GE-International Journal of Management Research
ISSN (O): (2321-1709), ISSN (P): (2394-4226)
Vol. 13, Issue 02, Feb 2025 Impact Factor: 8.466

www.aarf.asia,**Email** : editoraarf@gmail.com

To study detection and Quantification of nitrogen, leaf chlorophyll, and water content in sesame crop through Green Ratio Vegetation Index. at Instructional Farm, College of Agricultural Engineering and Technology, Junagadh Agricultural University, Junagadh, Gujrat.

Khade Patilba Ramdas
Assistant Professor College of agriculture Business Management Narayangaon.

ABSTRACT

Remote sensing data are capable of capturing changes in plant phenology (growth) throughout the growing season, whether relating to changes in chlorophyll content or structural changes. The remote sensing-based bio-physical variables maps were used for crop monitoring using near surface remote sensing at the Instructional Farm, College of Agricultural Engineering and Technology, Junagadh Agricultural University, Junagadh area of Gujarat state, India. Multi date satellite images of Sentinel- 2A for summer season, year 2019-20 were used in the QGIS 3.16 QGIS software to derive remote sensing-based bio-physical variable maps i.e., like Green Ratio Vegetation Index (GRVI) were used for crop monitoring.

The Maximum and Minimum GRVI in the study area was 4.78 April 30, 2020 and 2.16 on May 10, 2020 respectively. The average Green Ratio Vegetation Index (GRVI) value ranges from 2.45 to 4.78 for Sesame crop. GRVI value increases up to 4.78 from March month (Initial stage) to last week of April (Mid-crop growth stage) and then decreases during the May month (End season stage). The GRVI Value was high the maximum Nitrogen, Chlorophyll and water content in vegetation. The GRVI Value was lower the minimum Nitrogen, Chlorophyll and water content in vegetation.

Key words: *Crop Monitoring, Sentinel-2A, GRVI, bio-physical variables map.*

1 Introduction:

Crop monitoring is the technology which facilitates real-time crop vegetation index monitoring via spectral analysis of high-resolution images for different fields and crops which enable to track positive and negative dynamics of crop development. It enables the farmer to implement timely interventions that ensure optimal yields at the end of the season.

Monitoring crop condition with remote sensing can get the condition of cereal crop seedlings, oil crop seedlings as well as the status and trend of their growth. It also helps to acquire the crop production information (Wu *et al*., 2013) Acquiring the crop condition information at early stages of crop growth is even more important than acquiring the exact production after harvest, especially when large scale commissariat shortage or surplus happens. Acquiring crop condition as early as possible has great influence on the policy making on price, circulation and storage of commissariat (Chen and Zhao, 1990). Satellite systems provide temporally and spatially continuous data most of the globe using relatively few instruments.

Along with the development of remote sensing applications, satellite data has become the uppermost data source to monitor large-scale crop condition. United States Department of Agriculture of the *United States* and Vegetation indices of *European Union*, as well as *Food and Agriculture Organization*, have built their own crop monitoring systems based on remote sensing (Liu, 1999).

Considering the research above, the general goal of this work is to evaluate the performance of Sentinel-2 images for crop growth monitoring by using the green ratio vegetation index. The GRVI was selected because of its reported sensitivity to changes in canopy structure and green colour both symptoms of water stress in Sesame.

1.2 Objectives of study

1) To monitor the crop growth by using near surface remote sensing
2) To study detection and Quantification of nitrogen, leaf chlorophyll, and water content in sesame crop through Green Ratio Vegetation Index.

2. Materials and Methods

2.1 Study area

The experiment was conducted at the Instructional Farm, College of Agricultural Engineering and Technology, Junagadh Agricultural University, Junagadh (Fig 3.1). The latitude and longitude of the study area are 21°28’59.19” to N 21°29’02.54” N (North latitude) and 70°26’09.83” E to 70°26’10.45” E (East longitude).

Fig.1 Location map of study area

2.2 Data Collection and Software Used

The Remote sensing and GIS software used for the study. QGIS 3.16 is a software working with maps and geographic information. It is used for creating and using maps; compiling geographic data; analyzing mapped information; sharing and discovering geographic information in a range of applications and managing geographic information in a database. The satellite images of Sentinel - 2A were used for the study.

GE-International Journal of Management Research
ISSN (O): (2321-1709), ISSN (P): (2394-4226)
Vol. 13, Issue 02, Feb 2025 Impact Factor: 8.466

www.aarf.asia,**Email** : editoraarf@gmail.com

For the present study, all available Sentinel-2A Level-1C (TOA) products were examined for cloud coverage in the study area for the year 2019-20. Only cloud-free images were downloaded from the official website of European Space Agency (ESA). A total of 7 images of tile were downloaded from 22 February 2020 (sowing) to 19 may 2020 (harvest)

3.9.14 Green Ratio Vegetation Index (GRVI)

This index uses the aerial colour infrared photography for determining Early in- season nitrogen requirements in Corn.

$$\text{GRVI} = \frac{\text{NIR}}{\text{Green}}$$

This index is sensitive to photosynthetic rates in forest canopies, as green and red reflectance are strongly influenced by changes in leaf pigments. GRVI is compute by using the following formula (Sripada and Prakash 2006)

2.3 Statistical Analysis

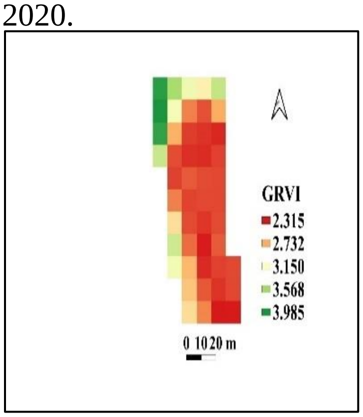
The collected data was used by regression model to predict sesamum yield (Ren *et al.*, 2008, Franch *et al.*, 2015, Lopresti *et al.*, 2015).

3. Estimation of Bio-Physical Variables

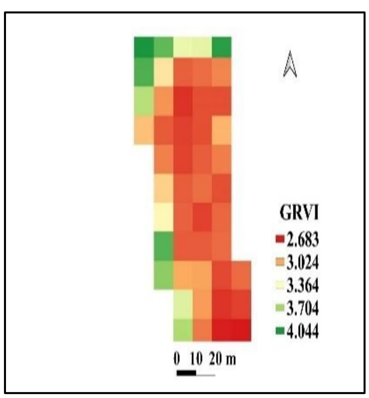
The remote sensing -based vegetation index maps were calculated. Remote Sensing based - vegetation index was estimated for different dates of Satellite overpass. Vegetation index was calculated Sentinal-2 images for different dates from February 22, 2020 to May 19, 2020. The image was processed and raster calculator of QGIS 3.16 was used to prepare map.

3.1 Green Ratio Vegetation Index (GRVI)

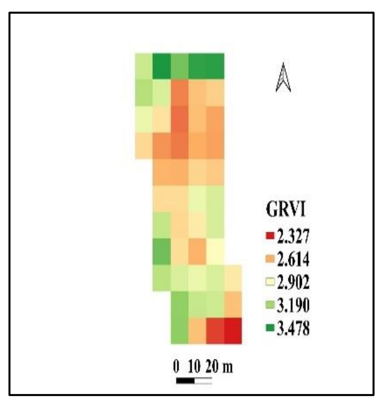
Green Ratio Vegetation Index (GRVI) was calculated from reflectance measured in Green and NIR bands of Sentinal-2 images. The raster calculator in QGIS 3.16 was used to prepare GRVI maps for different dates of Satellite overpasses as shown in Fig.3.1 (a-g). The GRVI maps were prepared from acquired Sentinal-2 images of different dates: March 01, 2020; March 21, 2020; March 31, 2020; April 10, 2020; April 20, 2020 and April 30, 2020; May 10, 2020.



a) 01/03/2020

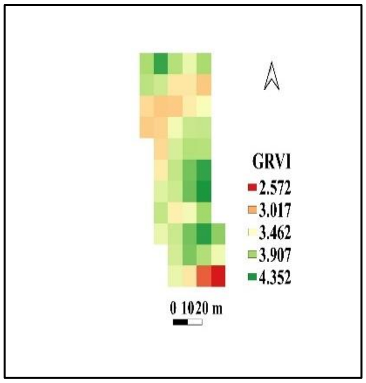


b) 21/03/2020

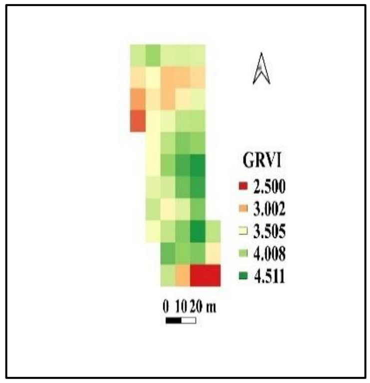


c) 31/03/2020

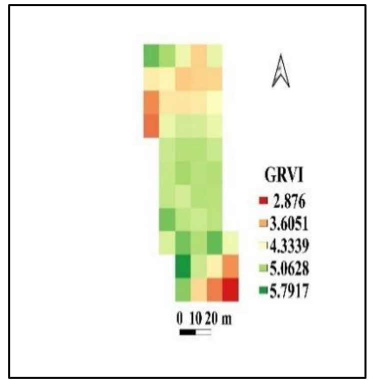
GE-International Journal of Management Research
ISSN (O): (2321-1709), ISSN (P): (2394-4226)
Vol. 13, Issue 02, Feb 2025 Impact Factor: 8.466
© Association of Academic Researchers and Faculties (AARF)
www.aarf.asia,**Email** : editoraarf@gmail.com



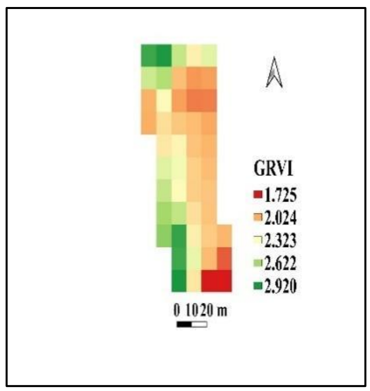
d) 10/04/2020



e) 20/04/2020



f) 30/04/2020



g) 10/05/2020

Fig. 3.1 Green Ratio Vegetation Index (GRVI) maps using Sentinal-2 images (a to g)

The values of GRVI in the study area for summer season of 2019-20 were ranged from 2.31 to 3.98, 2.68 to 4.04, 2.32 to 3.47, 2.57 to 4.35, 2.50 to 4.51, 2.87 to 5.79, 1.72 to 2.92 for March 01, 2020; March 21, 2020; March 31, 2020; April 10, 2020; April 20, 2020 and April 30, 2020; May 10, 2020 respectively. The maximum GRVI in the study area was 4.78 on April 30, 2020 whereas minimum value was 2.15 on May 10, 2020. Higher value of GRVI indicates higher nitrogen, leaf chlorophyll, and water content in vegetation while lower values of GR*VI indicate* lower nitrogen, leaf chlorophyll content and moisture-stressed condition of vegetation.

The GRVI for different Location of Sesame crop and temporal variability of GRVI for the period from March 01, 2020 to May 10, 2020 at interval of 10 days is given in Table 3.1. The trend of GRVI for different Location of sesame is shown in Fig. 4.1.

GE-International Journal of Management Research
ISSN (O): (2321-1709), ISSN (P): (2394-4226)
Vol. 13, Issue 02, Feb 2025 Impact Factor: 8.466

www.aarf.asia,**Email** : editoraarf@gmail.com

Table 3.1 Green Ratio Vegetation Index (GRVI) values for Sesame crop

Sr. No.	Date of satellite overpasses	1	2	3	4	5	6	Average GRVI value
1	01-03-2020	2.419	2.432	2.450	2.458	2.429	2.493	2.447
2	21-03-2020	2.743	2.922	2.917	2.862	2.794	2.983	2.870
3	31-03-2020	2.497	2.640	2.720	3.036	3.117	3.026	2.839
4	10-04-2020	3.182	3.254	3.819	4.353	4.303	4.035	3.824
5	20-04-2020	3.158	3.513	4.064	4.400	4.512	4.075	3.953
6	30-04-2020	4.109	4.762	4.767	4.912	5.389	4.737	4.779
7	10-05 2020	1.999	2.239	2.055	2.113	2.133	2.397	2.156

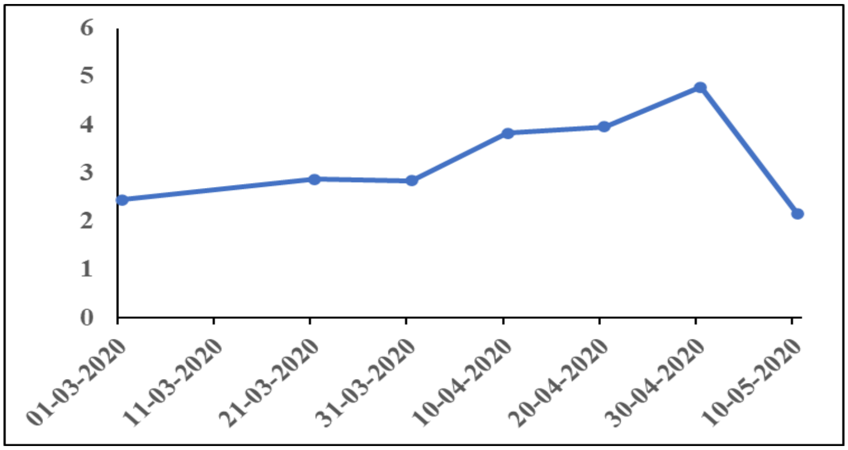


Fig. 4.1 Temporal Variability of Green Ratio Vegetation Index (GRVI) value for Sesame crop

Temporal variability of average GRVI values were ranged from 2.44 to 4.77 from March 1 to April 20, 2020. The GRVI values of the vegetation were found continuously increased up to 4.78 on April 20, 2020 during the maximum Nitrogen, Chlorophyll and water content in vegetation and then after decreased 2.16 during May 10, 2020 during harvesting stage of the crop.

4. Conclusion:

Based on the results obtained and the analysis done the following conclusions can be drawn from the present study. Minimum value of GRVI was 1.72 on May 10, 2020 whereas the maximum value of GRVI in the study area was 4.78 on April 30, 2020. The average Green Ratio Vegetation Index (GRVI) ranges from 2.44 to 4.78 for Sesame crop.

The GRVI value increases up to 4.78 from March month (Initial stage) to last week of April (Mid-crop growth stage) and then decreases during May (End season stage). The GRVI Value was high the maximum Nitrogen, Chlorophyll and water content in vegetation. The GRVI Value was lower the minimum Nitrogen, Chlorophyll and water content in vegetation.

GE-International Journal of Management Research
ISSN (O): (2321-1709), ISSN (P): (2394-4226)
Vol. 13, Issue 02, Feb 2025 Impact Factor: 8.466
© Association of Academic Researchers and Faculties (AARF)
www.aarf.asia,**Email** : editoraarf@gmail.com

5. References:

Chen, S. and Zhao, Y. 1990. Ceo-science Analysis of Remote Sensing. The Publishing House of Surveying and Mapping.

Franch, B, Vermote, E. F., Becker-Reshef, I., Claverie, M., Huang, J., Zhang, J., Justice, C. and Sobrino, J. A. 2015. Improving the timeliness of winter wheat production forecast in the United States of America, Ukraine and China using MODIS data and NCAR growing degree day information. *Remote Sensing Environment*, **161**: 131–148.

Gontia, N. K., and Tiwari, K. N. (2009). Estimation of Crop Coefficient and Evapotranspiration of Wheat (Triticum aestivum) in an Irrigation Command Using Remote Sensing and GIS. *Water Resources Management*, **24(7),** 1399–1414.

Liu, H. 1999. applications of remote sensing in agriculture in the united states. *Journal of China Agricultural Resources and Reginal Planning,* **20(**2):56 – 60

Lopresti, M. F., Di Bella, C. M. and Degioanni, A. J. 2015. Relationship between MODIS-NDVI data and wheat yield: a case study in Northern Buenos Aires province. *Argentina. Inf. Process. Agric*. **2(2)**:73–84.

Monpara, B. A. and Vaghasia, D. R. 2016. Optimizing sowing time and row spacing for summer sesame growing in semi-arid environments of India. *International Journal of Current Research and Academic Review*, **4(1)**: 122-131.

Ranganatha, A. R. G. 2010. Improved Technology for Maximizing Production of Sesame. (Revised Ed) Project Coordinator, AICRP on Sesame and Niger, ICAR, JNKVV Campus, Jabalpur, **1**-17.

Rouse, J. W., Hass, R. H., Schell, J. A. and Deering, D. W. 1973. Monitoring vegetation systems in the Great Plains with ERTS. *Proceedings Third Earth Resources Technology Satellite 1 Symposium*, Greenbelt. NASA SP-351: 3010–3017.

Ren, J., Chen, Z., Zhou, Q. and Tang, H. 2008. Regional yield estimation for winter wheat with MODIS-NDVI data in Shandong, China. *International Journal of Applied Earth Observation,* **10(4)**: 403 – 413.

Remote Sensing Vegetation Indices: A Review of Developments and Applications. *Journal of Sensor*

Sripada, R. and Prakash, R. 2006. Determining In-Season Nitrogen Requirements for Corn Using Aerial Colour-Infrared Photography. Ph.D. dissertation, North Carolina State University.

Wu, B., Meng, J., Li, Q., Yan, N., Du, X. and Zhang, M. 2013. Remote sensing-based global crop monitoring: experiences with China's Crop Watch system. *International Journal of Digital Earth,* **7(2)**: 113–137.