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RESEARCH ARTICLE

SELECTION INDICES FOR YIELD AND YIELD CONTRIBUTING CHARACTERS IN SLENDER GRAIN RICE GENOTYPES

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ABSTRACT

Since grain yield is a complex trait, controlled by non-additive gene action and is believed to have low heritability, hence direct selection for grain yield *per se* is often not reliable and effective. Further intergenotypic competition and a large experimental error associated with yield measurements often bias the outcome of selection for higher yield. Therefore, several workers in different crop plants have emphasized the importance of indirect selection for yield through the use of component traits governed by genes with additive effect and with strong correlation on grain yield. As no single trait could be taken as an adequate criterion of selection for yield, therefore, selection indices provide a useful method by making use of several correlated traits for greater efficiency of selection in yield. Selection indices study revealed that the thirteen character index was superior over the direct selection for yield per se. On the basis of thirteen character selection index promising genotypes namely MTU110, RTN28-1-5-3-2, CB12186, NP3003, WGL-821, RGL7011, R1130-80-1-52-1, GNV-14-25, CR3511-3-2-2-5-1, BPT2675, NLR3337, RGL7012, BPT2595, NLR3350, RP5947-123-6-2-1-1-B, AD12074, MLR3313 and RP5949-122-2-5-1-1 may be used for future breeding programme. It was interesting to note that the relative rankings of varieties selected on the basis of *per se* performance and index score differed indicating the importance of selection index over direct selection on grain yield.

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INTRODUCTION

Rice provides 21% of global human per capita energy and 15% of per capita protein. In India rice has the largest areaunder rice cultivation, as it is one of the principal food crops. It is in fact the dominant crop of the country. India is one of the leading producers of this crop. Rice is the basic food crop and being a tropical plant, it flourishes comfortably in hot and humid climate. Rice is mainly grown in rainfed areas that receive heavy annual rainfall. Rice is staple food for more than70% of people and a source of livelihood for 120-150 million rural households of the country. It provides more than fifty percent of daily calorie intake and considered as the cheapest source of food, energy and protein in the developing countries. It contributes to 43 percent of total food grain production and 53 percent of cereal production, thus continues to hold the key to sustain food sufficiency in the country (Siddiq*et al.*, 2004).Now-a-days emphasis has been given not only for higher yield but also for different quality traits such as texture, aroma, appearance etc. As standard of living of people are increasing day by day people showing more interest towards slender grain for consumption due to its flavour and palatability. But most of the rice varieties are having medium bold grain. So development of slender grain rice varieties is need of the hour. Slender grain rice varieties collected from different parts of the country will help to identify varieties suitable for cultivation in this region as well as for selecting promising varieties for use as parent material in future breeding programme. Hence the present study was undertaken to evaluate forty-nine elite slender grain rice genotypes to find out useful criteria for selection of yield through construction of selection indices and identify promising cultures for their possible use in future breeding program.

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MATERIALS AND METHODS

The experimental material used in the present investigation consisted of forty-nine elite slender grain rice genotypes .The test genotypes were evaluated under normal situations at Rice Research Station, Orissa University of Agriculture and Technology, Bhubaneswar during kharif, 2015. Trials were laid out in a Randomized Block Design with two replications with the spacing of 15 x 20 cm and the recommended cultural practices were followed. Observations were recorded on the following thirteen charactersDays to 50% flowering , Plant height, Panicle length, Number of effective tillers per plant, Flag leaf area, Fertile grain number, Fertility percentage, Kernel length, Kernel breadth, L/B ratio, 100-seed weight, Harvest index, Grain yield per plant were recorded. Observations were recorded for thirteen metric traits taking five competitive plants selected randomly from middle rows of each plot; whereas, character like days to 50 % flowering was recorded on plot basis. All the characters were used for the construction of the selection index based on Fisher's (1936) discriminant function.

Table 1. Expected Genetic advance selection index over direct selection on grain yield

Index number and number of characters	Characters	Expected GS (10%)
1 (One character index)	GYP	6.00
2 (Two character index)	GYP+DF	6.00
3 (Three character index)	GYP+DF+PH	6.00
4 (Four character index)	GYP+DF+PH+PL	6.00
5 (five character index)	GYP+DF+PH+PL+ETN	6.00
6 (Six character index)	GYP+DF+PH+PL+ ETN+FLA	6.00
7 (Seven character index)	GYP+DF+PH+PL+ ETN+FLA+FGN	6.01
8(Eight character index)	GYP+DF+PH+PL+ ETN+FLA+FGN+F%	6.01
9 (Nine character index)	GYP+DF+PH+PL+ ETN+FLA+FGN +F%+KL	6.02
10 (Ten character index)	GYP+DF+PH+PL+ETN+FLA+FGN+F%+KL+KB	6.03
11(Eleven character index)	GYP+DF+PH+PL+ETN+FLA+FGN +F%+KL+KB+LB	6.04
12(Twelve character index)	GYP+DF+PH+PL+ETN+FLA+FGN +F%+KL+KB+LB+SW	6.04
13 (Thirteen character index)	GYP+DF+PH+PL+ETN+FLA+FGN +F%+KL+KB+LB+SW+HI	6.05

Table 2. Selection of Genotypes on the basis of thirteen characters index

Sl. No.	Genotype	Index score	Grain yield/plant (g)
1	MTU110	24.54(1)	24.64(1)
2	RTN28-1-5-3-2	20.52(2)	20.99(2)
3	CB12186	20.01(3)	19.99(3)
4	NP3003	19.67(4)	19.86(4)
5	WGL-821	19.21(5)	18.28(5)
6	RGL7011	17.97(6)	17.37(7)
7	R1130-80-1-52-1	17.90(7)	17.55(6)
8	GNV-14-25	17.60(8)	17.60(8)
9	CR3511-3-2-2-5-1	17.41(9)	16.20(11)
10	BPT2675	17.40(10)	16.69(9)
11	NLR3337	16.96(11)	16.22(10)
12	RGL7012	16.31(12)	15.36(14)
13	BPT2595	16.28(13)	15.87(12)
14	NLR3350	15.74(14)	14.78(16)
15	RP5947-123-6-2-1-1-B	15.71(15)	14.90(16)
16	AD12074	15.62(16)	15.40(13)
17	MLR3313	15.56(17)	13.68(22)
18	RP5949-122-2-5-1-1	15.44(18)	15.13(15)

Figure in the parentheses indicate relative ranking of genotypes

RESULTS AND DISCUSSION

Since grain yield is a complex trait, controlled by non-additive gene action and is believed to have low heritability, hence direct selection for grain yield *per se* is often not reliable and effective. Further intergenotypic competition and a large experimental error associated with yield measurements often bias the outcome of selection for higher yield. Therefore, several workers in different crop plants have emphasized the importance of indirect selection for yield through the use of component traits governed by genes with additive effect and with strong correlation on grain yield. As no single trait could be taken as an adequate criterion of selection for yield, therefore, selection indices provide a useful method by making use of several correlated traits for greater efficiency of selection in yield (Das *et al.,* 2000; Mathur, 2011). During the present investigation selection indices were constructed with grain yield as the economic criterion and thirteen different characters namelyGrain yield per plant (GYP), Days to 50% flowering(DF), Plant height (PH), Panicle length(PL), Number of effective tillers per plant(ETN), Flag leaf area (FLA), Fertile grain number(FGN), Fertility percentage(F%), Kernel length(KL), Kernel breadth(KB), L/B ratio(LB), 100-seed weight(SW), Harvest index(HI), were chosen for the construction of thirteen character indices. The thirteen character index including all the thirteen traits was used for the selection of genotypes. Those genotypes which occupied better rankings in the above selection indices were selected for their future use. The expected genetic advance in yield from selection and different selection indices over direct selection on yield is presented in (Table 1). The predicted genetic advance from different indices at 10% selection intensity ranged from 6.00 q/ha in one character index to 6.05 q/ha in thirteen character index. Thus in terms of predicted genetic advance, the results of the present study brought out superiority of thirteen character index over direct selection on yield *per se.* This is in general agreement with those of Surek and Beser (2005), Sabouri *et al.* (2008), Fazlalipour *et al.* (2008), Bastia *et al.* (2008), Sabouri *et al.* (2010), Singh *et al.* (2013) and Alam *et al.* (2014). The promising genotypes occupying better ranking in the thirteen character index were selected for their future use. The plot yield and the index score of promising genotypes namely MTU110, RTN28-1-5-3-2, CB12186, NP3003, WGL-821, RGL7011, R1130-80-1-52-1, GNV-14-25, CR3511-3-2-2-5-1, BPT2675, NLR3337, RGL7012, BPT2595, NLR3350, RP5947-123-6-2-1-1-B, AD12074, MLR3313, RP5949-122-2-5-1-1 are presented in Table 2. It was interesting to note that the relative rankings of varieties selected on the basis of *per se* performance and index score differed indicating the importance of selection index over direct selection on grain yield. Most of the published works on selection indices based on index scores reflect the genotypic worth of a particular culture and the relative efficiency has been assessed in terms of genetic advance. However, the validity of such expectations in selecting different genotypes on the basis of different selection indices is often questioned as it varies due to difference in the composition of material, selection of characters for the construction of indices and the experimental precision associated with yield measurement. Therefore, it becomes imperative to study the relative efficiency of different selection criteria and to test the validity of expected superiority of selection indices over direct selection by testing the promising genotypes through appropriate field trials.

Conclusion

During the present investigation selection indices were constructed with grain yield as the economic criterion and thirteen different characters were chosen for the construction of thirteen character indices. Those genotypes which occupied better rankings in the above selection indices were selected for their future use. The predicted genetic advance from different indices at 10% selection intensity ranged from 6.00 q/ha in one character index to 6.05 q/ha in thirteen character index.Thus in terms of predicted genetic advance, the results of the present study brought out superiority of thirteen character index over direct selection on yield *per se.* The promising genotypes occupying better ranking in the ten character index were selected for their future use. The plot yield and the index score of promising genotypes namely MTU110, RTN28-1-5-3-2, CB12186, NP3003, WGL-821, RGL7011, R1130-80-1-52-1, GNV-14-25, CR3511-3-2-2-5-1, BPT2675, NLR3337, RGL7012, BPT2595, NLR3350, RP5947-123-6-2-1-1-B, AD12074, MLR3313 and RP5949-122-2-5-1-1were selected for future use.

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