SHORT COMMUNICATION

Relationship Among Seed Yield Attributes in Rice under Temperate Conditions

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Five local cultivars of rice, *viz.*, SKAU-23, SKAU-98, SKAU-105, SKAU-341 and SKAU-382 were evaluated for seed vigour in relation to seed size and boldness. The rice cultivars were graded into four types, *viz.*, (Grade A) partially filled and shriveled seeds, (Grade B) bold coloured seeds, (Grade C) bold discoloured seeds and (Grade D) short bold seeds. The results revealed a positive correlation between seed size and seed vigour during different laboratory conditions under standard techniques. A significant association was also observed between seed boldness and seed vigour. Short sized and bold seeds gave significantly higher values under different vigour tests and hence proved to be more vigourous.

Key Words: Cultivar, Rice, Correlation, Vigour index, Yield, Seed grade

Rice is a most important cereal crop of developing world and a staple food of half of the world's population. About 92 per cent of world's rice is produced and consumed in Asia-Pacific region. Rice being a staple food of Kashmiri people is cultivated on an area of 2.56 lakh hectares in Jammu and Kashmir with a productivity of 32.9 q/ha. The problems of rice cultivation in Kashmir are essentially those of temperate regions associated with long day conditions, short growing season, high altitude and low temperature. During last few years aberrant weather conditions have prevailed in the Kashmir valley resulting in considerable losses in production. High vigourous seeds of superior varieties if available to farmers at convenient time may result in better plant stand in field and lower seed requirement. The principle object of a seed vigour test is to differentiate a wide range of quality levels like high, medium and low vigourous seeds.

As the climatic conditions in Kashmir valley in the early crop season of rice are comparatively cool and the temperature during April-May is not conducive, the germination capacity and the speed of germination are adversely affected. With the result, the plant stand in the field is decreased ultimately reducing the yield. The field response of a particular seed lot may more closely correlate with the vigour test than the ordinary laboratory test depending upon nature of field conditions under which planted. Keeping this in view the present investigations were made to explore the seed vigour using different local cultivars of rice.

The experimental material for the present study consisted of five cultivars of rice, *viz*., SKAU-23, SKAU-98, SKAU-105, SKAU-341 and SKAU-382 procured from Section of Genetics and Plant Breeding, Rice Research and Regional Station SKUAST-K Khudwani Anantnag (J & K) during June-July 2006. All the cultivars were subjected to physical purity analysis in the laboratory. The pure seed component of all the cultivars was later classified into four categories on the basis of physical appearance and size of seed into following classes:

1. Partially filled and shrivelled seeds-R1 (Grade A)
2. Bold coloured seeds-R2 (Grade B)
3. Bold discoloured seeds-R3 (Grade C)
4. Short bold seeds-R4 (Grade D)

All the grades of each variety were later subjected to various vigour tests in the laboratory, *viz.*, germination on blotter paper (top of paper), germination index (speed of germination),vigour index I, seedling dry weight and seedling dry weight vigour index (vigour index II)

Laboratory Analysis

Hundred seed weight: Hundred seeds from each fraction of all the varities were counted and later weighed on electronic weighing balance.

Rate of germination: Three sets of 25 seeds from all four grades of each variety were placed on a blotter paper inside a 90 cm petridish. After adding 3 ml of distilled water to each petri dish, these were kept inside a germinator (25°C temperature and 97% RH). First count was taken after 48h and final count after 336h. Rate of germination index was calculated according to Seshu *et al*. (1988).

Germination test on top of paper: To calculate seedling root length, seedling shoot length and vigour index, the seeds were allowed to germinate on top of paper. The paper used in this test was free from any type of infection and enough strong to resist any pressure. The seeds were kept at proper distance on germination paper and kept in incubator (25°C and 90% RH).The total number of seeds germinated were counted later.

Seedling root length, seedling shoot length and seedling dry weight: Roll towel method (Seshu *et al.,* 1988) was used to record root and shoot length of seedlings. Measurement of root and shoot length was made on14th day after setting the seeds for germination. After root and shoot measurements, ten seedlings from each set were placed in paper bags and dried in an oven at 80°C for 48h and then weighed on a Mettler balance for obtaining seedling dry weight in mg.

Vigour index I and vigour index II: The germination percentage obtained in the germination test was used to calculate vigour index. The vigour index was calculated adopting the method of Abdul-Baki and Anderson (1973).

Seed weights of different fractions of rice cultivars revealed that 100-seed weight of short bold seeds ranged from 2.30 g–4.90 g in comparison to other fractions which merely touched this level (4.90 g in SKAU-382). Hence, short bold seed component that has higher seed weight in all the cultivars can be considered as more vigourous than other fractions (Grade A, B and C).

The seeds under germination test were examined after 336h. The germination percentage was as low as 44% in SKAU-341 (R1) and as high as 100% in SKAU-382 (R4).The seeds with smaller seed size (short bold seeds) exhibited highest germination percentage in all the rice cultivars: SKAU-23=96%; SKAU-98=88%; SKAU-105=76%; SKAU-341=90% and SKAU-382=100%) (Table 1).

The germination percentage was calculated on 15th day of germination test. The value of germination index (RG) revealed that short bold seed component (R4) in all five rice cultivars had higher values. It means that short bold seeds (R4) got germinated earlier than any other component of seed (SKAU-23, R4=10.11; SKAU-382, R4=17.28) (Table 1).

Table 1. Determination of 100-seed weight, germination percentage and rate of germination index

Name of variety	Fraction of seed (g)	Hundred seed weight (g)	Average weight of seed (g)	Germination percentage (%)	Germination index
* SKAU-23	R1	1.90	0.019	72	6.37
	R2	3.60	0.036	88	7.82
	R3	2.60	0.026	52	6.77
	R4	2.50	0.025	96	10.11
SKAU-98	R1	2.00	0.020	64	5.95
	R2	2.80	0.028	87	11.09
	R3	2.60	0.026	72	11.14
	R4	2.50	0.025	88	13.38
SKAU-105	R1	1.70	0.017	68	5.65
	R2	2.60	0.026	72	6.85
	R3	2.10	0.021	68	6.75
	R4	2.30	0.023	76	7.12
SKAU-341	R1	1.80	0.018	44	7.12
	R2	2.70	0.027	88	13.53
	R3	2.30	0.023	64	12.78
	R4	2.50	0.025	90	15.42
SKAU-382	R1	1.60	0.016	52	6.36
	R2	2.50	0.025	84	17.23
	R3	2.20	0.022	64	15.95
	R4	4.90	0.049	100	17.28

R1=Partially filled and shriveled seed
R2=Bold coloured seed
R3=Bold discoloured seed
R4=Short bold seed
* SKAU: Sher-e-Kashmir Agricultural University
Relative Humidity =70%
Substratum =Paper
Temperature=28°C
Seeds x Replicates =25 x 4

Table 2. Calculation of average seedling length, vigour index I and vigour index II

Name of variety	Fraction of seed	Total seedling length (cm)	Germination percentage (%)	Vigour index I	Seedling dry weight (mg)	Vigour index II
SKAU-23	R1	8.25	72	594.00	42.43	3054.96
	R2	8.16	88	718.08	41.81	3679.28
	R3	8.04	52	418.08	38.58	2006.16
	R4	7.42	96	712.32	43.11	4138.56
SKAU-98	R1	6.47	64	414.08	42.60	2726.40
	R2	8.19	87	712.53	42.56	3702.72
	R3	8.22	72	591.84	42.00	3024.00
	R4	8.31	88	731.28	48.32	4252.16
SKAU-105	R1	7.66	68	520.88	38.64	2627.52
	R2	6.32	72	455.04	31.61	2275.92
	R3	7.00	68	476.00	35.00	2380.00
	R4	7.55	76	573.80	38.96	2960.96
SKAU-341	R1	7.60	44	334.40	38.63	1699.72
	R2	7.73	88	680.24	47.34	4165.92
	R3	7.71	64	493.44	46.52	2977.28
	R4	8.07	90	726.30	42.84	3855.60
SKAU-382	R1	7.26	52	377.52	47.00	2444.00
	R2	7.05	84	592.20	47.32	3974.88
	R3	6.75	64	432.00	46.77	2993.28
	R4	6.89	100	689.00	47.80	4780.00

R1=Partially filled and shriveled seed
R2=Bold coloured seed
R3=Bold discoloured seed
R4=Short bold seed
Seeds x Replicates=25 x 4
Substratum =Paper
Temperature=28°C
Relative Humidity =70%

The highest value of average seedling height was recorded in R4 of SKAU-98 as 8.31 cm and lowest in case of SKAU-105 as 6.32 cm (R2).The highest seedling dry weight was found in R4 of SKAU-98 (48.32 mg) and lowest in R2 of SKAU-105 (31.61 mg). Here the smaller size of seed had a negative correlation with the above mentioned parameters (Table 2). On examining the vigour index I of rice cultivars, the short bold seeds (R4) showed highest values in SKAU-98, SKAU-105, SKAU-341 and SKAU-382 but not in SKAU-23.

Similarly, the vigour index II was found highest in short bold seeds of SKAU-23, SKAU-98, SKAU-105 and SKAU-382, except in SKAU-341, in comparison to other fractions of seed. Hence, the short bold seeds also exhibited a positive correlation with vigour index II.

The present investigation was conducted to study the effect of seed size and in fact the seed boldness (filled or partially filled) on seed vigour. Upon conducting and observing various vigour traits, it was seen that seed vigour was directly associated with seed size and boldness in different rice cultivars. Similar results were obtained by Takeda (1972) while working on correlation of seed weight and seedling length in rice. A positive correlation was found between smaller seed size (short bold seeds) and seed vigour parameters in all rice cultivars except seedling dry weight. Similar observations were also recorded by Sharma *et al.* (1990) while studying 46 local rice cultivars of Himachal Pradesh. The vigour values of partially filled and shrivelled seeds lagged behind in all the rice cultivars brought under study. Amaral (1978) also reported that vigour of rice seeds increased with an increase in seed density.

The short bold seeds were observed to be well filled and showed highest vigour values. This clearly indicates that well filled seeds always give rise to healthy seedlings in comparison to partially filled seeds. The positive correlation of seed weight with seedling length and vigour index II may be because of higher quantity of food reserves in the healthy seeds that may have eventually contributed to the increased shoot length and seedling dry weight. Wu (1975) also got the similar results while working on the seedling growth on rice plants.

The results indicated that larger seed size had nothing to do with the plant stand in the field; and vigour values

were found highest in short bold seeds in the present study. So, the farmers need not to worry about the size of the rice seeds as short sized seeds proved to be more vigourous in all the cultivars. The above parameters may also be used in selection of genotypes as parents in improving seed and seedling vigour traits in rice.

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