

Automation in Horticulture: The Future of Orchards

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Abstract

Horticulture is one of the fastest growing industries worldwide which provide varied agricultural produce. However, for providing quality produce it is facing numerous challenges such as lack of skilled labors, climate change and other biotic stress. Artificial intelligence can play an indispensable role in different arena to enhance production and quality. Technologies like Machine Learning can help to solve many ground reality problems like predicting weather and crop health status which further can help famers choose appropriate crops for yield and quality. This technology can also detect soil moisture and pathogens in the field which shall directly enhance fruit and vegetable yield. Big Data Analytics can be used to integrate with Data Image Processing for detection of pest and pathogens with their cure. Drone and Robotic technology can further be used in intercultural operations like weeding, spraying and irrigation. Post harvest losses which accounts for 40 percent in our country can also be reduced with such high tech technology.

Keywords: Artificial Intelligence, Big Data Analytics, Horticulture, Machine Learning

Introduction

Horticulture industry encompasses growing of quality fruits, vegetables, flowers, medicinal and aromatic plants [1], plantation crops etc. India ranks second in fruits and vegetable production in the world behind China. The total area under horticulture in India is 25, 870 thousand hectare and total production is 31, 4671 thousand MT (NHB, 2018-19). This industry at present is facing different biotic and abiotic stresses. Increasing cost and decreasing availability of labour is one of the prominent challenges this industry is going through. Plant protection risk is yet another reason which reduces quality and productivity of produce. Due to continuous traditional farming systems Indian agriculture still stands at subsistence level. Climate change in recent have posed new threats to food [2] and nutritional security (Kumar and Joshiba, 2019). With increasing

population and future challenges automation in horticulture seems to be need of the hour (Smitha, 2019).

Automation in horticulture industry can resolve number of ground problems which the orchard growers are facing. Artificial Intelligence helps farmers to choose right crop depending on climatic and soil conditions which may result in high productivity. AI provides 98% accuracy in identification of pest and [3] pathogens. Sensors can provide information about different ripening stages of fruits and vegetables (Soffar, 2019). Different advance technologies like AI, Block Chain Technology, Machine learning and Big Data Analytics may help farmers to enhance production and quality which [4] further shall be a step ahead in sustainable agriculture.

Applications in Horticulture

Prediction of weather

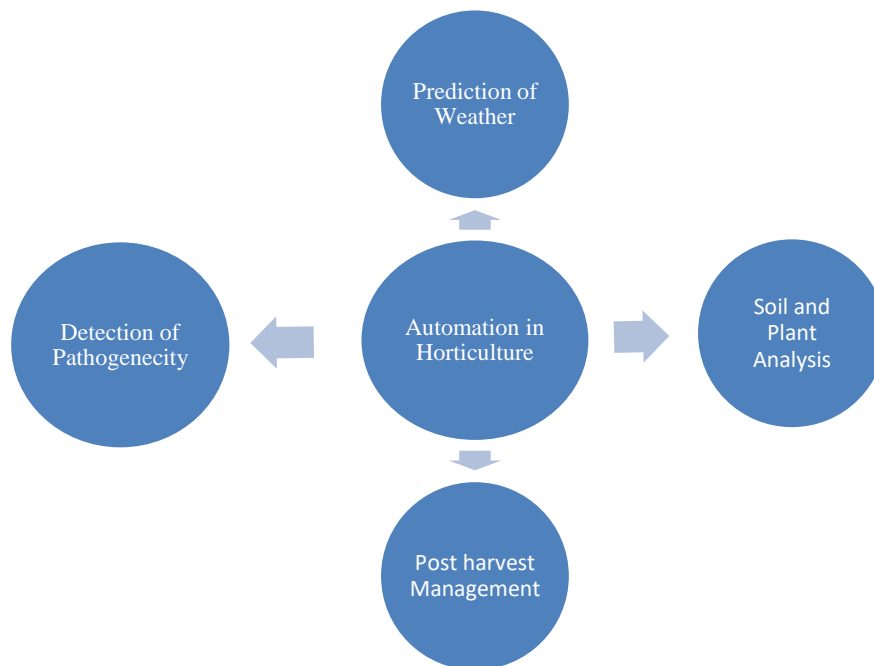
Weather prediction is an important component in horticulture industry as numerous intercultural operations depends on weather. Machine Learning technology can be handy in using algorithms in connection with satellites to predict changing weather on daily basis. These algorithms can also be used in predicting crop [5] health without any contact with large fields. Machine learning also widens the scope of prediction and detection of pest and pathogens in the farmer's field. (Anonymous, 2019).

Soil Health Analysis

Soil health in terms of both moisture and nutrients are basic need for horticultural crops. Nutrient and moisture rich soils not only enhance [6] yield but also increases fruit quality. Both artificial Intelligence and Machine Learning may develop algorithms and sensors for detection and quantification of moisture and nutrients in the soil. Robots may also be used in quantification of soil nutrients which may further provide predictive [7] analysis for recommended dose of fertilizers and irrigation. Cash crops like Cashew nut and rubber are exhaustive crop and require high dose of nutrients. Machine learning and robots may [8] prove solving such problems in these crops.

Detection of pathogenecity

Horticultural crops are more prone to pest and diseases in comparison to other cereal crops. These pest and diseases not only reduce yield but also decrease quality which further fetches a lesser price in the market. Algorithms in integration with [9] captured images may detect types of diseases which may further predict their control. This technology can be used in vineyards where grape leaves can be detected with diseases. Due to improper knowledge, farmers generally spray pesticides and fungicides equally in all plants, which enhances the cost of input and wastage of chemicals. Machine learning hence can develop algorithms which shall direct farmers where exactly these chemicals are required, which will further reduce the cost of input and wastage (Sennar, 2019).



Agrochemical Production

Horticultural crops require numerous synthetic chemicals such as plant bio regulators, weedicides, pesticides etc for high production and quality. These chemicals have a tendency to remain in soil and plant, enhancing toxicity. Moreover, these chemicals go into the food chain, which creates various metabolic ruptures. Machine learning with Big Data Analytics can be used to develop models which may help in the production of appropriate agrochemicals by capturing images of pathogens, weeds, and pests (Baruah, 2019).

Post Harvest Management

Post harvest processes such as cleaning, sorting and grading can be done using Artificial Intelligence and Robots. Sensors can also be used in storage and warehouses to detect stored pest and pathogens. About 40% of horticultural produce is wasted as post harvest loss. Machine learning and Digital Image Processing can be used in reducing such losses which may enhance annual horticultural production (Kamilaris, 2018).

Stress Management

Horticultural crops like fruits and vegetables in their production cycle go through different biotic and abiotic stresses. These stresses at any point of time may harm quality and production of such crops. Digital Image Processing for example may help in detection of such stresses and Machine learning as a result with use of algorithm can help in overcoming such stresses (Singh et al. 2016). Stress management can be released through IT technologies like IOT, AI and cloud [10-15] etc.

Conclusion

Horticulture industry at present revolves around numerous problems which is hampering yield and productivity of crops. Being profitable industry farmers cannot avail the profit through this industry because of such variables. Automation technology like Artificial Intelligence, Big Data Analytics, Digital Image Processing, Block Chain Technology can solve such real issues which directly or indirectly shall improve production and quality of farmers produce. These technologies can also be used in reducing environmental damage developed through improper use of synthetic chemicals used in producing fruits and vegetables.

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Conflict of Interest

There is no conflict of interest among authors.

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