

Interlaced with palm-fringed waterways, beautiful Kuttanad is Kerala's paddy bowl. That it could be a treasure chest of coconuts too, seems evident from this discussion of

THE PROBLEMS AND PROSPECTS OF COCONUT CULTIVATION IN KUTTANAD

By N. G. PILLAI (*Soil Chemist*), M. V. PUSHPADAS (*Research Assistant*),
JOHN KURIAN (*Research Assistant*), AND S. B. LAL (*Director*)
Central Coconut Research Station, Kayangulam

KUTTANAD, known as the granary of Kerala, is one of the taluks in the Alleppey district of the State. Here the land, as though enmeshed in a system of rivers, canals, paddy fields and lakes, provides a magnificent and picturesque landscape which makes it one of the beauty spots of the State.

The main crop of the area is wet paddy cultivated from October to March under conditions peculiar to this region. Coconut, which forms the next important crop is mostly cultivated on reclaimed land. It is becoming less and less remunerative owing to the attack of pests and diseases. The Indian



Planting on newly reclaimed land

Central Coconut Committee has, therefore, initiated a package scheme for coconut in the area. The scheme envisages a comprehensive programme of work involving manurial, cultural and plant protection measures aimed at enhancing the production of coconuts in spite of the diseases. For this purpose 50 experimental plots, comprising 3852 adult palms distributed over an area of about 10 square miles in four villages viz., Pulinkunnoo, Nedumudi, Champakkulam and Kainakari have been selected.

During a reconnaissance soil survey of the area covering the experimental plots, a number of interesting observations have been made on the soil conditions and on coconut cultivation in this area. These are briefly discussed in this note.

THE SOIL

The soil in this area is generally known as the reclaimed clayey soil of the backwaters. The age of these reclaimed lands varies from 15 to 300 years. New reclamation is still in progress in some places. During the survey wide variations were visible in the texture and structure of the soil, depth of water

table and root penetration and these were generally reflected on the condition of the coconut palms. A study of the history of reclamation showed that these differences were mainly due to the materials and methods used for reclamation. River silt, clay from the paddy fields and clay from the lake along with river sand and loamy sand from the hills were the materials generally used. Good soil conditions with proper drainage and aeration, conducive to healthy growth of coconut, were always found to be associated with addition of river silt and sand or loamy sand in alternate layers during reclamation.

Reclamation with clay as the major component resulted in hard pans in sub-soil layers making proper root penetration, drainage of water and good aeration of the soil impossible. Coconut palms in such plots were generally found to be infected with leaf rot and root (wilt) diseases and had a general yellowing of the foliage.

HIGH WATER-TABLE

Kuttanad is mostly an area with high water table which fluctuates to some extent on account of seasonal and

tidal effects.
importance
not so much
its physical
structure.
growth of
conditions, t
distribution
to give it
withstand
porosity to
aeration. I
and lime ha
condition of

The ri
from the p
good poly
field clay p
manurial s
more comp
hard clods
is less stic



tidal effects. What is of paramount importance in such soil conditions is not so much the fertility of the soil as its physical properties like texture and structure. To ensure a satisfactory growth of coconut under the above conditions, the soil should have an even distribution of clay, silt and sand so as to give it the necessary cohesion to withstand erosion and the required porosity to facilitate drainage and aeration. Presence of organic matter and lime helps to improve the physical condition of the soil.

SILT AND CLAY

The river silt and clay collected from the paddy fields and lakes have good polymanurial value, the paddy field clay possessing comparatively lower manurial status. The clay is usually more compact and sticky and forms hard clods when dry while the silt is less sticky and compact. The silt

also contains more of organic matter than the clay. Therefore, it is the river silt rather than the clay which is helpful in giving the soil the good physical attributes so essential for it under water-saturated conditions. However, if large quantities of sand are used in alternate layers clay reclamations may also possess the desirable physical properties. When reclamations from deeper waterbeds are attempted, the clays may perhaps be more helpful for raising the level of the soil up to the surface of water.

The water-table in these areas varied from 0.6 metre to 1.2 metres. Most of the soils were found to be wet up to about 0.15 metre to 0.3 metre from the top even in summer. The sub-soil water was found to be either neutral or slightly acidic. The deeper zones of these areas were invariably clay throughout.

A healthy coconut garden in Kuttanad



THE PLANTATIONS

The plantations were mainly of the West Coast Tall variety palms which were planted either on bunds in single or double rows or on extensive reclaimed plots. Bund cultivation was found to be very productive and healthy while deterioration in health and yield was noticed in plantations standing on extensive areas. In the bunds, the adjacent water is subjected to ebb and flow of the canal or lake which gives proper movement of water and subsequently proper aeration to the root rhizosphere. The facilities for drainage through the sides of the bunds also contribute to the better performance of palms grown on bunds. Availability of more sunshine may be another advantageous factor. In extensive areas with soil having a preponderance of clay, however, stagnation of water and the concomitant ill effects will prevail and the palms growing in such areas are likely to be unhealthy and poor in yield. Young plantations were found to be comparatively healthy.

MANURIAL AND CULTURAL PRACTICES AND IRRIGATION

Even though cultural and manurial practices were not followed to any appreciable extent, the palms were found to be high yielding. This may be due to the inherent fertility of the silt and clay fractions which account for the major portion of the reclaimed soil. Clay possesses the property of absorbing the nutrients and retaining them against leaching. The absorbed nutrients are slowly released and made available to the palms.

The application of river silt is a usual practice here. About one ton of silt is applied at the base of the tree in alternate years in March-April and sometimes in September-October. This is followed by the application of river sand in May-June or September-October approximately at the rate of $\frac{3}{4}$ to 1 ton per tree. The river silt has a number of advantages over fertilizers. The silt, in addition to providing nutrients to the palm, exerts a mulching effect in summer and has binding properties which prevent erosion during rainy season. Unlike fertilizers, the nutrients are not easily leached and lost. The maintenance of soil depth and replenishment of soil for production of fresh roots, indispensable in an area like Kuttanad are also served by the addition of silt. Application of river sand is meant for improving the aeration of the soil. Addition of burnt lime incorporated with silt was also a practice followed in many areas. Lime is added mainly to improve the physical condition of the soil which has a major fraction of clay, as lime flocculates clay, making clayey soils less sticky, more friable and crumbly and easily cultivable. The deleterious effect of addition of excess lime e.g., non-availability of phosphate or trace elements, is not likely to occur in clayey soils since such soils are never well aerated as sands, so that the pH of even a calcareous clay never rises to a considerably high level.

Cultural operations are not practised widely here. Available information is inadequate to assess the efficacy and economics of cultural operations in Kuttanad. The operations like digging generally have the beneficial

effect of preventing surface matting, moisture during enhancing the aeration in Kuttanad which is high and available root penetration 0.9 metre, will help this depth still for definite experimental operations in Kuttanad are available, it is to make a comparison of conflicting effects by adopting silt, best carried out during summer which is moist but not ex-

SUMMER IRRIGATION

Some progress has been made that summer irrigation for coconut. It is to expect drought waterlogging. That drought is generally very high water-table a shallow root system is able to get to ground level water as during the water-table recession season, it may be available at the palms may be irrigation. In the strips bordering other permanent water-table areas of high tides irrigation ma-

river silt is a
out one ton of
ise of the tree
arch-April and
October. This
eation of river
ember-October
e of $\frac{3}{4}$ to 1 ton
has a number
zers. The silt,
g nutrients to
hing effect in
ng properties
during rainy
, the nutrients
and lost. The
and replenish-
tion of fresh
an area like
y the addition
river sand is
e aeration of
burnt lime
was also a
areas. Lime
e the physical
has a major
cculates clay,
sticky, more
ily cultivable.
addition of
availability of
ents, is not
ils since such
as sands, so
careous clay
y high level.

are not
Available
o assess the
of cultural
e operations
he beneficial

effect of preventing weed growth and surface matting of roots, retaining moisture during dry months and enhancing the aeration of the soil. But in Kuttanad where the water-table is high and available depth of soil for root penetration is only about 0.6 to 0.9 metre, will have the effect of reducing this depth still further. So, until some definite experimental data on cultural operations in Kuttanad or similar areas are available, it would be reasonable to make a compromise between the conflicting effects of cultural operations by adopting shallow digging which is best carried out just before the onset of summer when the soil is sufficiently moist but not excessively so.

SUMMER IRRIGATION BENEFICIAL

Some progressive cultivators reported that summer irrigation was beneficial for coconut. It may be paradoxical to expect drought in the midst of waterlogging. But it is to be admitted that drought and heat conditions are generally very harmful for heavy soils of impervious nature. Because of the high water-table the palms develop only a shallow root system which may be able to get sufficient water from the ground level when it is maintained high as during the rainy season. But as the water-table recedes during the summer season, it may be that the water is not available at the root zone and thus the palms may therefore benefit by irrigation. In the case of the long narrow strips bordering rivers and canals and other permanent waterways with high water-table and subject to the influence of high tides, the question of summer irrigation may not arise, even during

the summer, as the water will percolate from the sides regularly. But in the case of other garden lands, summer irrigation may be necessary, as the benefits mentioned above are not available to them, in spite of their being situated on the sides of canals, rivers or lakes. The elevation of the ground level from the water surface has to be duly considered, in such cases.

During the summer season the river water in Kuttanad becomes saline and it is this saline water that is usually used for irrigation. It is not known whether the beneficial effect observed by some cultivators is due to the salt content of the irrigation water or to the water *per se*. Since the soil in Kuttanad is clayey, continuous irrigation with saline water for a number of years may spoil the good physical properties of the soil. But there is, at present, no data to corroborate or contradict this possibility.

INTERCROPPING

Banana is the main intercrop in coconut gardens in these areas. This is found to give in summer proper shade to the seedlings and the bases of the older palms. The coconut may also be benefited by the heavy doses of manures applied to bananas and water used for their irrigation. Cultural practices with regard to banana cultivation are also highly beneficial to the coconut palm and the cost of seasonal cultural practices can be reduced in coconut gardens intercropped with banana. It will be definitely advantageous if the remnants of the banana plant after harvest are returned to the soil as manure, instead of being thrown away.



Coconut palms grown on bunds

Bananas are usually planted 3 meters apart. The economics of this intercrop have been worked out roughly. The expenses of bringing up a plantation of one acre to bearing stage are estimated to be about Rs. 300-400. The income from the yield will come to about Rs. 600-700, thereby giving a net profit of Rs. 300-400 per year. In such gardens, production of coconuts per acre was found to range from 3000-4000 nuts per annum, indicating that intercropping with banana does not adversely affect coconut cultivation. Areca cultivation was also met with in certain places. Homestead trees like mango, jack etc., were also seen in some of the areas.

PESTS AND DISEASES

The leaf rot and root (wilt) diseases occurred on a wide scale in the areas.

Bud rot also was of common occurrence. Many of the old plantations were badly infected. Palms grown on bunds were infected by diseases less than those on extensive gardens. Besides the rhinoceros beetle the main pest causing damage to the palm was the red palm weevil.

SUMMARY AND SUGGESTIONS

The potentialities of Kuttanad for development of coconut cultivation are immense. The condition of the present plantations can be improved by plant protection measures viz., spraying with fungicides for leaf diseases and injections with pyrocon E2/20 for the control of red palm weevil and filling the axils of leaves with B.H.C. and sand. Palms affected with bud rot are found to be easily susceptible to red palm weevil

A coconut garden with infected palms

attack, emphasis on simultaneous control of pests. The soil should be improved by proper drainage. Wherever there is no proper drainage, it should be opened to facilitate water and subsurface drainage in the root zone. For coconut, it is important to know the fertility status of the soil to some extent. The use of fertilizers will be beneficial to the yield. The use of very sound polymanurial fertilizers with physical properties like river sand is essential to improve the texture of the soil. Underplanting with quality coconuts is essential since

ut palms grown
nds

*A coconut garden with badly
infected palms*



mon occurrence.
tions were badly
on bunds were
s than those on
ides the rhino-
i pest causing
as the red palm

GGESTIONS

of Kuttanad for
cultivation are
n of the present
roved by plant
spraying with
ases and injec-
for the control
filling the axils
d sand. Palms
re found to be
d palm weevil

attack, emphasising the need for simultaneous control of diseases and pests. The soil condition could be improved by proper cultivation practices. Wherever there are extensive plots, proper drainage systems should be opened to facilitate free movement of water and subsequent aeration at the root zone. By long cropping with coconut, it is possible that the inherent fertility status of the soil has been lost to some extent and addition of suitable fertilizers will be effective in increasing the yield. The addition of silt is a very sound practice because of its polymanurial value and beneficial physical properties. The addition of river sand is also to be advocated to improve the texture and structure of the soil. Underplanting the whole area with quality coconut seedlings is very essential since many of the palms of the

area are old and give reduced yields. The place also offers immense scope for bringing more area under cultivation. Bund cultivation is always to be recommended in this area rather than cultivation on reclaimed extensive plots for the reasons already stated. As the bunds are usually raised adjacent to paddy fields, it is advisable to have a wide interspace of about 8-9 metres between seedlings for the following reasons:-

1. The trees will not cast any shade on the paddy fields and adversely affect paddy cultivation particularly when the plantation is in double rows.
2. The trees will not prevent free wind action so essential for paddy cultivation.

3. Wide interspacing will provide enough space for lateral spread of the roots which will be beneficial as the roots cannot go deep owing to high water-table.
 4. This will also provide enough space for early underplanting.
- and manurial practices are followed, strict plant protection measures taken, under-planting of existing gardens done and more area brought under cultivation.

Recommendations for improving coconut cultivation in Kuttanad based on the results of the physico-chemical



Banana grown as subsidiary crop in coconut gardens

Among intercropping practices, banana cultivation is found to be most economical and this may prove beneficial to the palm provided manuring and cultural practices are followed.

Thus Kuttanad can be developed into a major coconut-growing area of Kerala, provided judicious cultivation

examination of the soil samples collected during the present survey will be communicated in due course.

ACKNOWLEDGEMENT

The authors are thankful to Shri K. P. Amrithanatha Iyer, Mankompu for the valuable suggestions made by him during the conduct of this survey.