KSK 133-A HIGH YIELDING, STIFF STEMMED AND EXTRA LONG GRAIN COARSE RICE VARIETY

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ABSTRACT

A high yielding, stiff stemmed and extra long grain coarse rice variety was developed by crossing KS282 and advance line 4321. It was tested in series of station and national yield trials during 1991-2003 for yield performance reaction to insect pests and diseases and grain quality. It was compared with KS282 in 64 trials. It exceeded KS282 by 7.58% and IR6 by 5.16% in station trials. In national trials i.e. NURYT 1998 and 1999, it out yielded KS282 by 7.77 %. In regional adoptability trials its superiority over local check was 10%. Overall, it had 8.6% and 18% yield edge over KS282 and IR6, respectively. The stem and leaves of KSK 133 remains green at the time of maturity. Therefore, can be used as a green fodder. It had similar response to insect pests and diseases as KS282. The new variety KSK133 is moderately resistant to bakanae / foot rot and paddy blast. In physico-chemical tests conducted at Rice Research Institute, Kala Shah Kaku, head rice recovery and grain length are more than KS282. Its grain is bold so it can not be mixed with any Basmati variety. It was approved for cultivation by Punjab Seed Council, Government of the Punjab and VEC at the Federal level in 2006.

Key words: Rice; variety; breeding, high yielding, Pakistan.

INTRODUCTION

Plant breeding is a continuous process (Poehlman and Borthakur, 1959; Singh et. al., 2000). Society supports plant breeders for only one purpose: to develop more productive varieties for farm use (Jenning et.al., 1979; Hallauer, 1981). Genetic improvement in rice plant made a great contribution to achieving food security in Asia over the last 3 decade (Hossain and Fischer, 1995; Khush, 1995; Hossain, 1996). Human needs for plentiful, rich and cheap food dictate continuous research for new varieties. Several other factors compel changes. The variety complex under goes changes in response to biotic and a biotic compulsions (Rothchild,1996; Singh et. al., 2000; Mann 1999). Rice Research Institute, Kala Shah Kaku is a premier Rice Research Organization. It is actively involved in the development of new Basmati and non-basmati rice varieties that are high yielding, stiff stemmed and possess good cooking and eating quality (Akram et. al., 2006, Ahmad and Akram, 2005). Every year, hundreds of new lines are tested for these attributes in Punjab to meet the food requirements and farm sector welfare (Anonymous, 1996).

KS282 replaced IR6 in 1982 due to its higher yield and earliness. KS 282 remained popular for a long time. Presently, the farmers of non traditional rice area i.e., Jhang, Okara and Pakpattan districts, are demanding a high yielding and stiff stemmed coarse rice variety having better yield and grain quality than KS 282. Keeping this scenario in view, scientists at RRI Kala Shah Kaku put their efforts to develop a high yielding, stiff stemmed and extra long grain rice variety KSK133. It was released for general cultivation by Punjab Seed Council and the VEC in 2006.

MATERIALS AND METHODS

KSK133 with pedigree PK 4154-11-1-1 has been evolved by hybridizing KS 282 and 4321(PK 198-12-3-2-1-1) in 1985 at Rice Research Institute, Kala Shah Kaku (RRI, KSK). KS 282 is a high yielding, early maturing and coarse grain rice variety whereas, 4321 is also high yielding, tall line with excellent cooking quality.

Subsequent segregating generations were handled in a pedigree arrangement. In F_5, progeny of a single panicle was bulked for yield testing disease and quality evaluation. The pedigree method of selection continued with the pedigree No. PK 4154-11-1-1. Then this line was evaluated in observational plots / lines with entry No. 133. It was tested in observational trial, coarse grain yield trials, micro plot yield trials and regional adaptability trials (National Uniform Yield Trials) from 1991 to 2003.

KSK 133 was tested in a series of station yield trials in a randomized complete block design with four replications from 1993 to 2001 (Table 1). The nursery was raised by conventional method i. e., seed soaking (24 hours), Incubation (48 hours) and broadcasting of sprouted seed in the puddled soil / field. The seed rate was 20-22 kg / hectare. The plot size for each treatment was 1.8m x 6.75m. Thirty days old seedlings were transplanted with a plant spacing of 22.5 cm x 22.5 cm. All standard agronomic practices were adopted.

The new variety KSK 133 along with KS 282 was tested for adaptability for four years at different locations in Punjab in a randomized complete block design with four replications (Table 2). National Uniform Rice Yield Trials (NURYT) are conducted by a Federal Organization (PARC) to ensure neutral assessment. NURYT were planted in a randomized block design with three replications. The plots size was 3m x 5 m.

Transplanting date trials were conducted at RRI, Kala Shah Kaku for four years to determine the optimum time of transplanting of this new line as mentioned in Table 4. The experiment was laid out in Randomized complete Block Design with three replications and plot size was 2mx9m. The transplanting dates were i.e. 16/5, 1/6, 16/6, 1/7, 16/7 and 1/8.At harvest individual plot was harvested and threshed at site to record yield. Analysis of each site was done following standard analysis of variance technique (Steel *et al*. (1997). Variety characteristics were recorded during national testing (Anonymous, 1996). Reaction against diseases and insects was recorded both at provincial and federal levels. Quality assessment was made using the standard methods (Dela Cruz and Khush, 2000) by public and private sector.

RESULTS AND DISCUSSION

Yield and adaptability: The results of station yield trials are summarized in Table 1. New variety KS133 gave significantly higher yield than KS282 and IR6 except during 1994 and 1997. On the average of 9 years, KSK133 gave 7.6 % and 5 % higher yield than KS282 and IR6, respectively. In regional adaptability trials the new variety KSK133 produced 5.5 t/ha while the yield of the check variety KS 282 was 5.0 t/ha. In this way KSK 133 gave 10 percent higher yield than check variety on the average of four years (Table 2).

Table 1 Paddy yield (t/ha) of KSK 133 in station yield trials

Year	KSK 133	KS 282	IR 6
1993	5.12^{a}	4.07b	4.87^{a}
1994	4.03^{ns}	4.28	4.01
1995	4.06^{ns}	3.99	3.96
1996	5.56^{ns}	4.65	4.27
1997	4.45^{abc}	4.81^{ab}	4.^{70ab}
1998	3.46^{ns}	3.32	3.74
1999	5.41^{ns}	4.96	5.11
2000	4.65^{ns}	4.05	4.47
2001	5.45^{ns}	5.11	5.02
Average Yield	4.69	4.36	4.46
Percentage increase over check varieties		7.6	+ 5

Table 2 Paddy yield (t/ha) of KSK 133 in regional adoptability trials

Year	Location	Varieties / paddy yield (t/ha)	
		KSK 133	KS282
1997	Farooqabad	4.^{26ns}	3.96
	Gujranwala	4.93^{ns}	4.57
1998	Kala Shah Kaku	4.50^{ns}	4.36
	Farooqabad	4.95^{ns}	4.85
	Faisalabad	6.55^{ns}	5.54
2002	Kala Shah Kaku	5.08^{ns}	4.65
	Chakanwali	6.99^{ns}	6.96
	Gujranwala	6.80^{ns}	6.43
	Shor Kot	4.78^{ns}	4.25
2003	Kala Shah Kaku	5.61^{a}	5.24^{ab}
	Farooqabad	5.62^{a}	5.41^{ab}
	Gujranwala	5.23^{a}	4.88^{ab}
	Faisalabad	6.41^{a}	5.45^{abc}
	Shor Kot	5.54^{a}	4.20^{bc}
	Chakanwali	6.10^{ns}	5.69
	Sialkot	4.79^{a}	3.72^{b}
Average of four years		5.50	5.00
Percentage increase of KSK133 over		-	+ 10%

Table 3 Paddy yield (t/ha) of KSK133 in NURYT during 1998 ND 1999

Year	Location	Varieties / paddy yield (t/ha)	
		KSK133	**KS282**
1998	Kala Shah Kaku	1.95^{ab}	1.72^{ab}
	Pindi Bhattian	4.78^{ab}	4.67^{ab}
	Faisalabad	4.33^{b}	4.03^{c}
	NARC	5.10^{a}	4.68^{ab}
	Dokri	5.33^{bc}	6.60^{a}
	Tandojam	4.51^{a}	3.62 ^{c}
	D.I.Khan	2.83^{b}	2.50^{b}
	Usta Muhammad	2.49^{a}	1.91 ^{b}
1999	Kala Shah Kaku	5.19^{a}	4.59^{abc}
	Pindi Bhattian	5.29^{ab}	5.52^{a}
	Sialkot	5.42^{ab}	5.83^{a}
	Gujranwala	6.79^{a}	5.39^{a}
	Faisalabad	6.21^{b}	6.20^{b}
	Farooqabad	4.33	4.04
	D.I.Khan	6.33^{a}	4.00^{ab}
	Mingora	4.27^{a}	2.75^{b}
	Dokri	7.07	6.73
	Jamra	8.10	8.27
	Tandojam	6.92^{c}	6.19^{b}
	Usta Muhammad	5.36^{a}	5.91^{a}
	Average of two years	5.13	4.76
	Percent increase over	-	+7.77

Results of the National Uniform Yield Trials conducted during 1998 and 1999 are reported in Table-3. The result indicate that KSK133 got the average yield of 5.13 t/ha in comparison with the check variety (KS282). The new variety produced 7.77% higher yield than KS282. KSK 133 produced 6.0 % higher yield than KS 282 in the Punjab locations.

Table 4 Paddy yield (t/ha) of KSK 133 in date of transplanting date trials

Year / Variety	Transplanting dates / paddy yield (t/ha)					
	Ist June	16th June	1st July	16th July	1st August	Average
			1998-1999			
KSK133	-	3.91	3.89	2.88	1.87	3.14
KS282	-	3.31	4.03	2.77	1.87	3.00
IR6	-	2.97	3.83	2.9	1.92	2.91
			1999-2000			
KSK133	4.61	5.56	4.55	4.79	3.71	4.64
KS282	2.83	4.76	4.86	4.28	3.37	4.02
IR6	4.63	4.92	4.73	4.48	3.72	4.50
			2000-2001			
KSK133	5.63	5.74	5.32	4.52	3.82	5.01
KS282	4.38	5.40	4.82	3.24	3.37	4.27
IR6	5.01	5.05	4.71	3.37	3.37	4.30
			2001-2002			
KSK133	4.55	6.12	6.33	5.12	4.68	5.39
KS282	4.44	5.94	5.73	5.06	3.81	5.10
			Average of four years			
KSK133	***4.93***	***5.33***	***5.02***	***4.33***	***3.52***	***4.78***
KS282	***3.88***	***4.85***	***4.86***	***3.84***	***3.11***	***4.36***
IR6	***4.82***	***4.31***	***4.42***	***3.58***	***3.00***	***4.03***

The average of four years YIELD data of KSK133 indicates that the highest yield 5.33 t/ha was obtained from the transplanting of 16June whereas the transplanting of Ist August gave the lowest yield (3.52 t/ha) (Table 4). The data indicate that the maximum yield of KSK133 can be obtained if transplanted during mid June to Ist week of July.

In total, sixty four (64) trials were conducted to compare new variety KSK133 with KS282 and IR6 for yield and adaptability. The over all average of KSK133 was 5.02 t/ha against 4.62 t/ha and 4.25 t/ha of KS282 and IR6 respectively. The new variety KSK 133 gave 8.6% higher yield than commercial variety KS282. Furthermore, it also out yielded IR6 / IR9 by 18.0% (Table 5).

In conclusions, the paddy yield of KSK133 is 8.60 % and 18.0 % higher than KS282 and IR6, respectively. The stem and leaves of KSK 133 remains green till the time of maturity. Therefore, can be used as a green fodder. KSK 133 fits well in the rice-potato and rice-peas and rice-berseem fodder rotation. The quality characteristics like grain length, head rice recovery and cooked grain length of KSK 133 are also better than KS 282.

Table 5 Summery of yield trials

Name of trial	No. of Trials	Paddy Yield (t/ha)			Percent increase over	
		KS 282	IR6/ IR9	KSK 133	KS 282	IR6/ IR9
Varietal yield trials	9	4.36	4.46	4.69	+7.58	+5.16
Micro plot yield trials	16	5.00	-	5.50	+10.00	-
National uniform yield trials	20	4.76	-	5.13	+7.77	-
Sowing date trials	19	4.36	4.03	4.78	+10.0	+19.0
	Average	4.62	4.25	5.02	+8.6	+18.0

Table 6: Quality traits of KSK 133 in comparison with the check

Characters	Name of variety	
	KS 282	KSK 133
Paddy		
Av. Length (mm)	9.82	10.05
Av. Width (mm)	2.35	2.45
Av. Thickness (mm)	1.96	2.08
Rice kernel		
Av. Length (mm)	6.83	7.07
Av. Width (mm)	2.03	2.11
Av. Thickness (mm)	1.54	1.79
Boiled kernel length (mm)	11.58	12.13
Total milling recovery %	71.68	72.77
Head rice %	53.99	57.51
Broken %	19.86	15.65
Amylose content %	29.31	27.10
Alkali spreading value	6.50 (low)	5.33 (low)
Protein content %	8.63	8.52
Gel consistency (mm)	47.33	55.33
1000 grain weight (gm)	19.05	21.0

Resistance against insect pests and diseases: Pest population was recorded at Rice Research Institute, Kala Shah Kaku under non-sprayed conditions for three years i.e., 2000, 2001 and 2004. KSK133 was also tested during 1995 and 2001 against paddy blast, bacterial leaf blight and stem rot at Rice Research Institute, Kala Shah Kaku. The response of the new line was the same with the check varieties against insects and diseases.

Grain Quality: Quality analysis were made by RRI,KSK, Rice Programme NARC, Islamabad and two private rice exporters. Average values from all the four sources are given in Table 6. KSK 133 has longer paddy

and milled rice grain than KS 282. Furthermore, its grain is bolder than the check variety. In milling, head rice recovery is a very important character. The head rice recovery of KSK 133 was 57.51 % with compared to the check variety which was 53.99 %.

Table 7 Description of KSK 133 in comparison with existing commercial variety 'ks 282'

S. No.	Characteristics	KS 282	KSK 133
1	Plant height (cm)	106	114
2	Leaf colour	Green	Green
3	Leaf angle	Semi erect	Semi erect
4	Stem stiffness	Semi stiff	Stiff
5	Productive tillers	18	19
6	Grains per panicle	122	102
7	Maturity days	101	105
8	1000 grain weight (paddy) (g)	26.4	28.9

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