



## Removal of Agricultural Residues

Assessing soil effects when removing biomass for energy, fuels, and chemicals

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### INTRODUCTION

Above ground, non-grain plant matter can be converted to energy, fuels and fertilizer. Presently nearly all US consumption of these quantities comes from fossil fuels, predominantly from foreign sources. Several important benefits are realized when biomass (specifically lignocellulosic, or non-food, organic material) is used instead as the feedstock :

- First, emissions of greenhouse gases and other environmental pollution (e.g. heavy metals, sulfur, etc.) can be greatly reduced.
- Second, a greater proportion of a domestic supply provides energy security for our economy.
- Third, a smaller fraction of our national wealth is sent to foreign regimes, many of which are hostile to US interests.
- Fourth, with emerging technologies for alternative methods to produce energy, fuels, and chemical, the economics of farm operations becomes both less expensive and less volatile, thereby reducing price pressures on food.

Agricultural residue, the organic matter left over after grain harvesting, has the potential to displace large fractions of our petroleum and coal use, making this a national imperative. However, ag residues serve a useful function in farm soils, so it is important to understand the impact of removing these residues. This monograph provides a brief introduction. For more information, a list of references is included below.

### SOIL – BENEFITS OF ORGANIC MATTER

Soil (also called “earth”) is a porous aggregate of minerals and organic matter, including solids, liquids and gases. On farmland, ag residues contribute to a soil’s productivity – the ability to grow food. Ag residues, such as corn stover (the stalks, husks, cobs and leaves) or wheat straw contribute to healthy soil in several ways: [1] residue on top of the soil reduces raindrop impact and wind shear, affects radiation balance (sunlight in, infrared emissions out) and affects moisture evaporation rate; [2] the physical presence within the bulk of the soil affects water infiltration and retention, aeration, penetration resistance (to roots and to worms) and tith (how easily a plow cuts through); and [3] chemicals from the breakdown of organic matter affects acid/base

balance (pH level), nutrient availability and cycling, ion exchange capacity, and micronutrients such as phosphorus and potassium.

Ag residue is not entirely benign. Too much residue is a detriment to no-till farming in several ways: it is harder to plant through; it insulates the ground, and can delay planting; and the thicker mat tends to inhibit early plant growth, possibly reducing yields. In convention farming, when residue is tilled under in the fall, ag residue can decompose to form methane, a greenhouse gas 22 times more potent than carbon dioxide. Ag residue has other uses, such as animal bedding or feed extender, so there is farm equipment dedicated to collecting, baling and transporting bales of corn stover and wheat straw.

## REMOVAL OF AG RESIDUES

Complete removal of ag residues is harmful to soils. No removal has deleterious effects also. Somewhere in between is a happy medium between the national imperatives to displace fossil fuels and the farmer's need to maintain healthy, productive soil. Fortunately, this issue has been studied in depth for at least 30 years. A summary of the findings of the 9 references at the bottom of this monograph is presented here.

Considering above ground material, the highest removal rate recommended is 70%. Many sources cite 50%, but nearly all agree that 30% of ag residues can be removed without harm to soil quality. These are general guidelines, but a more accurate and specific removal rate depends on soil type (clay, sand, silt), slope, and prevailing weather conditions. An individual farmer can make a scientific assessment of a suitable removal rate (determined by settings on harvesting equipment) using software tools such as RUSLE2, which factor in all these variables, and provide a recommendation.

## SUMMARY

With today's technology, about 30% of ag residues can be removed for power, fuels and chemicals to displace fossil fuels, without hurting soil. Using practices common to farmers, software tools allow them to make accurate decisions based on the conditions of their farm. This happy circumstance allows the US to meet its national imperatives while increasing revenues for the farmer, without harm to the food supply.

## REFERENCES

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