Agric. Res. J. Kerala, 1984, 22 (2), 155—160

COMPARATIVE STUDY OF THE CONTRIBUTION OF BIOMETRIC CHARACTERS ON YIELD IN DESSERT VARIETIES OF BANANA*

Vijayaraghavakumar[1], K. C. George and N Krishnan Nair[2]

College of Veterinary & Animal Sciences
Mannuthy 680651, Trichur, Kerala

Banana grows in many parts of Asia, South America, France, Australia, and East Africa. India is having the second position in the world of production of banana and Kerala stands first among the states. Since the demand of the fruit in the international market is increasing, any aim for improving its yield is not in vain. Systematic planningand breeding are needed for its improvement in quality and quantity. In the present study th3 following attempts were made. (1) The phenotypic, genotypic and environmental correlations in dessert varieties of banana were calculated and the path coefficient analysis was performed, and the comparative performance of the biometric characters on yield was studied. (2) A discriminant function is constructed and the genetic advance through this function is compared with that of straight selection. (3) By calculating index scores to the varieties a proper method of selection is evolved.

Materials and Methods

The effect of morphological characters on yield and their inter-relationships by the above methods have been studied on many crops, even though such works were rarely done on this crop.

The present study was based on the crop raised at the Banana Research Farm, Kannara of the Kerala Agricultural University in randomised blocks with three replications. From 56 dessert varieties, measurements on twelve morphological characters were taken. They were (1) height (2) girth (3) number of leaves (4) weight of hands (5) weight of fingers (6) number of fingers (7) length of fingers (8) thickness of fingers (9) number of hands (10) number of fingers per hand (11) length of peduncle, and (12) yield. The varietal difference among the characters was studied by the construction of analysis of variance tables. The phenotypic, genotypic and environmental correlations were estimated according to the definitions given in Falconer (1960) by performing the analysis of covariances. Then from the estimates of phenotypic and genotypic variances, the heritability in the broad sense can be estimated as the ratio of the two. The genotypic correlation is used for the computation of the path coefficients. A linear model is assumed with regard to the characters having significant influence on yield and the analysis is done in accordance with Li (1956) and Wright (1934, 1968) and the path coefficient values are obtained,

---

* Part of M. Sc. (Ag. Stat.) thesis of the senior author submitted to the Kerala Agricultural University, 1981

Present address:
1 Rubber Board, Kottayam
2 College of Agriculture, Vellayani 695 522, Trivandrum

By maximising the correlation between the genetic worth and phenotypic performance of the characters, a discriminant function of the form $Z = \sum b_i x_i$ is fitted. Since the relative importance of the characters is not known, all of them have given equal importance in the construction of the discriminant function. Smith's (1936) method is used for the construction of the discriminant function. The per cent gain due to selection can then be estimated from the 'b_i' values. The genetic advance defined as the expected value of the difference between the genetic worth and its mean can be estimated through this discriminant function. This value can be compared with the genetic advance calculated through the straight selection method by the formula;

$$\text{gain in efficiency} = \left[\frac{\text{G. A. (through discriminant function)}}{\text{G. A. (through straight selection)}} - 1 \right] \times 100$$

Now for the fiftysix varieties; index values can prepared for selecting the best varieties. This is accomplished as given in Singh and Chaudhary (1977) ie., $Vi = \sum x_{ij} \times b_j$ where b_j are the discriminant function values and 'x_{ij} is the mean of the observation corresponding to the i th variety.

Results and Discussion

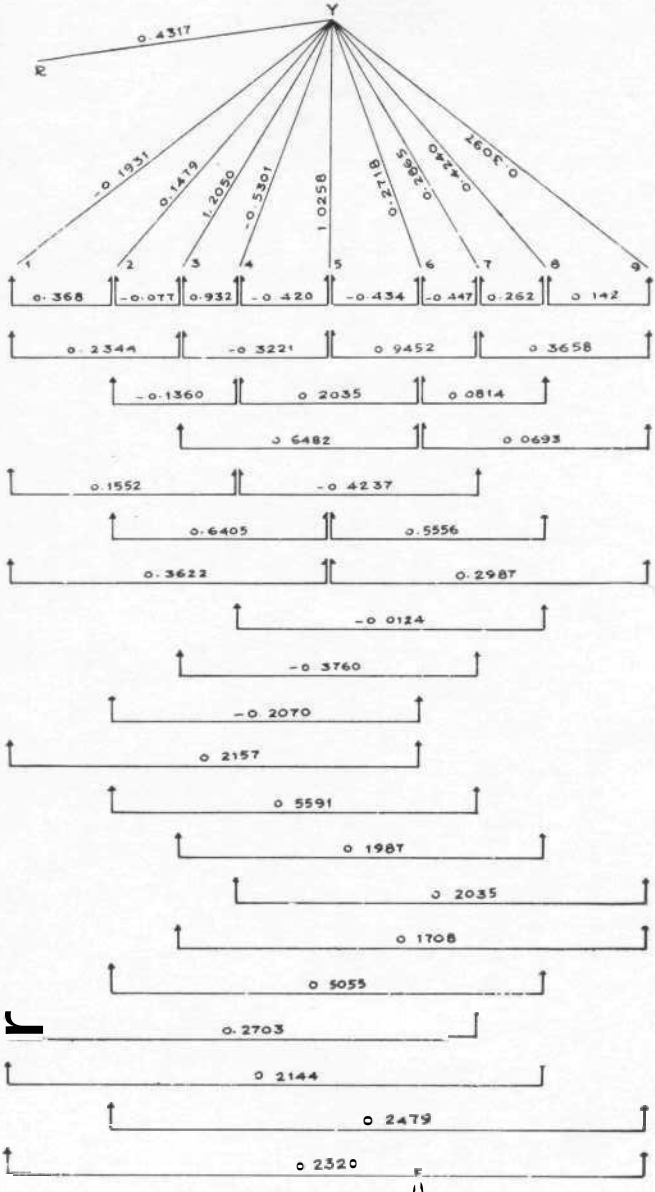
Analysis of variance of the data revealed high significant difference among the varieties in all characters. The environmental correlations are less than the phenotypic and genotypic correlations in many combinations The phenotypic and genotypic correlations of all characters with yield were positive. Only the number of fingers per hand had shown a negative environmental correlation (—0.0365) with yield.

The heritability values revealed that all characters except number of hands and the number of leaves are highly heritable. Nine characters were found to have significant correlation with yield at the 95% and 99% probability levels. The characters and the path coefficients are given in the Table 1.

The Fig. 1 gives the cause and effect relationship of yield with the above 9 characters. It also gives the direct and indirect effect of the causes on yield. It can be observed that the character weight of hands had a positive direct effect of 1.2050 with yield. But it had no significant indirect effect through any other character. But the thickness of fingers also produces an indirect influence of 1.0161 through the weight of hands. The weight of fingers had a direct negative effect of —0.5301 on yield. At the same time it has an indirect positive contribution of 0.9182 through the third character, weight of hands. This means that th e weight of fingers can influence the yield through the weight of hands.

Another character producing appreciable variation in yield is the number of fingers with a direct effect of 1.0258. The effects of the remaining characters such

fig-1 CAUSE AND EFFECT RELATIONSHIP OF YIELD WITH OTHER CHARACTERS



CHARACTERS: 1 GIRTH 2 NUMBER OF LEAVES 3 WEIGHT OF MALO
4 WEIGHT OF FINGERS 5 NUMBER OF FINGERS 6 THICKNESS OF FINGERS
7 NUMBER OF HANDS 8 NUMBER OF [illegible]ERS PER HAND
9 LENGTH OF PEDUNCLE AND R - RESIDUAL(R)

Table 1

Path coefficients of selected yield components in dessert varieties of banana (direct and indirect effect)

Character	Effects via								
	Girth (X_1)	Number of leaves (X_2)	Weight of hands (X_3)	Weight of fingers (X_4)	Number of fingures (X_5)	Thickness of fingers (X_6)	Number of hands (X_7)	Number of fingers per hands (X_8)	Length of peduncle (X_9)
Girth	—0.1931	0.0544	0.2825	-0.0823	0.3715	0.0586	0.0774	0.0909	0.0717
Number of leaves	—0.0718	0,1479	—0.0928	0.0721	0.6570	0.0563	0.1602	0.2143	0.0765
Weight of hands	—0.0457	—0.0114	1.2050	—0.4039	—0.3304	0.2292	—0.1077	0.0842	0,0528
Weight of fingers	—0.0303	—0.0201	0,9182	—0.5301	—0.4308	0,0553	-0.1214	—0.0180	0.0629
Number of fingers	—0.0707	0.0947	-0,3881	0.2226	1.0258	—0.1180	0.2708	0.2356	0,0914
Thickness of fingers	—0.0421	-0,0306	1.0161	-0.1079	—0.4452	0.2718	—0.1281	0.0345	0.0215
Number of hands	—0.0522	0.0827	—0.4531	0.2246	0.9696	—0.1215	0.2865	0.1111	0.113
Number of fingers per hands	-0.0414	0.0748	0.2387	0.0066	0.5699	0.0221	0.7678	0.4240	0.0440
Length of peduncle	—0.0448	0.0359	0.0206	— 0.1079	0.3033	0,0188	0.1048	0.0602	0,3097

Note: Diagonal values are the path coefficients

Table 2

Varieties and index scores

Sl. No.	Varieties	Index scores
1	2	3
1	Chenkadali	3905.922
2	Redbanana	3528.791
3	Wather	3455.829
4	Redrajah	3070.690
5	Gros Michel	2937.125
6	Ayiramka Poovan	2883,328
7	Robusta	2637.425
8	KNR 2/75	2597.831
9	Mouritus	2578.642
10	Chirapunchi	2563.318
11	Chinali	2556,464
12	Highgate	2540.116
13	Krishna Vazhai	2537.267
14	Princkchel	2537.042
15	G. C.	2531.638
16	Paykunnan	2466.324
17	Sira	2419.242
18	Lacatan	2343.119
19	Neendra Padathi	2332,168
20	Peddapacha Arathi	2328.420
21	D. C.	2515.244
22	Pacha Chingan	2310,302
23	Valiyakunnan	2264.333
24	Varnanakela	2249.355
25	Redja	2231.168
26	Kodupillakunnan	2212.418
27	Pirija	2211.415
28	Poovan	2181.582
29	Njalipoovan	2176.187
30	Pacha Nadan	2170.961
31	Prebon	2133.112
32	KNR 1/76	2117.874
33	Piroopakshy	2113,210
34	Ladys finger	2100.175
35	Neendrakunnan	2094,233
36	Vadakkankadali	2077.573

1	2	3
37	Amrt Sagar	2071.481
38	Harichal	2061.971
39	Ambalakadafi	2022.098
40	Charapadathi	2009.115
41	Thiruvananthapuram	2003.610
42	Toongate	1987.251
43	Chakarakadali	1978.376
44	Poochakunnan	1925.235
45	Sapumalanamudu	1901.107
46	Kunnikadali	1893.397
47	Adukkan	1892.343
48	Theankunnan	1891.189
49	Sirumulai	1833.847
50	Rasthali	1827.298
51	Mons Marie	1789.791
52	Maethman	1734.420
53	Chingan	1668.111
54	Sikugani	1530.104
55	Adukakunnan	1482.346
56	Pilian	8281.423

as number of hands, number of fingers per hand and length of peduncle were not much worth mentioning. Using the above 9 characters (Table 1} and yield (X_{10}) the discriminant function was fitted. The function is $Z = 2.4012X_1 - 4.1300\ X_2 - 0.0545X_3 + 8.9878X_4 - 2.2901X_5 + 56.1297X_6 + 37.4433X_7 + 34.4781X_8 - 2.0017X_9 + 35.5615X_{10}$.

At the 5% intensity of selection, the genetic advance was found to be 1085.61% (through discriminant function). But at the same intensity, the genetic advance through straight selection was found to be 11 63.77, Thus the latter was a tittle superior to the former (the percent gain in efficiency through discriminant function was only −6.72%) indicating that it is enough we select the characters by straight selection. This may be due to the inadequacy of the characters included for the calculation of the selection index.

All the fiftysix varieties were given in the Table 2 with the corresponding index scores. The best varieties are the ones with maximum scores.

Summary

Investigations of twelve morphological characters were carried out on the crop raised at the KAU Banana Research Farm, Kannara. Fifty six dessert varieties of banana plants were grown in randomised blocks of three replications. The analysis

revealed that all the twelve characters showed high significant difference among the varieties. All the phenotypic and genotypic correlations of the characters with yield were positive. From the path coefficient analysis the character having maximum contribution to yield is 'weight of hands'. The 'weight of fingers' and 'number of fingers' also influence the yield indirectly. The genetic advance through discriminant function was found to be less than that through straight selection. Chenkadali and Red banana were the best two varieties selected through the method of selection indices.

സംഗ്രഹം

കേരള കാർഷിക സർവകലാശാലയുടെ കണ്ണാറ വാഴ ഗവേഷണ കേന്ദ്രത്തിൽ വെച്ച് അൻപത്തിയാറ് തീൻമേശയിൽ വെക്കുന്ന ഇനം വാഴകളുടെ പന്ത്രണ്ട് ബാഹ്യരൂപലക്ഷണങ്ങളെ കുറിച്ചുള്ള താരതമ്യ പഠനം നടത്തുകയുണ്ടായി. പടലയുടെ തൂക്കം, പടലയിലെ കായ്കളുടെ എണ്ണം, കായ്കളുടെ തൂക്കം ഇവ വിളവർദ്ധനവിനെ സാരമായി സഹായിക്കുന്നതായി കാണാൻ കഴിഞ്ഞു. ചെങ്കദളിയും, റെഡ്ബനാനയും മെച്ചപ്പെട്ട ഇനങ്ങളാണെന്ന് പരീക്ഷണങ്ങളം തെളിയിച്ചു.

References

Falconer, D. S. 1960, *Introduction to Quantitative Genetics.* Oliver and Boyd, Ltd. Edinburgh, London. pp. 68

Li, C. C. 1956. The concept of path coefficient and its impact on population genetics. *Biometrics* 12: 190-210

Singh, R. K. and Chaudhary, B. D. 1977. *Biometrical Methods in Quantitative Genetic Analysis.* Kalyani Publishers, New Delhi, Ludhiana. pp. 250

Smith, H. F. 1936. A discriminant function for plant selection. *Ann Eugenics, London 7:* 240–250

Wright, S. 1934. The method of path coefficients. *Ann. Math. Stat.* 5: 161-215

Wright, S. 1968. *Genetic and Biometric Foundations.* Vol. 1. University of Chicago Press, Chicago