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Short communication

Selection Indices for Yield and Yield Attributes of Paddy under Coastal Saline Ecosystem

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Yield is a complex quantitative character influenced by environmental fluctuations. Therefore, direct selection for yield as such will not be reliable and fruitful. Hence, selection criteria based on yield components would be helpful in suitable plant types. The knowledge of inter-relationship between yield components and the relative weightage that should be given to different yield components to obtain maximum gain is therefore most important. The discriminant function affords an efficient method for simultaneous selection (Smith, 1936). Thus, construction of selection indices will be highly helpful to discriminate desirable genotypes on the basis of their phenotypic performance.

The experiment was laid out in a randomized block design with 3 replications and 30 paddy genotypes during Rabi 2013 at Agricultural Research Station, Machilipatnam representing coastal saline ecosystem with pH 7.35, EC 14.21 and ESP 17.57. A healthy crop was raised as per the recommended agronomic practices and data were recorded on 10 random and competitive plants on ten yield traits viz., plant height, days to 50% flowering, tillers m^{-2}, filled grains $panicle^{-1}$, unfilled grains $panicle^{-1}$, panicle length, root length, root dry weight, test weight, sodium content of the stem and yield. The mean values of the characters like plant height (x_2), days to 50% flowering(x_3), tiller m^{-2} (x_4), filled grains (x_5), unfilled grains (x_6), panicle length (x_7), root length (x_8), root dry weight (x_9), test weight (A) and sodium content of the stem (B) were used for the construction of the selection index based on Fisher's (1936) descriminant function. The expected genetic advance and relative efficiency over selection were computed for all the traits according to Brim *et al*. (1959).

The selection indices comprising various character combinations along with their genetic advance and relative efficiency were furnished in Table-1. Data revealed that maximum gain of 98.149% may be expected when 9 attributes viz., seed yield, plant height, days to 50% flowering, tillers m^{-2}, filled grains, panicle length, root length, root dry weight and sodium content with seed yield were included in the function. The trait tillers m^{-2} (88.23) followed by filled grains (28.92) showed maximum genetic advance individually. When a combination of two attributes (plant height and tillers m^{-2}) was made in the function there is no satisfactory grain. A combination of 5 traits viz., seed yield, tillers m^{-2}, filled grains, panicle length, root length indicated substantial gain 98.149%. The highest relative efficiency was observed with index involving seven characters days to maturity + panicle length + panicles per hill + plant height + filled grains + 1000 grain weight + seed yield. Thus, when more characters were included in the construction of index more relative efficiency is realised. Habib *et al*. (2007) reported that a progressive increase in the efficiency of selection with inclusion of additional characters in the selection index. They also reported that among the single variable indices filled grains per panicle showed maximum relative efficiency over the straight selection for grain yield. While, Ukaoma *et al*. (2013) considered number of grains per plant as the most reliable selection index for yield improvement. Among the two component character indices, combination of seed yield and tillers m^{-2} showed highest genetic advance (89.22) with a relative efficiency of (119.18). The other traits combinations with seed yield that exhibited higher values of genetic advance and relative efficiency were filled grains (28.9 and 39.04) and plant height (11.07 and 14.9). Likewise 3 character combinations showed still higher genetic advance. Maximum genetic advance (98.14) and relative efficiency of 131.023 was shown when seed yield, plant height, days to 50% flowering, tillers m^{-2}, filled grains, panicle length, root length, root dry weight and sodium content with seed yield were included in the function. The inclusion of character one by one in the function resulted in the increased efficiency of selection. From the result it can be concluded that the index based on the traits tillers m^{-2}, filled grains $panicle^{-1}$,

Table 1. *Selection indices for different character combinations*

S.No.	Character combination	Index score	Expected genetic advancement	Relative efficiency	Grand mean	Vg value with seed yield
1	Seed yield x1	1.53	0.74	100.00	2.40	—
2	Plant height x2	22.01	10.68	14.43	76.72	0.5128 **
3	Days to 50% flowering x3	11.71	5.68	7.68.	75.73	0.0986
4	Tillers m^{-2} x4	181.76	88.23	119.19.	337.73	-0.0136
5	Filled grains x5	59.59	28.92	39.07.	82.61	-0.0340
6	Unfilled grains x6	14.01	6.80	9.18.	11.81	-0.0315
7	Panicle length x7	4.85	2.35	3..18.	22.07	0.2971 *
8	Root length x8	4.61	2.42	3.02.	14.78	0.0915
9	Root dry weight x9	4.89	2.37	3.20.	5.64	0.3058 *
10	Test weight A	0.52	0.25	3.4.	3.38	-0.4461 **
11	Sodium content B	3.70	1.79	2.42.	2.60	-0.1464
	x1x2	22.814	11.075	14.96.		
	x1x3	11.903	5.778	7.80.		
	x1x4	191.736	89.222	119.18.		
	x1x5	59.540	28.903	39.04.		
	x1x6	13.997	6.795	9.17.		
	x1x7	5.351	2.598	3.50.		
	x1x8	4.929	2.393	3.23.		
	x1x9	5.531	2.685	36.2		
	x1A	1.888	0.916	12.3		
	x1B	3.723	1.807	24.4		
	x2x4x5	194.680	94.505	127.66.		
	x1x2x4x5	194.720	94.524	127.69.		
	x2x4x5x7	196.604	95.439	128.92.		
	x2x4x5x9	197.055	95.658	129.22.		
	x1x2x4x5x9	197.106	95.682	129.25.		
	x2x4x5x7x8	197.482	95.865	129.50.		
	x2x4x5x7x9	199.029	96.616	130.52.		
	x1x2x4x5x7x9	199.088	96.645	130.55.		
	x2x4x5x7x8x9	199.935	97.056	131.11		
	x1x2x4x5x7x8x9	199.996	97.085	131.15.		
	x1x2x3x4x5x7x8x9	200.009	97.092	131.16.		
	x1x2x4x5x7x8x9A	200.036	97.105	131.18.		
	x1x2x3x4x5x7x8x9B	200.126	98.149	131.23		
	x1x2x3x4x5x7x8x9AB	200.166	97.168	131.26		

Table 2. *Weighing coefficients (bi) and economic weights (ai) for different traits*

S.No.	Character combination	bi	ai
1	Seed yield x1	1.235	0.013
2	Plant height x2	0.697	0.013
3	Days to 50% flowering x3	0.964	0.013
4	Tillers m^{-2} x4	1.226	0.002
5	Filled grains x5	0.646	0.012
6	Unfilled grains x6	-1.047	0.084
7	Panicle length x7	0.907	0.045
8	Root length x8	0.540	0.178
9	Root dry weight x9	-17.761	0.29
10	Test weight A	1.945	0.38
11	Sodium content B	5.643	0.416

Table 3. *Selection criteria for the 30 genotypes*

S. No.	Genotype	Designation	Score
1	4	IR 68144-2B-2-2-3-2	730.7
2	11	IR 74095-AC-45	688.106
3	5	IR 68144-2B-2-2-3-3	686.635
4	26	IR78806-B-B16-1-2-2-AJY1	685.523
5	7	IR 72593-B-18-2-2-2	671.086
6	13	IR 73571-3B-14-2	642.844
7	14	IR 72593-B-3-2-3-3	611.311
8	6	IR 72593-B-13-3-3-1	601.64
9	12	IR 74095-AC-64	591.358
10	15	IR 71895-3R-60-3-1	577.158
11	19	IR 76346-B-B-10-1-1-1	574.818
12	30	MTU 1010	553.349
13	16	IR 75395-2B-B-19-2-1-2	547.928
14	3	TCCP 266-1-3B-10-2-1	546.855
15	18	IR 76397-2B-6-1-1-1-1	538.686
16	1	IR 51499-2B29-2B-1-1	518.087
17	10	IR 72579-B-2R-3-1-1	512.263
18	8	IR 71829-3R-89-1-1	500.581
19	17	IR 76393-2B-7-1-1-3-1	496.434
20	23	IR 77674-3B-8-2-2-13-4-AJY 2	490.422
21	24	IR 77674-3B-2-2-14-2-AJY 3	484.428
22	2	IR 59418-7B-21-3	465.873
23	25	IR 77674-3B-8-2-2-14-2-AJY 4	450.887
24	28	IR 77664-B-25—1-2-1-3-12-5-AJY 1	446.053
25	20	IR 63731-1-1-3-3-2	437.978
26	27	IR 77664-B-25-1-2-1-3-12-3-AJY 1	436.603
27	9	IR 71991-3R-2-6-1	436.238
28	22	IR 77674-3B-8-1-3-13-2-AJY 2	426.647
29	21	IR 72579-B-2R-1-3-2	403.349
30	29	IR 29	371.079

plant height, days to 50% flowering and panicle length gave most efficient genetic advance and relative efficiency and may be used for simultaneous improvement of these traits and yield.

The economic weights (a_i values) allotted for each character along with weighing coefficients (bi, values) are furnished in Table 2. Inverse of mean values for respective characters were considered as allotted weight**.** Among the traits sodium content showed highest weightage (0.416) as well as high bi (5.64) value followed by test weight (0.38 and 1.94). Yeo *et al.* (1990) reported that physiological characteristics such as low shoot sodium concentration would increase the ability of the plant to cope with salinity and that vigor was strongly correlated with survival shoot sodium concentration, which a priority expected to be important and accounted for a small proportion of the variability in the survival under the soil salinity. The selection criteria for the 30 genotypes of paddy were furnished in Table 3. Higher values of selection criteria were observed for the genotypes IR 68144-2B-2-2-3-2, IR 74095-AC-45 and IR 68144-2B-2-2-3-3. While, lowest being reported by IR29 and IR 72579-B-2R-1-3-2. From the results it can be concluded that the function involving seven characters viz. days to maturity, panicle length, panicles per hill, plant height, filled grains, 1000 grain weight and seed yield had the highest genetic advance and relative efficiency and as such, results in simultaneous yield improvement in paddy under saline condition of soils.

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