



## How Remote Sensing are Used for Crop Protection

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Remote sensing involves the use of sensors on aircraft or satellites to collect data about the Earth's surface, including information about crop health and the presence of pests and diseases. This data can be used by farmers to make informed decisions about how to protect their crops and maximize yields. In recent years, satellite-based systems and unmanned aerial vehicles (UAVs or drones) have been developed for this purpose, using high-resolution imagery and machine learning algorithms to detect problems in fields and provide real-time data to farmers. Remote sensing has the potential to greatly improve crop protection in agriculture by providing timely, accurate information to farmers. GIS, or Geographic Information Systems, is a tool that can be used to analyze and manage this data. By combining remote sensing with GIS, farmers can create detailed maps of their fields; identify patterns in crop health or pest and disease distribution and create models to predict how crops will respond to different conditions. This information can help farmers make informed decisions about how to protect their crops and optimize their agricultural operations.

Remote sensing technologies, such as satellites and aircraft equipped with sensors, can be used to monitor the health and growth of vegetation in agricultural fields. One way this is done is by measuring the reflectance of crops at various wavelengths of light using multispectral sensors, which can be used to calculate indices like the Normalized Difference Vegetation Index (NDVI) to estimate biomass and crop health. Other remote sensing techniques that can be used for vegetation monitoring in agriculture include radar and thermal imaging, as well as machine learning algorithms for detecting and classifying different types of crops. By using remote sensing, farmers can gain a better understanding of the health and productivity of their fields and make informed decisions about how to protect and optimize their crops [1,2]. The authors review the various ways in which remote sensing has been used to assess the condition of crops, including the use of different

types of sensors and data processing techniques. It is used to assess the condition of crops by collecting data about the reflectance of crops in different wavelengths of light using multispectral sensors. This data is used to calculate indices like the NDVI, which can be used to estimate the biomass and overall health of the crops. Other techniques for assessing crop conditions using remote sensing include radar, and thermal imaging, as well as machine learning algorithms for classifying crops based on their condition.

It can be utilized to evaluate the nutrient and water status of crops by collecting data on the reflectance of crops in different wavelengths of light using multispectral sensors. Other techniques that can be employed for assessing crop nutrient and water status using remote sensing include radar and thermal imaging, as well as machine learning algorithms for classifying crops based on their nutrient and water status [7]. It can be used for weed identification and management in agriculture by collecting data about the reflectance of crops and weeds at different wavelengths of light using multispectral sensors. Other applications of remote sensing for weed identification and management include the use of radar and thermal imaging to measure the height and structure of crops and weeds, as well as the use of machine learning algorithms to classify weeds based on their spectral characteristics [3,4]. Remote sensing can also be used for pest and disease infestation in agriculture by collecting data about the reflectance of crops and pests or diseases at different wavelengths of light using multispectral sensors. Other applications of remote sensing for pest and disease infestation include the use of radar and thermal imaging to measure the height and structure of crops and pests or diseases, as well as the use of machine learning algorithms to classify pests and diseases based on their spectral characteristics. Remote sensing can be used for crop yield prediction by collecting data about the reflectance of crops at different wavelengths of light using multispectral sensors. Other techniques for crop yield prediction using remote sensing in-

clude radar and thermal imaging to measure the height and structure of crops, as well as machine learning algorithms to classify crops based on their yield potential. Remote sensing is a valuable tool for predicting crop yield and production [5], providing farmers with important information about the potential productivity of their fields. Remote sensing can be used in precision agriculture to improve the efficiency and accuracy of farming practices by collecting high-resolution data about the physical, chemical, and biological properties of crops and soil [6]. One way this is done is by using multispectral sensors to measure the reflectance of crops at different wavelengths of light, which can be used to calculate indices such as the Normalized Difference Vegetation Index (NDVI) to estimate the biomass and health of crops. Other applications of remote sensing in precision agriculture include the use of radar and thermal imaging to measure the height and structure of crops, as well as the use of machine learning algorithms to classify crops based on their yield potential and identify areas of the field that may need attention. By using remote sensing to collect data about crops and soil, farmers can optimize their farming practices and improve the productivity and sustainability of their fields.

### Conclusion

Remote sensing has become an essential tool in the field of agriculture, with applications ranging from crop protection to yield prediction and precision farming. By using sensors on satellites and aircraft, farmers can collect detailed data about the health and growth of their crops, as well as identify and manage pests, diseases, and weeds. Remote sensing technologies such as multispectral sensors, radar, and thermal imaging, as well as machine learning algorithms, can be used to assess the condition and nutrient and water status of crops and make informed decisions about how to optimize agricultural operations. When combined with GIS, remote sensing can provide even greater insights, allowing farmers to create detailed maps, identify patterns in crop health, and predict how crops will respond to different conditions. Overall, remote sensing has the potential to greatly improve crop protection and production in agriculture and will likely continue to play a critical role in the industry in the future.

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