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Capacity building of women farmers through sustainable agricultural practices for rural prosperity

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Introduction

Women play a vital role in Indian agriculture. In India, about 70%[1] of the farm work is performed by women (Rao, 2006) and nearly 33% of labour force in agriculture is constituted by women (FAO, 2011)[2]. However, their knowledge, assets, input and services related to agriculture are limited in nature. Compared to men, women receive only 5% of agriculture-related training and advisory services known as agricultural extension services[3]. In rural India, agriculture takes away a major share of women's daily time. Despite putting in considerable efforts, their voices often go unheard. This is primarily because they lack appropriate knowledge and do not receive any financial support. Low literacy levels among women often worsen the case. Also, the grand agricultural extension services, provided by government, often don't have a provision of separate trainings for women to build their capacities. Women farmer's participation in agriculture-related trainings is low because of socio-cultural limitations, household work load and gender segregated society.

In this backdrop, Sehgal Foundation and K+S Kali GmbH joined hands to start Unnat Krishi (meaning *improved agriculture*) project in 2013. The aim of the project is to empower small and marginal women farmers in Alwar district of Rajasthan, India. Unnat Krishi strengthens the capacities of smallholding women farmers by educating them on standard fertilizer applications and use of scientific package of practices (soil testing, seeds, nutrients and pest management) to gain better crop yield. The project made use of improved technology that is otherwise not accessible to women farmers in the region. This project is carried out in 10 villages of Umrain block of Alwar, Rajasthan, covering 2,035 households (HH).

Implementation strategy

The project leverages the existing self-help groups (SHGs) to disseminate improved, well-established agricultural technology. A local NGO, Ibtada (meaning *beginning*), formed these SHGs. In total, 552 members from 52 groups are directly associated with the project. The project largely targets young women farmers with 65% (358) of its members in the age group of 20-40 years (Fig. 1). The land holding of 59% (319 SHG's members) farmers ranges from 0.25 to 1 ha. The program facilitates micro lending in the groups to help women procure agricultural inputs and other services. The financial capacity of SHGs is increased by sharing 60% of the cost of input, which is deposited with their federation[4] as project corpus fund. The corpus fund is to ensure sustained supply of agricultural inputs and services to SHG members.

A baseline survey conducted at the beginning of the project found that 47% of households are engaged in agriculture[5]. Here, 97% of women in families are involved in agriculture. The literacy rate of women (39.2%) is quite low in comparison to men (76.5%). With an average family size of seven, 41% of family heads are illiterate. The average land holding in the study was found between 0.2 and 0.4 ha (Fig. 1). Also, the farm mechanization is considerably low with 21% HH having tractors and 4% having threshers. Agriculture in the district is largely rain dependent. The average rainfall in the district is 657 mm, which is often uneven and scattered, resulting in cyclic droughts and floods. Wheat, rapeseed, millet, pulses and horse gram are major sources of income for people here. However, high cost of cultivation and use of traditional farming practices render agriculture a non-profitable activity.

Initially, an orientation meeting in each village is organized, where all SHG members are invited. They were briefed about the project objectives, interventions and implementation strategy. Initially, 70 soil samples were collected and tested at a private laboratory. On the basis of the soil test report, packages of practices (PoP) are

[1]Role of Women in Agriculture: A Micro Level Study: Article provided by Research Centre for Social Sciences, Mumbai, India. Journal of Global Economy 2006(2), 107-118.
[2]FAO (2010-11) The state of food and agriculture. Page 11(http://www.fao.org/docrep/013/i2050e/i2050e.pdf.
[3]Source: http://www.theguardian.com/global-development-professionals-network/2013/sep/25/women-agriculture-access-india
[4]Women Federation is a block level women association having representation of village level SHG.
[5]Saxena N. and Mangla B. (2013). Baseline Report of Unnat Krishi Project. Sehgal Foundation – K+S Kali partnership project on Agriculture. Published by the Sehgal Foundation, www.smsfoundation.org

developed using State Agriculture Department recommendations for mustard and millet. The PoP includes hybrid seed varieties, fertilizers and micronutrients like urea, di-ammonium phosphate (DAP), KCl (MOP), bentonite-sulphur, zinc sulphate and granubor. The selection of beneficiary for each season is done by the SHG members themselves.

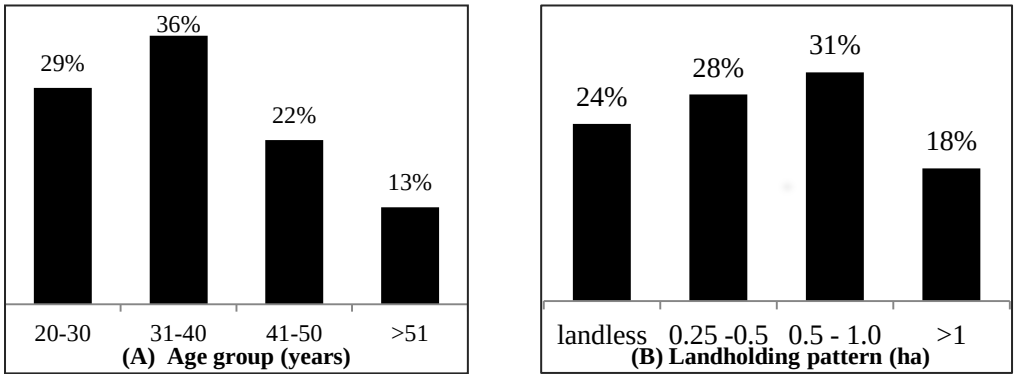

Fig. 1: Age group of women farmers (A) and landholding pattern of self-help group (SHG) members (B) as recorded during a baseline survey of the project area in 2013[5].

The PoP for millet and mustard were given to 305 (195 for millet and 110 for mustard) women farmers in three seasons. The demonstration was done on 0.25 ha (one bigha) land, wherein PoP was used on 0.125 ha (half bigha; demo plot), and the other half is cultivated as per farmer's practice (FP) prevalent in the area (control plot). Seeds for 0.25 ha were provided to women farmers to ensure that the difference in crop yield and quality should not depend on the variety and seed quality used. Since the majority of women farmers are illiterate, they were trained about the soil test results and the benefits that the use of package of practices can bring. Based on soil test result variations, PoP are developed for millet and mustard each year, details of which are given in Table 1. The fertilizers were distributed as pre-mixed packages adequate to supply nutrients for the demo plots (0.125 ha).

Table 1: Packages of practices (PoP) developed according to recommendations issued by the Rajasthan state agriculture department, based on soil test results and farmer's practice (FP), for millet and mustard in different cropping seasons.

Crop	Practice	$N^{(1)}$ (kg ha^{-1})	P_2O_5 (kg ha^{-1})	K_2O (kg ha^{-1})	Sulphur (S) (kg ha^{-1})	Zinc (Zn) (kg ha^{-1})	Boron (B) (g ha^{-1})	Seed (kg ha^{-1})
Millet (kharif season 2013)	PoP	75	36	18	22	2	0	3.6
	FP	110	0	0	0	0	0	6
Mustard (rabi season 2013/14)	PoP	56	33.4	14.4	16	4	208	2.5
	FP	113.6	55.2	0	0	0	0	6
Millet (kharif season 2014)	PoP	78	38.5	23.4	21.6	1.8	0	3.6
	FP	110	0	0	0	0	0	6

(1) N, P_2O_5, K_2O, S, Zn, and B provided as urea, DAP, MOP, Bentonite-S, $ZnSO_4 \bullet H_2O$, and Granubor, respectively.
(2) Seed varieties used were Hytech 4201 and 86M88 for millet in 2013 and 2014, respectively, and 45S42 and 45J21 for mustard.

To ensure active participation, to create ownership and constant inflow of information to all women farmers, a woman farmer is designated as "Krishi Sakhi" (KS) (*Agriculture Friend).* She works as an agriculture resource person or agriculture service provider in her village. During the training, she is informed on new agricultural practices, such as integrated nutrient and pest management (IPNM), soil health management, soil testing, composting techniques, vegetable production, and nursery raising**.** She later facilitates field demonstration, conducts field days, and ensures farmers' contribution in the project. KSs are equipped with customized IEC material that helps them educate other illiterate women farmers on agricultural practices. During Unnat Krishi, nine KSs are trained to take the role of agricultural leaders. Women federation support is taken for wider dissemination of knowledge to other villages. At the outset, the project work is conducted with existing women SHGs, which later share their experience and learnings with other women farmers in the region.

To spread knowledge about PoP to farmers, a wall painting is done in each village. These paintings contain the information on PoP of wheat, mustard and millet crops. Paintings are done at common place in the village, where people gather every evening. It resulted in better adoption of PoP by non-SHG members.

KS facilitate field days on demo plots which are organized by field representatives of K+S and Sehgal Foundation. On field days, women farmers assemble at one demonstration plot and discuss the changes they observed in crop growth. The Krishi Sakhi explains the effect of PoP in plant growth and highlights the difference between demo and control plot. The owner of the plot explains the practices that she followed in the demo plot. The field days are organized at germination, flowering, fruiting and before harvesting.

The village-level trainings are conducted in each cropping season wherein all women farmers are educated about new agriculture technologies. These include use of drip and sprinkler irrigation, no tillage practices and soil health management. The training on PoP is given in each village.

The donors covered 100% costs of the PoP and participating women farmers contributed 60% of the PoP cost to their SHG and created a corpus fund, which is reserved with women federation in the name of Unnat Krishi Sustainability Fund (UKSF). The corpus money is to ensure sustained supply of inputs and other service to SHG members after the project completion. After the completion of the first year of the project, a total of INR 78,040 has been reserved for UKSF.

Results and Discussion

During three cropping seasons field demonstrations were given to 305 women farmers in 10 villages. The yield data of millet and mustard were collected randomly from 128 demo plots. The results show that on an average crop yield increased over control (farmer's practice) in millet by 41 and 31% in 2013 and 2014, respectively, and by 33% in mustard, when applying the improved PoP (Table 2).

The higher yield, even when accounting for the somewhat higher costs of production in mustard, increased the total gross income per ha by INR 6,436 (EUR 80) and INR 5,776 (EUR 72) in millet in 2013 and 2014, respectively, and by INR 14,066 (EUR 176) in mustard. In addition, the laboratory tests of mustard seeds revealed that oil content has also increased by 0.5-1%. Farmers also received higher prices of INR 600-1,000 (EUR 7.5-12.5) per tonne as compared to normal market prices for mustard crop.

During the first three cropping seasons of the project[6], the adoption of improved PoP has increased 31% in millet (kharif season 2013) and 58% in mustard (rabi season 2013/14).

Table 2: Impact of improved PoP on economics of millet and mustard production in different seasons as compared to control (farmer's practice).

	Millet (kharif 2013)		Mustard (rabi 2013/14)		Millet (kharif 2014)	
	Demo	Control	Demo	Control	Demo	Control
Total cost of input[(1)] (INR ha^{-1})	11,419	9,346	13,547	14,156	14,018	11,980
Yield (t ha^{-1})	2.74	1.94	2.11	1.59	2.48	1.90
Income[(2)] (INR ha^{-1})	22,146	15,710	57,301	43,235	24,820	19,044

[(1)] *Cost include input like seed, fertilizers, field preparation and harvesting*

[(2)] *Millet grain sold at INR 8,080 t^{-1} (2013) and INR 10,000 t^{-1} (2014), mustard grain sold at INR 27,150 t^{-1} (EUR 1 = INR 80)*

The benefit-cost ratio (BCR) and returns on investment (RoI) is calculated for millet and mustard. The cost of PoP includes seeds, fertilizers, field preparation and thrashing. Fixed cost of INR 6,250 for millet and INR 7,500 per hectare for mustard is included in total cost of cultivation. The fixed cost includes field preparation using tractors and seed drills and thrashing. Farmers don't have to bear the cost of harvesting since it is compensated with the values of fodder in millet and fuel wood in mustard. Therefore the market value of fodder and fuel wood is not considered for BCR and RoI.

A comparison of net returns and benefit cost ratio in millet reveals the economic benefit of applying NPKS fertilizers. Singh and Majumdar (2012)[7] observed a maximum mean net profit of Rs. 25,561 per hectare in millet with NPKS application. Singh and Wanjari (2013) stated based on multi crop experiments on various cropping systems across India that the external supply of nutrients in balanced form is essential to sustain crop productivity[8]. Proper nutrient management not only sustained the productivity over a long period, but also improved chemical,

[6] The agricultural crop year in India is from July to June. The Indian cropping season is classified into two main seasons-(i) Kharif and (ii) Rabi based on the monsoon. The kharif cropping season is from July –October during the south-west monsoon and the Rabi cropping season is from October-March (winter). The crops grown between March and June are summer crops. The kharif crops include rice, maize, sorghum, pearl millet, finger millet, pigeon pea, soya bean, groundnut, cotton etc. The rabi crops include wheat, barley, oats, chickpea, linseed, mustard etc.

[7] Singh, V and Majumdar, K. (2012). Nutrient response and economics of nutrient use in pearl millet under semi-arid conditions. Better Crops South Asia, 6 (1), 22-24.

[8] Majumdar, K. and Govil, V. (2013). Potassium response and fertilizer application economics in oilseeds and pulses in India. Better Crops South Asia, 7(1), 23-25.

physical and biological soil properties. Majumdar and Govil (2013) reported the K response in oilseeds ranged from 3.7 to 10.4 kg of grain per kg of applied K_2O and indicated RoI on fertilizer K in oilseeds was INR 3.5 to 9.8 per rupee invested on potassium[9]. The lower RoI reported here are – at least partly – attributed to the sub-optimal crop management associated with adhering to the recommendations issued by the State Department of Agriculture.

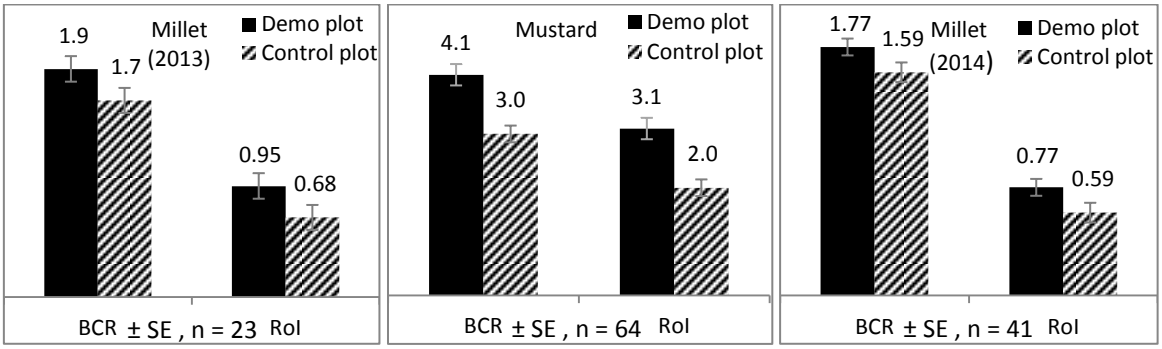

Fig. 2: Impact of improved PoP on benefit-cost ration (BCR) and return on investment (RoI) of millet and mustard production in different seasons as compared to control (farmer's practice). For details on input data, see Table 2.

It is interesting to note that the improved PoP were not necessarily associated with higher costs of production. In fact, input costs of improved PoP for millet were less costly than farmer's practice, and only marginally increased in case of mustard (Table 2). Obviously, the widely indicated notion that the overall slow pace of adoption of improved practices by the farmers in general is attributed to higher input costs in association with limited financial capacity of the farming households cannot be sustained by the data presented. The BCR and RoI are also highly favourable for putting improved PoP into use (Fig. 2). With reference to the present study it is tempting to speculate that the adoption of improved PoP is merely hampered by limited awareness of farmers for improved agricultural technologies, limited availability of suitable training and lack of adequate educational material. Indeed, before the initiators of this project got involved, women farmers expressed limited awareness of soil testing procedures[5], and were unaware of recommendations issued by the State Department of Agriculture. This clearly indicates that the agricultural extension services offered by various organisations got to be improved in order to 'bridge the last mile gap'.

Conclusions and Outlook

More than 1,000 women are benefitted with the project. Women farmers' knowledge regarding appropriate use of fertilizers, micronutrients, seed and pesticides has increased substantially. On average yield across both crops and seasons was increased by 35% with the appropriate use of PoP, providing additional income per hectare of about INR 6,436 for millet and INR 14,066 for mustard. The BCR and RoI of the improved PoP have shown its effectiveness in terms of economic viability. The creation of sustainability funds increases women farmers' self-confidence. Also, the knowledge with Krishi Sakhi is an intangible aspect as it will remain in the village and continue to support projects targeting increased adoption of new technologies. This aspect becomes even more important as the economics of production would support the adoption of improved agricultural technologies, putting even more emphasis on the need for adequate, target-oriented extension work. The project in the long-run has the potential to bring positive socio-economic changes in the lives of women farmers.

Acknowledgement

The authors thank Pawan Kumar, Sehgal Foundation and Pramod K. Saini, K+S Fertilizers (India) Pvt. Ltd. for their excellent field work for executing Unnat Krishi project.

[9]Singh, M and Wanjari, R.H. (2013). Balanced nutrient management – a key to sustain productivity and soil health on long term basis. Indian J. Fert. 9(12), 72-81.