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Perspective

Effects of Bioenergy on Agriculture and its Vulnerability to Escalating Global and Climatic Change

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DESCRIPTION

In agricultural and food value chains, energy is crucial, particularly when it comes to food processing. However, the agriculture and food industries also have a significant impact on greenhouse gas emissions. The world will require more food that is produced with less energy or other non-fossil fuel based energy sources, such as renewable energy technologies, due to an ever-growing population and the increasing scarcity of fossil fuels [1]. As with wind, solar, and other renewable energy sources, bioenergy can benefit the environment by reducing our reliance on fossil fuels that contribute to climate change.

Biofuel, biomass, and other related terminology are frequently used interchangeably. Biofuels are fuels made from biomass, and all energy is considered to be bioenergy. For bioenergy, biomass is the source. Coal, oil, and other preserved remains of species are widely thought to be excluded from the word, along with soils. Biomass energy refers to crops, waste products, and other biological materials that can be utilised in place of fossil fuels to produce energy and other goods [2].

The production of food, feed, and fibre may be replaced by bioenergy crops grown on fertile cropland, driving up the cost of the displaced goods and prompting farmers to plant replacement crops elsewhere. The name of this procedure is indirect land-use change (ILUC). If grasslands or forests are used for crop production, enough CO_2 may be emitted from the disturbed biomass and soil to cancel out the climate benefits of switching to biofuels. Although estimates of ILUC emissions are still imprecise, ILUC can be decreased or even prevented by reducing rivalry between agricultural commodities in high demand and feedstock's for bioenergy [3].

Energy derived from living things, or bioenergy, is carbon-neutral and renewable. The biological resources are renovated, which takes place over enough time to make the resources continuously available, to absorb the carbon produced during combustion. Although, when taking into account the life cycle emissions, which include emissions from cradle to grave, the carbon emissions from a bioenergy system can be larger than zero. In bioenergy systems, emissions may result from the use of resources such as water, soil, herbicides, pesticides, pre-treating biomass, collecting, and transporting biomass. In life cycle analysis, direct and indirect emissions from changes in land use should also be considered. The amount of carbon stored in soil and plants can be significantly impacted by changes in land cover. For instance, when forest land is turned into pasture or agricultural land, carbon emissions occur. If a piece of agricultural land begins to be used for energy crops and the demand for food and feed persists, another piece of land must be turned to agriculture, resulting in carbon emissions. Life cycle analysis has demonstrated the significance of accurate analysis when choosing these systems, as some bioenergy systems based on resource-intensive energy crops may have higher carbon emissions than the fossil fuel they plan to replace [4]. Additionally, bioenergy systems may have socioeconomic effects on matters like the environment, the availability and cost.

A by-product of harvesting and processing agricultural crops is a material with a carbon composition known as an agricultural residue. Primary or field-based agricultural residues are those created during harvest, whereas secondary or processed-based residues are those formed concurrently with the product during processing. Agricultural residues fluctuate in bulk density, moisture content, particle size, and distribution in relation to operational treatment, making them heterogeneous materials. They vary geographically and are often fibrous and deficient in nitrogen. These agricultural wastes are occasionally used as fertiliser, to prevent erosion, and as cattle feed. Before the start of new farming season, about half of these resources are burned on the farm [5].

Process waste has great potential as a source of energy. Any agricultural residue's chemical composition changes based on a number of variables, including the crop's species when it was harvested, physical characteristics including how long it was stored for, and harvesting techniques. A waste product from food crops including maize, wheat, sunflowers, and others is

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known as agricultural residues. Only a small percentage of these residues are currently utilised by farmers as animal feed, and the remainder is either burned or turned back into the soil to get rid of the enormous amounts of biomass before planting the following crop. The main benefit of using agricultural waste is that it does not compete with the production of food, and if it can be economically converted into a by-product for the production of electricity, it will lead to lower food costs. For every tonne of harvested grain, around one tonne of residue is thought to be created.

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