

ENERGY CONSUMPTION AND OUTPUT OF WEST COAST TALL COCONUT PALM (*COCOS NUCIFERA* L.)

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ABSTRACT

Under rainfed conditions a West Coast Tall (WCT) coconut palm produces annually about 2,83,710 K Cal of energy, excluding the trunk. This massive output is against an input of about 11,471 K Cal per annum. The energy output/input ratio is 24.73.

INTRODUCTION

Energy consumption in agriculture is an important aspect of crop production that has attained relevance in the recent past. Studies on energy consumption are conducted with a view to understanding the energy cost for production of various food and industrial crops and are especially aimed at minimising the cost for increased crop production based on anticipated resource availability problems (Lockeretz, 1977; Pimental, 1980; Bhatia, 1977; and Terhune, 1977). The present report is based on a preliminary study on energy cost of coconut cultivation in the West Coast of India.

MATERIALS AND METHODS

For calculation of energy content of inputs a crop of average management (Operations and inputs as in Table I & III) is considered in the present paper, where in all agricultural operations in the various seasons are done

manually and fertilizers at the recommended doses (N - 340 g, P₂O₅ - 170g., K₂O - 680 g) are applied annually so as to realise an average annual yield of 50 nuts per palm (Anonymous, 1979; Nelliath, 1981). It is also assumed that although more often the coconuts are sold at the farm site itself, often transportation to the nearest market, in bullock carts or country boats may be necessary. Although all parts of the palm are used for various household purposes, the present estimates take into consideration only the annual productivity of the above ground parts such as leaves, spathe, copra, husk, shell and nut water. The major portion of the trunk is not considered for calculation of energy output as it is cumulative effect of previous yields of dry matter, and the same is used only when the palm is cut for timber.

The annual dry matter production of adult palms growing under rainfed conditions and average management is

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described in Table II and was estimated by destructive analysis. The energy content of the inputs and outputs was calculated on the basis of estimates given in various reports (Lockeretz, 1980; Stout, 1979; Larcher, 1980; Verghese, 1952). The energy estimates for the annual outputs of a tall palm are presented in Table II.

Table I. *Agricultural operations and approximate work volume in a ha. of rainfed plantation*

Operations	Period	Work volume Mandays/year
Fertilizer application	Apr-May, Sep	35
Bunds, drains, fence etc.	Apr-May	10
Plant protection	June	15
Harvest	Every month	50
Weeding	Oct.-November	15
Intercultural operations	Sept. - October	45

Table II. *Annual dry matter production and energy output of various parts of a WCT coconut palm*

Parts	Quantity (Kg.)	K cal
Copra	8.25	55,700
Husk	20.00	88,000
Shell	7.50	36,000
Dry leaves (12nos./yr.)	14.64	65,880
Spathe, Peduncle etc. (12 nos./yr.)	10.00	45,000
Nut water (Lit.)	6.50	1,130*
Total		2,83,710

(*Verghese, 1952)

RESULTS AND DISCUSSION

Under average management, tall coconut palms yield on an average about 50 nuts annually (Nelliatt, 1981).

The labour requirements for cultivation of palms in rainfed conditions is reported to be 130 man days

(Nelliatt, 1981) per hectare per year which includes ploughing once a year using a tractor. On small holdings, use of tractor for ploughing coconut gardens is not generally practiced in the West Coast only manual intercultural operations are considered in the present paper. It is seen in the coconut growing areas of the West Coast that about 45 man days/ha/year would be adequate to replace the work done by tractor. Hence the labour requirement for intercultural operations would be one man day per year per palm. A major input in order to obtain 50 nuts/palm/year is by way of fertilizers. The energy equivalent for fertilizer input (Stout, 1979) including green leaves alone is 8910 K cal per year (Table III).

The coconut palm produces about 2,83,710 K cal of energy annually. These estimates agree with the estimated calorific output of coconut published recently (Anonymous, 1981). This output is in return to a meagre annual input of about 11,471 K cal, by way of fertilizers, intercultural operations, transport and harvest (Table III). It may be noted that a palm produces 6-7

Table III. *Annual energy consumption in various inputs to a coconut palm under rainfed condition*

Inputs	Quantity (Kg.)	K cal
Labour	1.0 man day	2,500
Implements	5.0	8.50
Nitrogen	0.34	4,940
Phosphorus	0.17	390
Potash	0.68	1,090
Green leaves	5.00	2,500
Transport	50.00	42.50
Total		11,471

times more dry matter than its main economic product, *viz.*, the copra and also about 25 K cal of energy per 1 K cal of input. This high ratio of output to input (*viz.*, 24.73), perhaps, is an unique instance among the cultivated agricultural crops. The only other cultivated crop which has such high ratio is *Sorghum*. Although *Sorghum* crop has yielded a ratio of about 4.1 in United States it is about 37.27 in Sudan (Bukantis, 1980). In most of other cultivated agricultural crops where data are available the energy output/input

ratio is rarely more than 5.0 (Pimental, 1980).

Tall coconut palms exhibit wide variability in annual productivity, ranging from 30 nuts to more than 400 nuts. Similarly, the fertilizer and general management practices also vary widely. The present studies, however, indicate tremendous potentialities of this unique palm in meeting the energy requirements of rural areas. Efforts are being made for producing a variety of renewable energy resources out of coconut products such as gas, electricity and ethanol (Anonymous, 1981).

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