Journal of Plantation Crops 25 (1): 103-105, June, 1997

Short Scientific Reports

A NON-DESTRUCTIVE METHOD TO ESTIMATE SURFACE AREA OF ARECA FRUIT FOR ENTOMOLOGICAL STUDIES

(Manuscript received : 11.10.95; revised:13.3.96, accepted:07.10.96)

In arecanut palm about 90 insect and non-insect pests have so far been recorded (Nair and Daniel, 1982). Nair and Menon (1963) reported three species of scale insects viz. *Gossyparia* sp., *Pinnaspis aspidistrae* Sign. and *P. strachani* Co. infesting tender floral parts and cause pre-mature flower and button shedding. Severe infestation results in drying of inflorescence. Scale insect, *Aonidiella orientalis* (New stead) is one of the very minor pest commonly found infesting on seedlings and nuts of adult palms. However, a serious outbreak of scale insect on arecanut palms was reported in Puttur (Karnataka) and Kasaragod (Kerala), which prompted us to undertake the present investigation.

Regression models are widely used in the estimation of surface area of fruits and leaves of various crops (Anandaraj and Bhagavan, 1983; Reynolds, 1971; Mc Kee, 1964). Anandaraj and Bhagavan (1983) have worked out two separate regression models for large and small nuts to estimate the surface area of arecanut. In the above method, weight of nut has been used as independent variable and this can be obtained only after the harvest. Therefore, a non-destructive method has been developed to work out the percentage of scale insect, *Aonidiella orientalis* infestation at various stages of nut development and also to estimate the corresponding crop loss.

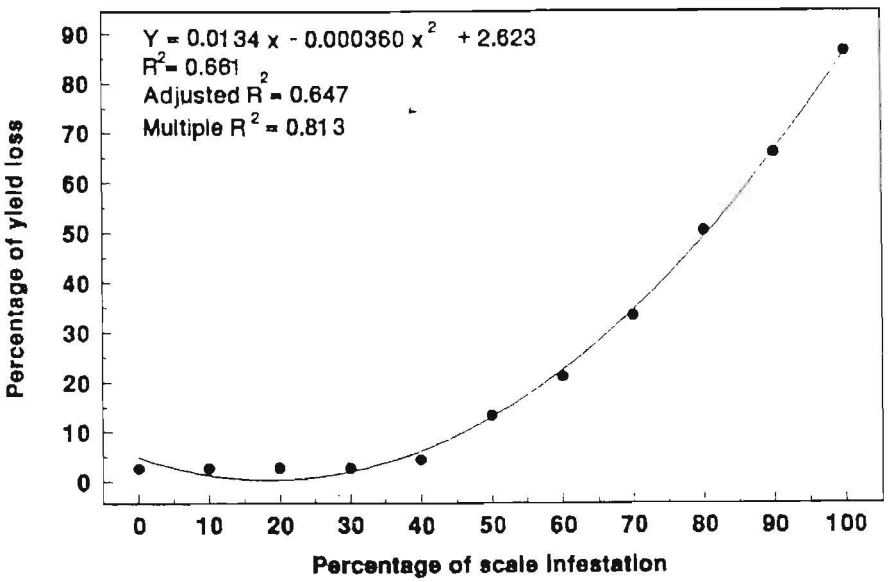

Fig. 1. E nation of yield loss (chali) due to *A. orientalis*

CPCRI Contribution No. 918.

Table 1 *Regression equation at different stages*

Stage	Constant	Regression coefficients L	B	L x B	L^2	B^2	R
		5.35	-17.52	0.07	-0.06	5.34	
I	7.35	(8.50)	(9.75)	(2.80)	(1.05)	(2.13)	0.96
		5.37	-17.43	-	-0.04	5.39	
II	7.14	(8.37)	(8.85)		(0.72)	(1.27)	0.96
		4.86	-17.26	-	-	5.37	
III	8.28	(0.64)	(8.37)			(1.21)	0.96

Figures in parenthesis indicate standard errors

Sixty nuts of different stages viz. (1) very tender (upto 15g fresh weight) (ii) tender (16-25g), (iii) mature green (26-34g), (iv) semi ripe (35-60g) and (v) ripe (36-60g) were collected from 10 randomly distributed arecanut palms from CPCRI Regional Station, Vittal. The surface area was determined by peeling off the pericarp and flattening it on a graph paper and the area was measured. The length and breadth of the nut was measured using vernier calipers. Step down regression procedure starting with quadratic polynomial in length and breadth has been used to obtain the best prediction model.

For the estimation of yield loss, observations were recorded from the 10 year old palms from the farmers' garden in Puttur taluk, Karnataka. Monthly observations on bunch production, infestation status, nut size were recorded. *A. orientalis* infestation was calculated from the tagged bunches. For the convenience of analysis, various stages of nuts were categorised into five groups, as mentioned earlier. Various levels of infestation has been categorised into five types with scores (0 to 5), viz; (i) No infestation score-1 (ii) 21-40% (score 2) (iii) 41-60% (score 3), (iv) 61-80% (score-4) and (v) 81-100% (score-5) (Fig. 2). Tagged nuts were enclosed in a perforated polythene bag to avoid fresh infestation. Nuts were harvested periodically, when they ripe and dried for about 90 days under solar radiation. Nuts were dehusked and the chali weight was taken for the analysis. Nuts were labelled to avoid mixing up. Surface area and percentage of infestation was calculated and correlation matrix was worked.

Fig. 2. *A. orientalis* infested arecanuts

Anandaraj and Bhagavan (1983) have used weight of the nut as independent variable to estimate the surface area of arecanut. Surface area of any solid object like arecanut will depend on both size and shape.The weight mainly indicates the size of the nut but not the shape. Varietal as well as palm to palm variations in size and shapes of nuts are common in arecanut (Bavappa, 1974; Thangaraj *et al. 1985).* The shape of the arecanut is almost like an ellipsoid and hence the length and breadth of the nut will provide a better representation of size and shape of nut than that of weight. In the first stage of analysis quadratic polynomial in length (L) and breadth (B) of the nut has been tried and this gives an R^2 value 0.96. Subsequent stages (II & III) the non-significant variables with minimum 't' values have been

elimitated. It can be seen that (Table 1) the elimination of variables in the II id III stages have not affected the R^2 values. Finally we obtained the prediction model $Y = 8.28 + 4.86, L - 17.26 B + 5.37 B^2$ with a coefficient of determination (R^2) as high as 0.95, where Y is the surface area of the arecanut fruit, L and B are length and breadth of the arecanut fruit. Regression model based on the weight of the nut has also been worked out to estimate the surface area of arecanut and it gives a coefficient of determination of 0.91 only.

Among the five distinct stages of arecanut during development viz., very tender, tender, mature green, semi ripe and ripe (Bhat *et al.* 1962), scale insect infestation on very tender and tender nut stage leads to arrest of growth and yield loss. Whereas in other stages infestation cause significant damage.

Yield loss due to scale insect infestation was calculated from the tagged bunches. Surface area and percentage of infestation was calculated in a non-destructive method using the presently developed formula, $Y = 4.481 - 21.33b + 6.12\ b_2 = 15.31$ and tabulated. Correlation matrix was worked out and this is the regression equation, $Y = 0.0134\ x - 0.000360\ x^2 + 2.623$. Analysis indicated that upto 30 per cent of infestation the corresponding crop loss was only 2.7 per cent and a maximum loss was 86.3 per cent in a completely infested nut (Fig. 1).

In the present study a non-destructive method, based on the length and breadth of the nut, the surface area of arecanut, scale infestation due to *A. orientalis* and the corresponding loss, has been developed. This method will be useful for similar entomological and pathological studies *in situ*.

ACKNOWLEDGEMENT

Thanks are due to Acting Head, CPCRI Regional Station, Vittal for providing necessary facilities to undertake this work. Mr. Viswanath Rai, Kalinja, Karnataka for his help in conducting the experiment at his garden. Authors thank Mrs. P. Nandini, JTA and Mr. N. Gopala for technical assistance.

REFERENCES

ANANDARAJ, M. and BHAGAVAN, S. 1983. A simple method to determine the surface area of areca fruits (*Areca catechu* L.). *J. Plantn. Crops*, **11** : 165-166.

BHAT, K. S., KRISHNAMURTHY, S and RAO, V.N.M. 1962. Studies in the development of the fruit in arecanut, *South Indian Hort.*, **10** : 1-17.

BAVAPPA, K.V.A. 1974. Studies in the genus *Areca* L. Ph.D. thesis, University of Mysore, India, pp. 170.

NAIR, C.P.R. and DANIEL, M. 1982. *IN* the Arecanut palm (Eds.) KVA Bavappa *et al.*, CPCRI, Kasaragod, pp 151-176.

NAIR, R. B. and MENON, R. 1963. Major and minor pests of arecanut crop, *Areca catechu* L. *Arecanut J.* **14** : 139-147.

MC KEE, G. W. 1964. A coefficient for computing leaf area in hybrid corn. *Agron J.*, **56** : 240-241.

REYNOLDS, S. G. 1964. A note on the estimation of leaf area of cocoa (*Theobroma cocoa* L.) from three leaf parameters *Trop. Agric.*, **48** : 177-179.

THANGARAJ, T., MUTHUSWAMY, S., MUTHUKRISHNAN, C. R. and JBM.MD. ABDUL KHADER, 1985. Performance of VTL cultivars of arecanut (*A. catechu* L.) at Coimbatore. *In* Arecanut Research and Development (Eds.) K. S. Bhat & CPR Nair.

Central Plantation Crops Research Institute
Regional Station, Vittal 574 243
Karnataka, India.

B. PADMANABAN
MARIAMMA DANIEL
CT JOSE