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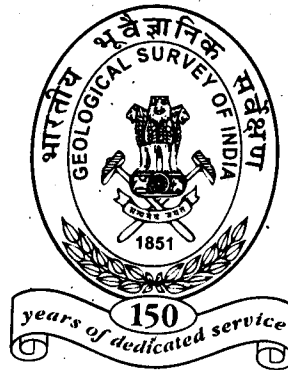
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**PROCEEDINGS OF WORKSHOP ON STATUS OF  
SCIENTIFIC DATABASE ON LAKSHADWEEP ISLANDS**

भारतीय भूवैज्ञानिक सर्वेक्षण

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## AGRICULTURE RESEARCH AND DEVELOPMENT - EXPERIENCES IN LAKSHADWEEP ISLANDS

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### INTRODUCTION

The archipelago of 36 coral atolls in the Arabian sea roughly about 200-400 km from the Kerala coast provide a land area of 28.5 sq km and an extensive lagoon (4200 sq km) around them. The area of the largest inhabited island (Androth) is only 4.8 sq km and that of the smallest (Bitra) is ten hectares. The islands experience both the monsoons and receive an average rainfall of 1600 mm a year, the peak being May-September. The temperature varies from 24° C to 32° C.

The islands are marked by the absence of forests, rivers, canals and waste lands.

### PRESENT STATUS OF AGRICULTURE

The inhabited islands of Lakshadweep command an area of 2800 ha under coconut, with negligible area under vegetables and fruits. The coconut palms are thickly planted (300 to 600 palm/ha) and the yield per bearing palm is about 55 nuts (Shamsuddin, 1986), with an annual production of 22.5 million nuts. Besides coconut, other field crops like brinjal, green chillies, tomato, pumpkin, radish, amaranthus, behindi, bitter gourd, snake gourd, beans, cucumber, banana, papaya, sapota, guava, drumstick, sweet potato and colocasia are being grown in the research stations of the ICAR and the Agriculture departmental farms in different islands. On a small scale, growers also have switched over to growing of the vegetables of late. As the per-capita land area is about 20 cents in the islands the owners also diversify their activity in fishing and 'mas' making.

### RESEARCH

#### Planting Material

Since there is no scope for area expansion under coconut, the productivity of coconut in the island can be stepped up considerably only with the judicious planting of superior quality planting materi-

als of high yield potential. It is estimated that about 1,00,000 quality coconut seedlings are required to replace the unproductive and senile palms in the island (Bavappa and Biddappa, 1986). The popularly known Laccadive Ordinary variety has been recognised for its higher oil content and nut production. The ICAR Research Complex, Minicoy is producing hybrid coconut seedling with the available parent materials. In an observational trial on the performance of DxT, TxD and Laccadive Ordinary at the Regional Station, Minicoy (CPCRI), it was recorded that the earliest flowering was observed under orange dwarf x Laccadive Ordinary crosses at the age of 30 months. (Anon, 1994). The Laccadive Ordinary (control) was the last to flower (at the age of 54 months). This clearly indicates the need for production of large number of hybrid seednuts in the island. Until adequate supply of DxT plants are produced to cater to the needs of the islands, quality seedlings of prepotent, Laccadive Ordinary coconut parents of known characters may be raised judiciously.

#### Soil Fertility

An extensive soil survey of all the major islands conducted by Singh and Velayutham (1980) and in Minicoy by Hameed Khan *et al.*, (1977) revealed that these soils are highly calcareous, structureless and alkaline in reaction (pH - 8.5), low in organic matter and soil fertility status (Table 1) and poor water holding capacity. The moisture content at wilting point is around 3% and at field capacity between 8% and 12%. The available macro and micronutrient concentration in the soil is given in Table 1.

The nutrient concentration in the diagnostic leaf of coconut is presented in Table 2.

The data clearly indicate that palms are near sufficiency level in case of nitrogen, phosphorus, calcium and magnesium, while potassium and sulphur

TABLE 1

## AVAILABLE MACRO AND MICRO NUTRIENTS IN THE SOIL OF LAKSHADWEEP

Island	Depth	pH	Org.	CaCO <sub>3</sub> %	N %	P ppm	K mg/ 100g	Mg mg/ 100g	Fe ppm	Mn ppm	Zn ppm	Cu ppm
Kalpeni	0.25 cm	8.3	1.21	85.0	0.128	2	1.8	1.5	2.00	0.38	0.43	1.55
Minicoy	—	8.0	1.99	88.8	0.190	15	1.7	2.3	3.36	0.46	0.24	1.89
Kiltan	—	8.6	1.22	93.0	0.123	10	1.8	3.4	2.90	0.37	0.21	0.55
Kavaratti	—	8.3	1.36	85.3	0.130	14	1.7	2.5	2.25	0.43	0.33	0.64
Cherian	—	8.7	0.70	83.3	0.071	15	1.6	3.1	1.62	0.23	0.32	0.55
Chetlat	—	8.4	1.17	85.3	0.097	62	2.9	2.5	2.29	0.37	0.24	0.49
Agatti	—	8.5	1.51	87.3	0.124	7	1.8	3.1	2.50	0.50	0.26	0.60
Kadamat	—	8.1	1.57	86.3	0.141	20	1.4	2.7	2.15	0.33	0.36	0.48
Amini	—	8.1	1.39	81.6	0.133	125	1.7	2.5	2.22	0.28	0.32	0.87
Androth	—	8.4	1.71	83.5	0.165	52	2.7	3.0	2.36	0.39	0.40	0.50

Source : Singh and Velayutham (1980)

TABLE 2

AVERAGE NUTRIENT CONCENTRATION IN THE COCONUT LEAVES IN LAKSHADWEEP  
(14th LEAF)

Island	N %	P %	K %	Na %	Ca %	Mg %	S %
Kalpeni	1.78	0.14	0.60	0.49	0.56	0.36	0.12
Minicoy	1.75	0.13	0.54	0.49	0.56	0.46	0.09
Kiltan	1.64	0.14	0.56	0.51	0.46	0.40	0.07
Kavaratti	1.78	0.13	0.75	0.35	0.45	0.35	0.09
Cherian	1.78	0.12	0.78	0.26	0.55	0.36	0.09
Chetlat	1.48	0.13	0.66	0.51	0.40	0.31	0.09
Agatti	1.63	0.13	0.45	0.45	0.45	0.46	0.08
Kadamat	1.60	0.11	0.49	0.55	0.46	0.36	0.07
Amini	1.70	0.14	0.59	0.53	0.46	0.38	0.07
Androth	1.78	0.14	0.48	0.52	0.51	0.37	0.01

Source : Singh and Velayutham (1980)

are far below the critical limits. Therefore, there is scope for replenishing these nutrients in the island. Singh and Velayutham (1980) reported that leaf manganese levels varied from 12 to 35 ppm (the critical level being 66 ppm) marking acute deficiency. Leaf iron (Fe) level varied from 67-317 ppm. Leaf zinc (Zn) levels ranged between 10 and 72 ppm, the

optimum being 11 ppm.

#### Nutrient Management

In view of the existing situation in the supply of plant nutrients, attempts were made to work out manurial schedule for the coconut in the islands. Bopaiah and Cecil (1993), reported that the treatments N<sub>1</sub>P<sub>1</sub>K<sub>1</sub>, N<sub>2</sub>P<sub>0</sub>K<sub>2</sub> and N<sub>2</sub>P<sub>2</sub>K<sub>2</sub> produced signifi-

cantly more coconuts than control and in plots where potassium alone was applied (Table 3). Though the available P content in the soil increased with phosphorus addition, the effect of P enrichment on the nut yield was not noticed. However, N, P, K, dose has given an increased yield of 123 to 160 percent over control. On the basis of this, they recommended

compost etc, as basal dose coupled with the recommended dose of NPK in split doses and providing irrigation at frequent intervals. This practice is being followed by some progressive growers to produce vegetables on commercial scale. Similarly in the case of banana, guava, sapota and other fruit crops breaking the "hard pan" and filling the pits

TABLE 3

MEAN COCONUT YIELD AND LEAF NUTRIENT CONTENTS AS INFLUENCED BY NPK APPLICATION

Treatments	Yield (No. of nuts)			Leaf nutrient contents (%)						
	1988	1989	1990	N	P	K	Ca	Mg	Na	S
Control	21.50	32.25	33.50	1.70	0.14	0.38	0.69	0.32	0.34	0.18
N <sub>0</sub> P <sub>0</sub> K <sub>1</sub>	37.50	54.00	45.75	1.72	0.14	0.15	0.57	0.25	0.43	0.20
N <sub>0</sub> P <sub>0</sub> K <sub>2</sub>	38.00	63.67	73.75	1.70	0.15	1.28	0.60	0.25	0.37	0.20
N <sub>1</sub> P <sub>0</sub> K <sub>1</sub>	47.00	65.00	69.00	1.81	0.15	0.79	0.56	0.29	0.45	0.21
N <sub>2</sub> P <sub>0</sub> K <sub>2</sub>	65.30	85.00	87.75	2.00	0.16	1.12	0.57	0.27	0.42	0.21
N <sub>1</sub> P <sub>1</sub> K <sub>1</sub>	72.30	82.00	75.25	1.96	0.16	0.96	0.16	0.96	0.42	0.21
N <sub>2</sub> P <sub>2</sub> K <sub>2</sub>	54.00	83.75	73.75	2.01	0.16	1.26	0.56	0.24	0.40	0.21
CD at 5%	24.72	28.78	29.91	0.15	N.S.	0.20	N.S.	N.S.	0.06	0.02

Source : Bopaiah and Cecil (1993)

an annual application of 250 g N, 160 g P<sub>2</sub>O<sub>5</sub> and 600g K<sub>2</sub>O/palm/year in Lakshadweep. Effect of NPK soil application on the foliar nutrient concentration is also given in Table 3.

Application of micronutrient such as ferrous sulphate at the rate of 5 g, 10 g, 15 g and 20 g at the bole region in a hole for 3 years on the five year old coconut palms did not reveal any beneficial result (Bopaiah, 1991, unpublished), in the research station at Minicoy. Therefore, at the initial stage for coconut, it would be better to give importance on major nutrients.

In fruit and vegetable crops leaf chlorosis is common resulting in poor yields. Trials conducted at the research complex (CPCRI) have shown that the malady can be overcome by adopting proper management practices viz, applying enough organic manures such as cowdung, poultry waste, fish meal

with organic manures and planting has been found to be effective in establishment of the plant and production without chlorosis. Replenishment of nutrients (NPK) at all stages is found to be essential.

A field trial using variety CO-2 of Papaya conducted at the research station, Minicoy by Bopaiah (1991) showed that highest dose of NPK (200 : 100 : 200 g) and fruit weight, per plant recorded maximum height and weight of fruits per plant (Table 4). It is clearly indicated that there is steady response of fruit yield for increasing the dose of fertilisers.

#### CROPPING PATTERN AND LAND UTILISATION

As production target of 5000 tons of fruits and 6000 tonnes of vegetables are set per annum by the turn of the century (Bavappa and Biddappa, 1986), this can be achieved by adopting suitable high den-

TABLE 4

MEAN VALUES OF GROWTH, YIELD AND QUALITY OF PAPAYA AS INFLUENCED BY NPK COMBINATIONS (6 MONTHS STAGE)

Vegetative part				Fruit			
Treatments	Stem girth (cm)	Leaf stalk length (cm)	Leaf number	Fruit wt. (kg)	Volume (lit)	Height (cm)	T. S. S. (%)
N <sub>0</sub> P <sub>0</sub> K <sub>0</sub>	26.6	60.8	31.1	5.0	0.86	12.8	12.2
N <sub>0</sub> P <sub>0</sub> K <sub>1</sub>	25.9	60.1	26.8	2.1	0.63	11.2	12.0
N <sub>0</sub> P <sub>1</sub> K <sub>1</sub>	28.9	62.9	30.6	12.2	1.76	19.9	12.0
N <sub>1</sub> P <sub>0</sub> K <sub>1</sub>	38.6	73.9	39.6	21.8	1.41	15.6	12.2
N <sub>1</sub> P <sub>1</sub> K <sub>0</sub>	26.2	63.6	39.6	15.6	1.32	14.9	12.0
N <sub>1</sub> P <sub>1</sub> K <sub>1</sub>	36.5	78.3	34.1	21.8	2.03	17.2	11.8
N <sub>2</sub> P <sub>2</sub> K <sub>2</sub>	34.6	76.8	37.8	29.2	1.70	18.8	12.3
C.D at 5%	8.6	N.S.	7.35	13.0	0.80	4.8	N.S.

Source : Bopaiah (1991 unpublished)

TABLE 5

MEAN VALUES OF COCONUT YIELD AT DIFFERENT DENSITIES

Private			Research		
Plant	Nut / palm / year	Nuts / ha / year	Plant density	Nuts / palm / year	Nuts / ha / year
300/ha	24	37200	156/ha	155	24180
650/ha	43	27950	312/ha	74	23088
800/ha	15	12000	---	---	---

Source : Bopaiah (1993)

sity multi-species cropping system in the existing coconut plantation.

In an attempt to rejuvenate the existing thickly planted coconut garden, 35 percent of the existing palms were removed and recommended doses of fertilisers (500 : 320 : 1200 NPK) were applied in a privately owned garden. A 150 percent increase in the coconut production was recorded (Bopaiah, 1993) (Table 5).

Thinning the coconut gardens also provide scope for planting suitable intercrops such as fruits and vegetables. Work carried out at the Research Station. Minicoy has clearly demonstrated the prof-

itability of growing these crops. The income from some intercropped areas is given in Table 6.

In the management of the vegetables as intercrops sweet water availability may become a limiting factor as the reservoir of sweet water is limited due to surrounding sea water. Hence growing vegetable crops in the months of January to May must be restricted. Water economy measures using drip irrigation system, production of compost and organic manures must be encouraged in the islands.

#### PEST MANAGEMENT

Pest and disease management is an important component in any cropping system. Some of the

TABLE 6

INCOME FROM INTERCROPPED AREAS UNDER COCONUT IN LAKSHADWEEP

Sl. No.	Crop Combination	Income / ha (Rs)	Sl. No.	Crop Combination	Income / ha (Rs)
1.	Coconut (8 x 8 m)	59200	4.	Coconut (8 x 8 m)	50310
2.	Coconut (8 x 8 m)	52208	5.	Coconut with quincunx, planting betelvine.	58761
3.	Coconut (8 x 8 m)	55742	6.	Coconut quincunx, alone	46800

Note : Copra price was worked out at the rate of Rs. 15 / kg

Source : Bopaiah (1990)

pests of economic importance are rhinoceros beetle, red palm weevi, coroid bug, scale insects and mealy bugs. Rhinoceros beetle (*Oryotes rhinoceros*) is a commonly occurring major pest on the growing portion of the coconut plant. In certain islands like Androth, 90% of the trees were found infested with this pest. An integrated approach in the control of this pest include i) judicious disposal of the dry leaf, stem, crown etc., ii) hooking of beetle from the burrowing tunnel in the crown, iii) application of B.H.C + sand mixture in the axils of the fronds and iv) mixing B.H.C. in the heaps where decomposition of the trash takes place to kill the grubs. Another novel approach has been successfully handled in the control of this pest in the island by Mohan et al,

(1989). This is a biological suppression of the population of the beetle by inoculating the baculovirus (*Oovotes baculovirus*). Rhinoceros beetles were infected with this virus (30 LD 50 dose/ml of inoculum) and released into the pest population in Minicoy island. The virus was previously isolated from field collected diseased beetles from Kayangulam in Allepey district. The post release observations (Table 7) recorded after two years revealed spread of the virus disease to the subsequent generations of the beetle and larvae in breeding sites.

Among the vertebrate pests on coconut, rodents cause damage from 10% to 20%. In Minicoy island, the damage is more severe as the rats could easily hide in the screw pines. Among the rats *Rattus*

TABLE 7

PERFORMANCE OF BACULOVIRUS AT MINICOY, LAKSHADWEEP

Observation	Leaf damage (%)	Spathe damage (%)	Fresh incidence (%)	Baculovirus disease incidence (%)
Pre-release (1983)	56.6	31.1	39.2	0.0
Post release (Jan 1984)	44.9	6.4	5.0	50.0
Post release (Nov. 1984)	20.4	2.3	5.1	25.9
Post release (Sept. 1985)	17.5	1.6	9.2	43.3
Post release (May 1986)	10.0	0.5	1.2	50.0
Post release	7.0	Negligible	Negligible	62.0

Source : Mohan et al. (1989)

*rattus* (Wroughtoni) is the most damaging and the loss is estimated to be about 32% of the annual production in the islands. Studies conducted at Minicoy have shown that wooden live trap is the best for trapping black rat in coconut gardens. The rodent control trials have shown that both warfarin and bromadiolone were effective in reducing the rodent population and damage of coconut. According to Sethumadhava Menon (1972), warfarin blocks were successfully used to reduce rat damage to coconuts in Androth island and copra exports in 1970-71 was increased by about 40% over the previous year as a result of rodent control. It is suggested that integrated control measures and community approach are the best methods for reducing the loss of coconut in the islands.

### AGRICULTURE DEVELOPMENT PROGRAMMES

The development programmes for coconut carried out in Lakshadweep islands are detailed by Shamsuddin (1976 and 1986). The development programmes consisted of control of pests and diseases, improvement of cultural, manurial and intercropping practices, distribution of fertilisers, power tillers on subsidised rates. The research station in Minicoy has conducted field days, exhibitions and pilot-cum-demonstration trials in the growers' fields. Farmers have also been trained on aspects

of hybridisation technique, pest and rodent control measures and other aspects. In spite of several development measures, the spontaneous response from the growers is not forthcoming for intensifying coconut cultivation and intercropping. The approach should be reoriented to bring about change in the attitude of the growers in the island.

### FUTURE THRUST

1. Establishment of mixed farming systems in co-conut gardens with grass and legumes as intercrops and rearing of goats and cows.
2. Establishment of coconut based small scale cottage industries for coconut coir, oil, desiccated coconut powder, vinegar, coconut cream and bottling of coconut water for soft drink.
3. Integrated fertiliser management using locally available agricultural wastes, intercropping and fish byproducts.
4. Water management practices, water harvesting and saline water recycling.
5. Intensification of hybrid seed production to meet the requirement of the island.
6. Integrated pest management practices must be popularised.
7. Suitable facilities for the scientific staff to conduct research.

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