# No-Tilling Wheat With Single Disc and Double Disc Drills

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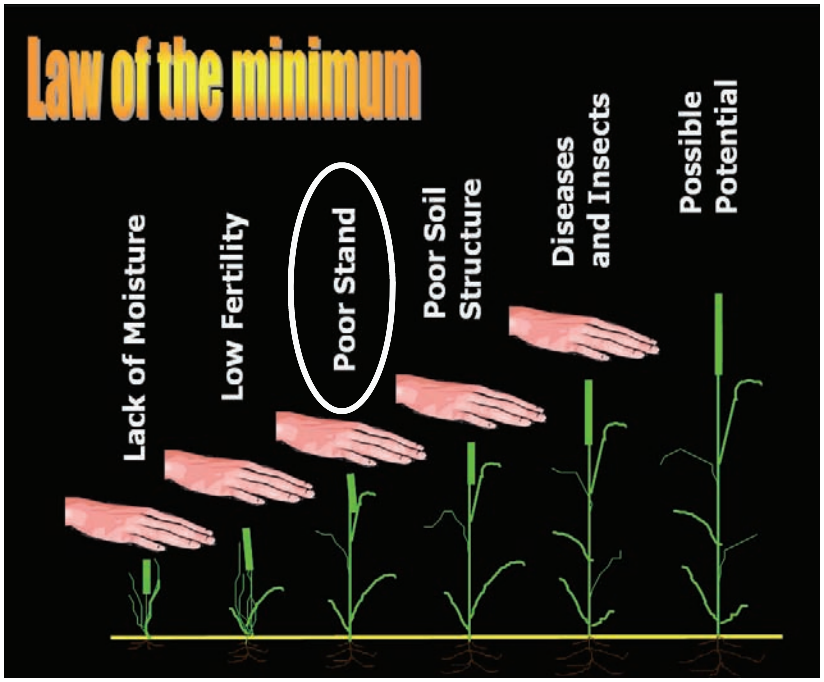


**Well Sown = Half Grown**

The above saying comes from England and suggests that if producers do a good job seeding their crops, they are half way to good yields. While there may be other weak links (as illustrated within the graphic to the right), if adequate or above rainfall occurs and soil fertility problems can be addressed, the next common weak link is frequently poor stands and this weakness can limit yields.

Poor stands may be interpreted in many different ways, but what I look for when I walk into a wheat field is uniform distribution of seeds at a consistent seeding depth across the drill/seeder width and across the field. Attaining these criteria consistently becomes a challenge, especially when differences in topography, soil types, soil moistures, variations in residue levels etc. all occur within the same field. If the above challenges are not enough, adding no-tillage into the equation (especially into high residue level conditions), presents even greater challenges.

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Image 1 (right) illustrates a grower who no-tilled wheat back into heavy wheat residue. While the standard of residue uniformity was not too bad, the drill/seeder configuration was not able to consistently position seeds into moist soil. Some of the later emerging plants were seeded shallow and took a rain to allow them to emerge. If soil moisture is available, then its very important to position all seeds into that moisture profile.

2

While some producers claim that its much easier to achieve a uniform stand in conventional soils, many of them still do not achieve the standards of seeding depth and seed spacing consistency required for high yields. The loose soil conditions and the moisture losses as a result of the tillage make uniform emergence a challenge unless it rains shortly prior to seeding. Image 2 (right) illustrates the differences in seed distribution and planting depth in a loose conventional tilled field. Notice the even rows and then the clumps. Such stands are difficult to manage with nitrogen, it easy to bring a field forwards or backwards with regards to tiller manipulation and N timing, but when you need to do both in the same regions of the fields, it becomes a huge challenge.

No-Tilling is the preferred option for sustainable and profitable production in the Central Plains. This handout, together with the presentation it accompanies, will help provide solutions to help improve stands.

**Jethro Tull** (1674 – 1741, was an English pioneer during the Industrial and Agricultural Revolution.

Before the seed drill was introduced, seeds were sown simply by being cast upon the ground, to germinate (or fail to germinate) where they landed. Tull's seed drill significantly improved this process, by creating a slot of specific depth, dropping in a seed, and covering it over. The result was an increased rate of germination, and a much-improved crop yield (up to eight times).

### What Defines A Superior No-Till Seeding System Today?

I am not sure if many principles have changed in the last 300 years, but there are more challenges with regards to equipment weight, consistent down pressure and depth consistency across the working widths of larger seeders and issues of seed distribution with air-seeding systems. A system which consistently provides the means to achieve consistent placement of the seed within the row, across the broadest range of soil types, residue and moisture conditions is preferred, but a more general list of considerations is listed below for extended thought.

**Measures Of Performance** (in no specific order)

- Emergence Percentage (stand counts).
- Row spacing.
- Degree of soil disturbance.
- Seed depth control consistency (and ability to penetrate hard and/or dry soils consistently)
- Seed distribution within the row.
- Window of emergence for the 90% percentile, for a specific growth stage (say the 2 leaf stage).
- How the above measures change as a result of forward speed, soil moisture, wear on components etc.
- Root development characteristics.
- Draft requirements.

### Soil Disturbance?


Image 3 (left) illustrates a no-till wheat after wheat field where the operator forgot to turn on the seed & fertilizer flow on his single disc air-seeder for the first two passes of the field. He turned on the seed plus fertilizer and seeded those two passes again. The image shows the difference that a small amount of soil disturbance can have on the emergence of wheat following wheat. The wheat with the disturbance was one leaf stage larger and healthier. Whether the difference in emergence and early plant health is as a result of soil warming, residue handling or the breaking up of sub-lethal soil pathogens is unknown, but the differences can be frequently seen.

How can we duplicate the conditions as illustrated above left within a single pass no-till system? Well, the addition of row cleaners may be one option, but on 7.5" rows or even 10" rows where do you move the residue to and how do you keep it off the rows that have already been seeded? A planter currently has the ability to install row cleaners and if these are configured properly, they could help move residue and significantly improve the standards of emergence. Planting wheat with a corn planter may be an option, and this topic is discussed later within this report in more detail.

**Soil Disturbance (continued).**


4

If a producer seeds wheat into lower yielding wheat, soybean or canola residue, or lower yielding corn residue: providing the material has been evenly distributed, no soil disturbance should be required. The only exception may be later planting dates when increased soil warming may be preferable, especially into higher moisture soils. Image 4 (right) illustrates a grower planting wheat with a 30’ Great Plains no-till drill. Notice the poor residue distribution in the image. Despite frequent adjustments, it was not possible to achieve the same seeding depth and similar standard of soil disturbance within the different previous crop residue densities.


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Image 5 (right) illustrates one of the challenges facing producers who raise 80-100 bu/ac wheat and plan to no-till wheat back into these high volumes of residue. In this example, the residue was heavy, but it was dry enough to facilitate good cutting. The soil below the residue was moist, allowing rapid emergence, but as years of no-till accumulate, we may need to look at different options for moving residue slightly away from the seed zone.


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Some producers who no-till into heavy residue struggle obtaining a uniform wheat stand. This is especially a challenge in higher moisture conditions where marginal soil/residue cutting and damp soils negatively impact both the depth control and the health of the emerging seedlings, as illustrated in Image 6.

Some producers have found that the following additions help move or disrupt residue enough to help improve stand emergence.


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1) **No-till disc openers**. Such options (illustrated in Image 7, right) can reduce hair-pinning within damp residue and create more loose tilth to help increase soil warming and crop emergence. Different no-till disc coulter options allow producers to match their forward speeds to the soil conditions and settle on an acceptable level of soil disturbance. Higher moisture, cooler soils and later planting dates appear to benefit the most from a no-till coulter. In hard, dry soils or low residue conditions, the no-till coulter can result in undesirable levels of soil disturbance and the burying of precious surface residue.


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2) **Improvements in closing systems**. Exapta Solutions and Martin Industries both offer closing wheels with an interrupted outer periphery, both can be installed to single disc seeders and planters to help close the seed slot and allow increased seed zone warming and crop emergence. Both designs are substantially better then the smooth round designs commonly available on most drills/seeders. Smooth round closing wheel systems perform to an acceptable level within tillage systems, but they struggle with high residue no-till systems. Examine the various aftermarket options closely.

**Different Drills and Air-Seeders Compared**

While its not totally accurate, the maximum amount of available weight per opener can be used as a rough guide to compare different brands of drills and seeders and establish their potential standards of performance in heavy residue no-till systems. Where the comparative confidence becomes less accurate is especially evident when different blade diameters are compared, such as between the Case SDX and the John Deere single disc openers. So as you review the comparative charts below, take note of the disc diameters and whether or not a no-till opener is fitted to a double disc drill, because three blades will require more down-force to push them into the ground compared to two.

| Drill Type | John Deere 1890 | John Deere 1990 CCS | Case SDX 30 |
|---|---|---|---|
| **Row Spacing** | 7.5” | 7.5” | 7.5” |
| **Empty Frame Weight (lb)** | 17,000 | 18,800 | 24,500 |
| **Seeding Width** | 30’ | 30’ | 30’ |
| **Number of openers** | 48 | 48 | 48 |
| **Weight per opener *** | 354 | 391 | 510 |
| **Disc Diameter** | 18” | 18” | 22.5” |

| Drill Type | Crustbuster 4000 | Great Plains 3N 3010P | Sunflower 9433 |
|---|---|---|---|
| **Row Spacing** | 7.5” | 7.5” | 7.5” |
| **Empty Frame Weight (lb)** | 14,000 | 20,500 | 16,460 |
| **Seeding Width** | 30’ | 30’ | 30’ |
| **Number of openers** | 48 | 48 | 48 |
| **Weight per opener *** | 291 | 427 | 342 |
| **Disc Diameter** | 16” notched | 17” No-till + 13.5” smooth disc openers | 15” smooth |

* Weight per opener is measured in pounds and assumes that all of the frame weight is available to the openers. This is not possible because some weight is transferred to the hitch, frame wheels, etc. So this information is provided for guidance purposes only.

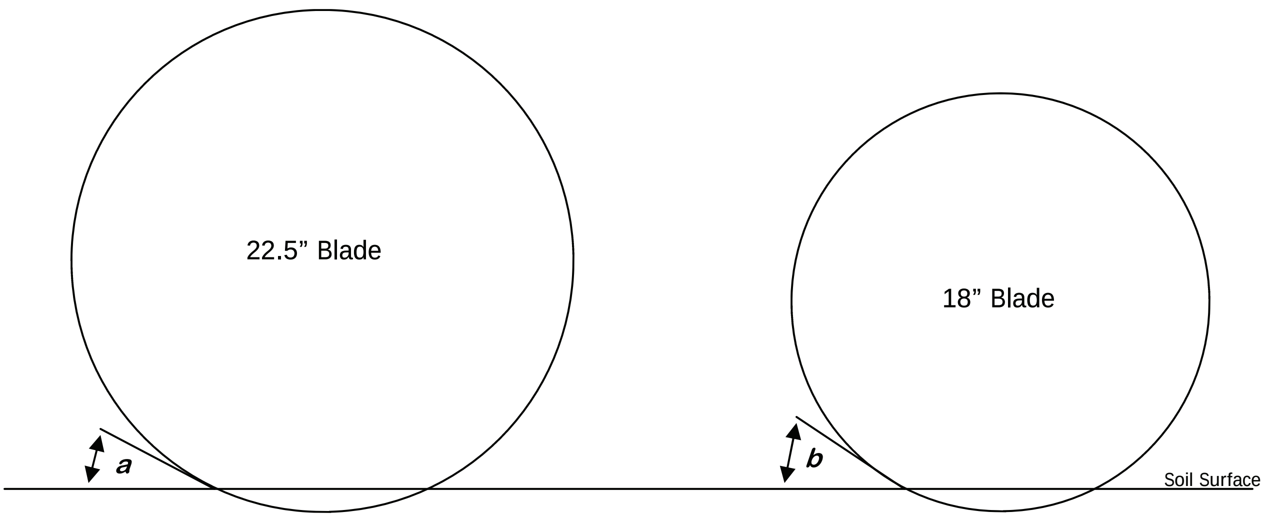
**Optimal Disc Condition and Diameter For Maximum Performance and Least Amount of Hair Pinning.**

A pair of scissors offers the best explanation as to the best configuration for optimal residue and soil cutting performance. A sharp pair of scissors will only begin to cut a thick piece of cardboard when the internal angle between the blades is over approximately 30 degrees. This same theory can then be transferred to disc configurations and I have found a sharp disc combined with a smaller diameter will always provide better performance than a greater disc diameter as a result of the reduced shearing angle. Increased plugging is one potential drawback with a smaller blade, but appropriately positioned gauge wheels or residue control flaps can help reduce this problem. Larger blades are claimed to last longer, but some producers are replacing disc blades when the cutting edge has deteriorated rather than replacing them at a specific diameter. This subject is continued on the following page.



Image 9 (above) illustrates a pair of scissors with a low included angle, trying to cut through cardboard. The amount of force required to cut into the cardboard, even with sharp scissors is almost beyond what is humanly possible at this angle.

If the scissors are opened and the force is concentrated over a smaller surface area (Image 10) the scissors can cut though the cardboard without significant effort.




**Larger Disc: Advantages**

- Potential longer life before disc replacement
- Less angle required to achieve an appropriate seed slot width. Some claim this reduces hair-pinning but I have never seen this to be the case in the field.
- May retain the edge longer than a smaller disc, especially in rocks because of the longer circumference.

**Smaller Disc: Advantages**

- Increased angle (b compared to a, as illustrated above) increases shearing force per unit of cutting area and reduces hair-pinning.
- Takes less down pressure than a larger disc to penetrate residue and soil.
- Cheaper to replace than larger blades, but the time to replace them should be taken into consideration.

## Disc Blade Condition

Whichever drill/seeder is purchased, it is important to keep the blades in good working order. Once the blades lose their sharp edge, then hair-pinning increases significantly, especially in loose soils or damp residue conditions.

## 2007 No-Till Wheat Row Spacing Trial

On October 9th 2006, two similar Great Plains No-Till drills were utilized to plant a wheat row spacing study in Jewell, KS. Prior to the wheat being planted, the previous crop was 25bu/ac soybean. Grain sorghum was consecutively grown on the 56 acre field two years previous to the soybean and the field had been no-tilled for the past four years.

One Great Plains No-Till drill had 7.5" spacing, while the other was 10" spacing. Both drills were calibrated to deliver the same number of Jagalene seeds per square yard (330), together with 100 lb/ac of fertilizer (60#/ac 11-52-0 and 40#/ac 46-0-0). The field was top-dressed on February 7th with 60lb/ac of actual N, together with 10lb/ac of actual sulphur. A second topdressing was planned, but as a result of wet soil conditions, it was not applied. An early fungicide (Quilt) was applied to most of the field at growth stage 6-7. The Quilt was applied at this early stage at the rate of 8oz/ac and this fungicide was mixed with 1pt/ac of Phosyn Zinflow (zinc oxide) and 1/2pt of Phosyn Copflow (copper oxide). Both regions of the above were kept separate and yields were checked at harvest time.

Without Feekes 6-7 Application of Quilt Fungicide, zinc and copper.

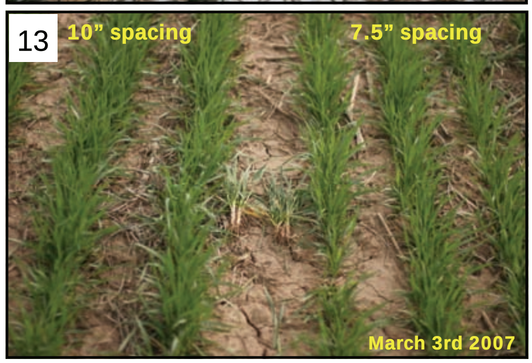
| Row Spacing | Yield (adjusted to 13.5% moisture) (bu/ac) | Average Yield (bu/ac) |
|---|---|---|
| 10" | 47.94 | |
| 7.5 | 49.87 | |
| 10" | 48.47 | |
| 7.5" | 49.87 | |
| 10" | 52.09 | 49.50 |
| 7.5" | 55.66 | 51.80 |

With Feekes 6-7 Application of Quilt Fungicide, zinc and copper.

| Row Spacing | Yield (adjusted to 13.5% moisture) (bu/ac) | Average Yield (bu/ac) |
|---|---|---|
| 10" | 51.72 | |
| 7.5 | 55.88 | |
| 10" | 55.26 | |
| 7.5" | 56.10 | |
| 10" | 54.94 | 53.97 |
| 7.5" | 55.55 | 55.85 |

*Thanks to Great Plains Manufacturing (Salina, KS) for their invaluable co-operation with this 2006-2007 research trial.*







### What About Seeding Wheat With A Planter?

A number of producers across the Mid West and Central Plains have experimented with planting wheat with a corn/soybean planter on 15” rows (Image 16 below). While there are advantages with this practice, growers should also be aware of some disadvantages.

<u>Benefits of Wheat Seeded With a Corn Planter.</u>

- Growers can plant wheat, corn and soybean with the same planter, increasing equipment utilization and reducing fixed costs.
- A planter has better potential to cut through heavy no-till residue than a no-till drill, especially when the planter is equipped with row cleaners. Be aware that without row cleaners, poor stands may occur within heavy residue bands (see Image 17, below), so residue management becomes even more important.
- A planter can singulate seeds and place them in the soil more accurately than a no-till drill.

<u>Disadvantages of Wheat Seeded With A Corn Planter.</u>

- +/- 10% Lower yields are likely with 15” spacing (compared to 7.5” spacing)
- Increased weed problems will occur in fields, especially within those with high historic weed pressures
- The lack of crop competition increases weed populations and makes chemical control more of a challenge.
- To achieve similar or greater yields than a drill/air seeder, fields will need to be seeded twice, preferably using RTK GPS systems.


Driving a John Deere 1790 over rubber belts to determine the wheat seed population. Picking up a consistent number of seeds with a milo plate (inset image above) became a challenge, especially within no-till conditions and 5-6 mph forward speeds (even with higher vacuum).


The biggest problem illustrated in Image 17 (above) was not the drill or seeder selection, but poor residue distribution. This is a frequent problem for many no-tillers. However, row cleaners would have significantly helped within the areas of heavy residue, especially if the row cleaner wheels were equipped with depth bands.

### Opportunities For The Future

Will the advantages of improved seed spacing and more consistent depth control with a planter, offset the disadvantages documented above? Probably not for now, but there may be ways of narrowing the gap or perhaps even raising higher yields with a corn planter. These opportunities need to include specifically designed wheat plates capable of delivering seeds more consistently within the row than the currently available milo plates. The use of RTK Auto-Steer systems to enable growers to split the rows is also encouraged. Although this is another pass across the field, the benefits of not having to buy a no-till drill might be justified for smaller scale wheat growers. Row cleaners must be also utilized within higher residue no-till systems, but be aware that they may move material on top of planted rows when the second pass is made across the field. The addition of a side treader wheel to each row cleaner wheels has been found to reduce the excessive movement of residue, such approaches should significantly improve soil warming, nutrient availability and final wheat emergence uniformity.