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Innovative strategies and smart skills for dissemination of Climate-Resilient Rice Production technologies to farmers

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Abstract
In the present study a combination of *experiential, reinforcement and integrative* extension methods were employed to disseminate selected climate-resilient rice production technologies to farmers (150) in Devunigadda, Yellammatanda and Korra Tanda villages of Telangana, India. The *experiential* methods (method demonstrations, training, video film, exposure visits) allow the learner to gain experience with or to feel the information presented. *Reinforcement* methods (fact sheet, poster, pamphlet) were used to provide informational, emotional, or social support for the learner to facilitate learning and enhance or maintain the motivation to continue in the learning process. *Integrative* methods (discussion groups, personal visit, meeting) were utilized to provide opportunities for learners to merge new information with their existing knowledge. Selected climate-resilient rice production technologies i.e., use of green manure crop, Integrated Nutrient Management (INM), use of Leaf Color Chart (LCC) for optimizing nutrient use, setting up of vermi-compost units were demonstrated on the farmer's fields during kharif 2016. Nutrient-smart technologies like, green manure crop was grown for 45-60 days on farmers' fields in Devunigadda village and was incorporated into the soil before puddling. Farmers expressed satisfaction over the use of green manure and vermi compost along with zinc and balanced chemical fertilizers in reclaiming problem soils. The yield improvement ranged from 22.1 to 36.6% due to INM practice. Water smart interventions that improve water use efficiency were demonstrated through creating awareness on System of Rice Intensification (SRI) techniques. Skill training on use of drum seeder was undertaken in two villages as an energy smart technology. These Climate Smart interventions aim to sustainably increase productivity and income, build resilience to climate change, reduce greenhouse gas emissions and enhance achievement of food security goals. The farmers were thus motivated to adopt these climate-resilient rice production technologies to achieve food and livelihood security.

Keywords: Innovative strategies, smart skills, Resilient Rice Production, farmers

Introduction

Agricultural production remains the main source of income for most rural communities, adaptation of the agricultural sector to the adverse effects of climate change will be imperative for protecting and improving the livelihoods of the poor and ensuring food security (FAO, 2012a). Climate-smart crop production is a sustainable crop production system to address climate change and it is increasingly being reiterated that, increasing food production alone may not enable rural people to come out of poverty. It is essentially important to build the capacity of smallholders to harness the power of collectives, manage the natural resources, acquire financial literacy, engage in profitable enterprises and innovate and add value to their produce. All of these form important elements of sustainable agricultural development strategy.

There are a large variety of methods that can be used to deliver the Extension education programs or disseminate information and the choice depends on the needs, interests and purpose of the educational program. The choice of best methods for teaching new information (experiential), reinforcing and motivating learning, as well as expanding existing information determine the successful implementation of interventions.

Experiential These methods allow the audience to gain experience with the information being taught. It involves hands-on activities that utilize the senses. These methods are excellent for teaching new information.

Reinforcement: These methods reinforce learning and provide motivation for continued learning. They also reinforce information that has already been taught or that which learners already know.

Integrative: These methods allow the learner to clarify, discuss, and gain a greater understanding of the information; and integrate new information with existing information. The learners gain increased in-depth knowledge of a topic.

The following extension methods were used to disseminate selected climate-resilient rice production technologies to the farmers.

Experiential methods	Reinforcement methods	Integrative methods
• On-farm trial	• Fact sheets	• Meeting
• Field day	• Posters	• Personal visit
• Interactive CD	• Leaflets / flyers	
• Tour		
• Interactive workshop		

Methodology

Different approaches and practices for sustainable crop production can contribute to climate change adaptation. They provide options for location-specific contexts and should be adapted with local farmers/farming communities (FAO-PAR, 2011). Therefore, a combination of *experiential, reinforcement and integrative* extension methods were employed to disseminate selected climate-resilient rice production technologies to farmers (150) in Devunigadda, Yellammatanda and Korra Tanda villages of Telangana, India. Nutrient-smart interventions, Viz.Green Manuring (GM) cultivation of legumes in a cropping system to improve the nitrogen supply and soil quality and Integrated nutrient management through the integrated use of organic and chemical fertilizers were demonstrated on the fields of selected farmers. The System of rice intensification (SRI) was demonstrated as Water Smart: Intervention that improves water use efficiency. Climate information services help farmers cope with climate variability an awareness program on crop insurance scheme was organised to educate the farmers about the benefits of availing the various governmental schemes to safeguard the crops from calamities.

Soil samples were collected for initial analysis from around 30 farm sites and soil analysis was done for important soil properties. Based on the severity of soil problems (high sodicity and low fertility status) soil amelioration measures were implemented on the selected farmers' fields. Multi variety green manure seeds consisting of 15 crops (cereals, pulses, oil seeds, spices and green manures) were distributed to the selected farmers. The farmers were motivated to grow green manure crop before taking rice cultivation. Other critical inputs like vermicompost, urea, Zinc sulphate and zinc chelate were also distributed to the selected farmers as a component of integrated nutrient management (INM) adopting the experiential methods of crop trials, field day, tour and interactive workshop.

Findings and Discussion

The interventions to ameliorate soil health were closely monitored during growth period of green manure and rice. Due to very late onset of monsoon and severe water shortage, the growth of the green manure crops was different in different fields based on the water availability. Green manure crop was grown for 45-60 days and was incorporated into the soil before puddling. Vermi compost was applied to the soil in the last puddle along with urea and zinc sulphate and rice was transplanted in the month of August which was delayed by one month. The rice varieties, Amansona, Tellahamsa and Sona Mahsuri were taken up in this area. Zinc chelate was sprayed on the crop at about one month after transplanting.

The difference between INM plot and control plot were very clear where control plot showed nutritional deficiencies due to alkalinity problem and treated plots were green showing good crop growth. Farmers expressed satisfaction over the use of green manure and vermi compost along with zinc and balanced chemical fertilisers in reclaiming their soils. They were happy and expressed that they recorded higher yields due to improvement in plant population, crop stand, crop growth, more number of tillers and panicles. Farmers harvested the crop between third and fourth week of December. The average yield improvement recorded for twenty farmers was 37.72% (tabe1.) due to INM practice through the demonstrated interventions.

SRI is a knowledge-based rather than an input-dependent innovation, the most crucial factor for its successful use is having sufficient attentive and motivated labor. *Reinforcement* methods (fact sheet, poster, pamphlet) were used to provide informational, emotional, or social support for the learner to facilitate learning and enhance or maintain the motivation to continue in the learning process.The average increase in income from SRI in eight countries (Bangladesh, Cambodia, China, India, Indonesia, Nepal, Sri Lanka and Viet Nam) has been shown to be around 68 percent with yield increases of 17 to 105 percent and decreases in water requirements between 24 and 50 percent (Africare *et al*., 2010). The farmers' were motivated to adopt SRI.

Well-designed and targeted agricultural insurance can enable farmers to re-invest in inputs and technologies despite bad years (Dhanush D.2016). Farmers' perception of crop insurance schemes were elicited and farmers reported certain constraints in availing the schemes as depicted in figure 1. There is a need to overcome these constraints to enable farmers to benefit from the scheme.

Table 1: Problem Soil Management through INM on farmers' fields N=20

S.No	Farmer's name	Yield (kg/ha)		% Yield advantage
		INM	Farmer's practice	
1	K. Kumar	4625	3600	28.5
2	P. Gopal	3550	2675	32.7
3	K. Narsimhulu	5250	4300	22.1
4	T. Anjaneyulu	3525	2850	23.7
5	K. Swetha	4400	3220	36.6
6	N. Sankaraiah	4050	3220	25.8
7	M.Kisthaiah	5062	3500	44.6
8	M.Ramaiah	3543	2438	45.3
9	Adepu Bikshapathi	5225	4300	21.5
10	Mandula Lakshmaiah	3025	2350	28.7
11	M. Bikshapathi	5400	4220	28.0
12	Pallerla Bikshapathi	4050	2813	44.0
13	Chatla Kistaiah	4000	3050	31.1
14	M.Mallaiah	2850	2150	32.5
15	Mandula Eraiah	4690	3650	28.5
16	Mandula Ramaiah	3500	2813	24.4
17	K.Rani	4050	3220	25.8
18	N.Padma	5400	4220	28.0
19	N. Kumar	4000	3050	31.1
20	K. Shankeraiah	3520	2800	25.7

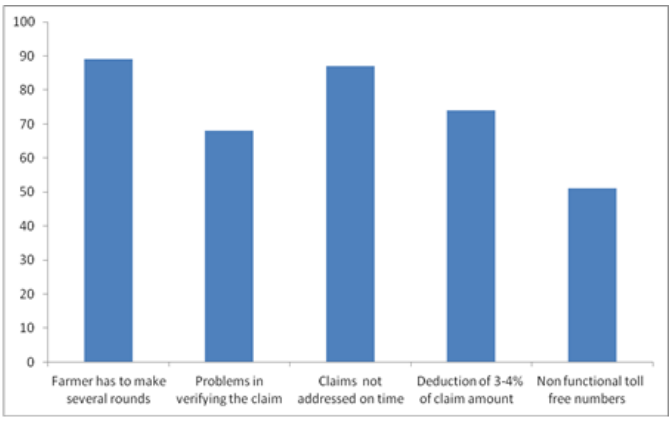

Fig 1: Constraints faced by farmers in availing crop insurance scheme

Effective extension strategies for promoting climate smart technologies

Rural Advisory Services (RAS) have a crucial role to play in linking farmers with sources of new information and tools so that they can transition to CSA practices (Simpson and Burpee, 2014). The provision of personalised support to farmers depending on their vulnerability to climate change at the household level, as well as according to their risk profile and the availability of other livelihood options is a big challenge for the extension personnel (Rasheed 2017) and working with organized groups of smallholders to promote adoption of climate smart technologies maybe an effective strategy for the following reasons:

- Many tasks can be tackled only by groups of farm families or by the community as a whole.
- Working with groups lets one reach many more people than if one was to visit individual Farmers.
- Organized groups are likely to be much more effective due to pooling of knowledge, resources and risks than individuals working independently.

Building the resilience of farmers through developing their human and social capacity and providing support services to manage the uncertainties and risks associated with climate change is the need of the hour. The following skill sets designed by Catholic Relief Services (CRS.2012) may enable the farmers to diversify their agricultural and income options and become more resilient.

The SMART skills approach aims to strengthen the following skill sets the farmers need in order to create effective and sustainable linkages to markets.

- **Organizational management:** the group members need to plan and monitor the performance of their work.
- **Financial skills:** they need to save money, invest it in the enterprise, and maintain financial records.
- **Market and enterprise skills:** they need to produce something that customers want to buy; they need to find those customers; and they need to plan their business to make a profit.
- **Natural resources:** they need to conserve their soil, water and other natural resources so they can produce on a sustainable basis.
- **Innovation**: they need to find new, more efficient and more profitable ways of doing things.

Conclusion

A combination of *experiential, reinforcement and integrative* extension methods were employed to disseminate selected climate-resilient rice production technologies to farmers. These selected Climate Smart interventions aim to sustainably increase productivity and income, build resilience to climate change, reduce greenhouse gas emissions and enhance achievement of food security goals. Farmers expressed satisfaction over the use of green manure and vermi compost along with zinc and balanced chemical fertilisers in reclaiming their soils. The farmers were thus motivated to adopt these climate-resilient rice production technologies to achieve food and livelihood security.

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