Golden wheat becomes more Golden

Extending SRI to wheat

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People's Science Institute carried out the first trials of the System of Wheat Intensification (SWI) during rabi 2006-07. Starting with systematic research trials on farmers' fields, SWI practice has now spread to many Indian states, through the efforts of PSI and other voluntary organizations.

Paras Ram, a poor farmer of Dhargod Balli village in Hamirpur district in Himachal Pradesh, agreed to experiment with the System of Wheat Intensification (SWI) on 5 *kanals* (2000 sq.m.) of land during the *rabi* 2011-12 season. The results astounded him and his fellow farmers. He harvested 980 kg of grain from the land which had till then never yielded more than 640 kg. *"That year I purchased only 300 kg of wheat from the market to meet my family's need, as against annual purchases of 600 kg earlier,"* says Paras Ram. In the current *rabi* season, he has decided to double the area under SWI to 10 *kanals*, from which he expects to obtain as much grain as he earlier obtained by broadcasting seeds over 15 *kanals*. *"Now I can spend more time driving a taxi and enhance my income,"* he adds smilingly. It is not just Paras Ram, but many farmers like him are adopting SWI.

From SRI to SWI

Small farm holdings and low productivities of mountain farms in Himachal Pradesh and Uttarakhand, force most rural families to purchase substantial food grains from the market. Since rice and wheat are the staple food in the mountains, enhancing their productivity is a prime need. In 2006, People's Science Institute (PSI), a non-profit public interest research and development support organization based in Dehradun, identified the System of Rice Intensification (SRI) as a potential method for enhancing food and livelihood security in these mountain states. Farm trials with paddy in the 2006 *kharif* season demonstrated that SRI could be a cost-effective method of enhancing grain yields and straw volumes. The much higher SRI crop's stalk volume provided more fodder for cattle leading to increased milk production and increased farm yard manure for fertilizing fields. Inspired by this success of SRI

Farmers are adopting SRI in wheat and harvesting better yields

Table 1: SWI Grain and Straw Yields through different Sowing Methods

Parameter	Conventional Method/ Broadcasting	Line Sowing with Seed Drill	Line Sowing behind Plough	SWI -1		SWI-2	
Line Spacing (cm)		25	25	25 x 25		20 x 20	
Seed Spacing (cm)				25 x 25		20 x 20	
No. of seeds/hill				1	2	1	2
No. of Tillers/Plant	2	4	1	9	11	11	8
Avg. Plant Height (cm)	63	66	67	71	67	68	67
Avg. Ear Length (cm)	8.8	9.2	8.4	11.2	11	11.8	10.8
Avg. No .of grain/ear	45	49	48	62	59	65	53
Grain Yield (t/ha)	2.0	3.5	3.0	4.4	4.2	5.3	5.0
Straw Yield (t/ha)	3.0	4.8	3.8	8.0	6.7	8.0	6.7

demonstrations, PSI decided to apply SRI principles to wheat and termed it as the System of Wheat Intensification (SWI).

The first trial on SWI was carried out by PSI during *rabi* 2006-07 on its own campus land in Dehradun. Two varieties of wheat, HD-2329 and PBW-396, were sown at different row-to-row and plant-to-plant spacings. Only a single seed was sown at marked intervals and irrigation was provided twice. Weeding was done after 30 and 45 days along with the application of *Panchgavya* (a liquid organic manure prepared from a mixture of five cattle products, i.e., milk, yoghurt, clarified butter, urine and dung). The performance of the SWI plants on the research plots was closely monitored against that of wheat grown by the locally practiced broadcasting method.

The average grain yield of HD 2329 increased by 35 per cent from 1700 kg/ha on the conventional plots to 2300 kg/ha on the SWI plots. The average PBW 396 yield increased about 67 per cent. Straw yields on the SWI plots also increased by 10 to 30 per cent as compared to the conventional method plots. *"PSI's experiments and adaptations of SWI in Dehradun are the first documented trials of SWI methods,"* says Prof. Norman Uphoff of Cornell University, who has been tracking the diffusion of SRI knowledge and practice in over 50 countries.

SWI increased crop production while enhancing the intrinsic productivity of the land, with minimum use of external inputs. Healthy roots and more productive plants were ensured. Systematic sowing of seeds at fixed spacing, compared to the conventional broadcasting method saved 60-70 per cent seed requirement, and also reduced competition among the plants. Adequate availability of sunlight, water, nutrients and proper aeration lead to good tillering and higher production. These results motivated PSI to promote SWI in Uttarakhand and Himachal Pradesh.

Research to supplement adoption

SWI harvests routinely show increases of 80 to 100 percent grain yields compared to the conventional irrigated wheat crop. Even under rainfed conditions, the average SWI yields have increased by 50 to 70 per cent. To promote it in a more systematic and scientific way, PSI started systematic research trials on farmers' fields to explore different options under different conditions. These included (a) direct seed sowing maintaining both seed to seed and row to row spacing, (b) line sowing maintaining only row to row spacing, and (c) transplanting of 15-20 days' old seedlings at different spacings under irrigated conditions. These trials show that maximum grain production from an SWI crop requires keeping a row to row and seed to seed spacing of 20cm with one seed per hill.

PSI has developed prototype single and double row seed drills along with an SWI weeder which have had a mixed response from farmers. Keeping in mind their diverse requirements and for maintaining the soil nutrient status, the Institute is also experimenting with intercropping of wheat with different pulses like gram and lentils.

Spreading SWI

The scaling up operation of SWI in the two mountain states of Uttarakhand and Himachal Pradesh was done through a network of local voluntary organizations. It trained their personnel and other progressive farmers as Master Trainers and experienced local farmers as village level resource persons. From 50 farmers practising SWI on an area of only 0.3 ha in 2007, more than 12,000 farmers experimented with it on 556 ha in 2011-12.

Mountain farmers have experimented and adapted SWI in different ways. Few maintain both seed to seed and row to row spacing during seed sowing, whereas most adhere to just line sowing. Farmers prefer sowing of two seeds per hill against a single seed. They have innovated different ways of marking, weeding and manuring fields. They have realized that SWI requires time bound operations like sowing, weeding, water management, etc. for better results. All these are labour-intensive operations, especially in the absence of a seed drill. In spite of higher labour inputs in sowing and weeding, farmers have expressed immense satisfaction with the much higher SWI grain and straw yields. Farmers also appreciate other benefits like low seed requirement, savings in

> The scaling up model of mobilizing a network of local voluntary organisations and creating a pool of trained personnel in the villages has proved to be successful.

water use, less use of chemicals and improved soil quality and health.

Since 2010, PSI has also promoted SWI in Bundelkhand where within two years the number of farmers increased to 1015 with area coverage of 48 ha. The response in the Central Highlands has been more encouraging as the availability of farm labour for timely operations is not a constraint as in the Western Himalaya region.

The scaling up was made possible by establishing linkages with local voluntary organizations, the state agriculture departments and their officials, Krishi Vigyan Kendras (KVKs), agriculture universities and research institutes in the two states. *"PSI's approach of mobilizing a network of local VOs and creating a pool of trained personnel in the villages is a model for scaling up the cultivation of crops by using SRI principles,"* says Bishwanath Sinha, Senior Program Officer at Sir Dorabji Tata Trust which invested over Rs 30 crores between 2006 and 2010 to promote SRI practices throughout India.

Way forward

SWI practice has now spread to many states in India, especially, to Bihar, Chattisgarh, Madhya Pradesh, Orissa, Punjab, and Uttar Pradesh. While PSI is committed to further popularizing the SWI technique for greater food security among farming families in the Western Himalaya and Central Highlands regions of India, it is also well aware of the constraints. Limitations like lack of seed drills to ensure fixed spacing of seeds, lack of farmers' access to quality weeders, non-availability of water under rainfed conditions and insufficient capacities in farmers to adopt SWI, need to be addressed on priority. Also, the experiences of SWI farmers across the country, need to be shared more effectively to help formulate better strategies for upscaling SWI in the different agro-climatic regions of the country.

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