

# THE FACTS OF AFTER-HARVEST RESIDUE REMOVAL

**By: Terry Buettner, Ward Laboratories**

For many years I have seen producers bale their crop residue, specifically cornstalks and soybean stubble, after harvest. This practice has been driven somewhat by feedlot demand after the advent of distillers co-products from ethanol plants in the early 2000's. Distiller's co-products are high in protein and energy for livestock. Therefore, there is a demand for a cheap roughage source like cornstalks or soybean stubble. In lean economic times extra income is always welcome. Also, some producers who no-till feel that removing some residue can make planting the following season "easier". But there are some trade-offs that come with this practice.

There are four items to consider when mechanically harvesting residue: cost of the nutrients removed in residue, increased erosion risk, increased water loss, and reduced soil quality.

The first consideration is the value of nutrients remaining in the residue that are removed from the field. Dr. Ray Ward and I calculated the following values in the fall of 2021 based on September commercial fertilizer prices in relation to corn stalk removal.

## **COST OF REMOVING CORN RESIDUE---NUTRIENTS**

NUTRIENT	PRODUCT	\$/TON	NUTRIENT CONC.	PRICE OF NUTRIENT/TON	LB OF NUTRIENT/TON	\$/LB.	LB NUTRIENT <sup>1</sup> REMOVED/TON	\$/TON
NITROGEN	32% UAN	\$435	32% N	\$435.00	640	\$0.68	18	\$12.24
PHOSPHORUS	MAP	\$750	52% P2O5	\$600.00	1040	\$0.58	3.9	\$2.26
POTASSIUM	0-0-60	\$690	60% K2O	\$690.00	1200	\$0.58	30	\$17.40
SULFUR	THIO-SUL	\$400	26% S	\$236.80	520	\$0.46	2.9	\$1.33
MAGNESIUM	Mg SULFATE	\$1,600	10% Mg	\$1,497.00	200	\$7.49	3.4	\$25.47
CALCIUM	GYPSUM	\$285	24% Ca	\$136.80	480	\$0.29	9.7	\$2.81
MANGANESE	Mn SULFATE	\$1,725	28% Mn	\$1,600.00	560	\$2.86	0.23	\$0.66
<b>TOTAL COST OF REMOVAL TON</b>								<b>\$62.17</b>

Fertilizer prices are current for the week of September 13, 2021

Value of baled cornstalks September 13, 2021 was \$50/ Ton

2020 UNL Custom rates for windrow shredding and baling of residue totaled \$31.00/ Acre

As you can see from the table, the total calculated cost of the nutrients removed in the residue is \$62.17. Adding the 2020 custom rates for windrow shredding and baling the total cost per ton is \$93.17. Using the cornstalk bale value of \$50/ton, this equates to a per acre loss of \$43.17 per ton.

Then there is the question of the value of carbon (C). Sequestering carbon in the soil plays a part in many people's thoughts as one of the ways to reduce atmospheric CO2. Therefore, carbon has some social value. To put an economic value on carbon, we did some carbon calculations for cornstalks assuming 40% C and 15% moisture in cornstalks with a market value of \$60.00 per ton. We took 1700 pounds of dry matter (2000 X .85) per ton and multiplied by 40%, the percentage of the stalk that is carbon, to get 680 pounds of carbon per ton of residue. This brings the total value of the carbon in one ton of stalks to approximately \$23.80 (dry matter is \$0.035/lb, and 680 pounds of the dry matter is carbon.)

Many people think that carbon is not an essential plant nutrient because it is not a physical product someone buys at their local fertilizer retailer. But in fact, it is an essential nutrient and is responsible for certain plant functions such as photosynthesis and plant growth. It is also what microbes use to build organic matter, which benefits the soil and serves as their house.

Removing crop residue and leaving topsoil exposed increases the risk of both water and wind erosion. Removal of soybean stubble can be especially risky as post-harvest soybean residue provides minimal ground cover at best. Flooding in March 2019 was a prime visual in the value of residue. In hilly areas of the state, fall disked ground eroded at a rate I have never seen in my life. Fields left in standing stalks had some erosion in field valleys but only slightly compared to the fall tilled or unprotected ground. The protection that residue provides from wind erosion is easily recognized and understood. One simply can drive around on a spring day with 30 mph plus winds to see the difference between covered and uncovered soil.

Keeping residue in the field also acts as a mulch that protects moisture accumulated in the soil over the winter from evaporation. In fields susceptible to seasonal variances in rainfall, this accumulated moisture could be crucial to next season's crop. Even in irrigated fields limiting winter evaporation is important. Conserving soil moisture both in season and over winter reduces irrigation expenses. Studies have also shown that fields where the residue was left had greater water infiltration rates over time versus fields where residue was removed, thus allowing soils to become more resilient to varying rainfall patterns.

As previously stated, plant residue in soil is one of the major building blocks for increasing organic matter. Earthworms and microbes cycle the residue beneath the soil creating stable OM and add a source of slow releasing nutrients for the growing plant. In addition, carbon is sequestered in the soil instead of being hauled away. A 200 bushel corn crop produces about 2 tons of carbon or about 7.3 tons CO<sub>2</sub>.<sup>2</sup> Soil organic carbon is a key determinant of soil quality and provides essential ecosystem services. Higher organic matter soils have better water holding capacity and can store more nutrients than low OM soils. Healthy soils with a large microbial population also decomposes crop residue faster than an unhealthy soil. A healthy soil will improve the release of N, P, and other nutrients, resulting in increased fertilizer use efficiency. Increasing organic matter leads to a bounty of benefits including better fertility, more water storage, reduced soil erosion, increased soil pathogen control and ultimately greater profits.

In conclusion, it is wise and financially prudent to consider all the facts and consequences before harvesting and removing crop residue from your fields. Is the tradeoff worth the consequences? Adding the value of carbon to the residue inflates the nutrient loss dollar amount to an astronomical figure. The long-term health and productivity of your soil will be impacted by residue removal. Instead, consider renting your stalks to a neighbor and letting him or her run cows on the field. If managed correctly compaction will not be a concern, and the cows will remove and recycle some residue into manure and return it right back to your soil!

<sup>1</sup> Dr. Raymond Ward. 2011. Nutrient Content of Corn, Soybean & Wheat Residue.

<sup>2</sup> Dr. Raymond Ward. CARBON. [Powerpoint slides]