Contribution of Science in Agriculture

Name

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Date

**Introduction**

Science contribution to agriculture is significant. Science supported human civilization as early farmers invented the first tools to increase output. Today the contribution of science in agriculture is sophisticated and integrates all major disciplines of natural science. These include Chemistry, Physics, geology, and Biology. Agriculture is the art of producing food and other desired products through the cultivation of plants and rearing domestic animals. In the contemporary world, agriculture extends beyond providing food to the community and is a source of wealth in many countries. Developing countries export agricultural products and import industrial products—developed countries like the US export particular agricultural products to designated markets where demand is highest.

Natural science is the pursuit of knowledge covering general facts or the operation of fundamental laws in areas of biology, chemistry, physics, and geology. It has helped solve many challenges in the agricultural sector. For instance, it informs on ecological agriculture that involves sensitivity to the local conditions (*Sustainable agriculture-role of smallholding agriculture*, 2018). The value of chemistry in agriculture includes determination of soil pH, availability of major nutrients in the soil such as nitrogen, phosphorus, and potassium, among others. The soil has to be tested before the land is qualified for agricultural practices to determine the level of the soil pH (Gamble, 2017). Biological science is important in quality development; for instance, the knowledge of genetically modified organisms that have enhanced the increased production of different desired products (Lee & Chun, 2014). This research paper aims at explaining the role of science in agriculture through a review of different scientific studies. Science plays a central role in agriculture since the existing scientific studies show that knowledge in chemistry, physics, geology, and biology is a solution to agricultural challenges.

**Application of Chemistry in Crop Farming**

The first scientific study that illustrates the role of science in agriculture is Gamble (2017) that explains the application of physical chemistry in agriculture. The study is based on the observation that soils are physically and chemically irregular and also dynamic. Particularly the study sought to understand the physical chemistry of pesticides in the soil and water (Gamble, 2017). The study focused on increasing the knowledge of the physical chemistry of the soil to enhance better control of the pesticides. This has significant implications and has been supported by other scientific studies. According to Pradhan and Mailapalli (2020), the excessive use of pesticides leads to increased waste and poor targeted delivery, leading to different adverse effects, including pesticidal resistance. The knowledge of physical chemistry includes exploring how many moles of pesticides are sorbed in the soil-water interface to create adverse effects (Gamble, 2017). Analytical instrumentation methods such as the High-Pressure Liquid Chromatography (HPLC) are important in kinetic and mechanism calculation to define the chemical components in the soil. One application is the surface runoff into the freshwater, causing pesticide contamination. A better understanding of the physical chemistry of these chemical components in water solid-interface is critical. The study concludes that a better understanding of the physical chemistry of pesticides is critical to enhancing effective application without harming the populations.

The study demonstrates the application of chemistry in agriculture in the management of pesticides. With soil and water providing food to more than 7 billion people, it is important to ensure the value is leveraged without poisoning the population or contamination of the environment (Gamble, 2017). Although there are alternative means for controlling the pests in the farms, pesticides are the most effective methods and hence the need for science to control adverse effects. Gamble (2017) concludes that the significant research progress made in other fields such as astronomy, high energy physics, and Genetics must be replicated in physical chemistry to enhance effective outcomes. In genetics, the most notable area of progress is in genetically modified food (GMO) to improve productivity.

**Application of GMO**

Scientific also plays an important role in agriculture through the GMO. Lee and Chun (2014) explore the value of GMOs in addressing climatic change effects. The study was based on the observation of the increased impact of climate change in the whole world. Geological and climatic changes have negatively affected the ecology (Lee, S., & Chun, 2014). This scientific study's focus is to explore the potential of GMOs as a solution to the problem. The efficacy of GMOs as a solution to climatic change has been established. Lee and Chun (2014) focus on increasing the knowledge on GMOs, including the merits and demerits and the alternatives to the existing solution. Although there are reasonable concerns about the shortcomings, unscientific rumors hinder the effective utilization of this innovation (Lee, S., & Chun, 2014). People are concerned about inappropriate genetic modification despite the increased application. In Korea, where the scientific study is based, imported products 50% corns and 70% beans are genetically modified. GMO is confirmed to affect ecological biodiversity. The study concludes that GMOs are an effective solution to the problem of climatic change.

The GMO initiative improves the crop harvest through organisms that are well fit in the new environment. The crop can sustain itself in the worst situation by injection of genes that withstand the harsh climates. Considering that climate change is unexpected, it is appropriate to utilize the technology to enhance agricultural production. This will help to solve the problem of food shortage in the world. GMO illustrates how biological science contributes to agriculture throughout the world. As the world encounters different challenges following the impact of human and natural activities, knowledge is useful as a viable solution. The application of science in agriculture is thus extended to all branches of natural science.

**Application of Physics in Agriculture**

Physics is also effectively utilized in agriculture to limit hazards to agricultural objects and the environment. Gliński, Horabik, and Lipiec (2013) explain the role of agrophysics knowledge in managing the quality of the soil and agricultural products and the technological process involved. Agrophysics involves studying the physical process and all the properties that affect the production of plants. It has been observed that a better understanding of the physical process promotes efficiency in the use of water and agricultural chemicals (Gliński et al., 2013). Agrophysics also help reduce biomass loss in different activities, including storage, transportation, and harvesting. For the expansion of knowledge on agrophysics Gliński et al., (2013) explains application in the investigation of hazards to the agricultural products in the influence on environment, nutritional, and technological values.

In knowledge, the necessity is to utilize modern measuring methods for description of soil structure, coupled heat and water transfer, effects of multiple stresses (extreme temperature, salinity, etc.). In practice, it helps specify appropriate agricultural machinery, improve landscape management, utilize technology to create optimal physical conditions, and save energy in the technology process. Gliński et al. (2013) conclude that agrophysics is useful in both agriculture and management of the natural environment. Soil, water, plants, harvests, and all the physical characteristics of agricultural products directly influence the economic value of agriculture. Physics knowledge is thus effective in the management of the agricultural process to improve on effectiveness and efficiency of operations. This knowledge is also essential in enhancing the overall conservation of the physical environment, the backbone of agriculture. Science is thus useful in addressing all the major challenges experienced in agriculture.

**Science for the sustainability of smallholding agriculture**

Science is useful in agriculture within the smallholding as in large scale farming to increase the viability of this sector. It is observed that smallholding agriculture (SHA) is the foundation of the rural structure, and its damage would lead to unprecedented chaos (*Sustainable agriculture-role of smallholding agriculture*, 2018). *The Sustainable Agriculture-Role of Small Holding Agriculture (2018)* focus is to explain how science is useful in supporting the sustainability of SHA as an important component of society in developing countries. This is critical in the eve of the continuous debate on landholding to enhance optimum production and economic viability of agriculture. The study highlights scientific evidence that supports small landholding as an essential component for sustainability of agriculture. First is the ecological agriculture that promotes farming that is sensitive to the local condition. In this case, the farmers' quality of life is prioritized over economic viability *(Sustainable agriculture-role of smallholding agriculture*, 2018). Second is sustainable intensification by increasing diversity and productivity in SHA. It promotes using limited resources to achieve efficiency. The third is the green transformation, which promotes small scale farmers' contribution to sustainability through payment for ecosystem services. The study concludes that social benefit, economic viability, and environmental impact are primary measures in defining agricultural practices. Although there are limitations in SHA's economic viability, science can help establish solutions to make the sector viable. Agriculture is a science, and hence scientists hold solutions to agricultural problems.

**Conclusion**

The scientific studies show the application of scientific knowledge from different areas in agriculture as a solution to existing problems or to promote higher value. Physical chemistry is useful in the management of pesticides to ensure high crop production for the population without causing harm. Agrophysics is the foundation for improving agricultural processes, including recommendations for the use of machinery to improve effectiveness and efficiency while protecting the environment. Biological sciences have a viable application through the GMO that enhances high productivity to address food shortage challenges in the era of climatic change. The study also shows that science has the solution to social challenges surrounding agriculture by enhancing SHA's economic viability. One major question that arises is the sustainability of agriculture and the environment in the continuous use of scientific knowledge. It is clear from the studies that science makes a substantial contribution to agriculture both in solution to the external conditions and increasing productivity. Comprehensive studies in all scientific fields must be proactively undertaken to expand the knowledge applicable to address existing challenges.

**Reference**

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