

## No-Tillage Small Grain Production in Virginia

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### Introduction

No-tillage farming avoids the use of tillage for seedbed preparation or weed control. Soil disturbance only occurs with seeding. No-tillage production generally reduces the potential for soil erosion by mitigating the effects of wind and water on soil movement. Keeping more crop residue on the soil surface keeps more soil in place. Production costs involving fuel, labor, and machinery can also be significantly lower with this system. After residue accumulates and macropores form, water infiltration increases and runoff decreases. More timely planting can occur because the time typically used for conventional seedbed preparation is used for planting. No-tillage production requires herbicides to control weeds and a heavy seeder capable of penetrating residue and placing seed at a constant depth. Many Virginia farmers practice no-tillage small-grain production, but may still have questions about techniques to increase success. The key to making no-tillage production effective is good management of residue, fertility, and pests.

### Residue Management

The residue management goal should be 75 percent to 90 percent residue coverage on the soil surface at all times. In this respect, more is generally better. The easiest way to develop high levels of residue is to plan cropping rotations that include high biomass crops like corn and small grains and leave them on the surface. This surface mulch from previous crops not only reduces soil erosion but reduces evaporation by shading the soil. Covering the soil also can reduce weed pressure by depriving the weed seeds of the sunlight necessary to germinate, and after several seasons, weed seed present in the surface layer may be significantly reduced.

Planting small grains into heavy corn stubble can present special problems because of both residue volume and distribution. Using an appropriate drill that is set at the proper planting depth can overcome most problems with residue volume. Achieving an even distribution of residue after corn harvest is critical for adding beneficial organic matter evenly across the field and for facilitating small-grain seeding. Even distribution of residue is necessary so that a uniform plant stand can be achieved without constant adjustments to seeding depth and down pressure. Combine straw spreaders or choppers must be operating properly and set to distribute residue evenly. Very fine material tends to fall directly behind the machine. Increasing the airflow from the combine's chopper can spread lighter particles further.

Burning residue will cause the loss of nutrients and organic matter from the system and local regulations may prohibit the burning because it creates smoke emissions.

### Fertilization and Liming

The recommended rates and timing for lime and fertilizer applications are similar to those for conventional production. *Nitrogen Fertilization of Winter Barley: Principles and Recommendations*, Virginia Cooperative Extension publication 424-801 ([www.ext.vt.edu/pubs/grains/424-801/424-801.html](http://www.ext.vt.edu/pubs/grains/424-801/424-801.html)), *Nitrogen Management for Winter Wheat: Principles and Recommendations*, Virginia Cooperative Extension publication 424-026 ([www.ext.vt.edu/pubs/grains/424-026/424-026.html](http://www.ext.vt.edu/pubs/grains/424-026/424-026.html)), and *Intensive Soft Red Winter Wheat Production*, Virginia Cooperative Extension publication 424-803, have more information on these subjects. If lime is required as indicated by a soil test, it should be spread and incorporated with tillage prior to beginning no-tillage

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production. Surface application of lime is an acceptable practice but the pH will be affected in a much smaller layer of soil. Soil samples should be taken from the depth of the plow layer in tilled fields and from a two- to four-inch depth in no-tillage fields and pastures. Because early plant growth and tillering are often slower than with conventional production, top-dressing nitrogen (N) is especially critical with no-tillage seeding. Pay close attention to tiller density in late fall and winter and apply N as recommended to develop the optimum number of tillers to support high yields. This is especially important with later plantings.

## Weed management

In the absence of tillage, pre-plant weed control is accomplished solely with herbicides. It is advisable to begin no-tillage production on fields that are free of difficult to control weeds and to follow a well-planned weed control program. If difficult to control or perennial weeds are prevalent in a field, it might be best to use tillage to remove those pests before moving to chemical-only control options. Generally, annual weeds may become less problematic in no-tillage than in conventional tillage, but perennial weeds are more likely to become established in no-tillage systems. Weed control during the cropping season is also very important and is generally the same for no-tillage and conventional tillage production systems. See the latest edition of the *Pest Management Guide Field Crops*, Virginia Cooperative Extension publication 456-016 (<http://www.ext.vt.edu/pubs/pmg/>) or your local Virginia Cooperative Extension agent for specific information on herbicides and application strategies for controlling weeds in no-tillage production systems.

## Cultivar Selection and Seeding

Grain yields of high producing cultivars tend to be similar in conventional and no-tillage systems. The most recent Small Grain Testing Report from Virginia Tech (<http://www.ext.vt.edu/cgi-bin/WebObjects/Docs.woa/wa/getcat?cat=ir-cg-gr>) has information on selecting cultivars. Evaluating the top yielding cultivars from 1999 through 2003 reveals that Sisson, SS550, Tribute, McCormick, and SS520 all perform well in no-tillage and conventional tillage systems (Table 1). Overall, wheat yields from these tests were eight bushels per acre lower with no-tillage, but long-term research done on a field scale in Virginia and in other states suggests that no-tillage grain yields will be similar to conventional tillage yields.

It is best to increase no-tillage seeding rates by 10 percent over conventional rates when planting into heavy residue, such as corn stover, or when soil conditions make it difficult to maintain a constant planting depth. Increasing seeding rates generally is not necessary when planting after soybeans or when residue levels are not extremely high.

Because of the tendency for slower fall growth with no-tillage, extra effort should be expended to plant on time, or slightly earlier than with conventional tillage small grain crops. This gives more time for tiller development in warmer weather. Figure 1 has suggested planting dates across the commonwealth. These dates were determined based on evaluation of the Virginia Agricultural Statistics Service 50 percent fall freeze probability for over 90 sites in Virginia. With earlier planting, it is important to consider using cultivars with

**Table 1.** Grain yields (bu/ac) for winter wheat cultivars evaluated under conventional and no-tillage production systems at the Eastern Virginia Agricultural Research and Extension Center, Warsaw, Va. (1999-2003).

Cultivar	2003		2002		2001		2000		1999	
	Conv.	No-till.	Conv.	No-till.	Conv.	No-till.	Conv.	No-till.	Conv.	No-till.
	Yield, bu/ac									
SS 520	81	78	111	91	92	97	94	94	83	68
Tribute	78	86	107	101	95	97	92	86		
SS 550	72	83	112	96	93	94	91	94	76	73
Sisson	65	83	110	90	94	100	100	92	84	71
McCormick	81	88	105	98	97	88	93	97		
Pioneer 26R24	73	90	105	89	87	90	86	90	98	79
Pioneer 26R38	68	82	95	70	87	90	87	86		
Century II	68	79	98	81	84	88	96	87	87	75
SS 535	68	79	99	87	77	93	79	89	65	78
USG 3209	66	79	104	93	88	97	96	93	86	83
Average	70	76	98	82	83	88	82	81	73	62

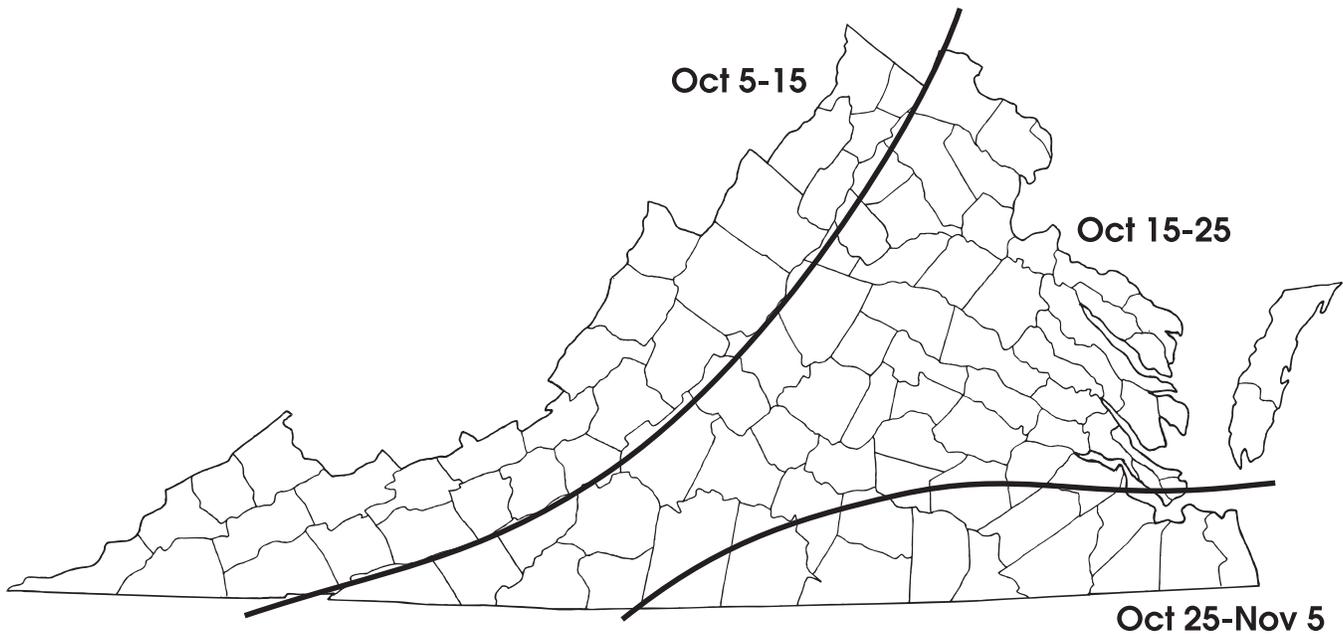


Figure 1. Suggested seeding date for no-tillage small grains in Virginia, based on 50 percent fall freeze probability (VASS, 2003, <http://www.nass.usda.gov/va/14-15.pdf>)

medium to late heading dates or those that are day-length sensitive regarding initiation of heading to lessen the chance of spring freeze damage. Information about heading dates, as well as disease and lodging resistance, is available from the Small Grain Testing Report.

It is important that seed be placed at least 3/4 inch into soil, not counting the residue layer, to reduce the potential for winter kill from frost heaving and root and crown exposure to freeze injury. Too often, seed is planted too shallow and germinates because of the residue coverage, but then cold temperatures cause significant winter kill.

## Insects

With a few exceptions like cereal leaf beetle and aphid transmitted barley yellow dwarf (BYDV), insects have historically not been a major problem in Virginia small grains. However, damage has occasionally been severe and certain pests could become more common with an increase in reduced or no-tillage practice across the state. Traditionally, producers have avoided damaging populations of Hessian fly and increased risk of aphid attack and BYDV by planting later in the fall. The need to establish no-tillage small grains earlier exposes the crops to more pressure from these insects and increases the risk of economic damage. Insect pests such as cutworm/fall armyworm and the wheat curl mite are associated with fields where producers have continuous wheat/soybean rotations, or where volunteer grain in soybean fields is present when fall grain crops

are planted. Volunteer small grain serves as a 'green bridge' for these pests and can lead to infestation problems. Producers should be vigilant when scouting for insects in no-tillage small grains. For insect population threshold levels and control options available see the latest edition of the *Pest Management Guide Field Crops*, Virginia Cooperative Extension publication 456-016 (<http://www.ext.vt.edu/pubs/pmg/>) or your local Virginia Cooperative Extension agent.

## Diseases

The increased prevalence of disease in no-tillage small grains is a major concern. This is especially true for fusarium head blight (FHB) or scab caused by the fungal pathogen *Fusarium graminearum*, when seeding occurs directly into corn stubble. Spores of the fungus develop on corn stubble and move to wheat plants by air currents or by splashing water. Head infection is most severe when moist, warm weather occurs during flowering. If a rain event occurs during anthesis, the incidence and severity of FHB dramatically increase. There is no effective fungicide treatment once the head is infected and colonized. As yet, there are no cultivars available with complete resistance to initial FHB infection. Some newer wheat cultivars exhibit moderate resistance to the spread of the pathogen from one colonized spikelet in the head to others. Cultivars with moderate resistance to FHB are publicly available in Virginia and should be considered for use. The Virginia Tech Small Grain Testing Report has a summary of cultivar reaction to FHB. Depending on the

timing of the infection, one to several spikelets can be infected, colonized, and display a bleached appearance at a time when “healthy” spikelets are still green. The grains produced in colonized spikelets may contain mycotoxins that are harmful to livestock and humans.

Other pathogens can be more severe in no-tillage production as well. These include: wheat spindle streak virus, tan spot, stagonospora leaf and glume blotch, and even pythium root rot. Planting no-tillage into soybeans that have been double cropped with small grains, particularly wheat, increases vulnerability to wheat streak virus, tan spot, barley yellow dwarf and cereal yellow dwarf viruses.

More information about small-grain diseases is available at Integrated Disease Management in Small Grains ([oak.ppws.vt.edu/stromberg/smallgrain/sgrain.html](http://oak.ppws.vt.edu/stromberg/smallgrain/sgrain.html)).

## Summary

No-tillage small-grain production can be highly successful in Virginia. However, techniques and management differ somewhat from conventional tillage. Below are some suggestions that can make the adjustment to no-tillage less troublesome.

1. Maintain as much residue as possible on the soil surface.
2. Set combine straw spreaders or choppers to evenly distribute previous crop residue.
3. Be aggressive controlling weeds pre-plant.
4. Choose a cultivar with high yield potential, strong seedling vigor, and a medium to late heading date.
5. Increase seeding rates 10 percent over conventional rates when planting into heavy residue.
6. Plant no-tillage acres first or 4-5 days before the optimum planting date for conventional plantings.
7. Choose cultivars with resistance to scab (FHB).
8. Scout fields in late fall and winter and apply N if tiller density is below optimum.
9. As questions arise, consult your local Virginia Cooperative Extension agent.