

# Sustainable Management of Agroecological Resources for Tribal Societies (SMARTS): A CONSERVATION AGRICULTURE-BASED PARTICIPATORY RESEARCH IN KENDUJHAR OF ODISHA



Orissa University of Agriculture & Technology, Bhubaneswar and University of Hawaii, USA, collaborative research project on "Sustainable Management of Agroecological Resources for Tribal Societies" (SMARTS)

## A CONSERVATION AGRICULTURE -BASED PARTICIPATORY RESEARCH IN KENDUJHAR OF ODISHA

**T**raditional agriculture followed by tribal societies in India is increasingly relegated to less productive land, often on steep slopes, resulting in lower productivity, degradation of soil and water resources, impairment of health and loss of livelihood options. Particularly affected are the smallholder tribal communities of the hilly regions as in Kendujhar district of the Odisha state, India. Environmental degradation has driven these tribal communities engaged in subsistence agriculture into severe malnutrition and loss of livelihood options. Conservation agriculture can be seen as a new way forward for conserving resources, enhancing productivity and sustainable livelihood. Conservation agriculture (CA) is not 'business as usual', based on maximizing yields while exploiting the soil and agro-ecosystem resources. Rather it is based on optimizing yields and profits, to achieve a balance of agricultural, economic and environmental benefits. It is the integration of ecological management with modern, scientific agricultural production. A major strength of CA is the steps like implementation by farmers of complementary, synergetic soil and crop husbandry practices that build to a robust, cheaper, more productive and environment friendly farming system. These systems are more sustainable than conventional agriculture because of the focus of producing on healthy soils in eco-friendly environment. The key elements which characterize CA include (i) minimum soil disturbance by adopting minimum-tillage and minimum traffic for agricultural operations (ii) adoption of diversified crop rotation and (iii) permanent organic soil cover. CA offers an opportunity for arresting and reversing the downward spiral of resource degradation, increasing costs of cultivation thus making agriculture more resource use efficient, competitive and sustainable. But it demands a strong knowledge

base and a combination of institutional and technological innovations. Hence the project “Sustainable management of agro-ecological resources for tribal societies (SMARTS)” - a collaborative research project of University of Hawaii, USA and Orissa University of Agriculture and Technology (OUAT), Bhubaneswar, India sets its eye on developing indigenous conservation agricultural production systems (CAPS) to improve agricultural productivity, household income and more specifically the sustainability of smallholder tribal communities of the hilly regions of India.



### **Research Objectives:**

The goal of the project is to improve agricultural productivity, economic opportunities, and the sustainability of smallholder agriculture based tribal livelihoods and their community life through selection, development, and implementation of locally appropriate CAPS.

### **Specific objectives are:**

1. Determine the set of CAPS for sustained productivity, soil impact, gender equity and profitability
2. Explore stakeholder preferences for CAPS to promote adoption
3. Implement preferred CAPS on-farm for validation, impact on farm household welfare
4. Build capacity of Farmers, Research & Extension Officials to scale up CAPS



## Research Progress:

Socio-economic baseline surveys were completed in two out of three selected tribal villages located in high elevation hilly terrains of Kendujhar district viz., Tentuli, Talachampe and Bayakumutia of Banspal Block. The surveys revealed that the average household family size is 7 members, with 2-3 generations in each household. Majority populations in these villages are in the age group of 11 to 30 years. Villages have very low literacy rates. Farm annual household incomes vary from low (Rs 2000/-) to somewhat high (Rs 1,22,400/-) for families having employment in mining industry. The major agricultural system practiced in this area is rainfed - shifting cultivation. The soil in the area is shallow with low fertility. Fertility is generally enhanced by slashing and burning of natural vegetation, use of animal manure, and limited use of chemical fertilizers, resulting in low input costs. All these villages grow maize and mustard as field crops in their own way with very low productivity level. Thus the idea of Maize based CAPS was perceived.



Focus group discussion at Tentuli



Workshop at RRTTS, Kendujhar



Sowing maize with minimum tillage



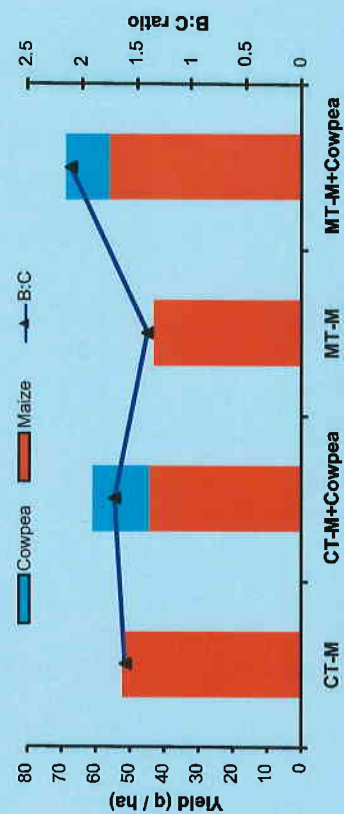
Maize crop in minimum tillage plots, Tentuli

**Table: Farmers' perception and preference for CAPS**

Program	Profit	Labor Saving	Yield	Soil Environ. Benefit
NO CAPS Maize Plow	3 coins	3 smiley faces	3 ears of corn	3 leaves
CAPS 1 Maize Minimum Tillage	3 coins	3 smiley faces	3 ears of corn	3 leaves
CAPS 2 Maize+ Cowpea Intercrop Plow	4 coins	3 smiley faces	3 ears of corn	3 leaves
CAPS 3 Maize+ Cowpea Minimum Tillage	4 coins	3 smiley faces	3 ears of corn	3 leaves

An on-station field experiment at the OUAT RRTTS/KVK experimental station in Kendujhar, India, was conducted from June 2010 to March 2011; the trials for the second growing season began in June, 2011 and are currently underway with complete harvest of maize and cowpea in rainy season and standing crops of Mustard/Horsegram during ensuing winter season. Crop and soil data are being documented and used to validate CAPS options. The results of 1st year were presented at a two-day workshop on March 16-17, 2011 at RRTTS, Kendujhar, the purpose of which was to introduce the concept of CAPS. On-farm CAPS were initiated in village Tentuli during June 2011 focused on maize-based cropping systems, involving legume intercrops (cowpea) and mustard/ horse gram as cover crops with residue management. Twenty households are involved in the process of on-farm validation of selected CAPS.

**Response of maize and cowpea to CAPS**





→ Maize seed yield in Maize + cowpea intercropping under minimum tillage (56.1 q/ha) was the highest but comparable to that with sole Maize under conventional tillage (52.1 q/ha)

→ Maize seed yield in Maize + cowpea intercropping under conventional tillage (44.4 q/ha) was comparable to that under sole Maize with minimum tillage (44.3 q/ha)

→ Cowpea pod yield in Maize + cowpea intercropping under minimum tillage (12.4 q/ha) was 24.4% less than that under conventional tillage

→ Maize + cowpea intercropping under minimum tillage recorded a net profit of Rs. 32,768/ha with a benefit –cost ratio of 2.1

→ Increase in soil pH was most prevalent in intercropped treatments with an average increment of 0.1 as against 0.02 under sole crop after a single cropping season

→ Decrease in bulk density of soil (0-5 cm) was prominent under minimum tillage with inter cropping followed by cover cropping, whereas the soil organic carbon showed an increasing trend under the same treatment



Monitoring on-station experiment



Recording maize yield (Tentuli)



Harvesting of cowpea (Tentuli)



Recording cowpea yield

## Academic Involvement :

Three Post Graduate students of OUAT namely, Miss Plabita Ray, Miss Bhagini Nabanita and Mr Priyabrata Bhoi from the Agronomy, Soil Science, and Agricultural Economics Departments, respectively, are currently working on the project as Student Fellows during the academic session 2011-12 with award of fellowship and one from Agronomy Miss Aliza Pradhan is joining in Ph.D. program in University of Hawaii commencing from January, 2012. One student from the University of Hawaii, Miss Cynthia Lai received her Master's degree with the research carried out by this project. Looking at the research accomplishments, Conservation Agriculture will go a long way for sustaining livelihood of tribal people of Odisha.



*Harvesting maize (on-station experiment)*



*Transporting the produce to local market*



*Horsegram as cover crop*



*On-farm mustard crop awaits harvesting*





Training on CAPS at Tentuli



Base line survey in villages



Community mobilization to protect crop



Automatic weather station at Tentuli

**Host Country Team at OUAT, Bhubaneswar:**

1. Dr. D. Naik, Dean, College of Agriculture
2. Dr. P.K. Roul, Associate Director of Research, RRTTS, Kendujhar, Host Country PI.
3. Dr. K. N. Mishra, Senior Scientist (Soil Science), Directorate of Research, Host Country Co-PI.
4. Dr. S. N. Dash, Associate Professor (Fruit Science), College of Agriculture, Host Country Co-PI.

**Lead Centre Team at University of Hawaii, Manoa, USA**

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3. Dr. Chittaranjan Ray, Professor of Civil & Environmental Engineering and Researcher, Water Resources Research Center, Co-PI

**Project Advisory Committee, OUAT**

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