

# Drought management in coconut garden through soil moisture conservation

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Fig. 1 Opening of palm basin

## Introduction

Coconut palms, as rainfed crop, are exposed to annual summer dry spells and frequent drought years of different intensities and durations in various parts of the country. The impact of drought on coconut persists for two to three years in view of the indeterminate flowering habit and perennial nature of the crop. As coconut yields are closely linked to favourable weather conditions, occurrence of drought leads to significant reduction in yields thereby resulting in considerable economic loss to the growers. Around 40 per cent of yield loss is estimated to be due to recent droughts, and lakhs of palms have died in Tamil Nadu and Karnataka due to severe drought for the past two to three years. Thus it is important to conserve the soil moisture so that the impact of dry spell can be reduced. Soil moisture conservation practices not only help to reduce the evaporative losses but also increase the soil water holding capacity thus prolonging the moisture availability to the palm during dry periods. Apart from this, the frequency of irrigation can also be reduced.

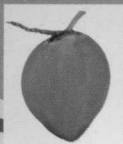
## Multilocation Experiments

Studies conducted in different

agro-climatic zones viz., Western coastal area hot sub-humid-per-humid (Kasaragod - Kerala; Ratnagiri - Maharashtra), hot semi-arid (Arsikere - Karnataka) and Eastern coastal plains - hot sub humid (Veppankulam Tamil Nadu; Ambajipeta- Andhra Pradesh), which represent the major coconut growing areas in India, indicated the differences in duration, frequency and intensity of drought occurrence in these areas. The experiments indicated that by conserving soil moisture, higher yield can be achieved in rainfed plantations (Rajagopal and Naresh Kumar, 2002; Naresh Kumar, 2004; Naresh Kumar *et al.*, 2006). Several soil moisture conservation practices were tested and recommended based on their suitability depending on soil type, location, raw material availability, etc.

## Impact of Drought on Coconut

**Effect of drought stress on coconut seedlings :** A dry spell of about 15 days makes seedlings to experience water stress resulting in leaf wilting and scorching. If stress duration is prolonged, it ultimately leads to seedling death. Seedlings need to be protected from high sunlight intensities by providing shade.



Regular irrigation should be provided to ensure better establishment. Frequent irrigations, once in 3 days, is recommended.

**Effect of drought stress on adult palms :** Summer dry spells cause drooping of leaves due to low leaf water potentials, shedding of buttons and immature nut fall. In severe stress conditions bending and breaking of leaves and death of palms occur. In view of long duration of 44 months between the initiation of inflorescence primordium and ultimate nut yield, with about 70 per cent of the period for pre-fertilization and only 30 per cent represented by fertilization and post-fertilization phases, any fluctuations in dry spell occurring during important stages of floral and fruit development would reflect on nut yield. Palms affected by drought stress take at least two years to recover thus affecting the productivity and income to the farmer. It is recommended to conserve the soil moisture to mitigate dry spell effects. Removal of senescent leaves will help in reducing the transpirational water loss.

### Drought Management Practices

#### Soil moisture conservation practices

The soil moisture conservation practices described below can be followed alone or in combination depending on the location, availability of material and suitability.

**Basin opening:** Conservation of soil moisture in root zone is very important for ensuring the moisture

availability for prolonged periods. For imposing soil moisture conservation practices in root zone, coconut basin (1.5 m radius from

moisture or rainwater. For each basin, about 1000 husk pieces are required for this treatment. This method of conservation is very



Fig. 2 Husk burial in palm basin

bole) can be opened to a depth of around 20 cm. Basin opening can be done from the base of trunk if sub-surface planting is done and no roots are visible near the base, or 30 cm away from the base of trunk if roots are exposed near base of palm. In opened basins, materials like coconut husk, farm waste, green manure, composted coir pith, etc. can be placed and covered with soil. In hard laterite soils, bunds can be made instead of digging the basin.

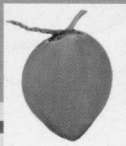
**Husk burial :** The coconut husks (half pieces) can be buried in the opened basin. Half splits of dry coconut husk should be placed in this trench with convex side facing up. Husks should be placed closely so as to cover the entire area as a mulch. This can be done in two - three layers. Husk layers should be covered with soil. This will help to retain the husks in trench for longer time and also to absorb the air

effective and buried husks can remain intact for two to four years depending on soil type.

**Composted coir pith :** Fully composted coir pith (50 kg/ palm) can be buried in the entire area of opened basin and covered with soil.

**Potassium application:** Potassium can be applied at double the recommended dose (recommended dose is 1.2 kg/palm/year) as per the regular fertilizer application schedule. After application of fertilizers in the opened basins, it should be covered with soil. Alternatively, application of NaCl (common salt) 2 kg/ palm is also helpful in mitigating water stress in coconut. However, this treatment can be applied only in suitable soils and under specific conditions.

**Burial of farm waste :** Farm waste (fresh and/or material) can be put in opened basin and covered with



soil. Materials such as leaves and small twigs of Casurina, Glyricidia, coconut bunch waste, and other farm waste can be used for burial. This also is a durable treatment. In the palm basin, farm yard manure (50 kg/palm) or Glyricidia leaves (25 kg/palm) can be placed as a layer. Tank silt (100-200 kg/palm) can also be applied in the basin to improve soil physical characteristics and water holding capacity which will help in reducing the water stress during dry periods.

**Surface mulching** : Mulching can be done by placing dried coconut leaves or any other leaf material in entire basin area in three - four layers. Coconut leaves can be cut into two - three pieces before using for mulching.

#### Water management in coconut gardens

- i) Bury two or three earthen pots/hollow bamboos in the basin and fill with water (sub-soil moisturing).

- ii) **Drip irrigation** : Four (in laterite soils) or six (in sandy soils) drippers in the palm basin may be placed to wet sub-soil layer. Drip irrigation is shown to increase not only field water use efficiency but also the physiological water use efficiency of plant

- iii) If adequate water is available, irrigate with 200 lit. water/palm once in four days and mulch with dry leaves.

- iv) Avoid flood irrigation. If water resources are good, save them for facing prolonged drought. Further, flood irrigation makes surface root system remain in the top layer of the soil and they are vulnerable to any drought situations because of damage to active roots due to high soil temperature and soil cracking.

- v) Practise effective recycling of used water from backyards.

- vi) Give only life saving irrigation. In undulated areas some of the

following practices are desirable for conserving soil and water.

- i) In terrains with slope, terracing the palm basins may be undertaken (intercepts run off water and enhances soil moisture).

- ii) Water harvesting methods in mildly slopped area (<math><10^\circ</math>) to enable water to be collected in between rows.

- iii) Prepare bunds dividing the field into plots to prevent run off of water.

These measures would help to enhance the ground water potential to increase the soil water availability.

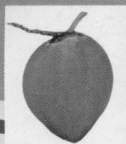
#### Crop Management

Crop management also offers scope to reduce the impact of drought on crop mainly by the removal of senescent (drying) leaves to reduce transpiration loss. If late rains occur, pulses or fodder crops can be sown in between coconut rows. After harvest, the plant residues can be used as mulches. Simultaneously, green manure crops can be raised in the coconut garden. Ploughing back tender Glyricidia has given encouraging results in alleviating the impact of water stress on production, by increasing the soil water holding capacity.

The above practices which lead to soil-water-plant management can be synergised by planting suitable cultivars/hybrids such as Chandra Kalpa, WCT, LCTxGBGD (Lakshaganga) and WCT x COD (Kera Sankara), which can adapt to the changing environmental conditions.



Fig. 3 Husk burial in palm basin (surface planted)



### Fertilizer application method

It is recommended that the soil moisture treatment may be imposed at the end of rainy season and

the fertilizers and organic manures can be applied over the decomposing husk or farm waste material and may be covered with soil. In areas where

(without husks) may be provided at about one meter radius to facilitate fertilizer application. Organic manure may be applied in the entire basin area.



Fig. 4 Coirpith burial in basin

fertilizers can be applied before imposition of treatments. In case, burial of husk or farm waste is practised in the first year, the treatments may be imposed after the application of fertilizers or organic manures. In subsequent two years,

the gap between rainy spells is too long, it is recommended that the soil moisture conservation treatments may be imposed at the end of first spell of rain. In such situation, for application of fertilizers and manures, a slight circular gap

### Summary

Drought which affects coconut growth and yield can be managed by soil moisture conservation practices. They should be imposed just after the first spell of monsoon showers. Depending on the availability of material, suitable practices can be adopted alone or in combination. It is also advisable to conserve the summer rainfall water in similar way. In soil types such as sandy soils, by practising soil moisture conservation methods, one can reduce the number of summer irrigations. Apart from this, available water may be supplied to all palms so that yield/palm can be maintained even during drought years. Soil moisture conservation in combination with water and crop management helps in mitigating the adverse effects of drought in coconut gardens.



Fig. 5 Leaf mulching in palm basin

### References

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