# RECENT PROGRESS
# IN
# JUTE CROP INFORMATION SYSTEM

Collaborative project
between

National Remote Sensing Centre
ISRO, Department of Space, Govt. of India
Balanagar, Hyderabad-500037

**And**

Jute Corporation of India Ltd
Kolkata, West Bengal- 700016

**And**

National Jute Board
Kolkata, West Bengal- 700016

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# EXECUTIVE SUMMERY

Jute ranks as the second most widely produced natural fiber globally, with an average annual production of 3 million tonnes. India leads in jute production and its related value-added products, contributing nearly 60% of the global output and providing employment to approximately 4.85 million families, workers, and traders. Jute is highly versatile, used in producing various goods such as textiles, ropes, nets, brushes, carpets, mats, mattresses, paper, and board materials. This makes the jute crop economically and ecologically significant, particularly for India and South Asia.

Jute crop typically cultivated between April and August, fits well between the *rabi* and *kharif* cropping seasons. However, the crop faces several climatic challenges, including frequent dry spells or droughts in the early stages and flood-related stress during maturity. Cyclonic storms from the Bay of Bengal often exacerbate these issues, causing lodging and water stagnation, which can damage the crop. As a vital cash crop for the rural economy, jute crop failures due to erratic monsoons, pests, or diseases can severely impact farmers, leading to socio-economic distress. To address these challenges, advanced techniques for jute crop monitoring and surveillance are essential. In response, the Indian Space Research Organization (ISRO), through its National Remote Sensing Centre (NRSC), collaborated with the Ministry of Textiles, the Jute Corporation of India Ltd. (JCIL), and the National Jute Board (NJB) to develop a jute crop information system based on space and ground data. A mobile app tailor made for jute was introduced for field data collection, with geo-tagged data hosted on the BHUVAN geo-portal for visualization and analysis. The system includes satellite-based jute crop mapping and smart sampling techniques using satellite yield proxies to determine Crop Cutting Experiment (CCE) locations through stratified random sampling. These CCE data, collected using standardized protocols, are used to model jute yields based on weather, soil, and satellite information, allowing for district-level yield estimates. The project envisions establishing a fully operational "Jute Crop Information System" (JCIS) for seamless integration into JCIL and NJB operations.

The present report discusses the recent progress of "Jute Crop Information System" in term of its initiation, approach, different modules and its operational readiness. It also discusses at length on the mobile app (BHUVAN JUMP) developed for jute crop monitoring and the PATSAN module for its web-based analytics towards jute surveillance in near-real time. The developing weather and satellite module are also discussed in term of real time ingestion of the weather and satellite data and their derived products. The satellite-based district-wise jute crop area estimation for the year 2023 and 2024 are also provided. The smart sampling-based Crop Cutting Experiments (CCEs) of jute across the growing districts during 2022-24 are also documented and further analyzed for jute variety wise yield performance. The district and national level jute production are provided based on satellite-based jute cropped area and CCE based jute dry fibre yield. At present, mobile app, PATSAN and weather module are fully functional. Other proposed modules will be augmented phase-wise. Advance machine leaning and modeling techniques are being implemented for jute production estimates.

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## 1. Introduction

Jute is the second largest among the natural fibre produced globally with an estimated average production of 3 million tonnes per year. India is the top producer of jute and its related value-added products, which is nearly 60% of the global production and generating employment to 4.85 million families, workers, traders. The jute fibre is very versatile and can be used to manufacture of a diverse array of products, including textiles, ropes, nets, brushes, carpets, mats, mattresses, as well as paper and board materials. Notably, governments in key countries like India, China, Brazil, and South Africa have actively championed the development and utilization of geotextiles. This promotion is anticipated to further drive demand in the upcoming decades, solidifying jute's pivotal role in various industries. Further, jute is a high biomass crop and has potential to be a strong carbon sink. The value-added products/ byproducts of jute fibre remain in the ecosystem for years before it is naturally degraded (Chander et al., 2002; Saha et al., 2012). Hence, jute crop plays an important role in capturing the atmosphere $CO_2$ as well as holding it in the ecosystem as fibre products for longer time. Thus, jute crop is economically and ecologically important particularly for India and south Asia as a whole.

Jute as a fibre crop typically grown between April – August month. Thus, it is well adjusted between the two dominating cropping seasons *i.e. rabi* and *kharif*. At the same time jute is exposed to frequent dry spells/drought in the early part of the crop season and followed by flood related stress in the later maturity stage. It is apt to mentioned here that cyclonic storms, originated from Bay of Bengal, are frequented during this time causing jute crop damage due to lodging and water stagnation. Jute crop being a cash crop for the rural economy, any failure of the crop due to vagaries of monsoon, pest/ disease results in eroding the resources of farmers resulting in socio-economic distress. Hence there is a need to develop techniques for mapping and surveillance of the jute crop using latest available technology. Geospatial technologies aid in the monitoring of this important crop and its spatial distribution that leads to efficient regional and local monitoring, especially during periods of surplus or deficit and also during periods of disasters or episodic events. In addition to inventory, transport of raw produce with various processing industries needs geo-tagging for efficient monitoring. Satellite remote sensing by virtue of its varied advantages, mainly the capability to provide an unbiased and synoptic view of the natural resources with better repeativity in a timely and cost effective manner has become one of the sought after techniques to provide thematic information for developmental planning on a sustainable basis.

Keeping this background in mind, Indian Space Research Organization (ISRO) through its technology center i.e. National Remote Sensing Centre (NRSC), along with and Ministry of Textile through The Jute Corporation of India Ltd. (JCIL) and National Jute Board (NJB) started a pilot level study in developing a monitoring system of jute crop based on space and ground information. Subsequently, a tailored-made mobile app for the jute crop has been designed and used for field data collection. These geo-tagged data were hosted in BHUVAN geo-portal for visualization and further analysis. A data analytics were conceptualize to use these ground based information to monitor and assess the progression of jute crop growth and development. Satellite based jute crop maps were also prepared over the jute growing districts. A smart sampling technique based on the satellite-based yield proxy was also implemented to provide locations of Crop Cutting Experiment (CCE) of jute following stratified random sampling. A systematic measurement of the jute biomass and fibre yield was done through CCE following the recommended protocol. These CCE data is being further utilized to model the jute yield based on weather, soil and satellite data to upscale it at district level. It is proposed to build a fully operational Jute Crop Information System towards seamless integration of it in the JCIL/NJB's operation.

## 2. Collaboration between NRSC, JCIL and NJB

A National Meet was organized dated $7^{th}$ September 2015 to facilitate interactions between scientists of ISRO and different ministries towards enhanced use of geospatial technologies for governance and local solutions. In this connection, a concept of fibre crop information system was floated after due consultations with Ministry of Textile and its attached bodies such as Jute Corporation of India Ltd, National Jute Board and Cotton Corporation of India Ltd etc. In this endeavor a mobile app-based surveillance of crops and geotagging of the assets were initiated since 2016. Beside mobile app-based data collections, satellite-based crop acreage and condition assessment was demonstrated. Considering the potential of the geospatial technology, Jute Corporation of India Ltd along with National Jute Board came forward for a formal MoU with NRSC to develop a full-fledged Jute Crop Information System. The MoU was signed on $29^{th}$ August 2023 at RRSC, Kolkata as shown in Fig. 1.

Fig 1: Formal signing of the MoU between NRSC and National Jute Board, Jute Corporations of India Ltd at RRSC- East, Kolkata dated $29^{th}$ August 2023.

## 3. Scope of work and objectives

This project can be considered as a digital agriculture initiatives for fibre crop like jute under Ministry of Textiles. It covers major jute growing districts over four states i.e. West Bengal, Assam, Bihar and Odisha. The project utilized the mobile technology for objective field data collection over the jute growing areas, assessment of in-season jute prospect based mobile data collected involving web analytics, satellite based jute crop mapping, conducting crop cutting experiments of jute using smart sampling techniques, and assessing jute yield by modeling approach. A dedicated portal for Jute Crop Information System is also proposed for operational use for the concerned departments.

## 4. Approach /Methodology:

A brief approach of the Jute Crop Information System is presented in Fig 2. Overall objective of the effort is to develop and deploy of a centralised Jute crop information system for monitoring and assessment of jute crop prospects and production in the country using ground and space-based observations.

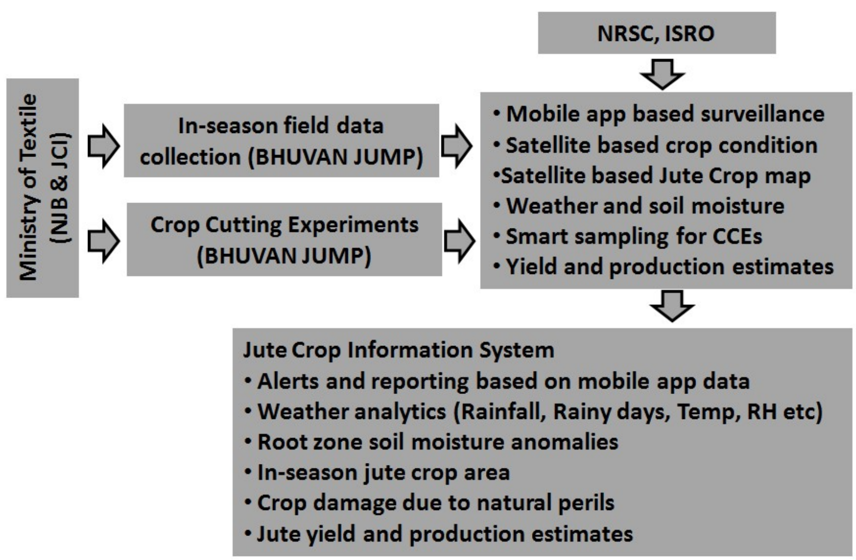



Fig. 2. Schematic diagram of the methodology for Jute crop information system.

The total field activities have been undertaken under the project Jute ICARE of National Jute Board and The Jute Corporation of India Ltd. It is a synergistic effort between Ministry of

Textile (JCIL/NJB) and National Remote Sensing Centre, ISRO, Hyderabad with defined role, responsibilities and deliverables as under;

**4.1 Role of Ministry of Textile (JCIL/NJB)**

- In-season collection of the ground truth information using the mobile apps via identified nodal agencies and focal points.
- Conduct Crop Cutting Experiments over the jute growing areas following the smart sampling scheme.
- Integration/utilization of the decision support system.
- Provide feed-back mechanism for further improvement of the information system

**4.2 Role of National Remote Sensing Centre (ISRO)**

- Ensuring mobile app based objective field data collection of jute crop and hosting it over BHUVAN geo-portal for visualization and reanalysis.
- Organizing awareness/training programme on the collection of field observations and CCE using mobile apps.
- Providing CCE locations using smart sampling technique
- Augmenting Crop Cutting module in the existing BHUVAN JUMP app
- Providing data analytics and automated reporting of jute crop prospect based on field data collected using mobile app.
- Modelling of crop biomass and yield estimate of jute crop
- Crop damage assessment due to climatic perils
- Development of Jute crop Information System towards informed decision making.

**4.3 Deliverables / Outputs**

- Mobile apps based total solution for field data collection, asset mapping and CCE of Jute.
- Geo-tagging of the offices / establishments / centers of Jute Corporation of India Ltd.
- Dedicated module for data hosting, visualization, downloading and analysis.
- Data analytics/automatic report generation of the jute crop based on information collected using BHUVAN JUMP mobile app.
- Weather and soil moisture information over the jute growing areas.
- Jute crop area map and yield estimation.
- Monthly/fortnightly reporting of Jute crop status based on the field and space based observations.

**5. Jute crop information system:**

It is a crop information system in a geo-portal to host, analyse and support the mobile based field observations, satellite and weather data-sets towards centralised monitoring and assessment of jute crop for informed decision making. A schematic diagram of the proposed information system is presented in Fig. 3

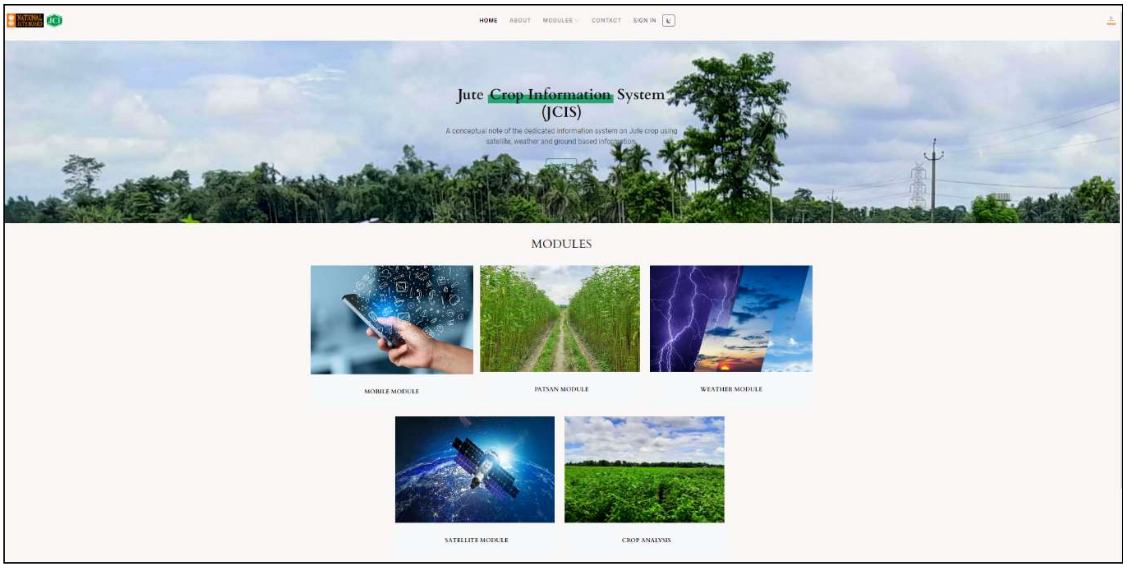



Fig. 3. Front-page of Jute Crop Information System (Beta version)

**5.1 Legacy data of the Jute crop**: All the historical data regarding the Jute crop and its production data can be kept in this module for consultation. Such data would be provided by JCIL and NJB for hosting it.

**5.2 Mobile app for Field Data Collection.**

An android-based GPS enabled mobile application (BHUVAN JUMP) was developed for the field data collection of Jute crop. The mobile app facilitates near-real time field data collection along with field photographs and geo-location of Jute crop. The data have been transferred to ISRO's geoportal (BHUVAN) for visualization, storage and further analysis. Presently, it is having crop surveillance and asset mapping module. Recently separate module on CCE data collection has been augmented. A schematic diagram of different module of BHUVAN JUMP is presented in Fig. 4


Fig. 4 Different module of BHUVAN JUMP Mobile app

The attributes of different module of BHUVAN JUMP mobile app were iteratively fixed based on several discussion with the JCIL officials and presented as below;

**5.2.1 Crop surveillance module:**

- Village name:
- *Soil type (Loam/Clayey/Red/ Black/Mixed)
- *Current week rainfall (Deficit/Excess/Normal)
- *Previous week rainfall (Deficit/Excess/Normal)
- *Crop types (Tossa (JRO)/White (JRC)/Mesta)
- *Presence of weed: (High/Medium/Low/None)
- *Sowing: (Broadcasting/Line sowing)
- *Sowing week:(1st week/2nd week/3rd week/4th week)
- *Sowing Month:(Jan/Feb/Mar/Apr/May/Jun/Jul/Aug/Sep/Oct/Nov/Dec)
- *Sowing Year: (2018/2019/..........2030)
- *Crop growth stages (sowing/early vegetative/late vegetative/maturity/others)
- *Crop health condition (Good/Average/Poor)
- *Crop stress: (Pest/Disease/Drought/Flood/No stress)
- *Height of the crop (feet): (0.5/1/1.5/2/2.5/3/3.5/4/4.5/5/6/7/8/9/10/11/12)
- Expected Total *fibre* yield (Qtls/bigha):
- Water source nearby for retting: (Pond/Ditches/river/others/none) :

- any other information:

 * Marked are mandatory; values in () are combo box options. All others are text
Dates are 6 digits DDMMYYYY format
Provide confirmation message to the surveyor

**5.2.2 Asset mapping module:**

1 *NAME OF THE DPC: 30 character/special character and numbers
2. *NAME OF PRSENT INCHARGE:  30 character/special character and numbers
3. *STATUS OF THE CENTRE: (RENTED / OWNED/ CO-OPERATIVE)
4. *BUILDING NUMBER: Both character/special character and numbers
5. *ROAD /STREET: Both character/special character and numbers
6. *POST OFFICE: Both character/special character and numbers
7. *CIVIC BODY: (PANCHAYAT/MUNICIPALITY/CORPORATION/OTHERS)
8. ASSESEE NUMBER: Both character/special character and numbers
9. *BLOCK / DISTRICT: Both character/special character and numbers
10. *STATE: 20 Characters
11. *PIN CODE: numbers
12. *PHONE NUMBER: numbers
13. *AREA (SQ FT): numbers
14. *RETTING TANK AVAILABILITY: (YES/NO)
15. *BOUNDARY WALL: (YES/NO)
16. LAND MARK: 50 character/special character and numbers
17a *NEAREST POLICE STATION: Both character/special character and numbers
17b *APPROXIMATE DISTANCE OF POLICE STATION (kms): numbers
18a. *NEAREST FIRE STATION: Both character/special character and numbers
18b *APPROXIMATE DISTANCE OF FIRESTATION STATION (kms): numbers
19a. NEAREST HOSPITAL: Both character/special character and numbers
19b *APPROXIMATE DISTANCE OF HOSPITAL (kms): numbers
20a. NEAREST WEIGHBRIDGE: Both character/special character and numbers
20b *APPROXIMATE DISTANCE OF THE WEIGH BRIDGE (kms): numbers
21a BANKING FACILITY: (YES/NO), IF YES
21b. Name of the BANK: 30 character/special character and numbers
21c. IFSC CODE of the bank: 20 character/special character and numbers
22. GODOWN STRUCTURE :( RCC / TIN/OTHERS)
23. GODOWN ROOF: (RCC/ TIN SHEETS/OTHERS)
24. GODOWN FLOOR: (CONCRETE / EARTHEN)
25. CAPACITY OF THE DPC (IN BALES):
26. ROAD CONDITION IN AND AROUND DPC:(PACCA/KACCHA/MORAM/OTHERS)
 * Marked are mandatory. Values in () are combo box options. All others are text
Provide confirmation message to the surveyor

### 5.2.3 Crop Cutting Experiment module:

Crop Cutting Experiment of Jute is the backbone of yield estimation. Hence it needs to be objective, bias-free, randomized covering all variations. Mobile app based CCE collection ensures high quality, geo-tagged, and analysis ready observations. Jute is a fibre producing crop. It is harvested before the flowering (July – August) to achieve maximum height, which is translated into maximum length of the fibre. The Crop Cutting experiment of jute is different from other field crops. It is tedious, time taking and follow three stages;

- ✓ **Stage 1:** Cutting of the fresh crop over the stipulated area (*i.e.* 10 $m^2$) of the field. Tied them into 10-15 bundles to get the fresh weight. Further, the bundles would be left in the field for shading of the leaves.
- ✓ **Stage 2:** Transportation of the bundles to the nearby water bodies and submerged it for 10-20 days for microbial processing (retting). Extract the fibre, wash it and keep it for sun drying.
- ✓ **Stage 3:** Take the weight of the sun-dried jute fibre and stick along with the quality of the fibre.

**Stage 1 attributes**

- CCE location ID: *The unique id provided by NRSC / JCI*
- Name of the farmer: Mention the name of the farmer
- Identity card of the farmer: Adhaar Card/ Voter Card/ PAN card/ Ration Card/ Driving License/ Passport/ Others/ Not applicable
- Farmers identity card no.: Provide if available otherwise not applicable
- Mobile no of the farmer: Provide if available otherwise not applicable
- Block : Mention the block name
- Village : Mention the village name
- Plot number or Dag number: Provide if available otherwise not applicable
- Jute type: Tossa/White/Mesta/Bimli/others (drop down)
- Jute seed: Certified/TL/Others
- Jute seed Variety: Select from drop down
- Date of sowing : Calendar (dd/mm/yyyy)
- Sowing method: Line sowing/Broad casting/others (drop down)
- Date of Harvesting: Calendar (dd/mm/yyyy)
- Plant age (in days): Mention the age of the crop during harvesting
- Water source for retting : Pond/Canal/Road side ditches/Artificial/ others/ none
- Soil type of the CCE plot: Loam/Sandy/Clayey/gravelly
- Crop abiotic stress : Drought/ Flood/ Wind/Hail/others/ None (radio button)
- Crop biotic stress: Insect/Pest/nematode/others/None
- Length of the CCE plot (m):
- Breadth of the CCE plot (m):
- Area of CCE ($m^2$) :
- Number of bundles obtained in 100 sq m:
- Approximate number of jute plants per bundle:
- Weight of the total fresh Biomass (Q):

**Stage 2 attributes**

- Date of starting of retting: Calendar (dd/mm/yyyy)
- Date of fibre extraction: Calendar (dd/mm/yyyy)
- Retting duration (days): Provide the duration of retting
- Retting accelerator used: CRIJAF SONA/NINFET/SUBHRA/OTHERS/ None

**Stage 3 attributes**

- Weight of the fibre obtained in 100 sq m (kg) :
- Moisture regain % of the dry fibre (%) :
- Weight of the dry stick obtained in 100 sq m (kg):
- Expected Grade of the lot (%) : Provide option to attribute all the grades
  - TDN1 (in %)
  - TDN2 (in %)
  - TDN3 (in %)
  - TDN4 (in %)
  - TDN5 (in %)

CCE location ID is utmost important. Take extra care need to be taken during entering the same. Date information is critical and follow the format (dd/mm/yyyy). If any information related to farmer is not available use dummy info. After filling up all the attributes either send it or save it for sent later option.

**5.3 Training and awareness for the BHUVAN JUMP mobile app**

Field data of jute crop have been collected by the Master Trainers (MTs) and monitored by the officials of Jute Corporation of India Ltd. Time to time training and awareness of the changes in the mobile app need to be updated. Hence, regular training programmes, both online and physical, have been conducted across the states for the MTs and Officials of JCI since 2016. Recently, four physical training programmes were conducted at Guwahati, Assam; Siliguri and Katwa, West Bengal; Jaspur, Odisha during June month of 2024 as shown in Fig. 5. Apart of training and awareness camps, standard operating procedures have also been developed for the field data collection and crop cutting experiment of jute (Fig. 6 & 7).


Fig. 5 Training cum awareness camps on mobile app-based jute crop surveillance and CCE during June 2024

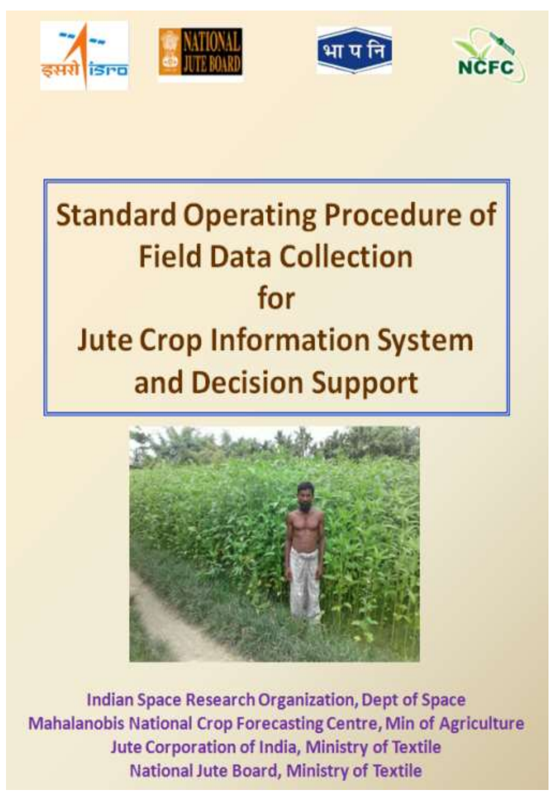



Fig. 6 Standard Operating Procedure of BHUVAN JUMP mobile app for field data collection

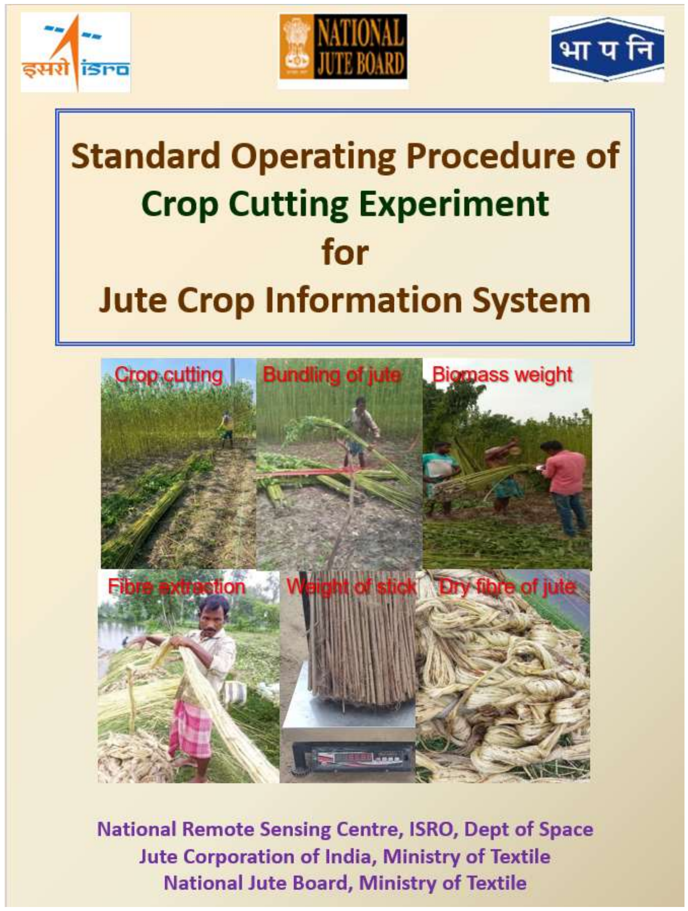



Fig.7 Standard Operating Procedure of BHUVAN JUMP mobile app for Crop Cutting Experiment

### 5.4 BHUVAN JUMP module: Collection of field data and asset mapping using mobile apps

The field staffs of JCI provided in-season field observation of the crop condition using the mobile apps, which were further hosted in BHUVAN geo-portal for analysis (https://bhuvan-app1.nrsc.gov.in/fdcviewer/fdcviewer.php). The participation and the enthusiasm of the ground staff of the JCI is really appreciable. The data collected in the last few crop seasons were presented in Fig. 8 mentioning the number of points and its spatial distribution. There has been steady increase in the number of field data collection over the years and current year registered 22647 data points till 31 August, 2024. BHUVAN JUMP asset mapping module was used to geotag all the assets of Jute Corporation of India with proper attributes as shown in Fig. 9.

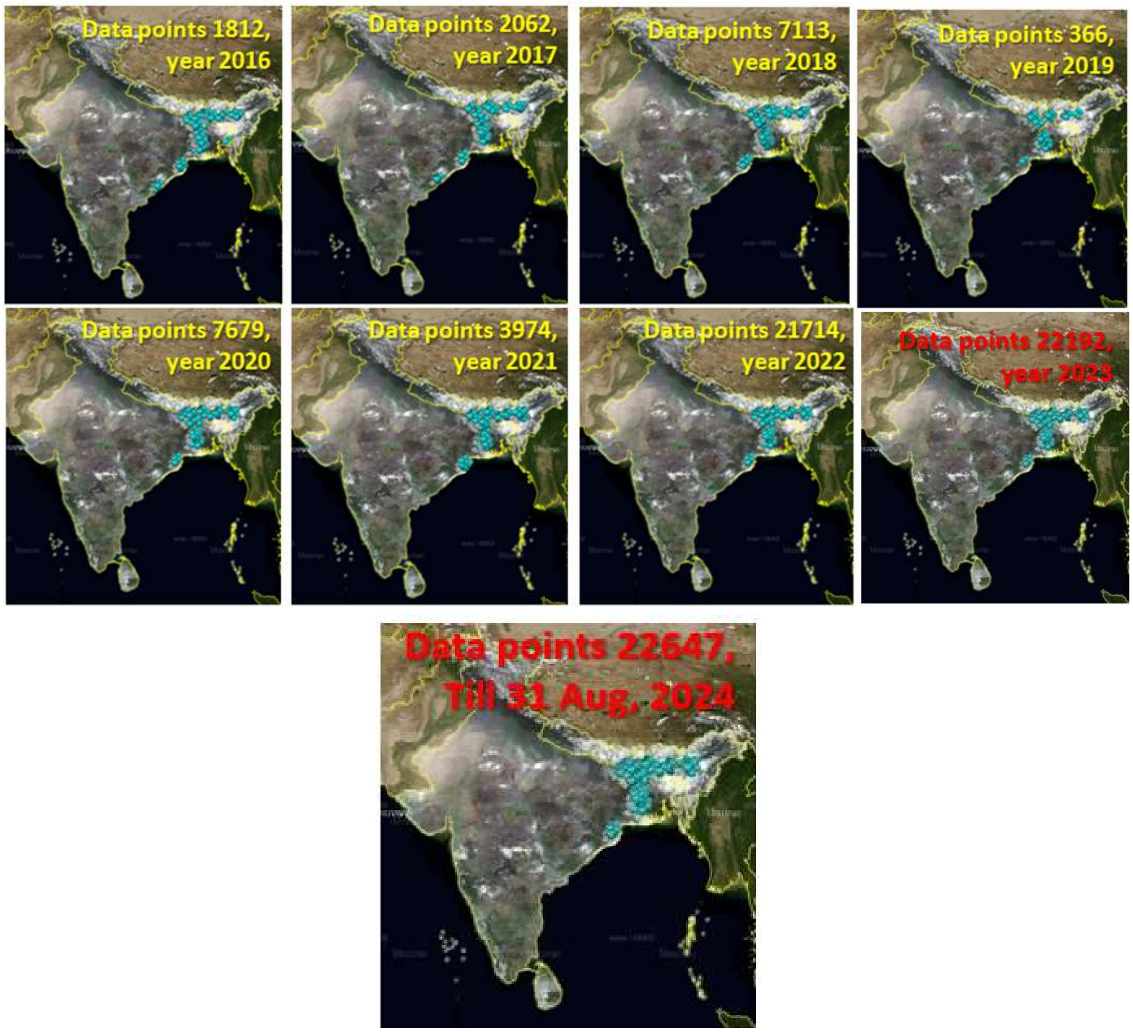



Fig. 8 Distribution of the field data points collected using the mobile app over the different jute crop growing states during crop season 2016-24.


Fig. 9 Geotagged assets of Jute Corporation of India Ltd.

### 5.5 PATSAN module: Automated report generation for in-season jute crop prospect based on field data collected using BHUVAN JUMP

Field data collected by JCIL has further been analysed to generate district level report at desired time interval automatically using PATSAN (**P**rospective **A**ssessment of ju**T**e u**S**ing mobile **A**pp based field **O**bservatio**N**s) interface. The front-end of the data analytic module PATSAN is shown in Fig 10. It ingests all the field attributes of BHUVAN JUMP crop surveillance module along with the geolocations. It requires selection of State, District, followed by the time of interest to view all the available field points. Further selection of attributes of interest need to done to generate a comprehensive report. A report can be generated by just simply clicking the preview button. It can further be downloaded in pdf format by print command.

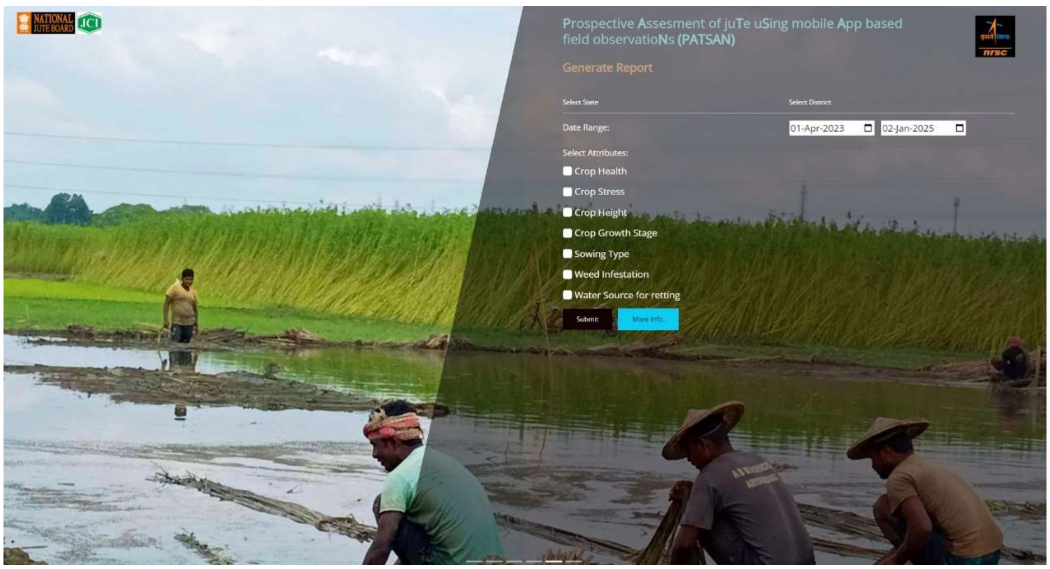



Fig. 10 Front-end of PATSAN, a data analytic module of crop surveillance of BHUVAN JUMP for automated report generation of jute prospect in near-real time.

Based on the selected time window and data attributes, it first subset the data and create a table showing a snapshot of the temporal progression of crop growth and condition. It tabulates fortnight-wise number of data points collected, percentage of data points under different categories of crop condition, crop stress, crop stage, sowing type, weed infestation and water resource for retting over a district. It also shows the fort-night wise changes of mean crop height along with its standard deviation over the district. It further depicts all the selected parameters in graphical format and also its spatial distribution in map format. As an example, a PATSAN report of Murshidabad district during April-July 2024 is presented.

Table 1 Fortnight wise different jute crop attributes collected using BHUVAN JUMP over Murshidabad district.

Prospective Assessment of JuTe uSing mobile App based field observatioNs (PATSAN)

A report on **MURSHIDABAD** District, **WEST BENGAL** for the period of **2024-04-01 to 2024-08-01**

| Attributes categories | April 1FN | April 2FN | May 1FN | May 2FN | June 1FN | June 2FN | July 1FN | July 2FN |
|---|---|---|---|---|---|---|---|---|
| **Total** | | | | | | | | |
| Total Count | 4 | 1 | 25 | 152 | 441 | 711 | 1291 | 1284 |
| **Crop Condition (%)** | | | | | | | | |
| Good | 0.0 | 100.0 | 72.0 | 51.97 | 44.44 | 41.35 | 59.41 | 50.08 |
| Average | 100.0 | 0.0 | 28.0 | 46.71 | 53.74 | 57.24 | 40.12 | 47.51 |
| Poor | 0.0 | 0.0 | 0.0 | 1.32 | 1.81 | 1.41 | 0.46 | 2.41 |
| **Crop Stress (%)** | | | | | | | | |
| No Stress | 100.0 | 0.0 | 40.0 | 25.0 | 12.47 | 12.8 | 30.75 | 20.95 |
| Pest | 0.0 | 0.0 | 0.0 | 44.08 | 65.08 | 54.71 | 44.77 | 44.94 |
| Disease | 0.0 | 0.0 | 0.0 | 1.97 | 5.67 | 5.2 | 4.96 | 5.37 |
| Pest, Disease | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Drought | 0.0 | 0.0 | 4.0 | 0.0 | 1.13 | 4.92 | 1.55 | 0.78 |
| Flood | 0.0 | 0.0 | 0.0 | 0.66 | 0.0 | 0.0 | 0.08 | 0.08 |
| Pest, Disease, Drought | 0.0 | 100.0 | 56.0 | 26.32 | 13.83 | 15.19 | 16.19 | 23.29 |
| Pest, Disease, Flood | 0.0 | 0.0 | 0.0 | 0.0 | 0.23 | 0.0 | 0.23 | 0.16 |
| **Crop Height (in ft)** | | | | | | | | |
| Average Height | 0.5 (± 0.0) | 1.0 (± 0.0) | 0.7 (± 0.35) | 2.22 (± 0.87) | 4.0 (± 1.21) | 5.51 (± 1.34) | 7.86 (± 1.7) | 8.96 (± 1.88) |
| **Crop Stage (%)** | | | | | | | | |
| Sowing | 0.0 | 0.0 | 0.0 | 3.95 | 0.0 | 0.0 | 0.0 | 0.23 |
| Early Vegetative | 100.0 | 100.0 | 100.0 | 96.05 | 69.61 | 54.99 | 54.69 | 41.59 |
| Late Vegetative | 0.0 | 0.0 | 0.0 | 0.0 | 30.39 | 45.01 | 44.23 | 36.84 |
| Maturity | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.08 | 21.34 |
| Others | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Sowing Type (%)** | | | | | | | | |
| Broadcasting | 100.0 | 100.0 | 84.0 | 91.45 | 95.69 | 96.62 | 97.29 | 98.83 |
| Line sowing | 0.0 | 0.0 | 16.0 | 8.55 | 4.31 | 3.38 | 2.71 | 1.17 |
| **Weed Infestation (%)** | | | | | | | | |
| High | 0.0 | 0.0 | 12.0 | 11.84 | 9.07 | 11.11 | 20.53 | 18.07 |
| Medium | 0.0 | 100.0 | 80.0 | 42.11 | 53.29 | 57.1 | 55.31 | 62.15 |
| Low | 100.0 | 0.0 | 8.0 | 30.92 | 17.91 | 15.61 | 12.63 | 10.36 |
| None | 0.0 | 0.0 | 0.0 | 15.13 | 19.73 | 16.17 | 11.54 | 9.42 |
| **Water source for retting (%)** | | | | | | | | |
| Pond | 25.0 | 100.0 | 96.0 | 86.18 | 81.63 | 86.36 | 78.78 | 84.5 |
| River | 0.0 | 0.0 | 4.0 | 5.92 | 6.35 | 6.47 | 11.39 | 2.73 |
| Ditches | 75.0 | 0.0 | 0.0 | 7.89 | 11.79 | 6.89 | 9.45 | 11.06 |
| None | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.14 | 0.0 | 0.0 |
| Others | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Table 1 depicts fortnight-wise different jute crop attributes over Murshidabad district during April-July, 2024. The first row provides you the number of data points collected in each fortnight over Murshidabad district. It further provides percentage of observations into different crop condition categories (good, average and poor) across the fortnight. The same observations were depicted in Fig. 11 and its spatial distribution is provided in Fig. 12. It may be observed that in the initial months of the jute season majority of observations were falling under "good" condition category. But as the season progressed, crop condition under "good" category came down and replaced by "average" categories. At the end of the season, we found that only 50% of the observation showed "good" crop condition. The Fig. 12 can provide you the exactly in which place "average" and "poor" crop conditions are recorded and its consistency over the fortnight. This observation only provides you the crop condition based on field assessment but not the cause of it. It may be found in the attribute of crop stress factor of the jute. The mobile app provides radio button, with multiple selection options, for the crop stress factor such as no stress, Flood, drought, pest, disease etc. Based on the field data the percentage of observations in each category / combination are provided in the Table 1. The graphical representation of the same is provided in Fig. 13 and the spatial distribution of it is also presented in Fig. 14. It is observed that the drought condition along with pest and disease was the principal stress factor for the crop. Later on, pest alone become the dominating stress factor in the later part of the crop season. It is apt to mention here that the field data are not collected by subject matter specialist, hence specific pest of disease could not be identified and recorded. The information is generic and can act as a triggering factor for broad level agro-advisory and alert system. More over the spatial distribution of the crop stress is also recorded (Fig. 14) using the geolocation and hence tailor-made intervention can also be possible for such situation. Moreover, the stage of the jute crop is also captured during the field data collection. The fortnight wise percentage of observation of jute crop stage in term of sowing, early vegetative, late vegetative and maturity are provided in the Table 1. The graphical representation of the same is presented in Fig. 15 and its spatial distribution in Fig. 16. It is observed that as per the latest data by July second fortnight majority of the observations are under late vegetative or maturity stage. Significant observations are also found in early vegetative stage also indicating the late sowing of the crop. Such information on the stage of the crop helps us to assess the probable harvesting time of the crop and also supports to assess the effect of the crop stress and its probable solutions.

The field data also provides the information on the type of jute sowing *i.e.* broadcasting or line sowing. Fortnight wise percentage of observations under broadcasting and line sowing are presented in Table 1. The overall percentage of observations under the two categories is presented in pie diagram in Fig. 17 and its spatial distribution in Fig. 18. As per the field data nearly 98% of the observations show broadcasting in Murshidabad. It is an established fact that line sowing is a better practice of jute crop cultivation, which fetch more yield and facilitate intercultural operations. Such observation can help as a success indicator of technology adaptation facilitated by iCARE project.

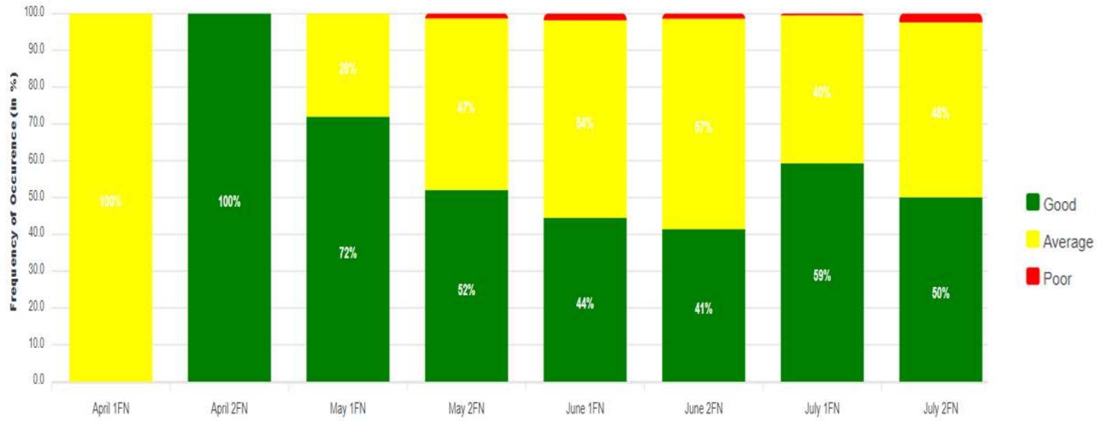



Fig. 11 Fortnight wise jute crop condition as per field observations using BHUVAN JUMP over a Murshidabad district during April-July 2024.

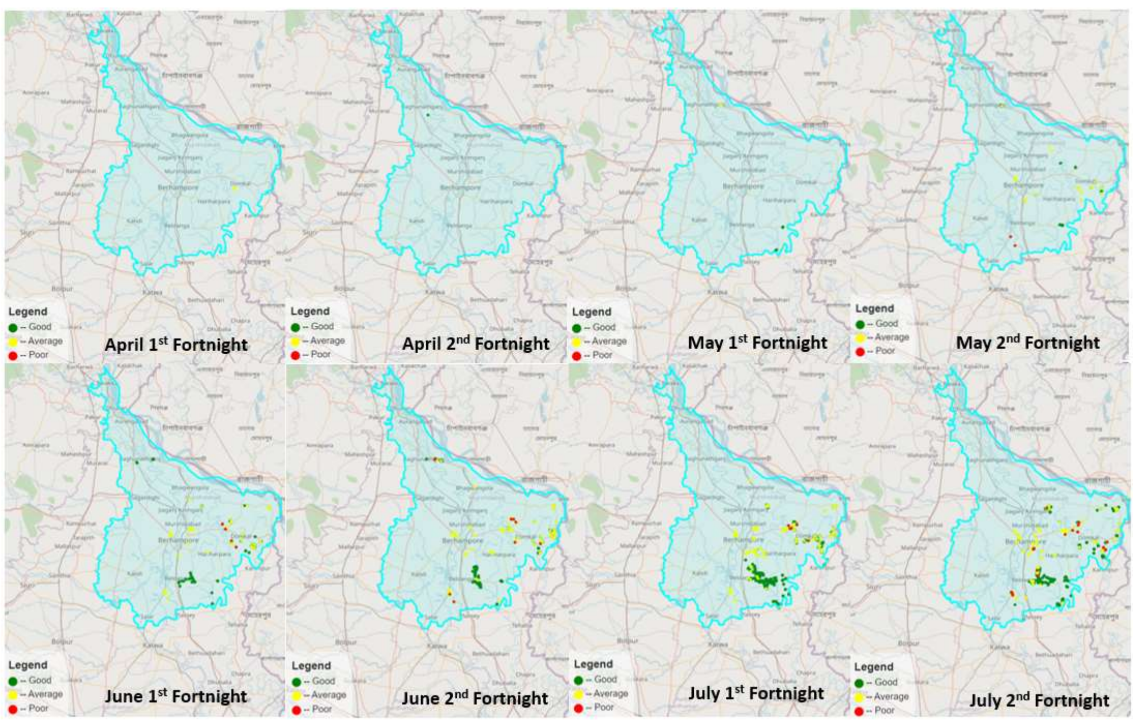



Fig. 12 Fortnight wise spatial distribution of jute crop condition as per field observations using BHUVAN JUMP over a Murshidabad district during April-July 2024.

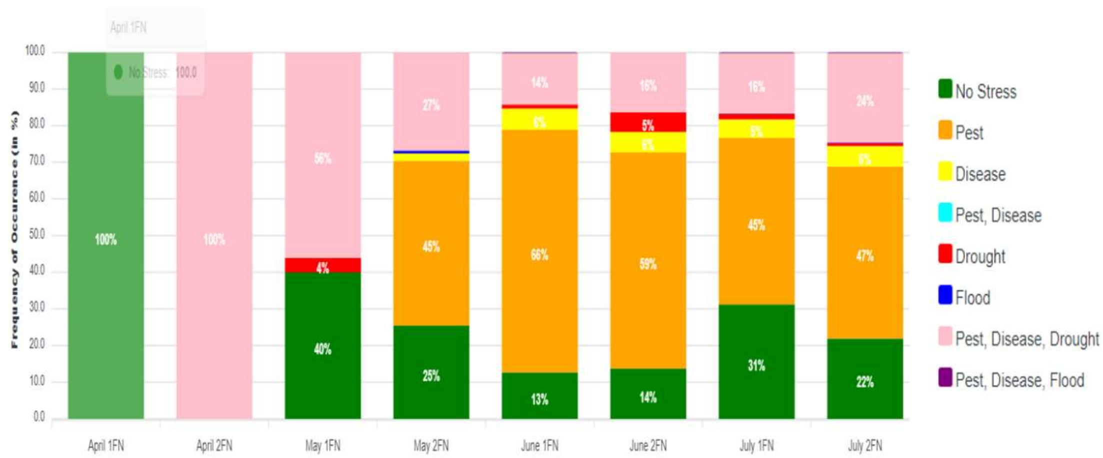



Fig. 13 Fortnight wise jute crop stress as per field observations using BHUVAN JUMP over a Murshidabad district during April-July 2024

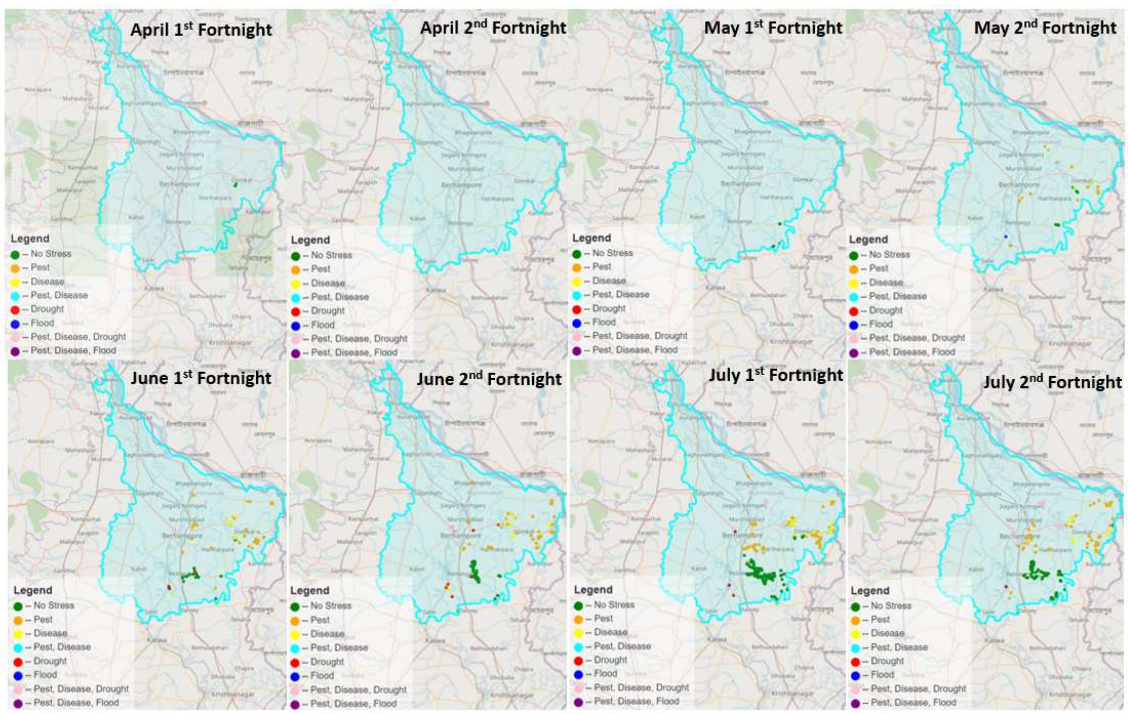



Fig. 14 Fortnight wise spatial distribution of jute crop stress as per field observations using BHUVAN JUMP over a Murshidabad district during April-July 2024

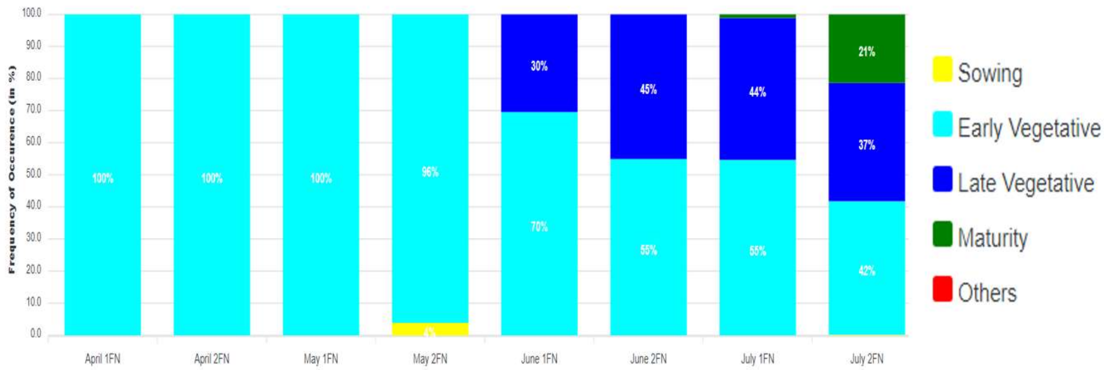



Fig. 15 Fortnight wise jute crop stages as per field observations using BHUVAN JUMP over a Murshidabad district during April-July 2024

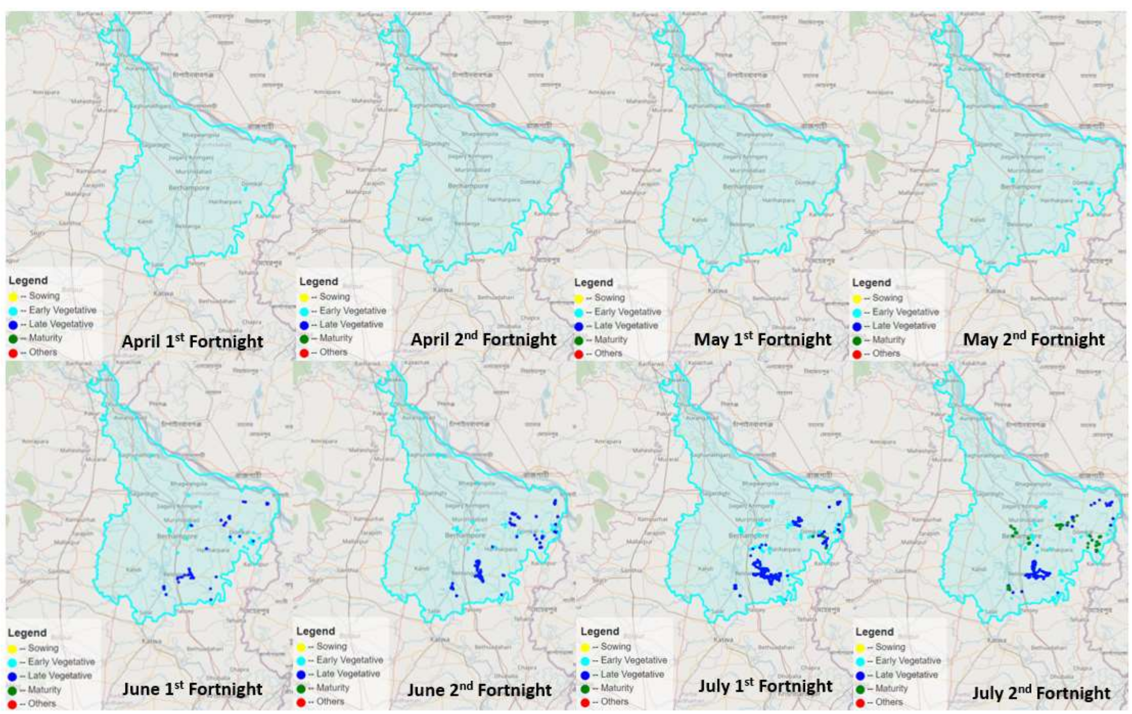



Fig. 16 Fortnight wise jute crop stages as per field observations using BHUVAN JUMP over a Murshidabad district during April-July 2024

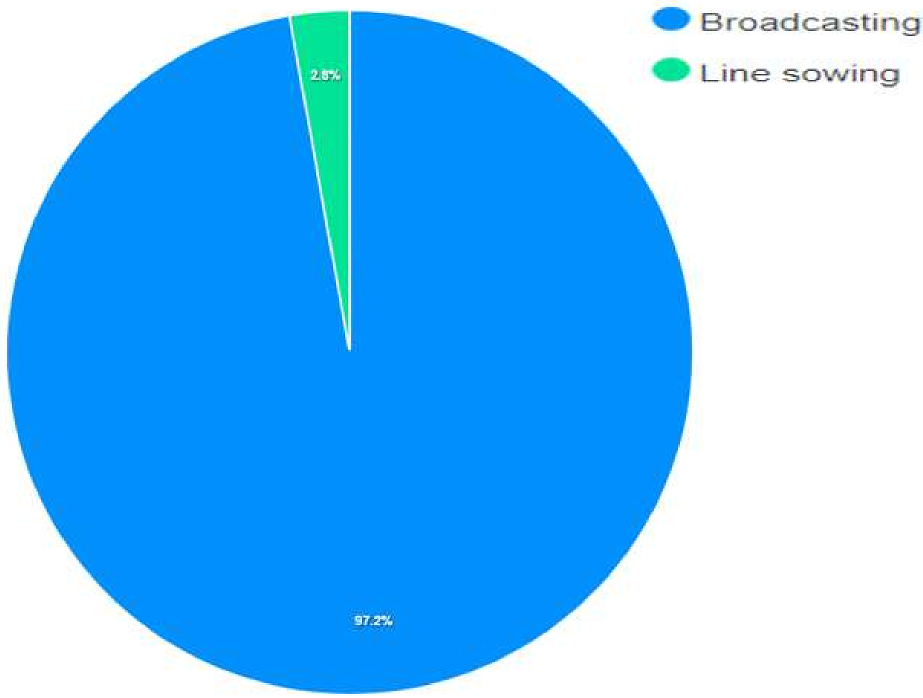



Fig. 17 Different sowing type of jute crop practiced over Murshidabad district during April-July 2024 as per field observations using BHUVAN JUMP

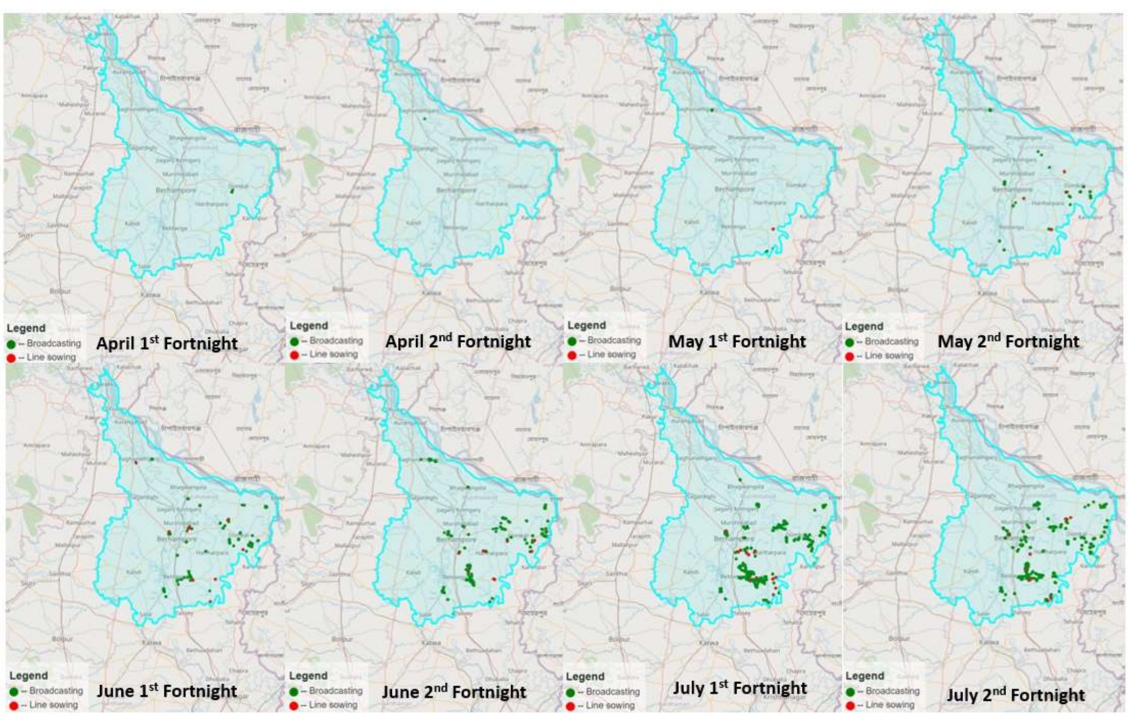



Fig. 18 Spatial distribution of different sowing type of jute crop practiced over Murshidabad district during April-July 2024 as per field observations using BHUVAN JUMP

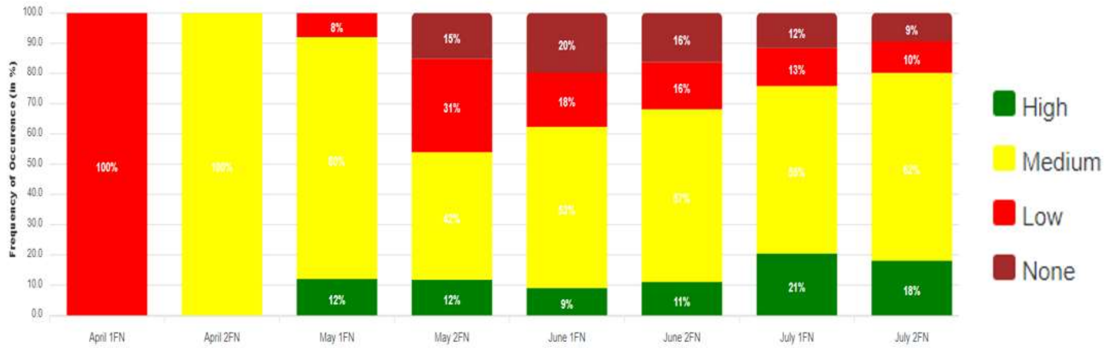



Fig. 19 Fortnight wise weed infestation in jute field as per field observations using BHUVAN JUMP over a Murshidabad district during April-July 2024

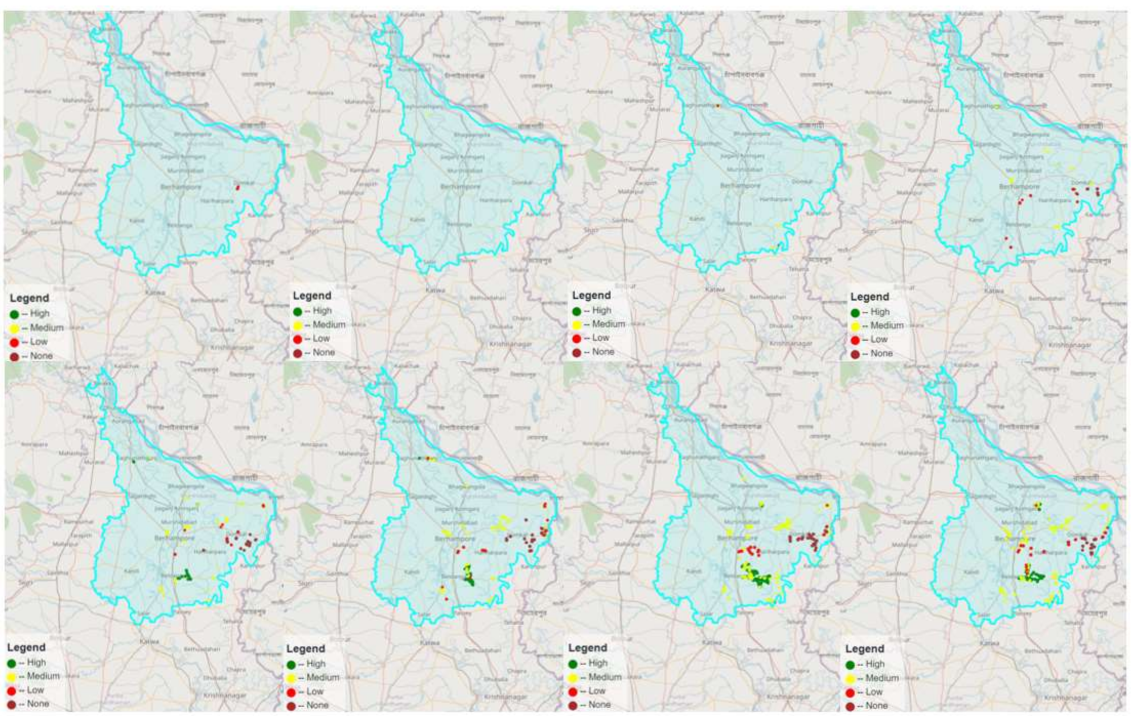



Fig. 20 Spatial distribution of fort-night wise weed infestation in jute field as per field observations using BHUVAN JUMP over a Murshidabad district during April-July 2024

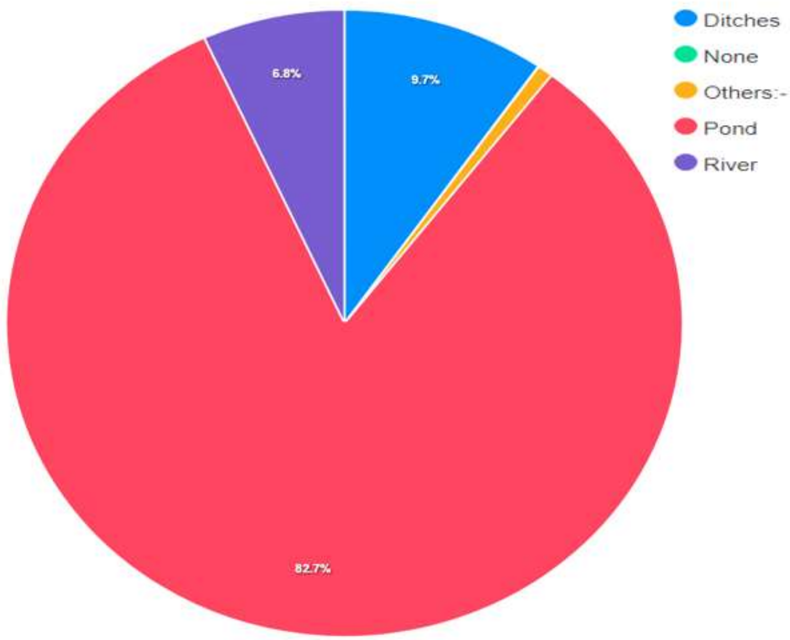



Fig. 21 Different type water source nearby for jute retting over Murshidabad district as per field observations using BHUVAN JUMP during April-July 2024

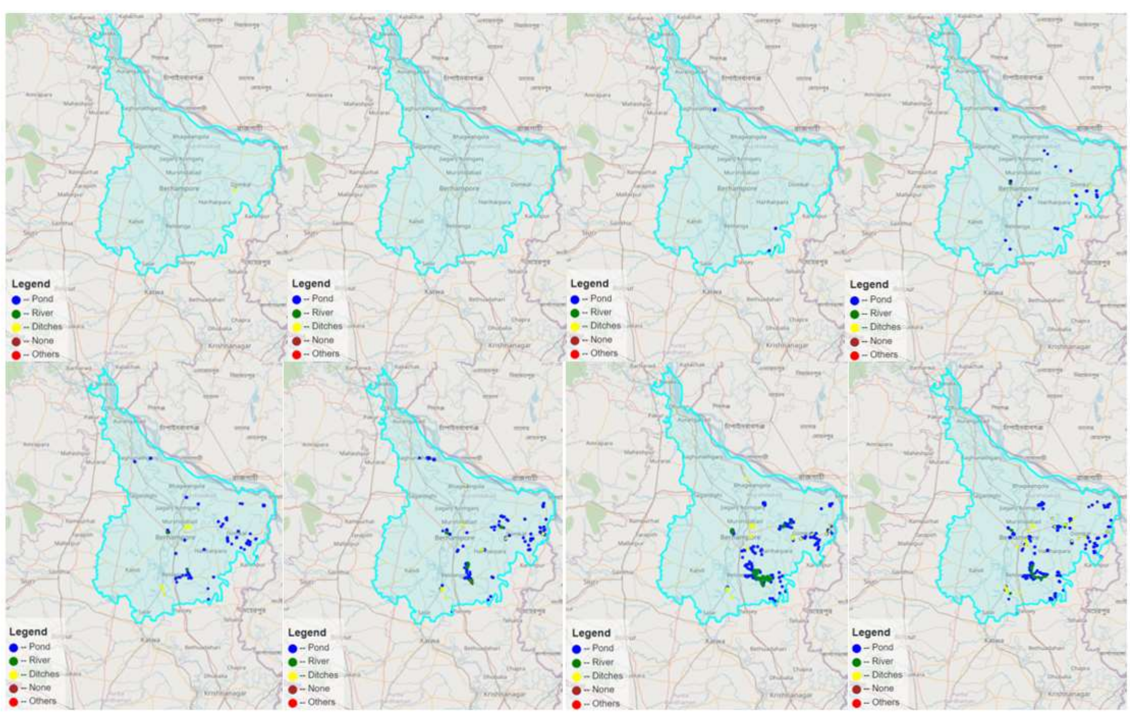


Fig. 22 Spatial distribution of different type water source nearby for jute retting over Murshidabad district as per field observations using BHUVAN JUMP during April-July 2024

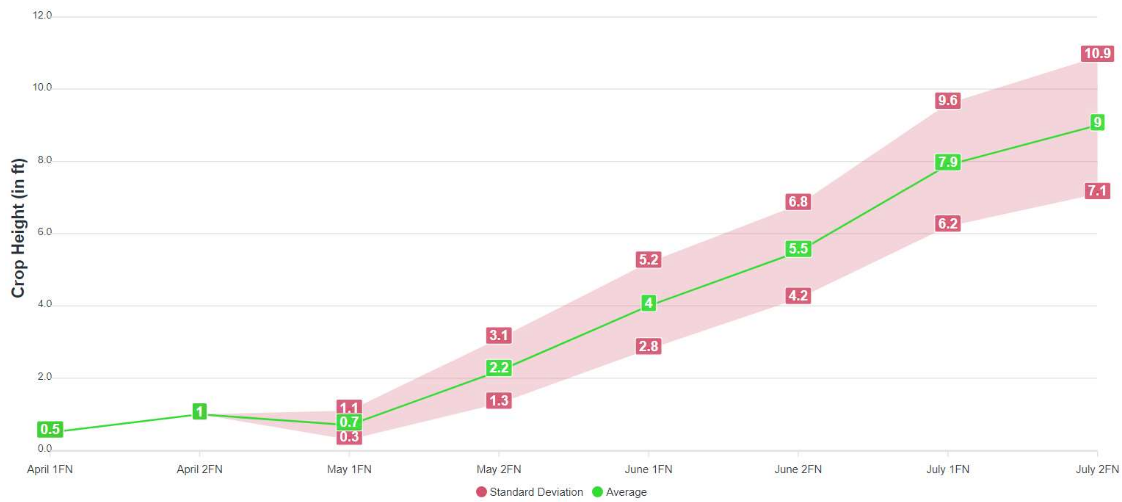



Fig. 23 Fortnight wise jute crop height (in feet) as per field observations using BHUVAN JUMP over a Murshidabad district during April-July 2024.

Weed infestation is one of the important indicators of good management practices and also related to fibre yield and quality. Presence of weed is also captured by the BHUVAN JUMP data and different categories of it is presented in Table 1. The fortnight-wise dynamics of different categories of weed infestation is presented in Fig. 19 and its spatial distribution in Fig. 20. It is observed that the weed presence was none to low in the initial period of the crop season. It was found to increase as the season progressed. At maturity medium category of weed presence dominated. The quality of jute fibre depends on the retting process. The water resource available for retting plays a vital role in determining the quality of the fibre. The BHUVAN jump also captures the available water sources nearby for the jute field and same are tabulated in Table 1. The pie diagram of the water sources is presented in Fig. 21 and its spatial distribution in Fig. 22. It showed that major water sources for retting for Murshidabad district is pond (82.7%), followed by ditches (9.7%) and river (6.8%). The spatial distribution of the water sources can be vital input for further digging of farm ponds or other rural infrastructures for jute retting. Finally, the height of the jute crop, which is a yield proxy, was captured by the mobile app and fortnight wise mean height the jute crop along with its standard deviation is presented in Fig. 23. It shows the growth profile of jute crop and can also be compared with the year-to-year variations.

**5.6 Weather module:**

This module primarily involves in the analysis of spatio-temporal distribution of rainfall, number of dry days and wet days, temperature maximum and minimum, hot extremes etc. IMD grided rainfall and temperature data will be utilized in this respect. This module is under construction and will provide the weather condition and its dynamics over the jute growing areas of India. The frontend of the weather module is prepared as depicted in Fig. 24.

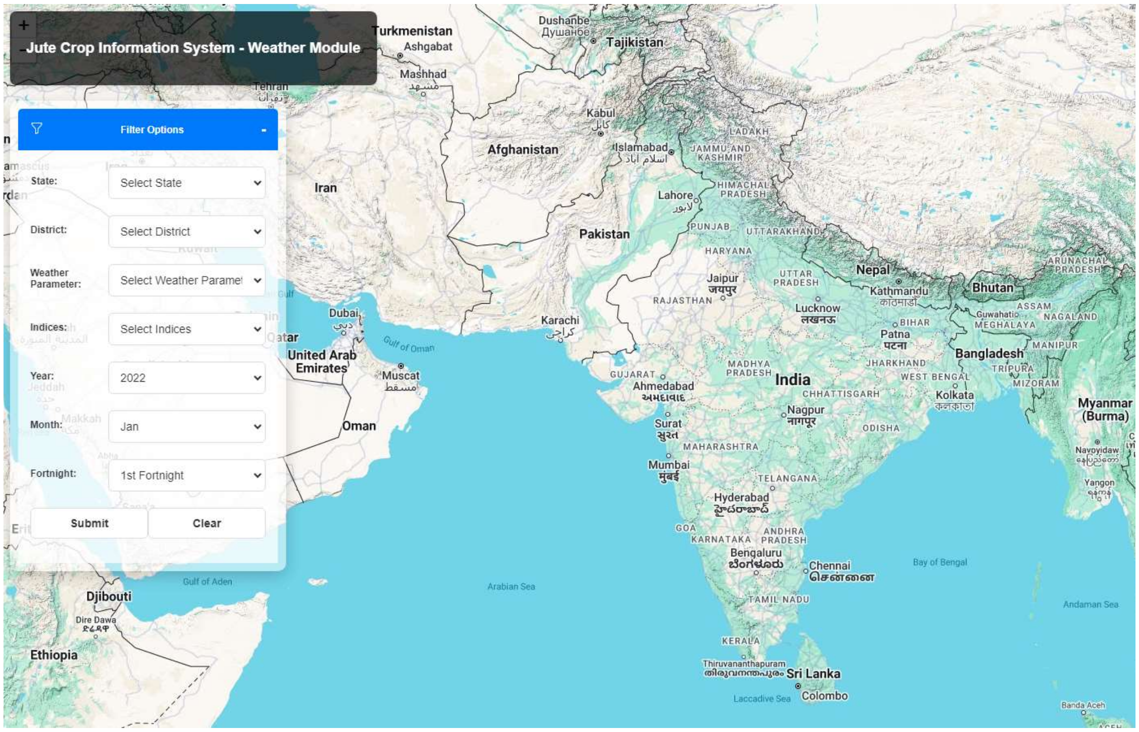



Fig. 24 Front-end of the weather module of Jute Crop Information system

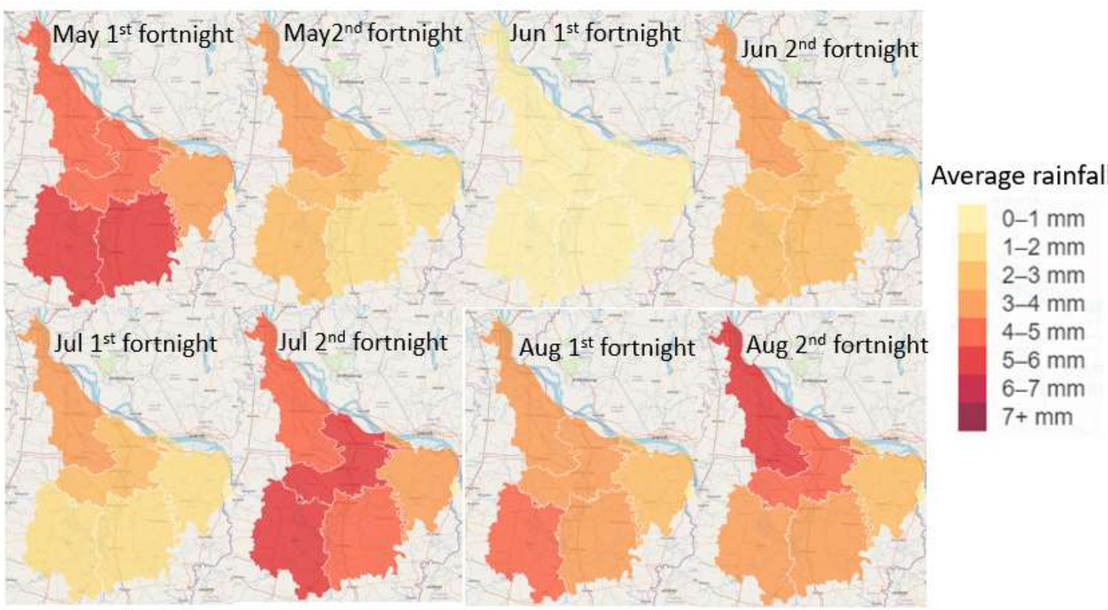



Fig. 25 Fortnightly average rainfall over Murshidabad district, West Bengal

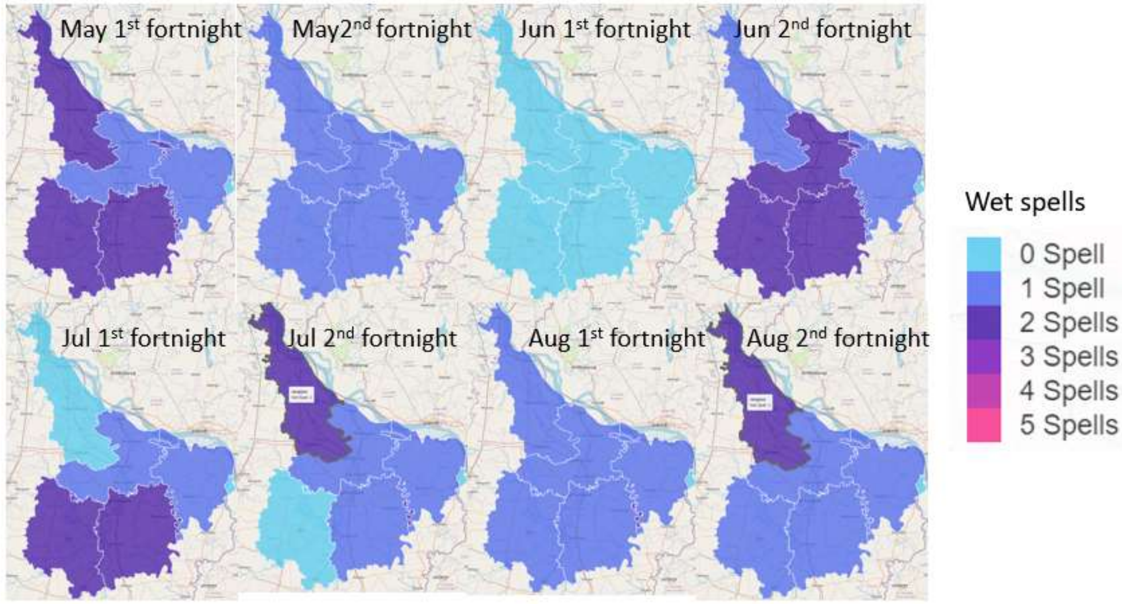



Fig. 26 Fortnightly wet spells over Murshidabad district, West Bengal

Based on the drop-down menu of the weather module, we can plot the district wise rainfall and temperature variations, wet spells, weather extremes etc. As an example, fortnightly average rainfall of Murshidabad district of the year 2022 is shown in Fig 25. The wet spell variation of the area is shown in Fig. 26.

**5.7 Satellite module:**

This module is under development and will primarily be involved in monitoring the satellite-based crop heath assessment using different vegetation indices such as Normalized Difference Vegetation Index (NDVI), Land Surface Water Index (LSWI), VH back scatter of SAR and its temporal profiles. It will also incorporate satellite based Fractional Absorbed photosynthetically Active Radiation, (FAPAR), False Colour Composites (FCC) and Ensembled root zone soil moisture condition. It can act as an early indicator of moisture/flood stress. As an example, fortnightly NDVI, LSWI and VH backscatter images over Murshidabad district is presented in Fig 27-29.

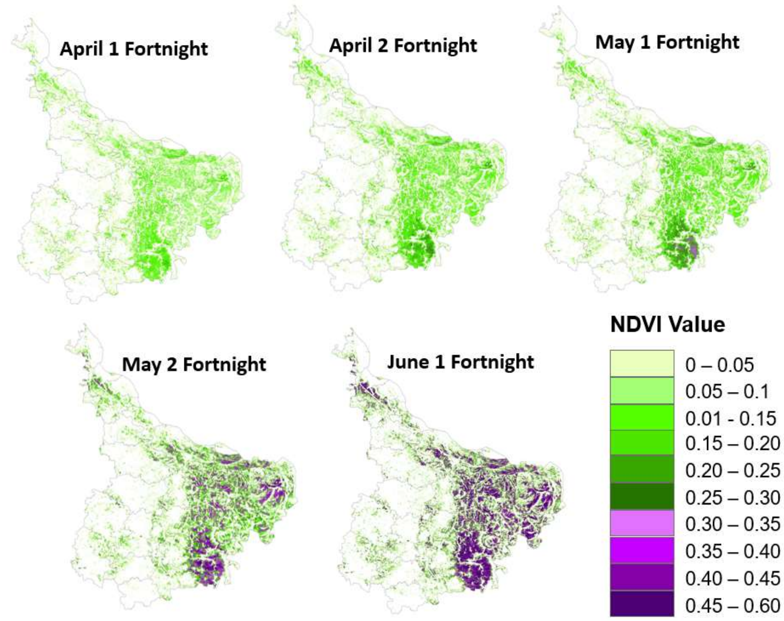



Fig. 27 Fortnight wise variations of satellite based NDVI over jute growing areas of Murshidabad districts, West Bengal during 2024.

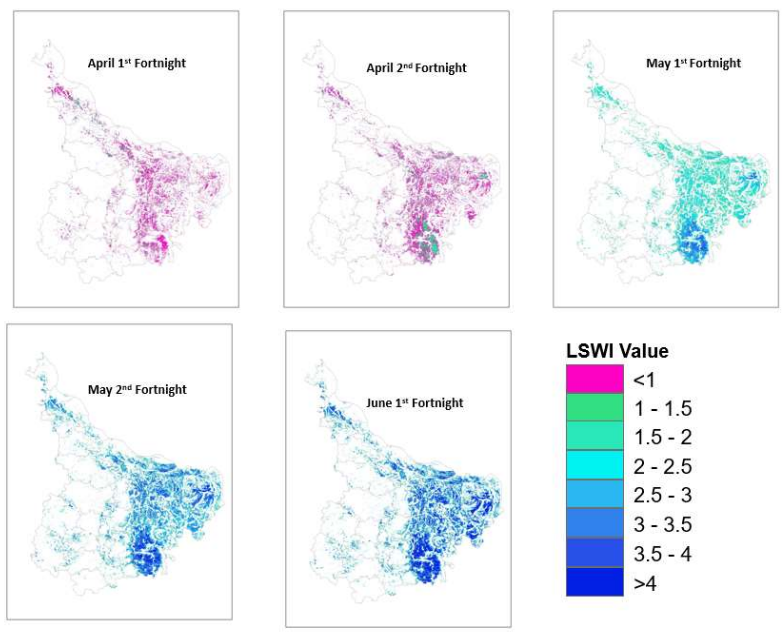



Fig. 28 Fortnight wise variations of satellite based LSWI over jute growing areas of Murshidabad districts, West Bengal during 2024.

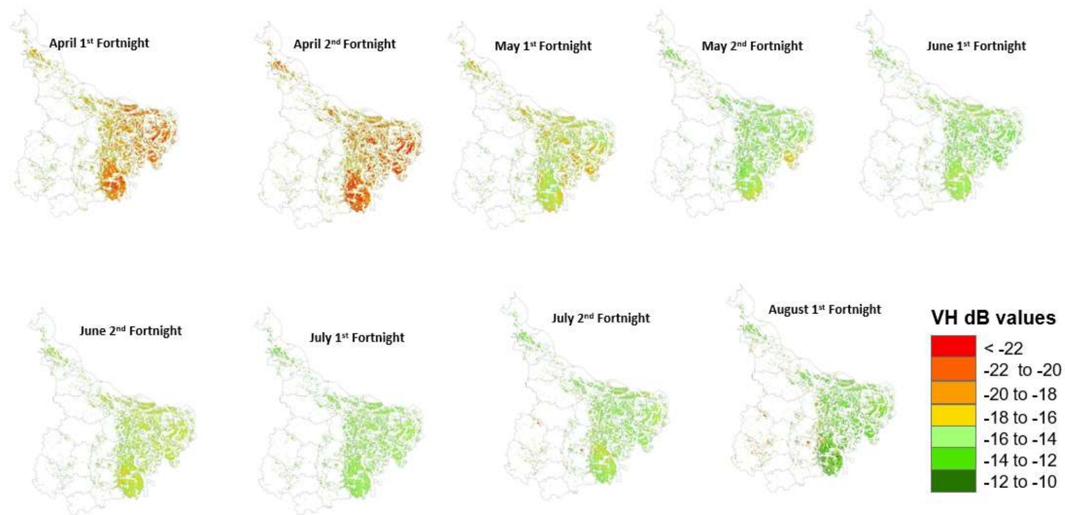



Fig. 29 Fortnight wise variations of satellite based VH backscattrer over jute growing areas of Murshidabad districts, West Bengal during 2024.

Satellite based drought, flood and cyclone damaged areas will also be incorporated in this module. Satellite data have extensively used to assess the crop affected due to weather extremes particularly for the damage of flood and cyclone. Synthetic Aperture radar (SAR) data has the capability to pick up water (flood) signature quickly and can be used to map the extent of inundated area operationally. Disaster Management Support programme of ISRO regularly map the flood affected area over India. Flooded area over Naogaon district during 2022 jute season has been mapped as presented in Fig. 30

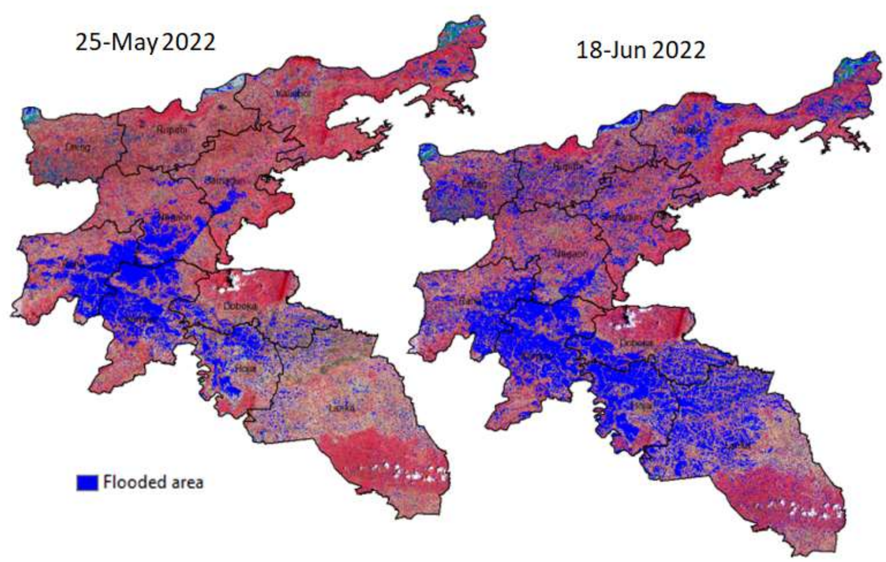



Fig. 30 Flood affected area over Naogaon in two episodic events i.e. 25 May and 18 June 2022

Satellite data has also been used to assess the jute crop lodging and partial inundation due to recent amphan cyclone in 2020 (Chakraborty et al., 2021). An operational methodology has been established using multi-temporal optical and SAR data to assess the jute crop affected due to cyclonic systems like amphan (Fig. 31). These near-real time information can been very help to support insurance claim and relief.

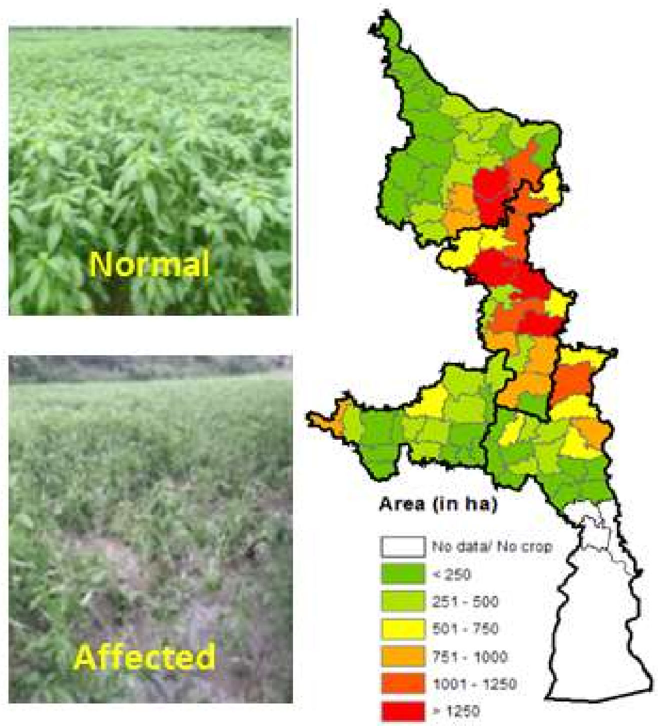



Fig. 31 The Jute growing blocks affected due to recent amphan cyclone, 2020

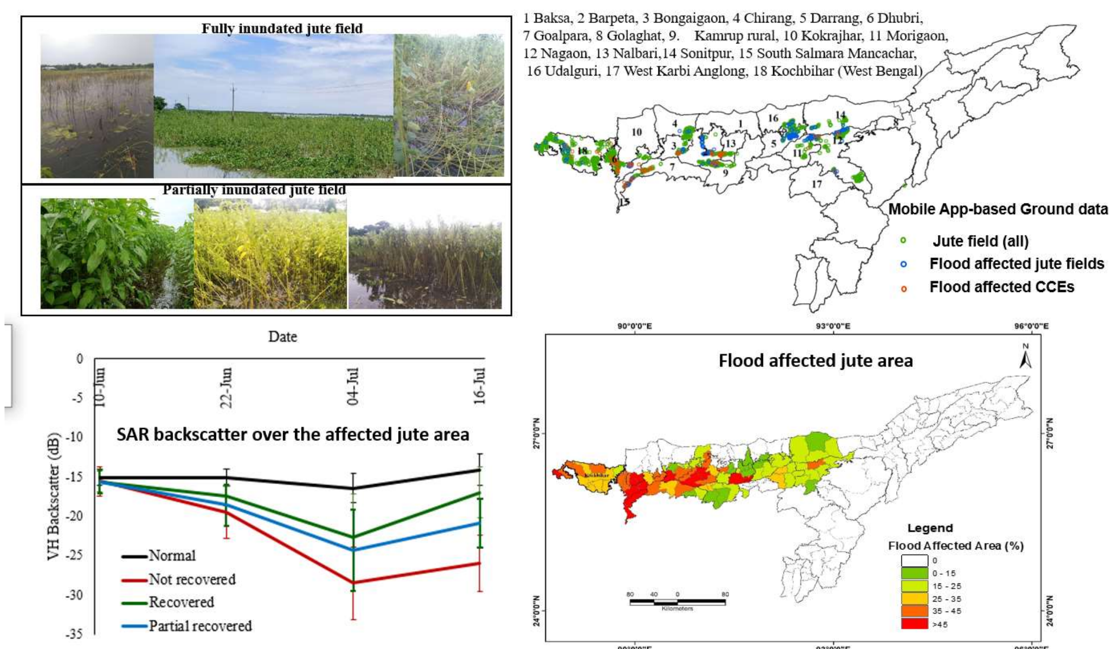


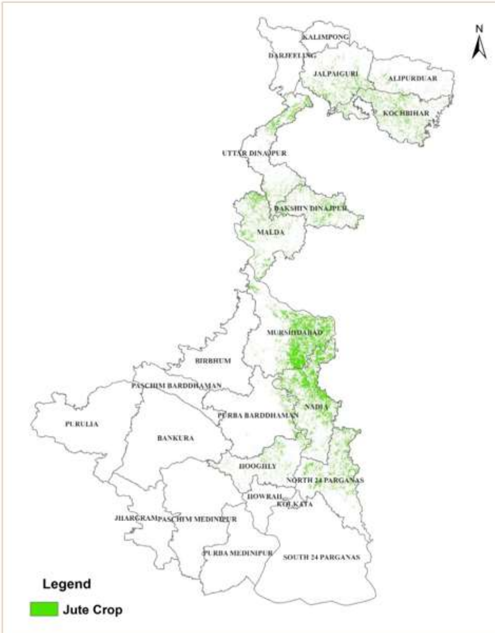

Fig. 32 Flood damage of jute crop in Assam-Kochbihar region, 2024

The India Meteorological Department (IMD) rainfall showed very high rainfall during 2nd fortnight of June and 1 fortnight of July. It has caused large scale recurrent flooding in the lower Assam and riverine plain of Brahmaputra-Barak region of India (https://ndem.nrsc.gov.in/documents/Disaster_Document/2024/AS/asflood50dsc01072024_1800hrs/asflood50dsc01072024_1800hrs_report.pdf.). The major crop in the area was found to be jute, which is 50-70 days old with 4-5 feet height depending on the date of sowing. The jute crop was found to be inundated fully (leaving only part of the twigs) showing water signature from the top of the canopy, or partially inundated with partial water signature from synoptic view as shown in Fig. 32. The jute crop was reported to be damaged across the area depending on the intensity and persistent of the inundation (https://www.thehindu.com/business/jute-production-to-be-20-lower-this-year-on-floods/article68638295.ece). BHUVAN JUMP mobile app data has used, as shown in Fig. 32, to generate the jute map of the area. The crop stress as "flood" has also been collected and was used as ground truth of the flood affected area. Few of the crop cutting experiments are also conducted in the flood affected area and can be a representative of the crop loss extend. The temporal VH backscatter of the Sentinel 1 (Fig. 32) showed large deviation between the normal, partially and fully flooded area along with its recovery. Finally, flood affected area was mapped and shown in Fig. 32.

**5.8 Crop analysis module:** This module is yet to developed. This module involves analysis of mobile app data, weather data and satellite data synergistically to assess the crop area, conducting crop cutting experiments and production estimates.

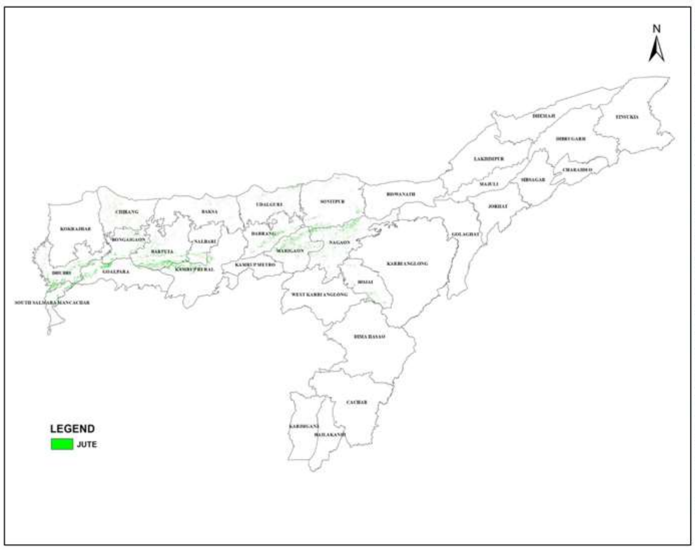
### 5.8.1 Jute crop mapping

Multi-temporal satellite data (both optical and microwave) were used to map in-season jute crop and accuracy assessment was done using the BHUVAN JUMP data points. It is found that Jute crop map can be generated using multi-temporal satellite data with 80-85% accuracy depending on the competing crops and associated terrain. The jute crop map of West Bengal of 2023 and 2024 are presented in Fig 33-40.



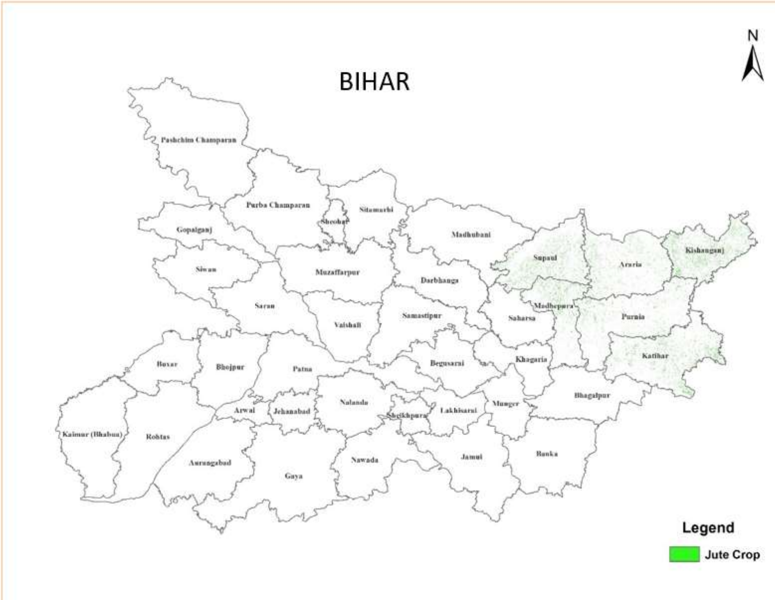

| DISTRICT NAME | AREA (ha) |
|---|---|
| MURSHIDABAD | 102267.04 |
| NADIA | 89757.02 |
| NORTH 24 PARGANAS | 39681.33 |
| COOCHBEHAR | 37042.3 |
| MALDAH | 32628.97 |
| DAKSHIN DINAJPUR | 24836.76 |
| UTTAR DINAJPUR | 24133.09 |
| JALPAIGURI | 21668.73 |
| HOOGHLY | 17543.33 |
| PURBA BARDHHMAN | 10529.33 |
| ALIPURDUAR | 5166.93 |
| **TOTAL** | **405254.83** |

Fig. 33 Jute crop map and area estimates over West Bengal in 2023.



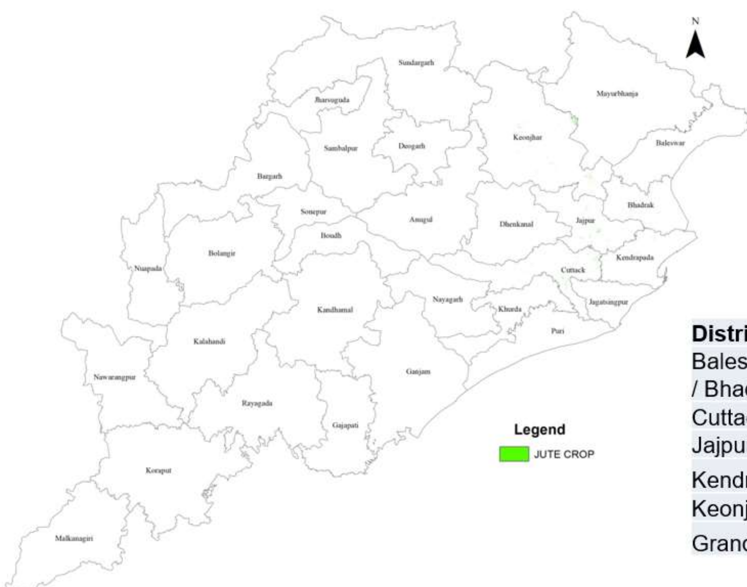

| District | Jute Area (ha) |
|---|---|
| BARPETA | 8580.52 |
| Bongai gaon | 3070.95 |
| Chirang | 2460.23 |
| DARRANG | 2967.76 |
| Dhubri | 6847 |
| GOALPARA | 5502.86 |
| HOJAI | -- |
| KAMRUP | 5806.02 |
| MORIGAON | 5778.21 |
| NAGAON | 7349.79 |
| NALBARI | 1048.05 |
| SONITPUR | 2451.76 |
| UDAL GURI | 1460.27 |
| WEST KARBI ANGLONG | -- |
| Kokrajhar | -- |
| GOLAGHAT | -- |
| Grand Total | 54538.68 |

Fig. 34 Jute crop map and area estimates over Assam in 2023.



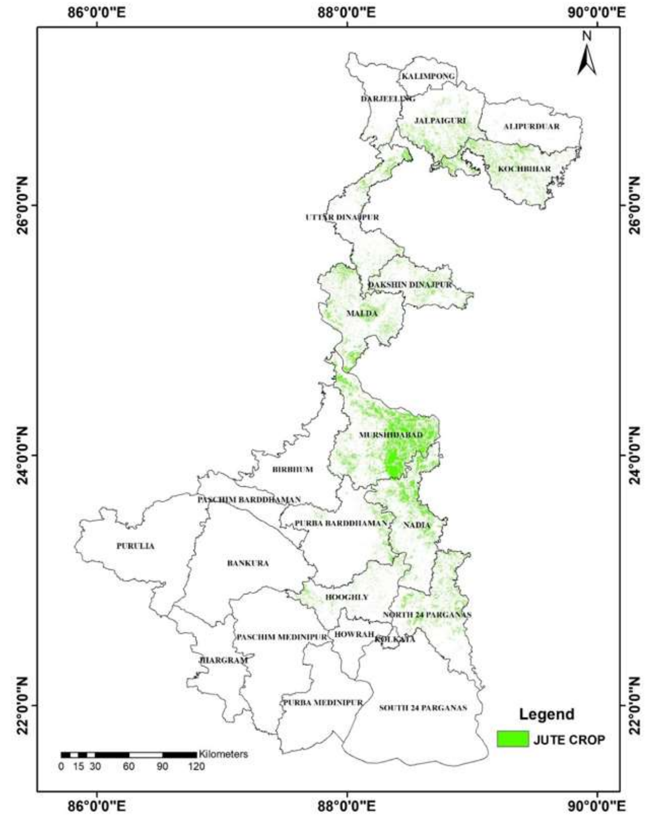

| DISTRICTS | Area (ha) |
|---|---|
| Araria | 8288 |
| Supaul | 12005 |
| Purnia | 7339 |
| Madhepura | 8290 |
| kishanganj | 15139 |
| kathiar | 13277 |
| Total | 64338 |

Fig. 35 Jute crop map and area estimates over Bihar in 2023.



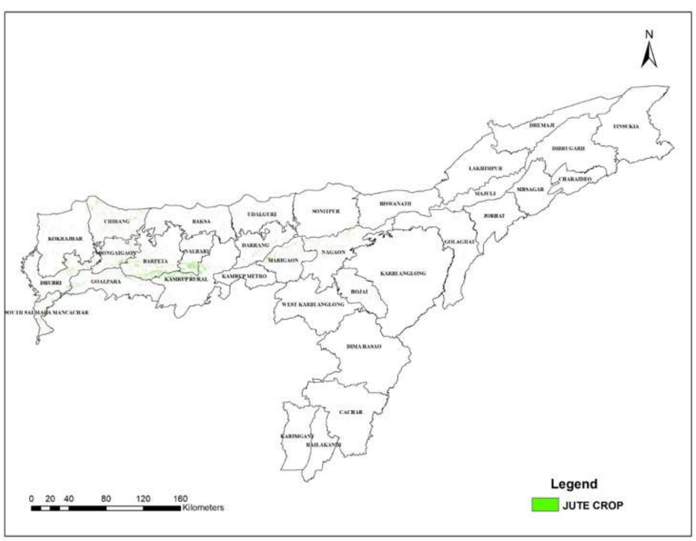

| Districts | Jute area (ha) |
|---|---|
| Baleshwar / Bhadrak | 1030.89 |
| Cuttack | 1249.71 |
| Jajpur | 784.62 |
| Kendrapara | 180.61 |
| Keonjhar | 1467.62 |
| Grand Total | 4713.47 |

Fig. 36 Jute crop map and area estimates over Odisha in 2023.



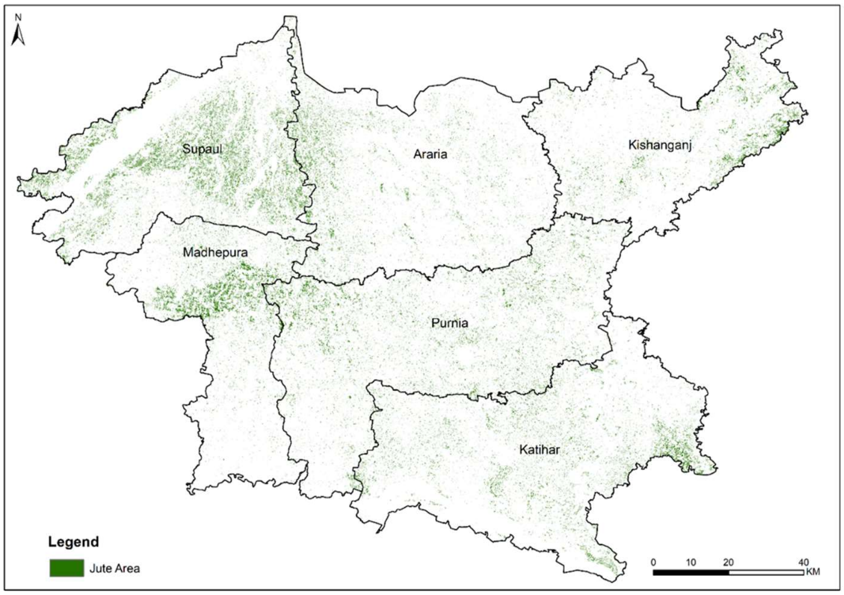

| Districts | Jute area (ha) |
|---|---|
| **Darjeeling** | **896.247** |
| **Alipurduar** | **2963.216** |
| **Murshidabad** | **104715.6** |
| **Cooch behar** | **34803.99** |
| **Dakshin Dinajpur** | **27409.88** |
| **HOOGHLY** | **8478.216** |
| **Jalpaiguri** | **19772.52** |
| **Malda** | **32236.43** |
| **North 24 PGS** | **27446.09** |
| **Nadia** | **89670.76** |
| **Purba Bardhaman** | **12550.5** |
| **Uttar Dinajpur** | **17986.68** |
| **Grand Total** | **378930.129** |

Fig. 37 Jute crop map and area estimates over West Bengal in 2024.



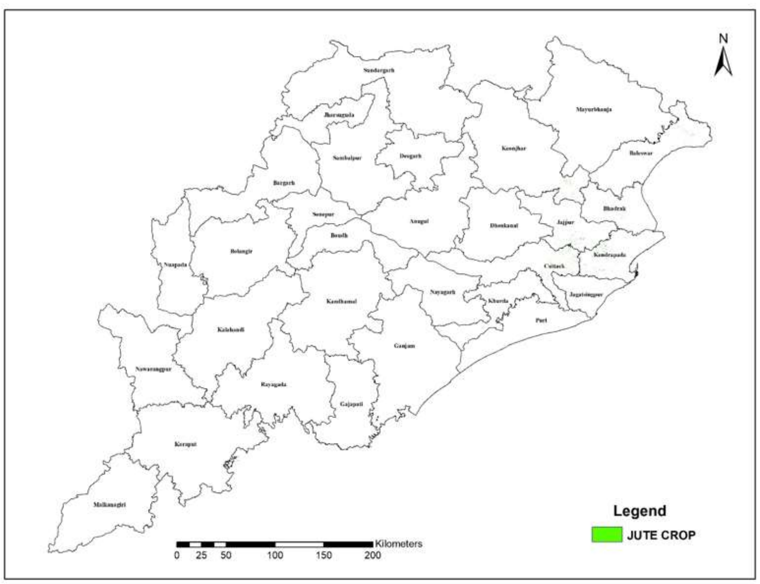

| **District** | **Jute area (ha)** |
|---|---|
| BARPETA | 6165.008 |
| Bongaigaon | 2867.48 |
| Chirang | 1827.92 |
| DARRANG | 1696.12 |
| Dhubri | 4460.95 |
| GOALPARA | 2443.86 |
| HOJAI | 592.58 |
| KAMRUP | 5729.45 |
| MORIGAON | 4492.55 |
| NAGAON | 3216.69 |
| NALBARI | 2983.69 |
| SONITPUR | 2556.84 |
| UDAL GURI | 1090.68 |
| WEST KARBI ANGLONG | 2878.64 |
| SOUTH SALMARA MANCHACHAR | 1559.22 |
| Kokrajhar | 2362.92 |
| GOLAGHAT | 387.94 |
| Baksa | 869.90 |
| Biswanath | 183.94 |
| Grand Total | 48366.44 |

Fig. 38 Jute crop map and area estimates over Assam in 2024.




| Districts Name | Area ('000 ha.) |
|---|---|
| Araria | 8.76 |
| Katihar | 8.87 |
| Kishanganj | 5.84 |
| Madhepura | 6.38 |
| Purnea | 9.37 |
| Supaul | 19.42 |
| Total | 58.64 |

Fig. 39 Jute crop map and area estimates over Bihar in 2024.




| DISTRICTS | Jute area (ha) |
|---|---|
| KENDAPARA | 1163.853 |
| JAJPUR | 1190.826 |
| CUTTACK | 2010.816 |
| BHADRAK | 360.585 |
| BALASORE | 537.597 |
| KEONJHAR | 644.769 |
| TOTAL | 5908.446 |

Fig. 40 Jute crop map and area estimates over Odisha in 2024.

**5.8.2 Crop Cutting Experiments of jute**

Crop cutting experiment is the primary requisite for any crop yield modeling. The project envisages independent crop cutting experiments of jute through the JCIL officials to maintain the high-quality crop yield data (biomass and fibre yield). A special initiative has also been taken to conduct Crop Cutting Experiments (CCE) for jute crop for objective assess the jute yield in terms of biomass and fibre. These data will be the base for further modeling and upscaling, using satellite and weather-based information. The first step of CCE is to identify its locations which is randomized and can accommodate all the variability of the jute yield. Hence, jute yield proxy was generated using satellite derived NDVI, LSWI, integrated cross-polarized backscatter to represent the jute crop vigour and health. Stratification of jute crop area was done based on the yield proxy. Maximum four strata were made as "Very high", "High", "Moderate", and "low" yield zone. A smart sampling module was generated based on python code to distribute the CCE locations based on the yield strata, area under the crop in each stratum and mutual distance between the location and ease of reaching to the locations. Primary locations of the CCEs were distributed over the selected jute growing districts. As a pilot it was done over Murshidabad, Nadia, Koochbihar, Araria, Noagaon in the year 2022 as presented in the Fig. 41. Each primary location is provided with two alternative locations, in case first one is not achieved due to lack of logistics or any other issues. All the CCE locations were then converted in KML file and linked to google map with navigational support. The field officials can click a particular location and get the navigational support (road direction) from google map so that the location could be reached at ease (Fig. 42). Proper training and support has also been provided to use the service and conduct the CCE. The JCIL successfully conducted the 314 CCEs over the five selected districts in 2022 and the data points were quality checked, geo-tagged and analyzed. CCE involves selection of crop field, measurement of 10×10 m plot, cutting of the fresh crop after it achieve maturity, making bundle of the crop, weighing the fresh weight. Further it was submerged in the water for retting followed by stripping of the fibre, drying the fibre and weigh the dry fibre and stick. A comprehensive activity of the CCEs is presented in Fig. 43, along with the district wise jute fibre /biomass yield and fibre quality.

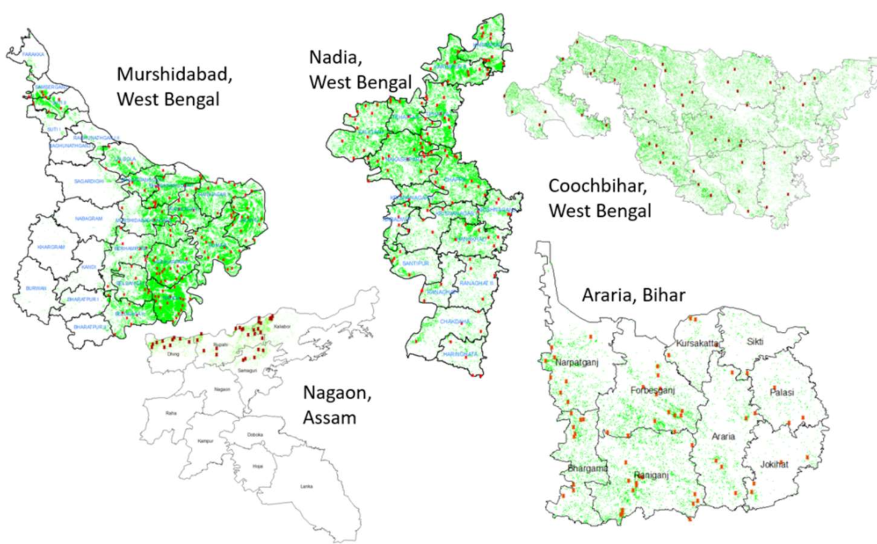



Fig 41 CCE locations of jute crop provided by NRSC based on smart sampling method over the selected districts in 2022

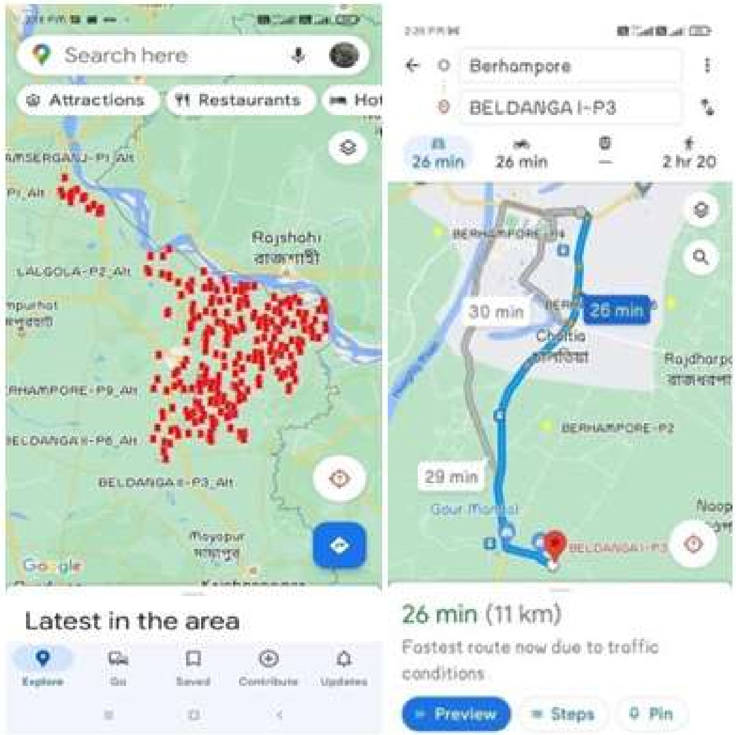



Fig 42. Navigational support to reach the proposed CCE locations


| District | CCE data points | Av green biomass (t/ha) | Av dry fiber yield (Kg/ha) | Jute Quality |
|---|---|---|---|---|
| Nadia | 80 | 38.6 ± 8.3 | 2834 ± 610 | TD3 = 0%, TD4= 15.3%, **TD5 = 46%, TD6 = 37.8%,** TD7 = 0.9% |
| Murshidabad | 99 | 33.4 ± 8.6 | 2924 ± 601 | TD3 = 0%, TD4 =3.5 %, **TD5 = 58.6%, TD6= 36.4%, ,** TD7 = 1.5% |
| Koochbehar | 36 | 37.1 ± 8.2 | 3481 ± 1062 | TD3 = 0%, , TD4 = 1.5%, **TD5 = 24.8%, , TD6 = 42.9%, ,** TD7 = 30.8% |
| Araria | 61 | 56.6 ± 8.2 | 4103 ± 596 | TD3 = 0.9%, **TD4 = 27.6%, TD5 = 53.2%,** TD6 = 18.3%, TD7 = 0% |
| Nagaon | 38 | 40.3 ± 5.4 | 3384 ± 328 | TD3 = 0%, TD4 = 8.2%, **TD5 = 62%, TD6 = 29.8%,** TD7 = 0% |

Fig. 43 Activities of crop cutting experiments of jute along with the snapshot of the comprehensive district wise fibre and biomass yield in the year 2022.

In the year 2023, smart sampling points were generated as described earlier over West Bengal and Bihar. The CCE locations provided by NRSC over West Bengal and Bihar are presented in Fig. 44 and Fig. 45 respectively. As smart sampling could not be provided for Assam and Odisha, JCIL conducted CCE based on their choice of locations. The final CCE locations is presented in Fig. 46.

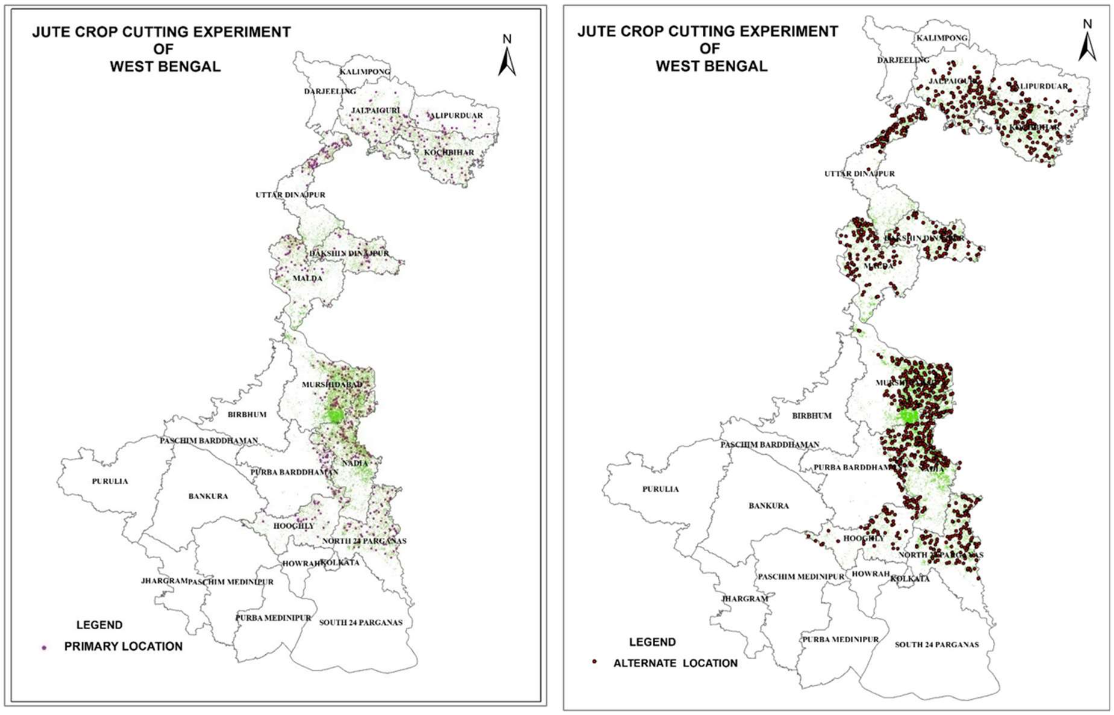



Fig. 44 Primary and alternative CCE locations provided by NRSC over West Bengal in 2023.

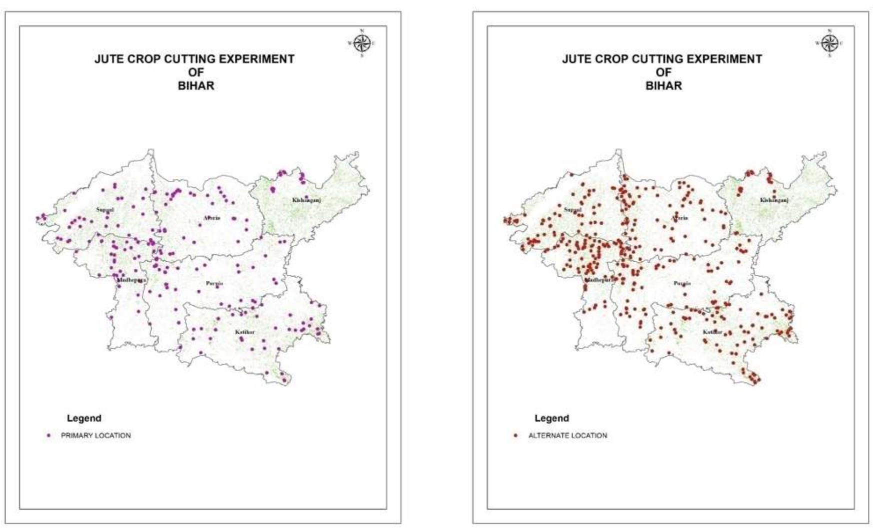



Fig. 45 Primary and alternative CCE locations provided by NRSC over West Bihar in 2023.

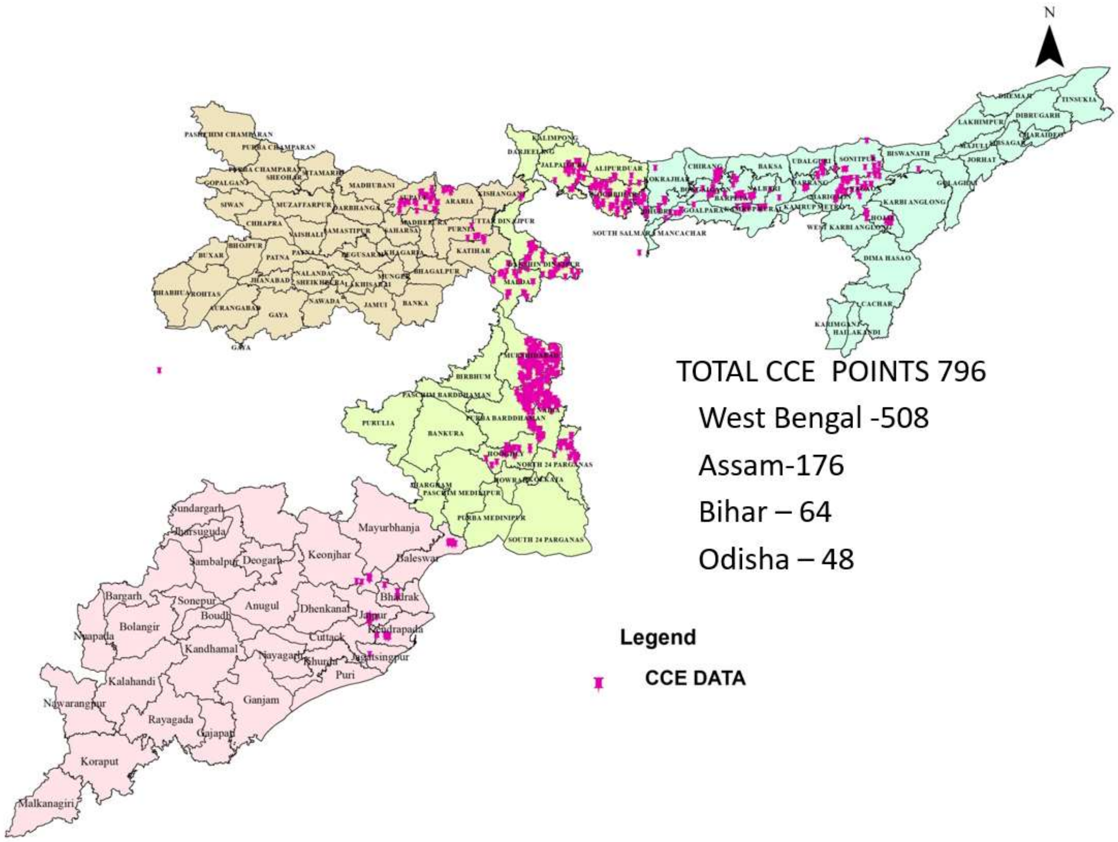



Fig. 46 Final locations of CCEs conducted by JCIL over four states in 2023.

In the year 2024, smart sampling points were generated over West Bengal, Assam, Bihar and Odisha. The primary CCE locations provided by NRSC over four states presented in Fig. 47 and alternative locations in Fig. 48. JCIL conducted CCE across the four states and the final CCE locations is presented in Fig. 49. Due to geolocation inaccuracy of few CCE points were further being checked for modelling purpose.

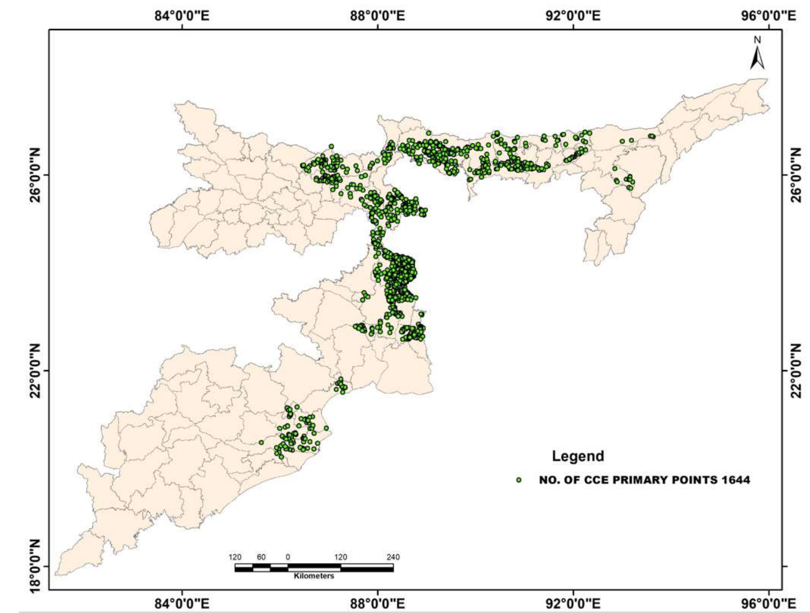



Fig. 47 Primary CCE locations provided by NRSC over West Bengal, Assam, Bihar and Odisha in 2024.

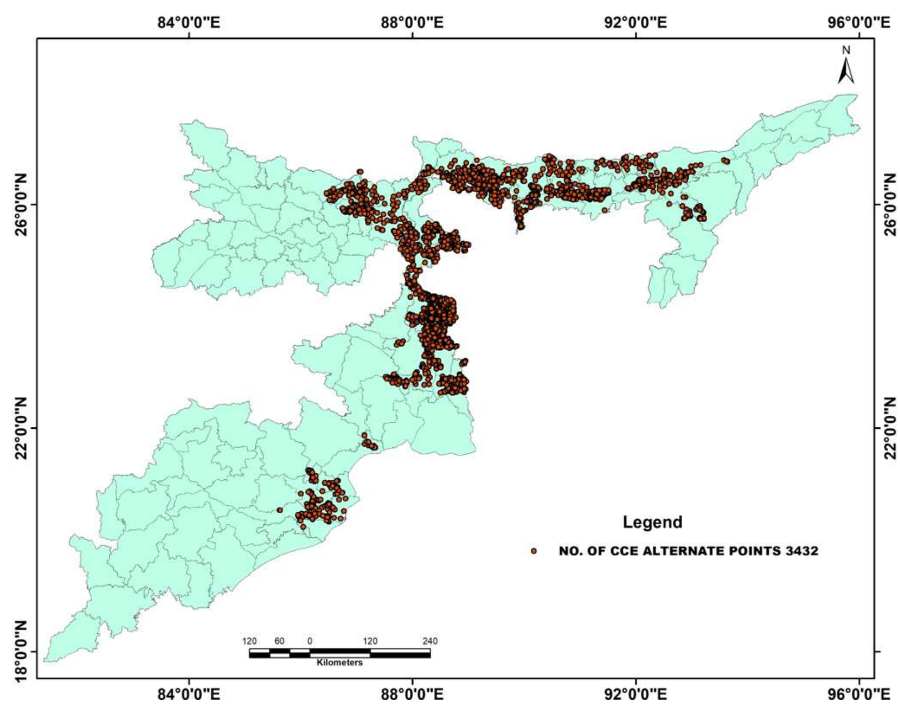
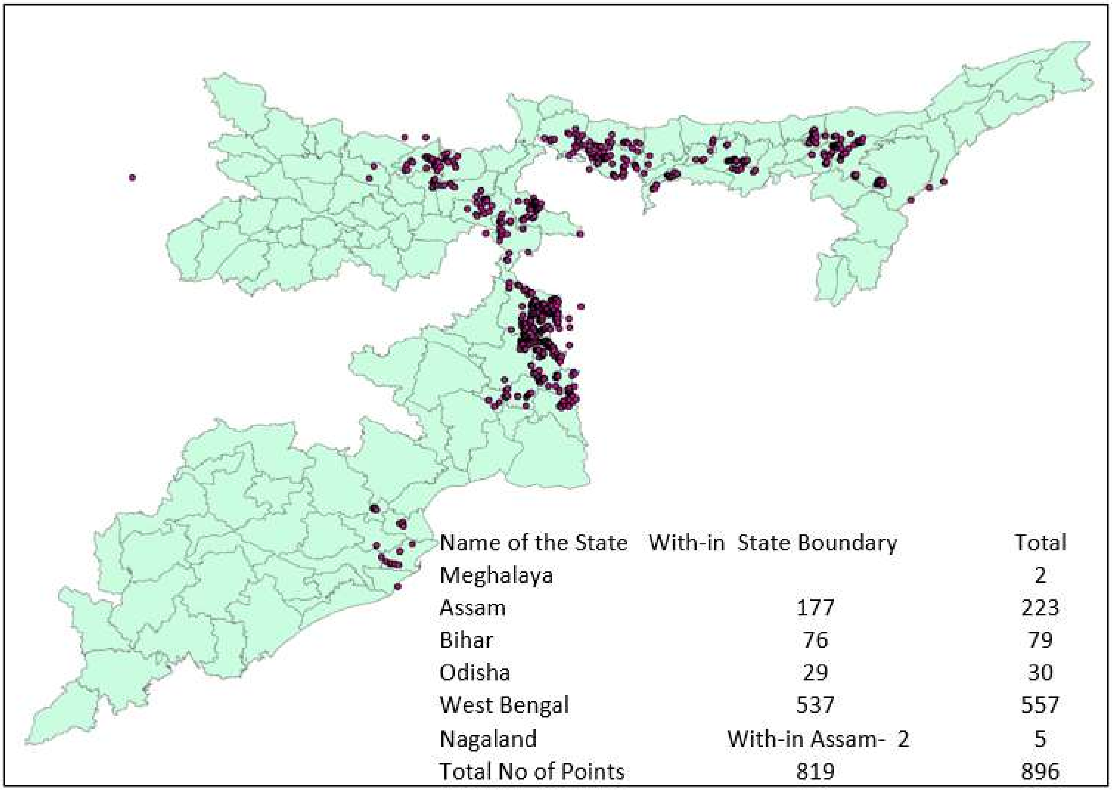



Fig. 48 Alternate CCE locations provided by NRSC over West Bengal, Assam, Bihar and Odisha in 2024.



| Name of the State | With-in State Boundary | Total |
|---|---|---|
| Meghalaya | | 2 |
| Assam | 177 | 223 |
| Bihar | 76 | 79 |
| Odisha | 29 | 30 |
| West Bengal | 537 | 557 |
| Nagaland | With-in Assam- 2 | 5 |
| Total No of Points | 819 | 896 |

Fig. 49 Final locations of CCEs conducted by JCIL over West Bengal, Assam, Bihar and Odisha in 2024.

### 5.8.3 Yield performance and distribution of jute crop varieties based on CCE data

To assess the performance of different jute varieties cultivated across India, CCE data of 2024 were analyzed with particular emphasis of its distribution and yield. As the CCE locations are randomly selected using smart sampling technique, it is assumed that it is free from any bias. At first all the jute varieties having significant data points are selected and plotted across the four states. The spatial distribution of these varieties is presented in Fig. 50. It may be seen that among the different jute varieties JRO-204 dominated across the region occupying nearly 47% of the share (Fig. 50). It is followed by JRO-G1 (11.7%), JRO B2 (10.05%), RAJA (10.19%), CO 58 (7.98%), JRO 524 (5.09%) and JRO MU1 (3.03%). Average dry fibre yield calculated from CCE data showed that JRO 2407, RAJA, RANI and JRO MU1 are high performing varieties with yield range of 3-3.6 t/ha. Whereas, JRO 2024, JRO B2, JRC 9057, CO 58, JRO G1 and JRC 212 are moderate performing varieties with yield range of 2.6-3 t/ha. Other varieties such as JBO 1, JRO 524 and JRC 532 produced dry fibre of 2.3-2.5 t/ha. It is apt to mention here that market return of the fibre not only depends on the yield but also the quality of the fibre. Hence, more analysis is required on the fibre quality for further assessment of the jute varieties.

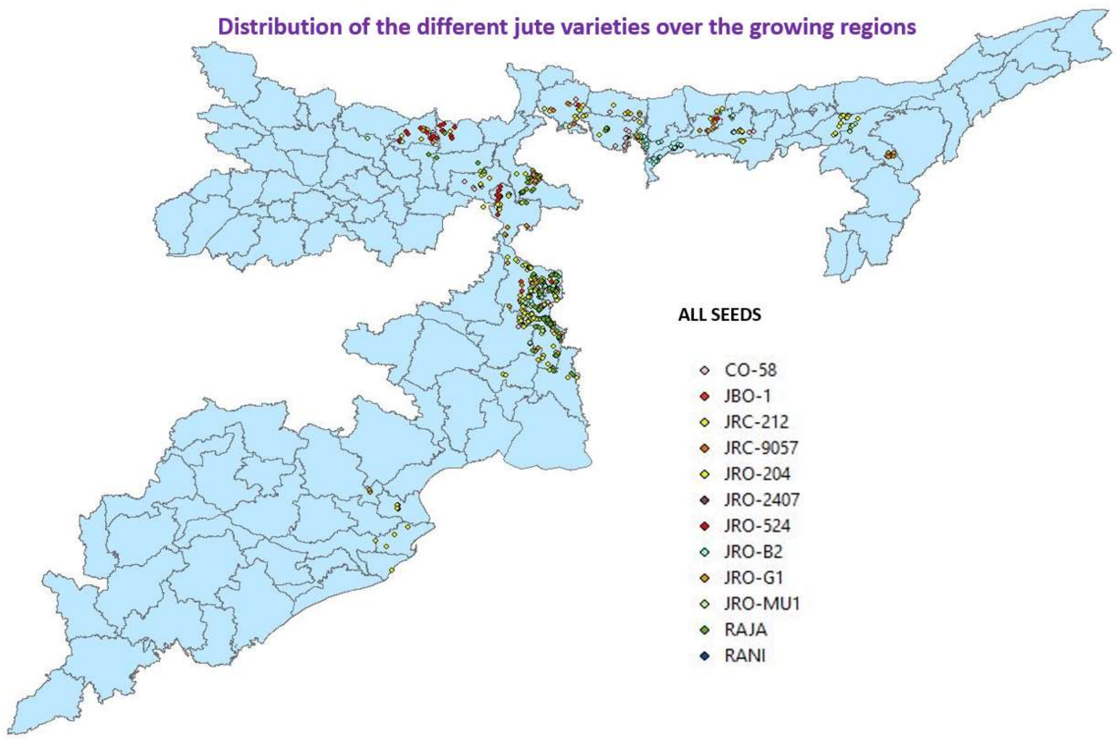
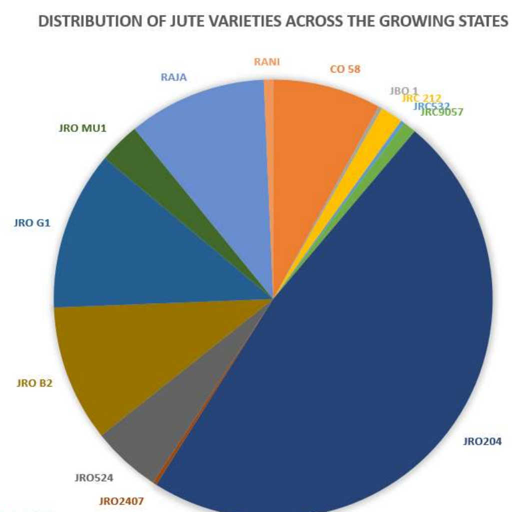



Fig. 50 Spatial distribution of different jute varieties across the jute growing regions.

| Jute variety | Count | Fresh biomass (t/ha) | Standard Deviation fresh weight | Dry fibre (t/ha) | Standard deviation dry fibre weight |
|---|---|---|---|---|---|
| JBO 1 | 2 | 32.6 | NA | 2.3 | NA |
| JRO524 | 37 | 35.4 | 6.3 | 2.5 | 0.5 |
| JRC532 | 2 | 47.3 | NA | 2.5 | NA |
| JRO204 | 347 | 38.8 | 8.1 | 2.7 | 0.5 |
| JRO B2 | 73 | 37.0 | 8.0 | 2.7 | 0.5 |
| JRC9057 | 7 | 38.1 | 9.4 | 2.8 | 0.4 |
| CO 58 | 58 | 40.8 | 7.5 | 2.8 | 0.4 |
| JRO G1 | 85 | 37.6 | 5.4 | 2.9 | 0.4 |
| JRC 212 | 12 | 45.7 | 9.9 | 2.9 | 0.5 |
| JRO MU1 | 22 | 41.4 | 5.0 | 3.0 | 0.4 |
| RAJA | 74 | 38.7 | 6.4 | 3.0 | 0.5 |
| RANI | 5 | 40.1 | 8.0 | 3.1 | 0.7 |
| JRO2407 | 2 | 39.4 | NA | 3.6 | NA |




- Dominance in term of distribution and reach
  JRO 204> JRO G1> JRO B2> RAJA> CO 58> JRO 524> JRO MU1
- High yield of 3-3.6 t/ha : (JRO2407, RAJA, RANI, JRO MU1)
- Moderate yield 2.6-3 t/ha: (JRO 204, JRO B2, JRC 9057, CO 58, JRO G1, JRC212)
- Low yield 2.3-2.5 t/ha: (JBO 1, JRO 524, JRC 532)

Fig. 51 Comparative yield performance and market share of different jute varieties across the jute growing regions.

### 5.8.4 Yield modelling and production estimates:

The final objective of the present activities is estimation of jute yield and production at district level based on satellite-based jute area and CCE based crop yield. The CCE is a point

observation and it acts as a basis of jute yield ground truth. In the current proposal, it is planned to use satellite-based crop condition/vigour proxies such as Normalized Difference Vegetation Index (NDVI), Land Surface Wetness Index (LSWI), VH backscatter, soil moisture along with weather data such as rainfall, temperature, insolation, FPAR etc to model the CCE-based jute crop yield. The modelling will be done using two approaches i.e. semi-empirical Light Use Efficiency based approach or Machine Learning based approach. Limited efforts have already been made to model the jute yield using machine learning based approach. It is realized that extensive and multi-year CCE data is required to training the model over the large jute growing areas of India. Hence, currently the production estimate is provided using the satellite-based jute area and CCE based district level jute yield using empirical approach.
The jute production and jute fibre quality of West Bengal in the year 2024 is provided in Table 2. District wise jute area, number of CCEs conducted, average yield of the dry fibre is also provided in Table 2. In general, the jute dry fibre yield was found to be 25-30 q/ha. The total jute area of West Bengal for the year 2024 was found to be 3.79 lakh ha with dry fibre production of 56.84 lakh bale. Majority of the jute fibre quality was found to be moderate with TDN3 (39%) and TDN4 (41%). Low quality fibre was also found to be significant with TDN5 of 16%.

Table 2 Jute production and fibre quality estimates of West Bengal, 2024

| Name of District | CCE no | Jute area (in ha) | Dry fibre (in q/ha) | Production (in lakh bale) |
|---|---|---|---|---|
| Alipurduar | 14 | 2963.22 | 25.71 | 0.42 |
| Coochbehar | 60 | 34803.99 | 32.84 | 6.35 |
| DAKSHIN DINAJPR | 18 | 27409.88 | 38.60 | 5.88 |
| Hooghly | 33 | 8478.22 | 29.16 | 1.37 |
| Jalpaiguri | 13 | 19772.52 | 15.46 | 1.70 |
| MALDA | 36 | 32236.43 | 28.33 | 5.07 |
| Murshidabad | 153 | 104715.60 | 23.92 | 13.91 |
| Nadia | 157 | 89670.76 | 26.63 | 13.27 |
| North 24 Parganas | 31 | 27446.09 | 23.98 | 3.66 |
| PURBA BURDWAN | 36 | 12550.50 | 30.43 | 2.12 |
| UTTAAR DINAJPUR | 27 | 17986.68 | 30.11 | 3.01 |
| Darjeeling | Extrapolated | 896.25 | 15.46 | 0.08 |
| Total | | 378930.13 | | 56.84 |

**Jute quality : TDN2: 4%, TDN3: 39%, TDN4: 41%, TDN5: 16%**

Likewise, the jute production and fibre quality estimates of Assam for the year 2024 is presented in Table 3. District wise jute area, number of CCEs conducted, average yield of the dry fibre over Assam are also provided in Table 3. In general, the jute dry fibre yield was found consistent and noticeably higher than West Bengal i.e. 25-33 q/ha. The total jute area of Assam for the year 2024 was found to be 0.48 lakh ha with dry fibre production of 7.87 lakh bale. Majority of the jute fibre quality was found to be moderate with TDN3 (45%) and TDN4 (40%). Low quality fibre was also found less with TDN5 of 8%.
On the other hand, the jute production and fibre quality estimates of Bihar for the year 2024 is presented in Table 4. District wise jute area, number of CCEs conducted, average yield of the dry fibre over Bihar are also provided in Table 4. In general, the jute dry fibre yield was

found consistent and noticeably higher than West Bengal & Assam i.e. 27-37 q/ha. The total jute area of Bihar for the year 2024 was found to be 0.59 lakh ha with dry fibre production of 10.88 lakh bale. The jute fibre quality was found to be low comparatively. TDN4 grade fibre was dominant with 57%, followed TDN5 (27%) and TDN4 (16%).

In Odisha, the jute area is not significant. The jute production and fibre quality estimates of Odisha for the year 2024 is presented in Table 5. District wise jute area, number of CCEs conducted, average yield of the dry fibre over Odisha are also provided in Table 5. The total jute area of Odisha for the year 2024 was found to be 0.06 lakh ha with dry fibre production of 1.14 lakh bale. Majority of the jute fibre quality was found to be moderate with TDN3 (56%) and TDN4 (38%).

Table 3 Jute production and fibre quality estimates of Assam, 2024

| Name of District | CCE no | Jute area ( in ha) | Dry fibre (in q/ha) | Production (in lakh bale) |
|---|---|---|---|---|
| Barpeta | 24 | 6165.01 | 31.79 | 1.09 |
| Bongaigaon | 20 | 2867.48 | 25.75 | 0.41 |
| Chirang | 8 | 1827.93 | 30.38 | 0.31 |
| Darrang | 13 | 1696.12 | 29.15 | 0.27 |
| Dhubri | 28 | 4460.95 | 25.57 | 0.63 |
| Goalpara | 10 | 2443.86 | 29.35 | 0.40 |
| HOJAI | 10 | 592.58 | 33.60 | 0.11 |
| Kamrup | 10 | 5729.45 | 30.60 | 0.97 |
| Morigaon | 23 | 4492.55 | 32.17 | 0.80 |
| NAGAON | 37 | 3216.70 | 29.78 | 0.53 |
| Nalbari | 6 | 2983.70 | 24.92 | 0.41 |
| SONITPUR | 10 | 2556.84 | 32.10 | 0.46 |
| South Salmara Mankachar | 8 | 1559.22 | 29.31 | 0.25 |
| Udalguri | 7 | 1090.69 | 28.50 | 0.17 |
| WEST KARBBIANLONG | 10 | 2878.64 | 25.30 | 0.40 |
| Kokrajhar | Extrapolated | 2362.92 | 30.38 | 0.40 |
| Golaghat | Extrapolated | 387.95 | 29.78 | 0.06 |
| Baksa | Extrapolated | 869.90 | 29.78 | 0.14 |
| Biswanath | Extrapolated | 183.94 | 29.78 | 0.03 |
| Total | Extrapolated | 48366.43 | | 7.87 |

**Jute quality : TDN2: 7%, TDN3: 45%, TDN4: 40%, TDN5: 8%**

Table 4 Jute production estimates of Bihar, 2024

| Name of District | CEE no | Jute Area (in ha) | Dry fibre (in q/ha) | production (in lakh bale) |
|---|---|---|---|---|
| ARARIA | 10 | 8760 | 31.90 | 1.55 |
| KATIHAR | 20 | 8870 | 31.70 | 1.56 |
| MADHEPURA | 10 | 6380 | 39.30 | 1.39 |
| PURNEA | 10 | 9370 | 27.00 | 1.41 |
| SUPAUL | 30 | 19420 | 37.17 | 4.01 |
| KISHANGANJ | extrapolated | 5840 | 29.45 | 0.96 |
| | | 58640 | | 10.88 |

**Jute quality : TDN3: 16%, TDN4: 57%, TDN5: 27%**

Table 5 Jute production estimates of Odisha, 2024

| Name of District | CCE no | Jute area in hec | Dry fibre (in q/ha) | Production (lakh bale) |
|---|---|---|---|---|
| Bhadrak | 10 | 360.59 | 28.10 | 0.06 |
| Jajpur | 3 | 1190.83 | 33.67 | 0.22 |
| Kendrapara | 8 | 1163.85 | 36.75 | 0.24 |
| Keonjhar | 10 | 644.77 | 37.60 | 0.13 |
| CUTTACK | extrapolated | 2010.82 | 33.67 | 0.38 |
| BALASORE | extrapolated | 537.60 | 36.75 | 0.11 |
| | | 5908.45 | | 1.14 |

**Jute quality : TD2: 5%, TD3: 56%, TD4: 38%, TD5: 1%**

State wise jute area and production of current two years i.e., 2024 and 2023 are provided in Table 6. The total jute area over four states i.e., West Bengal, Bihar, Assam and Odisha was found to be 4.91 lakh ha, which is significantly less than the previous of 2023 (5.34 lakh ha). Accordingly, jute dry fibre yield has also reduced to 76.73 lakh bale in 2024 in comparison to 84.33 lakh bale of 2023.

Table 6 State wise comparison of jute area and dry fibre yield of 2024 vis-a-vis 2023

| SL | State | Area ( lakh ha) | | Production dry fibre (lakh bale) | |
|---|---|---|---|---|---|
| | | 2024 | 2023 | 2024 | 2023 |
| 1 | West Bengal | 3.79 | 4.05 | 56.84 | 63.32 |
| 2 | Assam | 0.48 | 0.59 | 7.87 | 10.57 |
| 3 | Bihar | 0.58 | 0.64 | 10.88 | 9.04 |
| 4 | Odisha | 0.06 | 0.059 | 1.14 | 1.40 |
| Total | | 4.91 | 5.34 | 76.73 | 84.33 |

## 6. Conclusion:

The report is a brief compilation of the capabilities of geospatial technologies to cater / support to the jute sector in terms of monitoring in-season jute crop condition, pre-harvest estimation of the area under jute crop, mid-season adversities and assessment of the jute yield etc. All possible advanced geospatial technologies have been utilized such as mobile technology for objective field data collection over the jute growing areas, assessment of in-season jute prospect based on mobile data collected involving web analytics, satellite-based jute crop mapping, conducting crop cutting experiments of jute using smart sampling techniques, and assessing jute yield. It is planned to host all these databases in a centralized dedicated portal as "Jute Crop Information System" for operational use. Such intervention can be considered as a digital agriculture initiative for fibre crop like jute under Ministry of Textiles.

**7. Acknowledgements**

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