IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 2, December 2023

Exploring Knowledge about Industrial Pharming

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Abstract: *Nutrient pollution and greenhouse gas emissions related to crop agriculture and confined animal feeding operations (CAFOs) in the US have changed substantially in recent years, in amounts and forms. This review is intended to provide a broad view of how nutrient inputs—from fertilizer and CAFOs—as well as atmospheric NH3 and greenhouse gas emissions, are changing regionally within the US and how these changes compare with nutrient inputs from human wastewater. Use of commercial nitrogen (N) fertilizer in the US, which now exceeds 12,000,000 metric tonnes (MT) continues to increase, at a rate of 60,000 MT per year, while that of phosphorus (P) has remained nearly constant over the past decade at around 1,800,000 MT. The number of CAFOs in the US has increased nearly 10% since 2012, driven largely by a near 13% increase in hog production. The annualized inventory of cattle, dairy cows, hogs, broiler chickens and turkeys is approximately 8.7 billion, but CAFOs are highly regionally concentrated by animal sector. Country-wide, N applied by fertilizer is about threefold greater than manure N inputs, but for P these inputs are more comparable. Total manure inputs now exceed 4,000,000 MT as N and 1,400,000 MT as P. For both N and P, inputs and proportions vary widely by US region. The waste from hog and dairy operations is mainly held in open lagoons that contribute to NH3 and greenhouse gas (as CH4 and N2O) emissions. Emissions of NH3 from animal waste in 2019 were estimated at > 4,500,000 MT. Emissions of CH4 from manure management increased 66% from 1990 to 2017 (that from dairy increased 134%, cattle 9.6%, hogs 29% and poultry 3%), while those of N2O increased 34% over the same time period (dairy 15%, cattle 46%, hogs 58%, and poultry 14%). Waste from CAFOs contribute substantially to nutrient pollution when spread on fields, often at higher N and P application rates than those of commercial fertilizer. Managing the runoff associated with fertilizer use has improved with best management practices, but reducing the growing waste from CAFO operations is essential if eutrophication and its effects on fresh and marine waters–namely hypoxia and harmful algal blooms (HABs)—are to be reduced*

Keywords: Nutrients ,fertilizer, greenhouse

I. INTRODUCTION

The industrial agriculture system consumes fossil fuel, water, and topsoil at unsustainable rates. It contributes to numerous forms of environmental degradation, including air and water pollution, soil depletion, diminishing biodiversity, and fish die-offs. Meat production contributes disproportionately to these problems, in part because feeding grain to livestock to produce meat—instead of feeding it directly to humans—involves a large energy loss, making animal agriculture more resource intensive than other forms of food production. The proliferation of factory-style animal agriculture creates environmental and public health concerns, including pollution from the high concentration of animal wastes and the extensive use of antibiotics, which may compromise their effectiveness in medical use. At the consumption end, animal fat is implicated in many of the chronic degenerative diseases that afflict industrial and newly industrializing societies, particularly cardiovascular disease and some cancers. In terms of human health, both affluent and poor countries could benefit from policies that more equitably distribute high-protein foods. The pesticides used heavily in industrial agriculture are associated with elevated cancer risks for workers and consumers and are coming under greater scrutiny for their links to endocrine disruption and reproductive dysfunction. In this article we outline the environmental and human health problems associated with current food production practices and discuss how these systems could be made more sustainable. Key words: diet, environment, health, industrial agriculture, sustainability, sustainable agriculture.

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Industrial agriculture depends on expensive inputs from off the farm (e.g., pesticides and fertilizer), many of which generate wastes that harm the environment; it uses large quantities of nonrenewable fossil fuels; and it tends toward concentration of production, driving out small producers and undermining rural communities. The following environmental and public health concerns are associated with the prevailing

Production methods:

- Monocultures are eroding biodiversity among both plants and animals.
- Synthetic chemical pesticides and fertilizers are polluting soil, water, and air, harming both the environment and human health.
- Soil is eroding much faster than it can be replenished—taking with it the land's fertility and nutrients that nourish both plants and those who eat them.
- Water is consumed at unsustainable rates in many agricultural areas.

Many of the problems inherent in industrial agriculture are more acute when the output is meat. Our food supply becomes more

Resource intensive when we eat grain-fed animals instead of eating the grain directly, because a significant amount of energy is lost as livestock convert the grain they eat into meat. Cattle are the most inefficient in their energy conversion, requiring 7 kg of grain to produce 1 kg of beef (compared to 4:1 for pork and 2:1 for chicken) (2).

Despite this inefficiency, livestock diets have become higher in grains and lower in grasses. The grain raised to supply feedlots (cattle) and factory farms (chickens, hogs, veal calves) is grown in intensive monocultures that stretch over thousands of acres, leading to more chemical use and exacerbating attendant problems (e.g., pesticide resistance in insects, and pollution of surface waters and aquifers by herbicides and insecticides).

The use of growth-promoting antibiotics in animal agriculture is thought to be one of the factors driving the increase in antibiotic resistance in humans. In addition, the most prevalent foodborne pathogens are overwhelmingly associated

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with animal products, most of which come from factory farms and high-speed processing facilities. The crowded conditions in factory farms, as well as many of their production practices, raise ethical concerns about the inhumane treatment of animals.

Because they contain excessive amounts of fat—particularly saturated fat—and protein, animal-based diets are linked to many

II. ENVIRONMENTAL HEALTH PERSPECTIVES

Of the chronic degenerative diseases that are characteristic of affluent societies, such as heart disease; colon, breast, and prostate cancer; and type II diabetes. The animal-based diet that prevails in the industrialized world— and is on the rise in many developing countries—thus harms both the environment and the public's health.

High consumption of animal products in affluent countries can be placed in the context of broader global inequities between industrialized and developing countries. Since 1950, meat consumption has doubled among the world's richest 20%, whereas the world's poorest quintile has not increased its consumption of meat much at all (3). Some portions of the developing world are beginning to adopt Western dietary patterns and, as a result, are experiencing an increase in the chronic diseases associated with a richer diet. China offers a sobering case in point: meat consumption nearly doubled countrywide during the 1990s (4), with the increase especially pronounced among urban residents. This dietary shift is considered a major reason that chronic diseases have become a more common cause of death in China, with acute diseases becoming less common because of improvements in water, sanitation, and immunizations. According to Zhao et al. (5), measles, tuberculosis, and senility were the three most common causes of death before 1950, but in 1985 malignant tumors, cerebrovascular disease, and ischemic heart disease were the most common. To support its "Westernizing" diet, China has also begun a shift toward more of the resource-intensive agricultural practices that predominate in richer countries.Resource-intensive agricultural practices are considered unsustainable for two reasons:Much of the consumption is of nonrenewable.

Industrial Agriculture: Benefits And Risks Mitigation

Intensive agriculture is the most typical method of soil cultivation and the key source of food worldwide. It relies on reaping high yields with strong and often extreme land exploitation and often extreme inputs. The main benefits of intensive farming include sufficient food supplies at affordable prices.

However, advantages never come for free. Increased chemical applications are dangerous both to nature and the human body. Intensive farming causes environment pollution and induces major health issues due to poisonous agents. In this regard, the impacts of industrial agriculture require serious attention and management of risks.

III. METHODS

Overview

This paper begins with a review of the trends in total farms and their size. The change in use and form of chemical fertilizers (both N and P) in the US over time is then summarized as totals and for the major crops of corn, soybean, wheat, and cotton. The growth in major animal operations (including beef cattle, dairy, hogs, chickens as "broilers", and turkeys) is then considered, as is the total numbers of CAFOs and their change regionally, and the total N and P released by animal type regionally. Emissions of NH3 and greenhouse gasses are then summarized. The N and P in human wastewater was estimated by state, along with overarching status of wastewater infrastructure by state. Data for these different sources of N and P were compared by aggregated US regions. Every effort was made to capture data from similar time periods for the different parameters; dates encompassed by the different trends are noted throughout.

What Is Industrial Agriculture?

The concept of industrial agriculture implies increased use of farmlands to produce the highest yields possible to gain profit and support human food needs. The maximization is achieved through typical intensive farming practices like increased use of fertilizers, insecticides, abundant irrigation, heavy machinery land treatment, planting high-yield species, expansion of new areas, among others. This way, higher inputs in industrial agriculture condition higher outcomes.

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Most commercial agricultural enterprises apply intensive crop farming and regard agriculture primarily as a business, taking as much as they can from every single unit of land. On the contrary, extensive farming propagates a more sparing and healthy approach to land use, with fewer chemical inputs. It maintains productivity in natural and eco-friendly ways that echo with organic farming.

Benefits Of Industrial Agriculture

The main advantage of intensive farming is its increased performance when higher yields are harvested from smaller territories. This brings economic benefits to landowners and provides food for the growing population. Intensive agriculture fully satisfies the market demand even in densely inhabited areas. It also requires less labor compared to eco-friendly farming methods since chemical pest and weed controls work faster and are easier to implement.

Disadvantages Of Industrial Agriculture

The highest crops come with some drawbacks though. Traditional intensive agriculture neither aligns with the sustainability concept nor contributes to nature protection, so intensive farming problems require serious consideration.

Deforestation. Intensive farming causes soil degradation and leads to the expansion of new lands. In particular, forests are cut for the sake of new fertile and productive areas. The problem scope becomes clear with illustrative figures. Thus, modern industrial agriculture is to blame for 80% of global deforestation .

Pest and weed resistance to chemicals. Regular use of synthesized pesticides and herbicides in industrial agriculture induces adaptation when great and frequent amounts become less effective or ineffective at all. As a result, parasites become stronger and establish in multiplied numbers beyond any reasonable control.

Soil degradation. “Squeezing” from fields as much as possible causes soil depletion and erosion. So, strong industrial agriculture practices make lands weaker as they significantly interfere with natural soil processes. In particular, chemical pesticides destroy earth-dwelling microorganisms that ensure composting and proper organic matter incorporation.

Impact on natural habitats. The necessity of seeking new territories for industrial agriculture needs affects wildlife and deprives it of traditional living places.

Water pollution. Heavy chemical runoffs from fields due to industrial agriculture penetrate water bodies, poisoning aquatic populations. Deforestation and cuts of buffer strips for riverbank fortifications cause floods and sedimentation.

Climate change. Intensive agriculture practices are major drivers of global climate change speeding up soil erosion and environment pollution in general due to improper carbon sequestration, fossil fuel emissions, and exploitive approach to land and water use.

Human health impact. Extreme chemical quantities in consumed plants induce issues in the human body, including even congenital abnormalities .

Agrochemicals In Industrial Agriculture

Apart from the expansion of new territories when wildlife loses its natural habitation areas, animals are greatly affected by chemical applications in industrial agriculture. While herbicides pollute natural resources, pesticides are rarely selective and kill beneficial species as well, like pollinators and soil-dwelling microorganisms contributing to its fertility. Recent researches report decreased farmland bird and bee populations

Due to heavy insecticides in industrial agriculture, being a significant threat to further farming business and ecology in general. Hormones mitigating crop diseases are another harmful issue of intensive farming.

The agrochemical effects of industrial agriculture conditioned serious governmental regulation worldwide via banning

The most dangerous chemicals, especially those containing neonicotinoids.

Monocropping In Industrial Farming

Monocropping of high-yield species like rice, soybeans, corn, or wheat provokes high pest establishment and soil depletion. Particular pests attack particular crops; intercropped cultures act as barriers since they are non-host plants. Furthermore, reduced diversity of crops due to this fundamental industrial agriculture practice means better pest establishment and development of their resistance to controls applied. This results in extreme use of chemicals (often critical to humans and nature) and stronger option introductions.

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Also, the same agro culture requires the same set of nutrients, and intercropping vs. industrial agriculture monocropping is beneficial in this regard as well since it helps farmers to balance soil fertility and address erosion.

IV. CONCLUSION

This paper has attempted a broad review of the patterns and trends in nutrient inputs and greenhouse gas pollution arising from US farming practices. This analysis builds on publicly available and published data and makes use of available detailed inventories. Collectively these efforts have shown that for the entire US: (1) use of N fertilizer is increasing faster than that of P, leading to an increase in the N:P of this source; (2) fertilizer N inputs exceed those of manure, while fertilizer P inputs and those of manure are more comparable; (3) the number of CAFOs has increased over the past decades, including a near 10% increase since 2012, driven largely by a 13% increase in hog production; (4) atmospheric NH3 release and human wastewater total inputs are less than those of fertilizer and manure, but large regional differences exist across the country (and atmospheric NH3 may be underestimated); (5) while CH4 emissions from enteric fermentation remain the largest contributor of this greenhouse gas pollutant, CH4 and N2O emissions from manure management are rapidly rising.

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