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Swarna Sub-1 as a Suitable Climate Resilient Variety : A Boon for Increasing Paddy Productivity in Flood Prone Areas

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Abstract

Flash flood or submergence is a frequent incident in Paddy growing rainfed lowland areas in Barak Valley Zone of Assam, causing wide extends of damage to paddy crop growing during *kharif*. Therefore, Krishi Vigyan Kendra, Cachar has introduced submergence tolerant paddy variety Swarna sub-1 through frontline demonstration during *kharif* 2018 and 2019 at different locations in the district. The FLDs include scientific cultivation practices with line transplanting. The field was submerged after transplanting for a period of six days and four days during 2018 and 2019, respectively. The paddy productivity and economic returns under improved technologies were calculated and compared with the prevailing farmers' practice. The results revealed that swarna sub-1 variety under improved practices recorded higher yield of 17.67 and 21.05 per cent during 2018 and 2019 and the recommended practice gave higher net returns of Rs .27,400 and 30,625 per ha and B:C ratio of 1.58:1and 1.65:1, respectively as compared to farmer's practice.

Keywords: Flash floods, Barak valley zone, Submergence tolerant, Variety

Climatic vulnerability in North-East India has already been documented in terms of rainfall variability, including increased frequency of high intensity rains leading to flash flooding, a reduced number of rainy days and occurrence of mid season / terminal dry spells (Chauhan, 2011). The Barak basin receives average rainfall of 3204.6 mm with a standard deviation of 419.6 mm (Chauhan, 2011). Paddy crop holds the key for food security of Assam as well as the country. In Assam, presently the crop is grown on 2.43 million hectare areas with a production of 5.28 million tones (Deka *et al.,* 2013). Mostly the farmers of this region are going for cultivation of medium to long duration (140-160 days) Paddy varieties as rainfed crop. Among the various submergence tolerant Paddy varieties, *Swarna Sub-1* (Parent variety: Swarna*3/ IR 49830-7-1-2-2) has submergence tolerance up to two weeks. This variety is widely grown in flood prone ecologies of Odisha, West Bengal, Bihar, Assam and other eastern states of India (DE&S, 2018). Keeping this in view, Krishi Vigyan Kendra, Cachar has taken up frontline demonstrations to introduce and popularize Swarna sub-1 variety of paddy in the prevailing low-lying rainfed Paddy growing areas of the district.

Material and Methods

Frontline demonstrations (FLDs) in submergence tolerant paddy variety *Swarna Sub-1* were conducted during *kharif* 2018 and 2019 by Krishi Vigyan Kendra, Cachar at the farmers' fields in different locations. Total 33 frontline demonstrations were conducted in the selected villages by covering 12 ha of area. The seed was procured from Regional Agricultural Research Station, Titabar, Assam Agricultural University and National Seed Corporation, Guwahati for demonstration purpose. The whole package approach demonstrated to farmers through FLDs included components such as improved variety, line transplanting, recommended seed rate, seed treatment, weed and water management, fertilizers and plant protection measures (Table 1). In the demonstration plots, critical inputs in the form of certified seed of *Swarna Sub-1*, chemical fertilizers and plant protection chemicals were provided to the farmers. In the case of local check plots, farmers have adopted their traditional practices. The Subject Matter Specialists from KVK facilitated the participating farmers in performing proper field operations like timely sowing at nursery bed and transplanting in the

TABLE 1

Improved practices and farmers practices of paddy under FLD

Technology	Improved practice	Farmer's practice	GAP (%)
Variety	*Swarna Sub -1* (HYV)	*Balam* (Traditional)	100
Land preparation	Ploughing, Harrowing and puddling	Ploughing, Harrowing and puddling	50
Seed rate	40 Kg/ha	60 Kg/ha	50
Seed treatment	Carbendazim @ 2.5 g/kg of seed	No Application	100
Transplanting method	Line transplanting	Random transplanting	100
Herbicide application	Pretilachlor @ 0.75 kg/ha	No Application	100
Fertilizer dose	60-20-40 (N-P_2O_5-K_2O)	Indiscriminate application	50
Plant protection	IPM	Indiscriminate application	50

main field, application of balanced fertilizers, spraying of herbicides/plant protection chemicals and harvesting. Various extension activities like farmers' trainings, diagnostic visits, field days, etc. were carried out during the crop-growing period for the benefits of the farmers. Crop yield data were recorded by twenty-five-meter square observation method randomly from three to four places from an FLD plot. The yield data was collected from both the demonstrations and farmers' fields and analyzed using simple statistical tools. The technology gap, extension gap and technology indexes (PoP, 2019) were calculated using the following equation:

Technological Gap: Potential yield – demonstration yield

Extension Gap: Demonstration yield – yield under farmer practice

Technology index (%): (Potential yield - demonstration yield / potential yield) x 100

TABLE 2

Grain yield performances of FLDs and farmers practice

Year	No. of Demons-trations	Area (ha)	Demo yield (q/ha)	Farmers' practice (q/ha)	Yield increase (%)
2018	6	2.00	49.60	42.15	17.67
2019	27	10.00	51.75	42.75	21.05
Mean	16.5	6.00	50.68	42.45	19.36

RESULTS AND DISCUSSION

The selection of suitable crop varieties also comes under good agronomic practices, which can eliminate chances of biotic and abiotic stress (Samui *et al.,* 2000). Paddy yield recorded under demonstration was 49.60 and 51.75 q/ha during *kharif* 2018 and 2019, respectively (Table 2). Even though, after transplanting the crop was submerged in the early stage for a period of six days andfour days during 2018 and 2019, respectively, the yield enhancement due to the improved practices was to the height of 17.67 and 21.05 per cent over farmers' practice.

Extension gap of 7.45 q/ha and 9.00 q/ha was observed during *kharif* 2018 and 2019, respectively. It implies the need to bringing consciousness among the farmers for adoption of submergence tolerant varieties along

TABLE 3

Yield attributes of paddy under FLD and farmers' practice

Yield attributes	Demons-tration	Farmers' practice
Avg. plant Height	113 cm	122 cm
Avg. no. of effective tillers/ hill	18	15
Avg. length of panicle	24 cm	20.5 cm
Avg. no. of total grains/panicle	209	188
Avg. no. of filled grain/panicle	191	162
Avg. days to 50% flowering	128 days	122 days

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TABLE 4

Economical comparison of paddy cultivation between FLD and farmers' practice

Year	Demonstration				Farmers' practice				% increase in Net return
	Gross cost (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C ratio	Gross cost (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C ratio	
2018	47000	74400	27400	1.58	44500	63225	18725	1.42	46.33
2019	47000	77625	30625	1.65	44500	64125	19625	1.44	56.05

with improved production technologies and to revert the inclination of wide extension gap.

A technological gap between the improved technology and farmers' practice of 10.40 and 8.25 q/ha during *kharif* 2018 and 2019, respectively has been observed. Difference in soil fertility status and agricultural practices can be the major factors for such a deviation and may be rectified by following better management practices.

The technology index indicates the feasibility of the evolved technology at the farmers' fields. Lower the values of technology index more is the feasibility of the technology demonstrated (Singh *et al.,* 2012). The technology index in this study was 17.33 and 13.75 per cent showing the effectiveness of the technical interventions. The feasibility of the technology demonstrated has been well indicated by reduction in the technology index from 17.33 per cent in the first year to 13.75 per cent in the second year (Table 5).

The economical aspect of the improved technology indicates that the cost of production in FLD was higher than that of the local practice (Table 4). A net return of Rs.18,725 and Rs.19,625 was achieved in the farmers' practice, while improved technology fetched a higher net return of Rs.27,400 and Rs.30,625 per ha, which is 46.33 and 56.05 per cent higher than the existing farmers' practice. A similar pattern has been observed in B:C ratio which is 1.58 and 1.65 during both the years in improved technology as compared to 1.42 and 1.44 under farmers' practice. A higher net return of Rs.27,400 and Rs.30,625 per ha was recorded

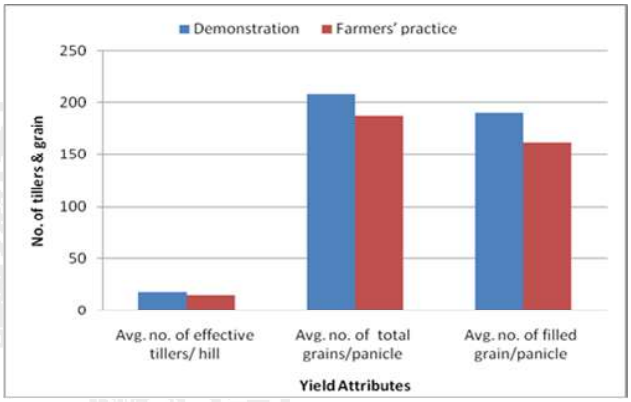

Fig. 1 : Comparison of yield attributes of *Swarna Sub-1*

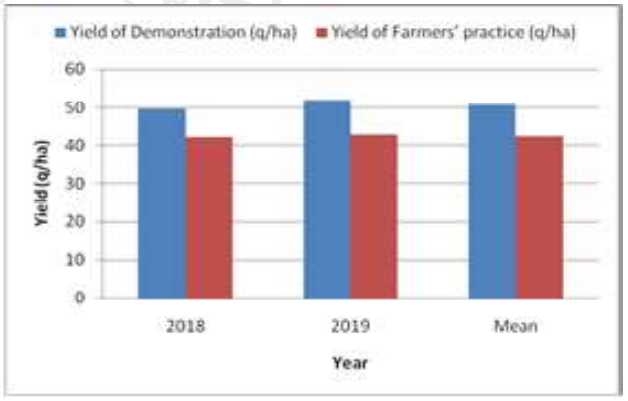

Fig. 2 : Yield performance of demonstration and farmers' practice of 2018 & 2019

during both the years as compared to Rs.18,725 and Rs.19,625 achieved as net returns in the farmers' practice. The benefit-cost ratio of paddy cultivation under improved cultivation practices was 1.58 and 1.65 during both the years as compared to 1.42 and 1.44 under farmers' practice. This may be due to higher yield obtained under improved technologies as compared to farmer's practice.

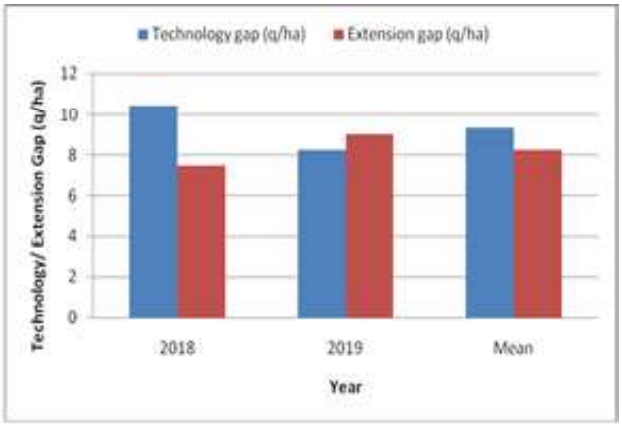

Fig. 3 : Technology gap and extension gap of 2018 & 2019

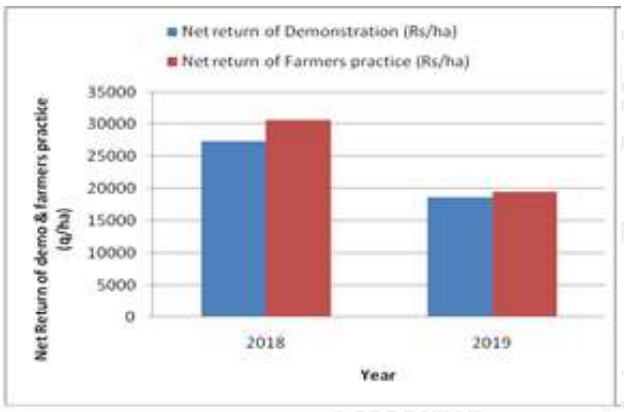

Fig. 4 : Comparative net return of demo and farmers' practice during 2018 & 2019

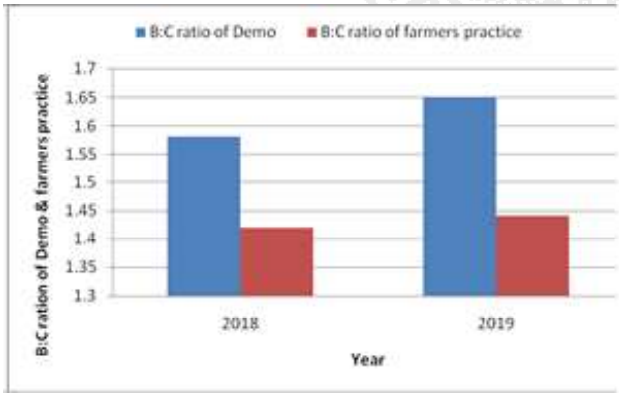

Fig. 5 : Comparative B:C ratio of demo and farmers' practice during 2018 & 2019

The yield attributes of improved technology indicates that the average plant height and average length of panicle were 113 cm and 24 cm against 122 cm and 20.5 cm in farmers' practice. It revealed that plant height is more in case of farmers practice as compared to demonstration. Further, average number of effective tillers/ hills, average number of total grains/panicle and average number of filled grain/panicle were 18, 209 and 191 in improved technology and 15, 188 and 162 in farmers' practice, respectively. It revealed that average no. of effective tillers / hill, average no. of total grains / panicle and average no. of filled grain / panicle were more than that of farmer's practice. On further observation it was found that *Swarna sub-1* required 128 days to attain the stage of 50 per cent flowering while the farmer's variety *Balam* required 122 days.

Table 5

Impact of paddy var. Swarna sub-1 on technology gap, extension gap and technological index under FLDs

Year	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)
2018	10.4	7.45	17.33
2019	8.25	9.00	13.75
Mean	9.33	8.23	15.54

The productivity gain under frontline demonstration over existing practices of paddy cultivation created greater awareness and motivated the other farmers to adopt suitable production technology of submergence tolerant paddy in the district. This variety of paddy (*Swarna sub-1*) gained a momentum in upscaling the paddy productivity, which created a positive impact on farming community.

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