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| **Sl no.** | **Methods for chilli disease detection** | **Advantages** | **Disadvantages** |
| 1 | Visual Inspection  : This involves physically examining the chilli plant for any signs of diseases,such as spots,discoloration,or wilting | A) Having access to expert advice provides a significant advantage | A) Manual identification of diseases through human eyes is strenuous and may lead to error prone results. |
| 2 | Molecular Methods  : These methods involves detecting specific DNA or RNA sequences that are unique to the pathogen causing disease.polymerase chain reaction(PCR) | 1. Molecular methods can provide results within a few hours, making them a rapid and efficient tool for disease diagnosis and monitoring. 2. Molecular methods can detect multiple pathogens in a single test, making them a versatile tool for identifying the cause of disease. | 1. Molecular methods can sometimes produce false negative/positive results. 2. Molecular methods require specialized equipment and expertise, which can be costly and require significant training and experience to operate effectively. |
| 3 | Imaging Techniques  : Chilli disease-causing pathogens and their interaction with plant tissue can be visualized using different imaging techniques like fluorescence microscopy and confocal microscopy. | A) Imaging techniques offer a non-intrusive and non-harmful means of visualizing and monitoring plant health and disease status, allowing for timely intervention and prevention of disease spread and severity, even before visible symptoms manifest. These techniques also possess high accuracy and sensitivity in detecting diseases, and furnish important information on disease progression, distribution, and intensity. Moreover, imaging techniques enable the study of pathogen-plant interactions and support the formulation of effective disease management measures. | A) While thermography and fluorescence imaging have been utilized in on-field disease detection, they have demonstrated susceptibility to environmental parameter changes and a lack of specificity for individual diseases. |
| 4 | Spectral Analysis  : This involves using a spectrophotometer to measure the light reflected by the plant and analyzing the data to detect any abnormalities or changes that may indicate the presence of disease. | A) Spectral analysis provides an objective and quantitative assessment of the health of the plant or field, reducing the potential for subjective interpretation and bias and can also be used to assess other plant parameters such as plant biomass, nutrient status, and water stress. | A) Spectral analysis requires specialized and often costly equipment, including spectrometers and cameras, which may be prohibitive for some growers or researchers.  can also be affected by environmental factors such as temperature, humidity, and lighting conditions, which can impact the accuracy and reproducibility of results. |
| 5 | Electronic nose  : Electronic nose: This is an instrument that uses sensors to detect the volatile organic compounds (VOCs) emitted by the chilli plant. Changes in the VOC profile can indicate the presence of disease. | A) E-nose technology offers a promising platform for plant pest diagnosis due to its high sensitivity, capability of real-time analysis, user-friendly operation, and portability. | A) Further exploration and enhancement are needed to address challenges related to the impact of the surrounding atmosphere on measurements and the challenges of detecting signals in open fields. |
| 6 | Sensor Based Techniques  : Sensor-based techniques: These techniques involve using sensors to detect physical or chemical changes in the plant that may indicate the presence of disease. Examples of sensor-based techniques include thermal imaging, which detects changes in temperature caused by infection, and electrochemical sensors, which detect changes in electrical properties of the plant. | 1. Sensor-based techniques are non-invasive, meaning that they do not require physical contact with the plant, reducing the risk of damage or contamination. 2. Sensor-based techniques can be easily scaled up for large-scale disease monitoring and management, making them suitable for use in commercial agriculture. | 1. Sensor-based techniques can be expensive to implement, especially when dealing with large-scale or complex systems. The cost of acquiring and installing sensors, as well as the cost of maintaining and calibrating them, can be high. |
| 7 | Image Processing Techniques  : Image processing techniques refer to a range of methods used to analyze and manipulate digital images. These techniques are commonly used in conjunction with imaging techniques for chilli disease detection to extract useful information from the images and improve the accuracy of diagnosis.  These approaches involve training machine learning algorithms on large datasets of plant images or spectral data to automatically detect signs of disease. | 1. Image processing techniques can be automated to process large volumes of images in a short period of time. This can reduce the time and effort required for manual processing. 2. Image processing techniques can extract useful information from an image, such as identifying objects, measuring distances, and detecting patterns. This information can be used for various applications, such as medical diagnosis, surveillance, and image recognition. | 1. Image processing techniques can be sensitive to noise or other types of image artifacts, which can reduce their accuracy and reliability. 2. The accuracy and reliability of image processing techniques can depend heavily on the quality of the images being analyzed, which can vary widely depending on factors such as lighting conditions, camera quality, and image resolution. |
| 8 | Biochemical Tests  : Biochemical tests: These tests involve analyzing the chemical composition of the plant tissue to detect any changes that may indicate the presence of disease. Examples of biochemical tests include enzyme activity assays and protein profiling. | 1. Biochemical tests can be designed to target specific proteins or enzymes produced by the pathogen, providing a high level of specificity and accuracy in disease diagnosis. 2. Biochemical tests often produce easily interpretable results, such as a color change or visible precipitate, allowing for rapid identification of disease presence. 3. Some biochemical tests can be performed in the field, eliminating the need for sample transportation and laboratory testing. | 1. Biochemical tests are often designed to detect a single pathogen or a limited number of pathogens, and may not be effective for detecting new or emerging diseases. 2. Biochemical tests are often designed to detect a single pathogen or a limited number of pathogens, and may not be effective for detecting new or emerging diseases. |

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