

Selection Indices for Yield and Physiological Traits of Paddy under Coastal Saline Eco System

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ABSTRACT

Selection indices constructed for 26 genotypes of paddy under coastal saline ecosystem for yield and physiological traits using the discriminant function revealed that the index involving seven physiological characters viz; Plant Height, Days to 50% flowering, Specific Leaf Weight, Calcium content of stem, Root length, Root Dry weight and Test weight with seed yield had the highest genetic advance and relative efficiency suggesting that simultaneous selection for these traits would be advantageous over straight selection for seed yield of paddy under saline conditions.

Keywords: Paddy, Physiological Traits, Selection Indices, Coastal Salinity

1. INTRODUCTION

The low success in rice (*Oryza Sativa* L) salt tolerance breeding is at least partially, due to the low selection efficiency using overall agronomic characters, lack of effective evaluation methods for salt tolerance among genotypes, and the complexity of salinity tolerance mechanisms. Yield is a complex trait influenced by environmental fluctuations as such, direct selection for yield 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. In addition to intergenetic variation of different crops to tolerate salinity, there is wide variation in

the inherent salt tolerance for various physiological traits in addition to the morphological and Agronomic characters

2. MATERIAL & METHODS

The trial was conducted at Machilipatnam Agricultural Research Station, Krishna District of Andhra Pradesh representing coastal saline eco system with pH - 7.35, EC (dS m⁻¹) - 14.21 and ESP % - 17.57 with 26 rice germplasm lines. The experiment was laid out in a Randomized Block Design with two replications and a good crop was raised as per the recommended agronomic practices. Data were recorded on 10 random and competitive plants on the physiological parameters viz., Plant height, Days to 50% flowering, Specific leaf weight, Specific leaf area, Sodium content of stem, Potassium content of stem, Calcium content of stem, Root length, Root dry weight, Chlorophyll a, Chlorophyll b, Total Chlorophyll, Test weight and Grain yield. The mean values of the characters like Plant height(x₂), Days to 50% flowering(x₃), Specific Leaf Weight (x₄), Specific Leaf Area (x₅), Sodium content of the stem (x₆), Potassium

content of stem(x7), Calcium content of stem (x8)Root length (x9), Root Dry weight (A), Test weight (B) Chlorophyll a (C) chlorophyll b (D) and Total Chlorophyll (E) were used for the construction of the selection index based on Fisher's (1936) discriminant function. The expected genetic advance and relative efficiency over selection were computed for all the traits according to Brim et al (1959).

3. RESULTS AND DISCUSSION

The selection indices comprising various character combinations along with their genetic advance and relative efficiency were furnished in table-1. . The trait plant height (13.52) followed by specific leaf area(8.08) and days to 50%flowering(6.92) showed maximum genetic advance individually. When a combination of two attributes(Plant Height, days to 50%flowering) was made in the function there is no satisfactory gain. A combination of 4 traits viz., Seed Yield, plant height, days to 50%flowering and specific leaf area indicated substantial gain (40.54). The highest relative efficiency was observed with index involving eight characters plant height + days to 50% flowering + Specific Leaf Weight + Calcium content of stem + Root length + Root Dry weight + Test weight + seed yield . Thus ,when more characters were included in the construction of index more relative efficiency is realised. These findings are in agreement with Sujoita and Majumdar .While, 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 grain per panicle showed maximum relative efficiency over the straight selection for grain yield. . While ,Ukaoma et al (2013) considered no. of grains per plant as the most reliable selection index for yield improvement.

Among the two component character indices, combination of seed yield and plant height. showed highest genetic advance (17.58) with a relative efficiency of (320.69). The other traits combinations with seed yield that exhibited higher values of genetic advance and relative efficiency were specific leaf area (9.52 and 173.71) and days to 50%flowering (8.20and 149.69). Like wise 3 character combinations showed still higher genetic advance. . The inclusion of character one by one in the function resulted in the increased efficiency of

selection. when 8 attributes viz., Seed Yield, Plant Height, Days to 50% flowering, Specific Leaf Weight., Calcium content of stem ,Root length , Root Dry weight and Test weight with seed yield were included in the function maximum gain was achieved. From the result it can be concluded that the index based on these traits 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 (b_i , values) are furnished in table 2. Inverse of mean values for respective characters were considered as allotted weight. Among the traits chlorophyll b content showed highest weightage(27.86) value followed by Days to 50% flowering (3.13).while specific leaf weight(16.6) followed by. chlorophyll a(2.32) showed maximum economic weightage.

A.R.Yeo, M.E.Yeo,S.A.Flowers and T.J.Flowers) 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 26 genotypes of paddy were furnished in table3. Higher values of selection criteria were observed for the genotypes MCM 225 , NLR 20017and MCM220 While, lowest being reported by NLR 33365

4. CONCLUSION

From the results it can be concluded that the function involving seven characters, Plant Height, Days to 50% flowering, Specific Leaf Weight., Calcium content of stem ,Root length , Root Dry weight and Test weight with seed yield included in the function. had the highest genetic advance and relative efficiency and as such, results in simultaneous yield improvement in paddy under saline condition of soils.

S. No.	Character Combination	Index Score	Expected Genetic Advancement	Relative Efficiency	Grand Mean	Vg Value with Seed Yield
1	Seed Yield x1	11.293	5.482	100.000	11.6831	--
2	Plant Height x2	27.855	13.522	246.650	89.3677	0.6491 ***
3	Days to 50% flowering x3	14.263	6.924	126.299	103.7692	-0.1312
4	Specific Leaf Weight x4	0.177	0.086	1.569	0.0658	0.1523
5	Specific Leaf Area x5	16.649	8.082	147.421	21.3158	-0.0639
6	Sodium Content of the Stem x6	3.931	1.908	34.812	2.6950	-0.1112
7	Potassium Content of the Stem x7	2.383	1.157	21.104	1.6592	0.0535
8	Calcium Content of the Stem x8	2.483	1.205	21.983	3.9538	0.163
9	Root Length x9	5.363	2.603	47.486	18.7731	0.3069*
10	Root Dry Weight A	13.018	6.319	115.271	11.5962	-0.0325
11	Test Weight B	1.275	0.619	11.291	1.5962	0.0339
12	Chlorophyll a C	0.117	0.057	1.038	0.4318	-0.0850
13	chlorophyll b D	0.379	0.184	3.356	0.6802	0.1034
14	Total Chlorophyll E	0.377	0.183	3.342	1.1705	0.0251
15	x1x2	36.216	17.581	320.693		
16	x1x3	16.906	8.207	149.699		
17	x1x4	11.322	5.496	100.252		
18	x1x5	19.618	9.523	173.714		
19	x1x6	11.459	5.563	101.468		
20	x1x7	11.617	5.639	102.870		
21	x1x8	11.924	5.789	105.589		
22	x1x9	13.892	6.744	123.011		
23	x1A	16.911	8.209	149.741		
24	x1B	11.380	5.524	100.770		
25	x1C	11.281	5.476	99.891		
26	x1D	11.334	5.502	100.366		
27	x1E	11.304	5.487	100.094		
28	x1x2x3x5	40.549	19.68	40.55		
29	x1x2x3x8	40.763	19.79	40.76		
30	x1x2x3A	43.313	21.03	43.31		
31	x1x2x3x4A	43.361	21.05	43.36		
32	x1x2x3x8A	44.411	21.56	44.41		
33	x1x2x3x4x8A	44.460	21.58	44.46		
34	x1x2x3x8x9A	45.320	22.00	45.32		
35	x1x2x3x4x8x9A	45.362	22.02	45.36		
36	x1x2x3x8x9AB	45.415	22.05	45.41		
37	x1x2x3x4x8x9AB	45.459	22.07	45.46		
38	x1x2x3x8x9ABC	45.470	22.07	45.47		
39	x1x2x3x4x8x9ABC	45.523	22.10	45.52		
40	x2x3x4x5x6x7x8x9ABCDE	37.034	17.98	37.03		
41	x1x2x3x4x5x6x7x8x9ABCDE	43.252	21.00	43.25		

Table: 1.Selection Indices for Different Character Combinations

Table: 2. Weighing Coefficients(b_i) and economic weights(a_i) for different physiological traits

S.No.	Character Combination	b_i	a_i
1	Seed Yield	0.9900	0.085
2	Plant Height	1.0041	0.011
3	Days to 50% flowering	3.1376	0.009
4	Specific Leaf Weight	1.003	16.6
5	Specific Leaf Area	1.0493	0.046
6	Sodium Content of the Stem	1.0835	0.371
7	Potassium Content of the Stem	-0.1460	0.60
8	Calcium Content of the Stem	1.2862	0.25
9	Root Length	1.0991	0.05
10	Root Dry Weight	-0.5086	0.09
11	Test Weight	-66.6170	0.62
12	Chlorophyll a	-18.9497	2.32
13	chlorophyll b	27.8698	1.47
14	Total Chlorophyll	0.9897	0.85

Table: 3. Selection criteria for the 26 genotypes

S. No.	Genotype	Designation	Score
1	19	MCM 225	285.814
2	12	NLR 20017	272.674
3	18	MCM 220	254.713
4	23	NLR 40024	233.226
5	17	IR 46072	285.105
6	25	NLR 33359	270.154

7	20	NLR 30491	254.535
8	26	NLR 33671	231.790
9	11	NLR 3084	279.672
10	10	NLR 33636	267.978
11	15	MTU 1001	253.886
12	3	NDRK 50016	223.397
13	5	NLR 33057	278.659
14	4	RGL 11416	265.651
15	14	BPT 2270	251.536
16	2	NLR 34442	222.331
17	21	NLR 20002	277.424
18	7	RGL 1880	265.117
19	24	RGL 3442	242481
20	1	NLR 33358	208.234
21	16	POKKALI	276.439
22	9	NDRK 50015	262.968
23	13	NONABOKRA	262.211
24	22	NLR 9672	273.566
25	6	NLR 27999	257.174
26	8	NLR 33365	241.785

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