

Vector Analysis for Selection of Parents for Hybridization in Wheat

By

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ABSTRACT

Nine varieties of wheat were tested to find out the best combinations by vector analysis. It was concluded that the ideal values to the extent of 86 per cent can be obtained in the second back cross of S310 x S409 while using S310 as the recurrent parents and further selection may be practised to set a line still closer to the ideal.

INTRODUCTION

Varying methods have been in use for the selection of parents for the hybridization programmes. But there has been no method by which one could find out the combination and proportion of parents which have most favourable blend of germplasm and are of considerable value for the development of new varieties. The value of r^2 has been used to measure the degree of determination of one set of data by another. A vector representation of biological fields of force based on the degree of determination was developed by Grafius and Kiesling (1958). Since then, a more comprehensive model has been developed. In these models the degree of determination was used as cosine of the angle between two vectors. Hence the present studies were made on a group

of varieties of wheat to have the idea of the parents, the combinations of which could result in the desired plant type/ideal varieties.

MATERIALS AND METHODS

The present study was made on a group of nine diverse varieties of wheat grown in a completely randomized block design. The spacings within and in between plants were maintained at 30 and 7.5 cm, respectively. The plot size was a single row of 3 metre length.

Twenty five plants were randomly selected from each plot and the data on the eight characters including, plant height (cm), length of flag leaf (cm), width of flag leaf (cm), number of effective tillers, spikelets per spike,

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TABLE 1. Relative values expressed as per cent of the mean and the range of error

Parent	Height (cm)	Tiller Number	Length of flag leaf (cm)	Width of flag leaf (cm)	Spikelet number	100 K. W. (g)	Seeds per spike	Total yield (g)
C 306	122	92	102	84	88	103	75	93
NP 839	129	101	105	90	87	101	64	85
S 210	92	112	86	100	103	92	69	93
S 310	84	91	97	118	100	110	96	110
K 227	86	99	111	104	100	81	12	121
S 409	60	126	86	116	97	57	75	70
S 308	98	89	103	89	83	118	75	114
USA 190	119	87	99	85	94	123	68	94
USA 255	109	91	112	116	102	114	89	120
Ideal	83	127	111	118	102	116	12	121
Range	2.5	11.8	7.0	6.8	2.3	3.7	1.4	12.4

grains per spike, 100-kernel weight (g) and yield per plant (g).

Mean values of 20 plants per entry were used for statistical analysis. The data for each character was converted to percentage of mean of the population to use relative percentage values. An ideal with the optimum was decided upon. The dates were weighted on the basis of the range of acceptability and the correlation coefficients with an ideal and intercorrelation among three positive vectors were worked out by using the formula suggested by Hanson and Robinson (1963).

RESULTS AND DISCUSSION

Vector analysis was applied to nine varieties of wheat selected on the basis of their performance. The value of eight characters were expressed as percentage of mean of nine varieties and an ideal constructed from the available data. The ideal was with (Table 1) higher values for yield, seeds per spike, 100-seed weight, spikelet number, width of flag leaf, length of flag leaf, total yield per plant and tiller number and with minimum height. The means were weighted on the basis of range of error and then the correlation and degree of determination of

TABLE 2. Weighted means and correlation co-efficients of nine varieties with an ideal.

Parent	Height (cm)	Tiller Number	Length of flag leaf [cm]	Width flag leaf (cm)	Spikelet number	100 K. W. (g)	Total yield per plant (g)	Seeds per spike	Correlation with ideal (r)	Coefficient of determination (r ²)
C 306	188	93	103	76	48	108	94	54	-0.75	...
NP 839	216	101	101	85	43	103	88	33	-0.77	...
S 210	68	110	80	100	113	78	94	43	0.21	0.0441
S 310	36	92	96	126	100	127	108	93	0.93	0.8649
K 227	44	99	116	106	100	49	117	122	0.47	0.2209
S 409	-60	122	80	124	87	-16	76	54	0.58	0.3364
S 308	92	99	104	98	27	149	111	54	0.22	0.0484
USA 190	176	89	99	78	74	162	95	41	-0.20	...
USA 255	136	92	117	124	109	138	116	80	-0.07	...
Ideal	32	123	116	126	109	143	117	122

the ideal with each variety was worked out (Table 2).

A few varieties viz. C 306, NP839, USA 190 and USA 255 showed negative association with the ideal. This negative association seemed to be due to maximum height of these varieties and least spikelet number. The two varieties viz. S210 and S308 possessed very little correlation. The positive and relatively higher correlation and degree of determination was observed for S310, Kalyan 227 and Shug with the ideal. These strains

were considered as the best strains and were further used, for finding out best combination which could yield best strains. The intercorrelations among these positive vectors were calculated and are presented in Table 3. It was observed that Kalyan 227 and S 409 varieties were very close with each other, however the maximum diversity was between S 310 and Kalyan 227 and was followed by S 310 and S 409 combination.

Since maximum concentration of genes is expected in crosses from

TABLE 3. Inter-correlation among three positive vectors

Parent	Height (cm)	Tiller Number	Length of flag leaf (cm)	Width of flag leaf (cm)	Spikelet Number	100 K. W. (g)	Total yield per plant (g)	Seeds per spike	Correlation between
S 310	36	92	96	126	100	127	108	93	S 310 × K 227 0.36
K 227	44	99	116	106	100	49	117	122	K 227 × S 409 0.81
S 409	-60	122	80	124	87	-16	76	54	S 409 × S 310 0.53

TABLE 4. Degree of determination of the expected progenies of various crosses. The actual equations are substitutes for the theoretical crosses.

Cross	Height	Tiller Number	Length of flag leaf	Width of flag leaf	Spikelet Number	100 K. W.	Trial yield	Seeds per spikelet	Correlation	Actual degree of determination
(a×b)*	40.0	95.5	106.0	116.0	100.0	88.0	112.5	107.5	.74	.5476
(a×c)	-12.0	107.0	88.0	125.0	93.5	55.5	92.0	73.5	.79	.6241
(a×c) xa	12.0	99.5	92.0	125.5	96.8	91.3	100.0	83.3	.89	.7921
(a×c) xa ²	24.0	95.8	94.0	125.8	98.4	109.1	104.0	88.1	.93	.8649
Ideal	32.0	123.0	116.0	126.0	109.0	143.0	117.0	122.0

* S 310 = a, Kalyan 227 = b, S 409 = c.

diverse sources, the hypothetical crosses were made between S310 x Kalyan 227 and S310 x S409 and their corre-

lations with the ideal were worked out (Table 4). The hypothetical F¹ between S310 x S409 had 0.6241 degree of

determination. It was further observed that in first back cross with S310 the degree of determination increased to 0.7921 and with another back cross, it further increased to 0.8649.

It is then evident that two back crosses of S310 x S409 combination with S310 will be sufficient to get a line which is closer to the ideal by 86 per cent and further selection may be done to get a line cent per cent like the ideal.

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