# FLORAL INITIATION AND ABORTION IN ARECANUT (*ARECA CATECHU* L.)

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In arecanut, the spadix which is enclosed completely by a boat-shaped spathe, is infrafoliar in location. So every leaf-fall should be accompanied by a production of an inflorescence, provided inflorescence primordia are present in each leaf-axil. However, when the leaf is shed, inflorescence is absent in a number of leaf axils. Khandige *et al.* (1956) reported seasonal variation in the percentage of inflorescence to the leaf-fall for middle-aged (25–35 years) palms. Bavappa and Ramachander (1967) observed a correlation of 0·41 between number of inflorescences produced and yield. No information is available about the mode of initiation of the inflorescence, its course of development and the natural variation existing in its failure. Studies taken up on these aspects are reported in this paper.

## MATERIAL AND METHODS

Fourteen crowns of 10-year old palms grown under average soil-fertility and management conditions were dissected in June. Four crowns from another set of trees of the same age grown under completely neglected conditions (no irrigation, no manure) were also dissected. All the opened leaves, the spindle and unopened leaves up to the seventh leaf were removed and the primordia with the remaining leaves fixed in FAA (formalin-aceto-alcohol). For identification of different leaves in the crown, spindle leaf was considered as 0 and unopened leaves (—), inside the crown as 1, 2, 3, 4 etc. upward from the spindle and those opened leaves (+) outside as 1, 2, 3, 4 etc. downward. Sections of the primordia were cut at 12 $\mu$ and stained with safranin. Primordia from 5 palms were examined. Data on leaf-fall and production of inflorescence in 300 palms (grown at the Central Arecanut Research Station) were gathered from their commencement of bearing in the fifth year of planting.

## RESULTS

### *Floral initiation and development*

Detailed dissection studies showed that the crowns had 8 to 9 opened leaves, 1 spindle leaf and 10 to 13 leaves and leaf primordia in varying stages of development. Inflorescence initiation was observed in every leaf-axil up to the growing point. The inflorescence primordium was initiated alternating with leaf primordium (Fig. 1).

The size of inflorescence subtended by each leaf varied considerably (Table 1).

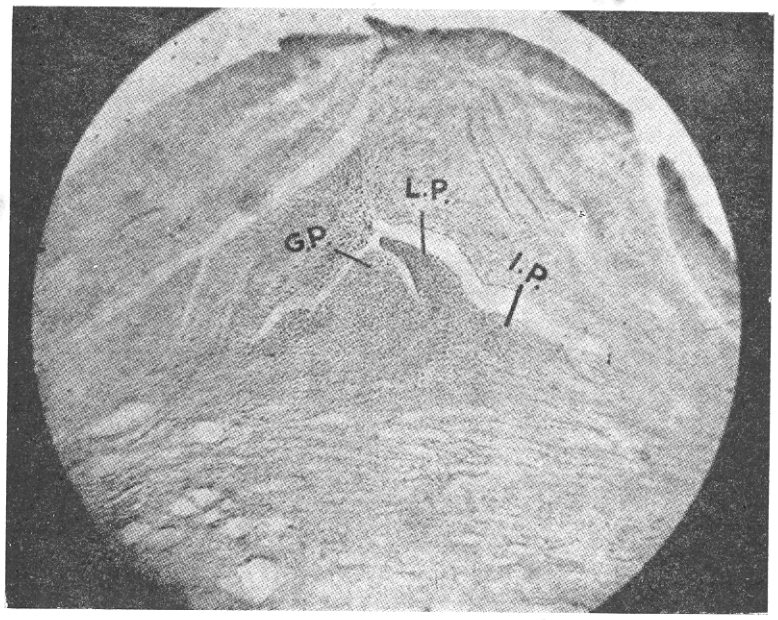


Fig. 1. L.S. of growing point of arecanut. G.P., growing point; L.P., leaf primordium; I.P., inflorescence primordium.

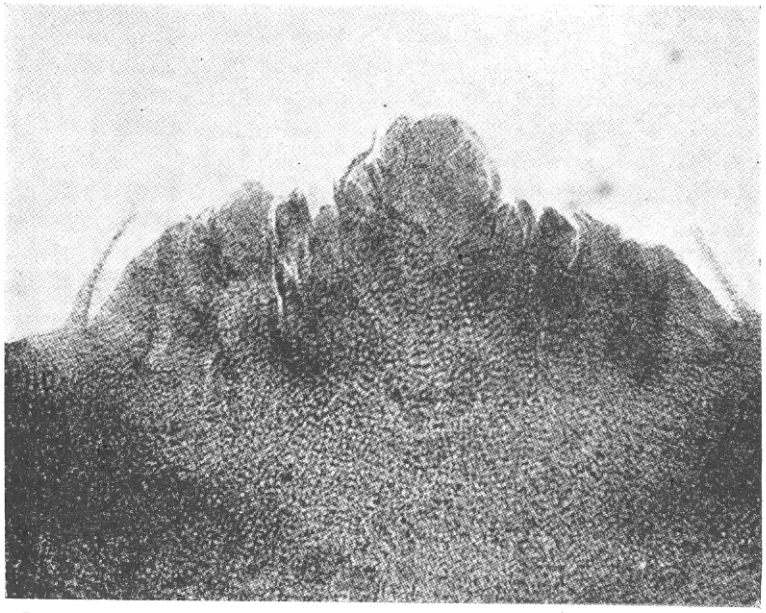

Fig. 2. Differentiation of inflorescence primordium into primary rachis.

TABLE 1. MEAN LENGTH OF INFLORESCENCE SUBTENDED BY DIFFERENT LEAVES

| Type of leaf | Leaf No. | Length of inflorescence (cm) |
|---|---|---|
| Opened leaves (+) | 9 | 39·80 |
| | 8 | 17·70 |
| | 7 | 8·20 |
| | 6 | 4·30 |
| | 5 | 2·90 |
| | 4 | 2·20 |
| | 3 | 1·80 |
| | 2 | 1·40 |
| | 1 | 1·20 |
| Spindle | 0 | 0·67 |
| Unopened leaves (—) | 1 | 0·45 |
| | 2 | 0·30 |
| | 3 | 0·25 |
| | 4 | 0·20 |

The rate of growth of inflorescence was slow till it reached the sixth leaf-axil. Thereafter the length increased twice regularly.

The inflorescence primordia subtended by the fourth unopened leaf showed an initial differentiation into primary rachis (Fig. 2). Subsequent inflorescence in the second unopened leaf differentiated into secondary rachis. The spathe covering the spadix also differentiated at this stage. The inflorescence located in the first unopened leaf had tertiary rachis and the filaments. The initiation of male flowers commenced from the inflorescence subtended by the spindle (Fig. 3).

The growth of filaments and initiation of the male flowers continued in the inflorescence located in the axil of the first opened leaf. Female flowers also began to develop at this stage (Fig. 4). All the male and female flowers were completely initiated in the inflorescence located in the sixth leaf-axil (Fig. 5). The inflorescence at this stage had a mean length of 4·3 cm. All the 16 secondary rachis, observed normally in a fully developed inflorescence, were present adpressed side by side, indicating that the initial primordium located horizontally to the stem differentiated simultaneously into different secondary parts.

*Abortion of the inflorescence*

To study the relationship, if any, existing between inflorescence abortion, leaf emergence and leaf-fall, data on the interval between leaves shed and leaves produced in a number of plants were gathered (Table 2).

Fig. 3. Tertiary rachis showing filaments and initiation of male flower.

Fig. 4. Initiation of female flower at the base of filaments.

Fig. 5. Inflorescence showing complete initiation of male and female flowers.

TABLE 2. MEAN INTERVAL (DAYS) BETWEEN SUCCESSIVE LEAF-EMERGENCE AND LEAF-FALL

| Interval | Leaf-emergence | Leaf-fall |
|---|---|---|
| First | 44·7 | 48·7 |
| Second | 47·3 | 44·4 |
| Third | 42·9 | 41·0 |
| Fourth | 39·6 | 37·0 |
| Fifth | 39·7 | 33·5 |
| Sixth | 44·1 | 42·0 |
| Seventh | 47·3 | 54·3 |
| Eighth | 41·0 | 46·8 |
| Mean | 43·3 | 43·4 |

The mean interval between the emergence of leaves and mean interval between leaf-fall was more or less the same, i.e. 43 days.

The presence or absence of inflorescence in the leaf-axil was regularly recorded in 300 progenies of 10 mother palms, month-wise for 7 years, from the commencement of their bearing (Table 3).

TABLE 3. PERCENTAGE OF INFLORESCENCE PRODUCED TO LEAF-FALL

| Month | 1961–62 | 1962–63 | 1963–64 | 1964–65 | 1965–66 | 1966–67 | 1967–68 | Mean percentage for each month |
|---|---|---|---|---|---|---|---|---|
| July | 11·20 | 45·35 | 65·90 | 33·93 | 34·90 | 32·50 | 70·70 | 42·07 |
| August | 21·80 | 52·45 | 50·10 | 29·00 | 31·90 | 39·80 | 39·70 | 37·82 |
| September | 35·80 | 71·96 | 55·80 | 36·60 | 45·00 | 58·00 | 29·30 | 47·50 |
| October | 54·00 | 74·80 | 64·00 | 46·60 | 49·70 | 89·50 | 33·70 | 58·90 |
| November | 61·97 | 84·64 | 74·90 | 59·00 | 76·00 | 88·20 | 38·00 | 68·96 |
| December | 76·19 | 84·76 | 82·40 | 78·07 | 99·40 | 93·20 | 67·00 | 83·00 |
| January | 89·03 | 90·64 | 87·90 | 90·00 | 96·50 | 98·10 | 90·70 | 91·84 |
| February | 87·45 | 94·06 | 93·70 | 92·30 | 97·40 | 99·00 | 94·30 | 94·03 |
| March | 58·13 | 90·00 | 88·30 | 94·10 | 94·30 | 100·00 | 96·70 | 88·79 |
| April | 69·68 | 83·81 | 84·80 | 91·30 | 80·00 | 95·70 | 95·30 | 85·80 |
| May | 37·47 | 67·60 | 66·00 | 84·40 | 63·80 | 97·20 | 94·70 | 73·02 |
| June | 35·26 | 79·20 | 76·80 | 65·80 | 47·40 | 81·30 | 48·00 | 61·97 |
| Mean percentage per year | 53·16 | 76·61 | 74·22 | 66·76 | 68·02 | 81·04 | 66·51 | |

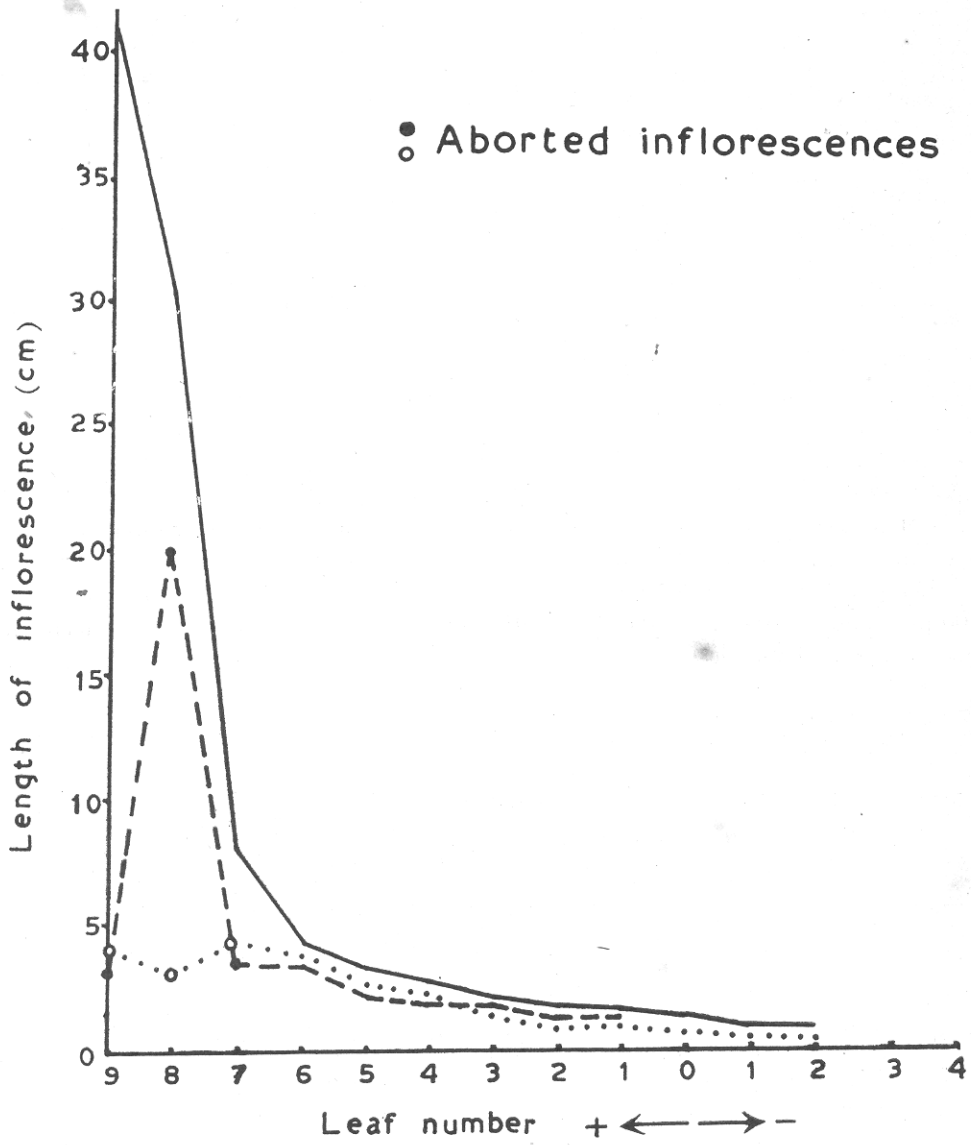


Fig. 6. Development of inflorescences in 3 arecanut palms. Leaf 0, the spindle leaf.

Considerable variation was observed in the production of inflorescence in different months of the year as well as between different years. More than 50 per cent inflorescences aborted in leaves shed in July, August and September.

Under different management conditions of plantation (Table 4), for corresponding leaf axils the percentage of inflorescence abortion was considerably high under neglected condition.

TABLE 4. MEAN PERCENTAGE OF ABORTION OF INFLORESCENCE UNDER DIFFERENT MANAGEMENT CONDITIONS

| Management condition | Leaf number (from spindle) | | | | | |
|---|---|---|---|---|---|---|
| | 9 | 8 | 7 | 6 | 5 | 4 |
| Average | 60 | 20 | 20 | | | |
| Neglected | 80 | 100 | 60 | 20 | | |

The length of the aborted inflorescences located in different leaf-axils in relation to others in different stages of development (Fig. 6) show that the length of the inflorescence aborted was more or less the same.

## DISCUSSION

Significant variation in the extent of abortion of the inflorescence took place in different months. Aborted inflorescences had more or less equal length, indicating that abortion in all the inflorescences took place after they had grown to a uniform extent. It also appears that the time of abortion coincides with the period at which the inflorescence starts to develop at a rapid rate. A more or less similar pattern in inflorescence abortion was observed in oil palm, *Elaeis guineensis* Jacq. (Hartley, 1967). This critical stage in inflorescence development and its determination are necessary for understanding the cause of abortion. The curves in Fig. 6 show that an inflorescence enters the critical stage when it is in the sixth leaf-axil from the spindle. As the shedding of leaves takes place at an interval of 43 days, the critical stage for an exposed inflorescence was about 4½ months before the shedding of the leaf subtending that inflorescence. So for the inflorescences located inside the leaves shed in July, August and September, the critical period is from middle of February to middle of May.

The year-wise production of inflorescence also shows that in 1961–62, the first year of flowering, the percentage was low. The percentage of inflorescences produced increased in the subsequent year and thereafter slowly decreased, becoming constant at about 66 per cent. However, in 1966–67 there was a phenomenal increase in the percentage of inflorescences produced to leaf-fall. This high variability in the abortion of inflorescence existing in different seasons of the year, in different years as well as under different management conditions, shows that this character is subject to environmental influence to a great extent. Availability of nutrients and moisture in the soil in adequate quantities to meet the demand of the plants at the critical stage in inflorescence development and climatic factors such as rainfall appear to be some of the factors affecting the abortion of inflorescence. Detailed studies on various aspects of this problem are under way.

## SUMMARY

One inflorescence is initiated in every leaf axil of arecanut. Differentiation of the inflorescence primordia commences when it is located in the axil of the fourth

unopened leaf. Initiation of the male and female flowers takes place when the inflorescence is in the axil of the spindle leaf and the first opened leaf respectively. Inflorescence located in the sixth leaf-axil in February to May aborted to a greater extent. Abortion took place at the stage when the inflorescence started developing rapidly. Age of palms, management conditions and season influenced the abortion of inflorescence.

## REFERENCES

BAVAPPA, K. V. A. and RAMACHANDER, P. R. 1967. Selection in arecanut palm (*Areca catechu* Linn.). *Trop. Agric. Mag. Ceylon agric. Soc.* **123:** 25–35.

HARTLEY, C. W. S. 1967. *The Oil Palm* (*Elaeis guineensis* Jacq.). 1st edn, pp. 174–5. Longmans, Green & Co. Ltd, London.

KHANDIGE, S. B., BALAKRISHNAN, N. and ADYANTHAYA, N. R. 1956. Some facts about arecanut. *Madras agric. J.* **43:** 456–63.