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An Analytical Study on the Advancement of Modern Agricultural Technologies

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Abstract

Agriculture holds a vital position in India's economy. It contributes nearly one-third of the national income, ensures food security for the growing population, supplies essential raw materials to agro-based industries, accounts for a significant portion of export earnings, and provides employment to nearly 70% of the country's workforce. Agricultural production in India is broadly categorized into food grains and non-food grains, with food grains comprising about two-thirds of the total output. Within this category, rice is the most prominent crop, followed by wheat. The evolution of agricultural practices has been a continuous process, spanning from prehistoric times through the medieval and renaissance periods to the industrial revolution, ultimately shaping the modern agricultural industry as we know it today.

Keywords: Agricultural, Production, Prehistoric, Revolution

Introduction:

Precision agriculture started in the 1990s through rapid use of personal computers. By the year 1994, development of satellite technology enabled farmers to assess and map their farming activities depending on information like weather and vegetation indices. It was during this period that information-based farming was first applied, to pave way to other future developments. Towards the mid-2000s, agricultural production changed drastically as the genetically modified (GM) crops became commercialized. The farmers could produce crops that had improved features, including resistance to pests and tolerance to herbicides through biotechnology increasing their yields and cutting down on chemical development. Traditionally, before the 20 th century, agriculture was still a manual process. To carry out all farming procedures farmers had to use mostly human force and animal energy: plowing, sowing, or harvesting. The agricultural knowledge was not scientifically supported and was mostly transferred down the generations without modern farming tools resulting in a reduction in productivity and the diversity of crops. The Green Revolution in the mid-20 th century however changed all this. It brought in high yielding varieties of seeds, chemical fertilizers and mechanised equipment, which boosted food production by significant levels. After this, the 1980s and 1990s produced great technological changes including incorporation of Global Positioning System (GPS) in farm equipments. This enabled them to plant, nourish and move with precision, doing farming in a much controlled and effective way. When we got to the 21 st century, the pace of agricultural innovation began to gather steam. Since the beginning of the 2000s, big data, the Internet of Things (IoT), and Artificial Intelligence (AI) have started



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to transform the farming process. The data analytics accompanied informed decision-making and real-time field data through the usage of drones and sensors. Intelligent irrigation systems saved on water consumption which was remotely controlled. Newer methods including hydroponics, vertical farming and urban agriculture were developed that are resource efficient and particularly well suited to urban populations where space is limited.

Since the 2010s, the concept of sustainability became one of the key movements in agricultural development. Such practices as managing crops (cover cropping planning), reducing tillage, and crop diversity rotations were gaining momentum within the concept of conservation agriculture. The Integrated Pest Management (IPM) was initiated to reduce the levels of chemical usage by the use of biological mechanisms. In the meantime, the climate-smart agriculture concept solved the problem of climate change challenges with the incorporation of weather prediction applications and other types of resistant crops at the farming scale. And as the evolution continues, agricultural technology has grown to be of critical essence in creating food security, advancing productivity and finally achieving metabolic support. As the transformation is described through the feat of the Green Revolution, the height of precision farming, biotechnology, and data-driven production, the journey also evidences the shift of a revolutionary change, coming off of a world of basic subsistence farming, to a technologically enabled and sustainable future of food production.

As far back as history does recollect, the agrarian society of Haryana would knowingly or unknowingly rely on the plough as an important tool towards transforming its arid and rugged topography into productive agrarian term. Introduction of plough was also a major milestone towards rationalizing agricultural productivity as farmers were able to cultivate larger farm lands thereby developing a food security to the growing populations. In addition to its usefulness the plough had another impact by affecting the socio-economics structure of the region which has been characterized by interdependence among the community members where agriculture laws have come to play a central role in the lives of people as it became their joint activity and source of responsibility.

In the traditional culture of Haryana the plough has a deep symbolic meaning. It is a lamentation because it commemorates the un-dying endeavor of farmers who work tirelessly to unleash nourishment out of the earth. Ploughing rites and harvest festivals that are held on an annual basis show reverence and the huge esteem that the society has towards its agricultural origins. The traditions are highly placed on the significance of the plough in both the culture and in agricultural identity of the area. The legacy of the plough, though in an age of modern mechanization continues to remind that Haryana was once an agricultural state and that the champions of this land battled valiantly with this ancient tool to develop a true relationship with the land. The design of the plough is deliberately strong based on functional consideration. The shoe and the body are made as one piece and this increases the strength and durability of the furrow it forms. This solid build construction is specially designed not to have weak joints



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so that this implement can be used in hard and stony soils and it overcomes natural humps situated in ploughing. This ingenious construction represents a mix of tradition and functionality, the creativity of the instruments, which defined the agricultural heritage of Haryana.

The power tiller is an outstanding invention that has revolutionized procedures in agriculture by its effectiveness, flexibility and small size. This new device substitutes what can be referred to as labor-intensive techniques in the process of plowing, harrowing, and cultivating with little physical strains. Compared to the traditional farming equipment such as hand ploughs or ploughs carried by animals, power tillers use powerful engines, adjustable blade and maneuver easily to become very efficient in all types of farming. The interchangeable attachments are one of the best options included in the power tiller as it has been able to move effortlessly among various tasks and at the same time saved a lot of time and labor on land preparation. The accuracy of this machine guarantees that there is uniformity of turning and seedbed preparation of the soil thus enhancing better establishment of crops and the increase of yields. Through the incorporation of the modern-day technology and tradition of farming requirements, the power tiller has been doubly vital in the modernization of farming, productiveness, and growth of the lives of the farmers particularly in medium and small-scale farming communities.

In historic terms, the yoke was an element of the traditional agriculture in Haryana. Made with strong woods like neem or mango, this heavy duty wooden land machine was meant to be worn around the neck of an ox or another life harnessing animal, and farmers could use the power of the animal to do many of the chores on the farm. It served a primary purpose in tilling the soil and breaking hard ground and working of the fields before planting became the mainstay of the agricultural economy and food production in the region since times immemorial. Yoke was more than functional, it was a symbol of an inseparable connection of man with animals, of wisdom and sustainability of ancient methods of farming. This was an important part of farming equipment used by the farmers of Haryana to meet the labor-intensive tasks of plowing, sowing, and preparing the lands. The utilization of the yoke however went into decline with the introduction of modernization and mechanization. The emergence of tractors, power tillers and other mechanical devices provided better and quicker support that transformed the agricultural sector and lowered dependence on animal-powered devices. Nevertheless, in a few pockets of rural Haryana the yoke is still used being a living Juan de los Muertos and a representation of the farm legacy. The yoke is still not a modern concept as its use has decreased, but folk culture, artistic output, and oral history continue to remind the reflection of the yoke. It is yet an inspiring reminder of the agrarian identity of Haryana, and it is a symbol of resilience, creative thinking, and eternal spirit of the farming community. Continuous attempts to keep the cultural and historical value of the yoke alive and to officially leave a mark



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in the history of the farming development of Haryana make sure of the continuity of this simple, at the same time rich, tool in the history of Haryana.

Conclusion:

The farming system in the past cannot adapt with the change of climatic conditions and modern challenges on a larger scale as the modern system of farming appears to be highly adaptive to the challenges in farming with the help of technology and modern methods. Traditional agriculture involves little use of data to do decision making and this usually occurs through experience and observation. Contrastingly, sophisticated agricultural systems take advantage of the power of data analytics and real-time insights as they implement better and strategic choices. The other great difference is on effectiveness of time. Conventional farming is labor demanding and time consuming whereas modern farming makes use of automated technologies and acts as a substitute of the manual techniques and tools of farming which frees substantial time consumed in various operations. Moreover, the traditional agriculture is not innovative, as it is still based on all-time-old practices, but modern one continuously evolves, assimilating all the novelties of the biotechnology, AI, and smart farming tools. Finally, the two also have a big distinction in sustainability activities. Conventional approaches differ in their levels of environmental impact and modern agriculture is focused on precision farming that implies the optimal resource utilization and the increase of the ecological sustainability. The shift highlights that the constant improvement in the technological aspect of farming does not only increase productivity but also creates a more sustainable and resilient future of the farming system.

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