Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(5): 3288-3290
Received: 21-07-2020
Accepted: 25-08-2020

Patel Dipika P
Department of Genetics and Plant Breeding, College of Agriculture Junagadh Agricultural University Junagadh, Gujarat, India

Kulkarni GU
Department of Genetics and Plant Breeding, College of Agriculture Junagadh Agricultural University Junagadh, Gujarat, India

Corresponding Author:
Patel Dipika P
Department of Genetics and Plant Breeding, College of Agriculture Junagadh Agricultural University Junagadh, Gujarat, India

Selection indices for yield improvement in bread wheat (*Triticum aestivum* L.)

Patel Dipika P and Kulkarni GU

Abstract
Fifty diverse genotype of bread wheat (*Triticum aestivum* L.) evaluated in a randomized in a block design with three replication to study selection indices during *Rabi* 2018-2019. Sixty-three selection indices involving grain yield per plant and its five components *viz*., plant height, ear length, number of grains per main spike, grain weight per main spike and harvest index were constructed using the discriminant function technique. The efficiency of selection increased with the inclusion of more characters in the selection index. The index based on six characters *viz*., grain yield per plant, plant height, ear length, number of grains per main spike, grain weight per main spike and harvest index recorded the highest genetic gain and relative efficiency. The use of these indices is advocated for selecting high yielding genotypes of bread wheat.

Keywords: Selection indices, discriminant function, relative efficiency, and bread wheat

Introduction
Wheat (*Triticum aestivum* L.) is the second most important cereal crop of India with 29.32 million hectare which produces 103.60 million metric tonnes of wheat with a productivity of 3.53 metric tonnes per hectare (Anon., 2019). In Gujarat, wheat is grown in about 0.79 million hectare with total production of 2.41 million metric tonnes and a productivity of 3.02 metric tonnes per hectare (Anon., 2019). Grain yield is governed by a polygenic system and is highly influenced by the fluctuations in the environment. For this purpose, the utilization of an appropriate multiple selection criteria based on the selection indices would be more desirable. An application of discriminant function developed by Fisher (1936) and first applied by Smith (1936) helps to identify important combination of yield components useful for selection by formulating suitable selection indices. Therefore, the object of the present study was to construct and assesses the efficiency of selection indices in bread wheat.

Materials and Methods
The experimental material was conducted using fifty diverse genotypes of bread wheat during *Rabi* 2018-19 in a Randomized Block Design with three replications at Instructional Farm, Department of Agronomy**,** Junagadh Agricultural University, Junagadh. The characters studied were days to 50% flowering, days to maturity, grain filling period (days), plant height (cm), the number of productive tillers per plant, ear length (cm), number of grains per main spike, grain weight per main spike (gm), grain yield per plant (gm), biological yield per plant (gm), harvest index (%) and 1000 grain weight (gm) For constructing the selection indices, the characters which had high and positive correlation with grain yield per plant and direct effects on grain yield were considered. In this context, grain yield per plant (X1), number of productive tillers per plant (X2), plant height (X3), biological yield per plant (X4) and harvest index (X5) were identified and considered. The model suggested by Robinson *et al.* (1951) [8] was used for the construction of selection indices and the development of required discriminant function. A total of 63 selection indices were constructed using six traits. The respective genetic advance through selection was also calculated as per the formula suggested by Robinson *et al.* (1951) [8]. The relative efficiency of different discriminant functions in relation to straight selection for grain yield were assessed and compared, assuming the efficiency of selection for grain yield per plant as 100%.

Results and Discussion
Selection indices for grain yield per plant and other characters were constructed and examined to identify their relative efficiency in the selection of superior genotypes. The results on The data on selection indices, discriminant functions, genetic gain, relative efficiency and relative efficiency per character are presented in Table 1.

The results suggested that the selection efficiency was higher, in general, over straight selection when the selection was based on component character, which further increased with the inclusion of two or more characters. The highest efficiency was noted when six characters were considered. Robinson *et al.* (1951) [8] in corn recorded a progressive increase in efficiency of selection indices with the inclusion of every additional character in the index formula. Hazel and Lush (1943) [5] stated that the superiority of selection based on index increases with an increase in the number of characters under selection and Esheghi *et al.* (2011) [2] and Shah *et al.* (2016) [9] also suggested that the selection index be superior to direct selection in bread wheat.

The maximum relative efficiency in a single character discriminant function of 1138.09% was exhibited by plant height. However, it increased up to 1696.88% in two-character combination involving the plant height and harvest index (X2+X6); 2123.55% in three-character combination involving the plant height, number of grains per main spike and harvest index (X2+X4+X6); 2274.85% in four-character combination involving plant height, ear length, number of grains per main spike and harvest index (X2+X3+X4+X6); 2406.55% in five-character combination involving grain yield per plant, plant height, ear length, number of grains per main spike and harvest index (X1+X2+X3+X4+X6) and 6081.13% in six- character combination involving the grain yield per plant, plant height, ear length, number of grains per main spike, grain weight per main spike and harvest index (X1+X2+X3+X4+X5+X6). Ferdous *et al.,* (2010) [3] and Kemelew, (2011) [6] were also with the same opinion that, an increase in characters resulted in an increase in genetic gain and that the selection indices improve the efficiency than the straight selection for grain yield alone.

Further, it was observed that the straight selection for grain yield (X1) was not that much rewarding (GA = 0.91 g, RI =100%) as it was through its components like plant height, ear length, number of grains per main spike, grain weight per main spike and harvest index or in their combinations. Among all the 63 selection indices, the index based on five characters *viz.*, grain yield per plant, grain yield per plant, plant height, ear length, number of grains per main spike, grain weight per main spike and harvest index (X1+X2+X3+X4+X5+X6) possessed the highest genetic gain and relative efficiency (55.87 g and 6081.13%) as compared to straight selection for grain yield. However, in practice, the plant breeder might be interested in maximum gain with the minimum number of characters. In this context, the selection index consisting grain yield per plant, plant height, ear length, number of grains per main spike, grain weight per main spike and harvest index (X1+X2+X3+X4+X5+X6) could be advantageously exploited in the wheat breeding programmes. High efficiency in selection based on grain yield per plant, plant height, ear length, number of grains per main spike, grain weight per main spike and harvest index or in combination of all these six characters has been reported by Patel, (2006) [7]. The present study also revealed that the discriminant function method of making selections in plants appears to be the most useful than the straight selection for grain yield alone and hence, due weightage should be given to the important selection indices while making selection for grain yield advancement in bread wheat.

Table 1: Selection index, discriminant function, expected genetic advance in yield and relative efficiency from the use of different selection indices in bread wheat.

Sr. No.	Selection index	Discriminant function	Expected genetic advance	Relative efficiency	Relative efficiency Per character (%)
1	X1 Grain yield/plant	0.5373X1	0.91	100	100
2	X2 Plant height	0.8937X2	10.45	1138.09	1138.09
3	X3 Ear length	0.7132X3	1.21	132.21	132.21
4	X4 No. of grains per main spike	0.9387X4	5.51	600.79	600.79
5	X5 Grain weight per main spike	0.9481X5	0.80	87.52	87.52
6	X6 harvest index	0.7601X6	7.18	781.72	781.72
7	X1.X2	0.4651 + 0.9264	11.26	1225.59	612.79
8	X1.X3	0.2756 + 1.1757	2.40	261.23	130.62
9	X1.X4	0.2141 + 1.0708	6.54	711.84	355.92
10	X1.X5	0.0213 + 2.4149	2.07	225.31	112.65
11	X1.X6	1.2309 + 0.7155	8.41	915.38	457.69
12	X2.X3	0.8552 + 1.4336	11.72	1275.66	637.83
13	X2.X4	0.8826 + 1.0410	14.24	1549.94	774.97
14	X2.X5	0.8582 + 1.9436	10.98	1195.11	597.55
15	X2.X6	0.9609 + 0.7757	15.59	1696.88	848.44
16	X3.X4	-5.5653 + 2.3259	7.73	841.37	420.68
17	X3.X5	-4.5289 + 15.0337	6.76	735.79	367.89
18	X3.X6	1.1838 + 0.7294	8.20	892.52	446.26
19	X4.X5	0.8075 + 2.0436	6.31	686.81	343.40
20	X4.X6	1.0982 + 0.7202	11.22	1221.23	610.61
21	X5.X6	2.5387 + 0.6959	7.81	850.07	425.03
22	X1.X2.X3	-0.8576 + 0.8605 + 2.7876	12.68	1380.14	460.05
23	X1 X2.X4	-0.1288 + 0.9222 + 1.2003	15.25	1659.88	553.29
24	X1.X2.X5	-0.4694 + 0.8851 + 3.9492	11.94	1299.60	433.20
25	X1.X2.X6	0.6665 + 0.9711 + 0.7999	16.69	1816.61	605.54
26	X1.X3.X4	0.2958 + 0.5003 + 1.1604	7.90	859.87	286.62
27	X1.X3.X5	0.1901 -0.4011 + 4.6851	3.61	392.93	130.98
28	X1.X3.X6	1.0390 + 1.0485 + 0.7236	9.46	1029.67	343.22
29	X1.X4.X5	-0.2966 + 0.7504 + 4.3256	7.45	810.89	270.29
30	X1.X4.X6	0.6887 + 1.1297 + 0.7380	12.49	1359.47	453.16
31	X1.X5.X6	0.2073 + 3.4679 + 0.7461	9.11	991.57	330.52
32	X2.X3.X4	0.8824 + 1.1596 + 0.9861	15.65	1703.41	567.80

33	X2.X3.X5	0.8615 + 0.9772 + 1.9596	12.28	1336.61	445.54
34	X2.X3.X6	0.9193 + 1.6656 + 0.7158	16.90	1839.47	613.16
35	X2.X4.X5	0.8613 + 0.8102 + 3.0012	14.92	1623.96	541.32
36	X2.X4.X6	0.9398 + 1.1373 + 0.7352	19.51	2123.55	707.85
37	X2.X5.X6	1.0309 + 6.6197 -0.1362	15.17	1651.17	550.39
38	X3.X4.X5	-1.0920 + 0.8938 + 5.2927	7.79	847.89	282.63
39	X3.X4.X6	0.1633 + 1.2656 + 0.7478	12.51	1361.64	453.88
40	X3.X5.X6	-1.2784 + 6.3283 + 0.7559	9.05	985.04	328.35
41	X4.X5.X6	0.7235 + 4.1767 + 0.6883	12.01	1307.22	435.74
42	X1.X2.X3.X4	-0.8930 + 0.8872 + 2.5634 + 0.9794	16.72	1819.88	454.97
43	X1.X2.X3.X5	-0.9129 + 0.8773 + 1.6229 + 3.5428	13.32	1449.81	362.45
44	X1.X2.X3.X6	-0.3093 + 1.4057 + 0.2508 +0.7859	19.02	2070.22	517.55
45	X1.X2.X4.X5	-0.8108 + 0.8974 + 0.7496 +5.8118	16.04	1745.86	436.46
46	X1.X2.X4.X6	-0.1236 + 0.9621 + 1.2477 +0.8273	20.69	2251.99	562.99
47	X1.X2.X5.X6	-0.8264 + 0.9137 + 5.0541 + 0.8526	17.44	1898.25	474.56
48	X1.X3.X4.X5	0.0480 -0.9727 + 0.8273 + 6.9032	8.94	973.07	243.27
49	X1.X3.X4.X6	1.0180 -0.1150 + 1.3174 + 0.7452	13.79	1500.96	375.24
50	X1.X3.X5.X6	0.6113 -1.7680 + 7.6362 + 0.7871	10.41	1133.07	283.27
51	X1.X4.X5.X6	-0.2756 + 0.6485 + 6.0460 + 0.7824	13.35	1453.07	363.27
52	X2.X3.X4.X5	0.8939 + 0.1306 + 0.8043 + 4.3674	16.37	1781.78	445.44
53	X2.X3.X4.X6	0.9559 + 0.8336 + 1.1509 + 0.7287	20.90	2274.85	568.71
54	X2.X3.X5.X6	0.9467 -0.3940 + 5.2052 + 0.7357	17.57	1912.39	478.09
55	X2.X4.X5.X6	0.9045 + 0.7169 + 4.7849 + 0.7068	20.24	2203.01	550.75
56	X3.X4.X5.X6	-2.0528 + 0.8631 + 8.4086 + 0.7707	13.48	1467.22	366.80
57	X1.X2.X3.X4.X5	-1.1179 + 0.9054 + 1.0895 + 0.6789 + 6.4726	17.52	1906.95	381.39
58	X1.X2.X3.X4.X6	-0.5583 + 0.9595 + 1.5242 + 1.1775 + 0.8418	22.11	2406.55	481.31
59	X1.X2.X3.X5.X6	-0.8682 + 0.9599 -0.3319 + 7.0688 + 0.8747	18.81	2047.36	409.47
60	X1.X2.X4.X5.X6	0.0488 + 0.9668 + 1.3272 + 0.1084 + 0.8185	21.34	2322.74	464.55
61	X1.X3.X4.X5.X6	0.3099 -2.3593 + 0.8166 + 10.0037 + 0.8232	14.83	1614.16	322.83
62	X2.X3.X4.X5.X6	0.9786 -1.2857 + 0.7992 + 7.6597 + 0.7487	21.70	2361.92	472.38
63	X1.X2.X3.X4.X5.X6	5.1449 + 12.3865 -2.3058 + 5.2635 -10.2173 -0.6959	55.87	6081.13	1013.52

References

1. Anonymous. Directorate of Economics and Statistics. Department of Agriculture, Cooperation and Farmers welfare, Ministry of Agriculture and Farmers Welfare. http//:enads.dacnet.nic.in, accessed 2019.
2. Esheghi R, Javid O, Samira S. Genetic gain through selection indices in hull less barley. Int. J Agric. and Biol 2011;13(9):191-197.
3. Ferdous MF, Shamsuddin AKM, Hasna D, Bhuiyan MMR. Study on relationship and selection index for yield and yield contributing characters in spring wheat. J Bangladesh Agril. Univ 2010;8(2):191-194.
4. Fisher RA. The use of multiple measurements in taxonomic problems. Ann. Eugen 1936;7(2):179-188.
5. Hazel LN, Lush JL. The efficiency of three method of selection. J Hered 1943;33:393-399.
6. Kemelew M. Selection index in durum wheat *(Triticum turgidum* var. *durum)* variety development. Academic J. Pl. Sci 2011;4(2):77-83.
7. Patel VV. Character association and selection indices in bread wheat (*Triticum aestivum* L.). Unpublished M.Sc. (Agri.) thesis submitted to Junagadh Agril Uni., Junagadh 2006.
8. Robinson HF, Comstock RE, Harvey PH. Genotypic and phenotypic correlations in corn and their implications in selection. Agron. J 1951;43:282-287.
9. Shah S, Mehta DR, Raval L. Selection indices in bread wheat (*Triticum aestivum* L.). Electron. J Plant Breed 2016;7:459-463.
10. Smith HF. A discriminant function for plant selection. Ann. Eugen 1936;7(3):240-250.