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Estimating Onion Crop Acreage in Solapur district by using Normalized Difference Vegetation Index Method

Joshi P. S.[1], Dama L. B.[2]

[1]Research Scholar, School of Earth Science, Department of Environmental science Punyashlok Ahilyadevi Holkar Solapur University Solapur
[2]Professor, School of Earth sciences, Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Abstract

Efficient irrigation scheduling in the command areas of irrigation projects requires timely and accurate information about the type and extent of crops cultivated in the area. In India, traditional methods of crop estimation rely on field enumeration conducted by village revenue personnel who maintain land records. In certain states where land records are not available, crop estimates are based on sample field surveys. However, these approaches generate a large volume of data that are compiled in a decentralized manner, leading to potential issues with accuracy and timeliness of the information. The use of satellite-based NDVI data has grown in recent years as a result of developments in remote sensing technology. Efforts are taken to estimate onion crop acreage in Solapur district for the year 2021-2022 by using NDVI method. That can be useful for further study or to check health, disease, growth, area of onion production by using RS-GIS.

Key words: Onion crop, Crop acreage, NDVI

1. Introduction:

NDVI measures crop canopy health and stage by analysing near-infrared and visible light reflection, which aids in making very accurate decisions about fertilizer, irrigation, pest control, and yield management. NDVI may be obtained on a global and regional scale using a range of satellite sensors, which makes it easier to see vegetation patterns across a range of ecosystems and time periods (Geng *et al.*, 2025). Furthermore, this method is time-consuming and expensive, especially when dealing with larger areas. Timely assessment of area under different standing crops and their spatial distribution is essential for irrigation planning and management in command areas. For efficient agricultural planning and decision-making, it is essential to anticipate the Normalized Difference Vegetation Index (NDVI) accurately (Mitra *et al.*, 2025). Especially when huge regions are involved, the traditional techniques of gathering data on agricultural acreage are costly and time-consuming. Additionally, the collection of ground data may not align with the actual cropping season, making it challenging to gather consistent and reliable information for consecutive years. To address these challenges, alternative approaches using remote sensing and satellite imagery can provide valuable insights for crop estimation and monitoring. These technologies offer the potential for timely and cost-effective collection of data on crop types and their spatial distribution.

Additionally, the collection of ground data may not align with the actual cropping season, making it challenging to gather consistent and reliable information for consecutive years. To address these challenges, alternative approaches using remote sensing and satellite imagery can provide valuable insights for crop estimation and monitoring. These technologies offer the potential for timely and cost-effective collection of data on crop types and their spatial distribution. By analysing satellite images and utilizing advanced image processing techniques, it becomes possible to obtain accurate and up-to-date information about crop patterns and changes in land use. Remote sensing has opened up innovation in agricultural statistics across the world. Through officially supported programme, remotely sensed spectrum satellite data has been regularly used for this purpose. It is reported that area estimates are regularly made for key crops including cotton, peanuts, sorghum, rice, wheat, sugarcane, onions and peanuts. Modern remote sensing satellites' higher resolution and multitemporal spectral imagery might be utilized to further increase accuracy (Adawadkar *et al.*, 2024). This can greatly assist in irrigation planning and management, allowing for more precise scheduling of water resources and improving overall agricultural productivity. The Sentinel-2 imagery was used for remote sensing in order to offer prompt and precise identification of onion twisting disease (Alberto *et al.*, 2020). NDVI allows for the continuous monitoring of crop health, enabling farmers to make timely decisions in response to evolving climatic conditions. Crop yield and NDVI are positively correlated; crops with higher NDVI readings are healthier and more productive (Fuentes *et. al*., 2025). Onion crops exhibit distinctive spectral characteristics that can be captured by NDVI analysis. Healthy onion plants typically have high NIR reflectance and low red reflectance, resulting in a higher NDVI value. This is due to the fact that onion leaves strongly reflect NIR light while absorbing red light. By analysing NDVI values across an image or a study area, areas with high NDVI values can be identified as potential onion crop areas. This method enables the differentiation of onion crops from other vegetation and non-vegetated areas. The NDVI method offers several advantages for onion crop identification, including its non-destructive nature, capability for large-scale analysis and ability to monitor crop health and growth over time. It provides valuable information for crop management, yield estimation and decision-making in agricultural practices. By utilizing NDVI, farmers, researchers and policymakers can effectively assess and monitor onion crops, leading to improved agricultural productivity and resource management.

2. Methodology:

The classification of onion crops is based on the analysis of reflectance values acquired from Sentinel-2 satellites. Mean reflectance values are obtained from various areas or ground truth samples represented by individual pixels. The accuracy of the classification is verified by comparing the crop statistics data for the total sown area in the district, as provided by the Department of Agriculture, Maharashtra (2021-22), with the area determined for each crop through the classification process.

3. Result and discussion:

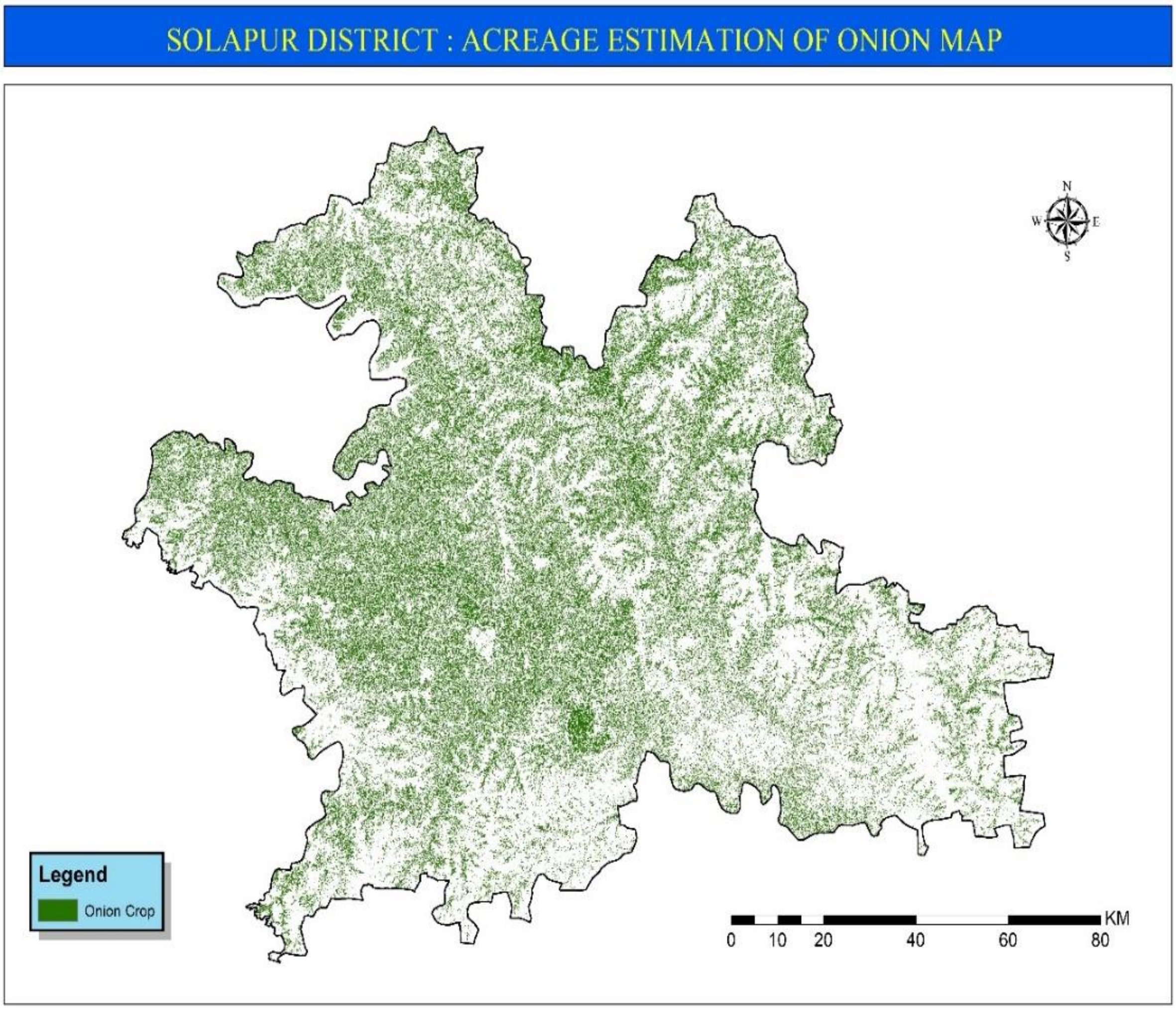

Figure 1. Onion Acreage Estimation Map of Solapur district during 2021-2022 of Solapur district, (M.S.), India.

4. Conclusion:

Agriculture, Maharashtra (2021-22), with the area determined for each crop through the classification process. To further ensure accuracy, geotagged ground-truth points are used for onion crop identification. Based on the crop statistics, it was observed that the onion area was recorded as 7,938 hectares (Figure 48, 49). However, the classification results indicate an onion area of 7,443 hectares. Which indicates 80-85% accuracy.

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