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# Capturing variability through different modes of selection in segregating generation of rice crosses

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## ABSTRACT

*Handling segregating population, especially in early generation is a tricky issue. Due to segregation, identification of desirable plant types is quite difficult and at the same time, there are chances of losing them. Moreover, the resource constraints also force the breeders to keep the size of population low. Using, $F_2$'s and $F_3$'s of seven different crosses, involving rainfed lowland rice germplasms, two methods were followed to handle the segregating populations from $F_2$ onwards. In the first case, one hundred plants were selected from $F_2$ and the seed of one panicle plant$^{-1}$ were sown in $F_3$ generation in individual panicle- progeny-row system. In the second, five seed from each of selected 100 individual plant were picked and a separate bulk population of 500 seeds of each cross were planted. The analysis of these early generation selection data was done to have an idea of the variability being captured to two different modes of selection. The two crosses IR70810 and IR70820 were effective for single plant decent as compare to single seed decent selection. The paper describes in detail and highlights the methods of analysis and the output to draw conclusions about handling of early generation segregating materials in breeding programme.*

***Key words:*** *Rice, segregation, populations, conventional*

Conventional breeding methods namely bulk and pedigree are generally adapted for handling segregation population of self-pollinated crops. Due to segregation, identifying desirable plant types is quite different and also there are chances of losing then (Singh and Dwivedi, 1996) Moreover, the resource constrains also force breeders to keep the size of population low. Singh and Dwivedi (1996) reviewed and enlisted the breeding methods being adapted by various research workers in Eastern India but no systematic work has been done on breeding methods and their comparative effectiveness in the rice ecosystem. However, in Sesame, Srinivas *et al* (1992) reported the ineffectiveness of pedigree in early generation yield testing. The idea of single seed descent (SSD) suggested by Goulden (1939) has aroused considerable interest among breeders and offers opportunity of rapidly advancing segregation generations. However, the procedure lacks in strict population control, which may result in loss of potential genotypes (Sneep, 1977). While in bulk method, it is the genetic drift due to inadequate sampling and natural selection affecting the competitive ability of genotypes (Suneson and Steven, 1953). In view of these, in the present investigation the bulk method was modified (five seeds from each of $F_2$ were blend to make a bulk) and single seed decent (SSD) as single panicle-decent (SPD) and these were compared in terms of retention of superior types and variability in seven different crosses of rainfed lowland rice ecosystem.

## MATERIALS AND METHODS

Using $F_2$'s of seven different crosses (Table 1) involving rainfed lowland rice germplasm, two methods i.e. modified bulk (MB) and single-panicle-decent (SPD) were followed to handle segregating population from $F_2$ onwards, One hundred superior plants were identify from each cross and from each plant, seeds for a single panicle was harvested and kept separately. Five seeds of each of the 100 panicle of crosses were bulked. With remaining seeds from each panicle, panicle-row progenies were raised which formed the materials for Single Panicle Decent. Thus two types of populations were developed in each crosse and were grown in

**Table 1. Seven crosses used in study and their parentage.**

| Crosses | Parents |
|---|---|
| IR 70803 | CN843-80-7-1/KDML-105//IR49830-7-1-2-2 |
| IR70804 | CN846-6-6-6/IR5500810-10-3-3-3// IR55040-B2-25-1-3-2-1 |
| IR70810 | CN846-6-6-6/IR550040-B2-5-3-3-2-1// IR55040-B2-25-1-3-2-1 |
| IR70820 | CT9506-38-M-6-1/IR58821-23-B-1-2-1// IR66883-10-B-1 |
| IR70842 | SABITA/IR55040-B2-5-3-3-2//BKP-242 |
| IR70843 | SABITA/IR55040-B2-5-3-3-2 |
| IR70845 | ABHAYA/IR57515-PM1-8-1-1-SRN-1-1// CN846-6-6 |

compact family block design with two replication at Crop Research Station Masodha, Faizabad during wet season 2001. From each plot of modified bulk populations, 100 plant were identified for recording observation. In case, data of seed yield plant$^{-1}$, plant height, panicle length, number of tillers per plant, flag leaf length and number of nodes per plants were recorded and calculate the mean and variance to be used for comparison.

## RESULTS AND DISCUSSION

The values for means and variance over crosses as well as cross-wise for both the methods are presented in Table 2 and 3. Superiority of modified bulk method was exhibited when means were considered over all crosses for seed yield and other important attributes, except number of tillers plant$^{-1}$. A cross-wise comparison of breeding methods to retain superior lines (reflected by increased means) also revealed a clear superiority of modified bulk method for five out seven crosses. However, the single panicle decent was effective in the two crosses IR70810 and IR70820 which were product of relatively less diverse parents. Similar

**Table 2. Mean and variance for MB and SPD-derived populations for yield and its components in traits.**

| Characters | Mean value | | Range | | Variance | |
|---|---|---|---|---|---|---|
| | MB | SPD | MB | SPD | MB | SPD |
| Seed yield plant$^{-1}$ (g) | 22.5 | 19.6 | 7.3-31.6 | 7.9-32.5 | 37.2 | 42.6 |
| Plant height (cm) | 111.7 | 103.6 | 82.3-124.0 | 90.6-140.0 | 108.5 | 126.3 |
| Panicle length (cm) | 23.8 | 22.8 | 21.6-24.8 | 20.2-26.0 | 24.2 | 30.6 |
| No. of tillers plant$^{-1}$ | 5.0 | 6.8 | 4.0-6.0 | 4.0-14.0 | 7.4 | 6.8 |
| Flag leaf length (cm) | 26.6 | 24.7 | 23.6-28.5 | 22.3-31.8 | 31.9 | 42.4 |
| No. of nodes plant$^{-1}$ | 6.0 | 5.8 | 4.0-6.0 | 4.2-7.1 | 6.8 | 8.6 |

**Table 3. Means of top 10 parental lines and their variance for yield and yield components in seven crosses of rice.**

| Crosses | Methods | Seed yield plant$^{-1}$(g) | | Plant height (cm) | | Panicle length (cm) | | No. of tillers plant$^{-1}$ | | Flag leaf length(cm) | | No.of nodes plant$^{-1}$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | variance | Mean | variance | Mean | variance | Mean | variance | Mean | variance | Mean | variance |
| IR 70803 | MB | 24.6 | 17.5 | 112.1 | 72.6 | 24.7 | 34.8 | 5.2 | 1.8 | 25.0 | 41.5 | 5.2 | 2.6 |
| | SPD | 22.9 | 21.6 | 112.2 | 91.2 | 23.3 | 41.5 | 5.0 | 1.7 | 24.1 | 54.8 | 5.5 | 2.9 |
| IR70804 | MB | 25.7 | 16.8 | 120.3 | 90.7 | 23.2 | 52.2 | 5.2 | 6.5 | 23.6 | 36.8 | 5.2 | 8.2 |
| | SPD | 24.3 | 19.6 | 98.1 | 103.2 | 20.8 | 68.8 | 6.0 | 7.2 | 21.8 | 32.8 | 5.1 | 9.6 |
| IR70810 | MB | 23.6 | 18.5 | 116.1 | 76.5 | 24.7 | 48.5 | 5.4 | 11.5 | 27.2 | 16.7 | 5.4 | 1.8 |
| | SPD | 23.9 | 19.7 | 116.1 | 74.2 | 21.4 | 26.4 | 7.0 | 13.5 | 25.4 | 24.8 | 5.9 | 3.4 |
| IR70820 | MB | 22.9 | 23.3 | 82.8 | 50.6 | 21.6 | 44.2 | 4.0 | 3.6 | 23.8 | 40.5 | 4.0 | 11.5 |
| | SPD | 23.2 | 17.4 | 94.7 | 41.2 | 24.6 | 37.5 | 6.0 | 4.2 | 24.5 | 46.5 | 3.8 | 10.7 |
| IR70842 | MB | 24.7 | 21.2 | 120.6 | 67.6 | 24.8 | 31.5 | 5.2 | 6.8 | 28.5 | 22.3 | 5.2 | 3.4 |
| | SPD | 24.1 | 22.6 | 100.4 | 71.5 | 23.3 | 36.8 | 7.2 | 8.2 | 26.1 | 31.5 | 4.9 | 4.2 |
| IR70843 | MB | 23.7 | 24.8 | 105.8 | 56.3 | 24.1 | 28.8 | 4.6 | 3.8 | 27.4 | 19.7 | 4.6 | 8.7 |
| | SPD | 24.2 | 28.7 | 101.8 | 105.8 | 23.9 | 31.6 | 8.8 | 7.3 | 25.9 | 36.5 | 4.5 | 14.6 |
| IR70845 | MB | 25.7 | 19.6 | 124.0 | 166.5 | 23.5 | 36.5 | 6.0 | 2.6 | 30.5 | 37.8 | 6.0 | 5.8 |
| | SPD | 24.2 | 19.8 | 103.6 | 182.8 | 22.8 | 41.6 | 6.8 | 4.9 | 30.4 | 39.5 | 5.7 | 8.2 |

observations were also made in sesame earlier by Srinivas *et al.* (1992). The superiority of bulk method over ingle panicle decent was also reported in wheat (Ndoni, 1986) and sesame (Srinivas *et al.,* 1995). Increase population yield over generations, as in the present case, might result due to selection (Palmer, 1952) shifting of gene frequencies for yield in positive direction (Reaber and Weber, 1953), shift towards types adapted to the location (Taylor and Alkins, 1954) and/ or elimination of low-seed-number individuals through competition (Muehlbauer *et al.,* 1981). The effectiveness of natural selection, in bulk methods of breeding was, however, questioned by Sandfaer (1970).

The comparison of variance, retained in the population derived by MB and SPD, gave a different picture. The SPD-derived population showed higher level of variability than those of the MB-derived population and this was true for both over crosses and individual crosses. As suggested by Frey (1968), this may largely be due to representation of each genotypes in successive generations, although in the present investigation, this drawback of single seed decent (SSD) might have been overcome by use single panicle decent (SPD) methods, wherein the seeds of selection procedures are used (Muehlbauer *et al.,* 1981). Haddal and Muehlbauer (1981) proposed advancement of two seed from each $F_2$ plant and Jensen (1988) used single head decent (SHD) procedure, to counter the loss of plants in SPD populations. A low level of variability in the MB-derived populations, in contrast of SPD-derived populations, may be attribute to stabilized selection occurring naturally in bulk populations (Khalifa and Qualset, 1975) and losses in genetic variability during generation advance as reported by Muehlbauer et al. (1981).

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