Evaluation of Improved Kalanamak Rice Technology: Accelerating adoption and stabilizing productivity in Eastern Uttar Pradesh

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Uttar Pradesh has been the home of some of the finest quality scented rices. While the long-grained Basmati rice is grown in Western U.P. and Uttranchal, the small and medium grained scented rices are distributed all over U.P. Due to the quest for high yielding varieties, beginning in the mid-sixties, a large number of small and medium grained scented rice varieties, slowly vanished from the farmers' fields. For example, only a few years back, U .P. had as many as 40 well-known scented rice varieties, but today, one finds not more than 3 or 4. In the absence of any systematic breeding work and seed production program, most varieties found on the farmers' fields show a high degree of admixture, so much so that the varieties are on the verge of losing their identity (Singh R.K.et. al. 2003).

A new initiative for the improvement of non-Basmati scented rices was launched in 1997 under an IRRI-GBPUAT collaborative program. The emphasis of the program was more on collection, characterization and pure line selections of some prominent varieties of Kalanamak, Hansraj, Tilakchandan and Tapovan basmati. In this paper, some of the achievements on kalanamak work and their evaluation are discussed in detail.

Kalanamak rice area has declined: Kalanamak vs Mahsuri

For ages, kalanamak occupied a prime position among the rice varieties in eastern Uttar Pradesh. Its cultivation is localized in the Tarai area adjoining Nepal particularly in the districts of Siddharthnagar, Santkabirnagar and Basti (Fig. 1) and in small pockets in districts Gorakhpur, Mahrajganj, Balrampur, Gonda, Bahraich, Shrawasti, Deoria and Padrauna (North Eastern Plain Zone of eastern UP). In eastern Uttar Pradesh, it is cooked in honor of guests and/or given as a gift. Its cooking at marriage is considered auspicious and its smoke is believed to purify the atmosphere. No wonder its name also appears in old Indian history.

Although there is no official record, extensive discussion with farmers of its native area of cultivation revealed that kalanamak used to be the most popular variety in this area until the 1970s. Even during the 1990s, statistics show that kalanamak was grown on more than 8 % of the rice area in Siddharthanagar alone. However, the area even in this district has now come down to less than 1% (Table-1). There were several factors responsible for the rapid decline in cultivation of this variety. With the advent of high yielding varieties, first the Mahsuri and Malasia and subsequently Swarna and Samba mahsuri, the farmers started fast replacing Kalanamak, particularly because of its low and unstable yields. The critical production environment (favorable rain fed lowland) that was well suited to kalanamak also provided an ideal situation for the Mahsuri group of rice varieties. Because of yield advantages, the inclusion of these varieties on farms enhanced farmers' gross income (Fig.2). Thus the area under these varieties increased and kalanamak decreased. The area income relationship became negative for kalanamak, while it was the reverse for Mahsuri (Singh H.N. et.al 2005). In farmers' fields, productivity ranged between 1.2 to 1.7 t/ha. In the absence of any systematic breeding program and disorganized seed production (100 % farmers use their own saved seed), the level of admixtures greatly increased, thus adversely affecting its quality. In addition, a recent shift in the cropping sequence and crop rotation and increased use of chemicals and fertilizers also spoiled the quality of kalanamak to some extent. Blast epidemics in two consecutive years i.e. 1998 and 1999, virtually wiped out kalanamak rice crops in this area. As a result, farmers drastically cut their areas of kalanamak. Neck blast and yellow stem borers are the major pest problems in kalanamak. The lower temperature during flowering accentuates the neck blast incidence. The total absence of a marketing network for procurement, processing and sale in domestic or foreign markets has been the other discouraging factor for kalanamak farmers (Singh et al. 2005).

Efforts towards Kalanamak improvement

Little attempt has been made in the past to improve Kalanamak with respect to quality and/or yield. The germ plasm of Kalanamak were collected and characterized by scientists from INDUAT, Faizabad, and Benaras Hindu University, Varanasi. At Faizabad, the scientists isolated and field evaluated 14 distinct types of Kalanamak, which showed wide variation, but none of them showed any superiority over the check.

In 1997, a systematic program for the improvement of Kalanamak was undertaken jointly by GBPUAT-IRRI. The team collected 41 germ plasm of Kalanamak from the districts of Siddharthnagar, Basti and Gorakhpur of eastern Eastern UP. The germ plasm were purified by single plant selection (SPS) and evaluated for various traits. A wide variation was recorded for most of the traits like plant height, panicle length, grain shape and size and extent of

aroma addition including yield.

Field performance of improved selections:
Interestingly, it was found from the data that a high degree of yield variations prevails among the selections when grown on farmers' fields in Siddharthanagar in 2002 and 2003. Many of these selections gave yields ranging from 2.3 to 3.6 t/ha as against the average yield of 1.5 t/ha for traditional kalanamak in their native area of cultivation (Table-2). Considering the high performances of two selections (3216 & 3131) on normal agronomic management, it was spread over more than 600 hectare in district Siddharthanagar during 2004 (DDA, Agriculture).

Impact of Improved technology in enhancing income and yield stability
In the native area of its evaluation, farmers use two crop establishment methods - Biju and Kalam, a two-step transplanting method. The Biju method is the usual transplanting practice for rice i.e. the raising and uprooting of 25-30 day-old seedlings to be transplanted in well puddled and planked fields with 3-4 seedlings/hill. Kalam is a special method that requires double transplanting, a practice most common for long maturing tall rice varieties, especially in rain fed lowlands areas (Singh HN et.al 2005).

Improved selections of kalanamak were distributed to 47 farmers covering 7.18 ha area in 2002 and to 60 farmers covering 18.84 ha area in 2003 in district Siddharthnagar, which is the native area for the cultivation of kalanamak. The performance of these improved germ plasm was much better than traditional kalanamak during both years. Their average yield varied between 2.3 to 3.6 t/ha against an average yield of 1.5 t/ha in farmers' fields of traditional kalanamak (Table-2).

In an economic analysis of improved selections of kalanamak cultivation using Biju and kalam practice involving 100 farmers, the cultivation of improved selections by the kalam method (double transplanting) was the most profitable with an average net return of Rs 22447.00 per ha over a paid-out cost followed by using Biju method (single transplanting) of cultivation where the return was Rs. 18501.00. The average net return from cultivation of traditional kalanamak by using both methods was only Rs 9250.00/ ha (Table-3).

Yield stability has been one of the major concerns of the kalanamak farmers. It was greatly improved in the case of improved selections when grown using the kalam method. The CV (coefficient of variation) was 10 % followed by improved kalanamak conventionally transplanted (CV 25%), compared to traditional kalanamak (CV 36%). As evident from Fig-3, the coefficient of variation of improved kalanamak was even less than that of the most stabilizing and promising high yielding rice variety of Samba Mahsuri (CV 19%) (Singh RK et al 2005).

No wonder the area under promising selections and new technology is fast increasing. Our survey showed that from about 7.18 ha of improved Kalanamak grown by farmers in Siddharthnagar in 2002, the area increased to 145 ha in 2004. This diffusion, though unrecorded, is also taking place in the neighboring districts of Sant Kabir Nagar, Basti, Gonda, Balrampur, Bahraich, Shrawasti, Gorakhpur, Mahrajganj, Deoria, Kushinagar and bordering districts in Nepal.

Now steps should be taken to get these selections quickly released and promote their cultivation by properly organizing a seed production and distribution program. Tranning needs at farm level in seed health management and production would go a long way to maintaining the purity and quality of these selections.

Recommendations

A forum such as the Indigenous Aromatic Rice Export Development & Promotion Foundation needs to be established. Today such a forum exists only for Basmati viz. the Basmati Export Development Foundation, which largely functions in cohesion with APEDA and inputs from traders. The role of farmers and scientists in such a foundation needs to be significantly increased.

A suitable buy-back arrangement or contract farming mechanism between farmers and the corporate sector has to be put in place. Such an arrangement should involve the government and NGO's as facilitators. An awareness campaign regarding opportunities in the trade of indigenous scented rices will have to be carried out. Short and medium grain scented rices should be promoted on similar lines as basmati with emphasis on bond promotion and a clear vision of a supply chain. As the export of Basmati rice has been static over the past few years and the non-basmati rice trade has shown a downslide, non-Basmati aromatic rices could be substituted to maintain the level of export earnings. Also farmers growing these rices would benefit if these were promoted.

Farmers cultivating indigenous rices are, by and large, smallholders, poor and highly vulnerable to market risks. The government should work out some kind of price support mechanism and also provide subsidies as incentives to farmers cultivating these rices. A mechanism for bringing farmers, traders, policy makers and scientists together for better co--operation and synergy needs to be evolved. Even

public sector research institutions such as NDUAT, GBPUAT and SRBBPUAT should work in tandem with the IARI, sharing their knowledge, research goals and strategies as well as breeding materials, but at the same time keeping an eco-regional focus on varietal improvement and its diffusion among growers.

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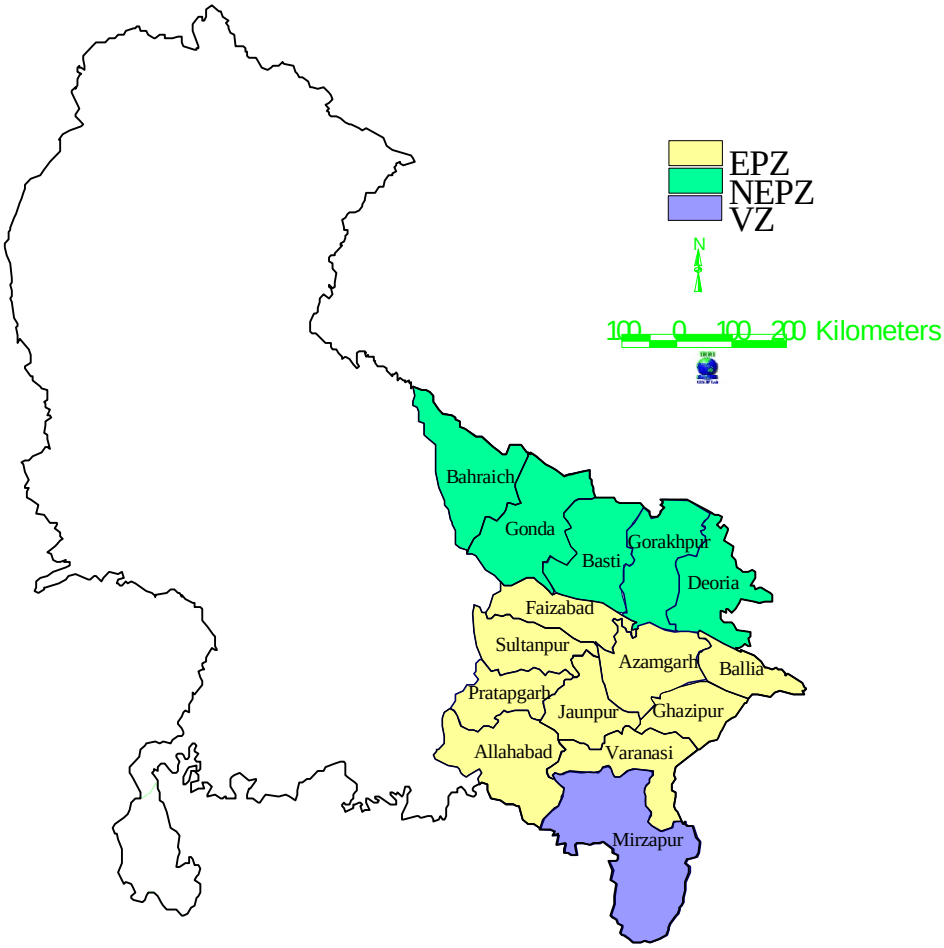

Fig. 1 Agro-ecological zones of Eastern UP.

Table 1: Extent of rice varietal diversity in Siddharthnagar-2001-03

Varieteis	Share in Percentage	Days of maturity	Yield (qtls/ha)
MV			
Mahsuri	1	150	25
NDR-97	5	90	29
Samba Mahsuri	63	145	35
Swarna	3	150	40
Basmati	3	145	20
Sarjoo-52	8	135	31
Pant-10	3	115	30
Hybrid	1	135	38
Sub-total	**86**		
TV			
Sarya	1	95	22
Oriswa	3	120	26
Kalanamak	<1	160	15
Bengalia	2	100	29
Malasia	7	140	27
Sub-total	**14**		
Total	**100**		**28**

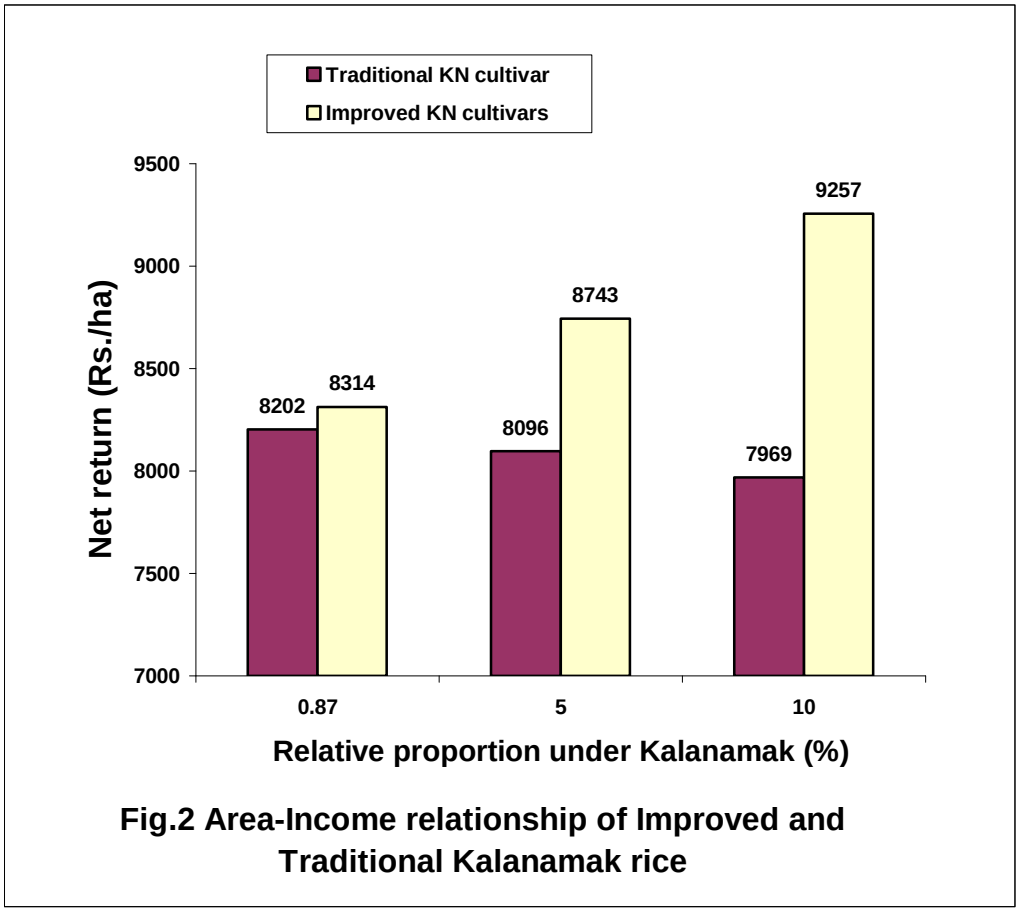

Fig.2 Area-Income relationship of Improved and Traditional Kalanamak rice

Table 2: Mean yield range of Improved kalanamak rice under on-farm diffusion 2002-03

Yield range (qtls/ha)	Designations
32-36 (5)	3131-1(SN), 3119-1(SN), 3216-1(SN), 3120-2(SN), 3120-1(SN)
25-32 (17)	3327(SN), 3215(SN), 3129-1(N), 3114-2(SN), 3119-1(N), 3120-1(SN), 3266(SN), 3319(CH), 3131-1(SN), 3120(N), 3131-2(CH), 3278(SN), 3130(SN), 3131-2(SN), 3131(N)
23-25 (2)	3259(SN), 3327(CH)

Table-3 Comparative costs and returns of Improved and traditional Kalanamak rice by different crop establishment methods in Siddharthnagar, 2001-03 (Rs/ha)

Particulars	Traditional Kalanamak TP	Improved Kalanamak Normal TP	Improved Kalanamak *Kalam*
No of farmers	57	69	31
a. Material cost	2645	2858	3520
b. Labour Cost	2856	3266	4433
Total cost (a+b)	5501	6124	7953
Yield (qtls/ha)	15.13	25.00	30.00
Gross return	11751	24625	30000
Net return over paid-out cost	9250	18501	22447
Cost/qtls	363	245	241
Yield increase over traditional (%)		**65**	**98**

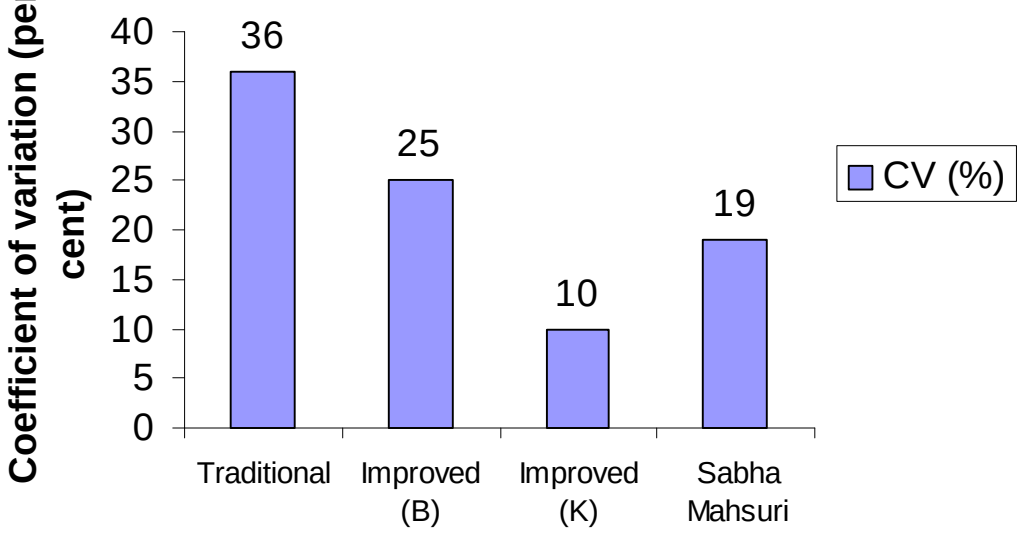

Fig. 3 Plot-level yield variability (%)