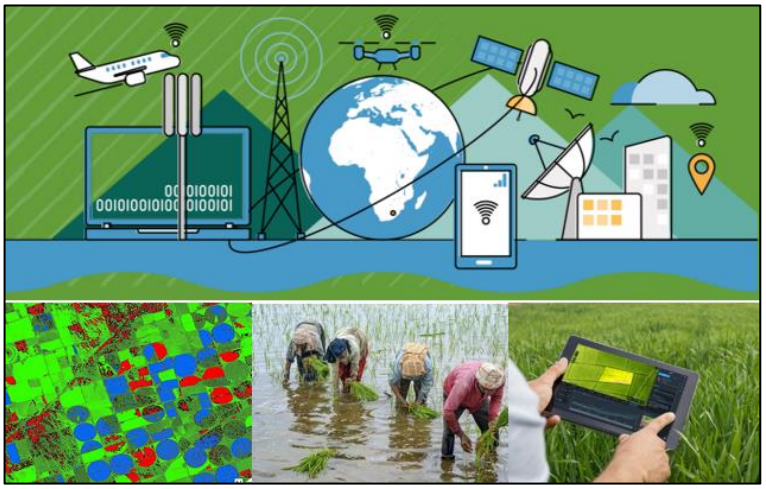
# Crop Survey for Estimation/Assessment of Acreage, Crop Health and Expected Yield of Basmati Rice during Kharif-2023

## Volume: II



**Submitted To:**

**Basmati Export Development Foundation**

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# Contents

# Executive Summary

- Basmati is one of the most popular long-grain rice varieties due to its texture, nutty flavor, and popcorn-like aroma. Much of the basmati rice is cultivated in India and India is the major exporter of Basmati rice.

- The scope of present report (Volume-II) is to provide field and satellite data-based acreage of Basmati rice and crop health assessment in GI areas.

- The study area is covered total of 85 districts, which includes 23 districts of Punjab, 30 districts of Uttar Pradesh, 22 districts of Haryana, 3 Districts of Jammu & Kashmir, 4 districts of Uttarakhand, 2 districts of Himachal Pradesh and NCT of Delhi.

| Satellite data and Field-based Basmati Rice Acreage Details | | | |
|---|---|---|---|
| **S. No.** | **State Name** | **Basmati Acreage (000' ha)** | **Major Basmati Rice varieties Found** |
| 1 | Punjab | 785.97 | • Major varieties observed (PB-1509, PB-1692, PB-1847), (PB-1121, PB-1718) and (PB-1401, PB-01, PB-06).<br>• Sharbati and Sugandha are majorly found in some districts of UP and Haryana.<br>• (CSR-30, B-370, HBC-19) is also observed in J&K, Haryana and Punjab. |
| 2 | Haryana | 748.23 | |
| 3 | Uttar Pradesh | 463.93 | |
| 4 | Uttarakhand | 17.05 | |
| 5 | Jammu & Kashmir | 46.13 | |
| 6 | Himachal Pradesh | 5.59 | |
| **Total** | | **2066.90** | |

- Satellite data and field survey observation base study was carried out for estimation of Basmati acreage. The state of Punjab has the highest acreage with Basmati rice, which is around 785.97 thousand hectares, followed by Haryana with 748.23 thousand hectares, and Uttar Pradesh, which has 463.93 thousand hectares. The targeted districts in Uttarakhand, Jammu & Kashmir and Himachal Pradesh have basmati rice acreages of 17.05, 46.13, and 5.59 thousand hectares, respectively.

- A field Survey was scheduled from 21st August to 27th August in all the districts of Punjab, Haryana, and Uttar Pradesh. During the field survey it was observed that major Basmati Rice transplanting is done in the month of July and 1st fortnight of August. The mostsown Basmati varieties in the study area are (PB-1509, PB-1692, PB-1847), (PB-1121, PB-1718, PB-1885) and (PB-1401, PB-01, PB-06). Sharbati and Sugandha majorly found in Some districts of UP and Haryana. (CSR-30, B-370, HBC-19) is also observed at some places in study areas.

- During the Basmati field survey, a few new varieties, such as PB-1847, PB-1885 and PB-1886, were also spotted in the field.

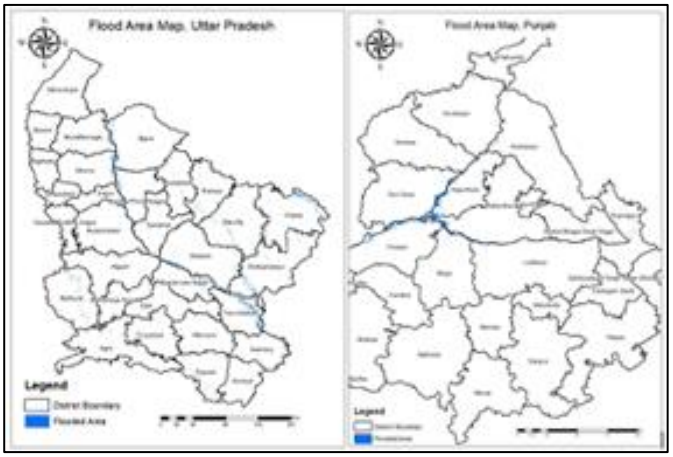
- Based on the rainfall recorded so far, excessive rainfall is observed throughout the study area. In Punjab and Haryana states excess rainfall conditions are seen in districts located in north-east parts. Very few districts of Uttar Pradesh received normal rainfall while most of the districts are received excess rainfall. Basmati districts of J&K and Uttarakhand also received excess rainfall however Normal rainfall is observed in Himachal Pradesh. Crop yields could be low in areas where excess rainfall has already passed.

- As far as crop health is concerned, in the overall study area, specifically for Punjab and Uttar Pradesh have slightly lower NDVI values in comparison to last year NDVI values which may lead to possibly low yield in the states.

- According to the field survey report and farmer-based interaction, it is revealed that the Basmati area has increased in Punjab and Uttar Pradesh.

- It is also observed that, Paddy crop area has increased while cotton crop area has decreased in the states of Punjab and Haryana.

- Flood conditions were also seen near rivers/drainage in Punjab and Uttar Pradesh. Therefore, at some places re-transplanting of Basmati crop was observed throughout the first to third week of August.



# 1. Introduction:

Among the food grains exported from India, basmati rice is a significant export product. Basmati rice is mostly farmed in India for export. a significant amount of money was made from exporting this fragrant rice product. The majority of the world's basmati rice production and exports come from India. It produces 75% of the world's basmati rice. Every year, India exports Basmati to close to 132 nations. Iran, Saudi Arabia, the United Arab Emirates, and Iraq are the main importers of these. For exporters and farmers alike, timely information regarding crop acreage, crop health, and crop varietal distribution may be essential in this situation. It aids exporters and other Basmati trade decision-makers in making judgements on the quantity and timeline.

Basmati rice is the most costly product in the world since its price is mostly set and it commands high rates on the worldwide market. Basmati rice is increasingly becoming the choice across consumer groups mainly because of its superior taste and aroma that is highly pleasing to the senses. India now has a fantastic chance to export Basmati rice to other nations. There are many downstream applications for basmati rice, and recently, deep processing and direct edible uses have elevated basmati rice to a more prominent position. The primary factor propelling the basmati rice market globally is the rise in demand for Direct Edible.

LeadsConnect services Pvt. Ltd. is working with BDEF for the estimation/assessment of acreage, crop health and expected yield of Basmati rice during 2022 and 2023. Basmati occupies a special status in Rice cultivation. It is a variety of long, slender grained, aromatic rice. In India, Basmati rice is grown in the specific geographical area, at the Himalayan foot-hills confined into few states of India. As part of scope, Basmati survey to be carried out in seven area viz., Punjab, Haryana, Himachal Pradesh, Uttarakhand, Delhi, Western UP and J&K. These states are located at northern parts of our country.

Keeping this in view, the Basmati Export Development Foundation (BEDF), New Delhi awarded M/s. LeadsConnect services Pvt. Ltd. the work of Crop Survey for estimation/assessment of acreage, crop health and expected yield of Basmati rice during 2023. This will include the all basmati rice crop varieties differentiated in traditional and evolved varieties of Basmati rice and Sharbati and Sugandha varieties of Non- Basmati. Survey will be attempted through the satellite imageries and field based methods for assessment of acreage, crop health and yield of Basmati rice during Kharif 2023.

The use of Satellite Image based Remote Sensing and GIS technique offers an effective system for monitoring crops, its type, Crop health and acreage estimation at large spatial extent. The remote sensing based solution is relatively quick, affordable, and more successful. Additionally, remote sensing sensors are a great option for retrieving temporal information about crop phenology, plant health (stress), response to weather, and soil nutrients (such as manure and fertilizer) due to their repetitive data acquisition capabilities. Monitoring agricultural crops and export vegetation phenology is made possible by the free availability of optical remote sensing data from Sentinel-2 satellites with multiple spectral bands in the red, red edge, and near infrared (NIR). The present study has been conducted on area, production and productivity of basmati rice of India. The nature of data used for study is based on the Remote sensing, field based study and secondary data collected from different sources. The growth in area, productivity and production of basmati rice was measured by integrated methods applied for the study.

The present report gives the estimates of field and satellite survey based acreage of Basmati rice, crop health and information of Basmati varieties along with other non-notified selected varieties present in field during survey. In the line with scope of the project, an app-based field survey was also conducted by LeadsConnect to know the current status of Basmati crop in districts of GI area.

## 2. Objective and Scope of work:

The major objective of the project can be listed as:

1. "Field based survey to be carried out on the basis of sample group of farmers selected at district level in seven GI area states viz., Punjab, Haryana, Himachal Pradesh, Uttarakhand, Delhi, Western UP and J&K".
2. To provide Remote Sensing based estimation of Crop Area, Crop Health and Production estimate of notified Basmati Rice varieties.

The scope of work which included satellite images and field-based survey will cover the following activities:

1. Acreage estimation of all basmati rice crop varieties differentiated in traditional and evolved varieties of Basmati rice and Sharbati and Sugandha varieties of non-Basmati. Reports will be submitted on district level basis for each state.
2. Variety-wise Crop Health Monitoring and Analysis.
3. Variety-wise Crop maturity survey, describing the percentage of acreage under particular crop growth.
4. Climate based yield modeling using historical yield and climate data (10 years) in order to predict yield well in advance.
5. Questionnaire based sample survey of farmers for area/districts mentioned above with a suitable sample size covering all blocks of the respective districts. The sample size may be arrived at, taking in to view the crop density in the concerned block. The contact details of the farmers included in the survey may be provided. Reports to mention as to how many farmers and how much crop area has been covered from each block/district.
6. Percentage-wise sale/distribution of basmati seeds by different agencies including Govt. sources, private sector for each variety. This information should be contained in report for the month of July.
7. Crop cutting experiment in sample areas for yield estimation.

# 3. Study Area:

The study area includes total 85 districts of Basmati rice and non-Basmati rice (Sharbati and Sugandha), which includes

- 23 Districts of Punjab,
- 30 Districts of Uttar Pradesh,
- 22 Districts of Haryana,
- 3 Districts of Jammu & Kashmir,
- 4 Districts of Uttarakhand,
- 2 District of Himachal Pradesh and
- NCT of Delhi

The map of the entire study area including all districts in the designated States is being given below:

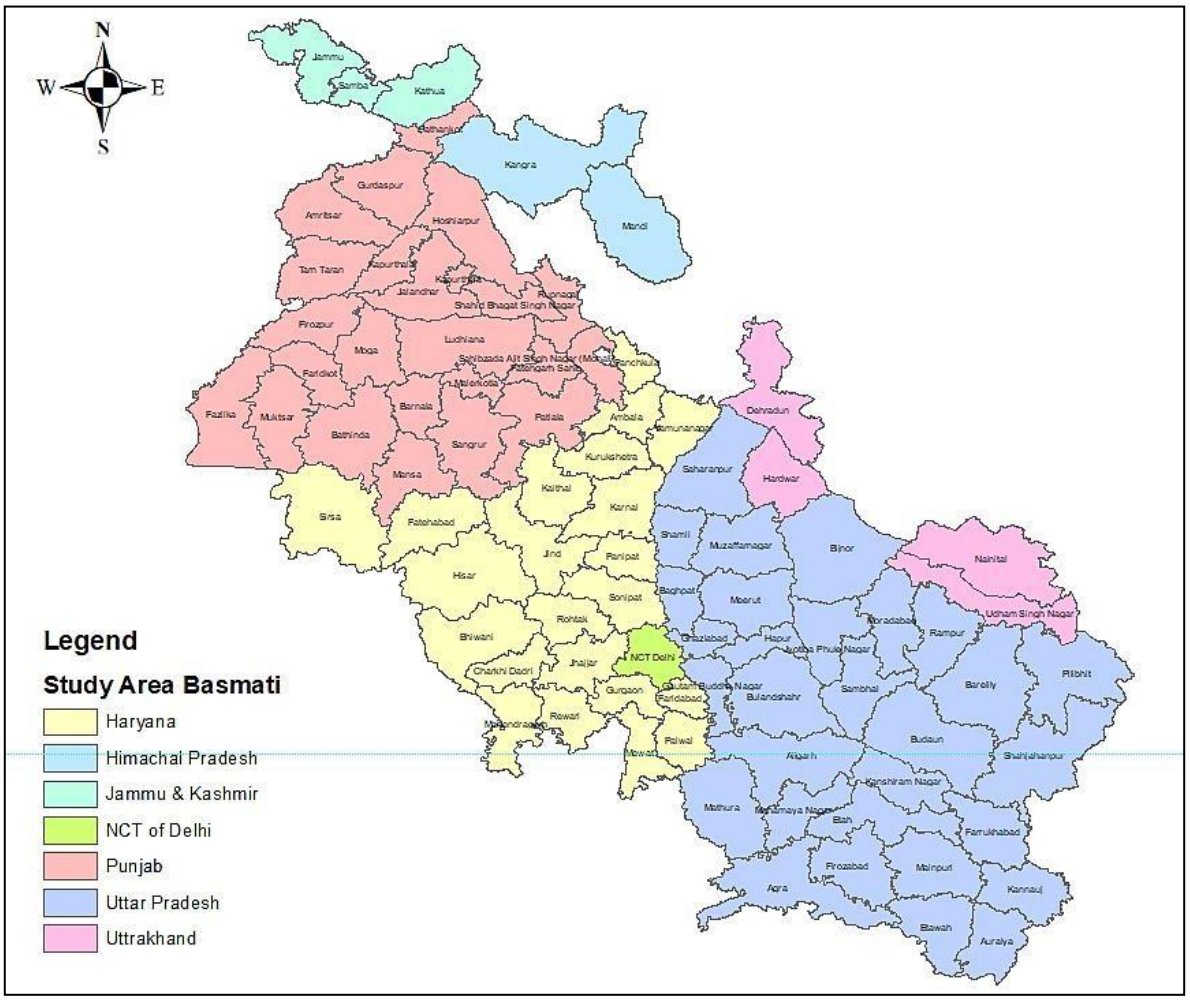



***Fig. 1: Project Study area***

# 4. Approach & Methodology:

## 4.1 Basmati Rice Acreage Estimation:

Remote sensing-based approach supported with field-based survey input is used for current study. The process flow below shows, how the methods listed below is used to estimate basmati rice acreage:

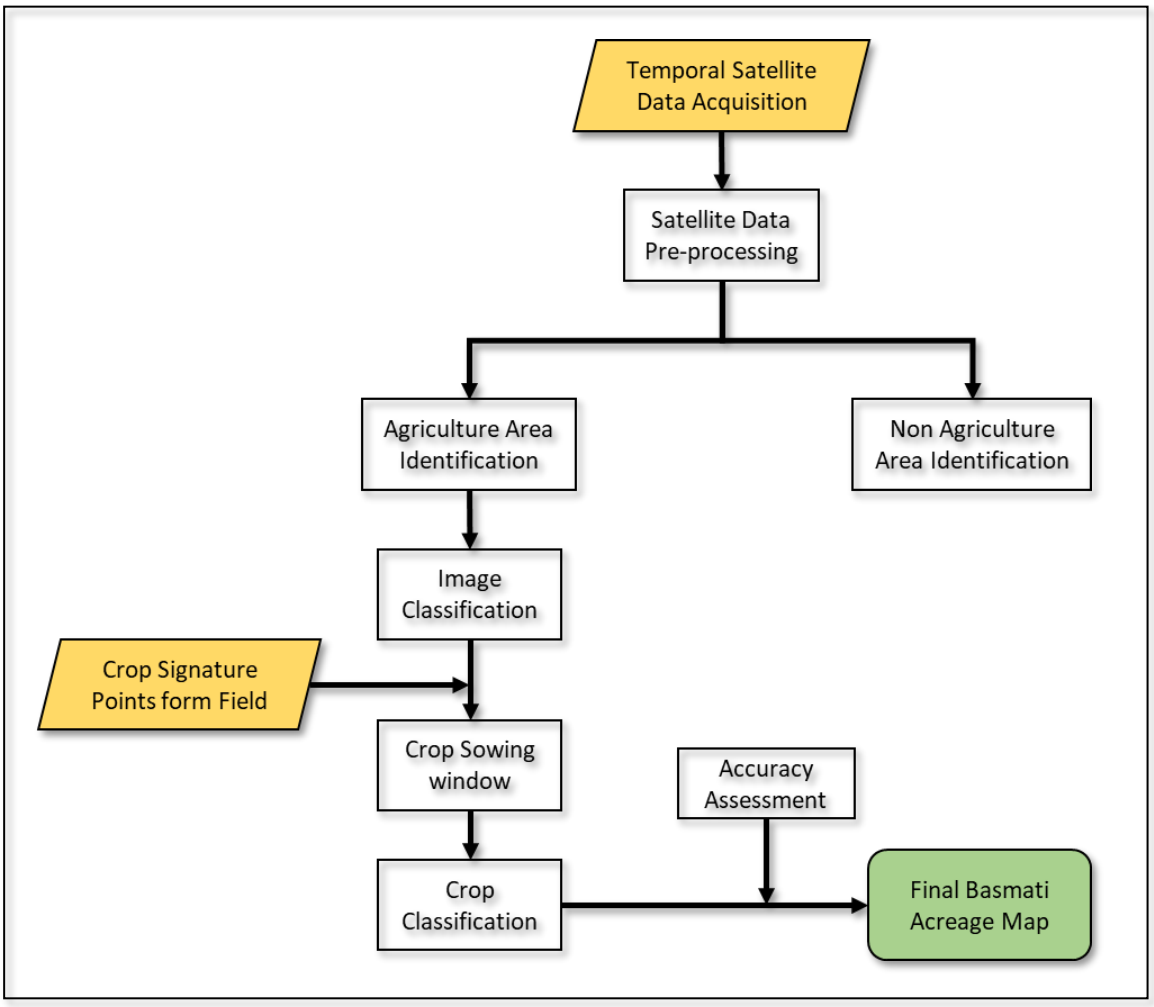



***Fig. 2: Crop classification using remote sensing***

The details of the adopted methodology can be summarized as below:

- Temporal data of sentinel-1 (SAR) during the cropping period was used for remote sensing based sowing estimation and corresponding best available optical data was used for reference. Date range which is used for acreage estimation of rice is given in table:

| State | Satellite Data Used | Data Duration | Reference Data & Duration |
|---|---|---|---|
| Punjab | Temporal Sentinel-1 (SAR) | 10th June to 21st Aug | Optical Satellite Data (02Aug -12Aug) |
| Haryana | Temporal Sentinel-1 (SAR) | 10th June to 21st Aug | Optical Satellite Data (02Aug - 12Aug) |
| Uttar Pradesh | Temporal Sentinel-1 (SAR) | 25th June to 21st Aug | Optical Satellite Data (02Aug - 17Aug) |
| Uttarakhand | Temporal Sentinel-1 (SAR) | 5th June to 16th Aug | Optical Satellite Data (02Aug - 12 Aug) |
| Jammu & Kashmir | Temporal Sentinel-1 (SAR) | 10th June to 14th Aug | Optical Satellite Data (12Aug) |
| Himachal Pradesh | Temporal Sentinel-1 (SAR) | 10th June to 16th Aug | Optical Satellite Data (02Aug - 12Aug) |

- Pre-processing of satellite data was performed, and all necessary corrections applied to remove noise in satellite data. FCC was generated using temporal dates for better interpretation.
- Non- agriculture area was removed using latest available optical satellite data.
- To achieve the accuracy of crop classification, a field survey is conducted during 21st Aug to 26th Aug 2023 in different districts of Haryana, Punjab and Uttar Pradesh. During field survey, estimation of sowing, GCP point collection for crop signature, field photographs and discussion-based crop condition was assessed. This information was used for the finalization of sowing status in study area.
- Image classification was performed using suitable software and reliable ground truth information to get the area statistics of rice.
- Ancillary data collected from different sources were also used for paddy area validation.

## 4.2 Crop Health Assessment

Crop Health Assessment is done using Normalized Difference Vegetation Index (NDVI) for all the study districts. NDVI measures the greenness and the density of the vegetation captured in a satellite image. NDVI calculated over a crop period can reveal a lot about the changes in their condition. Healthy vegetation has a very characteristic spectral reflectance curve which we can benefit from by calculating the difference between two bands – visible red and near-infrared. NDVI can be derived from satellite imagery and calculated in accordance with the formula:

**NDVI = (NIR-Red) / (NIR+Red)**

Where:

- NIR – light reflected in the near-infrared spectrum
- RED – light reflected in the red range of the spectrum

NDVI is that difference expressed as a number – ranging from -1 to 1. In most cases, NDVI values between 0.2 and 0.4 correspond to areas with sparse vegetation; moderate vegetation tends to vary between 0.4 and 0.6; anything above 0.6 indicates the highest possible density of green leaves.

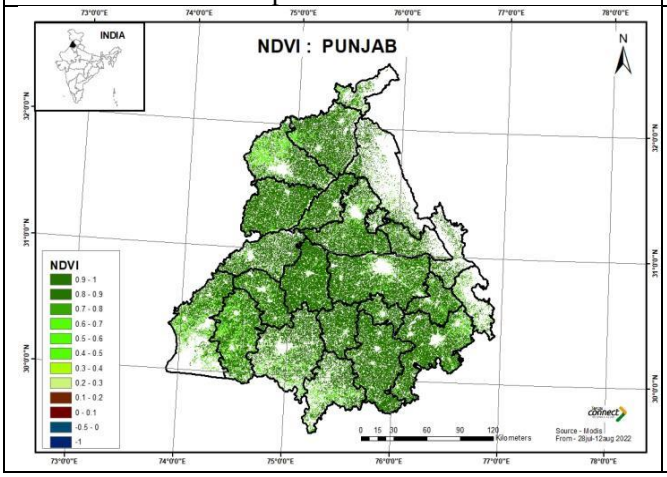
For current study crop health assessment is done for all the study districts using MODIS NDVI product (250m). Current year's NDVI (Mid July to Mid Aug 2023) is compared with last year's NDVI (Mid July to Mid Aug 2023).

District wise Crop Health Monitoring status for all the states is shown below:

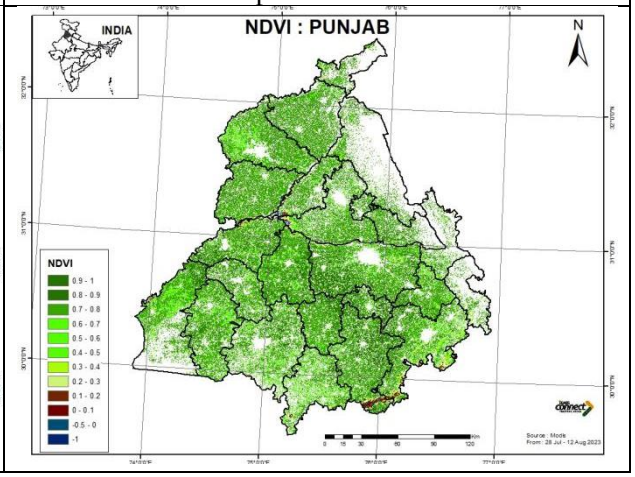
**Punjab:**

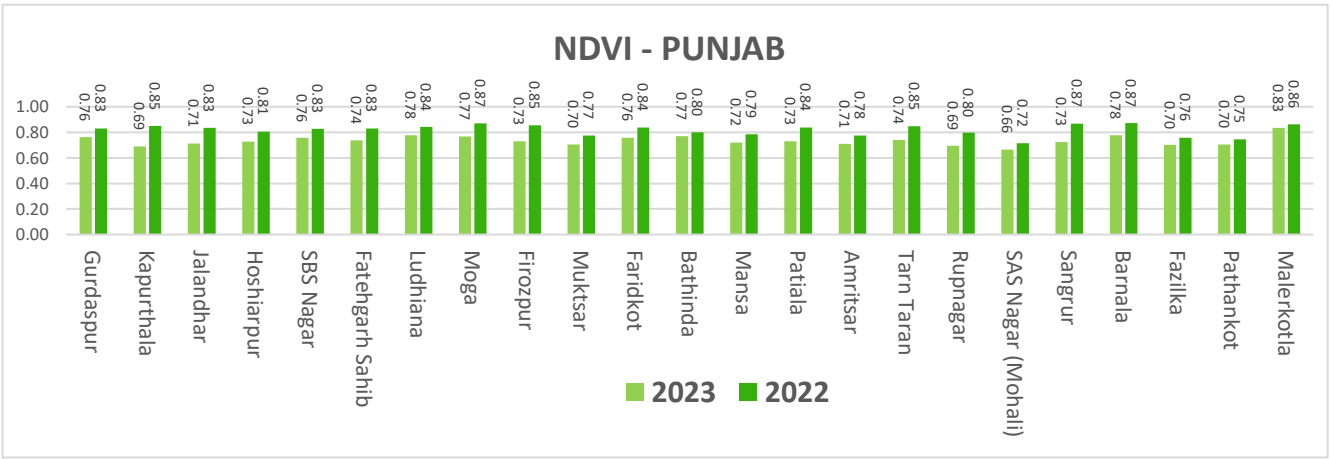
District wise rice crop health condition for 2022 and 2023 is presented in below map and graph. Overall crop condition is good in all districts however last year NDVI condition is better than current year. This may be due to difference in crop growth of plant therefore yield may be impacted and may be possibly low in Punjab state. Maximum NDVI is observed in Barnala district while lowest is in Jalandhar district.

Crop Health 2022



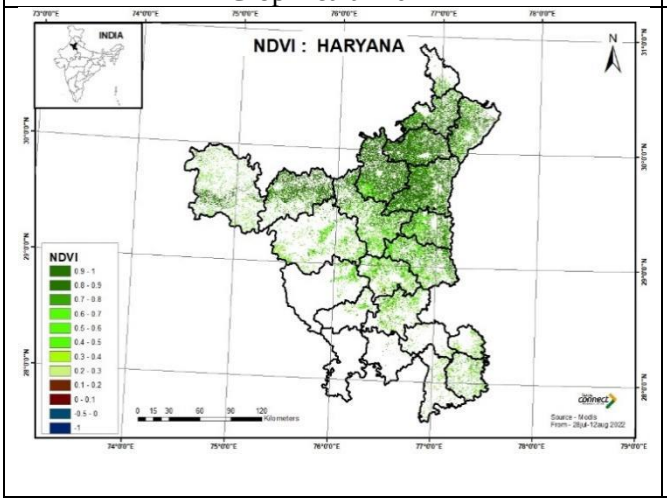
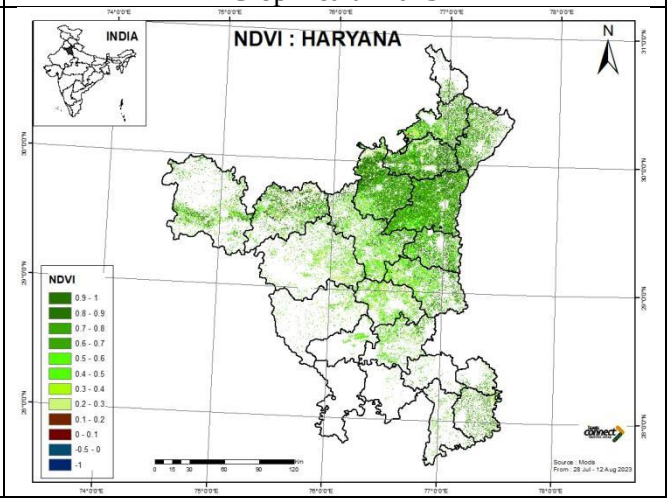

Crop Health 2023



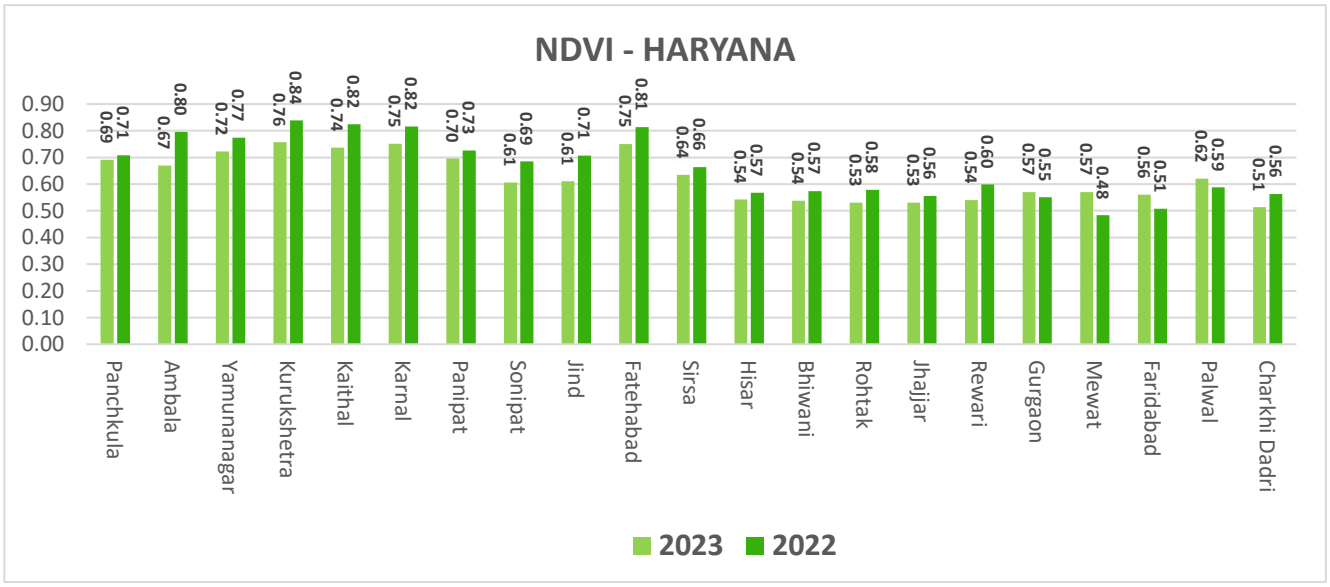



**Haryana:**

In Haryana, the status of the Basmati crop is generally favorable. Crop condition is good in almost districts of Haryana. The health of the basmati rice crop by district for 2022 and 2023 is shown below. Kurukshtra and Mewat districts are showing the maximum and minimum NDVI value in state respectively.

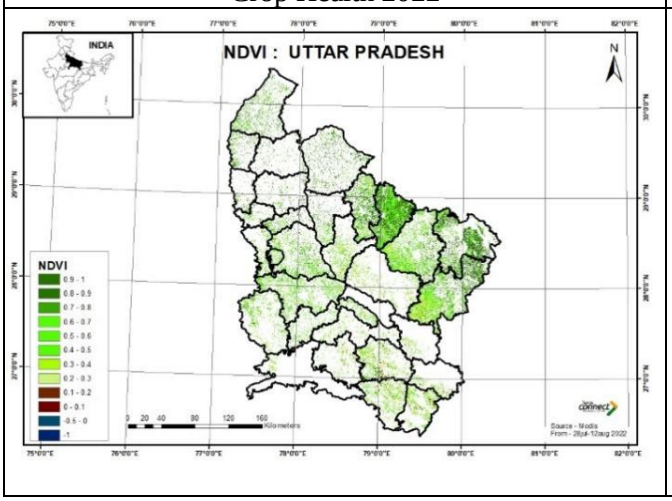
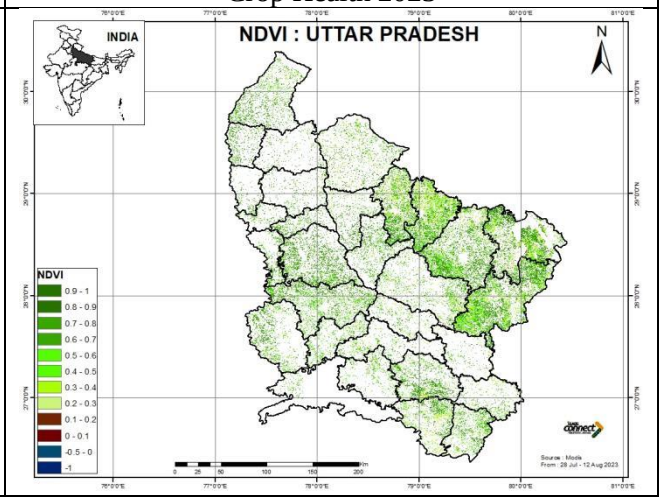
| Crop Health 2022 | Crop Health 2023 |
|---|---|
|  |  |



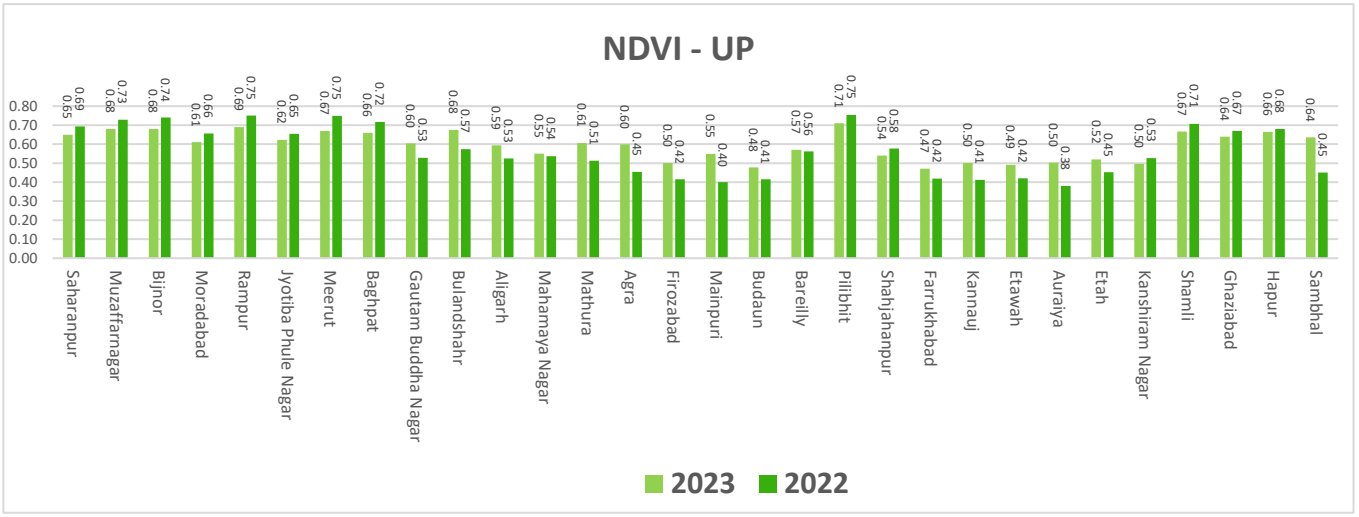


### Uttar Pradesh:

In Uttar Pradesh NDVI reveals that overall Basmati crop condition is good in all districts. Better Crop growth is observed as compared to last year in many districts. However, yield can be low in areas where crop growth is impacted due to excess rainfall. District wise basmati rice crop health condition for 2022 and 2023 is illustrated in below map and graph.

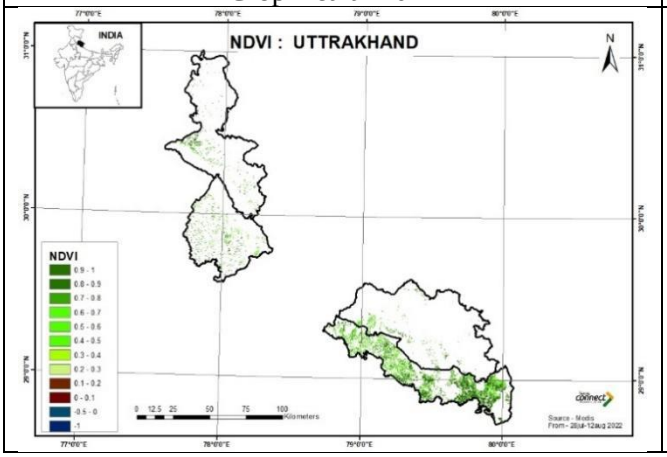
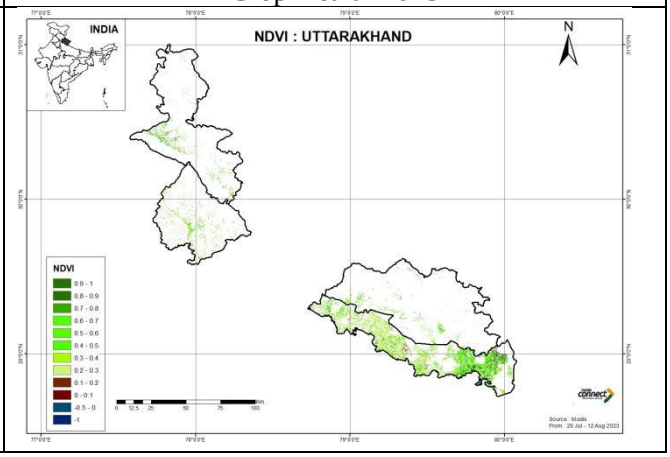
| Crop Health 2022 | Crop Health 2023 |
|---|---|
|  |  |





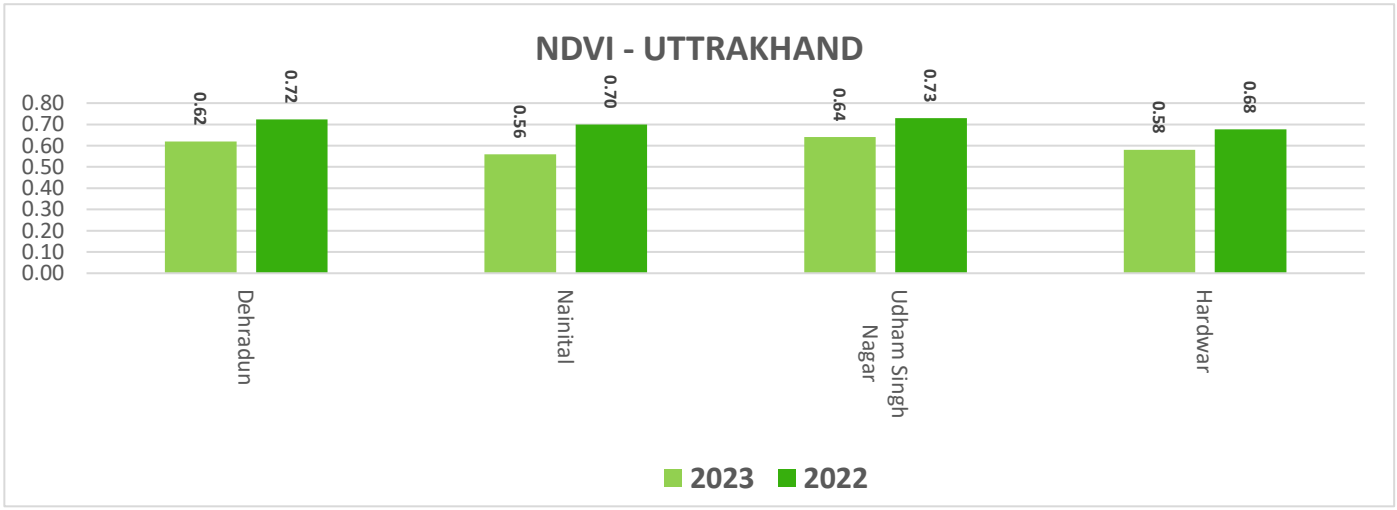
**Uttarakhand:**

The map and graph below show the district-level Basmati rice crop health condition for 2022 and 2023. In all districts, the overall crop status is good. The area with the highest NDVI is Udham Singh Nagar, followed by the Dehradun district.

| Crop Health 2022 | Crop Health 2023 |
|---|---|
|  |  |

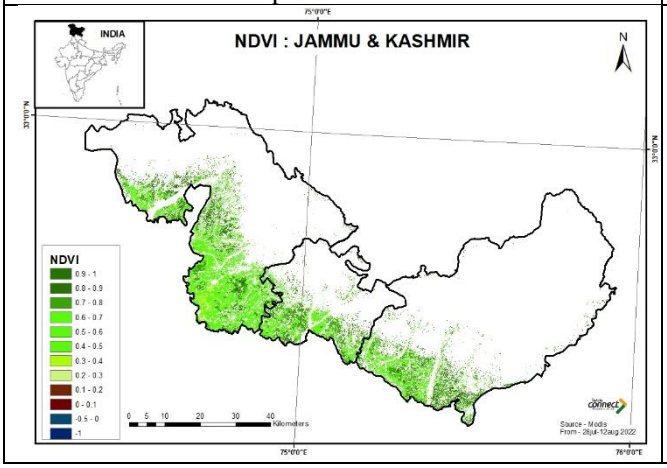
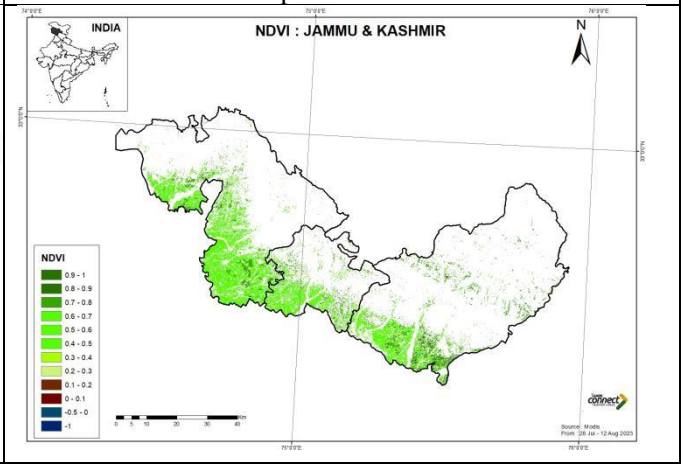




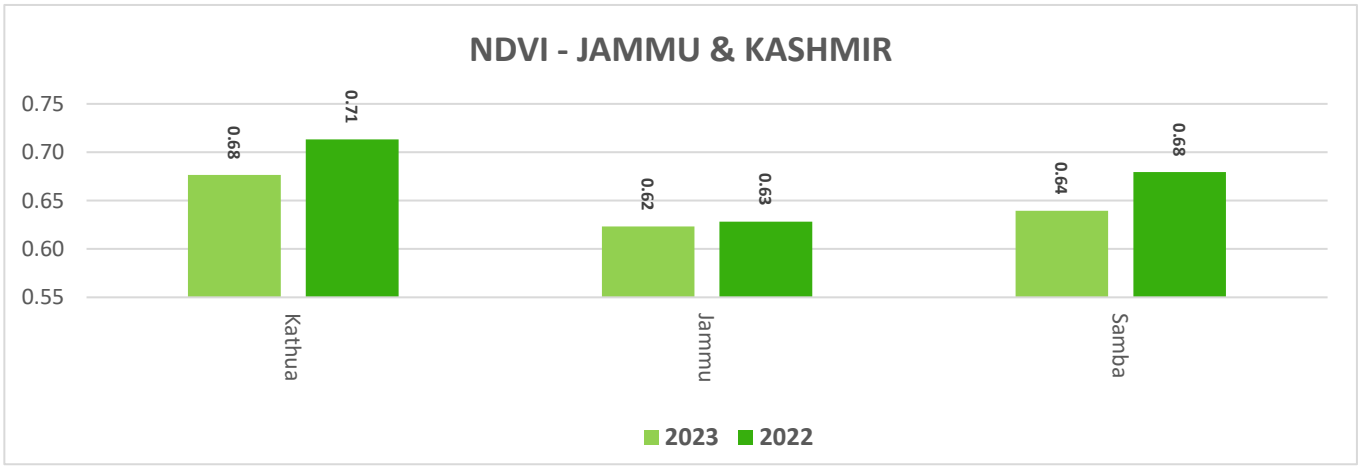


**Jammu & Kashmir:**

In comparison to previous year, districts in Jammu and Kashmir are displaying low NDVI however crop is healthy as showing by NDVI values. Kathua district is where the NDVI is at its highest.

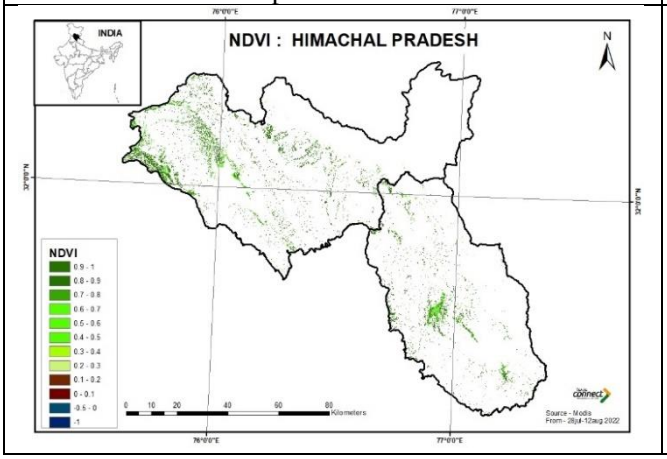
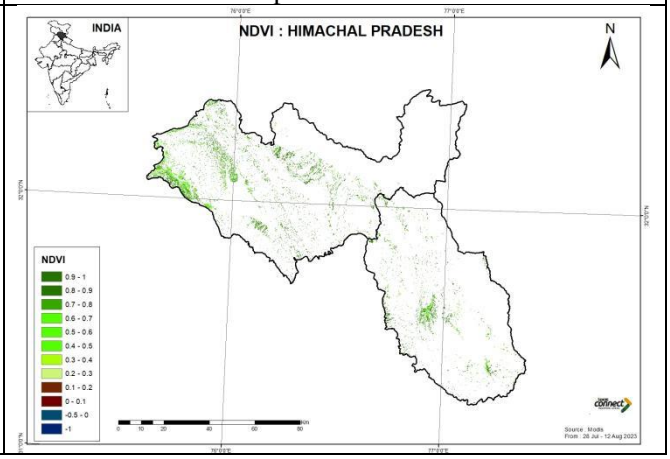
| Crop Health 2022 | Crop Health 2023 |
|---|---|
|  |  |



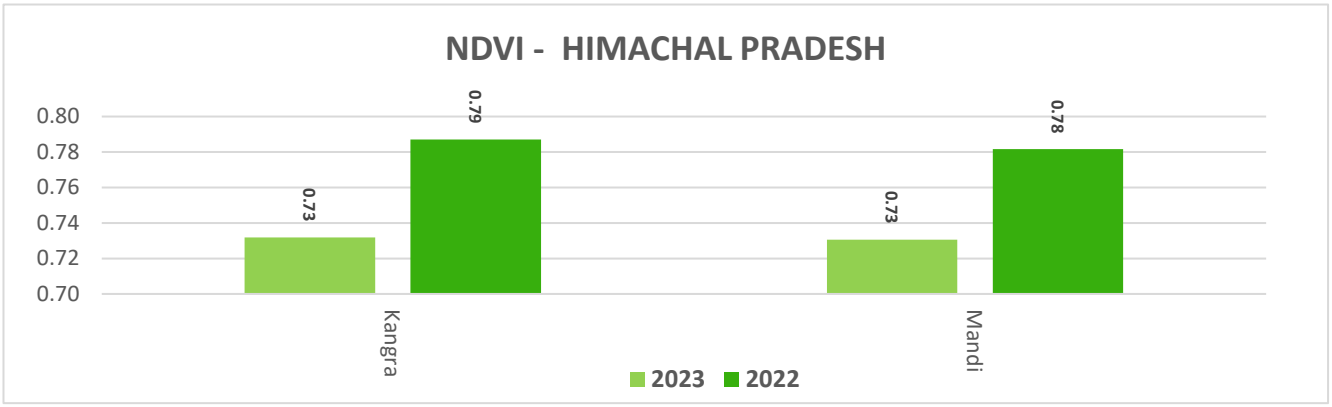


**Himachal Pradesh:**

Both the districts of Himachal Pradesh are showing good crop health condition as good NDVI value is observed in both the districts. District wise basmati rice crop health condition for 2022 and 2023 is presented in below map and graph.

| Crop Health 2022 | Crop Health 2023 |
|---|---|
|  |  |





# 5. Results:

- **Satellite Image and Field based Basmati Rice Acreage**

The estimation of Basmati rice acreage was carried out using a hybrid approach adopted. Sentinel-1 (SAR) data were utilized to classify the Basmati crop using GCP, the sowing cycle, and with the help of other field data collected in the study area. A state wise acreage map and area statistics are given below in the table. Punjab is estimated to have 785.97 thousand hectares of basmati area, followed by Haryana, Uttar Pradesh, Jammu & Kashmir, Uttarakhand, and Himachal Pradesh with 748.23, 463.93, 46.13, 17.05, and 5.59 thousand hectares, respectively.

| Satellite Data and Field-based Basmati Rice Acreage Details | | | |
|---|---|---|---|
| **S. No.** | **State Name** | **Basmati Acreage (000' ha)** | **Major Basmati Rice varieties Found** |
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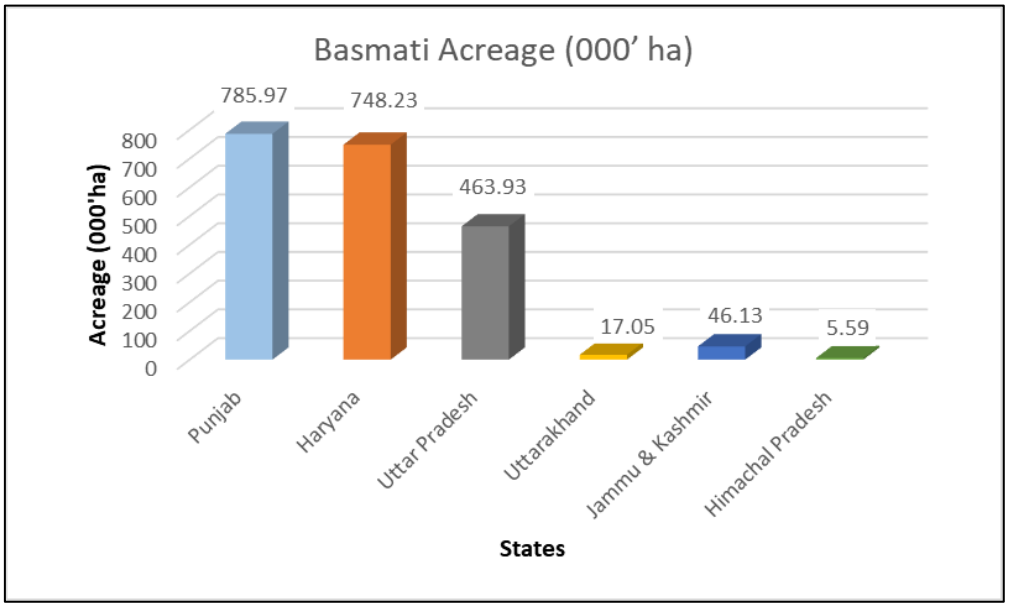
| **Total** | | **2066.90** | |




**State wise Basmati Rice Acreage**

## Basmati Rice Acreage- Punjab:

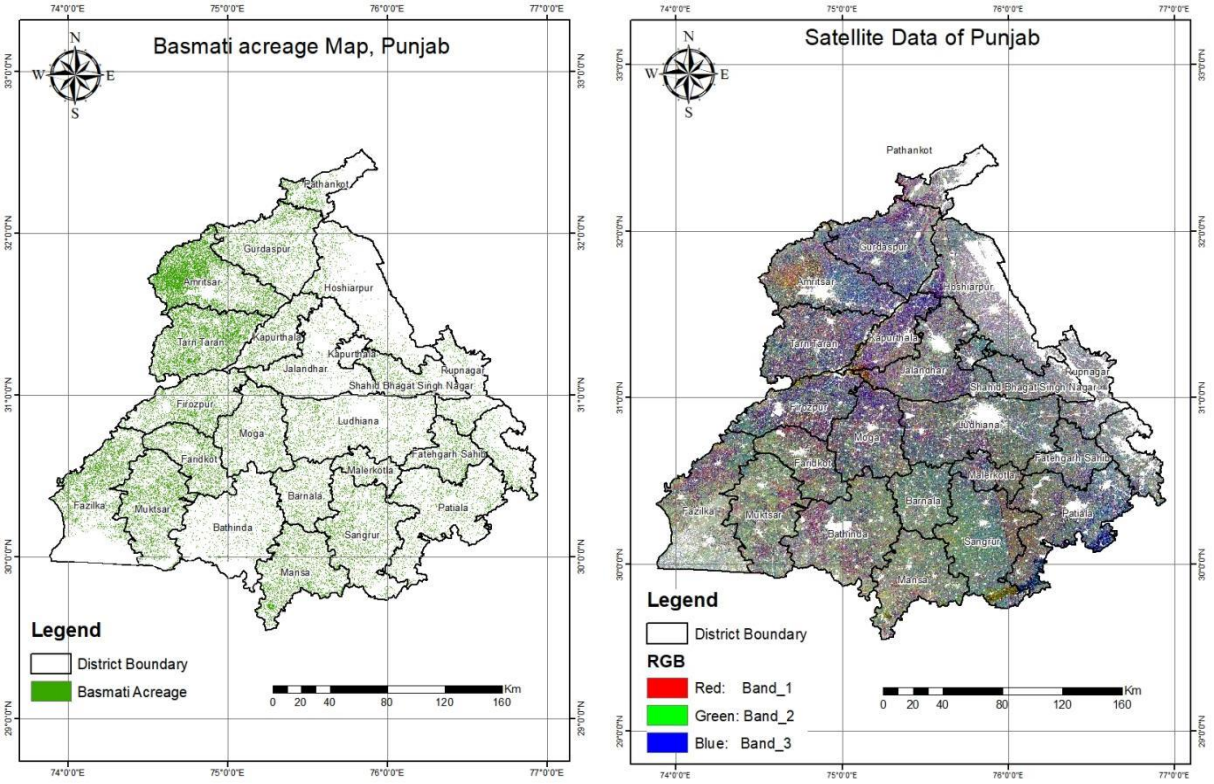



*Fig. 5: Basmati Rice Acreage map and satellite data, Punjab*

| Satellite data and field-based Basmati acreage detail of Punjab | | | |
|---|---|---|---|
| **S. No.** | **State Name** | **District Name** | **Basmati Acreage (000' ha)** |
| 1 | Punjab | Amritsar | 124.12 |
| 2 | | Barnala | 18.78 |
| 3 | | Bathinda | 20.82 |
| 4 | | Faridkot | 36.64 |
| 5 | | Fatehgarh Sahib | 15.38 |
| 6 | | Fazilka | 62.11 |
| 7 | | Firozpur | 48.27 |
| 8 | | Gurdaspur | 44.64 |
| 9 | | Hoshiarpur | 9.12 |
| 10 | | Jalandhar | 19.96 |
| 11 | | Kapurthala | 19.92 |
| 12 | | Ludhiana | 36.11 |
| 13 | | Malerkotla | 9.21 |
| 14 | | Mansa | 38.23 |
| 15 | | Moga | 32.93 |
| 16 | | Muktsar | 49.03 |
| 17 | | Pathankot | 9.86 |
| 18 | | Patiala | 29.17 |
| 19 | | Rupnagar | 8.72 |
| 20 | | Sahibzada Ajit Singh Nagar (Mohali) | 10.88 |
| 21 | | Sangrur | 44.98 |
| 22 | | Shahid Bhagat Singh Nagar | 13.54 |
| 23 | | Tarn Taran | 83.55 |
| | **Total** | | **785.97** |

The total area under Basmati rice coverage in Punjab is 785.97 thousand hectares. As per the acreage estimation study highest area is observed Amritsar district followed by Tarn Taran while lowest acreage is observed in Rupnagar district.

## Basmati Rice Acreage -Haryana:

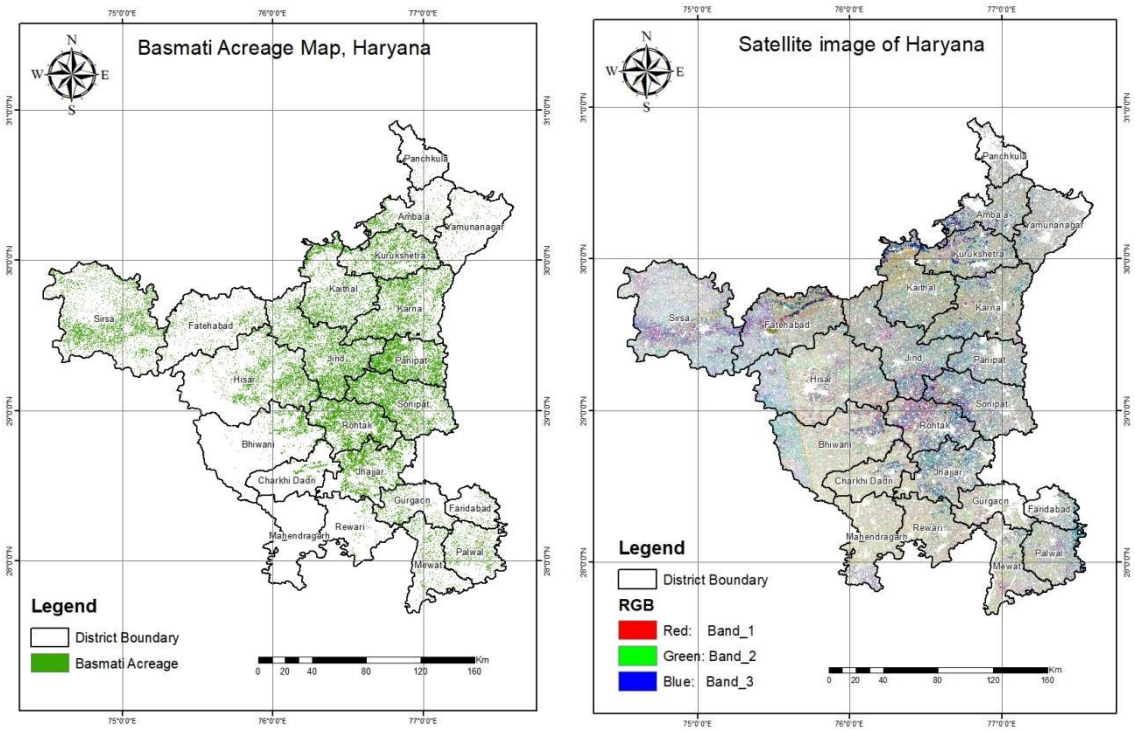



*Fig. 6: Basmati Rice Acreage map and satellite data, Haryana*

| Satellite data and field-based Basmati Rice Acreage detail of Haryana | | | |
|---|---|---|---|
| **S. No.** | **State Name** | **District Name** | **Basmati Acreage (000' ha)** |
| 1 | Haryana | Ambala | 15.40 |
| 2 | | Bhiwani | 17.36 |
| 3 | | Charkhi Dadri | 5.20 |
| 4 | | Faridabad | 6.48 |
| 5 | | Fatehabad | 16.29 |
| 6 | | Gurgaon | 2.20 |
| 7 | | Hisar | 65.47 |
| 8 | | Jhajjar | 46.54 |
| 9 | | Jind | 90.16 |
| 10 | | Kaithal | 54.88 |
| 11 | | Karnal | 72.90 |
| 12 | | Kurukshetra | 43.82 |
| 13 | | Mewat | 4.43 |
| 14 | | Palwal | 16.15 |
| 15 | | Panchkula | 0.83 |
| 16 | | Panipat | 61.71 |
| 17 | | Rewari | 3.41 |
| 18 | | Rohtak | 66.80 |
| 19 | | Sirsa | 74.94 |
| 22 | | Sonipat | 77.85 |
| 21 | | Yamunanagar | 5.43 |
| | | **Total** | **748.23** |

Haryana has been noted to have 748.23 thousand hectares of basmati rice. Haryana's Jind district has the highest acreage, followed by Sonipat and Panchkula district has the lowest acreage.

## Basmati Rice Acreage - Uttar Pradesh:

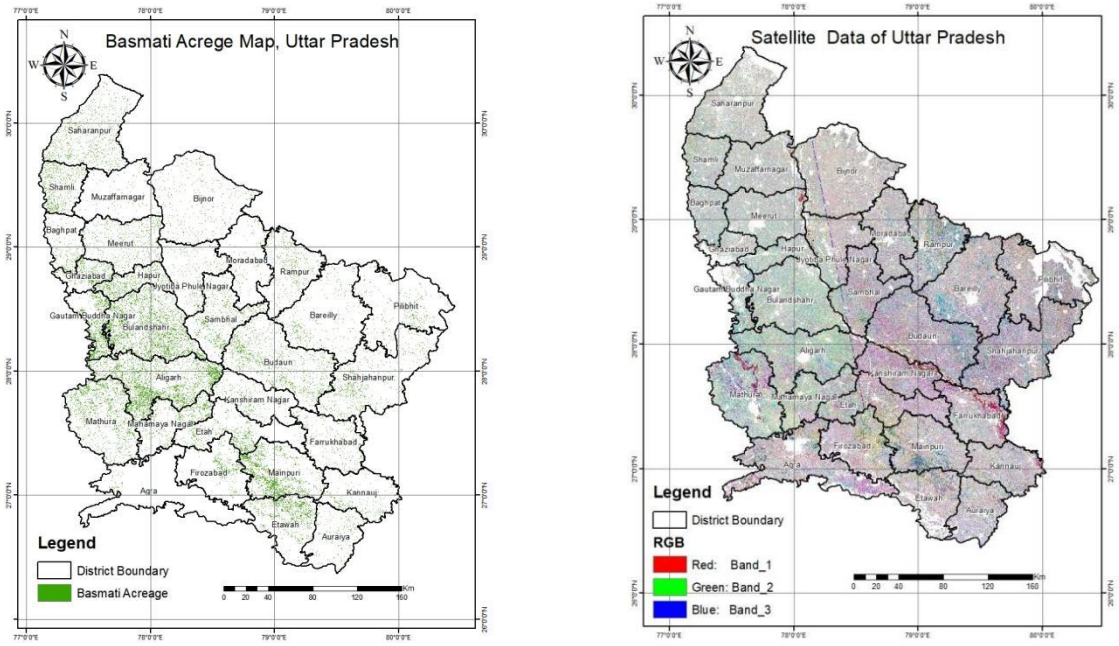



*Fig. 7: Basmati Rice Acreage map and satellite data, Uttar Pradesh*

| Satellite data and field-based Basmati Rice Acreage detail of Uttar Pradesh | | | |
|---|---|---|---|
| **S. No.** | **State Name** | **District Name** | **Basmati Acreage (000' ha)** |
| 1 | Uttar Pradesh | Agra | 0.95 |
| 2 | | Aligarh | 61.78 |
| 3 | | Auraiya | 4.95 |
| 4 | | Baghpat | 5.03 |
| 5 | | Bareilly | 8.42 |
| 6 | | Bijnor | 8.21 |
| 7 | | Budaun | 24.62 |
| 8 | | Bulandshahr | 62.92 |
| 9 | | Etah | 12.63 |
| 10 | | Etawah | 20.67 |
| 11 | | Farrukhabad | 7.82 |
| 12 | | Firozabad | 7.41 |
| 13 | | Gautam Buddha Nagar | 20.69 |
| 14 | | Ghaziabad | 11.79 |
| 15 | | Hapur | 13.86 |
| 16 | | Jyotiba Phule Nagar | 5.66 |
| 17 | | Kannauj | 5.15 |
| 18 | | Kanshiram Nagar | 6.23 |
| 19 | | Mahamaya Nagar | 13.82 |
| 20 | | Mainpuri | 32.32 |
| 21 | | Mathura | 29.89 |
| 22 | | Meerut | 12.67 |
| 23 | | Moradabad | 4.13 |
| 24 | | Muzaffarnagar | 2.47 |
| 25 | | Pilibhit | 8.28 |
| 26 | | Rampur | 9.55 |
| 27 | | Saharanpur | 18.36 |
| 28 | | Sambhal | 15.24 |
| 29 | | Shahjahanpur | 14.63 |
| 30 | | Shamli | 13.80 |
| | **Total** | | **463.93** |

The acreage of Basmati Rice is observed in Uttar Pradesh which is 463.93 thousand hectares. In UP the highest acreage is seen in Bulandshahr district followed by Aligarh while lowest acreage is observed in Agra and Muzaffarnagar.

## Basmati Rice Acreage-Uttarakhand:

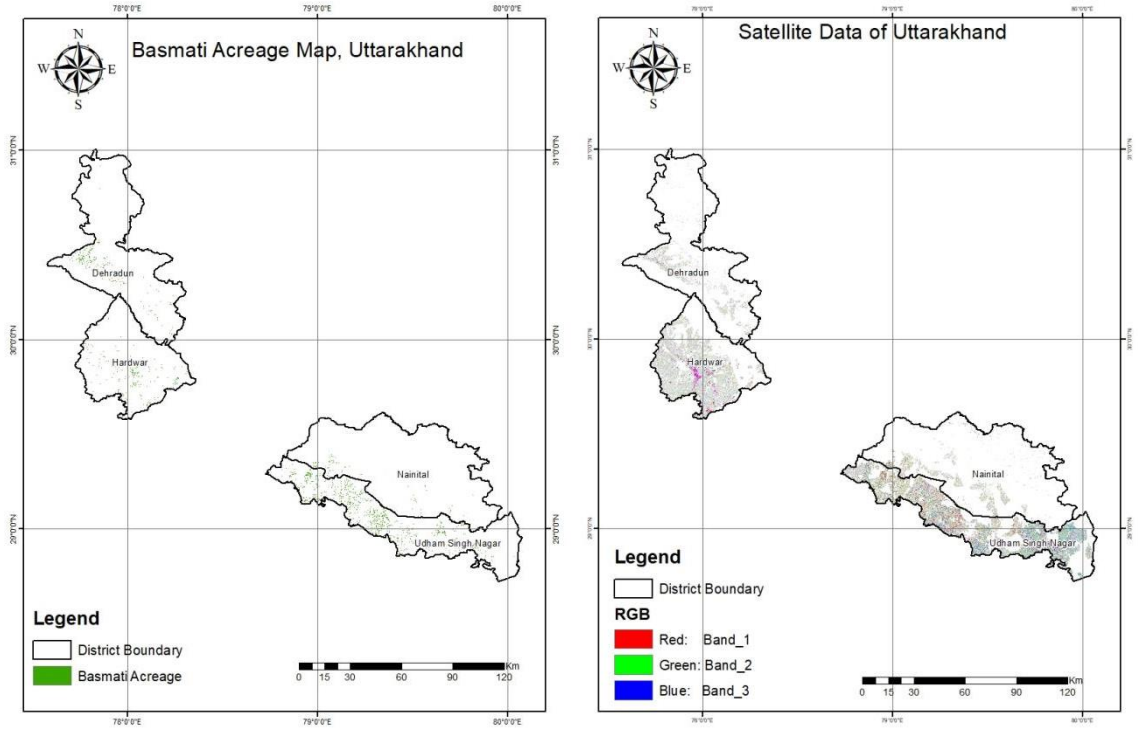



*Fig. 8: Basmati Rice Acreage map and satellite data, Uttarakhand*

| Satellite data and field-based Basmati acreage details of Uttarakhand | | | |
|---|---|---|---|
| **S. No.** | **State Name** | **District Name** | **Basmati Acreage (000' ha)** |
| 1 | Uttrakhand | Dehradun | 2.68 |
| 2 | | Hardwar | 3.22 |
| 3 | | Nainital | 1.23 |
| 4 | | Udham Singh Nagar | 9.91 |
| | **Total** | | **17.05** |

The acreage of Basmati Rice is observed in Uttarakhand is 17.05 thousand hectares. In Uttarakhand the highest acreage is observed in Udham Singh Nagar district followed by Hardwar while lowest acreage is observed in Nainital district.

## Basmati Rice Acreage-Jammu & Kashmir:

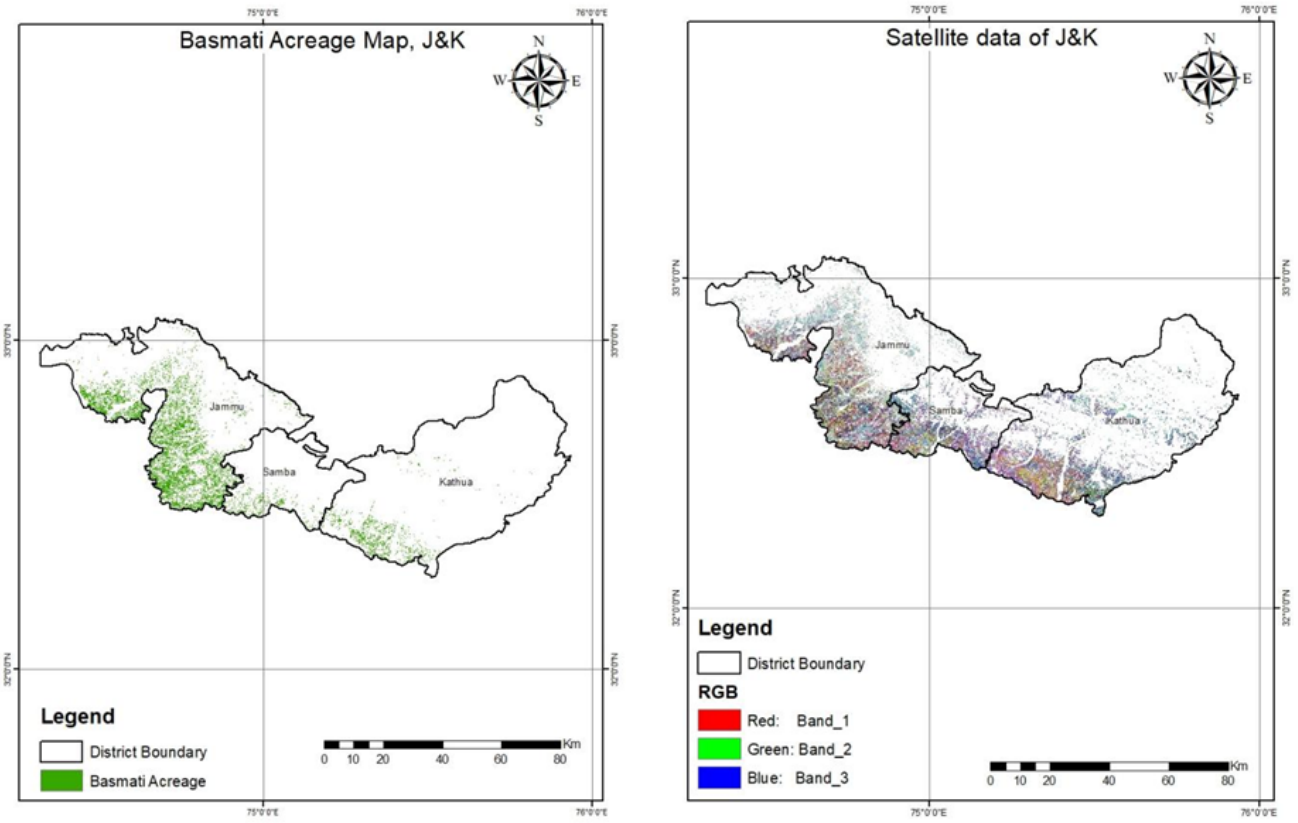



*Fig. 9: Basmati Rice Acreage map and satellite data, Jammu & Kashmir*

| Satellite data and field-based Rice acreage detail of Jammu & Kashmir | | | |
|---|---|---|---|
| **S. No.** | **State Name** | **District Name** | **Basmati Acreage (000' ha)** |
| 1 | Jammu & Kashmir | Jammu | 36.73 |
| 2 | | Kathua | 6.48 |
| 3 | | Samba | 2.93 |
| | **Total** | | **46.13** |

The J&K region has a basmati rice acreage of 46.13 thousand hectares. The largest acreage in J&K is found in the district of Jammu, followed by Kathua, while the lowest acreage is found in the district of Samba.

## Basmati Rice Acreage-Himachal Pradesh:

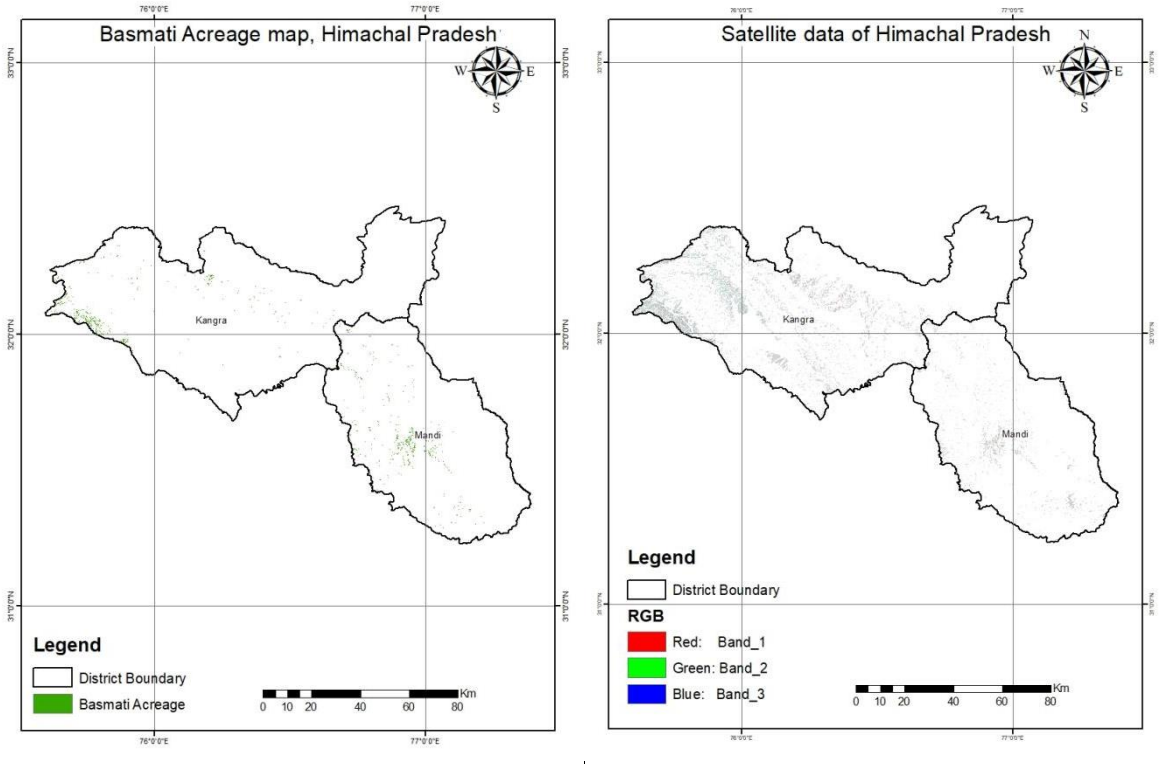



***Fig. 10: Basmati Rice Acreage map and satellite data, Himachal Pradesh***

| Satellite data and field-based Basmati acreage detail of Himachal Pradesh | | | |
|---|---|---|---|
| **S. No.** | **State Name** | **District Name** | **Basmati Acreage (000' ha)** |
| 1 | Himachal Pradesh | Kangra | 2.54 |
| 2 | | Mandi | 3.05 |
| | **Total** | | **5.59** |

The acreage of Basmati Rice is observed in Himachal Pradesh which is 5.59 thousand hectares. In HP the highest acreage is observed in Mandi while lowest acreage is observed in Kangra.

# 6. Rainfall Status:

- As per the rainfall observed till date, normal rainfall is observed in many districts of Haryana and Punjab. Excess rainfall conditions are also seen in districts located in north-east parts of Haryana and Punjab states.
- Excess rainfall has been observed in Uttar Pradesh. Very few districts received normal rainfall while most of the districts have excess rainfall condition in Uttar Pradesh.
- In the first and third week of August heavy rainfall was observed in many districts of Uttar Pradesh. Overall normal to excess rainfall conditions are seen in the State.
- In Uttarakhand, normal rainfall is observed in the Basmati districts. Basmati districts of Himachal Pradesh is showing excess rainfall conditions.
- As per the rainfall received till date, excess rainfall conditions were observed in Jammu and samba districts of J&K while normal rainfall was observed during August month in both of major Basmati growing districts.
- Cumulative rainfall conditions from 1st of June to 30th of August are presented in the figures below.

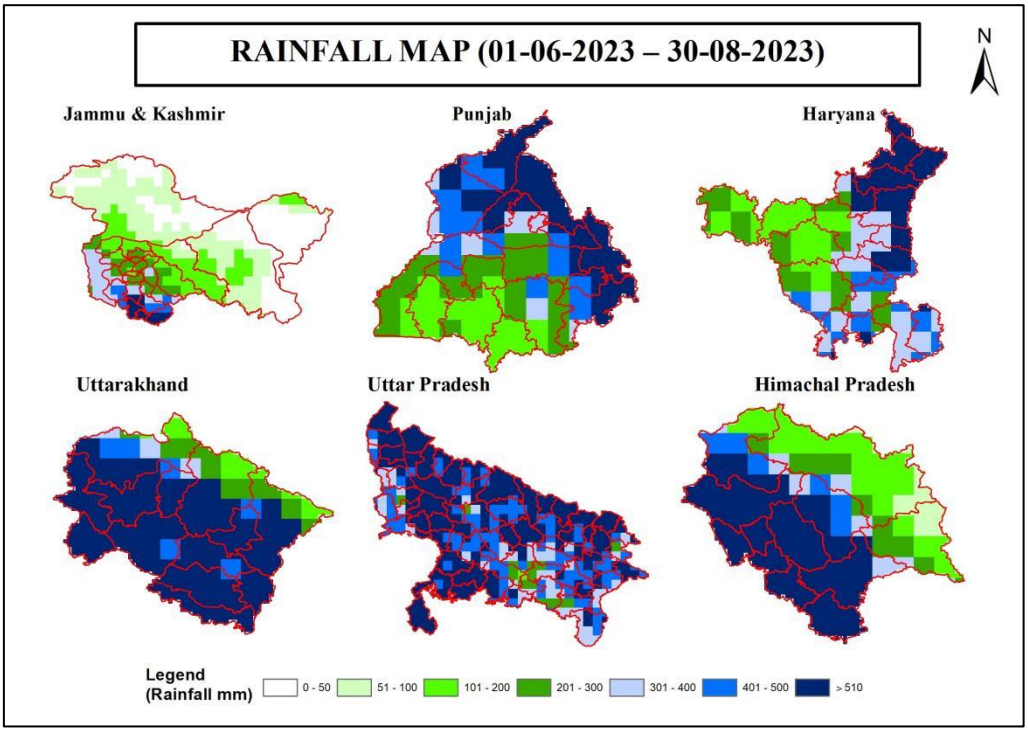
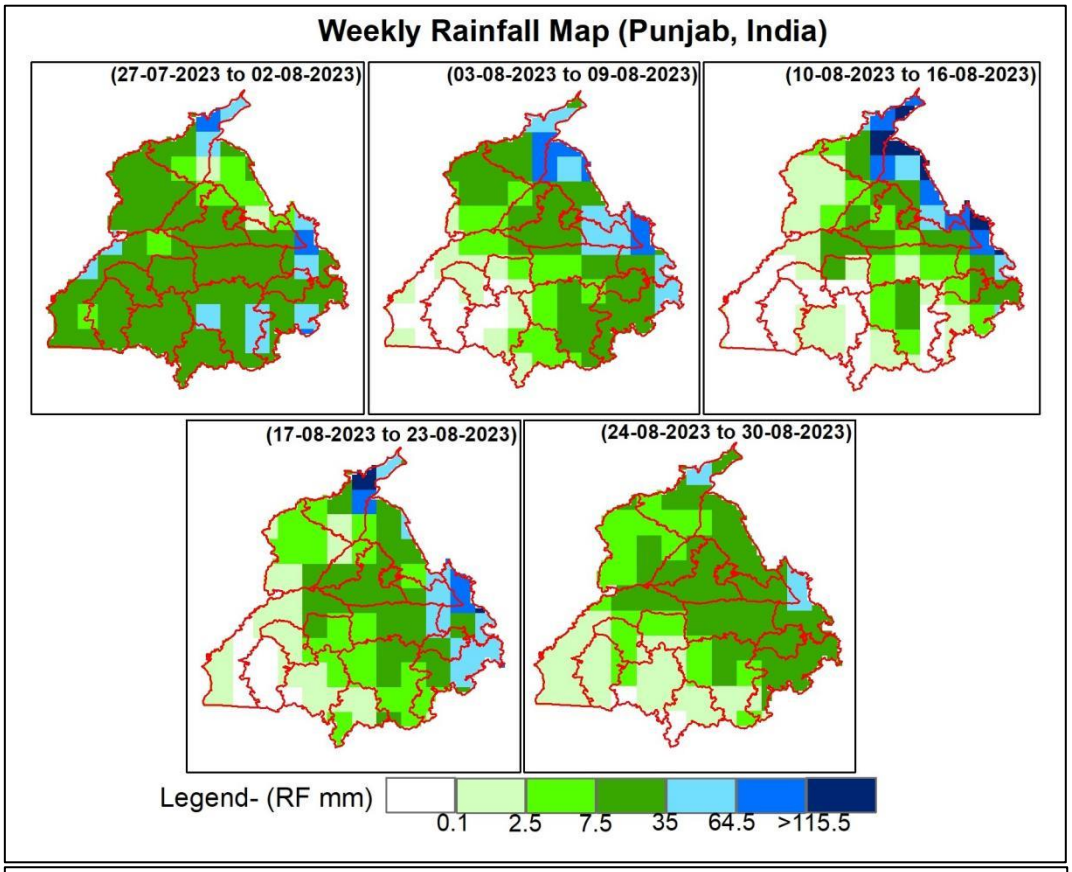
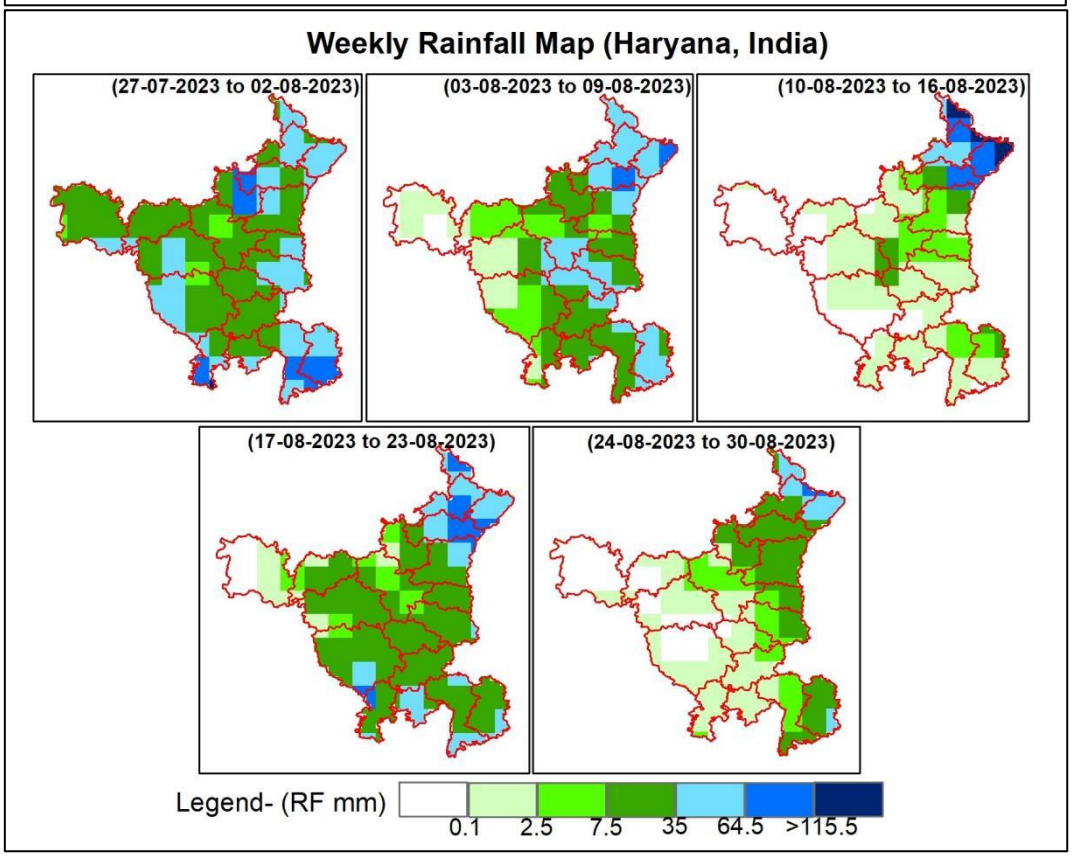
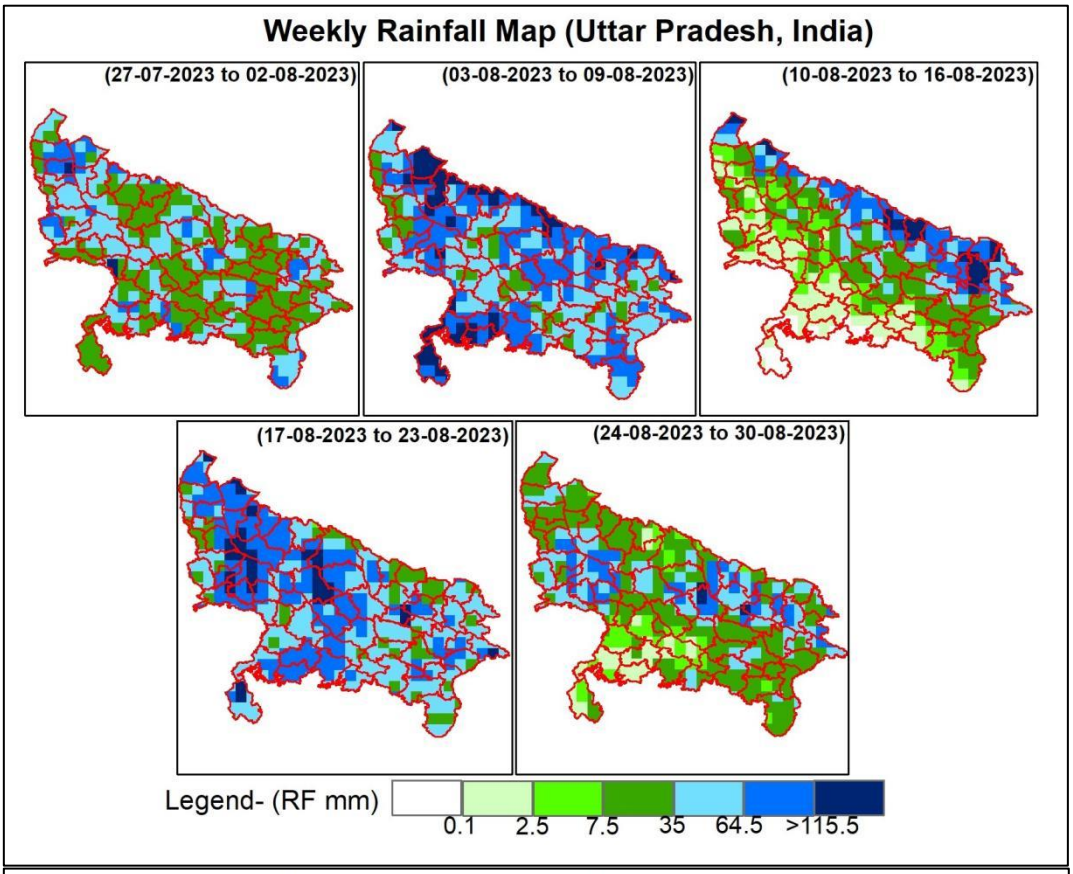
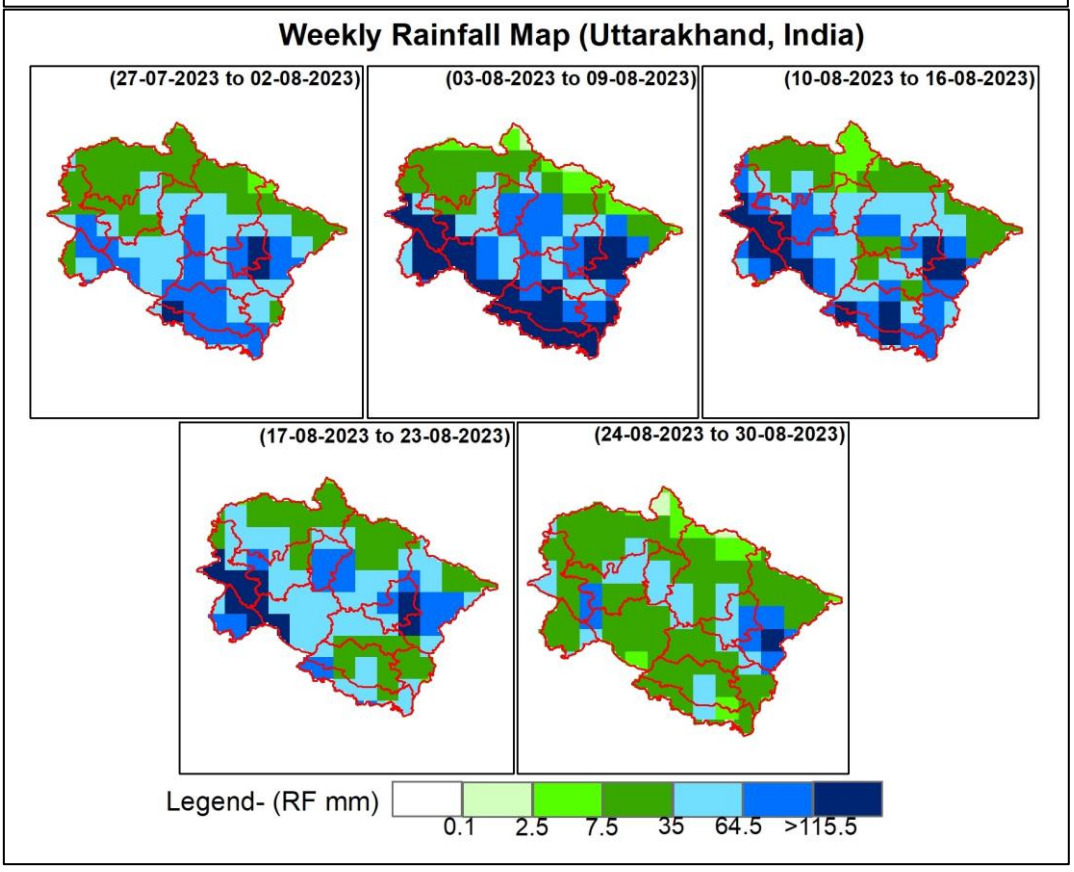


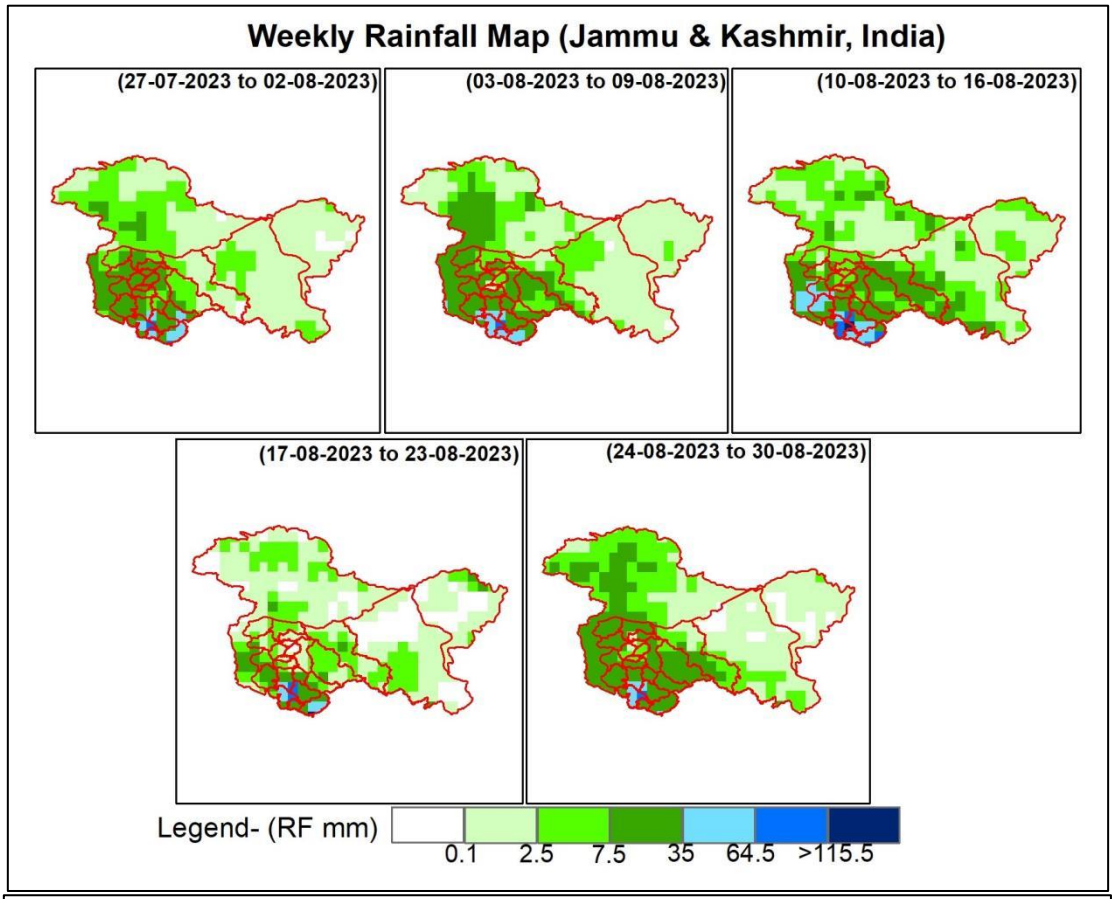

***Fig. 11: Cumulative rainfall map starting from 1st June 2023***

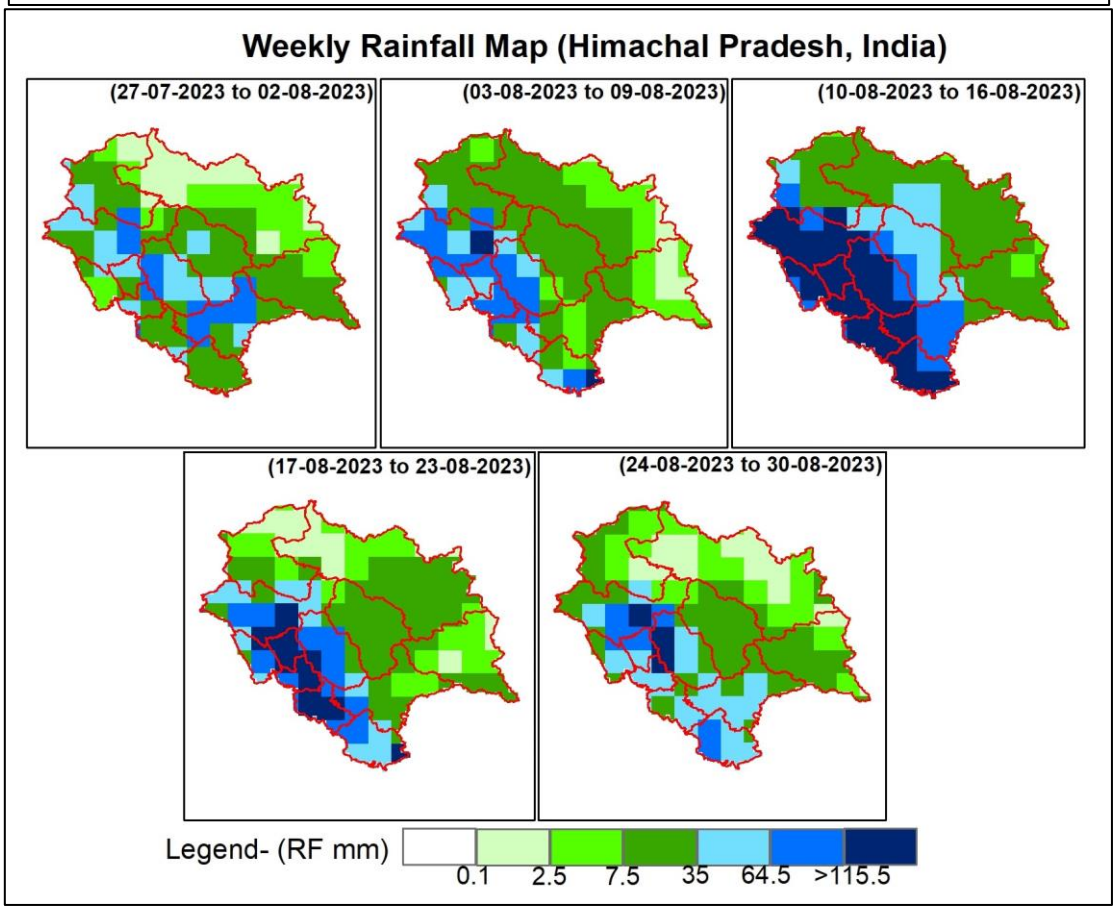

Weekly Rainfall Map (Punjab, India)
(27-07-2023 to 02-08-2023)
(03-08-2023 to 09-08-2023)
(10-08-2023 to 16-08-2023)
(17-08-2023 to 23-08-2023)
(24-08-2023 to 30-08-2023)
Legend- (RF mm)
0.1 2.5 7.5 35 64.5 >115.5


Weekly Rainfall Map (Haryana, India)
(27-07-2023 to 02-08-2023)
(03-08-2023 to 09-08-2023)
(10-08-2023 to 16-08-2023)
(17-08-2023 to 23-08-2023)
(24-08-2023 to 30-08-2023)
Legend- (RF mm)
0.1 2.5 7.5 35 64.5 >115.5


Weekly Rainfall Map (Uttar Pradesh, India)
(27-07-2023 to 02-08-2023)
(03-08-2023 to 09-08-2023)
(10-08-2023 to 16-08-2023)
(17-08-2023 to 23-08-2023)
(24-08-2023 to 30-08-2023)
Legend- (RF mm)
0.1 2.5 7.5 35 64.5 >115.5


Weekly Rainfall Map (Uttarakhand, India)
(27-07-2023 to 02-08-2023)
(03-08-2023 to 09-08-2023)
(10-08-2023 to 16-08-2023)
(17-08-2023 to 23-08-2023)
(24-08-2023 to 30-08-2023)
Legend- (RF mm)
0.1 2.5 7.5 35 64.5 >115.5


Weekly Rainfall Map (Jammu & Kashmir, India)
(27-07-2023 to 02-08-2023)
(03-08-2023 to 09-08-2023)
(10-08-2023 to 16-08-2023)
(17-08-2023 to 23-08-2023)
(24-08-2023 to 30-08-2023)
Legend- (RF mm)
0.1
2.5
7.5
35
64.5
>115.5


Weekly Rainfall Map (Himachal Pradesh, India)
(27-07-2023 to 02-08-2023)
(03-08-2023 to 09-08-2023)
(10-08-2023 to 16-08-2023)
(17-08-2023 to 23-08-2023)
(24-08-2023 to 30-08-2023)
Legend- (RF mm)
0.1
2.5
7.5
35
64.5
>115.5

# 7. Field Survey:

For Field based Basmati acreage estimation second field visits were done from 21st Aug to 29th Aug 2023 covering majority of the districts in study area of Punjab, Haryana, Uttarakhand, and Uttar Pradesh. During the field visit it is observed that major transplanting of Basmati varieties was done between 1st fortnight of July to 1st week of August. During the survey it was observed that the major sown Basmati varieties in the study area are (PB-1509, PB-1692, PB-1847), (PB-1121, PB-1718) and (PB-1401, PB-01, PB-06). Sugandha variety was observed in Bulandshahar, Aligarh, Mahamayanagar and Sharbati variety majorly observed in Rampur, Moradabad, Bijnor and Bareilly districts of Uttar Pradesh. Varieties (CSR 30, B370, HBC19) are also observed in J & K, Haryana and Punjab.

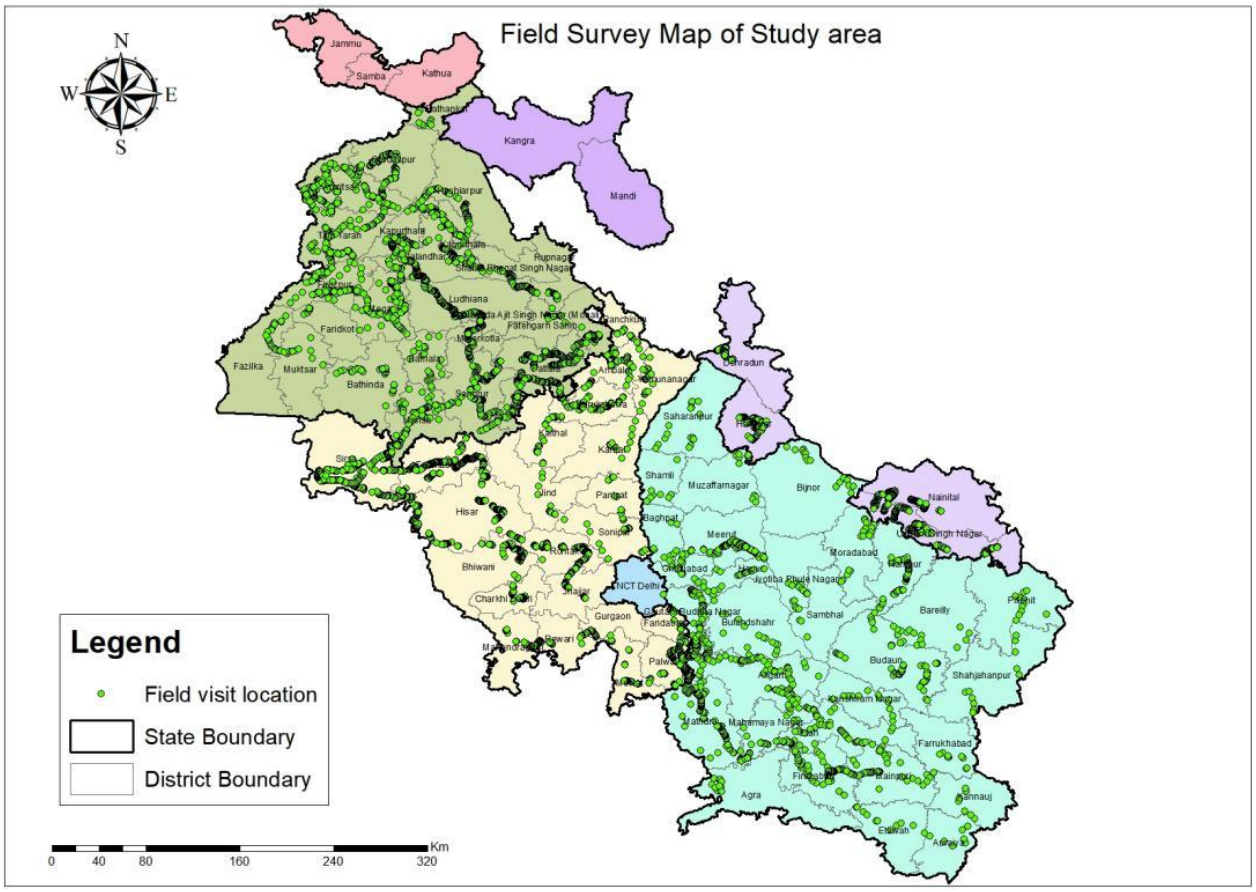



***Fig. 12: Field Survey Points distribution in the study Area.***

## State wise field observations:

The state wise field observations on the basis of field survey can be summarized as below:

**Punjab:**

- Major transplanting of Basmati rice was observed in 1st and 2nd fortnight of July. However, at few places transplanting is also observed in August month specially in Patiala and Sangrur districts.
- Major Basmati varieties observed are (PB-1509, PB-1692, PB-1847), (PB-1121, PB-1718) and (PB-1401, PB01, PB06)
- The good spread of PB-1401 was seen in districts of lower part however well distributed area of PB-1401 is also increasing in upper part of Punjab.
- In many districts a new variety PB-1885, which is an improved version of PB-1121, is increasing in a distributed manner.
- Basmati varieties of group (PB15-09, PB-1692, PB-1847) were in Panicle initiation - Booting to flowering stage while other groups (PB-1121, PB-1718, PB-1885) and (PB-1401, PB-01, PB-06) are in vegetative phase to reproductive

period.

- Other crops like Sugarcane, Maize, Cotton and fodder were present in the field.
- Major Basmati rice area was found in Amritsar, Firozpur, Tarn Taran, Gurdaspur, Fazilka and Mansa district.
- Damage was also observed due to flood condition in Firozpur, Tarantaran and some parts of Moga districts.
- No major disease was observed in Punjab except some localized patches, but these were below the Economic Threshold Limit. During field work it is also observed that farmers are using fungicides and insecticides actively.
- It is also observed that by replacing the cotton, Punjab state is seeing an increase in paddy acres.

**Haryana:**

- Major transplanting of Basmati rice was observed in the first and second fortnight of July.
- Major Basmati varieties observed are (PB-1509, PB-1692, PB-1847), (PB-1121, PB-1718), (PB-1401, PB-01, PB-06) and (CSR 30, B370, HBC19).
- Basmati varieties (PB-1509, PB-1692, PB-1847) are in Panicle initiation - Booting to flowering stage while other groups (PB-1121, PB-1718) and (PB-1401, PB-01, PB-06) are in vegetative phase to reproductive period.
- In some parts of Haryana state, Sugandha and Sharbati varieties were also seen.
- Varieties of groups (PB-1401, PB-01, PB-06) were observed in Sirsa, Fatehabad, Kaithal and Jind.
- Other competing crops observed in the field are Sugarcane, Sorghum (Jowar), Cotton and Bajra.
- Major Basmati sowing districts are Jind, Karnal, Panipat, Sonipat and Rohtak.
- Crop area was also damaged by flood condition in Fatehabad district.
- It has also been noted that in Haryana, paddy crops are leading cotton ones.

**Uttar Pradesh:**

- Major transplanting of basmati rice was observed in the first fortnight of July.
- Major Basmati varieties observed are (PB-1509, PB-1692, PB1847), (PB-1121, PB-1718, PB-1885), (PB-1401, PB-01, PB-06), Sharbati and Sugandha.
- A well distributed new variety of Basmati PB-1847 is also seen in GB Nagar, Mathura and Aligarh districts.
- Other crops like Jowar, Bajra, and Sugarcane were observed in the field.
- Major Basmati sowing districts are Bulandshahar, GB Nagar, Mathura, Hathras, Etah, Firozabad and Mainpuri, Aligarh and Hapur.
- No flood area were observed in month of August however crop was damaged due to flood condition near river/canals at few locations.

- **Punjab**

| **Basmati Variety – 1121** | | |
|---|---|---|
|  |  |  |
| **Basmati Variety – 1509** | | |
|  |  |  |
| **Muchal Basmati - 1401** | | |
|  |  |  |
| **Basmati Variety - 1718** | | |
|  |  |  |
| **Basmati Variety - 1692** | | |
|  |  |  |

**Note:** These Photographs are collected during field survey from different parts of the region. Each photograph is with their Geo-tag details withtheir Latitude and Longitude.

**Damage area map and Photographs of Punjab:**

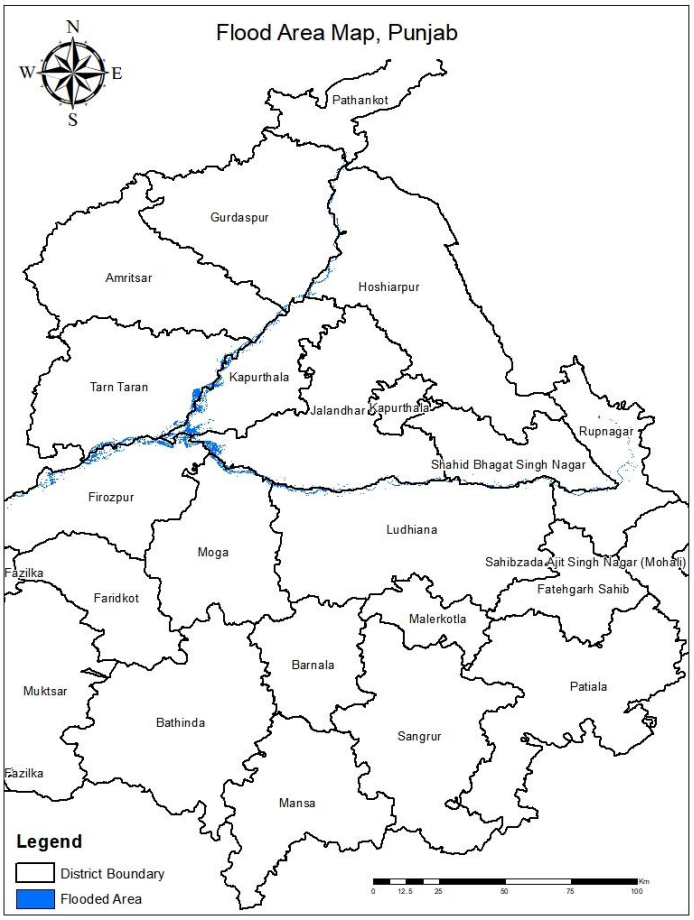



***Fig. 13: Flood Area map of Punjab***

| Punjab | | |
|---|---|---|
|  |  |  |
|  |  |  |

**Note:** These Photographs are collected during field survey from different parts of the region. Each photograph is with their Geo-tag details withtheir Latitude and Longitude.

- **Haryana**

| **Basmati Variety – 1121** | | |
|---|---|---|
|  |  |  |
| **Basmati Variety – 1509** | | |
|  |  |  |
| **Basmati Variety - 1718** | | |
|  |  |  |
| **Basmati Variety – 1692** | | |
|  |  |  |
| **Basmati Variety – 1882** | | |
|  |  |  |
| **Basmati Variety – 1847** | | |
|  |  |  |
| **Basmati Variety – 1401** | | |

| | | |
|---|---|---|
|  |  |  |
| **Sharbati** | | |
|  |  |  |

**Note:** These Photographs are collected during field survey from different parts of the region. Each photograph is with their Geo-tag details withtheir Latitude and Longitude.

**Damage area photographs of Haryana:**

| | | |
|---|---|---|
| **Haryana** | | |
|  |  |  |
| | | |
|  |  |  |

**Note:** These Photographs are collected during field survey from different parts of the region. Each photograph is with their Geo-tag details withtheir Latitude and Longitude.

- **Uttar Pradesh**

| Basmati Variety – 1121 | | |
|---|---|---|
|  |  |  |
| **Basmati Variety – 1509** | | |
|  |  |  |
| **Basmati Variety – 1692** | | |
|  |  |  |
| **Basmati Variety - 1718** | | |
|  |  |  |
| **Sharbati** | | |
|  |  |  |
| **Sugandha** | | |
|  |  |  |
| **Basmati Variety - 1847** | | |



**Note:** These Photographs are collected during field survey from different parts of the region. Each photograph is with their Geo-tag details withtheir Latitude and Longitude.

**Damage Area Map and Photographs collected during Field Survey:**


*Fig. 14: Flood Area map of Haryana*

| Uttar Pradesh | | |
|---|---|---|
|  |  |  |
| | | |
|  |  |  |
|  |  |  |
|  |  |  |

**Note:** These Photographs are collected during field survey from different parts of the region. Each photograph is with their Geo-tag details withtheir Latitude and Longitude.

# 8. Schedule wise Report Status:

The present report is second volume in series of reports which is being delivered. This report covers district wise total Basmati Rice area, Remote Sensing based Crop Health Assessment details. The status of Schedule wise report is beinggiven for the reference below.

| Report Schedule | | | | |
|---|---|---|---|---|
| **S. No.** | **Report** | **Report Content** | **Submission Date** | **Status** |
| 1 | 1st Report | District wise total rice area (Basmati + Rice)<br>Basmati seed sale distribution (in percent) | 30th July 2023 | Submitted |
| 2 | 2nd Report | Basmati rice acreage and health monitoring | 31stAugust 2023 | Submitted |
| 3 | 3rd Report | Basmati rice acreage estimation (Variety wise evolved Sarbati and Sugandha) | 30th September 2023 | In Process |
| 4 | 4th Report | Climate based Basmati rice yield model and production | 31st October 2023 | In Process |
| 5 | 5th Report | Questionnaire based farmer survey report of Basmati rice | 30th November 2023 | In Process |
| 6 | 6th Report | Final Report (All statistics and maps) | 30th December 2023 | In Process |

**Note: The Green Highlighted rows show reports are submitted.**