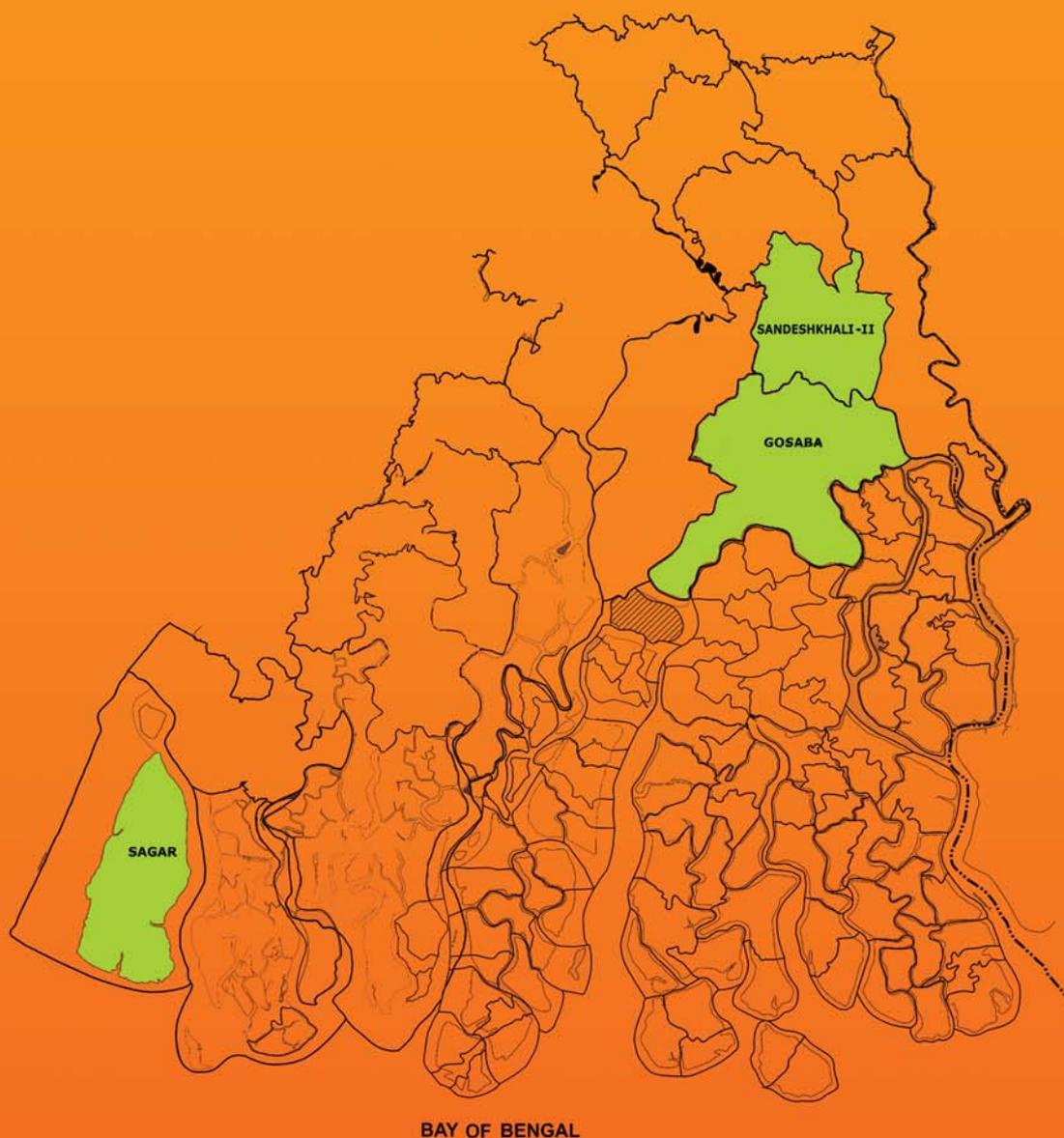


# Report on Feasibility Studies for Oil Palm Cultivation in Sagar and Sundarbans Islands of West Bengal, India



भारत - भारतीय तेल तालु अनुसंधान संस्थान  
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ICAR - INDIAN INSTITUTE OF OIL PALM RESEARCH  
Pedavegi - 534 450, West Godavari Dt., Andhra Pradesh





# Report on Feasibility Studies for Oil Palm Cultivation in Sagar and Sundarbans Islands of West Bengal, India

## The Study Team

**Dr. P. Kalidas**, Principal Scientist, IOPR, Pedavegi

**Dr. K. Suresh**, Principal Scientist, IOPR, Pedavegi

**Dr. K. Ramachandrudu**, Principal Scientist, IOPR, Pedavegi

**Dr. Sanjib Kumar Behera**, Senior Scientist, IOPR, Pedavegi



**भाकृअनुप - भारतीय तेल ताड़ अनुसंधान संस्थान**  
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January 2016

## **ACKNOWLEDGEMENTS**

We profusely thank Dr.P.Kalidas, Director (A), ICAR-Indian Institute of Oil Palm Research, Pedavegi, Andhra Pradesh for giving an opportunity for conducting the feasibility study in the islands of West Bengal, India.

We express our deep sense of gratitude to all the officers in general, and Shri P.K.Das and Shri T.K.Das in particular, of the Department of Agriculture, West Bengal for the logistic support extended at Kolkata, Sagar, Gosaba and Sandeshkhali II islands.

The services and support extended by Dr. K.V.Ramana and Dr. Abishek Chakraborty, Scientists of National Remote Sensing Centre, Indian Space Research Organization, Hyderabad in collection of soil and water samples along with GPS coordinates are highly appreciable.

The help rendered by the local administrative/supporting staff of the Department of Agriculture who accompanied the team while visiting the islands is highly acknowledged.

The information given by the local farmers of the islands regarding their experiences in farming and explaining their problems to the team members are worth mentioning.

We thank the Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture & Farmers Welfare, New Delhi for their financial assistance.

We are highly indebted to our Honorable Deputy Director General (Hort. Sci.), Indian Council of Agricultural Research, New Delhi for his valuable guidance.

Lastly, the team members profusely thank Dr. Ravi Kumar Mathur, Director, ICAR-Indian Institute of Oil Palm Research, Pedavegi for all his support.

**Dr. P.Kalidas**  
**Dr. K.Suresh**  
**Dr. K.Ramachandrudu**  
**Dr. S.K.Behera**

# Report on Feasibility Studies for Oil Palm Cultivation in Sagar and Sundarbans Islands of West Bengal, India

## Preamble

The Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India requested the Director, ICAR - Indian Institute of Oil Palm Research, Pedavegi, Andhra Pradesh to conduct the feasibility studies for oil palm cultivation in Sagar and Sundarbans islands of West Bengal vide letter No 3-3/2015-OP (SB)-338 dated 21-07-2015 (Annexure I). Accordingly, the Director, ICAR-IIOPR, Pedavegi has constituted a committee consisting of Dr.P.Kalidas, Dr.K. Suresh, Dr, K. Ramachandrudu, Principal Scientists and Dr. Sanjib Kumar Behera, Senior Scientist, ICAR-IIOPR, Pedavegi, to examine the feasibility for oil palm cultivation in the above mentioned islands (Annexure II). The members of the team visited the islands during September to December, 2015, surveyed the areas and interacted with the officials of Department of Agriculture, Govt. of West Bengal (Annexure III) and farmers of these areas. Soil and water samples of different villages were collected to get detailed information of the areas surveyed. A comprehensive report on the geography of the area, land use pattern, rainfall, irrigation resources, cropping pattern and socio-economic conditions of the farmers has been prepared for arriving at the feasibility of oil palm cultivation in these islands.

## Geographical Setting of the Study Area

The surveyed islands viz., Sagar, Gosaba and Sandeshkhali II (adjacent to Sundarbans) exist in the North and South 24 Parganas districts of West Bengal state. So far no information is available regarding the feasibility for oil palm cultivation in these islands, except in Gosaba, where a few palms were planted during 1990s. The details of the individual islands are given below:

**Sagar:** It is in the Ganges delta, lying in the continental shelf of Bay of Bengal, about 100 km south of Kolkata. The island is large with an area of 224.3 sq. km comprising of 28211.43 ha of land and lies between 21°36' to 21°56' North and 88°02' to 88° 11' East. It has 43 villages with a population of over 1,60,000. Although Sagar island is a part of Sundarbans Administration, it does not have any tiger habitation or mangrove forests or small river tributaries as is characteristic of the overall Sundarbans delta.

**Gosaba:** It is in Canning sub division of South 24 Parganas district of West Bengal, which is the last inhabited area adjacent to the deep forests of Sundarbans. During 1990s, oil palm was planted in this island and only 18 oil palm trees exist till date. The status of oil palm in this island has given vital leads regarding the feasibility of the crop under these conditions. Manmathanagar district seed farm (State Govt. farm) is situated at about 1.5 km away from the river.

**Sandeshkhali II:** It has an area of 197.27 sq. km comprising of 19,500 ha of land. It comprises of eight Gram Panchayats viz., Durgamandap, Korakati, Mouipar, Jeliakhali, Sandeshkhali, Khulna, Bermajur-I and Bermajur-II. The five islands in this block are Jeliakhali, Sandeshkhali, Dhaukhali, Khulna, Durgamandap and Dhamakhali. The Durgamandap, Korakati and Mouipar

islands possess a cultivated area of 4500 ha, which are very fertile. The area is surrounded by the river Vidyadhari. Irrigation source is mainly through shallow bore wells yielding about 1-1.5 inches of water. The fields are under submerged condition during July-December months and are dry during January to June.

Compared to South 24 Parganas islands, North 24 islands are progressive and prosperous. The basic infrastructural facilities like electricity and health are lacking in South 24 Parganas. In both the districts, farmers are enthusiastic and well versed with latest agro-techniques. The employment generation in these islands is very meager forcing them to migrate to towns and cities. The labour wages are almost uniform in all the islands and no gender discrimination is observed. Transportation is the main problem in these islands.

## Climate

The climate of the surveyed islands is humid-tropical. Days are bright with more than seven sunshine hours which are favourable for the growth of the crop. Temperatures are ranged between 28 and 44°C with higher temperatures during April to June. The relative humidity ranges between 70 and 80 % with less humidity (50-60 %) during summer. Rainfall starts from June-July and ends by September with occasional showers during March to May and October-November. The average rainfall in the North and South 24 Parganas islands is 1624 and 1876 mm respectively. Most of the rainfall occurs during June to September. The monthly rainfall distribution pattern in the two districts is given in Annexure IV.

## Land Use Pattern

The geographical area of the islands in both the districts is given in Annexure V. The total land area of islands in both the districts is 0.49 million ha (0.38 m ha in South 24 Parganas and 0.10 m ha in North 24 Parganas). Since the areas are under submerged conditions during the rainy season, paddy is the only crop grown during the Kharif. In the Rabi season, crops like pulses, oil seeds and vegetables are cultivated. In the recent years, farmers are taking up variety of crops like leafy vegetables, cole crops and potato as mixed crops under the nutritional security programme. Coupled with this, rearing of ducks, poultry and dairy systems is gaining importance which would help the farmers in getting additional income. Among palms, coconut, palmyra and wild dates are seen on the bunds of paddy fields. Some of the farmers are taking up horticultural and commercial crops like banana, guava, potatoes etc. due to newer irrigation sources. As the farmers are not getting enough income with the cultivation of traditional crops like paddy and due to incidence of diseases like false smut, if given an option, they may shift to new crops. This was observed when the team interacted with some of the farmers of these islands.

## Soils

The soils in the reported islands of both North and South 24 Parganas districts are predominantly alluvial with sandy clay loam to sandy loam texture. The depth of soil is more than 2 m. Soil samples were collected in all the surveyed islands and analyzed at ICAR-IIOPR, Pedavegi. The values of pH, electrical conductivity (EC) and organic carbon (OC) content of collected soil samples varied from 4.01 to 7.88, 0.16 to 1.32 dS m<sup>-1</sup> and 0.27 to 1.80 % respectively (Annexure VI, VII and VIII). The soils are acidic to alkaline in reaction and there is no marked variation of soil pH between surface and sub-surface soil layers. Low to moderate

salt content in the soils of these islands is mainly due to different levels of flooding by salt water. Soil organic carbon, available phosphorus and potassium contents are low to high. Several parts of the islands are submerged with salt water during high tidal conditions which leads to percolation of saline sea water into the ground and contaminate the ground water. Good quality ground water is available at 400 ft depth. The pH and EC of water samples collected from the tube wells and tanks of islands was varied from 7.64 to 7.72 and 0.90 to 1.15 dS m<sup>-1</sup> respectively (Annexure IX and X).

## Irrigation Sources

The sources for irrigation in the surveyed islands are rainwater, canals and bore wells. Only 10% of the total cropped area is under irrigation, which is being provided using water harvesting structures. The paddy crop is irrigated by means of rain water. Though underground water resources are available at less than 100 ft depth, it is not fit for irrigation due to salinity. Good quality water is available only at a depth of 400 ft. Hence most of the crops are being irrigated using tank water. The rain water harvesting tanks are the perennial source of irrigation for paddy and pisciculture. The economic conditions of the farmers are not conducive for digging bore wells, which is one of the main reasons for traditional paddy cultivation.

## Cropping Pattern

Paddy is the major crop, which is cultivated both during Kharif and Rabi seasons in all the islands using the available irrigation sources like rainwater harvesting tanks, canals and shallow tube wells. Other major crops that are grown are maize, sunflower, kesar and vegetables. In recent years, potato, banana and other fruits crops are also being cultivated but to a limited extent mainly as homestead cultivation. In all the areas, coconuts, wild dates and palmyra palms are seen on the bunds. Growth of coconut is moderately good even without adequate management. The palms on bunds are giving better yields compared to those existing in the fields. Banana and guava raised in North 24 Parganas district are giving better yields. The mixed cropping system and integrated farming systems (implemented by Department of Agriculture, Govt. of West Bengal) are yielding good results. The goatery, duckery, poultry and dairy are well adopted by farmers as part of integrated farming systems. The home-stead gardening practices with vegetables as inter/mixed crops in fruit crops are worth mentioning.

In Gosaba island, 18 oil palms (twenty year old) are existing nearer to the river shore. Apart from oil palms, palmyra (*Borassus* spp.) and wild date palms (*Phoenix* spp.) are also observed in this area with luxuriant growth. Coconut palms adjacent to oil palm are bearing nuts and not much affected by water logging. Many coconut palms exist in the Manmathanagar farm, which are in yielding stage (60-70 nuts/palm/year). The palms are affected by bud rot disease and rhinoceros beetle damage. Paddy, pulses and sunflower are the predominant crops grown in the region. During Kharif season, paddy is the main crop cultivated and during Rabi season, paddy, sunflower, moong dal and red chillies are being grown. The average net profit realized from these crops is Rs.20,000/ha.

In Sandeshkhali II island, during Kharif season, paddy is cultivated in 90 per cent of the total cropped area and pulses are grown in the remaining 10 per cent area. During Rabi season, 20-30 per cent of the area is under Boro paddy and rest of the area is cultivated with sunflower, mustard, sesame, moongdal, kesri dal. Coconut palms are planted on the bunds, and are

yielding about 80-90 nuts/year. The fields are under submerged conditions during July-December months and are dry during January – June.

### **Oil Palm in Gosaba Islands**

During 1990s, oil palms were planted in this island and at present, only 18 oil palm trees exist. The plants are under neglected condition with drying and yellowing of leaves. Most of these palms are submerged in one foot deep water for more than 6-8 months as they are close to the island. Few dead palms are also seen. Drying of older leaves, un-opening of leaves, more spindles, more male flowers, no fruit set, bunch failure and boron deficiency are the common characteristics observed in the palms. Water logging could be the main reason for drying and yellowing of leaves in all these palms. Emergence of male and female inflorescences was observed in these palms. Boron deficiency and rhinoceros beetle damage symptoms were also seen on these palms. Lack of pollinating weevils and water logging could be attributed as the main reasons for bunch failure. The growth of oil palm plants was poor due to water logged conditions and salinity.

### **Potentiality for Oil Palm Cultivation**

India is having nearly 1248 islands around its periphery. These areas are cultivated either with traditional /forest crops or left barren. Oil palm is being cultivated in an area of 1500 ha in Little Andamans of Andaman and Nicobar group of islands under island ecosystem of India. In Andhra Pradesh, the crop is being grown to a little extent in small areas of islands that are formed due to the passing of river Godavari in East Godavari district. The team had discussions with the farmers who are enthusiastic and interested to cultivate remunerative crops rather than traditional crops with less profits. They are also aware of the problems in raising perennial plantation crops.

The growth of oil palm in Gosaba island is an indication for the future performance of crop in these islands. The climatic conditions in these islands are not showing any extremity and are well within the tolerable limits required for successful oil palm cultivation. Based on the detailed examination of soil, water, climate, cropping pattern and socio economic conditions of the farmers of the islands, the team evaluated the prospects and constraints of oil palm cultivation in these islands and **Recommends the Feasibility for Oil Palm Cultivation in the Surveyed Islands, Subject to the Following Conditions:**

1. Oil palm is highly sensitive to water logging, hence adequate drainage should be implemented through sub-surface drainage channels (water logging in these areas is found to be for 6-8 months duration).
2. As oil palm cannot tolerate salinity conditions, ground water beyond 400 ft should be exploited for giving good quality irrigation to the crop.
3. Farmers should look into the water potentiality of their area and go for oil palm cultivation in a phased manner. Assured irrigation should be established before going for oil palm cultivation.
4. Soil conditions should be improved by applying copious amounts of sand for improving the drainage.

## Summary and Recommendations

The team, constituted by the Director, ICAR-Indian Institute of Oil Palm Research, Pedavegi has carried out the detailed survey of the islands located in North and South 24 Parganas districts of West Bengal State to find out the feasibility for oil palm cultivation. The team has examined the soil types, water sources, cropping systems, rainfall distribution pattern, ground water potential and socio-economic conditions of the farmers in these islands. Further, they have interviewed few farmers regarding the scope and prospects for oil palm cultivation in these areas. The members also held discussions with the villagers, officials of the Department of Agriculture, Govt. of West Bengal, Member of the Legislative Assembly from Sandeshkhali to get first hand information of these areas.

The team also examined the yield patterns of existing crops, cost benefit ratio of present cropping patterns, pests and diseases and compared with the proposed oil palm. The members came to know that the yield levels and benefit cost (B:C) ratios of the existing crops in the proposed islands are less and not remunerative. However, the growth of oil palm in Gosaba island is an indication for the future performance of crop in these islands. The climatic conditions in these islands are not showing any extremity and are well within the tolerable limits required for successful oil palm cultivation. Considering these aspects, the committee has got a clue for recommending the feasibility of oil palm cultivation in the proposed islands with conditions only.

Availability of copious amounts of water in the form of rainfall for more than six months followed by showers throughout the remaining months, availability of land and work force, availability of ground water resources, optimum temperatures and humidity suitable for crop are the strong points considered for recommending the feasibility of oil palm cultivation in these islands. Though some of the soils are clay loams and poor in drainage, the technology that has been developed and tested in other similar oil palm growing areas could definitely yield good results. Oil palm is highly sensitive to water logging, hence adequate drainage should be implemented through sub-surface drainage channels (water logging in these areas is found to be for 6-8 months duration). Oil palm cannot tolerate salinity. The ground water available within 400 ft is saline and unfit for irrigation. Hence ground water beyond 400 ft depth should be exploited for giving good quality irrigation to the crop. The team **Recommends the Feasibility of Oil Palm Cultivation in the Surveyed Islands Subject to the Conditions envisaged above**, in the larger interest of the farmers of these islands.



(Dr. K. Suresh)



(Dr. K. Ramachandrudu)



(Dr. S. K. Behera)



(Dr. P. Kalidas)

F. No. 3-3/2015 OP (SB)  
Government of India  
Ministry of Agriculture  
Department of Agriculture & Cooperation

Shastri Bhawan, New Delhi  
Dated the 08<sup>th</sup> June, 2015

To  
Dr. P. Kalidas,  
Director,  
Indian Institute of Oil Palm Research (IIOPR),  
Pedavegi, Andhra Pradesh.

**Sub: Prospects of cultivation of oil palm in the islands off East Coast under the 'Sagarmala' Project - reg.**

Sir,

Please refer to your e-mail dated 12.05.2015, wherein it has been informed that the islands off east coast of Odisha, Andhra Pradesh and Tamil Nadu are too small and not economical for oil palm plantation as the minimum area required for the establishment of one mill is 4000-5000 ha. As regards, cultivation of oil palm, possibilities may be explored in some of the islands of West Bengal viz; Sagar, Ajmalmari, Matla, Chotahardi, Chamta and Sunderbans.

2. You are also requested to kindly conduct a brief survey/study in consultation with Government of West Bengal and submit a report to this Department within one month to examine feasibility of oil palm cultivation in islands of West Bengal.

Yours faithfully,

  
(M.N. Sukumaran)  
Director (Oilseeds)  
Ph.011-23382021

Copy to:

- PrME*  
*for consultancy project*  
*9/6/15*
- S To*  
*9/6/15*
- (i) Principal Secretary (Agri.)/ Director of Agriculture, Government of West Bengal.
  - (ii) DDG (Horticulture), ICAR, Krishi Anusandhan Bhawan-II, Pusa, New Delhi.
  - (iii) Sh. A.K. Saran, Deputy Secretary, Ministry of Shipping, Transport Bhawan, New Delhi.
  - (iv) PPS to Agriculture Commissioner, DAC, Krishi Bhawan, New Delhi.
  - (v) PPS to Joint Secretary (Oilseeds), DAC, Krishi Bhawan, New Delhi.

**ICAR – INDIAN INSTITUTE OF OIL PALM RESEARCH**  
Pedavegi–534 450, West Godavari District, Andhra Pradesh  
Website: <http://dopr.gov.in>

F. No. PME/12(A-1)/2015(2)

Dated: 22-06-2015

**NOTE**

Director, IIOPR has constituted a committee with the following scientists to prepare a consultancy proposal for undertaking a survey and study the prospects of oil palm cultivation in the islands of West Bengal viz., Sagar, Ajmalmari, Matla, Chotahardi, Chamta and Sunderbans, in consultation with Govt. of West Bengal under 'Sagarmala' project. Letters received from DAC and Govt. of West Bengal are enclosed for reference.

Dr. P. Kalidas

Dr. K. Suresh

Dr. K. Ramachandrudu

Dr. S. K. Behera



(Dr. K. Suresh)

Principal Scientist &  
Scientist-in-Charge (PME Cell)

To

Dr. P. Kalidas, Director (Actg.), IIOPR, Pedavegi

Dr. K. Suresh, Principal Scientist, IIOPR, Pedavegi

Dr. K. Ramachandrudu, Principal Scientist, IIOPR, Pedavegi

Dr. S. K. Behera, Senior Scientist, IIOPR, Pedavegi



## List of Places Visited and Persons Contacted

### Places visited

- I. South 24 Parganas district
  1. Sagar island
  2. Gosaba
  3. Manmathanagar
  
- II. North 24 Parganas district
  1. Tushkhali
  2. Sandeshkhali

### Persons contacted

S. No.	Name of the officer	Designation
1.	Shri. B.K.Das	PC & Ex-Officio Addl. Director of Agriculture, West Bengal
2.	Shri. T.K.Das	Dy. Director of Agriculture (Oilseeds), HQ
3.	Dr. Abishek Chakraborty	SLB, SE, NRSC, ISRO, Hyderabad
4.	Shri. Swarup Choudhury	Asst. D.A. (HQ)
5.	Shri. Susanta Mondal	Asst. D.A. (S.M) Diamond Harbour Subdivision, Dt- South 24 Parganas
6.	Shri. Sagar Banerjee	Dy. Director of Agriculture (Admn.), South 24 Parganas
7.	Shri. Sudip Ganguly	Asst. Director of Agriculture (Oilseeds), HQ
8.	Shri. A.K. Shit	Asst. Director of Agriculture (Plant Protection), South 24 Parganas.
9.	Shri. Mihir Kr. Mondal	Asst. Director of Agriculture (HQ), North 24 Parganas.
10.	Shri. Dibyendu Choudhury	Asst. D.A. Gosaba, South 24 Parganas
11.	Shri. Dilip Momdal	Asst. D.A. (Farm), Manmathanagar Farm, South 24 Parganas
12.	Shri. Arup Das	Dy. Director of Agriculture (Admn.), Sandeshkhali- II Block, North 24 Parganas
13.	Shri. Manaranjan Kurmi	Asst. D.A. Sandeshkhali- II Block, North 24 Parganas
14.	Shri. Nirapada Sardar	Member of Legislative Assembly (MLA), Sandeshkhali, West Bengal
15.	Shri. Vivekanada Bag	Asst. D.A., Sagar block

Annexure IV

**Rainfall (mm) in North and South 24 Parganas districts of West Bengal**

District	January	February	March	April	May	June	July	August	September	October	November	December	Total
<b>North 24 Parganas</b>	8.6	36.4	40.9	65.3	144.3	287.8	333.7	303.6	265.7	95.3	28.1	13.9	<b>1623.6</b>
<b>South 24 Parganas</b>	10.8	24.4	31.2	52.8	122.7	309.7	386.9	409.3	340.2	135.0	42.4	10.9	<b>1876.3</b>

**Annexure V**

**Land Use Pattern in North and South 24 Parganas districts of West Bengal**

Name of the block	Soil type	Latitude	Longitude	Cropping Pattern	Geographical Area (ha)	Forest (ha)	Total cropped area (ha)	Cultivable waste (ha)
<b>Gosaba</b>	Alluvial	22°16' N	88°80' E	1. Rice-Rice-Fallow	29672.52	66.00	21870.28	266.24
				2. Rice-Fallow				
				3. Rice-Sunflower-Fallow				
<b>Sagar</b>	Alluvial	21°80' N	88°10' E	4. Rice-Maize- Fallow	28211.43	298.42	15524.25	0.00
				5. Rice-Fallow- Moong				
<b>Sandeshkhali II</b>	Alluvial	22°36' N	88°90' E	6. Rice-Khesari-Fallow 7. Rice-Vegetables	19500.00	-	-	-

## Soil Analysis Report of Sagar Island

S. No.	Parameter	I	II	III	IV	V
<b>I</b>	<b>Physico-chemical properties</b>					
a	pH	5.33	5.09	7.45	7.44	7.01
b	EC (dS/m)	0.16	0.20	0.50	0.18	0.16
c	Organic Carbon (%)	1.79	1.59	1.09	0.93	0.663
<b>II</b>	<b>Nutrient content</b>					
a	Available phosphorus (kg/ha)	23.0	24.0	155	23.7	119
b	Available potassium (kg/ha)	283	276	820	758	612

### Critical limits

1. pH- <6.5 acidic, 6.5-7.5 neutral, >7.5 alkaline
2. EC (dS/m) - <2.0 normal
3. Organic carbon (%) - <0.5 low, 0.5-0.75 medium, >0.75 high
4. Available phosphorus (kg/ha) - <22 low, 22-56 medium, >56 high
5. Available potassium (kg/ha) - <141 low, 141-336 medium, >336 high

### Remarks

1. **Sample I:** Acidic in pH, normal in EC, high in organic carbon, medium in available phosphorus and potassium
2. **Sample II:** Acidic in pH, normal in EC, high in organic carbon, medium in available phosphorus and potassium
3. **Sample III:** Neutral in pH, normal in EC, high in organic carbon, available phosphorus and potassium
4. **Sample IV:** Neutral in pH, normal in EC, medium in available phosphorus, high in organic carbon and potassium
5. **Sample V:** Neutral in pH, normal in EC, medium in organic carbon, high in available phosphorus and potassium

### Soil Analysis Report of Gosaba Island

S. No.	Parameter	I	II	III	IV	V	VI
<b>I</b>	<b>Physico-chemical properties</b>						
a	pH	4.93	5.55	6.1	4.7	5.64	5.72
b	EC (dS/m)	0.36	0.30	0.74	0.80	1.32	0.58
c	Organic Carbon (%)	1.33	0.82	0.55	1.40	1.40	1.21
<b>II</b>	<b>Nutrient content</b>						
a	Available phosphorus (Kg/ha)	63.6	55.8	33.9	87.2	34.9	82.6
b	Available potassium (Kg/ha)	350	387	577	527	628	448

#### Critical limits

1. pH- <6.5 acidic, 6.5-7.5 neutral, >7.5 alkaline
2. EC (dS/m) - <2.0 normal
3. Organic carbon(%) - <0.5 low, 0.5-0.75 medium, >0.75 high
4. Available phosphorus (kg/ha) - <22 low, 22-56 medium, >56 high
5. Available potassium (kg/ha) - <141 low, 141-336 medium, >336 high

#### Remarks

1. **Sample I:** Acidic in pH, normal in EC, high in organic carbon, high in available phosphorus and potassium
2. **Sample II:** Acidic in pH, normal in EC, high in organic carbon, medium in available phosphorus and high in available potassium
3. **Sample III:** Acidic in pH, normal in EC, medium in organic carbon, available phosphorus and high in available potassium
4. **Sample IV:** Acidic in pH, normal in EC, high in organic carbon, high in available phosphorus and available potassium
5. **Sample V:** Acidic in pH, normal in EC, high in organic carbon, medium in available phosphorus and high in available potassium
6. **Sample VI:** Acidic in pH, normal in EC, high in organic carbon, high in available phosphorus and available potassium

### Soil Analysis Report of Sandeshkhali II Island

S. No.	Parameter	I	II	III	IV	V	VI
<b>I</b>	<b>Physico-chemical properties</b>						
a	pH	7.88	6.91	5.59	6.11	7.02	6.78
b	EC (dS/m)	3.03	0.32	0.71	0.35	4.68	4.38
c	Organic Carbon (%)	0.23	0.51	0.62	0.51	0.86	1.29
<b>II</b>	<b>Nutrient content</b>						
a	Available phosphorus (Kg/ha)	47.1	36.5	85.5	37.1	47.8	51.0
b	Available potassium (Kg/ha)	628	325	636	349	983	992

#### Critical limits

1. pH- <6.5 acidic, 6.5-7.5 neutral, >7.5 alkaline
2. EC (dS/m) - <2.0 normal
3. Organic carbon(%) - <0.5 low, 0.5-0.75 medium, >0.75 high
4. Available phosphorus (Kg/ha) - <22 low, 22-56 medium, >56 high
5. Available potassium (Kg/ha) - <141 low, 141-336 medium, >336 high

#### Remarks

1. **Sample I:** Alkaline in pH, high in EC, low in organic carbon, medium in available phosphorus and high in potassium
2. **Sample II:** Neutral in pH, normal in EC, medium in organic carbon and available phosphorus and available potassium
3. **Sample III:** Acidic in pH, normal in EC, medium in organic carbon, high in available phosphorus and available potassium
4. **Sample IV:** Acidic in pH, normal in EC, medium in organic carbon and available phosphorus and high in available potassium
5. **Sample V:** Neutral in pH, high in EC, high in organic carbon, medium in available phosphorus and high in available potassium
6. **Sample VI:** Neutral in pH, high in EC, high in organic carbon, medium in available phosphorus and high in available potassium

### Water Analysis Report (Tube well) of Sagar Island

S. No.	Parameter	I	II	III
a	pH	7.64	7.67	7.66
b	EC (dS/m)	1.00	0.97	1.15

#### Critical limits

1. pH- <6.5 acidic, 6.5-7.5 neutral, >7.5 alkaline
2. EC (dS/m) - <0.7 low salinity hazard, 0.7 to 1.6 medium salinity hazard, 1.6 to 3.0 high salinity hazard, > 3.0 very high salinity hazard

#### Remarks

1. **Sample I:** Neutral in pH, medium salinity hazard
2. **Sample II:** Neutral in pH, medium salinity hazard
3. **Sample III:** Neutral in pH, medium salinity hazard

**Water Analysis Report (Tank water) of Sandeshkhali II Island**

S. No.	Parameter	I	II
a	pH	6.94	7.19
b	EC (dS/m)	7.97	7.23

**Critical limits**

1. pH- <6.5 acidic, 6.5-7.5 neutral, >7.5 alkaline
2. EC (dS/m) - <0.7 low salinity hazard, 0.7 to 1.6 medium salinity hazard, 1.6 to 3.0 high salinity hazard, > 3.0 very high salinity hazard

**Remarks**

1. **Sample I:** Neutral in pH, EC- very high salinity hazard.
2. **Sample II:** Alkaline in pH, EC- very high salinity hazard.

# Soils of Islands



*Gosaba*



*Sandeshkhali II*



*Gosaba*



*Sandeshkhali II*



*Wet lands of Gosaba*



*Sandeshkhali II*

# Glimpses of Sagar Island



*Eucalyptus trees on bunds*



*Horticulture crops on bunds*



*Integration of paddy with pisciculture*



*Paddy field*

# Oil Palm in Gosaba Island..



*Submerged oil palm*



*Crown of oil palm*



*Male and female inflorescences*



*Female inflorescence*



*Crown with inflorescences*



*Bunch failure*

# Oil Palm in Gosaba Island..



*Male and female inflorescences*



*Male inflorescence*



*Emerging male inflorescence*



*View of oil palm*



*Neglected conditions*



*Drying and yellowing of leaves*

# Coconut in Gosaba Island



*Coconut on raised bunds*



*Coconut on road side bunds*



*Coconut with oil palm*



*Nuts of coconut*

# Other crops in Gosaba Island



*Palmyra palm*



*Paddy with pisciculture*



*Wild Date Palm*



*Royal palm*

# Crops in Sandeshkhali II Island...



*Integrated cropping system*



*Just sown onion crop*



*Paddy*



*Smut disease infected paddy*



*Pisciculture*

# Crops in Sandeshkhali II Island...



*Banana and Arecanut*



*Arecaeae palms*



*Banana*



*Homestead forestry*



*Horticultural Crops*



*Integrated cropping system*

# Integrated Farming in Islands



*Duckery*



*Goatery*



*Dairy*



*Pisciculture*



*Poultry*

# Visit of Team Members to Islands



*Oil palms at Gosaba*



*Dhamakhali, North 24 Parganas*



*Smut disease in paddy*



*Paddy fields in Sandeshkhali II*



*Collection of soil samples using GPS coordinates*

# Interaction of Team Members with Officers and Farmers



*Discussion with the officers of Department of Agriculture, West Bengal*



*Interaction with farmers in Sandeshkhali II*



*Discussion with farmers of Gosaba island*



*Interaction with farmers in Tushkhali*





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