

Performance of Flood Tolerant Rice Variety (Swarna Sub-1) in Different Submergence Areas of Bihar

Ashok K. Singh¹ and J. P. Singh²

ABSTRACT

On one hand, continued depletion of natural resources, persistent technological stagnation and climate change are posing serious threat to agriculture, while on the other side, vast potential area of submergence and flood-prone, are lying under exploited. The recent strategy for reducing poverty and hunger through enhancing food security and improving livelihood of farm families lies on the development and dissemination of high yielding varieties that are flood tolerant. In this regard, International Rice Research Institute (IRRI) with collaboration of NARES partners has made considerable progress to develop certain rice varieties, which are found flood resistant. Out of which SWARNA SUB-1 is most promising rice variety, which has shown excellent results on farmer's field under flash flood condition of eastern India. The present paper examines the importance of the situation in details with reference to Bihar state and highlighted the performance of this variety along with the farmer's perception in different submergence areas of the State. Based on experience and lesson learnt, there is an urgent need to develop appropriate farmer's centered seed production and delivery mechanism strategy for rapid and targeted dissemination of this variety among the resource poor farmers who are residing in flood-prone, condition of South Asia.

Keywords: Rice, cultivars, cooperation.

INTRODUCTION

The demand for rice has now increased drastically throughout the world with rapid growth of population. The rice is grown globally on about 150 million hectares of land, with an annual production of 600 million tonnes. It is staple food for more than half of the world population, and its production is a major source of income and livelihood for millions of people across the world. In Asia alone, where nearly 90 per cent of the world's rice is produced and consumed, more than 2 billion people obtain 60 per cent to 70 per cent of their energy intake from rice and with its several products.

The flooding affects about 15-20 million hectares of rice in Asia every year. In India, about 16.1 million hectares of rainfed low land rice are grown each year out of which 4.4 million hectares are highly submergence-prone due to flash flood of different sources. In Bangladesh, out of 2.65 million hectares of flash-flood-prone areas, approximately 1.6 million hectares are inundated almost every year. In addition, submergence might occur in shallow rainfed and irrigated lowlands and as per an estimate about 12 million hectares are flash-flood-prone in South Asia. The average rice productivity of submergence-prone areas in eastern India is 0.5-to 0.8-t/ha *vis-à-vis* 2.0 t/ha for favourable lowlands. Therefore, the incidence and severity of poverty in these areas are very high as farmers residing in these areas often found to suffer from various economic, social and political

disadvantages due to flood situation. In this background, the International Rice Research Institute has made considerable progress in developing certain rice varieties with increased tolerance of submergence. The submergence-tolerance gene SUB-I was identified, fine-mapped and transferred into several ruling mega-varieties of rice in South Asia such as Swarna (MTU-7029), Samba Mahsuri (BPT 5204), IR64, CR1009, and BR11 using marker-assisted backcross (MABC) approaches to conventional plant breeding. These varieties are being widely evaluated both in farmers' fields as well as on research stations trials through the project Stress-Tolerant Rice for Africa and South Asia (STRASA) funded by the Bill & Melinda Gates Foundation. They have shown excellent promising results on farmers' fields in India, Bangladesh and Nepal under flash-flood conditions even up to 15 to 17 days of complete submergence.

Rationale of performance assessment

The state of Bihar falls in the Middle-Gangetic Plains region and it is divided into three Agro-Ecological Zones. The agriculture is the lifeline of Bihar state, being blessed with rich soil, adequate rainfall and good ground water availability. However, the full agricultural potential of Bihar is yet to be exploited. With regard to rice environment, the state of Bihar can be classified into three regions; South Bihar Plateau, South Bihar Plains and North Bihar (Fig. 1). The South Bihar plateau is mostly rainfed. Due to climate vagaries, rice crop of this region often faces drought spell at tillering/ reproductive phase

¹ Professor of Extension Education, R.A.U. Pusa (Samastipur) 848 125. ² Senior Scientist, Agronomy, RAU, Pusa (Samastipur)-848125, Bihar

of rice crop. South Bihar Plains is irrigated through Sone-Command.



Fig:1; Rice environment of Bihar state

It is potential region for introduction of HYVs and hybrid rice for better yield. The region of North Bihar is flood prone having low-lying areas with acute submergence problems. The floods have been the perennial features of this region causing immense damage to crops, infrastructure and human every year. The National Commission on Flood identified Bihar as the most flood prone state in India as out of total flood affected population of the country, 56.5 per cent reside in Bihar state only. The total flood prone area in the state is about 68.80 lakh ha which constitutes 17 per cent of the total flood affected area of the country.

During the year 2008, International Rice Research Institute (IRRI) with the assistance of Bill & Melinda Gates Foundation (BMGF) has initiated a noble attempt to enhance the rice productivity in Africa and South Asia with the different stress tolerant rice varieties in submerged, draught and salinity effected areas for improving the food livelihood security of resource poor farm families living under stressful situation. In this endeavour, Rajendra Agricultural University, Bihar, Pusa is also identified as an active partner.

METHODOLOGY

In order to assess the performance of Swarna Sub-1, a flood tolerant rice variety, an attempts was made to demonstrate the potential of this variety on farmer's field in different location of flood prone regions of North Bihar. For the purpose, data pertaining to the submergence area using the GIS and remote sensing given by IRRI was used followed by physical verification made through site visits of the scientists. Accordingly, demonstration plots to the

tune of 100 hectares were selected in cluster in each identified districts namely Samastipur, Muzaffarpur, Darbhanga, Sitamarhi and West-Champaran, covering approximate total area of 500 hectares. The concerned areas have many important rivers which originate either from Nepal or from other eastern part of the country along with abandoned river courses which often damage the crop of larger area effecting the life of millions of poor farmers. A total 800 farmers participated during the demonstrations under the project. In order to make the demonstrations successful only progressive farmers were selected from each of cluster, keeping in view their willingness and cooperation.

In the meantime, with the reinforcement of project activities, RAU, Pusa has released this Swarna Sub-1 rice variety through its 68th Research Council Meeting with its recommendation to adopt this variety in the flood-prone submergence region of the state. Since then Rajendra Agricultural University, Pusa and Bihar Rajya Beej Nigam, Patna started to produce breeder and foundation seeds of Swarna Sub-1 for wider coverage of this variety and replacement of Swarna (MTU-7029) and other local cultivars which are being grown by the farmers on traditional basis under their existing cropping system. The other registered seed producing agencies have also entered in this seed chain as per the requirement of farmers of the state.

SALIENT FINDINGS

The salient findings emerging out through the project endeavour are presented in Table 1.

Table 1: Potential of Swarna Sub-1 against the local cultivars. n=800

Panchayat/District	Local cultivar (Average yield)	Intervention	Average yield (q/ha)
Ladaura (Samastipur)	BPT5204/Sonam (35-40 q/ha)	Swarna Sub-1	45.8
Chaumukh (Muzaffarpur)	Kalamsar/Deosaria (25-35 q/ha)	Swarna Sub-1	44.6
Jale (Darbhanga)	Kalamdoot/Kalma/Loharjang/Lohsar (25-40 q/ha)	Swarna Sub-1	48.2
Tilaktajpur (Sitamarhi) (in the basin of Bagmati river)	Kharihan (Karma)/Bharsar Ramshar/Harincane/Kusum Katki (20-25 q/ha)	Swarna Sub-1	43.8
(Samhota, Somgarh and Semri Khajuria) West Champaran	MTU 7029 (35-40 q/ha)	Swarna Sub-1	52.7

The findings contained in Table 1 indicated that farmers of the selected districts were involved in cultivation of local rice varieties in the past. Even in the district of West-Champaran, they were found to cultivate MTU 7029, but their crops were often damaged due to recurrent floods in their areas. With the introduction of Swarna Sub-1 (flood resistant variety), the extent of crop damage was checked and the farmers could harvest better yield of their rice crop. The farmers also reported other

merits of Swarna Sub-1, which is described under the heading of farmer's perception and feedback.

FARMER'S PERCEPTION & FEEDBACK

The qualitative responses were recorded from the participating farmers with respect to the advantages of Swarna Sub-1 rice variety over the local cultivars. The feedback of the farmers. (a) Swarna Sub-1 variety possesses greater degree of flood resistance ability and capacity as compared to local cultivars. (b) It is more suitable in flood-prone areas located under the basin of rivers especially for the areas lying under the river's bund of the state. (c) Swarna Sub-1 reduces the risk and uncertainty of crop as it rejuvenates after receding of water from the field. The traditional varieties were often damaged due to recurrent floods. (d) It gives higher yield and is less susceptible to the diseases and pests. (e) The entire crop of Swarna Sub-1 matures in the field at one time, while there is variation in maturity with respect to existing local cultivars. (f) The lodging problem was found to be less in Swarna Sub-1 as compared to other varieties of rice grown. (g) Swarna Sub-1 is found to be more attractive due to its colour as compared to even MTU 7029. (h) The by-product of Swarna Sub-1 (Rice & Cheura) which are common food of this region, were found to be better of quality as compared to the by-product of other local cultivars. (i) The quality of Swarna Sub-1 cooked rice was reported better by the participating women farmers because it remains afresh and soft up to two days while the cooked rice of local cultivars do not possess this attribute.

CONCLUSION

As poverty and hunger are rampant in the flood hit areas, the prime goal is to evolve strategies by which yield advantage can be given to the farmers who resides under flooding-submergence regions. Although, various rice varieties are being cultivated in millions of hectares of land under the flood-prone regions of South Asia yet, there is urgent need to evolve the suitable location-specific extension strategies to acceleration adoption of flood resistant varieties. The traditional rice varieties, which are intolerant to floods, need to be replaced by flood-tolerant rice varieties through of rapid dissemination of seeds and suitable crop presentation technologies for enhancing rice productivity.

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