USE OF TECHNOLOGY IN AGRICULTURE IN INDIA AND WORLD

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ABSTRACT

In this paper , we discuss Increasing of agriculture products is of importance so that research and development in this branch considers as one of the most important infrastructure which develops production growth. Technology has played a big role in developing the agricultural industry. Today it is possible to grow crops in a desert by use of agricultural biotechnology. With this technology, plants have been engineered to survive in drought conditions. Through genetic engineering scientists have managed to introduce traits into existing genes with a goal of making crops resistant to droughts and pests. Technology has turned farming into a real business, now farmers have electrified every process, a consumer can place an order directly online, and the product will be transported from the farm to the consumer in time when it's still fresh. This saves the farmer money and it cuts out mediators who tend to buy low from farmers and sell high to end consumers. Every farmer uses this technology in their own way. Some use it to create fertilizers, others use it to market their products, and others use it in production.

Keywords:- *Agriculture, Economic development, Agricultural crisis, Technology fatigue, Food security, Climate change.*

I INTRODUCTION

The history of **Agriculture in India** dates back to Indus Valley Civilization Era and even before that in some parts of Southern India. Today, India ranks second worldwide in farm output. Agriculture and allied sectors like forestry and fisheries accounted for 13.7% of the GDP (gross domestic product) in 2013, about 50% of the workforce. The economic contribution of agriculture to India's GDP is steadily declining with the country's broad-based economic growth. Still, agriculture is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of India. India exported $38 billion worth of agricultural products in 2013, making it the seventh largest agricultural exporter worldwide and the sixth largest net exporter. Most of its agriculture exports serve developing and least developed nations. Indian agricultural/horticultural and processed foods are exported to more than 120 countries, primarily in the Middle East, Southeast Asia, SAARC countries, the EU and the United States

II INDIAN AGRICULTURE AFTER INDEPENDENCE

In the years since its independence, India has made immense progress towards food security. Indian population has tripled, and food-grain production more than quadrupled. There has been a substantial increase in available food-grain per capita.Before the mid-1960s India relied on imports and food aid to meet domestic requirements. However, two years of severe drought in 1965 and 1966 convinced India to reform its agricultural policy and that they could not rely on foreign aid and imports for food security. India adopted significant policy reforms focused on the goal of foodgrain self-sufficiency. This ushered in India's Green Revolution. It began with the decision to adopt superior yielding, disease resistant wheat varieties in combination with better farming knowledge to improve productivity. The state of Punjab led India's green revolution and earned the distinction of being the country's bread basket.

The initial increase in production was centred on the irrigated areas of the states of Punjab, Haryana and western Uttar Pradesh. With the farmers and the government officials focusing on farm productivity and knowledge transfer, India's total foodgrain production soared. A hectare of Indian wheat farm that produced an average of 0.8 tonnes in 1948, produced 4.7 tonnes of wheat in 1975 from the same land. Such rapid growth in farm productivity enabled India to become self-sufficient by the 1970s. It also empowered the smallholder farmers to seek further means to increase food staples produced per hectare. By 2000, Indian farms were adopting wheat varieties capable of yielding 6 tonnes of wheat per hectare. With agricultural policy success in wheat, India's Green Revolution technology spread to rice. However, since irrigation infrastructure was very poor, Indian farmers innovated with tube-wells, to harvest ground water. When gains from the new technology reached their limits in the states of initial adoption, the technology spread in the 1970s and 1980s to the states of eastern India — Bihar, Odisha and West Bengal. The lasting benefits of the improved seeds and new technology extended principally to the irrigated areas which account for about one-third of the harvested crop area. In the 1980s, Indian agriculture policy shifted to "evolution of a production pattern in line with the demand pattern" leading to a shift in emphasis to other agricultural commodities like oilseed, fruit and vegetables. Farmers began adopting improved methods and technologies in dairying, fisheries and livestock, and meeting the diversified food needs of a growing population.

Men and women at work in rice paddy fields in Tamil Nadu

As with rice, the lasting benefits of improved seeds and improved farming technologies now largely depends on whether India develops infrastructure such as irrigation network, flood control systems, reliable electricity production capacity, all-season rural and urban highways, cold storage to prevent spoilage, modern retail, and competitive buyers of produce from Indian farmers. This is increasingly the focus of Indian agriculture policy.

III MAJOR CROPS AND YIELDS

The following table presents the 20 most important agricultural products in India, by economic value, in 2009. Included in the table is the average productivity of India's farms for each produce. For context and comparison, included is the average of the most productive farms in the world and name of country where the most productive farms existed in 2010. The table suggests India has large potential for further accomplishments from productivity increases, in increased agricultural output and agricultural incomes.

Largest agricultural products in India by value

Rank	Commodity	Value (US$, 2013)	Unit price (US$ / kilogram, 2009)	Average yield (tonnes per hectare, 2010)	Most productive country (tonnes per hectare, 2010)	
1	Rice	$42.57 billion	0.27	3.99	12.03	Australia

Largest agricultural products in India by value

Rank	Commodity	Value (US$, 2013)	Unit price (US$ / kilogram, 2009)	Average yield (tonnes per hectare, 2010)	Most productive country (tonnes per hectare, 2010)	
2	Buffalo milk	$27.92 billion	0.4	0.63	23.7	India
3	Cow milk	$18.91 billion	0.31	1.2	10.3	Israel
4	Wheat	$13.98 billion	0.15	2.8	8.9	Netherlands
5	Mangoes, guavas	$10.79 billion	0.6	6.3	40.6	Cape Verde
6	Sugar cane	$10.42 billion	0.03	66	125	Peru
7	Cotton	$8.65 billion	1.43	1.6	4.6	Israel
8	Bananas	$7.77 billion	0.28	37.8	59.3	Indonesia
9	Potatoes	$7.11 billion	0.15	19.9	44.3	United States
10	Tomatoes	$6.74 billion	0.37	19.3	524.9	Belgium
11	Fresh vegetables	$6.27 billion	0.19	13.4	76.8	United States
12	Buffalo meat	$4.33 billion	2.69	0.138	0.424	Thailand
13	Groundnuts	$4.11 billion	1.96	1.8	17.0	China
14	Okra	$4.06 billion	0.35	7.6	23.9	Israel
15	Onions	$4.05 billion	0.21	16.6	67.3	Ireland
16	Chick peas	$3.43 billion	0.4	0.9	2.8	China
17	Chicken meat	$3.32 billion	0.64	10.6	20.2	Cyprus
18	Fresh fruits	$3.25 billion	0.42	1.1	5.5	Nicaragua
19	Hen eggs	$3.18 billion	2.7	0.1	0.42	Japan

Largest agricultural products in India by value

Rank	Commodity	Value (US$, 2013)	Unit price (US$ / kilogram, 2009)	Average yield (tonnes per hectare, 2010)	Most productive country (tonnes per hectare, 2010)
20	Soybeans	$3.09 billion	0.26	1.1	3.7 Turkey

VI THE ROLE OF TECHNOLOGY IN SUSTAINABLE AGRICULTURE IN WORLD

The notion that agriculture, as a global practice, has been exploiting resources faster than they could be renewed has been a topic of discussion and debate for decades, perhaps centuries. Symptoms of imbalance have been seen in the form of pollution, soil erosion/loss, wildlife population decline/shifts, and general alteration of a "natural" flora/fauna as a result of human intervention. Indeed, agricultural practices are undeniably "unnatural", regardless of whether the production is a one square meter vegetable garden in Tokyo or a one million hectare rubber tree plantation in Malaysia. Of course, an equally unnatural and parallel phenomenon has been the exponential growth in human population, with associated demands for both food and shelter, which have often exceeded the "natural" carrying capacity of land. Based upon the premise that human population growth will not be constrained as a result of food shortages due to overriding social values, this article makes three assertions regarding the role technology in sustainable agriculture:

- Technology has/will increase agricultural productivity
- Technology development has-been/will-be sustainable
- Technology is, therefore, the basis for Sustainable Agriculture

Food is subject to the economic principles of scarcity. Unlike the artificial value of scarce items such as gold, an adequate supply of food is paramount to population survival and skill diversification, making agriculture a first level priority. Technology has enabled human civilization to leave the "Hunter / Gatherer" paradigm of existence and concentrate labor and land to the sole purpose of food production on an ever-increasing scale. The concept of "scientific agriculture" dates to publications by Liebig in 1840 and Johnston in 1842, which speculated about the role of chemistry in agriculture . The concepts of inheritance and Mendelian genetics were soon to follow in 1865 and subsequently stimulated the biological basis for modern agriculture. Soon, science-based institutions in Europe and North America eagerly expanded the application of biological and chemical sciences to agriculture, spawning new technologies and approaches. These early applications of technology have not only increased food production in real terms, but have dramatically reduced the number of individuals directly involved in food production/processing – enabling the diversification of society to address social issues not directly related to "survival", but generally seen to increase the quality of life.

To deny the role that biological and chemical technology have played, continue to play, and will play in the future development of agriculture is to deny natural history itself. The indiscriminate or inappropriate use of chemical and biological technology, however, can clearly produce negative consequences to the ecosystem and threaten the long-term viability of the enterprise. The central issue of sustainability, therefore, is preservation of nonrenewable resources.

Food production, habitat preservation, resource conservation, and farm business management are not mutually exclusive objectives. Credible arguments have been advanced to suggest that production of food via high-yield agriculture techniques can meet the nutrition requirements of the global population. The balance can be achieved through planning land use – with a considerate analysis of what parcels of land to employ for high-yield agriculture while retaining marginal or poor land for non-agricultural activities or wildlife habitat preserves . Studies to quantify the impact on production of reducing or limiting inputs to agriculture have suggested that yields/hectare would decrease from 35% to 80% depending upon the crop (Smith et al.). Without a concurrent decrease in demand, the amount of land that must be utilized would increase dramatically. In fact, global land in production today, which is roughly the size of South America, would need to be the size of South America and North America if the high yield benefits of technology were not employed . If the motivation of sustainability is optimization of production and resource conservation objectives, then progress can clearly be achieved.

Sustainability in agriculture relates to the capacity of an agroecosystem to predictably maintain production through time. A key concept of sustainability, therefore, is stability under a given set of environmental and economic circumstances that can only be managed on a site-specific basis. If the perspective of sustainability is one of bias against the use of biological and chemical technology, and espouses a totally natural ecosystem, then agriculture as a practice is already excluded. If, on the other hand, the perspective of sustainability is one of preservation of non-renewable resources within the scope of the agricultural enterprise, then the objective is not only achievable, but good business practice and good environmental management.

To a large extent, the rate of technology development and the degree of innovation in future technologies will greatly influence the stability, and certainly the productivity, of agriculture. Technology, in the classical sense, includes the development and use of nutrients, pest control products, crop cultivars, and farm equipment; but it also includes the vision of genetically modified crops providing greater nutritional efficiency (more calories per yield, or more yield), manipulation of natural pest control agents, and use of farm management techniques that focus on whole-farm productivity over time, not just annual production per hectare. Consider the basic premise of biotechnology: the least expensive and most renewable source of energy on Earth is the sun and the most abundant and predictable mechanism to convert the energy from the sun to useable energy is photosynthesis -- biotechnology has enabled methods to direct abundant natural energy to new more efficient or unique food products. The imagination is literally the limit to the opportunities. Short term objectives will of course focus on yield, quality, and input reduction. Long term, however, the genetically-created "transmissions" will focus on creating super-nutritious feed for animals, plants that outproduce the subtractive influence of pests (making "tolerance" a key pest management tactic), physiological adaptation to out-compete adjacent species (e.g., weeds), drought stress tolerance, and overall improvement in the rate of photosynthesis (leading to any number of industrial applications).

The development and use of agricultural technology is not, however, limited to genetic wizardry. Indeed, the use of computational technology, combined with geographical location devices and remote sensing advancements, promise to radically change the way all crops will be managed. Commonly referred to as "Precision Agriculture", the underlying theme is integration of information to create management knowledge as a means to address site-specific production goals. Uncertainty with the environment will always be a key issue with agriculture, but this too will be managed as environmental modeling, combined with risk management algorithms, will lead to the optimal use of genetics on specific soils within known weather profiles. And, breakthroughs will continue to be seen in the "classical" technologies that have exponentially increased world food production since the advent of "scientific agriculture" in the late 1800's. In addition to advances in productivity, technology will be used to remediate land that has been overused or misused through poor agricultural practices.

The concept of Best Management Practices will continue to be a key focus, regardless of the current state of technological offerings. Strategies, such as Integrated Pest Management (IPM) consider the site-specific circumstances, but also the values and business considerations of the agricultural producers. IPM has been essential in describing the role and rationale for responsibly managing pests, pointing scientists and practitioners alike to identify future needs in biological information, and placing pest control in perspective with production goals. To this end, the concept of pest Economic-injury Levels has been central to dismiss the notion that pests must be controlled at all cost in favor of break-even analysis

Sustainability is indeed an issue of survival, but is far broader than the concept of habitat destruction and soil erosion. Sustainability includes the goal of food production, welfare of the food producers, and preservation of nonrenewable resources. To that end, technology of all types has been and will be the enabling man-made component that will link these two overriding objectives. Indeed, history confirms that technology has been essential to agricultural productivity/stability, current breakthroughs in technology confirm that the discovery and development of new technologies is a sustainable endeavor, and common sense directs us to the conclusion that technology will enable Sustainable Agriculture.

V CONCULSION

Irrigation is globally critical to quality of life, providing at least 40% of the total worldwide food and fiber supply. Despite current problems and negative perceptions in many sectors of society, irrigation continues to be a necessary and important component of the world's well being and growth. The paradox is that agriculture needs to increase production to meet societal needs; but the productive irrigated land base and available water is declining. This will probably lead to targeting inputs to meet yield goals somewhere near the economic optimum; however, increasing the efficiency of water use usually means reduced yields at some level. Such production will necessitate a major paradigm shift in water use within the next 25 years in many areas in the world. Both urban and rural users will need to lower and adjust their expectations on how and where water will be used; and they may have to accept much higher water and food prices as a result. Irrigated agriculture can reduce its water use while maintaining reasonable production levels. However, the challenges are substantial. In this era of declining field research on cropping systems, we must determine the specific knowledge and technologies required to accomplish this sustainability. To function as a society, we have to trust enough water will be available to satisfy all the needs for food, fiber, feed, and fuels in addition to environmental, recreation and municipal requirements. Nevertheless, major questions on water's allocation in each river basin and watershed remain to be resolved.

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