



DEVELOPMENT OF SOLAR POWERED SEED SPRAYER MACHINE - A REVIEW

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Abstract

There is a demand in agriculture for technology that is simpler for farmers to use, understand, and put into practice. The agricultural industry relies heavily on equipment that can be implemented quickly, cheaply, and with little human labor. Some of the machines that used as a tool to assist farmers by saving the time of job. The cost is also saved by reducing the labor cost to do the various works of agriculture at the desired location. One of the primary farming procedures is the sowing of seeds. It is laborious, time-consuming and requires a lot of man power. Accordingly, this review paper is aimed to study the different research works carried out by the different researchers in the respective field of researches during last one decade. It is observed that different modern technologies like robot, AI, ML are used in the field of agriculture for reducing the hard work of the farmer. The smartphone application is also used to control the robot and move it into the required places. This paper primarily discusses the important points that are taken from the literature survey. The objective of this review was to view the trends in the development of seed sprayer machine within the past decade.

Keywords: Smart Farming, Solar Power, Seed Sprayer Machine, Internet of Things.

Introduction

India's agricultural production ranks second in the world. Machinery in agriculture, encompassing a wide range of mechanical devices. It serves the fundamental purpose of mechanizing farming processes to reduce the heavy reliance on manual labor, with farm machines by observing the figures below. It is also varied in complexity from the simplest hand-held tools implements that have been utilized [1]. From the prehistoric era it is highly intricate and advanced harvesters used in modern mechanized agriculture and harvesting technology has also evolved gradually. It has a longstanding history as the initial agricultural machines consisted of basic hand tools like hoes and ploughs. These are primarily employed for the essential tasks of tilling the soil and planting crops [2]. And later advancements saw the development of animal-powered machines such as threshers and reapers. These are specifically designed for the crucial tasks of harvesting crops and threshing grain etc. The transformative breakthrough in the late 19th century with the invention of the internal combustion engine paved the way for the widespread utilization of machinery in agriculture [3]. It leads to the replacement of animal's power by tractors, machines, and various other motorized devices. By using these the efficiency and productivity of agricultural practices and enabling the cultivation of more extensive areas of land with a reduced need for human labor.

Solar machines are becoming increasingly popular in agriculture, as they offer a number of advantages over traditional diesel-powered machines. Solar machines are more environmentally friendly, as they do not produce any emissions. They are also more cost-effective in the long run, as they require less fuel and maintenance. Additionally, solar machines can be used in remote areas where there is no access to electricity [4]. Solar machines are still a relatively new technology, but they have the potential to revolutionize agriculture. By using solar energy to power agricultural machines, farmers can reduce their costs, improve their environmental impact, and increase their productivity [5]. In addition to the examples above, there are a number of other solar machines that are being used in agriculture today, such as solar-powered fencers, milking machines, and egg incubators. Solar machines are also being used to power agricultural processing facilities, such as grain mills and oil presses. As the cost of solar technology continues to decline and the efficiency of solar machines



continues to improve, we can expect to see even more widespread adoption of solar energy in agriculture in the years to come.

Solar-powered seed sprayer machines are a new and innovative way to plant seeds. These machines use solar energy to power the fan that disperses seeds onto the ground. This eliminates the need for fossil fuels, making them a more sustainable option for farmers. Solar-powered seed sprayer machines offer a number of advantages over traditional seed sprayer machines [6].

Literature Review

• *Need of agriculture*

Gomiero et al [7] said that modern agricultural methods have a significant impact on the environment. One of the most pressing challenges is soil loss, which can lead to decreased soil fertility. Rising water demand from agricultural practices is also a concern, as is environmental contamination caused using agrochemicals. Additionally, changes in land use have led to the loss of biodiversity, and agricultural practices release greenhouse gases into the atmosphere. There is a need for alternative, more environmentally conscious agricultural methods. Research is needed to better understand the potential and limitations of these methods. Despite the successes of the Green Revolution, global food demand is expected to increase by 70-100% by 2050. This means that we need to find ways to feed nine billion people while using less land, water, and energy. Technological advancements will be necessary, but we also need to address socioeconomic challenges such as resource access inequity, population expansion, and educational access. Anderson et al [8] suggested the effects that may vary by region and crop, it is expected that climate change will have a considerable impact on agriculture and food security. In order to guarantee future food security for this expanding population, agriculture urgently needs to adapt to the growing global population. Adaptation Strategies include modifying cropping and land use, creating better crop types, and altering food consumption and waste. Some of the effects of climate change on food production can be mitigated by recent discoveries in genomics and agronomy, but given the time required to enhance crops, significant investment is needed to realize these changes. Agriculture can only adapt to climate change to a certain extent, therefore long-term food security depends on political commitment to reducing the climate change effects of burning fossil fuels.

Srivastava et al [9] emphasizes the urgent need to think holistically in order to achieve a sustainable agro-ecosystem. The complex network of dynamic interactions in agro-ecosystem soil is crucial to this effort. This network reflects the inherent tendency of dynamic ecosystems to achieve a more efficient state through improved interactions. The short-sighted and inefficient agricultural management practices of the Green Revolution era have been detrimental to these interactions in agricultural soils. This is evident in the declining efficiency, productivity, and multifunctionality of these soils. These practices have also eroded the efficiency-building interactions between biotic and abiotic components, jeopardizing the internal regulation of our agro-ecosystem. Ikerd et al [10] discussed the traditional and eco-friendly approaches in agriculture are primarily concerned with disparities in farming ideologies rather than actual farming techniques or procedures. The traditional agricultural model essentially follows an industrial development approach, perceiving farms as factories and regarding fields, plants, and animals as units of production. The aim of industrial development is to enhance human well-being by augmenting the production of material goods and services, while simultaneously increasing overall employment and incomes. The underlying assumption of this industrial model is that an improved quality of life can be achieved through increased income and consumption of goods and services. A fundamental strategy employed in industrial development is the specialization, standardization, and mechanization of agricultural production in order to attain the economic efficiencies inherent in large-scale industrial manufacturing. Novel technologies are designed to eliminate physical and biological constraints on production, thereby enabling limitless progress. On the other hand, sustainable agriculture is rooted in a comprehensive paradigm or developmental model that perceives production units as organisms



comprising numerous interconnected sub organisms, each with its own distinct physical, biological, and social limitations [11-13].

- ***Machinery in agriculture***

Chadalavada et al [14] said that Agricultural sprayers come in a variety of design types, sizes, equipment configurations, and performance requirements. Agricultural sprayers range in size from little ones that cover a small area up to very huge ones that cover a wide area and spray a plant. For the numerous different crops, types of plants, and types of soil that sprayers are employed on, engineers have created and optimized sprayers' application and performance. Fertilizers, insecticides, and other crop-performance and pest-maintenance chemicals are frequently applied with agricultural sprayers, along with water and water chemical solutions including acids or caustic compounds.

Kathiravan et al [15] improvements to agricultural practices are addressed. The mechanics for sowing the seeds are part of a manually controlled seed sowing machine. This process is simultaneous. The primary goal of a sowing operation is to plant seeds at the proper depth, with the necessary distance between them, and then cover them with dirt. The specified row spacing and sufficient compaction over the seed will help us obtain the highest yield possible [17]. Scolaro et al [16] explained about electrification of agricultural machinery, with a concentration on hybrid electric tractors and associated implements. shows taking a close look at the key findings in the literature and taking into account cutting-edge technology, a detailed discussion on the use of electric drives in farming tractors is provided. Additionally featured are manufacturer proposals and prototypes, economic analyses, and future trends.

Basharet al [18] were proposed the method in this a paper that makes use of an Android application to automate agricultural machinery via the internet of things. The automated machinery makes sure that all job is completed automatically and without human input. The main goal of their research was to build a ploughing device to be used for soil cultivation. The objective is to decrease the amount of labour required to operate the plough. The only solution is to automate it, however due to a few restrictions, we are unable to fully automate it. Full automation, for instance, would demand power, which is not always available in rural locations, as well as microprocessors and sensors, which would increase cost and maybe require specialized training to operate. We intended to semi-automate it using engines, motors, and power transfer tools as opposed to fully automating it.

- ***Seed Sprayer Machine***

Majumdar et al [20] said that conventional Machines for sowing seeds are ineffective and time-consuming. In Indian farms, conventional seed-sowing equipment is a typical sight. These devices, however, are frequently ineffective and time-consuming. They can harm the soil's texture and are labour-intensive to use. Additionally, traditional seed-sowing equipment is not very precise. Reduced yields and inconsistent crop development may result from this. There are a number of novel seed-sowing methods that are quicker and more effective. Mohamed et al [21] conclude that the agriculture industry is under increasing strain to meet the demands of a growing population in the quickly expanding globe of today. Farmers must develop new strategies to boost crop yield without compromising the soil. The solar seed sprayer machine is one intriguing new method. This device sprays seeds directly into the ground using a fan or blower, doing away with the requirement for labour-intensive manual labour. It also enables more precise sowing, which can increase agricultural yields while saving time and labor. It doesn't need an external power source because the solar seed sprayer is powered by a solar panel. This makes it an environmentally responsible and sustainable choice for farmers. Although it is still in development, the solar seed sprayer machine has the power to completely alter the way seeds are sown. With the use of this new technology, farmers may be able to produce more crops while spending less on labor and preserving the environment [22].

Surendra Poonia et al [23] investigated In conclusion, the development of a movable solar-operated sprayer offers a promising solution to the challenges faced by farmers in Nigeria. Its ability to operate using solar power, alongside its efficient design and incorporation of supplementary



features, makes it a suitable alternative to conventional sprayers. This innovation not only reduces user fatigue and maintenance costs but also mitigates environmental harm associated with fuel sprayers. The solar sprayer has the potential to significantly improve farming practices, particularly in rural areas where access to a reliable power supply is limited. Winnower-cum- PV dryer can be used for threshing the materials and cleaning of grains in the absence of erratic and unreliable natural winds and also for more effectively and efficiently dehydrating fruits and vegetables. Farmers can use solar dryer for drying fruits and vegetables, which are sold by farms at throw-away prices. The animal feed that is fed to dairy animals by using animal feed solar cooker. These activities will increase farm income by using solar energy in in.

Aroonsrimorakot et al [24] discussed about the agricultural activities demand continual energy resources for machinery operation, irrigation pumps, greenhouse heating. These are all traditionally powered by fossil fuels. Fossil fuel usage in farming promotes climate change since it produces a lot of greenhouse gases. Khyati Vyas et al [25] came to conclusion that the majority of people, the agriculture industry is their source of income. To benefit properly, the agricultural industry needs the right irrigation systems and other amenities. Many crops are seasonal; therefore, most farmers don't receive a consistent stream of income. Farmers don't appear to be able to profit from their dry or uncultivated land. Alternative energy may be effectively used to address these major global issues. A large amount of solar development is taking place as lands are being converted from agricultural land or vacant land into solar projects. This provides a huge opportunity to enhance our food security and advance agriculture while also advancing energy development.

Yuliana et al [26] concluded that the need for more ecologically friendly energy sources has arisen as a result of the rising global food demand and the volatile price of fossil fuels. One of the biggest overhead expenses in the cultivation of greenhouse crops for effective climate control is energy. The sustainability of greenhouse output is improved by the employment of wind-solar renewable energy systems for the management of greenhouse settings. Ahmed Ali Hussein et al [27] discussed the Alternatives to fossil fuels like renewable energy are getting a lot of attention these days. Solar energy is the most significant renewable energy source since it can be found everywhere. This energy source is also employed in a number of other sectors, such as agriculture, and it may be utilized to cultivate crops even in the most distant regions of the globe. Additionally, unlike other fossil fuels, this fuel does not contribute to pollution. All agricultural lands are capable of using solar energy. As the population increases, this will undoubtedly assist fulfill the rising need for agricultural products. However, it is well recognized that agricultural land has a finite area, and occasionally, agricultural goods cannot be grown. The construction of solar greenhouses in remote locations can be aided by the use of solar energy and this modern greenhouse approach. Other uses for solar energy include ventilation outlets, drying devices, and irrigation. Researchers in this study talked about a few advantages of solar energy in farming.

Conclusion

The following are the inferences drawn from the above literature review based on various research works associated with the performance of solar powered seed sprayer which are used for spraying of the different seeds related.

- The environmental impact of modern agricultural methods, it lacks a deeper exploration of regional variations in these impacts. Different geographic locations may experience unique challenges and opportunities related to agriculture and technology adoption.
- The need for technological advancements in agriculture, it would benefit from specific case studies showcasing successful implementation and outcomes of AI and other technologies in real-world farming scenarios.
- socio-economic challenges is limited. Further exploration of how factors like education, income levels, and cultural aspects impact technology adoption in agriculture is needed.



- While there is substantial research on using solar energy for various agricultural processes, there is a need for more studies that focus on the practical integration of renewable energy systems into agricultural operations. This includes assessing the economic feasibility, scalability, and long-term benefits of such integration.
- The use of automation and robotics in farming, more studies are required to optimize and fine-tune these technologies for efficient and precise seed sowing, pest control, and other farming activities.
- Incorporating advanced monitoring systems and data analytics in solar-powered agricultural machinery is an area with potential for further research. This could enable real-time data-driven decision-making and resource management.
- Although renewable energy and automation can have environmental benefits, there's a gap in comprehensive assessments of the environmental impact, including potential unintended consequences, of large-scale adoption of these technologies in agriculture.
- Research should focus on making solar-powered agricultural machinery and automation systems affordable and accessible to small-scale and resource-constrained farmers, especially in developing regions.
- Exploring how farmers interact with and adapt to these new technologies, including issues related to training and usability, is an area that requires more attention.
- Different crops and soil types may have unique requirements for seed sowing and other agricultural processes. Research should address how these technologies can be adapted to suit various agricultural contexts.
- Investigating the development of multi-functional agricultural robots or machinery that can perform multiple tasks efficiently, such as seeding, fertilizing, and pest control, could be an area for further exploration.
- That examine the regulatory and policy frameworks needed to support the widespread adoption of renewable energy and automation in agriculture are essential, as these technologies may require specific incentives and regulations.
- The solar powered seed sprayer is a machine that which help the farmers to the spray the different seeds in the specific dispensation with the low cost of maintenance.

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