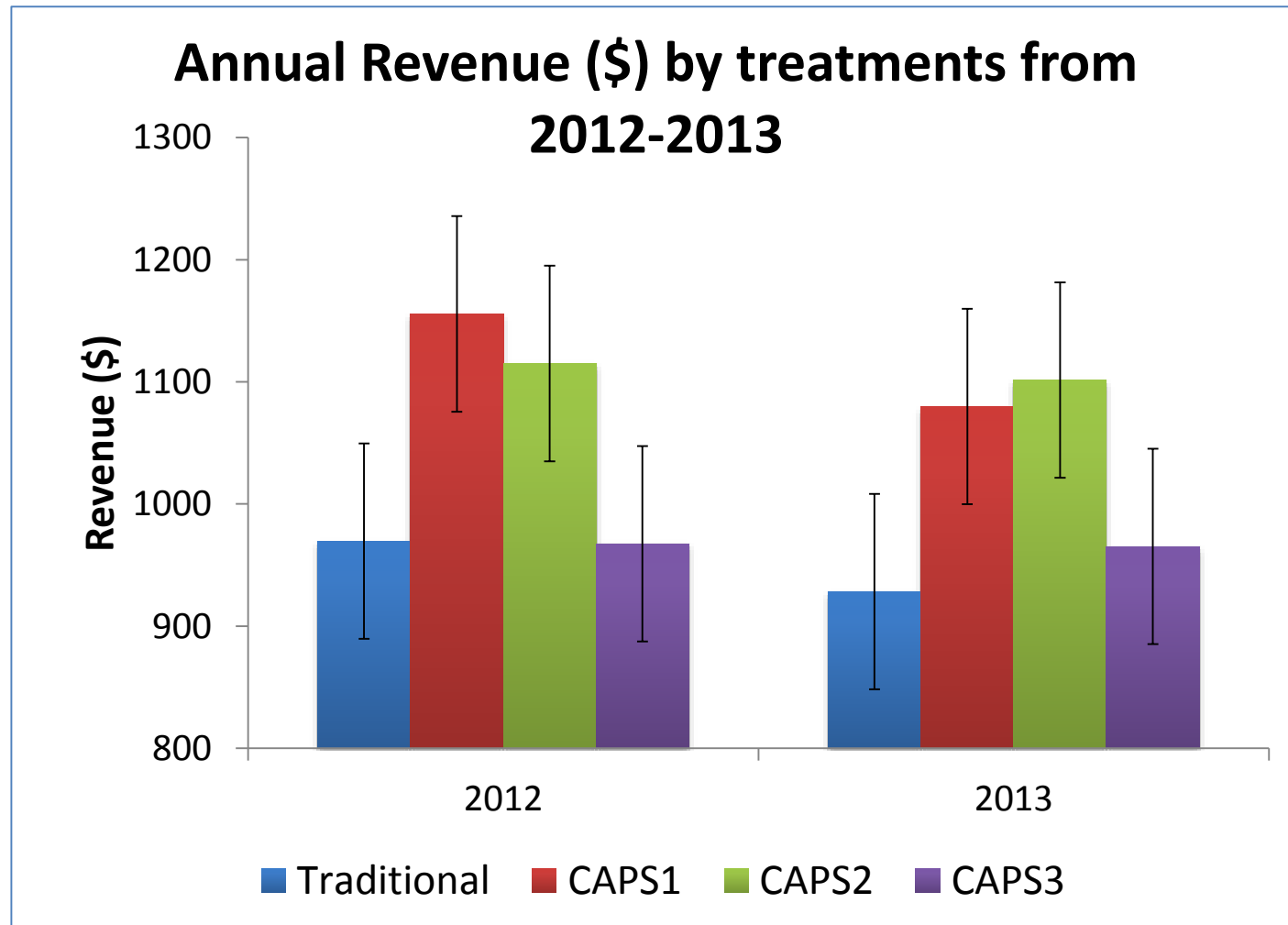


CAPS increased annual revenue

❑ CAPS1 & CAPS2 was higher than traditional system

- higher price of legumes

❑ CAPS3 was comparable to traditional system



Labor requirement significantly different by CAPS

Factors in ANOVA (Randomized block design)

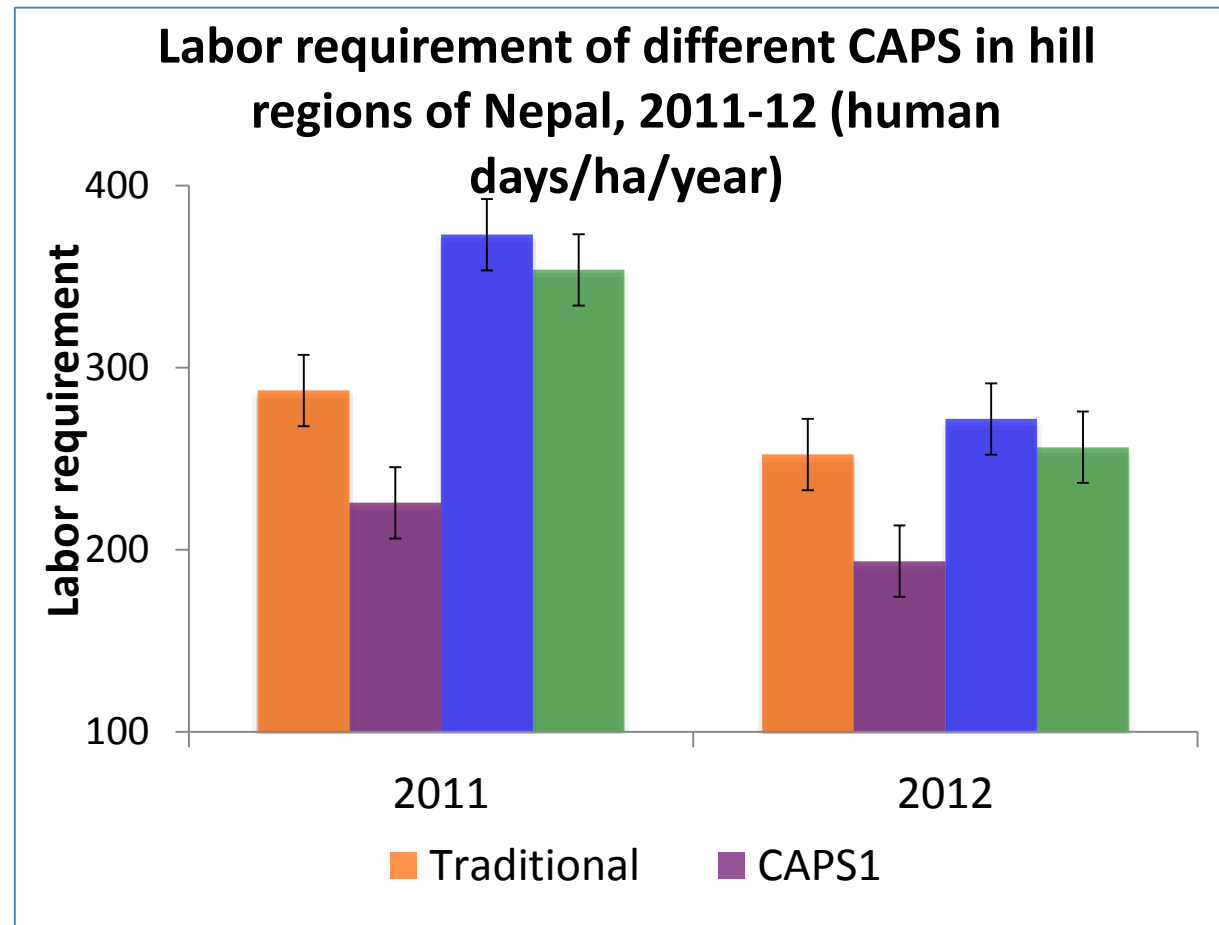
Source of variation	Total labor requirement (human.days/ha/year)
Year (Y)	***
Village (V)	**
CAPS (T)	***
Y x T	**
V x T	***
Y x V	NS
Field (village)	**

***, **, * indicate the factor were significant at $P < 0.001$, $P < 0.01$, $P < 0.05$; NS indicate factor was not significant at $p < 0.05$

Lower labor required for CAPS1, while higher labor required for CAPS2 & CAPS3

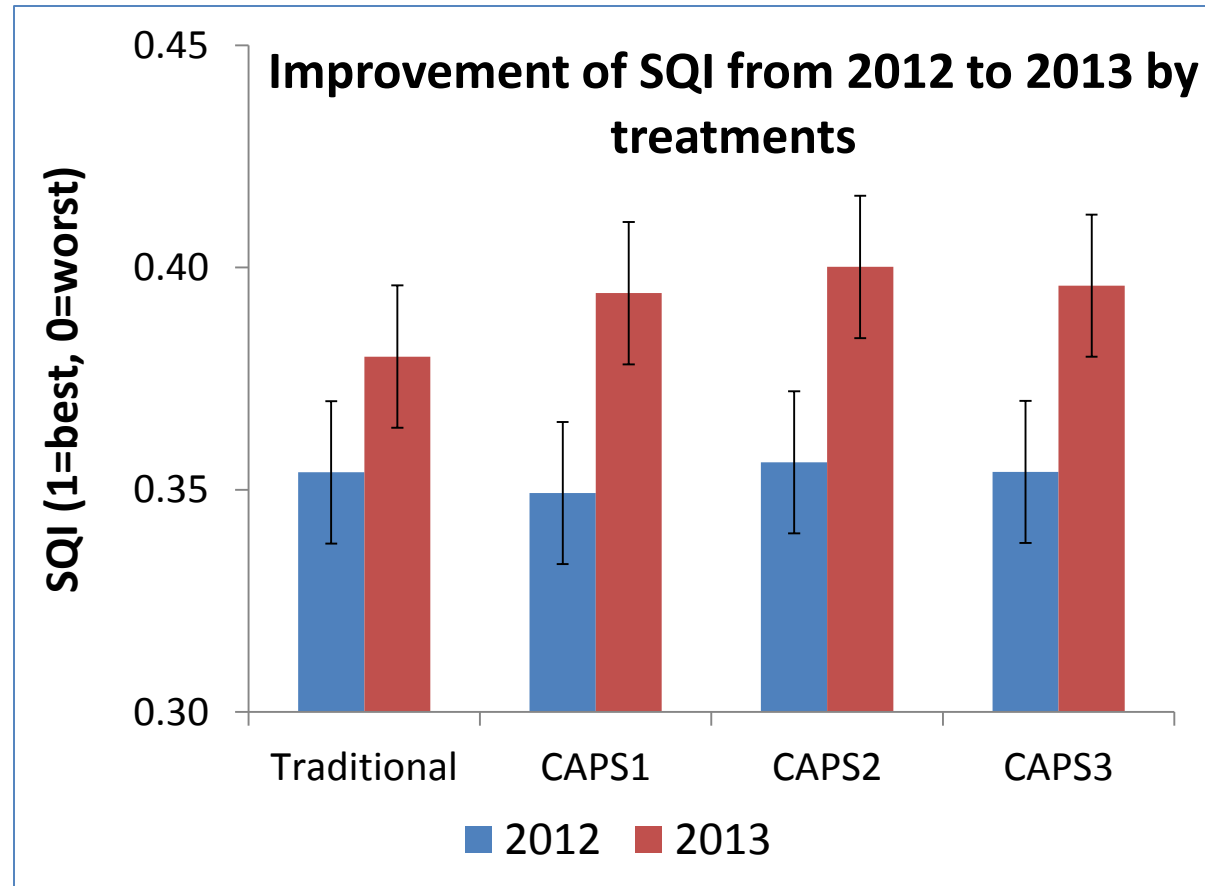
CAPS1 required lower labors than all other treatments b/c of low labor need for legumes

CAPS2 & CAPS3 required higher labor than traditional system and CAPS1



CAPS improve soil quality?

- SQI = $f(\text{BD}, \text{K}, \text{N}, \text{OM}, \text{pH})$ determined by PCA analysis
1=best, 0=worst
- Soil Quality Index not different by CAPS
- SQI significantly increased from 2012 to 2013 for all CAPS but not for traditional system



Summary from on-farm trials

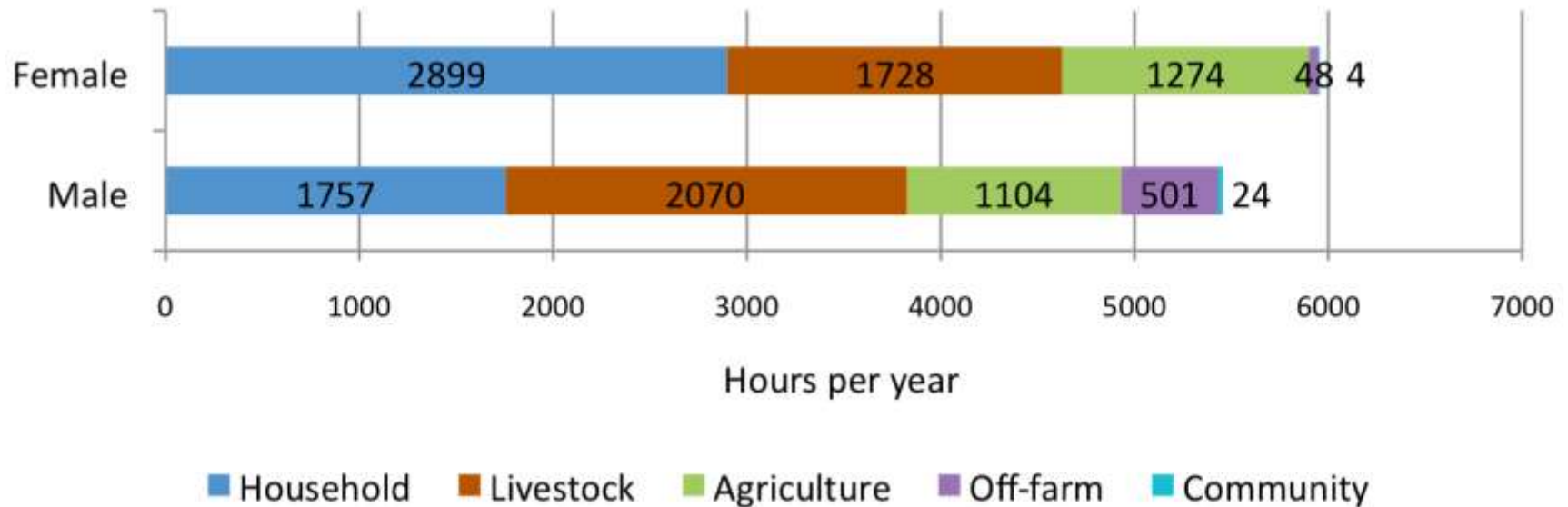
- ✓ FT Maize-legume: highest returns & lowest labor req.
- ✓ FT Maize-millet+legume: higher return & higher labor
- ✓ ST Maize-millet+legume :
 - Lower return & higher labor than maize-legume
 - Still better than traditional system
- ✓ Returns from ST was comparable to FT, but labor requirements was lower (under maize-millet+legume)
- ✓ For soil quality, all CAPS seems better than traditional system, though need more time to conclude

Gender Studies

Studies were conducted to:

- Determine the gender-based division of labor and time allocation for agricultural activities
- Measure expected shifts in labor from CAPS were also determined
- Determine gendered preferences for CAPS treatments
- Assess gender inclusion in agricultural decision-making

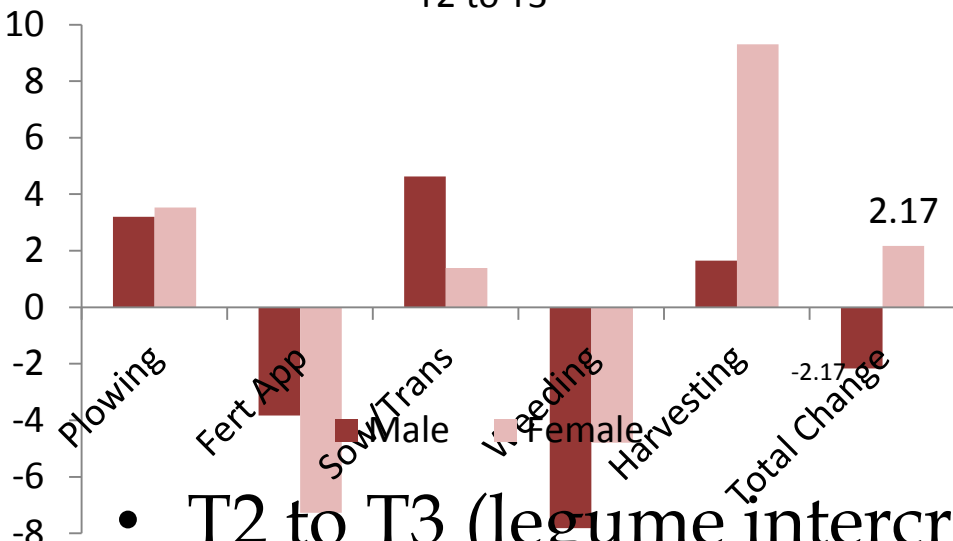
Annual Time Allocation by Gender



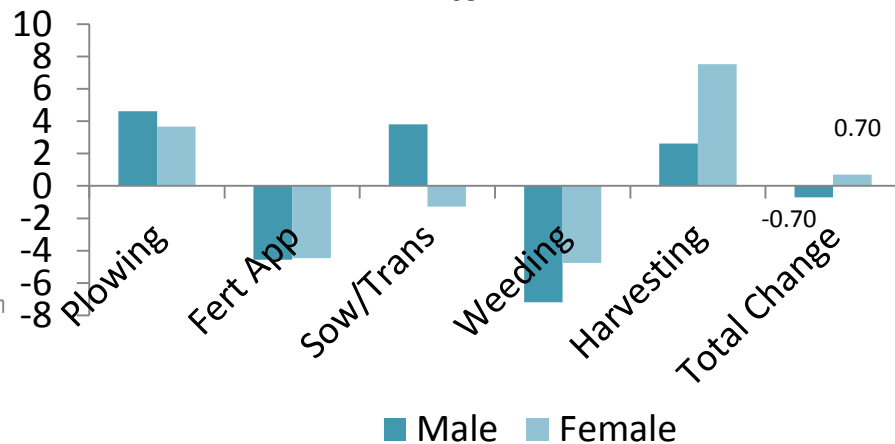
- Women spend 21.4% of their time on agriculture, while men spend 20.2% of time on agriculture

Shifts in Division of Labor Resulting from CAPS

% Labor change by gender for shifting from T2 to T3

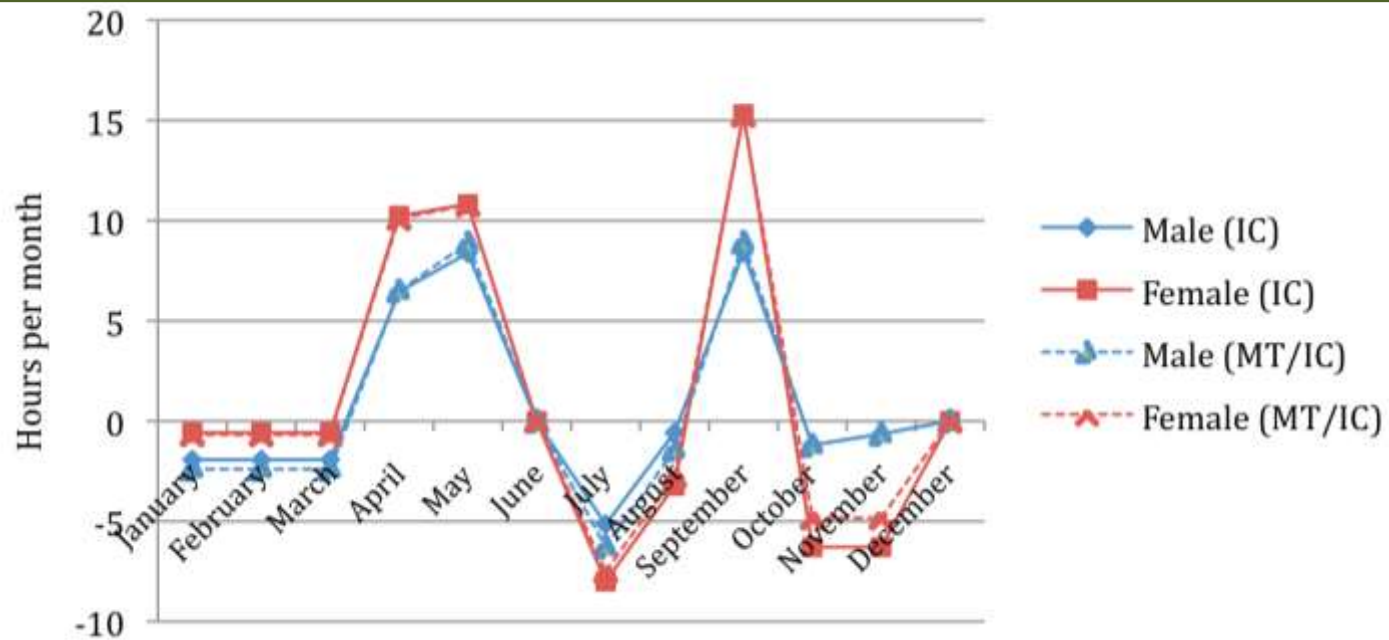


% Labor change by gender for shifting from T1 to T4



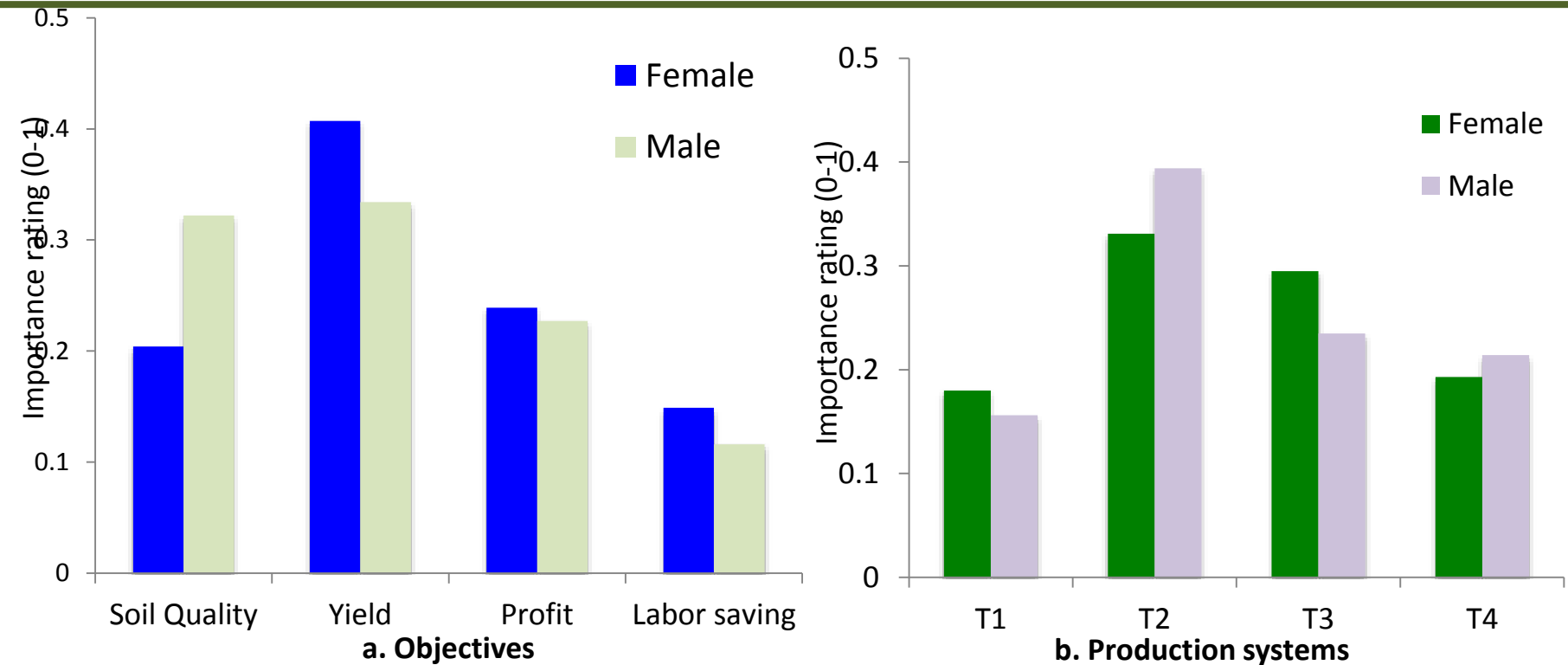
- T2 to T3 (legume intercrop w/ full till) resulted in the greatest labor increases for women
- T1 to T4 (legume intercrop w/ strip till) resulted in the least change to the division of labor
- Land preparation, sowing, and harvesting were the overall drivers for increased labor

Expected Labor Savings from CAPS, by month



- For both men and women, labor savings (+ values) are expected during land preparation, fertilization, and weeding for maize and legumes
- Labor increases (- values) are expected during harvest
- In general, women experience greater labor savings, as well as greater increases in labor over the course of the cropping season

Farmer Preferences of CAPS using AHP by Gender



- Both men and women placed high priority on yield, however men placed the 2nd priority on soil quality and women placed the 2nd priority on profit
- The preferred CAPS treatments for men and women, T2 & T3, both use full tillage and legume cultivation, meeting the simultaneous goals of yield, profit, and soil quality

Gender-based Agricultural Decision-Making

- While the majority of agricultural decision-making is conducted equally (60.5% men, 46.2% women), a large proportion of women reported only “some” (28.2%) or “no control” (23.1%) over on-farm decision-making
- Given that women take on a larger proportion of CAPS labor, there is a disconnect between those making decisions and those affected by those decisions (i.e. increased labor)

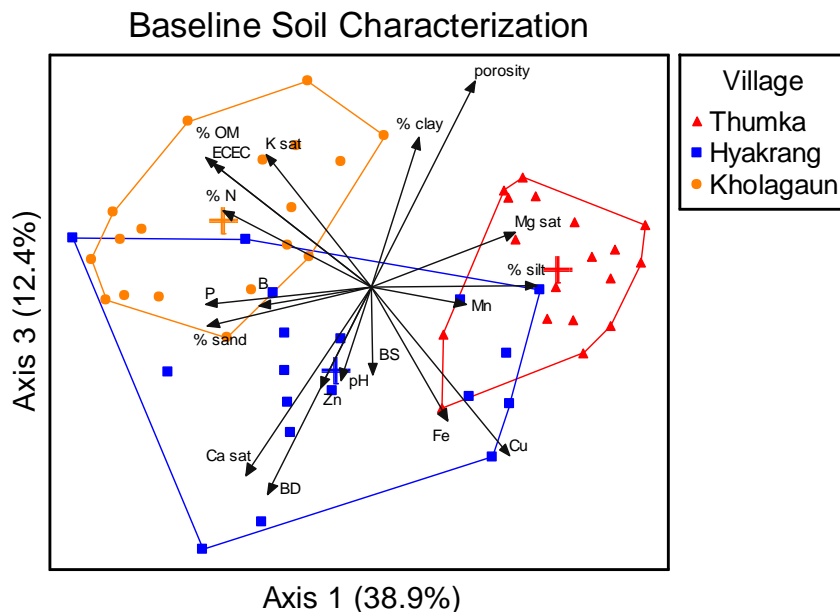
Cognitive Modeling Study

- Cognitive modeling was used to determine differences in researcher and farmer perceptions of the agricultural system
- The models were used to predict perceptions of conservation agriculture practices and their perceived outcomes

Cognitive Modeling: Perception Gaps

Group	Scenario 1: Minimum Till			
	Soil Nutrients	Soil Moisture	Soil Quality	Yield
Khola Gaun			X	X
Hyakrang	X	X	X	X
Thumka				
Researchers				

- **Red boxes** indicate factors of the farm system where perceptions differed from the other study groups in regards to minimum tillage (out of 20 total factors)
- Hyakrang and Khola Gaun showed the most differences from the Researcher group



- Variations in soil structure, texture, and composition can in part contribute to differing perceptions of the relative importance of soil within the system
- This can lead to differences in adaptive management strategies and decision-making over time

Impact on nutrition and health

- Study was undertaken in the Chepang communities of Nepal
 - Household with children (6 to 60 months) or women-
divided in 3 categories
 1. Change in agriculture practice (project intervention)
 2. Got some training and input supplies
 3. NO intervention from this project
 - Selected households were interviewed using structured questionnaires for
 - agriculture practices, health, nutrition and sanitation related knowledge, attitude and practices.

Impact on nutrition and health

- Results shows that:
 - Food consumption behavior of women, children and households did not differ significantly among different types of households.
 - Nutritional status of children based on weight/height was significantly related with the agricultural diversity and the production of legumes.
 - Total Household income, Land holding and Household dietary diversity were significantly related with the body mass index of women.

Impact on nutrition and health

- It can be concluded that:
 - Project intervention increased agricultural production, including legumes
 - Majority of produce were sold than consuming
 - Positive contribution to household income
 - Less impact on nutritional status
 - Various indicators evaluated in this study were not found significantly different among different types of households.
 - mixed farming system using legume as a crop had some positive impacts on some nutritional-health indicators of children.

Farmers preference and incentives for adoption of CAPS

- enhancing crop yields is the most important factor, while labor saving is the least important
- farmers have low preference for strip tillage based CAPS, because of knowledge gap
- profitability of all CAPS are better than traditional system
- farmers' production constraints do not hinders the adoption of CAPS.

Training & capacity building

- farmers from 101 households in 3 villages have taken multiple trainings (CAPS, IPM, soil and water management, etc.)
- about 20 farmers got exchange visits to research stations
- 2 visits for extension personnel to demonstration plots
- 5 research methods trainings to home country students and professionals
- 4 capacity building visits to host country Co-PIs and professionals
- 3 MS students (all graduated) & 1 Ph D student (expected to graduate by April 2015) from host country;
- students supported to participate in scientific conferences such as F-CASA, IFAMA, HumTech
- a conference titled 'Frontiers of Conservation Agriculture in South Asia and Beyond (F-CASA)' on 26-27 March 2013 in Kathmandu, Nepal (23 papers & 12 posters)
- a book is forthcoming

Development impacts

- The adoption of maize-legume system is already started (even before the project). However, the integration of millet+legume intercrop expected to improve the food security of Chepang people
- Not much adoption of intercropping and strip tillage. However, farmers have appreciated millet+legume more than strip tillage system
- Farmers groups in the adjoining areas of the project sites and other project sites of LI-BIRD and partner organizations are interested in receiving training on CAPS practices
- Opportunity to use CAPS as technology for climate change adaptation is being explored by tying up the results with other LI-BIRD projects in 8 more districts.

Ongoing works

- Continuation of the on-farm trials for 4th year
- We have started to implement two potential CAPS on larger (whole terrace) scale:
 - ST maize-millet
 - ST maize-millet+legume

The implementation of these CAPS will be done by using local plough on the entire terrace.



Thank you !!