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Genetic Basis of Yield Variations in Lowland Rice

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Abstract

The performance of thirty elite low land rice cultivars along with ten checks were evaluated under both normal and submerged situations to study the genetic basis of yield variations in low land rice and to identify the best performing genotypes for their future use. The experimental material possesses a highly significant differences among the test genotypes for all characters except fertility percentage and grain yield per plant under normal condition and except grain yield per plant under sub-merged condition. The majority of traits exhibited higher magnitude of both GCV and PCV under sub-merged conditions except for panicle length and plot yield. High heritability estimates associated with moderate to high genetic grain for days to 50 % flowering, plant height, grain number and 100-grain weight indicate the presence of additive gene effects and hence selection based on phenotypic performance would be effective suggesting the influence of additive gene effects in the inheritance of these traits. Grain yield per plant was positively correlated with panicle number, fertile grain number, fertility percentage and harvest index under normal condition whereas it was only positively correlated with harvest index under submerged condition. Both plot yield and grain yield per plant appear to show positive association with panicle number, fertile grain number and fertility percentage, whereas grain yield per plant exhibited positive association with harvest index under both the cultural conditions indicating the importance of such traits for realization of high yield in rice.

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The cultures like OR 1903-6-67, OR 2119-13, IR 70242-24-TTB-1-3, OR 2314-47, NDR 8024, OR 2315-6, OR 2109-2, NDR 8027, IR 53945-CN-35-8-2 and Kanchan were found promising under submerged condition.

Keywords: genetic analysis; lowland rice

1. Introduction

Rice is the staple food for more than 70 per cent Indians and a source of livelihood for 120-150 millions rural households. It contributes to 43 per cent of total food grain production and 53 per cent of cereal production, thus continues to hold the key to sustain food sufficiency in the country. It is estimated to achieve production by 70 per cent from irrigated ecology, 5 per cent from uplands, 21 per cent from rainfed medium lands and shallow low lands and 3 per cent from flood prone systems. Lack of suitable rice varieties with high yield and resistance to various biotic and abiotic stresses is the major constraint to high productivity in these ecologically handicapped low lands of the state. Therefore, there is a need for enhancement of genetic yield potential of rainfed low land rice with emphasis on flash flood submergence. Realizing the importance of high yield and greater stability of production of low land rice efforts were made to evaluate a set of low land rice genotypes including Swarna-Sub 1 for their yield performance and other characters under two different cultural conditions to study the genetic basis of yield variation in low land rice. Different yield attributing traits were examined to assess the availability and extent of genetic variability in yield and yield attributing characters, nature and magnitude of character association in relation to yield and various other traits, the direct and indirect effects of different component traits on yield through path coefficient analysis.

2. Materials and Methods

The experimental material used in the present investigation consisted of thirty elite low land rice cultures along with ten different checks (Table 1).

The test genotypes were evaluated under both normal and semi-deep water situations at Rice Research Station, Orissa University of Agriculture and Technology, Bhubaneswar during *kharif*, 2010 in order to study the genetic basis of yield variations in low land rice. Month wise total rainy days, weekly rainfall in mm, and water depth during crop growth period were recorded (Table 2 and 3) to justify the suitability of experimental site for evaluation of the low land rice cultures.

Both the trials were laid out in randomized block design with three replications. The recommended crop management practices were followed including need based plant protection to raise a normal crop. Observations were recorded in respect of eight metric traits on five competitive plants selected randomly from the middle rows of each plot, whereas, characters like plot yield and days to 50% flowering were recorded on plot basis to study the genetic basis of yield variations in low land rice and to identify the best performing cultures for their future use. The different parameters of variability like mean, range, standard error of mean (Sem)standard error of difference (SEd), critical difference (CD), phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability (h^2_{bs}) and genetic advance (GA) were estimated.

Table 1. Details of genotypes used in the study

Sl. No.	Name / Designation	Parentage	Origin
1	IR 53945-CN-35-8-2	IR 68 / IR 32720-138-2-1-2 // IR 39334-1-3-1-1	Chinsura
2	IR 69973-CN-8-33-1	Sabita / CT 9897-50-3-M-1-M	Chinsura
3	CN 1039-9	Sabita / IR 57540-8	Chinsura
4	CN 1230-27-5-1	Banla Phadao / Mahsuri // Sabita	Chinsura
5	CN 1592-5-1	CN 1503 / CN 1366-7-2	Chinsura
6	OR 2314-47	Mahanadi / IR 74	OUAT
7	OR 2109-2	Indravati / IR 72 // Salivahan	OUAT
8	OR 1878-3	OR 909-4-89 / Pankaj	OUAT
9	OR 2162-5	OR 142-99 / Surendra	OUAT
10	OR 2315-6	Mahanadi /PSBRC 2	OUAT
11	OR 2119-13	Manika / Manosarovar	OUAT
12	OR 1903-6-67	IR 49517 / OR 1301-32	OUAT
13	IR 70242-24-TTB-1-3	Kong Phlouk / IR 52555-UBN-3-2-1 // Sabita	AAU
14	TTB 303-1-13	Kmj 1-17-2 / IET 10016	AAU
15	RAU 759-5-41	WAT 31-B-B-70-3-8 / IR 73-1-16	RAU
16	RAU 1338-33	Rajshree / RAU 617-59-14	RAU
17	CR 2025-1	IR 53479-B-45 / IR 53519-26- 4 // IR 57519-PMI	CRRI
18	NDR 8024	IR 49830-7 / Sabita // IR 69502-6-SR-3-UB-1-3	NDAUT
19	NDR 8027	IR 49830-7 / Sabita // IR 69502-6-SR-3-UB-1-3	NDAUT
20	NDR 8034	IR 49830-7 / Sabita // IR 69502-6-SR-3-UB-1-3	NDAUT
21	SAVITRI	Pankaj / Jagannath	CRRI
22	SABITA	Pure line selection from Boyen	Chinsura
23	SWARNA	Vasistha / Mahsuri	ANGRAU
24	SWARNA SUB-1	Sub-1 in Swarna	IRRI
25	KANCHAN	Jajati / Mahsuri	OUAT
26	MAHANADI	IR 19661-131-1-3-1 / Savitri	OUAT
27	JAGABANDHU	Savitri / IR 4819 Sel. // IR 27301Sel.	OUAT
28	SALIVAHAN	RP 5-32 / Pankaj	DRR
29	DHANRASI	B 32-Sel. 4 / *O. rufipogan* // B-127	DRR
30	UPAHAR	Mahalaxmi / IR 62	OUAT

Table 2. Month wise total rainy days and total weekly rainfall during the crop growth period

Month	Weekly Rainfall (mm)				Total Rainfall (mm)	Total Rainy days
	1st	2nd	3rd	4th		
Jun.	27.7	26.6	11.1	96.6	162.0	18
Jul.	68.1	6.6	42.6	66.0	183.3	15
Aug.	258.3	28.7	8.1	51.3	346.4	16
Sept.	109.5	101.9	209.8	114.1	535.3	26
Oct.	106.8	0.5	5.8	17.4	130.5	9
Nov.	15.9	0.0	0.0	0.0	15.9	3

Table 3. Water depth during the crop growth period

Date (DAT)	Water Depth (cm)	Date (DAT)	Water Depth (cm)	Date (DAT)	Water Depth (cm)
0-7	5-10	29-35	41-50	57-63	15-20
8-14	5-10	36-42	50.0	64-70	15-20
15-21	20-37	43-49	20-30	71-77	15-20
22-28	38-41	50-56	20-25	78-84	15-20

(DAT: Days after transplanting)

Note *:* The crop between 28-42 DAT was completely submerged for fifteen days and the crop was seriously damaged

The analysis of variance was carried out separately for each trait following the procedures of randomized block design analysis [1]. The phenotypic, genotypic and environmental variance components for different characters were estimated from ANOVA using the expectations of mean square [2,3]. Heritability (in broad sense) coefficients of different characters were estimated by the formula [4]. The expected genetic advance (GA) from selection among varieties for different characters was calculated [5]. The phenotypic, genotypic and environmental correlations were estimated to examine the pattern of association between the component characters[2]. The path coefficients were obtained by solving the simultaneous equations which give the basic relationship between correlations and path coefficients in a system of correlated causes [6,7].

3. Results and Discussion

The analysis of variance in respect of ten different traits under both normal and sub-merged condition (Table 4 and 5) revealed that there existed a highly significant difference among the test genotypes for all the characters except fertility percentage and grain yield per plant under normal condition and except grain yield per plant under sub-merged condition.

Table 4. Analysis of variance for 10 characters of 30 low land rice genotypes under normal condition

Sl. No.	Characters	Source of variation (df)		
		Replication (2)	Genotype (29)	Error (58)
1.	Days to 50% flowering	5.05	88.96**	2.94
2.	Plant height (cm)	*130.68*	624.22**	48.81
3.	Panicle length (cm)	1.07	8.10**	1.15
4.	Panicle number	3.38	4.35**	1.76
5.	No. of fertile grains/panicle	2303.47	2385.38**	768.78
6.	Fertility percentage	139.21	78.18	49.29
7.	100-grain weight (g)	0.007	0.23**	0.03
8.	Harvest index.	188.19	53.01*	31.65
9.	Grain yield / plant (g)	50.21	21.78	20.60
10.	Plot yield (g/ha)	308.99	132.63**	66.65

* and ** Significant at 5% and 1% level of probability respectively

Figures in parentheses indicates degrees of freedom (df) for corresponding sources of variation

The magnitude of genetic variance was high for majority of traits except for panicle length, panicle number,100-grain weight and grain yield per plant. However, the higher magnitude of genetic variance for grain number, fertility percentage, harvest index and plot yield which have direct bearing on yield may be sorted out as important selection criteria for realization of higher productivity in rice. In general, under the sub-merged condition the days to flowering was longer with taller plant height, higher panicle number and the traits like fertility percentage, harvest index, grain yield per plant and plot yield were reduced considerably and the characters like panicle length, fertile grain number and 100-grain weight were least affected under submerged situation.

The genotypic and phenotypic co-efficient of variation maintained correspondence for most of the traits except for panicle number, grain number, fertility percentage, harvest index, and grain yield per plant indicating the greater influence of the environment in the expression of these traits. It was interesting to note that the majority of traits exhibited higher magnitude of both GCV and PCV under submerged conditions except for panicle length and plot yield and in general phenotypic coefficients of variation was higher than genotypic coefficients

of variation suggesting the influence of environmental factors in the expression of these traits. Among the characters studied, the GCV ranged from 3.81% for fertility percentage to 17.30% for grain number and for PCV, it ranged from 4.88% for days to flowering to 30.39% for grain yield per plant under normal condition. GCV varied from 5.63% for days to flowering to 20.22% for grain number and for PCV, it ranged from 5.70% for days to flowering to 26.88% for grain yield per plant under submerged condition. As majority of traits except panicle number, grain number, fertility percentage, harvest index and grain yield per plant showed smaller difference between GCV and PCV indicating least influence of environment, therefore, selection on the basis of phenotypic values for majority of characters is expected to be effective. In many cases, these estimates were found to be moderate to high for plant height, panicle number, grain number, 100-grain weight, grain yield per plant and plot yield. The contrasting and conflicting reports available for these two parameters for studying variability, is primarily ascribed to the type of experimental materials used in various experiments [8,11].

Table 5. Analysis of variance for 10 characters of 30 low land rice genotypes under submerged condition

Sl. No.	Characters	Source of variation (df)		
		Replication (2)	Genotype (29)	Error (58)
1.	Days to 50% flowering	20.23	144.58**	1.29
2.	Plant height (cm)	220.21	1128.93**	35.80
3.	Panicle length (cm)	6.78	8.30**	1.31
4.	Panicle number	14.93	4.77**	1.61
5.	No. of fertile grains/panicle	4477.49	2766.84**	519.98
6.	Fertility percentage	113.56	194.66**	84.33
7.	100-grain weight (g)	0.001	0.260**	0.010
8.	Harvest index.	167.35	50.04**	21.60
9.	Grain yield / plant (g)	134.35	14.96	12.64
10.	Plot yield (g/ha)	92.85	70.07**	9.31

** Significant at 1% level of probability respectively

Figures in parentheses indicates degrees of freedom (df) for corresponding sources of variation

The heritability values estimated for different traits varied from 1.9% and 5.8% for grain yield per plant to 90.7% and 97.4% for days to flowering and the genetic advance expressed as percentage of mean ranged from 1.2% and 3.2% for grain yield per plant to 24.1% and 34.2% for plant height for normal and submerged conditions respectively. A moderate to low degree of heritability estimates were observed for most of the traits except for days to 50 % flowering, plant height, grain number and 100-grain weight indicating high degree of influence of environment in the expression of these traits. High heritability estimates associated with moderate to high genetic gain for days to 50 % flowering, plant height, grain number and 100-grain weight indicate the presence of additive gene effects and hence selection based on phenotypic performance would be effective. The present findings is in

good agreement with the reported earlier[12,15].The characters like panicle length and plot yield exhibited moderately high heritability value and low genetic gain which suggested the influence of both additive and non-additive gene effects in the inheritance of these traits [15].Therefore, selection of genotypes on the basis of phenotypic performance for such traits may not be effective. Low heritability estimates with moderate to low genetic gain for panicle number, fertility percentage, harvest index and grain yield per plant suggested that dominance and epistatic gene effects may be operating in the inheritance of these traits[16,17].

Plot yield exhibited positive association with panicle number, fertile grain number, fertility percentage and grain yield per plant under normal condition whereas, it was positively correlated with plant height, fertility percentage, grain yield per plant and negatively correlated with days to 50% flowering under submerged condition. Grain yield per plant was positively correlated with panicle number, fertile grain number, fertility percentage and harvest index under normal condition whereas, it was only positively correlated with harvest index under submerged condition. However, it was interesting to observe that both plot yield and grain yield per plant appear to show positive association with panicle number, fertile grain number and fertility percentage; whereas grain yield per plant exhibited positive association with harvest index under both the cultural conditions indicating the importance of such traits for realization of high yield in rice. The association of different characters with plot yield and grain yield per plant exhibited more or less similar trend and the strong association between themselves revealed that selection on the basis of characters contributing grain yield per plant also bears relevance to plot yield.

The correlation of days to 50% flowering with plant height was negative under submerged condition. Plant height was positively correlated with panicle length and fertile grain number under both the cultural conditions. Panicle number was positively correlated with both grain yield per plant and plot yield but it exhibited negative or insignificant associations with majority of traits under study. Fertile grain number was found to be positively associated with fertility percentage but was negatively correlated with 100-grain weight where as fertility percentage was found to exhibit positive association with harvest index under both the cultural conditions (Table 6).

It is interesting to note that the association of panicle number and grain yield was found to be positive. This is in agreement with the results obtained earlier [18-20]. But the association of panicle number was observed to be low, negative and insignificant with majority of characters under the study. Therefore, the utility of this trait for selection of high yield becomes doubtful. Although the association between grain yield per plant and grain number was positive but the grain number exhibited negative association with 100-grain weight. Most of the published reports [9, 21, 22] revealed that grain number exhibited a positive association with grain yield which is in agreement with results obtained during the present investigation. As expected, grain number was found to show negative association with 100-grain weight and which might have resulted due to compensating mechanism. It is a foregone conclusion that where genetic selection has been made for large seeds, there has usually been compensating decrease in grain number, therefore, the best means to increase grain yield may be to select for more number of grains per panicle and allow the seed size to move as more or less a random variable. The positive association of grain yield per plant with harvest index during the present investigation reflects that yield is a function of total dry matter and harvest index and yield can be increased by increasing either biomass or harvest index or both.

It was observed from the path coefficient analysis that the grain yield per plant exhibited maximum positive direct effect on plot yield followed by plant height, fertility percentage, panicle number, days to 50% flowering, harvest index, fertile grain number, panicle length and 100-grain weight under normal condition and plant height exhibited maximum positive direct effect on plot yield followed by fertility percentage, grain yield per plant, panicle number, panicle length, 100-grain weight, harvest index, fertile grain number and days to 50% flowering under submerged condition thus, indicating the importance of such traits as criteria for selection in that order for realization of higher productivity under two cultural conditions (Table 7 and 8).

Table 6 Estimates of phenotypic correlation coefficients (r_p) among 10 characters in rice under two cultural conditions

Sl. No.	Characters		Plant height (cm)	Panicle length (cm)	Panicle number	No. of fertile grains/ plant (g)	Fertility percentage	100-grain Weight (g)	Harvest index	Grain yield per plant (g)	Plot yield (q/ha)
1	Days to 50% flowering	Normal	**.043**	**-.049**	**.098**	**.189**	**.049**	**-.147**	**-.108**	**.206**	**.179**
		Submerged	-.550**	-.350	.231	-.354	-.213	-.141	-.189	-.199	-.374*
2.	Plant height (cm)	Normal		**.409***	**.006**	**.492****	**.253**	**-.103**	**-.178**	**.317**	**.344**
		Submerged		.562**	-.438*	.431*	.412*	-.089	-.084	.269	.574**
3.	Panicle length (cm)	Normal			**.117**	**.259**	**.029**	**.067**	**-.104**	**.322**	**.162**
		Submerged			-.206	.301	.047	.126	-.084	.205	.375*
4	Panicle number	Normal				**.003**	**.134**	**-.125**	**.221**	**.577****	**.389***
		Submerged				-.300	-.173	-.075	.176	.220	.013
5	No. of fertile grains/plant	Normal					**.438***	**-.512****	**.079**	**.453***	**.367***
		Submerged					.496**	-.378*	.164	.264	.293
6	Fertility percentage	Normal						**-.315**	**.367***	**.395***	**.391***
		Submerged						.073	.296	.301	.472**
7	100-grain weight (g)	Normal							**.127**	**-.115**	**-.189**
		Submerged							.029	.060	.135
8	Harvest index	Normal								**.500****	**.286**
		Submerged								.612**	.203
9	Grain yield/plant (g)	Normal									**.617****
		Submerged									.493**

* and ** significant at 5 % and 1 % level of probability, respectively

Table 7. Direct and indirect effect of component traits on seed yield in rice at the genotypic level (normal)

Sl. No.	Effect of Characters	1	2	3	4	5	6	7	8	8	Correlation with plot yield
1	Days to 50 % flowering	**0.066**	0.009	0.003	0.011	-0.006	0.006	0.011	-0.007	0.085	0.179
2	Plant height	0.003	**0.218**	-0.022	0.001	-0.014	0.031	0.008	-0.011	0.131	0.344
3	Panicle length	-0.003	0.089	**-0.054**	0.013	-0.008	0.004	-0.005	-0.006	0.133	0.162
4	Panicle number	0.007	0.001	-0.006	**0.109**	0.0001	0.017	0.010	0.014	0.239	0.389
5	Number of fertile grains/panicle	0.013	0.107	-0.014	-0.003	**-0.029**	0.060	0.039	0.005	0.187	0.367
6	Fertility percentage	0.003	0.055	-0.002	0.015	0.014	**0.124**	0.024	0.023	0.163	0.391
7	100-grain weight	-0.010	-0.022	-0.004	-0.014	0.015	-0.039	**-0.076**	0.008	-0.048	-0.189
8	Harvest index	-0.007	-0.039	0.006	0.024	-0.002	0.045	-0.010	**0.062**	0.207	0.286
9	Grain yield/plant	0.004	0.069	-0.018	0.063	-0.013	0.049	0.009	0.031	**0.413**	0.617

Out of the different characters under study fertile grain number exerted greatest indirect effect on yield via other traits following panicle number, fertility percentage, harvest index, panicle length, grain yield per plant, plant height, days to 50 % flowering, and 100-grain weight under normal condition and fertile grain number exerted greatest indirect effect on yield via other traits following panicle length, harvest index, grain yield per plant, plant height, fertility percentage, 100-grain weight, panicle number and days to 50 % flowering under submerged condition. Thus from the foregoing observations on direct and indirect effects, the traits like grain yield per plant, number of fertile grains/panicle, fertility percentage, harvest index, panicle number, panicle length and plant height may be considered as important selection criteria for realization of high and stable yields in rice.

The correlation coefficients between characters like plant height, panicle number, fertility percentage, 100-grain weight and grain yield per plant with plot yield exhibited more or less similar direct effect under normal condition, and the correlation coefficients between characters like days to 50 % flowering, plant height, panicle length, fertility percentage, 100-grain weight and grain yield per plant with plot yield exhibited more or less similar direct effect under submerged condition, indicated that correlation explains the true relationship and therefore, direct selection through these traits would be effective under specific cultural condition.

Table 8. Direct and indirect effect of component traits on seed yield in rice at the genotypic level (submerged)

Sl. No.	Effect of Characters	1	2	3	4	5	6	7	8	9	Correlation with lot yield
1	Days to 50 % flowering	**-0.083**	-0.214	-0.042	0.048	0.027	-0.063	-0.004	0.007	-0.051	-0.374
2	Plant height	0.046	**0.390**	0068	-0.091	-0.033	0.121	0.002	0.003	0.068	0.574
3	Panicle length	0.029	0.219	**0.121**	-0.043	-0.023	0.014	0.003	0.003	0.052	0.375
4	Panicle number	-0.019	-0.171	-0.025	**0.209**	0.023	-0.051	-0.002	-0.007	0.056	0.013
5	Number of fertile grains/panicle	0.029	0.168	0.036	-0.063	**-0.076**	0.148	-0.009	-0.006	0.067	0.293
6	Fertility percentage	0.018	0.161	0.006	-0..036	-0.037	**0.295**	0.002	-0.011	0.076	0.472
7	100-grain weight	0.012	0.035	0.015	-0.016	0.029	0.022	**0.025**	-0.001	0.015	0.135
8	Harvest index	0.016	-0.033	-0.010	0.037	-0.012	0.087	0.001	**-0.037**	0.155	0.203
9	Grain yield/plant	0.016	0.105	0.025	0.046	-0.019	0.089	0.002	-0.023	**0.254**	0.493

Residual effect (P_R) = 54.03

Figures in the diagonal (bold) denote direct effects.

The correlation coefficient was observed to be positive and the direct effect was negative or negligible for traits like days to 50 % flowering, panicle length, number of fertile grain/panicle and harvest index under normal condition, and for traits like fertile grain number and harvest index under submerged situation indicating that under such situations, a restricted simultaneous selection model to be followed to nullify the undesirable indirect effects in order to use of direct effects.

4. Conclusion

Out of thirty cultures evaluated under both the cultural conditions separately during the present investigation, as many as ten cultures showing yield level of more than 45.0 q/ha under normal condition and yield level of more than 30.0 q/ha under submerged condition could be sorted out to be promising. The most promising cultures under normal condition were OR 2119-13, OR 2315-6, OR 1878-3, OR 2314-47, OR 1903-6-67, OR 2109-2, CN 1592-5-1, OR 2162-5 and Kanchan. Similarly the cultures like OR 1903-6-67, OR 2119-13, IR 70242-24-TTB-1-3, OR 2314-47, NDR 8024, OR 2315-6, OR 2109-2, NDR 8027, IR 53945-CN-35-8-2 and Kanchan were found promising under submerged condition

(Table 9 and 10). It was interesting to note that out of the thirty cultures evaluated, the cultures like OR 2119-13, OR 2315-6, OR 2314-47, OR 1903-6-67, OR 2109-2 and Kanchan were found promising under both the cultural conditions.

Table 9. Promising low land rice cultures (Normal)

Sl. No.	*Designation*	Days to 50% flowering	Plant height (cm)	PN	Grain yield (q/ha)
1.	OR 2119-13	116	91.7	8.7	50.06
2.	OR 2315-6	114	124.8	9.7	49.12
3.	OR 1878-3	113	103.8	8.3	48.42
4.	OR 2314-47	116	114.9	10.7	48.42
5.	OR 1903-6-67	107	109.7	9.3	48.18
6.	OR 2109-2	110	102.8	10.0	46.55
7.	CN 1592-5-1	118	113.8	8.0	46.08
8.	OR 2162-5	118	111.6	7.3	45.15
9.	SAVITRI	129	90.9	8.0	42.57
10.	SABITA	123	95.6	7.0	29.71
11.	SWARNA	108	75.4	8.0	38.36
12.	SWARNA SUB-1	115	86.3	8.7	43.04
13.	KANCHAN	122	116.4	10.0	53.80

Table 10. Promising low land rice cultures (Submerged)

Sl. No.	*Designation*	Days to 50 % flowering	Plant height (cm)	PN	Grain yield (q/ha)
1.	OR 1903-6-67	111	118.6	9.3	37.38
2.	OR 2119-13	132	88.6	11.0	36.60
3.	IR 70242-24-TTB-1-3	120	137.1	7.7	34.90
4.	OR 2314-47	131	107.9	8.7	33.72
5.	NDR 8024	115	128.9	7.0	33.20
6.	OR 2315-6	123	130.8	8.3	33.07
7.	OR 2109-2	124	104.0	10.0	32.42
8.	NDR 8027	116	129.8	8.0	30.98
9.	IR 53945-CN-35-8-2	120	147.9	6.0	30.85
10.	SAVITRI	135	80.9	9.0	20.39
11.	SABITA	133	88.2	8.0	21.18
12.	SWARNA	126	78.5	11.0	23.01
13.	SWARNA SUB-1	129	76.7	10.0	25.49
14.	KANCHAN	126	118.9	8.3	35.42

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