

Table of Contents

SAVING SOIL AND INCREASING PROFITS



CROP RESIDUE MANAGEMENT

Preserving your soil's most protective shieldPAGE 6



THE VALUE OF CROP RESIDUE

Consider your potential gains and losses while keeping goals in mindPAGE 9



Saving Soil and Increasing Profits: Do Strip-Till and No-Till Have a Place on Your Operation?

By Colin Rogers, Sustainable Systems Agronomist ForGround by Bayer

Why do we till our fields? Is it for weed control? Seedbed preparation? Perhaps to get a jump start in the spring and maximize yield? More critically, are your tillage practices affecting your profits?



Tillage can provide solutions to many in-field problems, but it can also cause problems of its own (erosion, compaction, accessibility, etc.), necessitating a need to switch our mindsets toward a systems approach for farming moving forward. Improvements in crop genetics, seed treatments, herbicides, and fungicides have provided solutions from stand establishment to weed control to disease protection that counter the challenging environment of reduced tillage. To maximize on-farm profits it is important to ask, "What problem am I solving with my tillage pass, and have I already solved that with a product purchase?".

Exploring information on no-till and strip-till farming can open a world of benefits for both practices. From field level improvements such as erosion control and soil structure, to cost reductions in fuel and labor. However, both are not necessarily ideal on the same fields and in the same farm management systems.



Strip-Till

When it comes to conservation tillage systems, strip-till toolbars are the multi-tools of the farm. Capable of repositioning residue, prepping the seedbed, breaking compacted layers, and precisely placing fertility for the following season's seeding all in one pass. A single pass that accomplishes all of these activities can save substantial amounts of income on application costs. When reviewing the 2022 lowa Farm Custom Rate Survey, the difference between strip-till and a 2-pass fall chisel/spring

cultivation and fertility application equates to a \$30.90/acre savings, while compared to a single pass vertical tillage operations netted \$17.20/acre. Most of these savings are realized in fuel and more importantly labor, which is getting harder for retail locations to acquire. Strip-till can also allow for reduced rates and higher utilization rates of fertility from being placed properly, as well as helping reduce losses from volatilization, leaching, and runoff.

1 Plastina, A., Johanns, A., Gleisner, A., and Qualman, A. 2022. 2022 lowa Farm Custom Rate Survey. [Fact sheet]. lowa State University. https://www.extension.iastate.edu/agdm/crops/pdf/a3-10.pdf.

In addition to the positive cost savings strip-till provides, arguably the greatest benefit provided is better soil health achieved while maintaining historic yields. Compared to no-till, strip-till provides conventional tillage-like planting conditions in the berm that is created, and when performed in the fall, provides a warmer², better drained seedbed to plant into. To no surprise, strip-tillage is very popular in areas with heavier, poorly drained soils, and is a good fit for operations trying to push the limits of crop maturity.

> Strip-till conversion does come with challenges. New purchases should be viewed as an **investment** in future opportunities on your operation.

With 52% savings in fuel³ and 58% savings in labor⁴ it does not take long for strip-till to begin paying dividends across your fields. Although most growers will have a compatibly capable tractor, there is a large horsepower requirement to pull the row units, generally between 25-35HP per row, so consider the size of your current equipment and see if you can justify the cost of a potentially larger tractor.

When considering the purchase, also realize that vou will be fixed on row width based on what the manufacturer can produce as well as what matches your current spacing; make sure you are confident in your row spacing decision now. Later changing a toolbar, planter, and combine head will be a very expensive endeavor.

• Unlike corn, soybeans do not typically see as much financial advantage in a strip-till system vs. no-till. However, at current soybean prices, even small gains in yield can have significant financial advantage in a strip-till system vs. no-till. However, at current soybean prices, even small gains in yield can have significant financial advantages. Be sure to ask other growers in your area what their experiences have been with soybeans in strip-till, their results may be in your favor.

 If planting soybeans extraordinarily early, strip-till will typically show more benefits from the residue clearing, and effectively warming the soil vs. no-till.

Lastly, strip-till requires precise planning. Since fertility is placed precisely in the berm, it is critical for the planter to follow the rows exactly. This will most likely require a repeatable GPS correction to the RTK/RTX level (2-4cm). Ensure you are happy with how the field was oriented this last season, and if so, upload the same guidance files (AB Lines) and repeat with the tool bar as if you were planting in the fall.

ETS SoilWarrior has excellent agronomic support and will work with you and your dealer to:



Make sure the fertilizer applicator is calibrated appropriately



Ensure your GPS is appropriately calibrated to seamlessly transition between tillage and planting



Set up the toolbar for ideal tillage in your soil



^{2.} Licht, M.A. and Al-Kaisi, M. Strip-tillage effect on seedbed soil temperature and other soil physical properties. Soil and Tillage Research, Volume 80, Issues 1–2,2005, Pages 233-249, ISSN 0167-1987. https://www.sciencedirect.com/science/article/pii/S0167198704001011#:~:text=Strip%2Dtillage%20has%20the%20potential,soil%20temperature%2C%20and%20penetration%20resistance.
3. CropWatch. 2018. Labor Requirements. University of Nebraska – Lincoln. https://cropwatch.unl.edu/tillage/labor

^{4.} CropWatch. 2018. Fuel Requirements. University of Nebraska - Lincoln. https://cropwatch.unl.edu/tillage/fuel

No-Till

Of course, no writing about farm resiliency, soil structure, or on-farm profit is complete without discussing the importance of no-till farming. No-till farming is not a new concept, but it may be a concept that has escaped some operations for some time now that should consider it to increase their profits. As stated earlier, managing the great improvements in crop genetics, seed treatments, herbicides, and fungicides, as a whole farm system takes substantial risk out transitioning to no-till farming. Plant breeding has improved emergence and early seedling



vigor, new seed treatments have protected that seed until emergence occurs, new premixes of herbicides keep rows weed free until canopy closure, and fungicides help protect plants in a cooler, damp, residue heavy environment.

Dollar for dollar, and hour for hour, no tillage practice change nets a higher return on investment than not tilling at all. This is not to say that there are not challenges. The first few years of no-till can be especially challenging, with a return to normal 3 to 5 years after beginning, and this adjustment to normal is very environmentally specific. Things like growing zone, annual rainfall, soil type, and average temperatures all play into success rates. In drier climates with sandier soils, no-till tends to outperform conventional tillage, but in wet, heavy clay soils the transition will test any great farmers patience. It may take years of patiently waiting in the spring while others are planting their fields before your soils marginalize, but rest assured that early starts do not necessarily equate to higher yields, and higher yields certainly do not mean higher profits. Generally, corn performs at maximum yield potential when it is planted when soil temperature, moisture, and air temperature all favor for fast, even stand establishment. Late emerging plants from uneven emergence often provide no economic return, and as such more emphasis should be placed on great stand establishment to take advantage of a very costly input.

Dollar for Dollar, and hour for hour, no-till practice change nets a **higher return** on investment than not tilling at all.



If you get into a situation where fields are almost fit, but the weather looks less than ideal in the next week, and you just need to get started with something, consider planting soybeans instead. Wait to plant corn until the weather is more guaranteed.

- Soybeans have a slower emergence, and as such will be protected from above ground conditions longer than corn.
- Soybean yields are less affected by population reductions, so long as the final stand is uniform enough for maximum light reception.

These challenges can also be overcome with planter modifications. Equipment such as row cleaners improve emergence rates and vigor, as do notched/spiked closing wheels that have more of a furrow sidewall chipping capability (virtually anything other than a round rubber wheel). These are both low cost, high return modifications to invest in.

A more expensive modification to reduce compaction, in combination with controlled traffic patterns, are hydraulic downforce systems. These systems help marginalized fields that may still be a little on the wet side and help keep the sidewall of the furrow fully intact without creating sidewall compaction.

If you are currently no-tilling or abut to switch, always consider on the planter fertility applications. Not only do these save a trip across the field (labor and fuel), but they also allow for less mobile nutrients such as phosphorus and potassium to be appropriately placed near the seed, and lower rates of nitrogen, further maximizing your investment in inputs. Ideally this application would happen in a 2x2 or 2x2x2 system, however placing phosphorus and potassium in-furrow with seed firmers and dribbling nitrogen on over the top is also highly effective, just be cautious of how much salt is being applied.

Farm resiliency is possibly more important than ever to think about, and no-till and strip-till can be a large contributor to make your operation thrive.

The world economic market is changing. Agricultural commodities and inputs have been on an incredible roller coaster ride of highs and lows, with inputs, fuel, and labor at all-time highs.

Farm resiliency is possibly more important than ever to think about, and no-till and strip-till can be a large contributor to make your operation thrive. Think of all the input costs that can be saved – less fertility, less fuel, less labor. For those not no-till farming, think of how many acres you currently till. How long does that take? What does that cost you per acre? Now, if land was available, how many acres could you harvest instead?



We Support You Every Step of the Way

The agronomist team at ForGround by Bayer is here to help support you as you begin your journey into no-till and strip-till or look to modify your current practices to become more efficient with your inputs.

Crop Residue: Your Soil's Protective Shield

By Bayer Crop Science

Harvest and planting are times to focus on residue management. The benefits of residue have led farmers to use less aggressive tillage to help conserve some crop residue. Additional residue management options can be used in continuous corn systems.

High amounts of crop residue (more than 40 percent) can reduce soil loss from water erosion by 80 percent. Even a small amount of residue cover (10 percent) can reduce erosion losses by 20 percent.¹ Additionally, residue maintains soil moisture, improves soil tilth and quality, reduces nutrient runoff, and provides wildlife cover. These improvements can be related to potential yield benefits and should be considered when managing residue (Table 1). Conservation tillage practices resulting in greater sustainability of cropping systems are being adopted on a wider scale. This comes as the loss of crop productivity correlated to land degradation becomes a global issue.

Table 1Comparison of water savings and yield on bare soil and residue-covered soil.

Year	Crop	Yield (bu/acre)			Water Savings (inch)		
		Residue	Bare Soil	Difference	Yield	Soil	Total
2007	Corn	197	172	25	3.0	0.0	3.0
2008	Corn	186	169	17	2.0	1.5	3.5
2009	Soybeans	68	58	10	3.0	2.0	5.0
2010	Soybeans	61	53	8	2.5	0.0	2.5

Source: Van Donk, S.J. and Klocke, N.L. 2012. Tillage and crop residue removal effects on evaporation, irrigation requirements, and yield. Proceedings of the 24th Annual Central Plains Irrigation Conference.

Residue can be managed through harvesting adjustments and tillage. However, tillage may not be desirable in all fields. Depending on crop rotation, additional steps may help decompose residue or allow for residue handling during planting of the next crop.

Crop residue maintains soil moisture, improves soil tilth and quality, reduces nutrient runoff, and provides wildlife cover.

Harvesting

- For proper residue distribution, combines or similar machines used for harvesting should be equipped with spreaders capable of uniformly distributing residue over the working width of the header.
- Chopper attachments can be adjusted to help with spreading residue the full width. Chaff spreaders attached to the rear axle are most effective for spreading wheat and soybean residues because a larger percentage of the harvested residue is handled by the cleaning shoe of the combine.²
- To reduce evaporative losses and to provide adequate snow retention in no-till and strip-till operations, it may be helpful to keep stubble height at a minimum of 10 inches for crops with a row spacing of less than 15 inches. For crops with a row spacing of 15 inches or greater, crop stubble height can be kept at a minimum of 15 inches.3 This crop height should be present over at least half the field. Leaving stubble taller than 10 inches can help capture more snow and provide better insulation to plant roots.
- After harvest, grazing is another option if residue has accumulated over years, especially for areas that have frozen soils during winter. In a typical corn stalk or grain sorghum grazing period, cattle generally consume 25 to 50 percent of the available residue in 30 to 100 days, depending on stocking density.⁴

Planting

- Planters equipped with row cleaners should be utilized to move residue and enhance seed-to-soil contact. Row cleaners can allow earlier soil warming and help reduce the chance of pinning residue into the seed slot. Aim for less than 10 percent residue cover on a zone one-third the row-width.
- Soil temperatures have been shown to be lower under corn residue compared to soybean residue. 5,6 Planting dates may be later for fields following corn if measures were not taken at harvest to evenly distribute residue.
- · Little to no modification will be needed for planters and drills operating with 20 to 30 percent residue cover on fields.1

Residue Remaining After Tillage

- "Vertical" tillage, a form of conservation tillage, helps size residue while limiting soil disturbance. Vertical tillage tools cut the residue into smaller pieces for even distribution and better soil contact.
- · Strip-tillage leaves the soil undisturbed except for narrow strips where tillage and residue removal are performed to facilitate planting. This allows for quicker soil warming in the planting area and helps reduce the potential for equipment-induced compaction.

Leaving stubble taller than 10 inches can help capture more snow and provide better insulation to plant roots.



- 2 Eck. K.J. and Brown, D.F. 2004. Managing crop residue with farm machinery. Agronomy Guide, AY-280-W. Purdue University Extension.
- 2 Eu., R.J. and Brum, D.E. 2004. Managing objects the wind manifold manifold of the States Department of Agriculture. Natural Resources Conservation Service. 2016. Residue and tillage management, no till. Code 329-C 4 Rasby, R.J., Drewnoski, M.E., and Stalker, A. 2014. Grazing crop residues with beef cattle. Publication EC278, University of Nebraska-Lincoln. 5 Al-Kaisi, M. 2007. Tillage challenges in managing continuous corn. Iowa State University Extension. Integrated Crop Management.
- 6 Shen, Y., McLaughlin, N. Zhang, X., Xu, M., and Liang, A. 2018. Effect of tillage and crop residue on soil temperature following planting for a black soil in Northeast China. Scientific Reports 7 Al-Kaisi, M. and Hanna, M. 2009. Tips for managing corn residue in continuous corn. lowa State University. Integrated Crop Management News.

Consider the amount of residue remaining after each tillage operation. Chisel plowing can leave about 50 to 85 percent of non-fragile residue (corn or small grains) on the soil surface.² Approximately 70 to 95 percent of the remaining residue is maintained over winter. Remaining residue is reduced further by 60 to 80 percent with spring cultivation. Multiplying these factors together means an estimated 21 to 65 percent of residue would remain at planting time.



Residue in Continuous Corn Systems

- Consider harvesting continuous corn first to help maximize the time and availability of warmer weather, which aids microbial activity and, therefore, decomposition of residue.
- Combine heads should be set to cut corn about one foot or more above the ground.⁵

Harvesting at this height can:

- 1. Help reduce potential tire damage during field operations
- 2. Make it easier to plant through because of less surface residue
- 3. Still provide wind and water erosion protection. Some heads chop the residue as it feeds through the head.
- Spring applications of additional nitrogen (N) would depend on environmental conditions that can influence microbial mediated residue degradation and release of N from residue. Residue decomposition is largely influenced by temperature and moisture that drives soil microbial populations. A corn crop that follows a late harvest, cold winter, and an early planting season may benefit from more N. Research has not consistently shown a benefit to fall applied N for the purpose of aiding residue decomposition.⁵

Measuring Residue

It may be helpful or required for conservation programs to estimate the percentage of crop residue cover. In some areas, about 12 to 20 percent residue is needed to protect relatively flat fields from water erosion. Fields with long or steep slopes may require at least 50 to 60 percent residue cover. The USDA recommends using the line-transect method for estimating and reporting percent residue cover. This method involves simple field observations and measurements using a 50- to 100-foot long measuring tape, line, or rope that can be marked at 100 equal intervals. Percent cover is determined by counting the number of marks that lie directly over a piece of residue.

For complete details on the line-transect method and worksheets for reporting percent residue cover refer to the USDA National Agronomy Manual (pages: 503-126 to 503-127) found at www.nrcs.usda.gov. For a more general estimate of crop residue cover, when reporting is not necessary, the photo-comparison method can be used. This involves comparing sections of the field that are representative of typical residue cover throughout the field and comparing them to photographs of known percentage cover. Example photographs and explanation on this method can be found in the Purdue University Agronomy Guide AY-269-W at www.extension.purdue.edu.

Eck, K.J. and Brown, D.E. 2004. Managing crop residue with farm machinery. Agronomy Guide. AY-280-W. Purdue University Extension.
 Al-Kaisi, M. 2007. Tillage challenges in managing continuous corn. lowa State University Extension. Integrated Crop Management.
 Al-Kaisi, M.M., Hanna, M., and Petersen, T.S. 2009. Residue management and cultural practices. lowa State University Extension, PM 1901a.

What is the Value of Your Crop Residue?

By Zachary Larson, CPAg, Sustainable Systems Agronomist ForGround by Bayer

While there are some financial benefits from removing and selling of corn or soybean stover, the process comes at a cost, including a lost value in nutrients. Additionally, there are effects that are harder to quantity, but can have meaningful impacts. Before committing to stover removal, consider your potential gains and losses, and keep both short and long-term goals in mind.

Assessing the Value of Your Crop Residue

Corn and soybean stover can have many benefits, including financial ones. However, the decision to remove and sell stover should be weighed against the agronomic value of keeping it in the field. Fortunately, the value calculation is a relatively straightforward one, although the economics may change from year to year depending on residue values and fertilizer prices.

Stover Production Amounts and Costs

The amount of stover produced is typically related to the amount of grain produced, meaning that higher yielding fields will most likely produce more stover. For corn, approximately 1 ton of stover at 10% moisture is produced for every 40 bushels of grain yield, and for soybeans 1 ton is produced for every 30 bushels of yield. The amount of stover harvested will be less than what's on the field, with raking and baling removing approximately 66% of stover, while following a combine windrow is approximately 50%. Since soybeans stover is mostly stems, and not all material is harvested, raking and baling will remove less than corn, with 50% or less being a reference point. Therefore, for a typical 200 bushel corn and 60 bushel soybean yield, approximately 3.5 and 1 ton of stover can be harvested, respectively.

The amount of stover harvested will be less than what's on the field, with raking and baling removing approximately 66% of stover, while following a combine windrow is approximately 50%.

The direct cost of harvest should be determined when considering harvesting stover. The 2022 Iowa Farm Custom Rate Survey median price for raking is \$8/acre, and corn stalk baling is \$15/bale for wrapped bales.³

Many farmers note that corn stalks result in more wear and tear on a baler, so custom prices are typically higher for baling stalks than hay, and for those doing it themselves, additional maintenance or repair costs should be expected. Assuming a bale weight 1,500 lbs., raking and baling a ton of corn stalks is approximately \$22 per ton, while for soybeans it is approximately \$28 for the scenario above, not considering the cost of transport of material from the field.

¹ Rees, J., Wortman, C., Drewnoski, M., Glewen, K., Pryor, R., and Whitney, T. (2018, December 31). What is the value of soybean residue? University of Nebraska – Lincoln. https://oropwatch.unl.edu/2018/what-value-soybean-residue 2 Lang, B. (2002). Estimating the nutrient value in corn and soybean stover [Fact sheet], lows State University, https://www.extension.lastate.edu/sites/www.extension.lastate.edu/sites/alyron/stovervalue.pdf 3 Plastina, A., Johannas, A., Gleisner, A., Qualman, A. (2022). 2022 lows Farm Custom Rate Survey. [Fact sheet], lows State University. https://www.extension.lastate.edu/sites/advmve.extension.lastate.edu/sit

Cost of Lost Nutrients

Comparable to what is removed in grain, stover also contains macro and micro nutrients. While amounts will vary some between management practices and genetics, the numbers in table 1 can be used as a starting point.⁴

Table 1

Value of nutrients contained in corn and soybean stover. Fertilizer prices come from the Illinois Production Cost Summary for 9/22/22, using urea @ \$0.43/lb N, MAP @ \$0.41/lb P2O5 and potash @ \$0.43/lb K2O.

S values calculated from AMS @ \$590/ton, or \$0.24/lb S. For MAP and AMS, an equivalent value of N was discounted @ \$0.43/lb.

Nutrient	Corn (lbs./ton)	Value (\$/ton)	Soybean (lbs./ton)	Value (\$/ton)
N	17	15.85	17	15.85
P2O5	4	3.19	3	2.39
K20	34	24.28	13	9.28
S	3	2.8	2	1.87

Corn and soybean stover contain some amount of nitrogen, phosphorus and potassium that translate into fertility value. While nitrogen is present in each crop, this amount may be discounted as it may not be immediately available to the plant as the residue undergoes mineralization to form organic matter. However, as residue breaks down, phosphorus, potassium and sulfur can be become plant-available. Therefore, using the fertility prices above, corn stover has harvest costs and a fertilizer value of over \$52 per ton, while soybean harvest costs combined with fertilizer values are around \$42 per ton.

Soil Health Benefits of Stover

In addition to the financial benefits of stover, keeping residue on the soil surface provides additional benefits. Maintaining residue to attenuate the impact of raindrop energy and slow the flow of water is critical in reducing soil erosion. Also, the presence of residue helps to lessen the effects of crusting and maintain good infiltration at the soil surface. Residue also serves as a feed source for earthworms and other organisms and cover for insects such as carabid beetles, which are natural predators of crop pests, including slugs. Finally, surface residue is a contributor to the soil organic matter pool, and over time consistent removals of stover may result in declines in organic matter content.

4 Rees, J., Wortman, C., Drewnoski, M., Glewen, K., Pryor, R., and Whitney, T. (2018, December 31). What is the value of soybean residue? University of Nebraska – Lincoln. https://cropwatch.unl.edu/2018/what-value-soybean-residue

Improve soil health, preserve your land.

For Ground is a new, **farmer-first platform** that supports growers in considering, adopting and expanding **regenerative agriculture practices**.

Joining ForGround unlocks access to expert agronomic support and exclusive discounts – plus opportunities to earn income for implementing **no-till**, **strip-till**, or **cover crops**.

ForGround

by Bayer



Benefits of Signing Up for ForGround by Bayer



SCIENCE-BASED SUPPORT

Training resources and events developed using the latest research to help you successfully put regenerative practices to work in your fields.



LOWER TRANSITION COSTS

Member-exclusive equipment rebates, discounts on tools and services, and a free subscription to digital farming's leading platform Climate FieldView™ PLUS.¹



NEW REVENUE STREAMS

Potential to earn extra income through the Bayer Carbon Program, along with being notified as additional revenue opportunities are added.



Enroll today to discover the benefits of ForGround by Bayer.

https://www.BayerForGround.com



- 1. Click **Enroll** at the top of the page
- 2. Sign-up using your Climate FieldView™ account
- 3. Confirm your ForGround account information
- 4. Start exploring your ForGround benefits

Services and products offered by Climate LLC are subject to the customer agreeing to our Terms of Service. Our services provide estimates or recommendations based on models. These do not guarantee results. Consult with your agronomist, commodity broker, or other industry professional before making financial, farming, or risk management decisions. More information at https://www.climate.com/legal/disclaimer/.





¹ ForGround members who agree to associate their Field/liew Plus account with ForGround will receive a Field/liew Plus subscription at no charge for one year. Current participants in the Bayer Carbon Program can participate in this offer by becoming ForGround members and complying with offer requirements. The Field/liew Plus opportunity set forth in this paragraph is subject to Bayer continuing to offer promotion. Promotion may be discontinued by Bayer at any time in Bayer's sole discretion. Promotion participants must not be in breach of any agreements between Bayer and its affiliates, including Climate LLC, in order to qualify. Field/liew Drive Starter Kits are not included in this offer. No commissions will be paid to dealers for subscribers participating in this offer. This offer may not be combined with any other offer for Field/liew Plus.

This Bayer Carbon Program described in this material is subject to the current version of the Bayer Carbon-Smart Practices Master Agreement. The information is to aid in the understanding of the Bayer Carbon Program and does not change or modify the Bayer Carbon-Smart Practices Master Agreement in any way.