PROC. NAT. ACAD. SCI., INDIA, 47(B), IV, 1977

# CORRELATION STUDIES IN ARECANUT (*ARECA CATECHU* L.)

R. B. R. YADAVA*, K. VIJAYA KUMAR AND K. N. MURTHY
*Central Plantation Crops Research Institute, Regional Station, Vittal Karnatka, India*

## ABSTRACT

The association existing between yield and its different attributes in a Vittal local variety of arecanut palm has been studied. The results indicate that yield per palm is positively associated with the number of nuts and negatively with height of the palm. Thus the number of nuts per palm is an important character for the success of selection.

## INTRODUCTION

Nut yield of arecanut is dependent on a number of morphological characters. These morphological characters are the best indicators of yield. A knowledge of the characters associated with yield is of greatest importance to the plant breeder, for early selection of the desirable material instead of conducting complicated field trials. Under such circumstances where several attributes are concerned, a more precise picture could be observed if partial correlation coefficients are worked out. But the actual relative contribution of an independent variable to the dependent variable can only be known if multiple correlation coefficients are studied. Partial and multiple correlations have also been examined in number of annual crop plants (Sikka and Jain, 1958 ; Sikka and Maini, 1962 ; Singh and Pratap 1968 ; Bhatt *et al.*, 1968 and Sangha *et al.*, 1971), but in perennial crops like arecanut ; such investigations are still lacking. Therefore, in the present investigation the same material was carried forward and partial correlation coefficients were obtained. Further, multiple correlation coefficients between nut yield per plam and the five important independent variables were worked out in order to ascertain the relative importance of these components in nut yield.

## MATERIALS AND METHODS

Fifty palms of arecanut (15 years old) type VTL (Vittal) local grown at Central Plantation Crops Research Institute, Regional Station, Vittal were selected at random during the year 1970-71. The following characters were considered : (1) Yield per palm (gm), (2) Height of the palm (cm), (3) girth at collar (cm), (4) Number of leaves per palm, (5) Number of inflorescence per palm and (6) Number of nuts per palm. Partial and multiple correlation coefficients were worked out by the formulae as suggested by Croxton and Cowden (1963).

## RESULTS

Partial correlation coefficients between nut yield and five important independent variables keeping one or more component characters constant, were worked out and are presented in Table 1.

*Present address: Division of Plant Improvement, Indian Grassland and Fodder Research Institute, Jhansi, U. P. (India).

TABLE 1

Partial Correlation Coefficients

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| r12 | −0.1919 | r13 | +0.0523 | r14 | −0.0106 | r15 | −0.0471 | r16 | +0.9231*** |
| r12.3 | −0.2073 | r13.2 | +0 0962 | r14.2 | +0.0346 | r15.2 | −0.0004 | r16.2 | +0.9302*** |
| r12.4 | −0.1946 | r13.4 | +0.0526 | r14.3 | −0.0122 | r15.3 | −0.0542 | r16.3 | +0.9234*** |
| r12.5 | −0.1863 | r13.5 | +0.0584 | r14.5 | −0.0094 | r15.4 | −0.0468 | r16.4 | +0.9268*** |
| r12.6 | −0.3494* | r13.6 | −0 0794 | r14.6 | −0.2141 | r15.6 | −0.1818 | r16.5 | +0.9256*** |
| r12.34 | −0.2100 | r13.24 | +0.0969 | r14.23 | +0.0363 | r15.23 | −0.0075 | r16.23 | +0.9295*** |
| r12.35 | −0.2006 | r13.25 | +0.0965 | r14.25 | +0.0346 | r15.24 | +0.0007 | r16.24 | +0.9317*** |
| r12.36 | −0.3417* | r13.26 | −0.0036 | r14.26 | −0.1459 | r15.26 | +0.1055 | r16.25 | +0.9310*** |
| r12.45 | −0.1891 | r13.45 | +0.0586 | r14.35 | −0 0110 | r15.34 | −0.0539 | r16.34 | +0.9270*** |
| r12.46 | −0.3153* | r13.46 | −0.0762 | r14 36 | −0.2129 | r15.36 | −0.1756 | r16.35 | +0.9257*** |
| r12.56 | −0.3203* | r13.56 | −0.0594 | r14.56 | −0.2138 | r15.46 | −0.1808 | r16.45 | +0.9292*** |
| r12.345 | −0.2034 | r13.245 | +0.0971 | r14.235 | +0.0360 | r15.234 | −0.0064 | r16.234 | +0.9310*** |
| r12.346 | −0.3069* | r13.246 | +0.0825 | r14.236 | −0.1460 | r15.236 | −0.1058 | r16.235 | +0.9304*** |
| r12.356 | −0.3150* | r13.256 | +0.0039 | r14.256 | −0.1506 | r15.246 | −0 1119 | r16.245 | +0.9326*** |
| r12.456 | −0.2839 | r13.456 | −0.0565 | r14.356 | −0.2124 | r15.346 | −0.1749 | r16.345 | +0.9293*** |
| r12.3456 | −0.2791 | r13.2456 | +0.0026 | r14.2356 | −0.1508 | r15.2346 | −0.1118 | r16.2345 | +0.9319*** |

rij.klmn = Correlation between ith and jth character keeping kth, lth, mth and nth character constant.

* Significant (P=0.05) *** Significant (P=0.001)

1 = Yield (weight of nuts in gm)

2 = Height of the palm (cm)

3 = Girth at collar (cm)

4 = Number of leaves per palm

5 = Number of inflorescence per palm

6 = Number of nuts per palm

TABLE 2

Multiple Correlation Coefficients

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| R1 (23) | 0.2138 | R1 (45) | 0.0480 | R1 (246) | 0.9344*** | R1 (2346) | 0.9343*** |
| R1 (24) | 0.1949 | R1 (46) | 0.9268*** | R1 (256) | 0.9316*** | R1 (2356) | 0.9337*** |
| R1 (25) | 0,1819 | R1 (56) | 0.9258*** | R1 (345) | 0.0762 | R1 (2456) | 0.9352*** |
| R1 (26) | 0.9328*** | R1 (234) | 0.2168 | R1 (346) | 0.9272*** | R1 (3456) | 0.9297*** |
| R1 (34) | 0.0538 | R1 (235) | 0.2140 | R1 (356) | 0.9259*** | R1 (23456) | 0.9352*** |
| R1 (35) | 0.0755 | R1 (236) | 0.9328*** | R1 (456) | 0.9294*** | R1 -- | -- |
| R1 (36) | 0.9236*** | R1 (245) | 0.1949 | R1 (2345) | 0.2168 | R1 -- | -- |

R1 (jklmn) = Multiple correlation coefficients showing the combined effect of jth, kth, lth, mth and nth character on the ith character.

*** Significant (P=0.001)

1 = Yield (weight of nuts in gm)

2 = Height of the palm (cm)

3 = Girth at collar (cm)

4 = Number of leaves per palm

5 = Number of inflorescence per palm

6 = Number of nuts per palm

As a measure of true relationship a non-significant negative correlation is noticed between the two characters (yield and height of the palm). However, significant negative correlation is observed between these two characters when number of nuts alone is held constant ; and number of nuts with girth at collar, number of leaves and number of inflorescence and number of nuts with girth at collar and number of leaves, girth at collar 1, number of inflorescence are kept constant. The true relation between the yield and girth at collar was noticed very low and not significant by keeping the other variables constant. Similar trend was noticed in the case of yield and number of leaves, number of inflorescence, a negative correlation coefficient was observed. Between yield and number af nuts, a close relationship was recorded and association became highly positive. It is also observed that the correlation between yield and number of nuts does not change substantially by keeping the other variables constant individually or collectively without any effect on the nature of the coefficients in all possible combinations.

Multiple correlation coefficients (Table 2) using combined effects of height of the palm, girth at collar, number of leaves and inflorescence and number of nuts were highly significant. But, real influeuce on yield character by the number of nuts per palm was noticed. The relative contribution to the sum of squares of nut yield by these component characters (as measured by $R^2$ values) was also determined and compared with their corresponding partial correlation coefficients (Table 3).

TABLE 3

Relative Contribution of the five component characters to nut yield

| Coefficient of Multiple determination | Proportion of variation explained in the dependent variable in percentage | Additional variation explained by introducing a new independant variable in percentage | Partial correlation coefficient |
|---|---|---|---|
| $R^2 1.2$ | 3.68 | - - | r12.3456 = -0.2791 |
| $R^2 1.23$ | 4.57 | 0.89 | r13.2456 = +0.0026 |
| $R^2 1.234$ | 4.70 | 0.13 | r14 2356 = +0.1508 |
| $R^2 1.2345$ | 4.70 | - - | r15.2346 = -0.1118 |
| $R^2 1.23456$ | 87.46 | 87.76 | r16.2345 = +0.9319*** |

*** Significant (P = 0.001)

1 = Yield (weight of nuts in gm)
2 = Height of the palm (cm)
3 = Girth at collar (c.n)
4 = Number of leaves per palm
5 = Number of inflorescence per palm
6 = Number of nuts per palm

The total contribution by these five variables to nut per palm is $R^2$ 1 (23456) =0.8746. Out of these five variables contributing to the nut yield, the contribution of number of nuts per palm was comparatively the maximum. The combined contribution of height of the palm, girth at collar, number of leaves and inflorescence is only about 4.70 per cent towards the yield. The pattern of contribution by these five variables also is in agreement with partial correlation coefficients.

## Discussion

In the present investigation it is found that the true relationship, as determined by partial correlation coefficients, between nut yield and its five components is fairly low with number of leaves per palm, number of inflorescence per palm and there is no real association, but it had positive and highly significant true relationship with number of nuts per palm. On the other hand, height of the palm shows a significant (P=0.10) negative correlation with yield character when all the other variables were kept constant.

The study of multiple correlations and pattern of relative contribution to weight of nuts per palm showed that the characters *viz*., number of leaves, number of inflorescence and girth at collar were not in association with the yield. But the number of nuts per palm was found to be an important character. This suggests that while selecting for higher yield in arecanut, more selection pressure may be exerted on number of nuts per palm. Present findings can be supported by the findings of Bhatt *et al.* (1968) in soybean and Sangha and Sandhu (1970) in the erect group of ground nut observed that pod number is the most important character contributing to the yield.

## Acknowledgements

The authors are grateful to Shri K. Shama Bhat, Arecanut Specialist, Central Plantation Crops Research Institute, Regional Station, Vittal for facilities and to Shri K. V. Ahmed Bavappa, Director of the Institute for encouragement during the investigation period.

## References

Bhatt, G. M., Sandhu, R. S. and Singh, A. (1968). *J. Res.*, **5** : (a supp.), 1–5.

Croxton, F. E. and Cowden, D. J. (1963). Applied general statistics. *Sir Issac Pitman & Sons Ltd., London*, Second reprint.

Sangha, A. S. and Sandhu, R. S. (1970). Genetic variability and correlation studies in groundnut (*Arachis hypogaea* L.) *in press*.

Sangha, A. S., Singh, B. V. and Singh, M. (1971). *Mad. agric. J.*, **58** : 224–227.

Sikka, S. M. and Maini, N. S. (1962). *Indian J. Genet.*, **22** : 181–86.

Singh, R. V. and Pratap, R. (1968). *Alld. Farm.*, **42** : 307–10.

Tan, M. T. (1945). *J. agric. Assoc. China* No. 182 : 3–4 (*Pl. Breed. Abstr.*, **19** : 2469, 1949).