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Short Communication

Agriculture in the era of Artificial Intelligence (AI)

Muzafar Riyaz*

Division of Taxonomy and Biodiversity, Entomology Research Institute, Loyola College, Chennai, Tamil Nadu, India

***Corresponding Author:** Muzafar Riyaz, Research Scientist, Division of Taxonomy and Biodiversity, Entomology Research Institute, Loyola College, Chennai, Tamil Nadu, India.

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Agriculture has always played a significant role in enhancing a nation's economy [1]. Man has been growing and harvesting crops since time immemorial. The primary source of income for countries that engage in agriculture and other farming sectors in the modern world is mainly agriculture and allied sectors [2]. Concerns regarding the need for food, which is expanding in lockstep with the world population, have increased because of the rise in global human populations. The world's population is hungry, and both developed and developing countries are doing everything they can to alleviate that situation.

Since 1970s, there has been a sharp increase in environmental devastation caused by pervasive agricultural activity [3]. About 12% of the world's greenhouse gas emissions are attributable to industrial agriculture and additional environmental damage brought on by large-scale agribusinesses, such as deforestation, habitat loss, pesticide toxicity and pollution, and high carbon outputs [4]. Increased demands of agriculture on natural ecosystems can also cause soil erosion [5]. To fulfil the rising demand for food, agricultural practices may need to be enhanced. Crops must be fertilized and pesticide-sprayed to prevent insect damage and ensure a good harvest. These crops can only be protected if we routinely spray them with insecticides, resulting in a healthy yield. The use of chemical pesticides on crops can have a number of detrimental effects. A good harvest must be produced without endangering the land, water, human health, or the local ecosystems. To do this, agriculture must be sustainable and eco-friendly.

Sustainability in agricultural development is "the management and conservation of the natural resource base and the orientation of technological change in such a manner to ensure the attainment of continued satisfaction of human needs for present and future generations," according to the Food and Agriculture Organization of the United Nations (FAO). Sustainable farming is becoming more prevalent in both developed and developing countries that are involved in the agriculture industry [6]. The adoption of sustainable agricultural practices in the agricultural industry has demonstrated to be a creative strategy for protecting natural resources like aquatic and terrestrial ecosystems, protecting human health, and preserving the diversity of beneficial insects, including pollinators and natural predators [7].

Higher crop yields are the goal of sustainable agricultural practices, which will also increase economic profitability. Modern techniques can be used in sustainable agriculture with the help of technological advancements, allowing eco-friendly practices to be carried out with the least amount of harvest and natural resource waste. In sustainable agriculture, not only can we protect the environment and our natural resources, but we can also provide farmers with training and exercises to help them maximize their use of pesticides and fertilizers. The farmers that use sustainable agricultural practices can increase crop yields while also protecting the aquatic and terrestrial ecosystems that are polluted by pesticide residues in both the environment and the crops.

Over time, technology has changed the farming is done, and it has had a variety of effects on the agriculture sector. In many nations around the world, agriculture is the main source of income, and as the world's population rises from 7.5 billion people in 2015 to 9.7 billion in 2050 [8]. According to UN estimates, there will be more pressure on the planet's resources because only an additional 4 percent of the land will be cultivated. Farmers will thus need to work harder with fewer resources. The same report estimates that in order to feed an additional two billion people, food output must rise by 60% [9]. Traditional approaches, nevertheless, are unable to meet this enormous demand. This is motivating farmers and agro-businesses to create novel solutions. This is pushing farmers and agribusiness to develop fresh strategies for raising output and cutting waste. As a result, artificial intelligence (AI) is progressively becoming a component of the technical advancement of the agri-

culture sector. The goal is to feed an additional two billion people by increasing global food production by 50% by the year 2050 [10]. AI-powered solutions will help farmers become more efficient while also enhancing crop quality, quantity, and speed of market entry.

Thousands of data points on temperature, soil, water use, weather, etc. are generated daily by farms. This data is utilized in real-time with the aid of artificial intelligence and machine learning models to get insightful knowledge, such as the best time to plant seeds, which crops to choose, which hybrid seeds to choose to increase yields, and similar things [11].

Precision agriculture, often known as artificial intelligence systems, is assisting in enhancing the overall quality and accuracy of harvests. AI technology aids in the detection of pests, plant diseases, and undernutrition in agricultural settings. Artificial intelligence (AI) sensors can identify and target weeds before deciding which herbicide to use in the area. This lowers the need for herbicides and lowers costs. Numerous tech firms have created robots that accurately monitor weeds with computer vision and artificial intelligence. The amount of chemicals typically sprayed on crops may be reduced by 80% thanks to these robots, which also result in a 90% reduction in herbicide costs. By significantly reducing the amount of pesticides required in the fields, these clever AI sprayers can increase the calibre of agricultural output while bringing about cost effectiveness [12].

The food on our kitchen table being harvested in bulk by robotic devices, which can do so faster and with more accuracy. These devices aid in increasing crop yield size and decreasing agricultural waste that is left in the field. The efficiency of agriculture is being improved by several businesses. Products like an autonomous strawberry-picking equipment and a vacuum harvester for ripe apples are available. These devices locate the harvestable produce and assist in fruit selection using sensor fusion, machine vision, and artificial intelligence models. The second-largest sector in which service robots are used professionally is agriculture, after military. According to the International Federation of Robotics, up to 25,000 agricultural robots have been marketed, which is the same amount utilized for military applications [13].

Simple timely information on a single data point-seeding timing can make the difference between a successful year and a lost crop. In order to avoid this, researchers at ICRISAT employed a predictive analytics algorithm to determine the exact time to plant the seeds in order to get the most yield. In addition to providing a 7-day weather forecast, it also offers insights on the health of the soil and fertilizer suggestions [14].

The variation in the crop's price is a major source of concern for many farmers. Farmers are never able to set a certain production pattern because of fluctuating pricing. This issue is especially common in crops with relatively short shelf lives, like tomatoes. Companies examine the land and continuously monitor crop health using satellite images and meteorological data. Big data, AI, and machine learning technologies allow businesses to anticipate pricing, estimate tomato output and yield, and identify pest and disease infestations. Farmers and governments can seek their advice on future pricing trends, consumer demand, the best sorts of crops to plant for optimal yield, the usage of pesticides, and other topics [15].

In conclusion, AI will be a potent instrument that can assist organizations deal with the rising level of complexity in contemporary agriculture. It greatly alleviates the shortage of resources and labour. It is past time for large corporations to make an investment here. These technology advancements will probably result in improved farming practices and yields as well as qualitatively better farmer lifestyles.

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