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PATH ANALYSIS AND SELECTION INDEX IN GROUNDNUT*

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The yield of groundnut per hactare is low in Kerala. This is mainly due to the lack of high yielding varieties suitable to the Kerala conditions. Yield is dependant on a number of factors. Simultaneous selection based on a number of characters that are influencing yield directly or indirectly is more reliable than for a single character like yield. The path coefficient analysis specifies the cause and measures their relative importance in determining the effect. By the use of selection index, based on descriminant function technique, selection of desirable types based on a number of characters can be made. The present study was an attempt in this line.

Materials and Methods

Twentysix bunch varieties, both indigenous and exotic, showing wide diversity in phenotypic characters were used for the study. The trial was laid out in RBD with three raplications at the Instructional Farm of the College of Agriculture, Vellayani during 1979-80. The plot size was 2.25 m x 1.2 m with 60 plants spaced at 15 cm x 30 cm. The management of the crop was done according to the Package of Practices Recommendations of the Kerala Agricultural University (Anon. 1978). Observations were recorded from 10 plants per plot on number of mature pods, dry weight of haulm, seeds per pod, 100 pod weight 100 kernel weight and pod yield.

Path analysis was performed with reference to the method described by Singh and Chaudhary (1977) for twentysix different combinations of the five characters, viz., number of mature pods, dry weight of haulm, number of seeds per pod, 100 pod weight and 100 kernel weight which were considered as the causes and pod yield as the effect. These models were compared for the least residual effect and also for the characters showing highest direct effect in all the combinations. Residual effect was calculated using the formula suggested by Singh and Chaudhary (1977).

Selection indices were constructed according to the procedure described by Singh and Chaudhary (1977). Using thirtyone different combinations of the characters, viz., number of mature pods, dry weight of haulm, number of seeds per pod, 100 pod weight, 100 kernel weight and pod yield, index value were determined. Efficiency of selection index was calculated by the genetic advance method of evaluation described by Singh and Chaudhary (1977).

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Results and Discussion

Out of the 26 combinations (Table 1) comparatively low residual effects were shown by 10 combinations, viz., combination numbers 23, 21, 26, 22, 12, 24, 16, 15, 14 and 3. When all the 26 combinations of characters were compared, it is seen that number of mature pods had the highest direct effect in all the 15 combinations wherever it was considered as a causal factor. Causal schemes involving number of mature pods showed comparatively low residual effect.

In seven other causal schemes where number of mature pods was not considered as a causal factor, the highest direct effect was shown by 100 pod weight. In three other combinations, 100 kernal weight expressed highest direct effect in which number of mature pods and 100 pod weight were not considered

The direct and indirect effects on yield when all the five components are considered in the causal scheme are presented in Table 2 The direct effect was highest and positive for number of mature pods. Chandola *et al.* (1973) and Sandhu and Khehra (1977) also observed similar results. Next to number of mature pods, 100 pod weight had the highest direct effect on pod yield. In the causal scheme involving number of mature pods, 100 pod weight and 100 kernel weight only, the residual effect observed was 0.4048 which was not significantly different from the residual effect observed when all the characters were included in the causal scheme (0.3561). The character 100 kernel weight also had a very high indirect effect through 100 pod weight.

The results discussed above indicate that these three characters, viz., number of mature pods, 100 pod weight and 100 kernel weight are the important factors contributing to yield and the addition of other factors in the causal scheme gives only very little contribution to pod yield.

The descriminant function technique developed by Fisher (1936) helps in formulating selection models for making selections on several characters simultaneously. Thirtyone different discriminant functions involving different combinations of five characters, viz., number of mature pods, dry weight of haulm, number of seeds per pod, 100 pod weight and 100 kernel weight with yield were tried for the construction of selection indices and presented in Table 3. This will help to identify the function having the minimum number of characters with relatively high efficiency so as to give preference and emphasis to these characters while exercising selection. The genetic advance due to selection based on discriminant function and relative efficiency of selection index as compared to selection for yield alone are presented in Table 3.

When yield and any one of the characters are considered in the selection model, the highest efficiency was observed in the combination of yield and dry weight of haulm and the lowest efficiency in the model using yield and 100 kernel weight. Function using yield and any other two components gives maximum relative efficiency for the combination of yield, number of mature pods and 100 pod weight. When combinations using yield and any other three characters were used in the function the highest relative efficiency was expressed by the function using yield, number of mature pods, dry weight of haulms, and 100 pod weight. Using yield and any other four characters, the highest relative efficiency was recorded by the combination of pod yield, number of mature pods, dry weight of

Table 1

Combination of characters used forthe path analysis, their residual effect and the character showing maximum direct effect

Sl. No.	Combination of characters	Residual effect	Character showing maximum direct effect	Direct effect
1	x_1,x_2	0.7822	x_1	0.6029
2	x_1,x_3	0.7545	x_1	0.7604
3	x_1,x_4	0.4228	x_1	1.1801
4	x_1,x_5	0.5469	x_1	1.0335
5	x_2,x_3	0.9711	x_2	–0.1814
6	x_2,x_4	0 9724	x_4	0.1402
7	x_2,x_5	0.9729	x_5	0.1365
8	x_3,x_4	0.9518	x_4	0.3719
9	x_3,x_5	0.9824	x_5	0.1168
10	x_4,x_5	0.9953	x_4	0.0614
11	x_1,x_2,x_3	0.7522	x_1	0.7459
12	x_1,x_2,x_4	0.4018	x_1	1.1691
13	x_1,x_2,x_5	0.5218	x_1	1.0213
14	x_1,x_3,x_4	0.4115	x_1	1.1477
15	x_1,x_3,x_5	0.4108	x_1	1.3343
16	x_1,x_4,x_5	0.4048	x_1	1.2136
17	x_2,x_3,x_4	0.9103	x_4	0.4879
18	x_2,x_3,x_5	0.9578	x_5	0.1664
19	x_2,x_4,x_5	0.9716	x_4	0.0864
20	x_3,x_4,x_5	0.7822	x_4	3.0862
21	x_1,x_2,x_3,x_4	0.3561	x_1	1.1244
22	x_1,x_2,x_3,x_5	0.3876	x_1	1.3152
23	x_1,x_2,x_4,x_5	0.3098	x_1	1.2045
24	x_1,x_3,x_4,x_5	0.4038	x_1	1.2503
25	x_2,x_3,x_4,x_5	0.6599	x_4	3.7854
26	x_1,x_2,x_3,x_4,x_5	0.3561	x_1	1.1127

x_1 = Number of mature pods x_4 = 100 pod weight
x_2 = Dry weight of haulm x_5 = 100 kernel weight
x_3 = Number of seeds per pod

Table 2

Direct and indirect effects of five yield components on pod yield

Components	Direct effect	Indirect effect via. Number of mature pods	Dry weight of haulm	Number of seeds per pod	100 pod weight	100 kernel weight	Total correlation
Number of mature pods	1.1127	—	0.0385	0.1642	0.7251	0.0271	0.6176
Dry weight of haulms	-0.2198	-0.1948	—	-0.0017	0.2374	-0.0099	-0.1889
Number of seeds per pod	-0.3037	-0.6017	-0.0013	—	07673	-0.0076	-0.1469
100 pod weight	1.1122	-0.7254	-0.0469	-0.2095	—	-0.0368	0.0935
100 Kernel weight	-00459	-0.6595	-0.0475	-0.0502	0.8924	—	0.0893

Table 3

Discriminant functions using different combinations of characters and their efficiency over direct selections for yield

Sl. No.	Combinations	Discriminant functions	Genetic advance of discriminant functions	Efficiency of selection index (%)
1	x_6,x_1	$0.2126x_6+0.0818x_1$	2.3059	104.35
2	x_6,x_2	$0.3803x_6-0.1902x_2$	2.5975	117.55
3	x_6,x_3	$0.3041x_6-0.9527x_3$	2.2583	102.19
4	x_6,x_4	$0.3056x_6+0.0050x_4$	2.2234	100.62
5	x_6,x_5	$0.3057x_6+0.0086x_5$	2.2133	100.16
6	x_6,x_1,x_2	$0.3069x_6+0.0603x_1-0.1812x_2$	2.6418	119.55
7	x_6,x_1,x_3	$0.2223x_6+0.0727x_1-0.2594x_3$	2.3083	104.45
8	x_6,x_1,x_4	$0.1105x_6+0.3450x_1+0.0521x_4$	2.7098	122.63
9	x_6,x_1,x_5	$0.0550x_6+0.2024x_1+0.0908x_5$	2.4745	111.98
10	x_6,x_2,x_3	$0.3764x_1-0.1875x_2-0.8149x_3$	2.6278	105.34
11	x_6,x_2,x_4	$0.3797x_6-0.1963x_2+0.0081x_4$	2.6728	118.92
12	x_6,x_2,x_5	$0.3783x_6-0.1964x_2+0.0220x_5$	2.6162	118.39
13	x_6,x_3,x_4	$0.2921x_6-2.3162x_3+0.0204x_4$	2.3785	107.64
14	x_6,x_3,x_5	$0.3010x_6-1.0256x_3+0.0144x_5$	2.2678	102.63
15	x_6,x_4,x_5	$0.3071x_6+0.0080x_4-0.0127x_5$	2.2263	100.75
16	x_6,x_1,x_2,x_8	$0.3210x_6+0.0473x_1-0.1819x_2-0.3679x_8$	2.6458	119.73
17	x_6,x_1,x_2,x_4	$0.0157x_6+0.3229x_1-0.1807x_2+0.0519x_4$	2.9991	135.76

Table 3 continued

Sl. No.	Combination	Discriminant function	Genetic advance of discriminant functions	Efficiency of selection index (%)
18	x_6, x_1, x_2, x_5	$0.1395x_6+0.1908x_1-0.1894x_2+0.01990x_5$	2.8166	127.46
19	x_6, x_1, x_3, x_4	$-0.1099x_6+0.3345x_1-2.0573x_3+0.0643x_4$	2.8115	127.23
20	x_6, x_1, x_3, x_5	$-0.0141x_6+0.2621x_1+0.9946x_3-0.1094x_5$	2.4995	113.11
21	x_6, x_1, x_4, x_5	$-0.1289x_6+0.3576x_1+0.0472x_4-0.0880x_5$	2.7207	123.12
22	x_6, x_2, x_3, x_4	$0.3670x_6-0.2001x_2-2.4350x_3+0.0244x_4$	2.7728	125.52
23	x_6, x_2, x_3, x_5	$0.3733x_6-0.1946x_2-0.9469x_3+0.0272x_5$	2.6563	120.21
24	x_6, x_2, x_4, x_5	$0.3797x_6-0.1964x_2+0.0038x_4-0.0006x_5$	2,.6200	118.56
25	x_6, x_3, x_4, x_5	$0.2925x_6-6.6904x_3+0.1032x_4-0.2283x_5$	2.6900	121.73
26	x_6, x_1, x_2, x_3, x_4	$-0.0129x_6+0.3112x_1-0.1846x_2-2.1849x_3+0.0649x_4$	3.1027	140,.41
27	x_6, x_1, x_2, x_3, x_5	$0.0719x_6+0.2489x_1-0.1890x_2+1.2033x_3+0.1037x_5$	2.8301	128,,07
28	x_6, x_1, x_2, x_4, x_5	$-0.0392x_6+0.3398x_1-0.1839x_2+0.0452x_4+0.0385x_5$	3.0176	136.56
29	x_6, x_1, x_3, x_4, x_5	$-0.0218x_6+0.2614x_1-4.6677x_3+0.1031x_4-0.1333x_5$	2,8871	130..65
30	x_6, x_2, x_3, x_4, x_5	$0.3615x_5-0.1845x_2-6.3462x_3+0.0983x_4-0.2046x_5$	2.9916	135,,38
31	$x_6, x_1, x_2, x_3, x_4, x_5$	$0.0545x_6+0.2490x_1-0.1789x_2-4.4299x_3+0.0983x_4-0.1320x_5$	3.1431	142 24

x_1 = Number of mature pods

x_2 — Dry weight of haulms

x_3 Number of seeds per pod

x_4 = Hundred pod weight

x_5 — Hundred kernel weight

x_6 — Pod yield

haulm, number of seeds per pod and 100 pod weight. Function using yield and all the five characters showed the highest relative efficiency.

By the addition of the character number of mature pods to any function where it was not involved, the efficiency was found to increase by 2 to 22.37%. Badwal and Singh (1973) found that pod yield was dependant upon the number of mature pods and kernel weight.

From the results discussed above it can be concluded that number of mature pods, 100 pod weight and 100 kernel weight are the important characters to be considered without overlooking dry weight of haulm and number of seeds per pod while exercising selection in groundnut.

Summary

A path analysis and selection index study on 26 bunch varieties of groundnut was made. Path analysis showed that number of mature pods, 100 pod weight and 100 kernel weight were the important factors contributing to pod yield. Discriminant function using pod yield, number of mature pods, 100 pod weight, 100 kernel weight, number of seeds per pod and dry weight of haulm showed the highest relative efficiency.

സംഗ്രഹം

ഇരുപത്തിയാറ് വ്യത്യസ്ത നിലക്കടലയിനങ്ങളിൽ പഥവിശ്ലേഷണം നിർധാരണ സൂചകം എന്നീ പഠനങ്ങൾ നടത്തി. കായ്കളുടെ എണ്ണം, 100 കായ്കളുടെ തൂക്കം, 100 വിത്തിന്റെ തൂക്കം എന്നിവയാണ് വിളവിന്റെ പ്രധാന ഘടകങ്ങളെന്ന് പഥവിശ്ലേഷണ പഠനത്തിൽനിന്നും കാണുന്നു. എന്നാൽ വിളവ്, കായ്കളുടെ എണ്ണം, 100 കായ്കളുടെ തൂക്കം, 100 വിത്തിന്റെ തൂക്കം, ഒരു കായിൽ ഉള്ള വിത്തിന്റെ എണ്ണം, ചെടി ഉണങ്ങിയെടുത്ത തൂക്കം എന്നീ ഘടകങ്ങളെ അടിസ്ഥാനപ്പെടുത്തിയുള്ള നിർധാരണ സൂചകത്തിനാണ് പരമാവധി നിർവ്വാഹണശേഷി കണ്ടത്.

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