



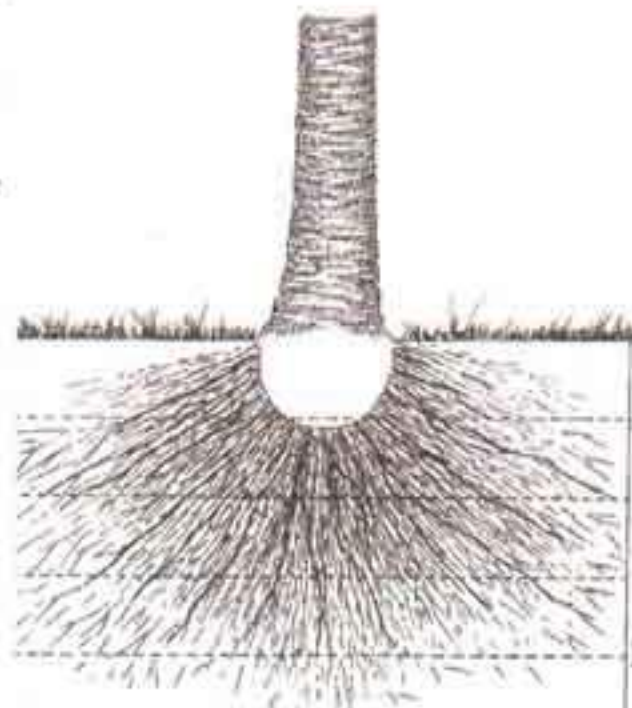
Coconut Research Institute of Sri Lanka



Advisory Circular No A 9

SOIL MOISTURE CONSERVATION IN COCONUT LANDS

Coconut palms require regular supply of water to maintain a consistent nut production throughout the year. The coconut palm has a spreading root system without a tap root. Although there can be a very large number of roots, their greatest concentration is in the top meter of the soil and within a radius of about 2 m (Picture 1). Each root has a growing point at its extremity. Just behind this, there is a whitish region, about 2 mm to 5 mm in length, which absorbs water. The older parts of the root are covered by a thick protective layer which is impervious to water. When the soils dry up for a prolonged period, this absorbing region develops a thick wall through which water will not enter. Roots so affected remain more or less in a resting condition and cease to absorb Water.



Picture 1: A diagram of active root zone of coconut

During rain free periods, soil moisture conservation in coconut lands has to be given high priority.

The main objectives of these practices are:

- Storage of as much rain-water as possible by getting it into the ground
- Conservation of moisture by minimizing evaporation

Drought effects

Drought symptoms first appear in seedlings, then in young palms and eventually in adult palms. Drought can slow down or totally arrest the activity of the growing point of the stem. Leaf production is reduced resulting in lesser number of inflorescence. Drought also arrests the formation of flowers, and prolonged droughts or lack of soil moisture could cause immature nut fall. A long dry spell result in a reduction in not only the number of nuts but also their size.

The recovery after a severe drought is a slow process. Normal root absorption does not commence with the first rain. First, the growing points of the root will have to be reactivated from their enforced rest. Root elongation and the formation of new absorbing regions in the roots follow this.

- The national coconut production has fluctuated widely during this decade, primarily as a result of adverse weather conditions. In some years, the loss has been as much as 30%. However, estates, which regularly carry out moisture conservation measures continue to obtain high yields of 10,000 to 15,000 nuts per ha/year (4,000 to 6,000 nuts per acre/year).

Soil moisture conservation methods

These methods can be grouped into:

- Reduction of moisture evaporation from the soil
- Mulching the manure circle
- Management of cover crop
- Adoption of good weed management practices
- Improvement of water holding capacity of the soil
- Application of organic matter
- Contour draining
- Burying coconut husks in pits

1. Mulching the manure circle

Mulch is a common term used to refer to a layer of leaves or similar materials spread over the ground to prevent drying out of soil. Among the materials that could be used as mulch are weed trash, straw and fallen leaves of trees etc. Out of these, coconut husks and fronds are the most easily and freely available materials for the coconut growers to use as mulching materials.

Benefits of mulching are :

- Reduce moisture evaporation
- Reduce soil erosion
- Reduce soil temperature during the dry periods
- Suppress weed growth
- Increase organic matter in the soil

1.1 Mulching with coconut fronds

Fallen coconut fronds should be cut into 2-3 pieces and used to cover manure circle. Button ends of dried fronds could be used as firewood (Picture 2). 2-3 layers of coconut fronds are sufficient. With the decaying of fronds, this should be maintained with new fallen fronds with covering area of 2.0 m radius of the palm.



Picture 2: Mulching with fronds

1.2 Mulching with husks

Fresh coconut husks have manurial and other properties (Picture 3). It also contains high amount of potassium. Approximately 100,000 husks contain potassium equivalent to 1.0 m.t. of Muriate of Potash.



picture 3: Mulching with husks

Guidelines for husk mulch application

- Use fresh husks
- Initially, apply 200-250 husks in 2.0 m radius circle round the palm. Leave mulching 15 cm from the bole.
- For continuous maintenance of the mulch, add approximately 125 new husks annually.
- Two layers of husks are sufficient. It is not necessary to arrange the husks neatly.
- When apply fertilizer remove husk mulch with a mamoty or a rake carefully (not disturbing decayed organic layer) and put back with new husk to maintain two layers of husks.
- Do not apply husk mulch to palms in water logging areas. These palms can be identified by observing root mat close to the bole.

1.3 Any other dried plant materials, leaves and weed trash could be used as mulch.

2. Burial of coconut husks in pits and trenches

For sustainable management of coconut plantations, it is always advisable to recycle husks to the soil. Generally, husks can absorb and retain six times their weight of water during the wet season and release it slowly to the soil during the dry season. Their spongy structure provides a good medium for root growth which is an essential character for coconut in hard and shallow soils (eg. Boralu series soil)(Picture 4).

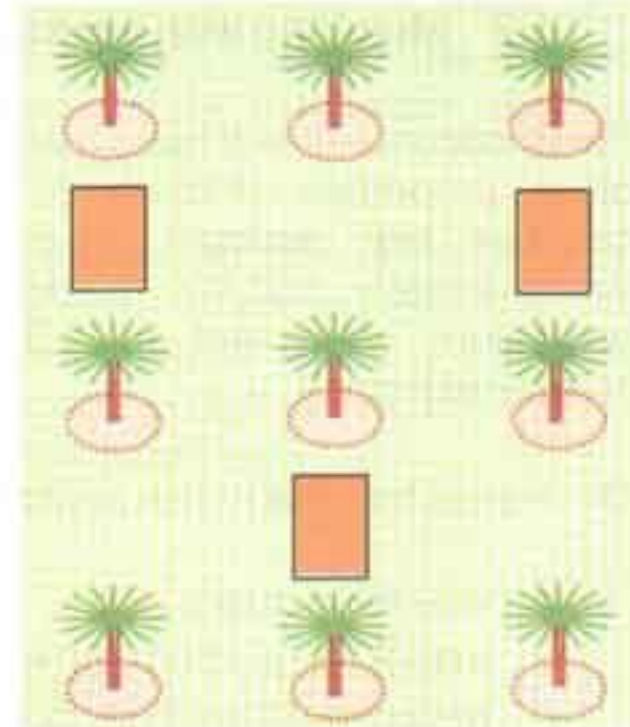


Picture 4: Root development of coconut towards the pit one year after burring husks

A) Husk-pits arranged in between palms:The size of these husk pits should be 2.4 m long, 1.2 m wide and 1.0 m deep (8'x 4'x 3'). These pits should be arranged alternatively between two palms along the coconut row (Picture 5 & 6).



Picture 5: A Husk pit arranged in between palms



Picture 6: A diagram showing arrangement of Husk pits between palms

Note:

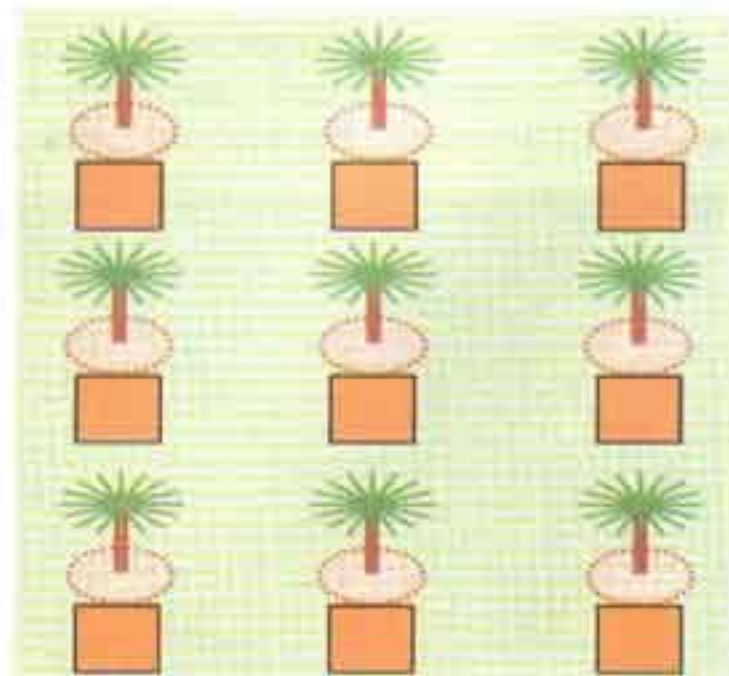
- Initially 78 pits are required for 1.0 ha of lands (32 pits/ac).
- 350-400 husks are required for one pit.
- The beneficial effects of this method last for about 5-6 years.
- Second round of husks burial should be carried out alternatively at new points as above(78 pits/ha).

Results of recent experiments conducted in several climatic/soil regions showed that this method is the best over tested methods detailed below.

B) Individual pits: Individual pits of the size 1.2 m long 1.2 m wide and 1.0 m deep (4 ft x 4 ft x 3 ft) arranged just outside the manure circle (2.0 m from the palm) (Picture 7 & 8). 200 husks are approximately required for this pit.



Picture 7: Individual husk pit



Picture 8: A diagram showing arrangement individual Husk pits

C) One-third circle trenches: In this method, husks are buried in 0.6 m (2 ft) deep and 0.6 - 1.0 m (2-3 ft) wide circular trenches covering on area of 1/3 around the palm just outside the manure circle (Picture 9 & 10).



Picture 9: One-third circle trenches



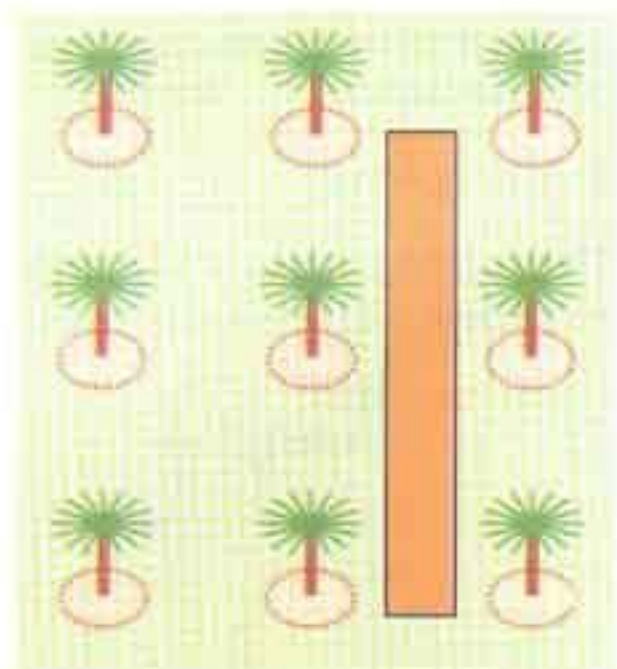
Picture 10: A diagram showing arrangement of one third circle trenches

D) Linear trenches (jumbo pits): The size of these pits is 1.0 m wide and 1.0 m deep running along the avenue, just outside the manure circle (2.0 m away from the palm). Trenches should be arranged alternative rows of palms and against the slope (Picture 11 & 12).

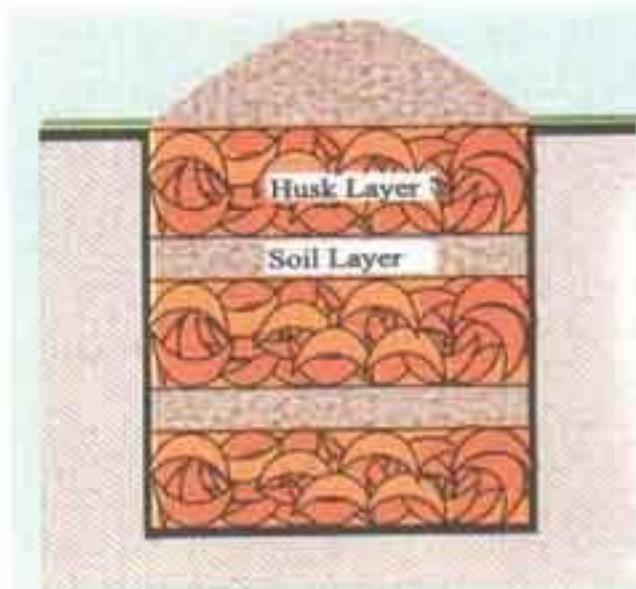
Generally, this method would be ideal for lands where husks are available excessively.



Picture 11: A Jumbo pit in a avenue



Picture 12: A diagram showing arrangement of jumbo pit along a avenue



Picture 13: Placement of husks in pits and trenches

3. Placement of husks in pits

Husk burying is usually done with the commencement of rains. Husks should be buried in pits or trenches layer by layer, each layer alternating with a layer of soil (10.0 cm), and finely filled up to the ground level. Thereafter, pits/trenches should be closed by piling the remaining soil on top (Picture 13). Systematic arrangement of husks is not necessary as it would not result in any extra benefit.

4. Excavation of pits

It is now economical to use 'Back-hoe' machine instead of manual labour for excavating pits/trenches. During this operation, it is important to pile the topsoil separately and use it for filling the pit.

Husk burial is not recommend for waterlogged lands with poor drainage.

5. Husk mulching/burial for young palm

At the planting of coconut seedlings, husks are placed in planting holes. So, adoption of moisture conservation practices for young palms is also an essential estate practice.

5.1 Mulching

This can be practiced as detailed for adult palms. However, mulch area should be as follows with the age of seedlings/young palms.

Age (year)	Distance from the seedlings	
	(meters)	(feet)
1	1.0	3
2	1.2	3.5
3	1.4	4
4	1.6	5
5	2.0	6

Note: Maintenance of excess mulch particularly with husk may cause damage by black beetle



Picture 14: Semicircular husk pit for a seedling

5.2 Husk burial

Individual pits could be established from the second or third year after planting.

- Provide semi-circular pits and the distance which the pit should be away from the seedlings is as given in the above table for mulching.
- The depth of the pit should be 0.6 m (2') and the width also 0.6 m (2'). A pit extending about half the circle (Picture 14).

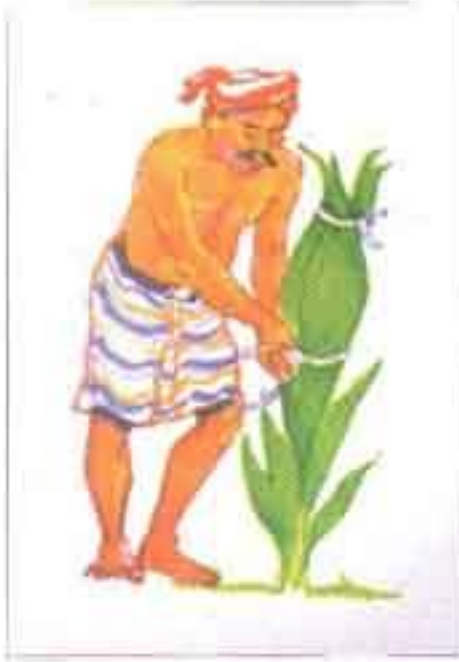
- This practice should be a continuous program and every year husk burial can be undertaken in a portion of the area surrounding the seedling/young palm.
- At the age of 6 years, husks burial should be followed as detailed for mature palms.

6. Other methods which can be practiced to overcome drought effects during dry periods

- Conserve rain water in coconut lands
- Plan irrigation properly
- Do not remove mulch
- Do not plant coconut seedling
- Do not apply inorganic fertilizers
- Do not harrow or plough
- Manage weeds and cover crops to a minimum level
- Do not make fires
- Control grazing by cattle
- Follow monthly coconut picking

Especially for coconut seedlings

- Collect and tie leaves (Picture 15)
- Provide shade
- Beware on red-weevil attack
- Cut drooping fronds
- Give a support to protect crown



Picture 15: Ting of leaves of a seedling