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Can Eco-friendly Food Feed the World?

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Abstract - ***This study aims to review the existing issues associated with providing eco-friendly food to the world's population as a whole. If what we grew actually made it into people's hands, we could easily feed more people. It is more likely that rural communities will adopt, refine, and keep in place innovations & interventions if they are informed by and based on indigenous agricultural methods. These green practices are seen as a viable option for use in organic farming since they are less harmful to the environment, more selective, biodegradable, cost-effective, & renewable.***

Keywords - Eco-Friendly, Agricultural, Food, Feeding.

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INTRODUCTION

Several studies predict that by 2050, the global population will have increased by two or three billion, which will result in a corresponding increase in the need for food of at least 50 percent. Since more individuals with better salaries can afford to eat more, especially meat, demand will increase for both. Using more of our arable land to produce biofuels will only make it more challenging to reach our doubling objective. It's clear that we'll need to double our current production if we're going to provide a steady supply of food around the world, even if we manage to tackle the problems of poverty & access that plague us today. More than that, actually. Human activity has transformed agriculture into the world's most significant environmental concern by destroying tropical forests, cultivating marginal lands, & increasing industrial farming in ecologically important areas. Agriculture already uses up a huge proportion of the planet's land area, and it is the single largest human source of habitat loss, groundwater depletion, river and ocean pollution, & greenhouse gas emissions. Assuring the world's long-term health requires significantly lowering agriculture's negative effects. As a result, the world's food supply is threatened by three major issues. During the next 40 years, Earth must double its food output while feeding seven billion people & still become ecologically self-sufficient. Do you think it's possible to reach both of those goals simultaneously? Together with a group of experts from around the world, I was able to settle on five steps that, if taken, would enhance the amount of food available for human consumption around the world by more than 100 percent, while also drastically cutting down on greenhouse gas emissions, biodiversity losses, water use, and water pollution. Taking on the triple challenge is one of humanity's greatest challenges. No matter what we do, our civilization's fate will be affected.

Methods of Eco-friendly farming:

Environmentally friendly methods include the following:

A. Organic farming: Synthetic fertilizers, herbicides, growth regulators, & animal feed additives are not used in organic farming. To keep soil productive and tilth, supply plant nutrients, & control insects, weeds, and other pests, organic farming systems depend on crop rotations, crop residues, animal wastes, lagumes, agricultural residues, off-farm environmental contaminants, mechanical cultivation, mineral-bearing rocks, & aspects of biological pesticides.

B. Biological farming: In biological farming, only certain chemical fertilizers are used (disruptive compounds like anhydrous ammonia and potassium choloride are avoided), and herbicides & insecticides are used in minimal quantities. (In biological farming, diagnostic tools are routinely employed to keep track of plant and soil health. Sugar content (Brix) in plant tissue sap can be measured using refract meters, energy released per gram of soil (ERGS) can be measured using electrical conductivity meters, oxygen reduction potential of soil (ORPS) can be measured using ORPS meters, & soil oxygen levels can be measured using radionics.

C. Nature farming: Additionally, regenerative agriculture & permaculture are well-known ways for sustainable farming. Nonetheless, similar to sustainable agriculture, these alphabetic systems are focused on ideas rather than practical applications.

D. Regenerative Agriculture: Regenerative agriculture relies on natural processes to reduce pest infestations, boost soil fertility, & boost yields. It presumes a permanent capacity to regenerate the

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resources needed by the system. To put these principles into action, regenerative farmers employ organic & low-input farming methods.

E. Permaculture: To this end, practitioners of permaculture adhere to a set of rules & principles that govern the planning and layout of sustainable communities and agricultural setups. Since permaculture is more of a land use planning philosophy than a production system, it can be applied to a wide variety of agricultural endeavors. Therefore, permaculture may be adapted to almost any ecological farming method that is site-specific.

HOW WE FEED THE WORLD TODAY

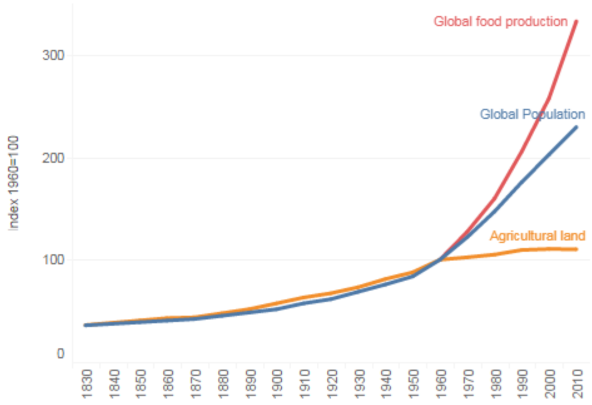
Food & agriculture: a (very) brief history

Humans have always been concerned that their food supply won't be sufficient to meet demand, from the earliest days of hunting and gathering to the present day of industrialized agriculture, aquaculture, & food processing. Thomas Malthus, in his now-famous Article on the Principle of Population (1798), foresaw widespread famine that could be remedied only via war and pestilence.

In truth, agricultural & maritime output have been steadily rising, easily keeping pace with rising consumer demand and worker pay. At initially, more and more area was devoted to farming (and fishing) (and water). Between 1960 and now, worldwide population has more than doubled, global food production has more than tripled, and agricultural land usage has increased by less than 15%; this independence among food production & agricultural land use emerged around the middle of the twentieth century.

Farmers increased output by implementing better inputs like synthetic fertilizers, superior plant varieties, and crop protection agents, as well as better management practices including crop rotation to maintain soil health and irrigation to maximize water use. The global fish supply has been boosted by the widespread use of cutting-edge technology and, more recently, aquaculture. These advancements allowed for greater output on a constant land and water footprint, but they frequently added to stresses on the natural resource base's viability.

The percentage of the population that faces food & nutrition insecurity has decreased from 15% in 2000 to roughly 11% today, despite the fact that the global population has doubled in size over the past 50 years, reaching 7.5 billion people. Although there is enough food for everyone, 820 million people are nonetheless at risk of becoming hungry. Widespread food insecurity today is a consequence of poverty, which is exacerbated by conflicts that make it harder to procure food.



Graph 1: Global food production, population and agricultural land use

Feeding the world today

Globally, food is produced under vastly different conditions. Numerous farms in developed countries are now able to affordably implement cutting-edge technology thanks to technological advancements. Despite making up the vast majority of farms (84%), those with less than two hectares of land account for barely a third of the world's total crop output. Due to a lack of knowledge and funds, small-scale farmers and fishermen often avoid experimenting with new methods for fear of jeopardizing their own food supply & economic stability.

Since the 1990s, the no. of people employed in the fisheries & aquaculture sector has more than doubled, from around 30 million to almost 60 million as aeffect of the broad adoption of aquaculture production, notably in Asia. Seafood consumption has increased faster than that of any other type of meat around the world. The proportion of the world's population engaged in agriculture has decreased, yet food production per farmer has climbed dramatically. While just a small percentage of people are employed in agriculture in the world's wealthiest nations today, the number rises to more than 40 percent in some key rising economies like India and much more in some less developed economies like many in Africa.

Graph 2: Medium term real price evolution

Food production has always been a high-stakes enterprise. Disease in livestock can have devastating effects on human & animal health, whereas crop production relies on healthy soil, clean water, a stable climate, and a long growing season. Supply constraints caused by drought can increase the volatility of prices caused by things like changing

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exchange rates or new trade restrictions. Farmers' ability to make a living depends on the money they make from their work, and these dangers threaten that.

Climate change will exacerbate problems in the food, agriculture, & fishing industries. Every year, the average temperature of the Earth sets a new record, while precipitation has become less predictable. Crop-destroying natural disasters like floods, droughts, and major storms have become increasingly regular in recent years. Crops, livestock, and aquaculture are all negatively impacted by the spread of pests, weeds, viruses, and disease to new regions. Future harvests are less assured because of the way climate change is affecting the productivity of capture fisheries and the dispersion of fish stocks.

Despite these unknowns, food prices have fallen dramatically over time as increases in supply have outpaced increases in demand. Poor harvests, short supplies, export restrictions, etc. all contributed to sharp increases in food prices in 2007 and 2008, followed by a period of very high price volatility. Ten years later, the global agricultural market is in a completely different place, & real prices for almost all commodities are forecast to resume their long-term trend downwards over the coming decade.

Agriculture, fishing, and other food production systems around the world are extremely varied. North and South America, with their vast arable land, have recently emerged as important agricultural exporters, whereas the Middle East and North Africa have far less arable land and water. Furthermore, many agricultural products are climate- or soil-dependent. Today, emerging economies, such as China and Vietnam, are no longer the primary suppliers of fish products worldwide.

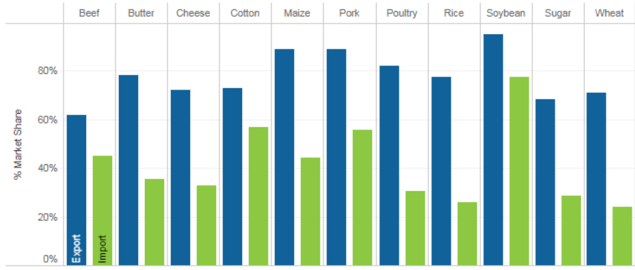
That's why the market for agricultural, marine, & food products has never been more active. Trade facilitates the distribution of a substantial portion of the food we consume every day. Consumers can buy fresh produce from overseas even when it's not in season, and the same goes for meat and fish.

Today, a few nations export a disproportionately large amount of certain agricultural commodities due to their substantial comparative advantage in this sphere. More than two-thirds of the world's wheat and beef exports are produced in just five countries. The proportion of soybeans is much above 90%. Sugar (Brazil accounts for 45% of global exports), oilseeds (Canada accounts for 54% of global exports), roots & tubers (Thailand accounts for 56% of global exports), number of dairy products are all exported predominantly from a single country, despite the fact that the share of the five main exporters is smaller for these commodities.

A smaller number of exporters often sell to a wider number of importers, making agricultural imports less concentrated. Soybeans and other oilseeds, roots and tubers, or other coarse grains are notable outliers, with demand predominating in China.

At the same time, the development of global value chains (GVCs) has enhanced the interconnection of our economies, since different countries participate in different stages of producing the food we eat and the clothes we wear. Direct participation in domestic value chains presents new chances for farmers and fishermen to gain access to global markets, but also new constraints. Further, consumers are shifting their expectations, which presents both new opportunities & problems for the upstream agricultural sector & food processing and distribution industries.

Compared to Malthus's period, the world's population and standard of living have both increased dramatically since then, and the global food system has evolved accordingly. But the world in which farmers and fishermen must work is constantly evolving, & rate of change is only accelerating. This sector can be more productive, sustainable, resilient, and responsive to consumer demand if governments do their part to make sure its policies, institutions, and infrastructure are adequate.



Graph 3: The export-import structure for specific food products

LITERATURE REVIEW

Amelia C. Montoya-Martínez et al. (2022) By 2050, the world's population is predictable to reach close to 10 billion, which means there will be a greater demand for food. Many researchers believe that by 2050, global food production would need to increase by at least 25%, and some estimate that it will need to increase by as much as 100%, just to keep up with the world's expanding population. Increased & sustained agricultural output is required to generate that quantity of food and other non-food agricultural items. Degradation of natural resources like soil and water, extinction of once-common microbiomes, the introduction of novel phytopathogens, pests, & weeds, and diminished agro-ecosystem fertility are only some of the negative outcomes of these practices. An ongoing difficulty is how to raise agricultural output without jeopardizing ecological stability or people's health. To keep ecosystems healthy and productive while yet producing enough food to satisfy demand, we must sustainably increase agricultural output. The usage of bio-products containing beneficial microorganisms, often referred as microbial inoculants or bioinoculants, is rising in prominence as a biotechnological tool to supplement conventional crop management. According to a survey by Fortune Business Insights, the agricultural bioinoculants market was worth $4.27 billion in 2019 & expected to be worth $11.81 billion by 2027, growing at a CAGR of 14.27%. When useful to seeds, plant surfaces, or soil, bioinoculants (which are environmentally friendly & sustainable bio-products comprising beneficial microorganisms) stimulate plant growth by, for example, increasing the supply or availability of nutrients to the host plant or shielding the plant from biotic and/or abiotic stresses.

Subhash Babu et al. (2022) everywhere in the world, the agricultural production system results in massive amounts of trash. Environmental degradation due to improper agri-waste management leads to monetary losses and health issues for humans. As a result, there is a pressing want for innovative, low-cost, & socially-acceptable methods of handling agricultural waste. Compared to materials used in the generation of energy from fossil fuels, agri-waste has a high efficiency of energy conversion. The opportunity exists to use agri-waste in the creation of advanced biofuels. However, in organic agricultural systems, composted agri-waste can replace energy-intensive chemical fertilizers. Additionally, agri-waste with added value can utilized as a source of nutrition for animals & manufacturing processes. However, there is a dearth of in-depth literature on the subject of agri-waste management. Consequently, this research analyzed the most recent innovations in effective agri-waste management technologies. This updated study will be useful for researchers & policymakers in their pursuit of environmentally sound residue management strategies that contribute to a green economy in the agricultural producing sector.

Muzafar Riyaz et al. (2021) Rapid population growth has led to a dramatic increase in food demand worldwide, which has coincided with a corresponding decrease in available agricultural land and water. Modern and developing countries alike are using every available resource to meet the challenge of feeding the world's growing population. Ecological disasters & widespread animal extinctions resulted from a cascade of these actions. Pests are a group of insects that cause significant damage to agricultural crops in our country. Our agricultural output has collapsed as aoutcome of these bugs feasting on our crops. We created compounds called pesticides to protect these crops from pests, and they proved to be highly effective. Overuse of these chemicals has caused widespread destruction in the meanwhile. It's important to note that most crops rely on cross-pollination, which is accomplished by a wide range of insects. Eighty percent of the world's food supply relies on insect pollination (entomophily), primarily from bees but also from many other insect families. The widespread use of chemical pesticides, however, has a devastating effect on pollinators and other important insects, posing a threat to their populations. Chemical pesticides have an effect on insects, but they also have a harmful effect on humans, fish, birds, and the land, water, and environment. Therefore, the phytochemicals found in botanical extracts has shown to be quite useful in preventing these terrible crises because of their favorable response from non-target organisms and their minimal influence on our environments and human health.

Sabin Shrestha et al. (2022) Attaining food security while also tackling poverty, achieving climate goals, & reducing strain on the environment has been hampered by rapid population increase in the face of depleting natural resources & more vulnerable ecological environment. The purpose of this research was to analyze a subset of the literature that addressed the topic at hand: the current state of the food system & prospective strategies for assuring its long-term viability. It is estimated that the need for food would rise by almost 50 percent by 2050, when the global population is predicted to have reached 10 billion. However, the supply chain wastes 1.3 billion tons of food annually. Food insecurity and obesity are serious problems in every region of the globe. An extra 593 million ha of farmland will be needed to generate 7.4 quadrillion calories in 2050, more than 1.5 times as much as was produced in 2010. This is just to keep up with the world's expanding population. Furthermore, agriculture accounts for a quarter of all GHG emissions; so, we need to take aggressive action if we are to sustainably feed the world's expanding population without destroying our natural resources. This study's main contribution is an in-depth analysis of different approaches to solving the problem of food insecurity. This study will help policymakers choose the best ways to combat hunger and global warming. Breeding programs, improving cropping intensity, intercropping, rediscovering NUS, eating more plants, reducing food loss, reforesting, recovering peat lands, and more efficient water usage are all proposed for in order to ensure sustainable food security.

Yi Deng et al. (2021) Environmental contamination & ecological disasters in the hydrosphere may result from the discharge of food waste and eutrophication in aquaculture. Here, we present a novel methodology for cultivating microalgae with the goals of recycling nutrients from food scraps and providing a suitable alternative feed for aquaculture. The purpose of this research was to determine the efficacy of various pretreating strategies for soybean fermentation effluent (SFE), and to evaluate the role

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of algal growth in the reclamation of nutrients from SFE. In order to learn more about how microalgae and bacteria work together in SFE cleanup, the composition of the bacterial community was studied. Microalgae were also researched for their impact on the aquaculture setting and the optimal degree of microalgae inclusion in fish feed was determined. Microalgal growth and biomass buildup were found to be facilitated by diluted, non-sterile SFE. Microalgae &acidogenic bacteria like Prevotella sp., Acidaminococcus sp., & Lactobacillus sp. worked together to increase nutrient recovery from SFE. In SFE, the elimination efficiencies for chemical oxygen demand, total nitrogen, total phosphorus, & total ammonia-nitrogen were 95.66 percent, 35.35 percent, 57.70 percent, and 42.21 percent, correspondingly. Micropterussalmoides reached a maximum size of 13.85 mm & weight of 1.73 g after 44 days in cultivation when 25% microalgae was included in fish meal. Further research revealed that fresh microalgae added to the fish meal successfully lowered ammonia levels in the aquaculture system. This concept has the potential to improve the environmental friendliness of aquaculture & waste reduction strategies within a circular economy. 2019 SCI: The Society of the Chemical Industry (SCI).

Moyosore Joseph Adegbeye et al. (2020) Improved resource use is essential in light of rising competition for scarce resources & inefficient allocation of existing supplies. Most at risk are resource-limited farmers in underdeveloped nations if these inefficiencies are not addressed. However, these farmers still make a significant contribution to the food supply in underdeveloped nations. To keep farming while making the most of scarce agricultural resources and even agricultural wastes, smallholder farmers need to be proactive and learn to adapt new tactics. Farming wastes can be put to better use in a number of ways, some of which have applications outside of agriculture. In addition, we propose combining waste resources, such as those produced by humans, animals, and crops. Farmers are also encouraged to adopt low-cost techniques like composting and vermicomposting to recover nutrients in the soil, as well as biocharing of crop and animal wastes from places like slaughterhouses and abattoirs. Mushroom cultivation and sales, as well as fermentation of crop residue to increase its feed value, are two examples of how the use of fungi could increase the efficiency with which resources are put to use. Farmers that are having trouble providing adequate nutrition for their livestock can use microbes to ferment plant material, reducing antinutritional elements (lignin, tannins), and making food and dairy waste more suitable for feeding. Instead, farmers are urged to improve resource utilization by keeping micro livestock such as rabbits, snails, and grasscutters on their farms. A number of methods, including the fermentation of phytate-rich plants with phytate in an industrial environment & utilization of cow urine and slurry as well as human feces, have been proposed for the large-scale recovery of nitrogen & phosphorus. The purpose of this chapter is to shed light on how farmers and companies, particularly in developing countries, might enhance their access to resources for agriculture and as animal feeds.

CONCLUSION

Sustainable farming practices are those that minimize negative impacts on the surrounding ecosystem. Only by using more fertilizers can farmers boost their output. As a result, we need to find ways to make better use of fertilizer. Countries of all economic statuses recognize the importance of boosting agricultural output. Technology that improves the use of scarce resources like land, water, & fertilizer is necessary for the long-term sustainability of increased food production for human consumption. Optimal conditions for soil health are maintained in a sustainable system. Crop rotation is used to replenish soil nutrients. Livestock grazes the land, and the waste they produce is used as soil fertilizer.

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