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

USAID FROM THE AMERICAN PEOPLE

UNIVERSITY of HAWAI'I MĀNOA

LI-BIRD

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

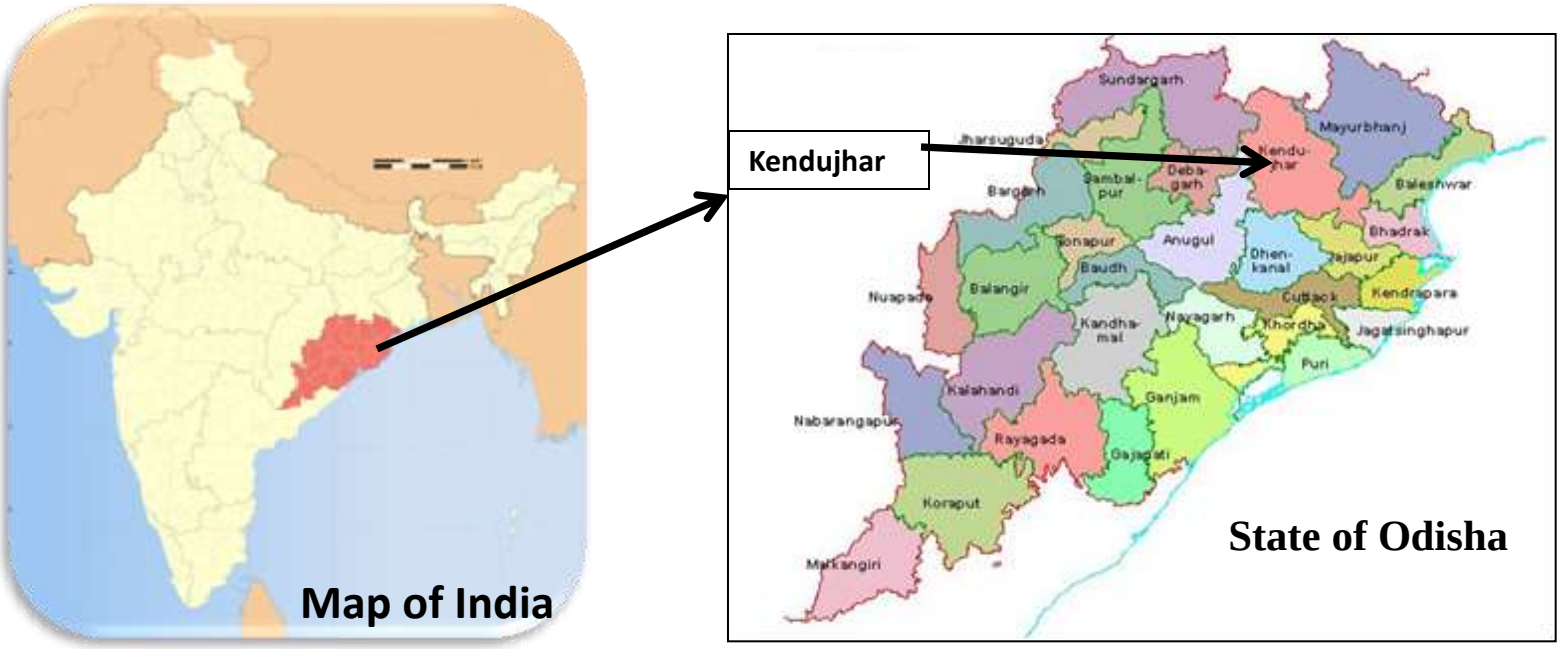
- The overall goals are to improve:
- Crop yield
- System productivity
- Soil quality
- Probability of adoption
- Capacity building (among students, farmers, Institutions and NGOs)
- Social networking
- Also to evaluate effects of CAPS on gender, & nutrition.

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

T_1: Conventional tillage with sole maize,
T_2: Conventional tillage with maize + cowpea,
T_3: Minimum tillage with sole maize,
T_4: Minimum tillage with maize + cowpea

- Improved varieties of maize and cowpea

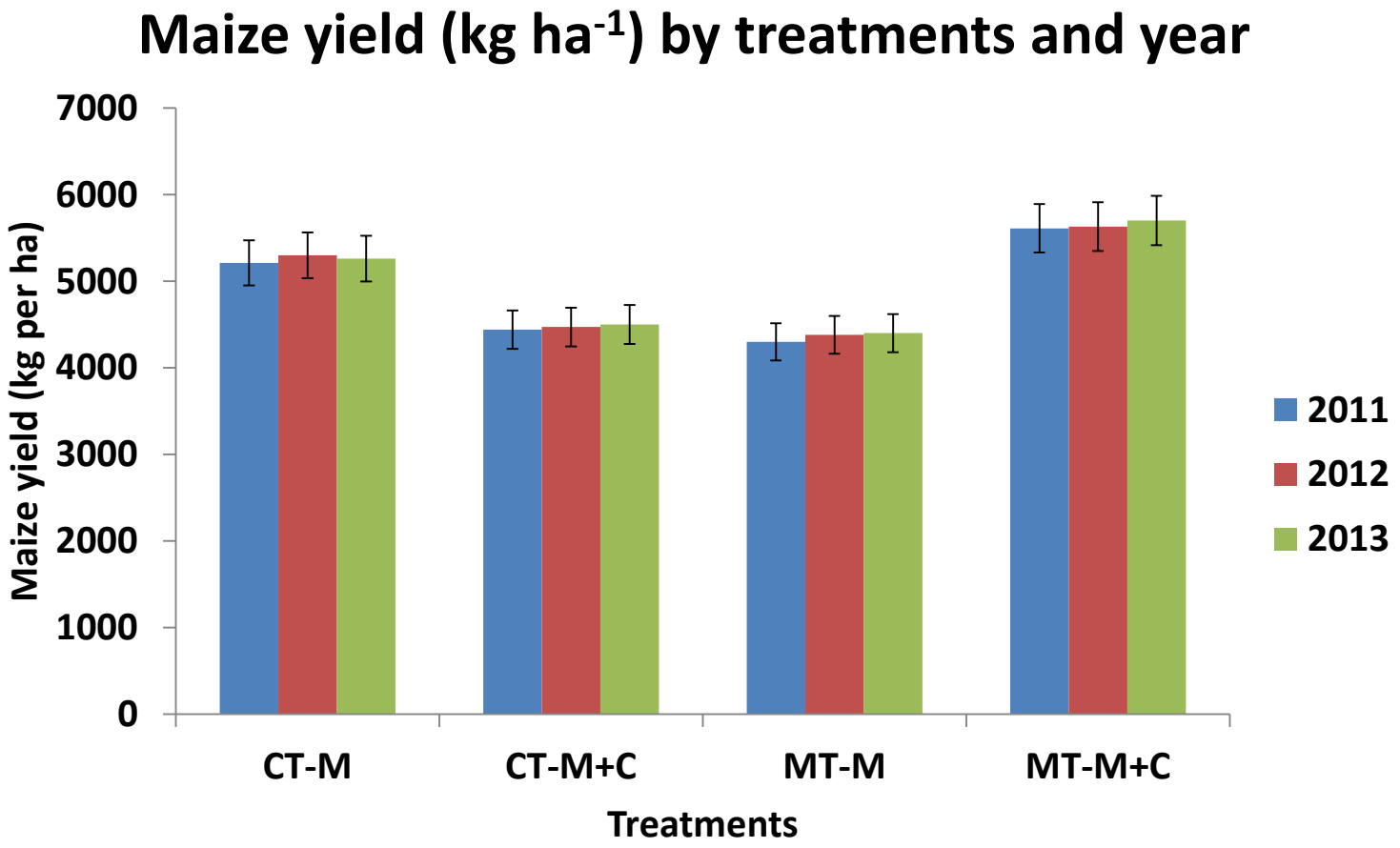
b) **2nd season (November-January):**

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

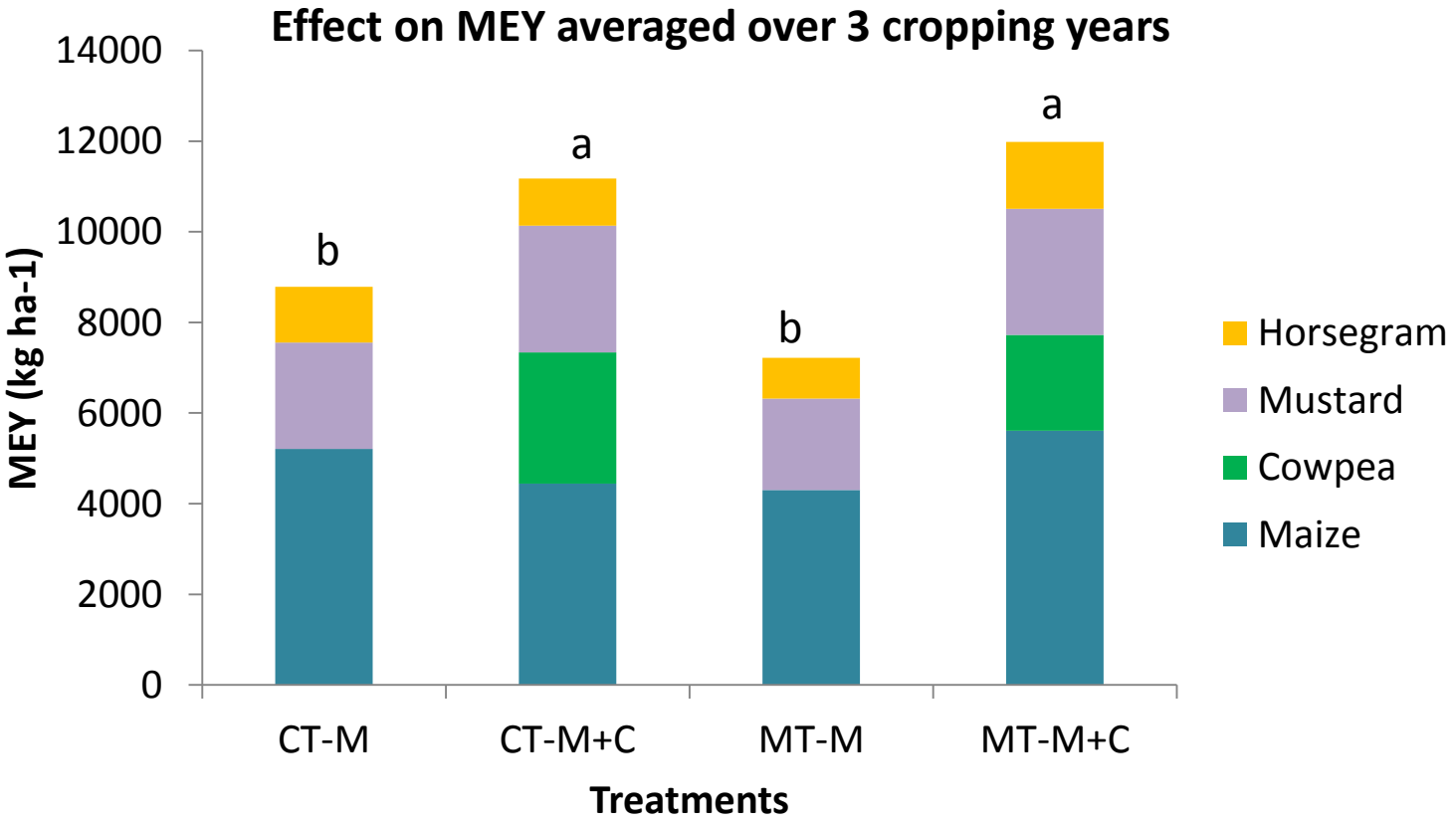
Results

- 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.



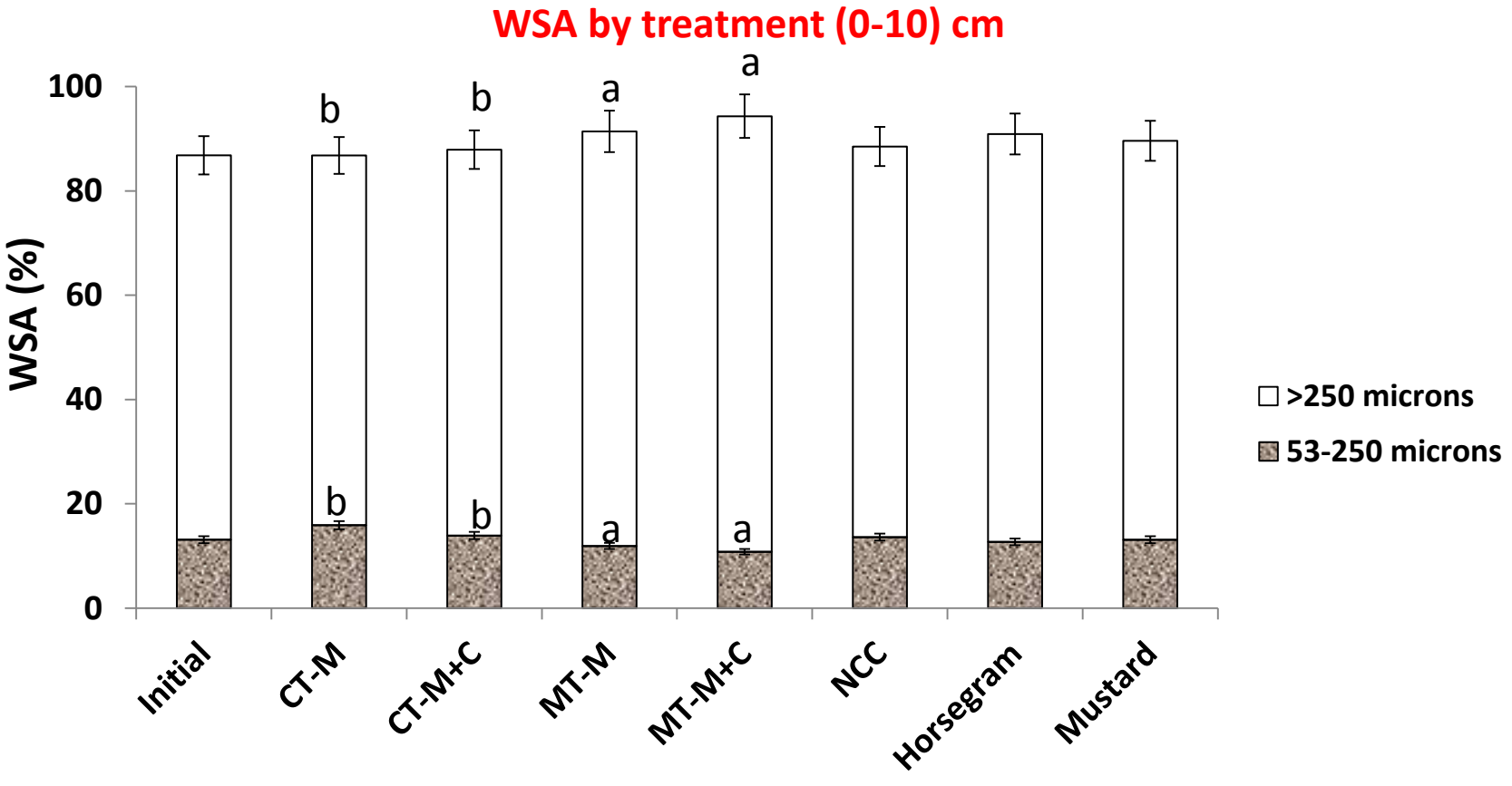
Effect on maize equivalent yield (MEY, kg ha^{-1})

- 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).



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	Talachampei	Bayakumutia
2011	20		
2012	26	10	
2013	30	26	20

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

Treatments	Season		Tillage
	1st season (June-October)	2nd 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

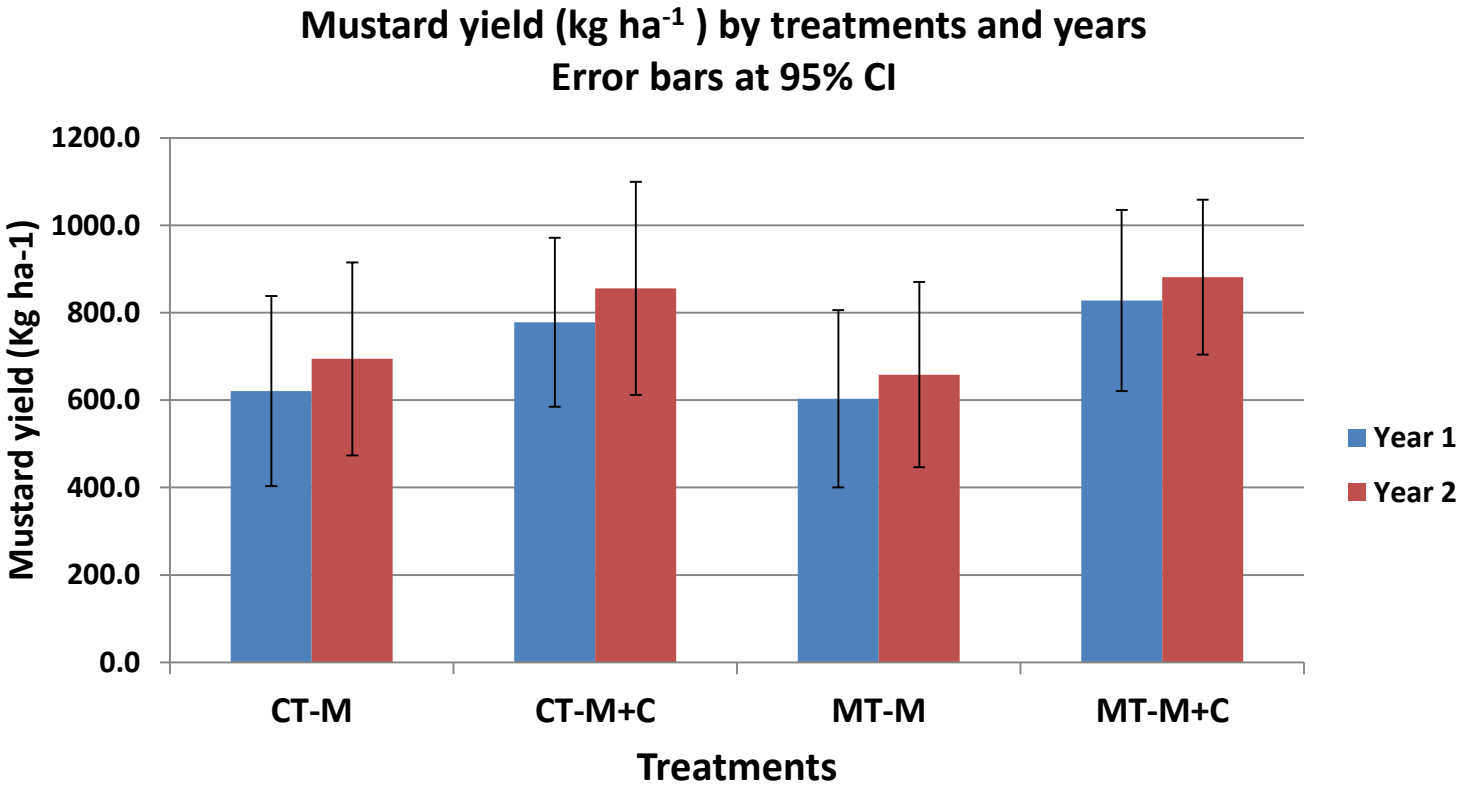
(Post-rainy season)

Market View

Officials visit to on farm trials

Results

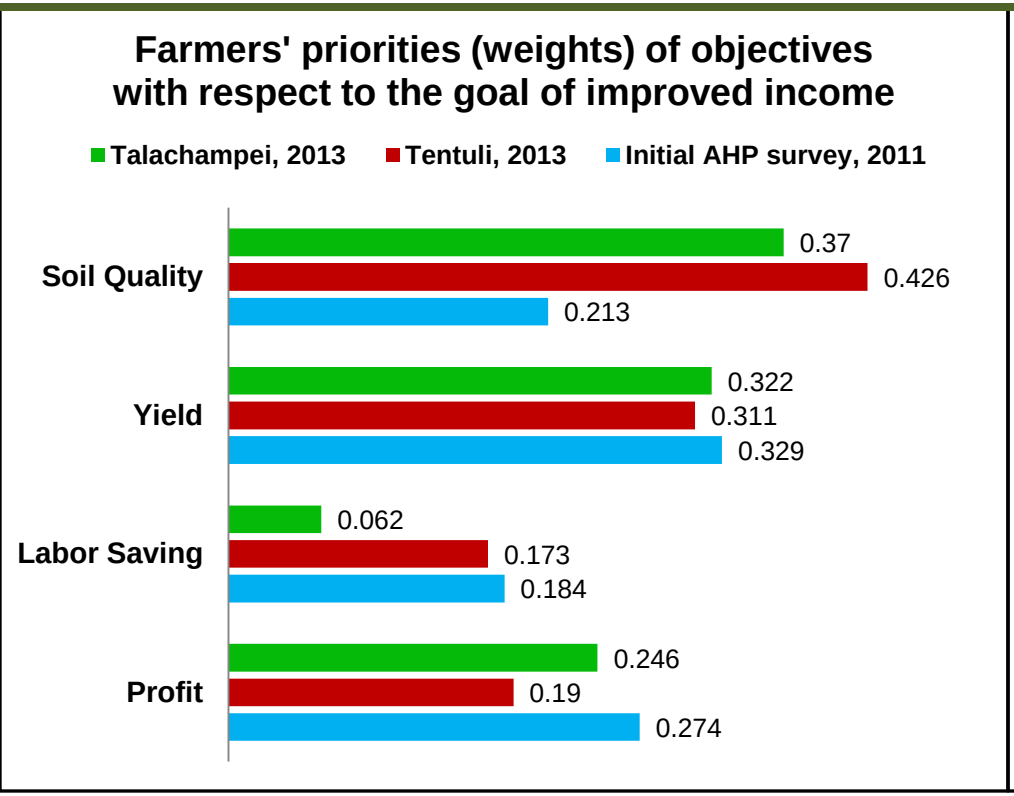
- Tillage and intercropping had no significant effect on maize yield.
- Intercropping had an significant effect on mustard yield.

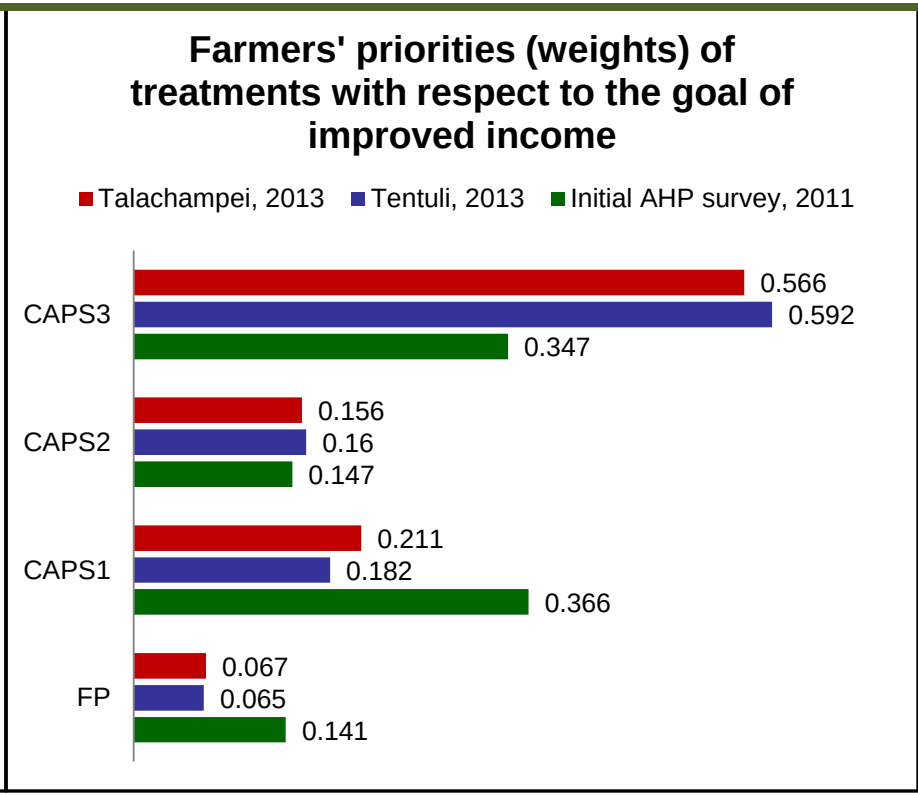


- Higher profitability of minimum tillage with intercropping (9.69%) over conventional tillage with sole maize ($386 ha-1 yr-1).

Stakeholder preference mapping

Farmers' preference mapping (AHP)





- 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

NEWS

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୪ ଜାନୁଆରି ୨୦୧୨

ବାଂଶପାଳ: ତେନ୍ତୁଳି ଗ୍ରାମରେ କୃଷକ ତାଲିମ ଶିବିର

ଜେନ୍ଦୁଝର,୩।୧(ଭମିସ): ବାଂଶପାଳ ବ୍ଲକ ତେନ୍ତୁଳି ଗ୍ରାମରେ ଓଡ଼ିଶା କୃଷି ଓ ବୈଷୟିକ ବିଶ୍ୱବିଦ୍ୟାଳୟ ଭୁବନେଶ୍ୱର ଓ ଆମେରିକା ହାୱାଇ ବିଶ୍ୱବିଦ୍ୟାଳୟର ମିଳିତ ସହଯୋଗରେ ଏକ କୃଷକ ତାଲିମ ଶିବିର ଆୟୋଜିତ ହୋଇଯାଇଛି। କୃଷି ବିଶ୍ୱବିଦ୍ୟାଳୟର ଜେନ୍ଦୁଝର ଗବେଷଣା କେନ୍ଦ୍ରର ସହଯୋଗୀ ନିର୍ଦ୍ଦେଶକ ଡ.ପ୍ରଭାତ କୁମାର ଜାଉଲଙ୍କ ଅଧ୍ୟକ୍ଷତାରେ ଆୟୋଜିତ ତାଲିମ କାର୍ଯ୍ୟକ୍ରମରେ କୃଷି ମହାବିଦ୍ୟାଳୟର ଅଧ୍ୟକ୍ଷ ଡ.ବିତାଳର ନାୟକ ମୁଖ୍ୟ ଅତିଥି ଓ ହାୱାଇ ବିଶ୍ୱବିଦ୍ୟାଳୟର ବରିଷ୍ଠ ବୈଜ୍ଞାନିକ ଡ.ଟ୍ରାଭିସ ଆଭଡଲ ସମ୍ମାନିତ ଅତିଥି ଭାବେ ଯୋଗଦେଇ ଉଦ୍‌ଘାଟନ ଉତ୍ତିଥିଲେ। ଏହି ଦୁଇ ବିଶ୍ୱବିଦ୍ୟାଳୟ ପକ୍ଷରୁ କାର୍ଯ୍ୟକାରୀ ହେଉଥିବା ସ୍ମାର୍ଟସ ପ୍ରକଳ୍ପ ସହାୟତାରେ ତାଙ୍କାମାନଙ୍କ ସହଯୋଗ ପରବର୍ତ୍ତୀ ତାଙ୍କାମାନେ ପଢ଼ବି, ଅ ମାନଙ୍କରେ ପ୍ର ତାଲିମ ପ୍ର ବିଭାଗର ବ ଉତ୍ପାଦ ଡ.ସତ୍ୟନାର ଡ.ଜୀବନଜ୍ୟୋ ସ୍ୱେଚ୍ଛାସେବୀ ତାଙ୍କାପ୍ରସାଦ କୃଷକ ଓ କୃ

THE NEW INDIAN EXPRESS
BHUBANESWAR MONDAY 17 SEPTEMBER 2012

BHUBANESWA

Farmers' Training Camp Held

Express News Service

Bhubaneswar: A farmers' training camp was organised 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 organised jointly by OUAT and University of Hawaii, the US.

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-monsoon. The mustard crop residue on incorporation in soil improves its health.

Fifty farmer families from two adopted villages — Tentuli and Talacharigeri — are participating as beneficiaries in the ongoing project activities to realise multifarious advantages of different CAPs. Nearly hundred interested farmers from both these villages attended the programme and visited the experimental crop fields. They also listened to experiences of fellow farmers.

The camp was conducted by Dr Pravat Kumar Rout, Principal Investigator of the project and head of OUAT Research Station at Keonjhar. Dr SN Dash, Horticultural Scientist, Dr KN 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.

THE NEW INDIAN EXPRESS
BHUBANESWAR THURSDAY 29 DECEMBER 2011

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.

Hundreds of local farmers gathered at a camp held at Tentuli in Banspal block to understand the Conservation Agricultural Production System (CAPS) farming practices under the project - Sustainable Management of Agro-ecological Resources for Tribal Societies (SMARTS). OUAT had launched the project in June to improve soil health and household income. The project focused on maize-based cropping systems involving legume and mustard and horse gram as cover crops with residue management. Twenty households are involved in the process of on-farm validation of selected CAPS.

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.

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

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.

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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

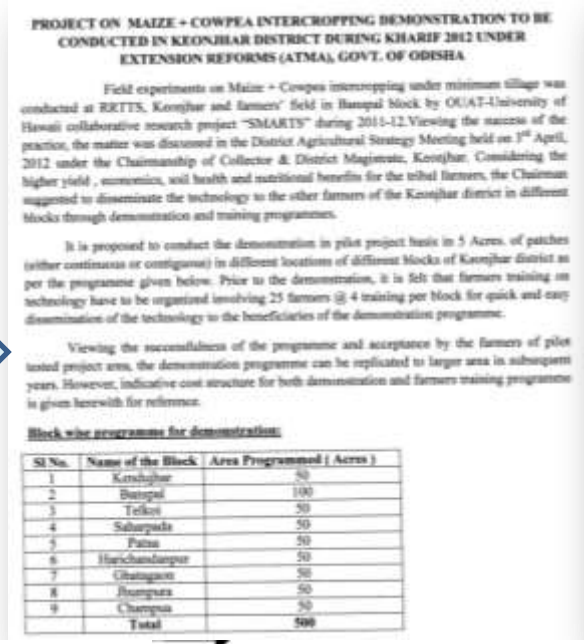
Polythene sheet for on field mustard threshing

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

CA Adoption in other areas of Kendujhar

Adoption in another district Mayurbhanj



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 RRTTS, Keonjhar and farmers' field in Banspal block by OUAT-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	Kanjhjhar	50
2	Banspal	100
3	Telkoi	50
4	Saharpada	50
5	Patna	50
6	Harichandanpur	50
7	Ghatagaon	50
8	Joranga	50
9	Champua	50
	Total	500

Cost structure for Farmers training

No. of Participants – 25 Duration- 1 Day

1	Training materials (writing pad with printed literature material & pen) @ Rs 25/- for 25 farmers	Rs 625/-
2	Working lunch allowance @ Rs 60/- for 25 farmers	Rs 1500/-
3	Honorarium charges for resource person @ Rs 250/- for 2 resource persons	Rs 500/-
4	Hiring of vehicle / POL charges for movement of resource person	Rs 1000/-
5	Banner, photograph & misc. contingencies	Rs 375/-
	Total	Rs 4000/-

N/B- Cost structure is indicative. Surplus in one component can be utilized to other as per requirement

Cost structure for demonstration

Unit- 1 Ac

Sl No	Items / material	Quantity	Indicative cost in Rs.	Scheme share in Rs.	Farmers share in Rs.
1	Hybrid Maize seeds	4.5 Kg	450	450	0
2	Cowpea seeds	4 Kg	1600	1600	0
3	FYM	2 Tons	800	0	800
4	PMS	2 qtls	40	0	40
5	PSB	2Kgs	80	0	80
6	Chemical fertilizer (@48:24:24 per Ac.for hybrid Maize and 10:20:25 per Ac. for Cowpea) i. IFFCO (0:26:26	100 Kgs	1750	1750	0
	ii. Urea (for Maize crop)	40 Kgs	250	0	250
7	Seed treatment chemicals	10gms	50	50	0
8	PP Chemicals need based application	-	250	0	250
9	Misc. Contingencies	-	150	150	0
	Total		5420	4000	1420

N/B- Cost structure is indicative. Surplus in one component can be utilized to other as per requirement

ALLOCATION REQUIREMENT

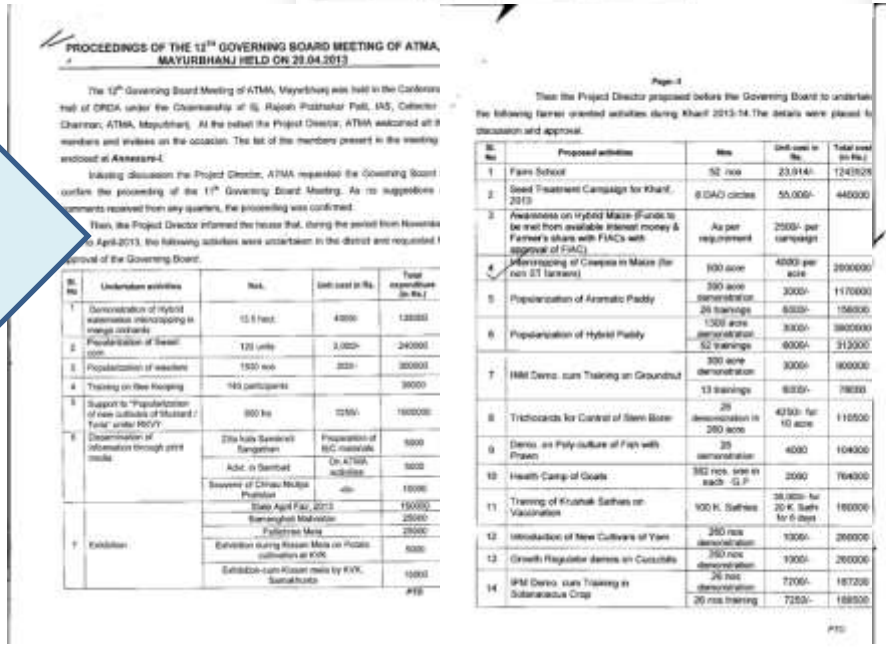
1	Farmers training @ Rs 4000/- per training X 4 trainings per Block X 9 blocks	Rs 1,44,000/-
2	Demonstration @ Rs 4000/- per 1 Ac demonstration over 500 Acs	Rs 20,00,000/-
	Total	Rs 21,44,000/-

(Rupees twenty one lakhs 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 Reforms (ATMA).

Project Director, ATMA
Keonjhar

Collector & District Magistrate
-cum- Chairman, ATMA
Keonjhar



PROCEEDINGS OF THE 13TH GOVERNING BOARD MEETING OF ATMA, MAYURBHANJ HELD ON 20.04.2013

The 13th Governing Board Meeting of ATMA, Mayurbhanj was held in the Conference Hall of DRDA under the Chairmanship of IS, Rajesh Pratiharkar Patil, IAS, Collector Chairman, ATMA, Mayurbhanj. At the outset the Project Director, ATMA welcomed all the members and invitees on the occasion. The list of the members present in the meeting enclosed at **Annexure-I**.

Initiating discussion the Project Director, ATMA requested the Governing Board to confirm the proceeding of the 11th Governing Board Meeting. As no suggestions / comments 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 for approval of the Governing Board.

Sl. No	Undertaken activities	Nos.	Unit cost in Rs.	Total expenditure (in Rs.)
1	Demonstration of Hybrid watermelon intercropping in mango orchards	12.5 hect.	4000/-	125000
2	Popularization of Sweet corn	120 units	2,000/-	240000
3	Popularization of weeders	1500 nos	200/-	300000
4	Training on Bee Keeping	149 participants		39000
5	Support to "Popularization of new cultivars of Mustard / Toria" under RKVY	800 ha	1250/-	1000000
6	Dissemination of information through print media	Dita kala Sandesh Rangathan	Preparation of IEC materials	5000
		Advt. in Sambad	On ATMA activities	5000
		Souvenir of Chhau Nrutya Prohibar	-do-	15000
7	Exhibition	State Agril Fair, 2013		150000
		Samanghati Mahotsav		25000
		Pulberias Mela		25000
		Exhibition during Rasan Mela on Potato cultivation at KVK		5000
		Exhibition-cum-Kisan mela by KVK, Samakhuta		10000

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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	Nos	Unit cost in Rs.	Total cost (in Rs.)
1	Farm School	52 nos	23,914/-	1243528
2	Seed Treatment Campaign for Kharif, 2013	8 DAO circles	55,000/-	440000
3	Awareness on Hybrid Maize (Funds to be met from available interest money & Farmer's share with FIACs with approval of FIAC)	As per requirement	2500/- per campaign	
4	Intercropping of Cowpea in Maize (for min 01 farmers)	800 acre	4000 per acre	2800000
5	Popularization of Aromatic Paddy	390 acre demonstration	3000/-	1170000
		26 trainings	6000/-	156000
6	Popularization of Hybrid Paddy	1300 acre demonstration	3000/-	3900000
		52 trainings	6000/-	312000
7	Hill Demo. cum Training on Groundnut	300 acre demonstration	3000/-	900000
		13 trainings	6000/-	78000
8	Trichocards for Control of Stem Borer	25 demonstration in 250 acre	4250/- for 10 acre	110500
9	Demo. on Poly-culture of Fish with Prawn	25 demonstration	4080	104000
10	Health Camp of Goats	982 nos. one in each G.P	2080	784000
11	Training of Krushak Sathies on Vaccination	100 K. Sathies	38,000/- for 20 K. Sathi for 6 days	190000
12	Introduction of New Cultivars of Yam	250 nos demonstration	1000/-	260000
13	Growth Regulator demos on Cucurbits	250 nos demonstration	1000/-	260000
14	IPM Demo. cum Training in Subarnarekha Crop	26 nos demonstration	7200/-	187200
		26 nos training	7250/-	188500

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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 Gramo 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 Similipal 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.

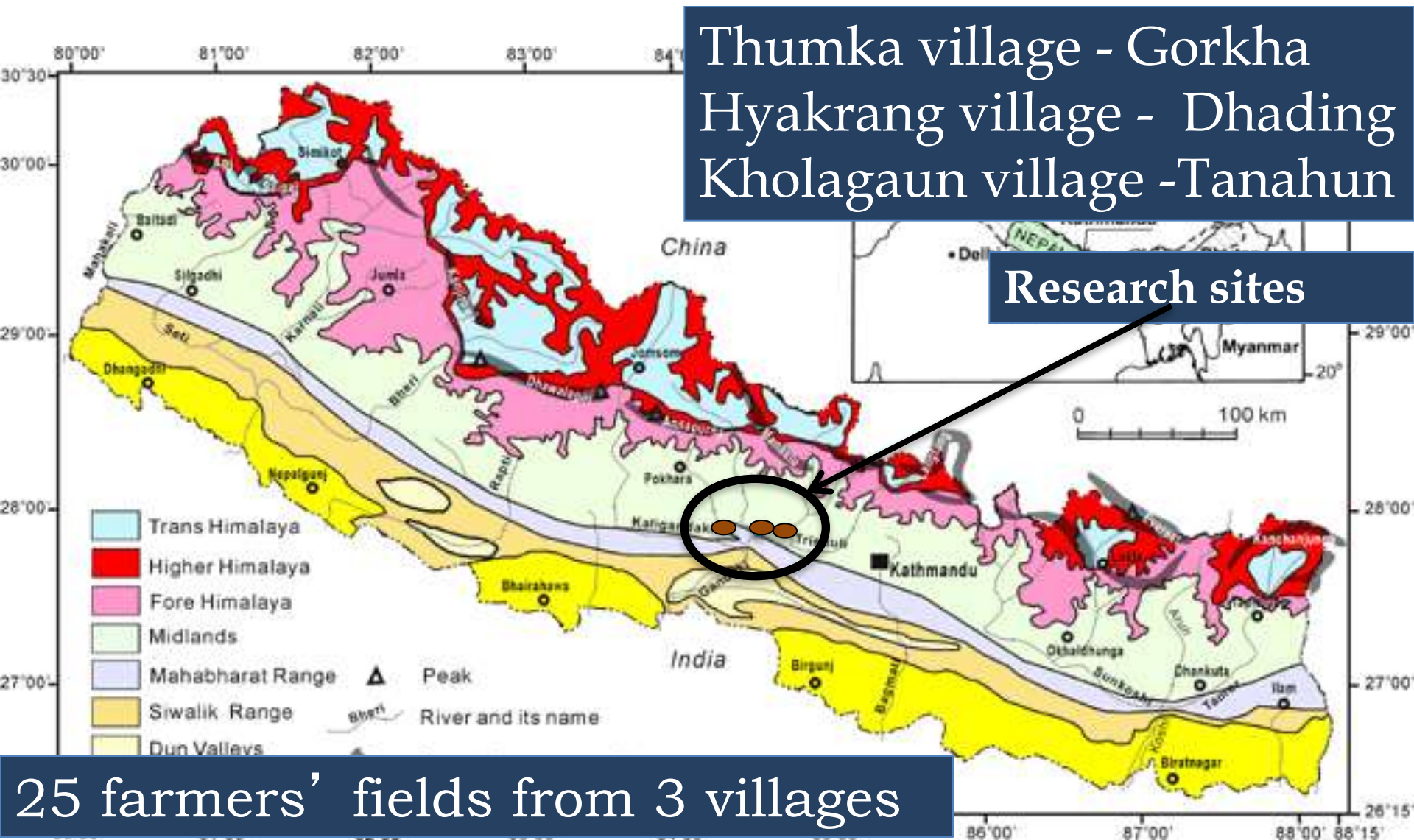
Project Director, ATMA,
Mayurbhanj, Baripada

Collector & District Magistrate,
cum- Chairman, ATMA,
Mayurbhanj, Baripada

CAPS Presentation before state level officials

Nepal

Nepal: study 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 (≈ 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

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

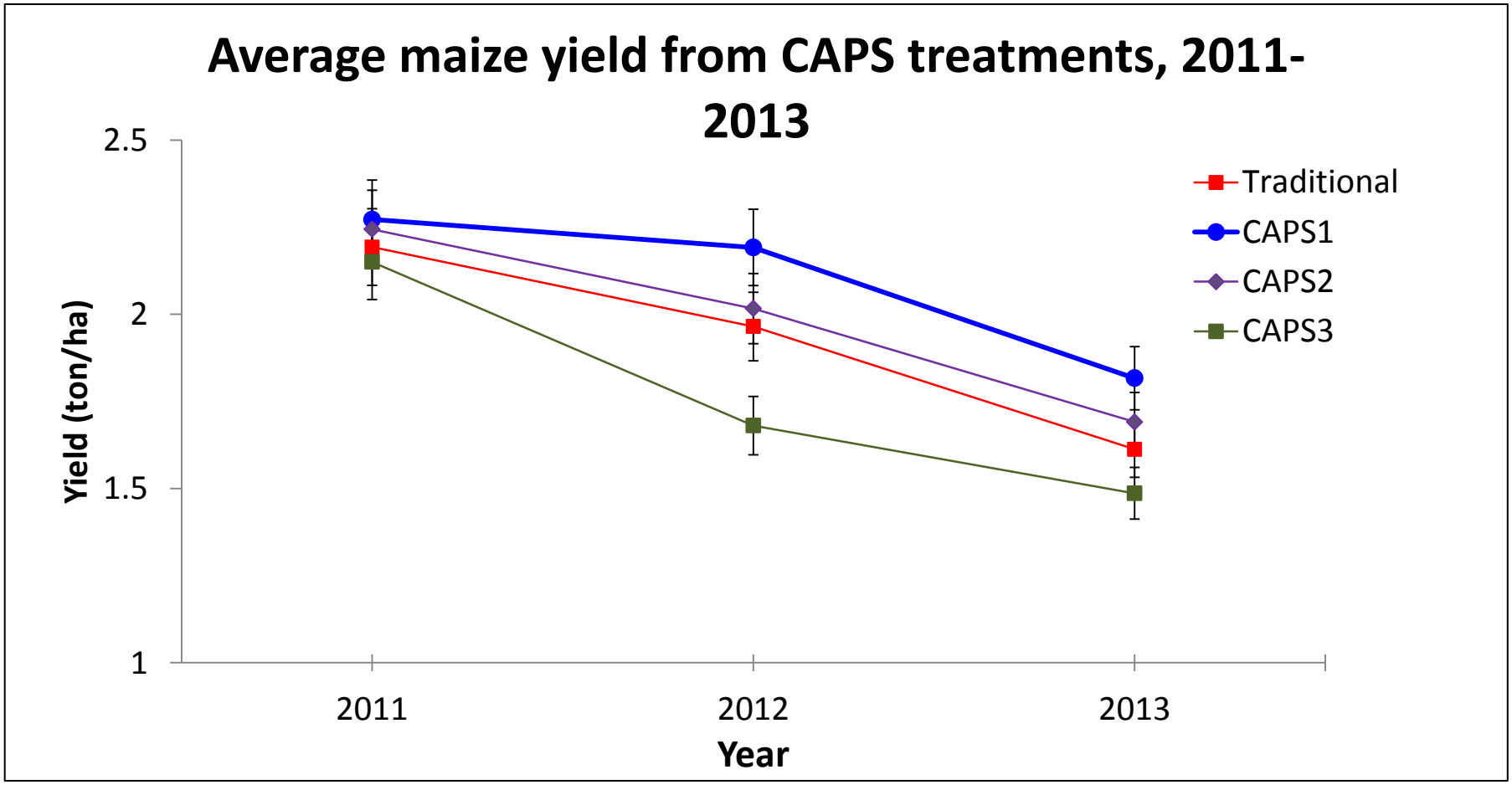
ANOVA

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

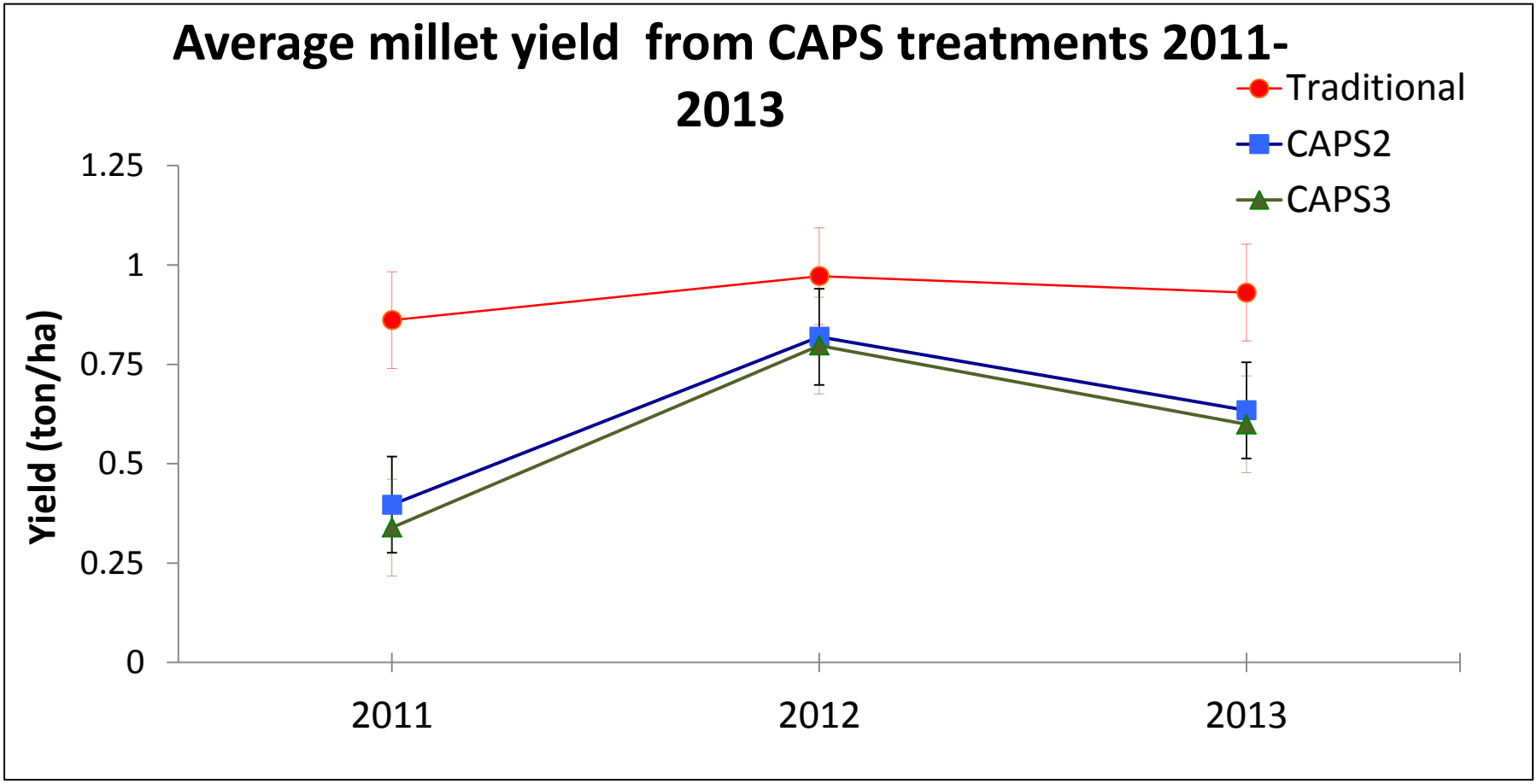
Higher maize yield in CAPS

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



Lower millet production in CAPS

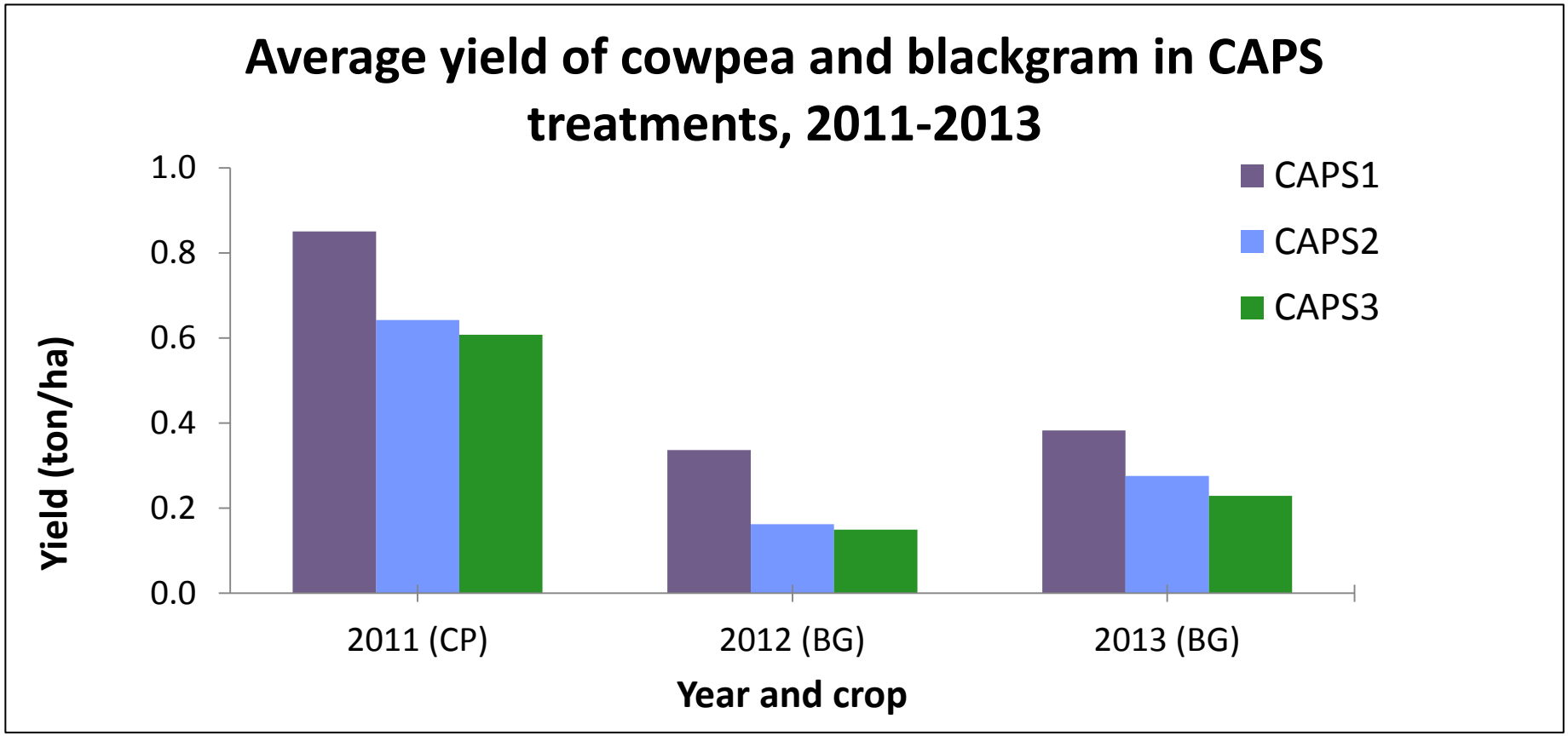
Millet production in traditional system was higher than CAPS2 & CAPS3 b/c of sole cropping



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

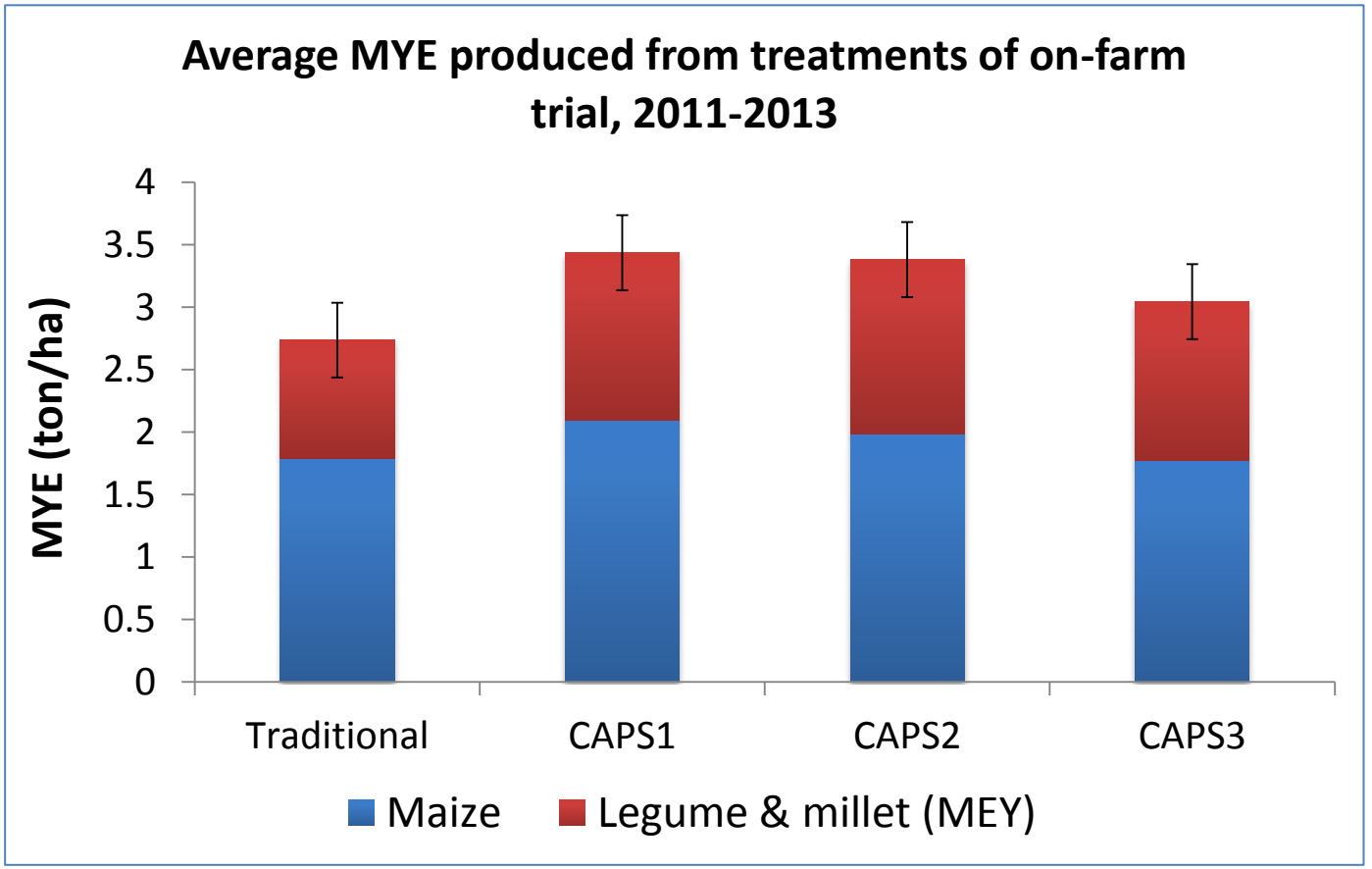
Source of variation	Maize Yield Equivalent (maize ton/ha)	Annual Revenue ($)
Year (Y)[c]	***	***
Village (V)	NS	NS
CAPS (T)	***	***
Y x T	NS	NS
V x T	NS	NS
Y x V	***	***
Field (village)	**	**

***, **, * 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

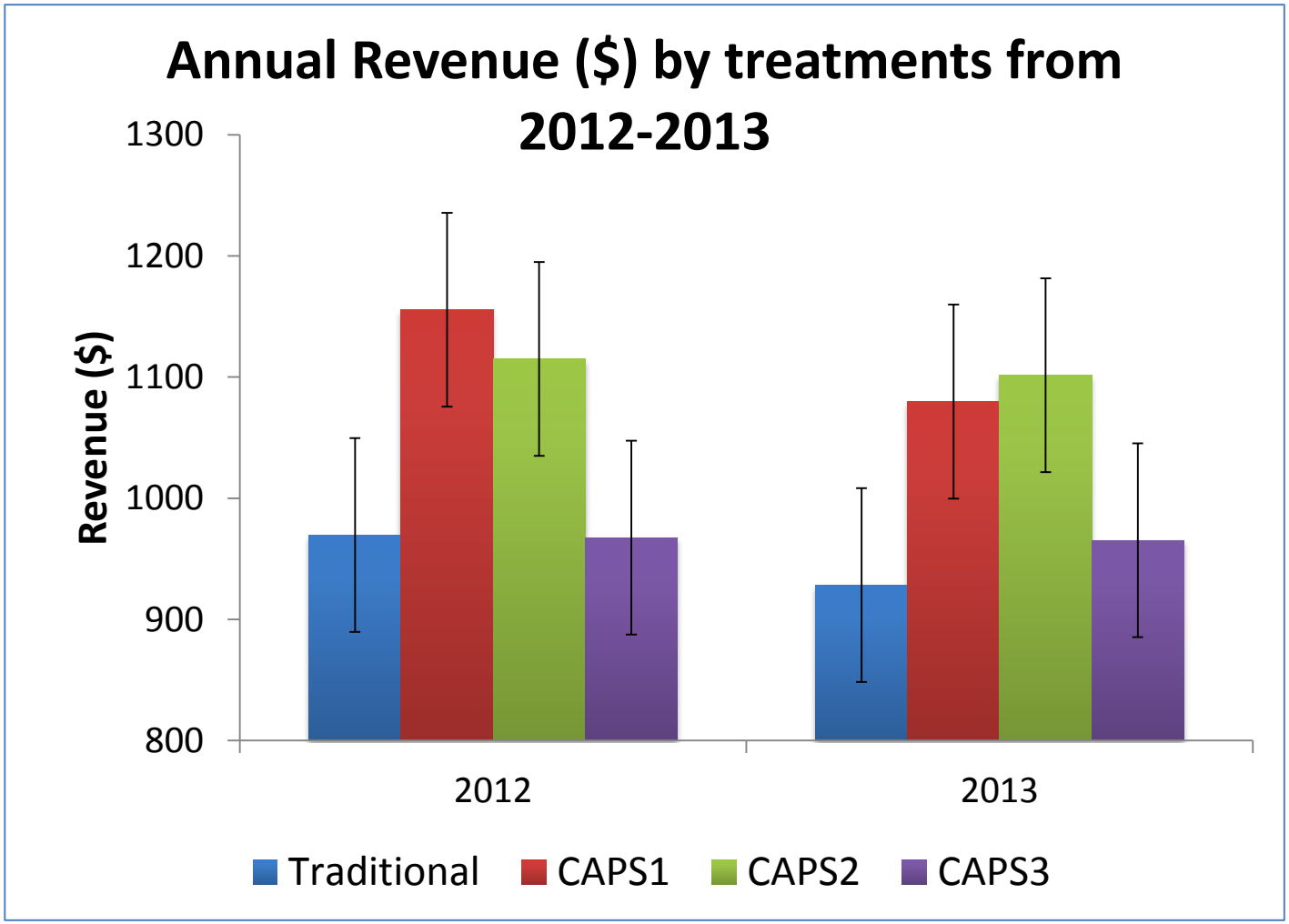
- CAPS1 and CAPS2 was higher than traditional system
- CAPS3 was was not different from all other treatments

- 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)

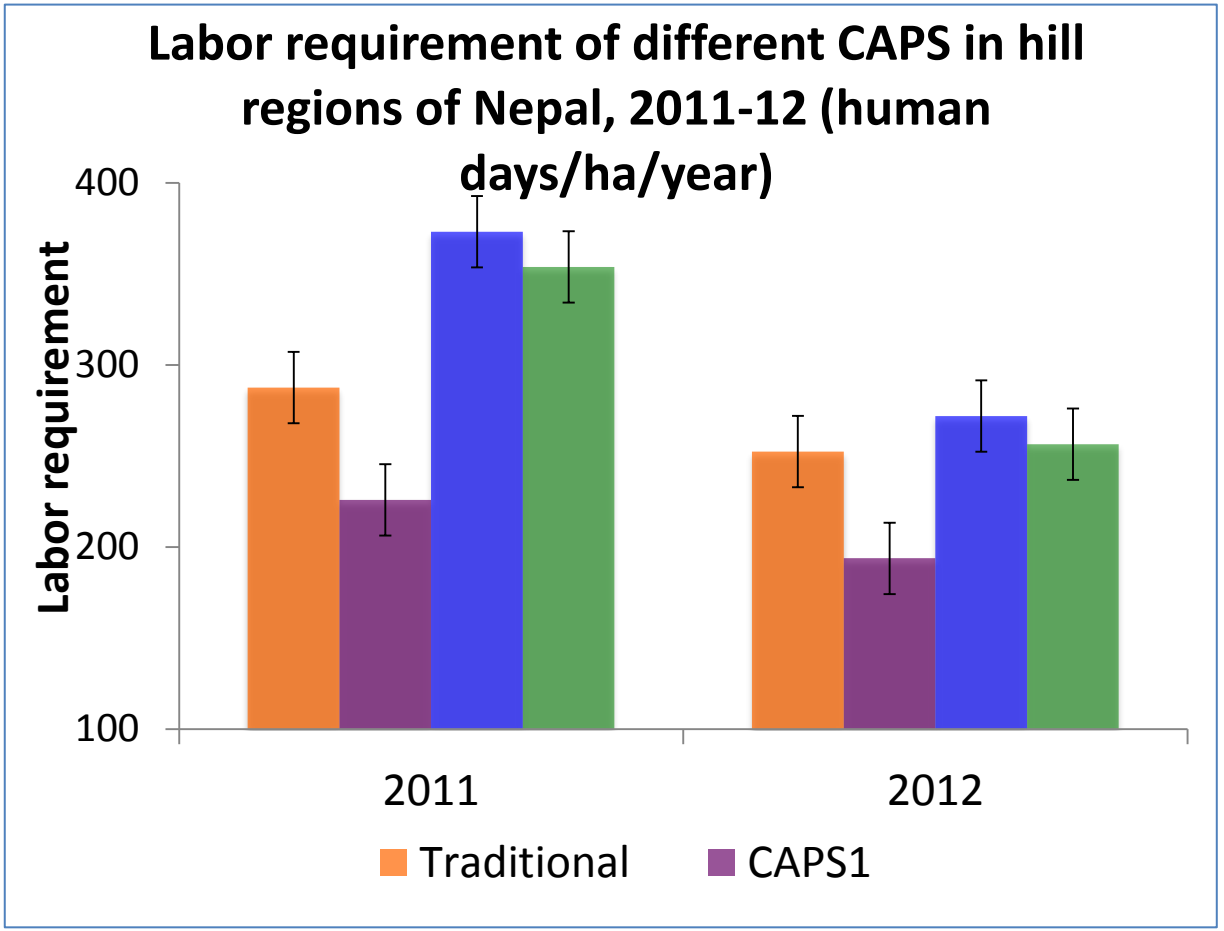
Source of variation	Total labor requirement (human.days/ha/year)
Year (Y)	***
Village (V)	**
CAPS (T)	***
Y x T	**
V x T	***
Y x V	NS
Field (village)	**

***, **, * 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

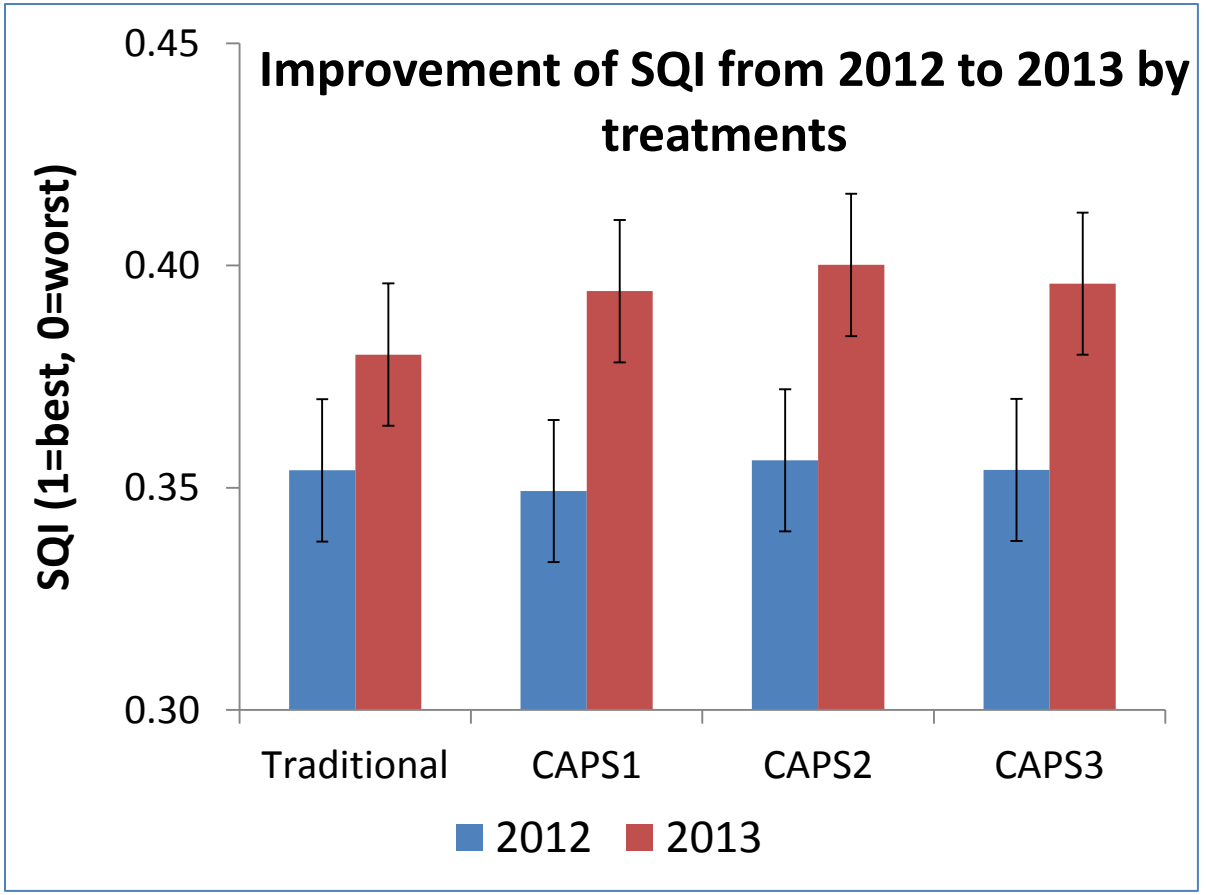
CAPS1 required lower labors than all other treatments b/c of low labor need for legumes

CAPS2 & CAPS3 required higher labor than traditional system and CAPS1



CAPS improve soil quality?

- SQI= f (BD, K, N, OM, 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

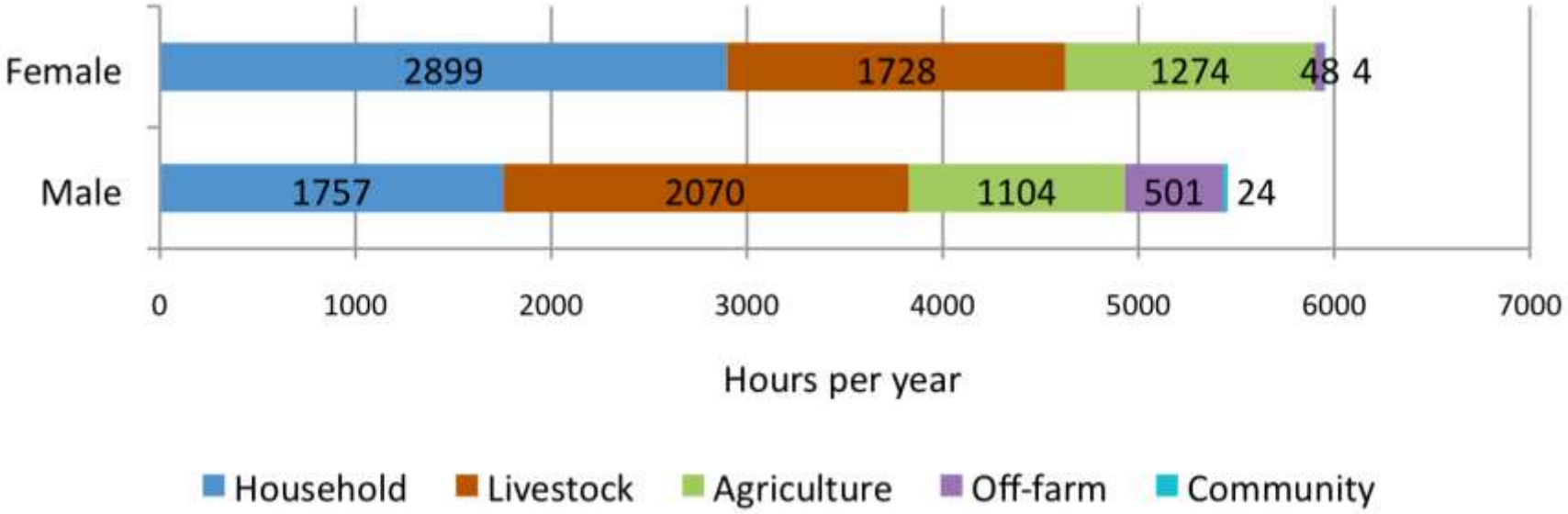
- ✓ FT Maize-legume: highest returns & lowest labor req.
- ✓ FT Maize-millet+legume: higher return & higher labor
- ✓ ST Maize-millet+legume :
  - Lower return & higher labor than maize-legume
  - Still better than traditional system
- ✓ Returns from ST was comparable to FT, but labor requirements was 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:

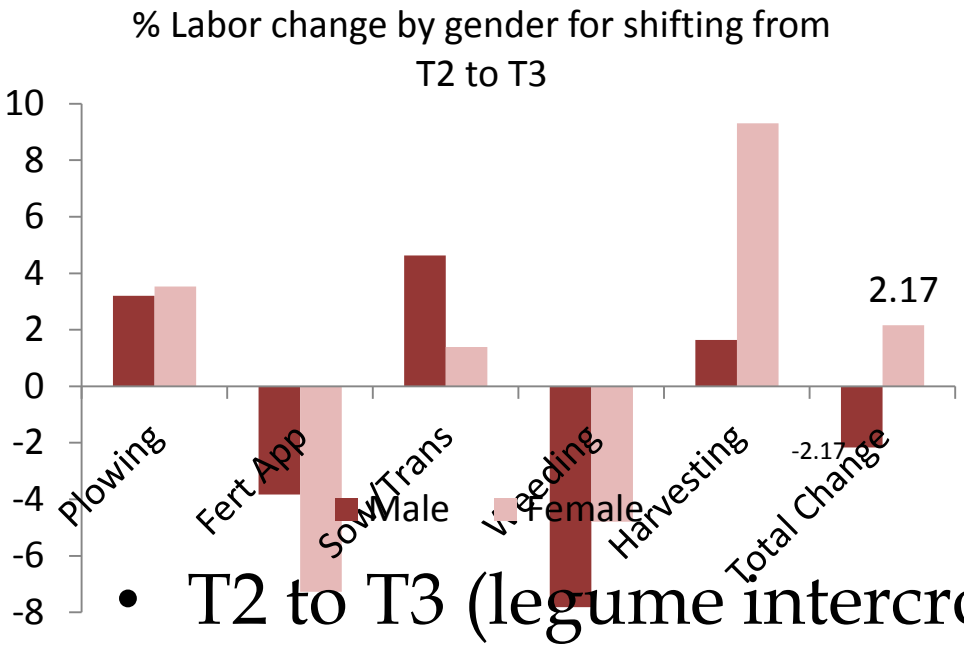
- Determine the gender-based division of labor and time allocation for agricultural activities
- Measure expected shifts in labor from CAPS were also determined
- Determine gendered preferences for CAPS treatments
- Assess gender inclusion in agricultural decision-making

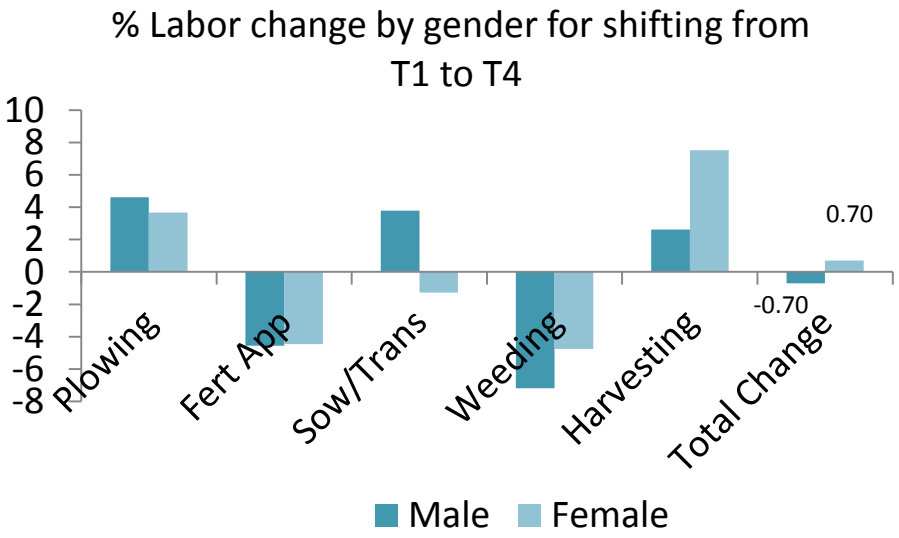
Annual Time Allocation by Gender



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

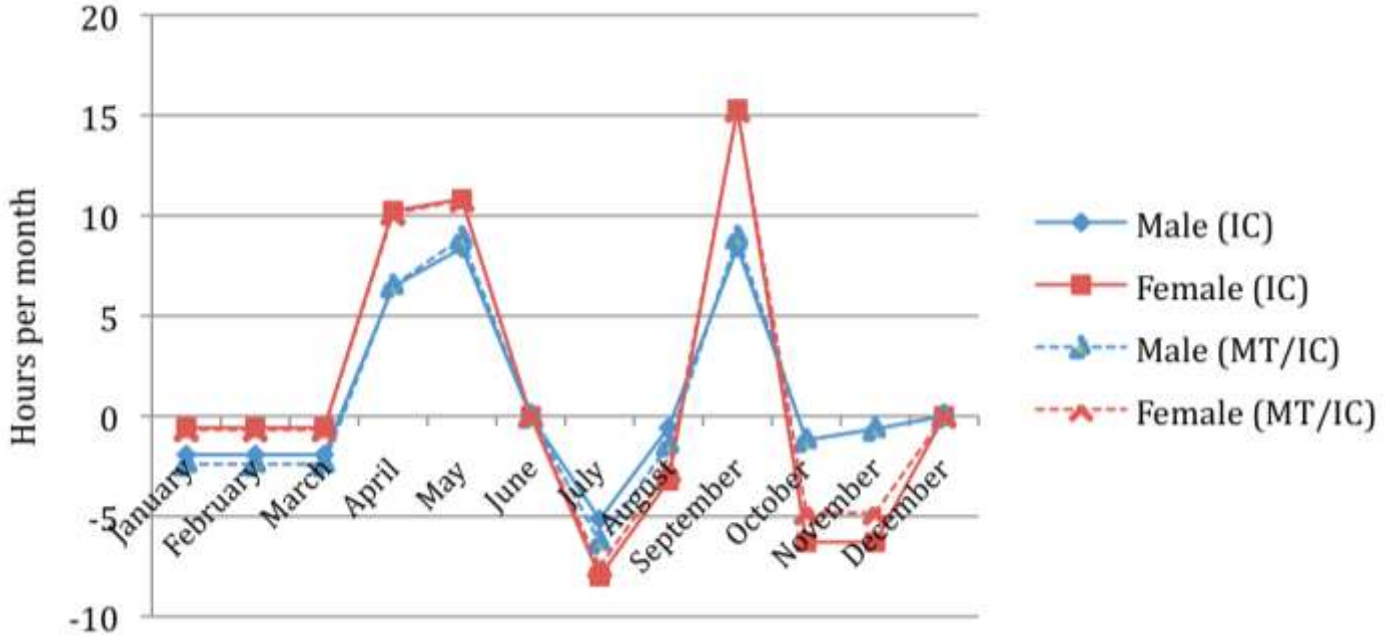
Shifts in Division of Labor Resulting from CAPS





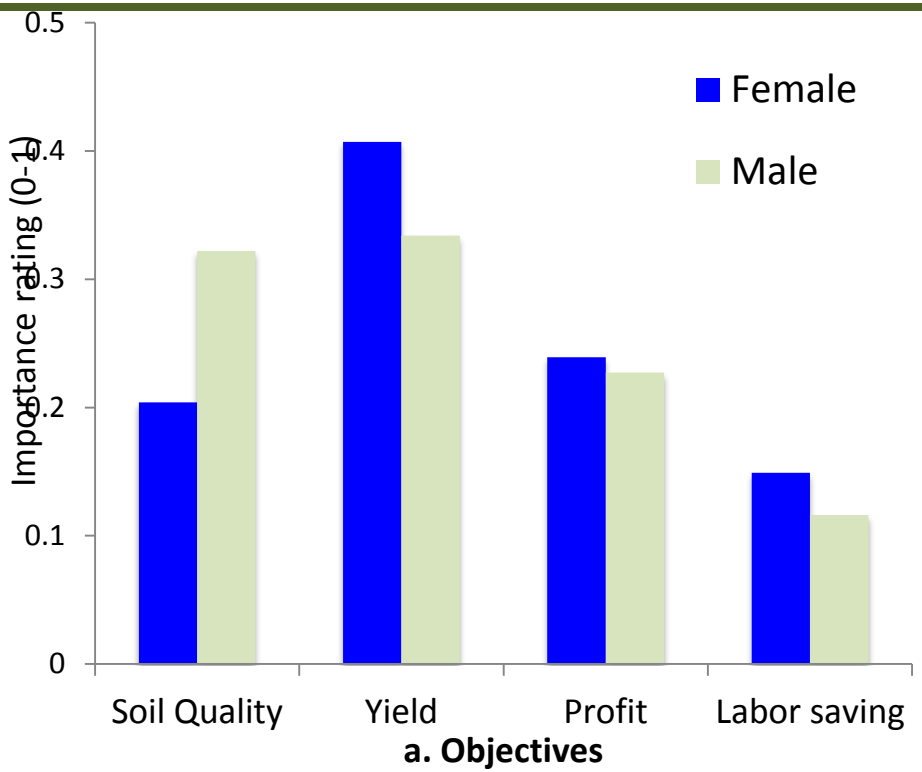
- T2 to T3 (legume intercrop w/ full till) resulted in the greatest labor increases for women
- T1 to T4 (legume intercrop w/ strip till) resulted in the least change to the division of labor
- Land preparation, sowing, and harvesting were the overall drivers for increased labor

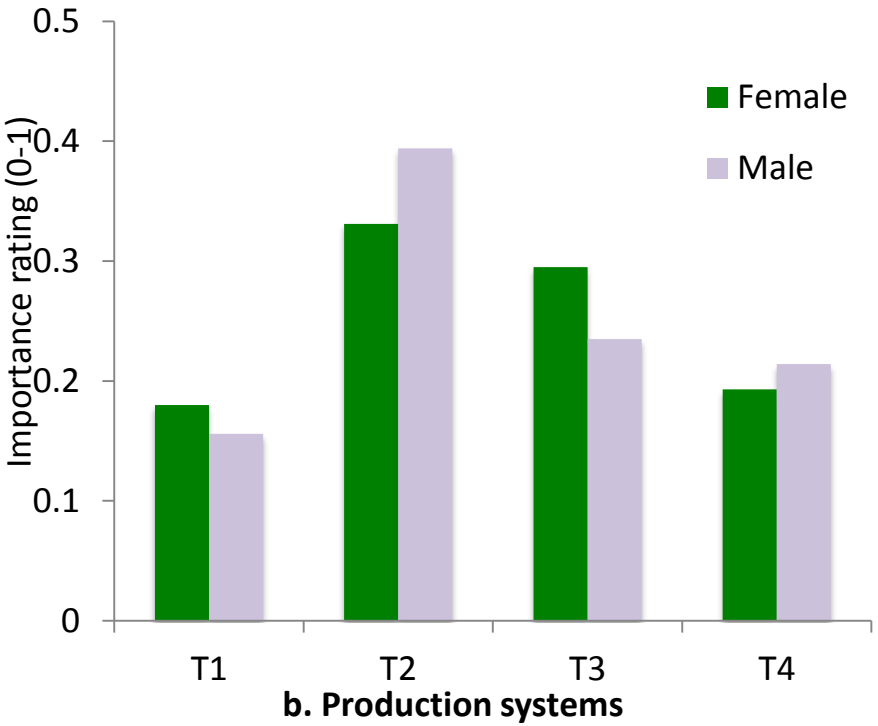
Expected Labor Savings from CAPS, by month



- 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)

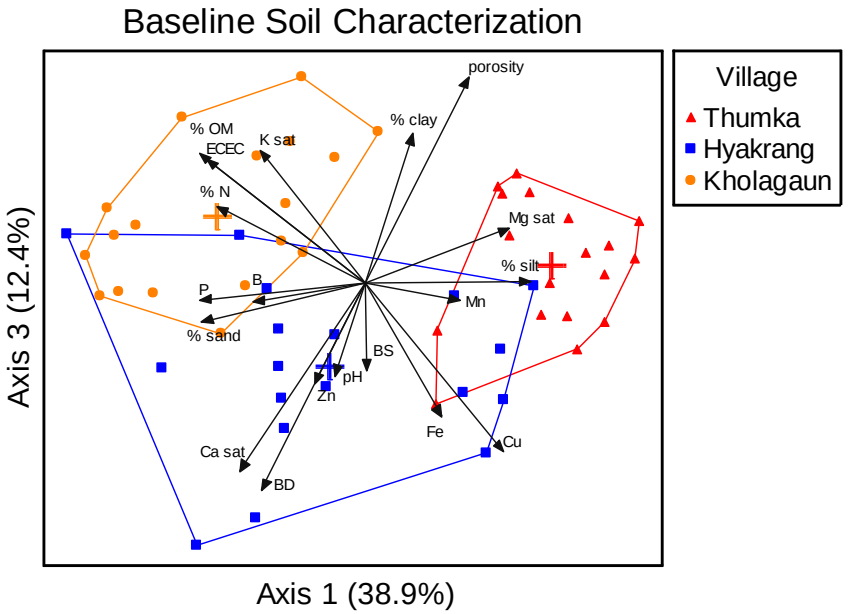
Cognitive Modeling Study

- 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 !!