R.P.F.III

**FINAL REPORT**

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**1.Institute Code No:** Phy.XXVIII(231)

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**2. I.C.A.R. Code No:** P-98/2-CI-F60

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**3. Name and address of Research Institute / Centre:**
**CENTRAL PLANTATION CROPS RESEARCH INSTITUTE**
**Kasaragod 671 124 (Kerala)**

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**4. Title of Project : Evaluation of Physiological and Biochemical parameters as related to productivity in the released coconut cultivars/hybrids**

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**5. Name and Designation of Principal Investigator: Dr.(Mrs.) K.V. Kasturi Bai**

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**6. Name(s) and Designation(s) of Associate(s) and establishment(s) on which borne** Dr. S. Naresh Kumar, Scientist
Dr.(Mrs)Shamina Azeez,Scientist

**(a) Whole time**

**(b) Part time**( indicate proportion of time to be devoted and other area(s)

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**7. Location of the Research Project with complete address (Division/Section/ Sub-Section):**

**Section of Physiology & Biochemistry**
**Central Plantation Crops Research Institute**
**Kasaragod 671 124 (Kerala)**

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**8. Date of start:** 1998

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**9. Likely date of completion:** 2001

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**10 (a) Objectives** (not more than 150 words):

To identify the superior cultivar/hybrid from among the released ones based on the physiological and biochemical parameters as related to higher productivity.

**(b) Practical utility** (not more than 100 words)

Earlier work in our laboratory has identified a number of Physiological and Biochemical traits for higher dry matter production and yield in WCT. The purpose of the present proposal is to investigate the variations if any among the released coconut cultivars for these physiological and biochemical traits related to productivity.

The study will help in identifying the most important yield limiting physiological and biochemical parameter which can be used for the evaluation of the varieties with higher yield potential.

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**11 Technical Programme** (Indicate briefly plan of procedure, techniques, instruments and special materials, organisms, special environments etc.)

- Gas exchange characteristics and Chlorophyll. Fluorescence
- Enzymes of carbon and nitrogen metabolism
- Leaf traits
- Dry matter production.

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**12 Final Report on the Project:** (A summary of results not exceeding 5 typed pages precisely and concisely stating the fundamental and/or practical significance thereof)

The released cultivars (WCT, LCT, Benaulim) and hybrids (COD x WCT, WCT x GBGD, LCT x GBGD, LCT x COD) were evaluated based on gas exchange characteristics, enzyme activities of carbon and nitrogen metabolism, leaf traits and dry matter (DM) production characteristics.

**Gas exchange characteristics**

Photosynthetic characteristics of the cultivars and hybrids revealed higher Pn rates in COD x WCT followed by WCT x GBGD and least in LCT. The hybrids recorded higher Pn rates as well as transpiration rates than the talls. Over all results showed higher photosynthetic efficiency in hybrids whereas talls recorded higher water use efficiency (Table 1) Water use efficiency (WUE) showed differences between the cultivars and the hybrids (range 3.01 to 3.20 $\mu mol\ mmol^{-1}$). Although high WUE has been observed in WCT and COD x WCT this did not reflect on the nut yield

**Table1. Photosynthetic characteristics in coconut cultivars/hybrids.**

| Cutivars/hybrids | Pn (μ mol $m^{-2}$ $s^{-1}$) | gs ( mol $m^{-2}$ $s^{-1}$) | Tr (m mol $m^{-2}$ $s^{-1}$) | WUE ((μ mol. $mmol^{-1}$ $H_2O$) |
|---|---|---|---|---|
| WCT | 5.23 | 0.071 | 1.99 | 3.03 |
| LCT | 4.99 | 0.050 | 1.71 | 3.19 |
| Benaulim | 5.15 | 0.073 | 1.99 | 3.14 |
| WCTx GBGD | 5.49 | 0.075 | 2.19 | 3.01 |
| COD x WCT | 6.04 | 0.080 | 2.20 | 3.20 |
| LCT x GBGD | 5.38 | 0.080 | 2.27 | 3.01 |
| LCT x COD | 5.13 | 0.073 | 2.08 | 3.06 |

**Enzymes of Carbon and Nitrogen metabolism**

Activity of Sucrose phosphate synthase which is the rate limiting enzme in carbon metabolism was estimated in the cultivars / hybrids. The activities were very low as well as inconsistent. Hence further studies were not carried out. The enzmes of nitrogen metabolism such as Nitrate reductase (NR) as well as Nitrite reductase (NIR) were also studied in the above palms. The activities of both the enzymes showed wide variation among the cultivars/ hybrids (Table 2).

**Table 2. Nitrate reductase (μg.$g^{-1}$.fwt) and Nitrite reductase ( Units $X10^{-1}$) activities in coconut cultivars/ hybrids**

| Cutivars/hybrids | NR activity | NIR activity |
|---|---|---|
| WCT | 31.11 | 35.97 |
| LCT | 25.92 | 31.00 |
| Benaulim | 20.92 | 19.32 |
| WCTx GBGD | 21.68 | 39.47 |
| COD x WCT | 20.94 | 22.18 |
| LCT x GBGD | 30.23 | 26.82 |
| LCT x COD | 21.05 | 12.26 |

**Leaf Traits**

Between the cultivar/hybrids WCT x GBGD exhibited higher specific leaf area, leaf dry weight and leaf area followed by Benaulim ( Table 3). LAI ranged between 2.1 and 2.7 among the cultivar/hybrids. Higher LAI was observed in both Benaulim and WCT x GBGD. The specific leaf weight (SLW) also has been found to be higher in the former than the latter.

**Table 3. Leaf characteristics in coconut cultivars/hybrids**

| Cultivar | SLW (mg cm $^{-2}$) | Leaf Dry Wt (Kg) | Leaf Area ($m^2$) | LAI |
|---|---|---|---|---|
| **WCT** | 14.25 | 1.84 | 4.88 | 2.26 |
| **LCT** | 14.13 | 1.79 | 4.7 | 2.09 |
| **Benaulim** | 14.36 | 1.99 | 4.99 | 2.66 |
| **WCTxGBGD** | 14.42 | 2.28 | 5.40 | 2.59 |
| **CODxWCT** | 14.26 | 1.91 | 4.99 | 2.4 |
| **LCTxGBGD** | 13.31 | 1.88 | 4.78 | 2.21 |
| **LCTxCOD** | 13.33 | 1.69 | 4.73 | 2.27 |

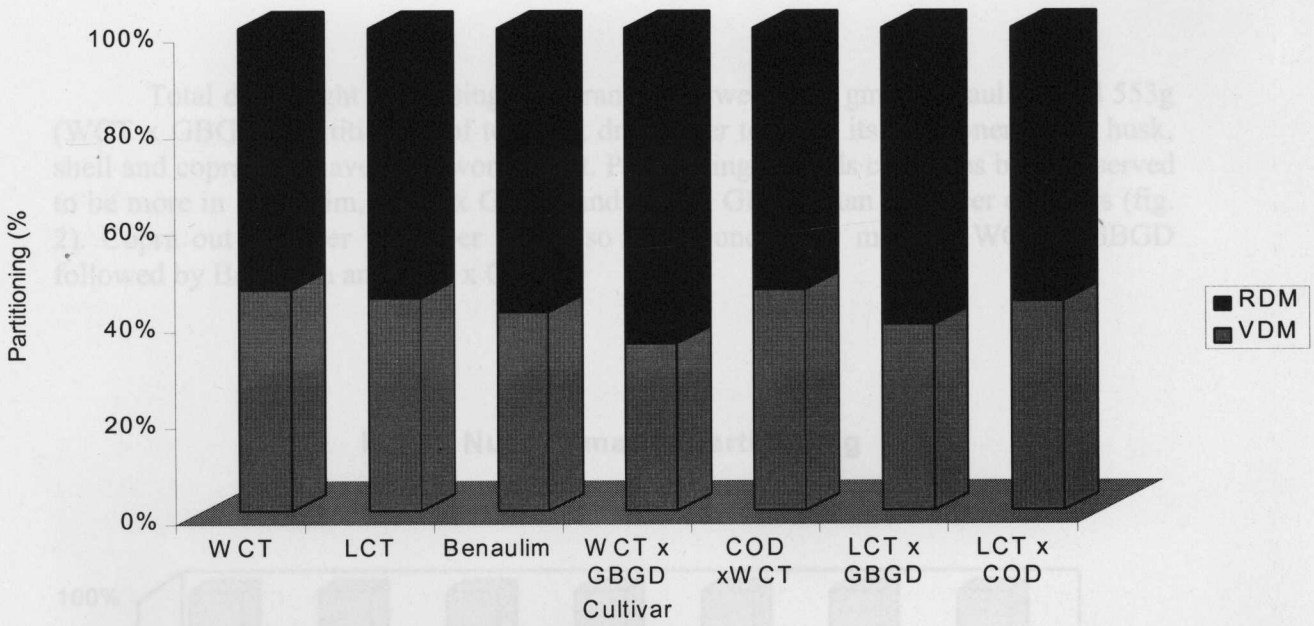
**Dry matter production**

Among the cultivars/ hybrids LDM production was found to be more in COD x WCT ( 26 Kg) and less in LCT ( 23 Kg). SDM production also showed great variation between the cultivars/ hybrids with higher SDM in LCT (7.3 Kg) and lower in LCT x GBGD (3.8 kgs). VDM production did not show significant differences between the cultivars/hybrids ( range: 28 to 31 Kg) where as RDM production showed wide variation ( range: 35 Kg- WCT to 53 Kg- WCT x GBGD). Total dry matter production ranged between 63.8Kg (LCT x COD) to 81.3 Kg (WCT x GBGD) (Table 4).

**Table 4. DM production in coconut cultivars / hybrids.**

| Cultivars | DM production palm$^{-1}$ year $^{-1}$ (kg) | | | | |
|---|---|---|---|---|---|
| | **LDM** | **SDM** | **VDM** | **RDM** | **TDM** |
| **WCT** | **23.97** | **5.8** | **29.8** | **35.0** | **64.8** |
| **LCT** | **22.73** | **7.3** | **30.0** | **37.8** | **67.8** |
| **Benaulim** | **24.84** | **5.7** | **30.5** | **43.4** | **73.9** |
| **WCT x GBGD** | **24.12** | **4.2** | **28.3** | **53.0** | **81.3** |
| **COD x WCT** | **26.10** | **4.5** | **30.6** | **36.0** | **66.6** |
| **LCT x GBGD** | **24.27** | **3.8** | **28.1** | **44.7** | **72.8** |
| **LCT x COD** | **23.29** | **4.5** | **27.8** | **36.0** | **63.8** |

**Fig. 1: DM partitioning in coconut**




Partitioning of dry matter towards VDM production ranged between 38.6% (LCT x GBGD) to 45% (WCT & COD x WCT) where as towards the RDM production it ranged between 54% (WCT & COD x WCT) and 65.2% (WCT x GBGD) (Fig.1).

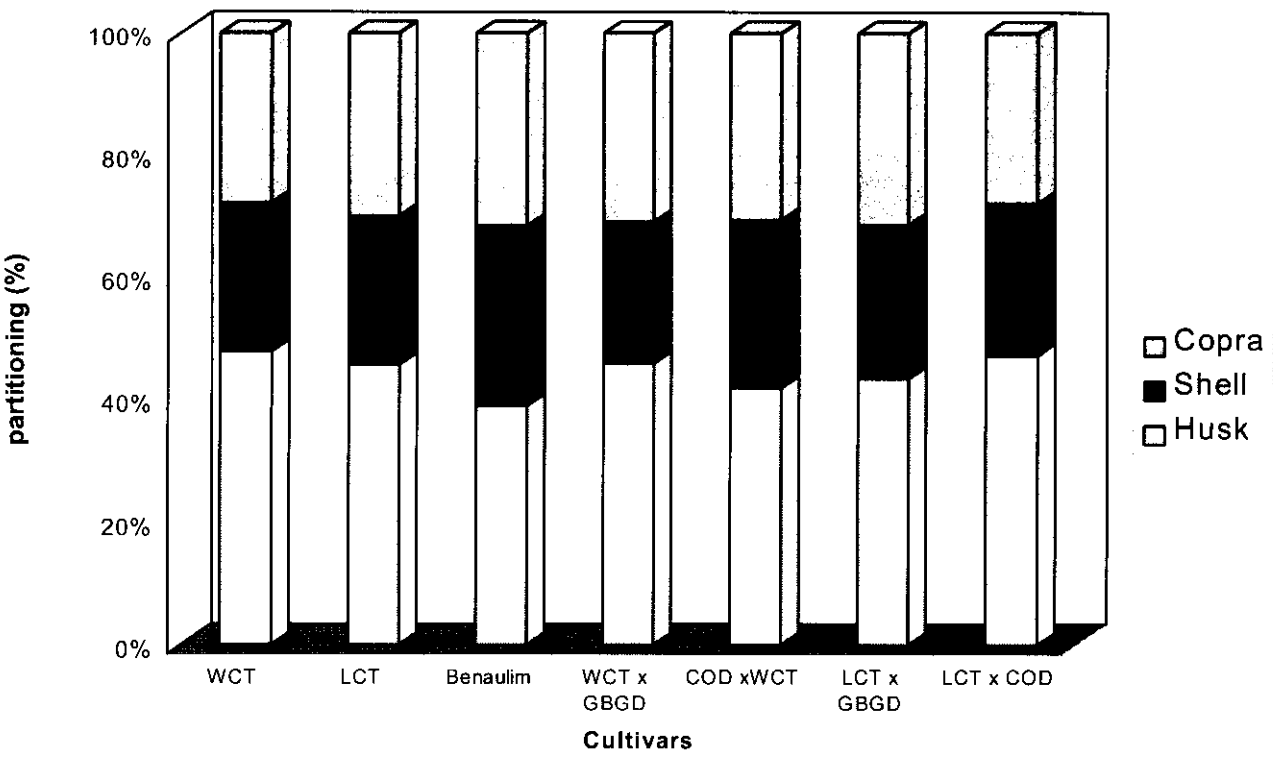
Nut production, palm$^{-1}$ year$^{-1}$, total dry weight of the nut as well as copra out turn also was found to be more in Benaulim, WCT x GBGD and LCT x GBGD than the others. Mean nut yield showed an increase ranging from 51% (Benaulim) to 165% (WCT x GBGD) over the years (from 1997-98). Nut yield per palm per year was found to be more than 70 in all the cultivar/hybrids with higher yield in Benaulim (104 nuts) and WCT x GBGD (92 nuts) than the others. Between LCT x GBGD and LCT x COD higher nut yield was observed in the former than the latter (Table 5).

**Table 5. Nut production and dry matter in coconut cultivar/hybrids**

| Cultivar | Nut production (No.) | | Total nut dry weight (kg) | Copra Out turn (Kgpalm$^{-1}$yr$^{-1}$) |
|---|---|---|---|---|
| | 2000-01 | Two years mean | | |
| **WCT** | 77 | 74 | 31.9 | 9.10 |
| **LCT** | 74 | 73 | 34.6 | 10.95 |
| **Benaulim** | 104 | 104 | 43.2 | 13.61 |
| **WCTxGBGD** | 92 | 84 | 50.3 | 16.70 |
| **CODxWCT** | 73 | 75 | 34.8 | 10.39 |
| **LCTxGBGD** | 89 | 83 | 41.1 | 13.76 |
| **LCTxCOD** | 67 | 69 | 33.0 | 9.43 |

Total dry weight of the single nut ranged between 415 gms (Benaulim) and 553g (WCT x GBGD). Partitioning of total nut dry matter towards its components viz. husk, shell and copra also have been worked out. Partitioning towards copra has been observed to be more in Benaulim, WCT x GBGD and LCT x GBGD than the other cultivars (fig. 2). Copra out turn per palm per year also was found to be more in WCT x GBGD followed by Benaulim and LCT x GBGD.

**Fig.2: Nut dry matter partitioning**





## Summary

Coconut cultivars and hybrids were evaluated based on physiological and biochemical traits for identifying the superior one from among the released ones. The studies clearly indicated that among the released cultivar/hybrids, WCT x GBGD was found to be better in terms of leaf traits, dry matter production and yield attributes, followed by Benaulim and LCT x GBGD. Between LCT x GBGD and LCT x COD the former performed better than the latter.

**13. Progress of work in relation to the time targeted for completion of work and reasons for non achievement of targets, if any.**

Work is completed according to the time targeted and objectives achieved

**14. Publications during the period: (Two copies each to be supplied with this proforma)**

**a) Research papers:** **NIL**

**(b) Popular articles :** one

**Reports**:

**15. Details (Nos. etc) of Field/Laboratory Note books and their final location.**

Two Nos. of field note books are kept in the physiology and Biochemistry section.

**16. Signature of Principal investigator:**

**Dr.(Mrs.) K.V. Kasturi Bai**

**17. Signature of the Head of Division/ Section:**

**Dr.(Mrs.) K.V. Kasturi Bai**

**18. Signature of Director:**

**(Dr. V. Rajagopal)**