Saskatchewan
Soil Conservation
Association

Soil Facts

Getting Started in Direct Seeding

When a producer first considers making the transition into a direct seeding system, the process may appear daunting. A number of decisions need to be made. For instance, what equipment is needed and what will it cost? How will weeds be controlled prior to seeding without tillage? What is the best rotation? What are the most suitable openers and packers? What is the preferred width of seed row?

Good residue management starts by uniformly spreading straw and chaff at harvest.

John Clair is a producer who decided to make it happen. He farms with his wife and two adult children near Radisson. Clair said they started direct seeding for two main reasons. First, he wanted to stop water erosion and second, he wanted to optimize their farm's crop inputs. Prior to low disturbance direct seeding, they were spraying approximately half their seeded acres with a pre-seed burn-off. They then seeded with an air seeder with sweeps and harrow packed. However, the previous years' residue would clear through the shovels only at a depth of 2 to 2.5 inches (5 to 6.5 cm). "Our emergence was slow and germination uneven", says Clair.

In 1995 Clair chose an air drill with very narrow row spacing because as he explained, "You never know when swathing will be a part of harvest". However the narrow spacing made straw management extremely important so they purchased a heavy harrow. Over the years they have found the best solution is to have the residue spread uniformly across the cut of the combine.

Clair continues to direct seed for a variety of reasons. "Direct seeding benefits our land, the input costs are lower, plus we save moisture. And one additional benefit we weren't counting on is that our saline areas have almost disappeared".

Getting started into a direct seeding system may seem overwhelming, but like any other process of change, it needs to be taken one step at a time. The SSCA promotes five pillars of direct seeding to assist producers with adopting, growing and maintaining a conservation farming system. The five pillars include Residue Management, Rotations, Seeding Principles, Weed Control and Fertility Principles.

Residue Management

Residue management is the handling of the previous crop's residues so that they complement the seeding and crop production process. When residue is properly managed it becomes a valuable asset that can increase overall production. Standing stubble and surface residue not only trap snow, they also reduce wind and water erosion and limit evaporation from the soil surface. The key to successful direct seeding is proper residue management. This means that the first step in any direct seeding system is not with the seeding but with the previous year's harvest. Straw and chaff need to be spread across the width of the cut. Before selecting openers and packers, the height of the stubble and the seeding implement's ability to clear residue must be taken into consideration. The following is a brief list of factors that affect residue management.

Crop Type

Different crops produce different quantities of both straw and chaff. In general, cereals tend to leave lots of straw, but little chaff. Oilseeds on the other hand have much higher levels of

chaff.

Width of Cut

The greater the width of cut, the greater the power requirement to spread both chaff and straw. As width of cut increases, the volume of material is increased so the ability to chop and spread residues uniformly across the cut tends to decline.

Stubble Height

Excessive stubble height can create plugging problems for hoe type openers when stubble bridges between openers. A general rule of thumb is that stubble height should not exceed 1½ times the row spacing of the seeding tool when using a narrow opener. When using a narrow sweep or similar type opener, stubble height should not exceed the row spacing of the seeding tool. With disc type openers, the more stubble that is standing, the better as there are fewer plugging problems with tall standing stubble. Failure to cut surface residues is a more common problem for disc openers.

Straw Choppers and Chaff Spreaders

The goal is to spread both straw and chaff over the entire width of cut. Research by PAMI found that straw should be spread over 80% of the width of cut and chaff should be spread over 50% of the cut. Fields can be harrowed to provide sufficient spread of straw across the field, however ***chaff spreading must occur at the back of the combine***. Chaff collection can be an excellent alternative and important cattle feed.

Cooler soils under direct seeding are the result of the crop residue layer on the soil surface. This layer insulates the soil. It slows warming in spring and restricts evaporation that also slows warming. Spreading crop residues evenly across the field will minimize any detrimental impacts. Research has shown that the cooler soils do not usually affect crop yields as long as good seeding practices are followed. Direct seeded soils should be seeded as shallow as possible into good soil moisture for quick crop emergence.

Rotations

Crop rotations should provide diversity and flexibility. A cereal-pulse-cereal-oilseed is a simple rotation that is easy to adopt. The cereal can be oats, barley, canary seed or wheat and the pulse can be lentils, peas or chickpeas. The oilseed could be canola, flax or even sunflower. The key is to have a variety of crop types and to alternate broadleaf and cereal crops.

Alternating cereal and broadleafed crops is an important part of an effective control strategy for some soil and residue borne diseases. Appropriate rotations reduce disease innoculum thereby, reducing risk of crop losses to the disease. By having diverse crop types, seeding and harvesting dates are automatically altered which aides in weed control. In general, broadleaf weed control is more consistent and less costly in cereals and grassy weed control is improved in broadleaf crops. Broadleaf weed control is limited for some broadleaf crops. Each crop type favors and discourages a different spectrum of weeds. Perennial and forage crops can also be added to a rotation. These crops can be excellent tools for controlling certain weeds. A diverse rotation allows diversity in the herbicide program to be used. Diverse rotations also spread out risk and workload. One can handle more acres with the same fixed costs. Crop diversity can also help prevent the building up of crop residue which can cause difficulty at seeding.

Direct seeded canola emerging in wheat stubble as a result of uniform seed depth and good soil moisture conditions.

Seeding Principles

The most important function of the seeding equipment is to place seed so it can germinate and emerge with minimal stress and produce the best crop possible. To do this, seed needs to be placed at uniform depth and be uniformly distributed at the desired rate. It is often desirable for seeding equipment to do other things. Seeding equipment is used to place fertilizer or reduce the need for other operations to manage residue or minimize soil disturbance to discourage weeds. However, growers need to be cautious not to compromise crop productivity to meet these secondary objectives.

Every farmer who wants to direct seed will require suitable

seeding equipment. Major items that should be considered when selecting direct seeding equipment include crop types, soil conditions, fertilizer type and application method, crop residue and power requirements.

Direct seeding equipment must be designed to operate in heavy residue conditions and in soils that have much wetter surfaces when compared to conventional tillage systems. The direct seeding implement must create an ideal environment for seed germination and quick seedling establishment within the row while discouraging weed growth between the seed rows. **The goal is to give the crop every advantage while leaving the weeds at a distinct disadvantage.**

Seeding equipment requirements include residue clearance, uniform soil penetration, good depth control, desired row spacing, acceptable width of seed row, reduced soil disturbance and stubble knockdown, good rock protection, adaptability to seed and fertilizer delivery systems, efficient soil openers, precise fertilizer placement, simplicity of design and acceptable equipment cost.

Peas emerging in barley stubble. Alternating broadleaf crops with cereal crops helps minimize weed, disease and insect problems.

Purchase priorities must be set when changing to a direct seeding program. Experienced direct seeders indicate that the most common mistake novices make is purchasing good seeding equipment and worrying about residue management later. **Only after crop residue is properly managed should a producer begin direct seeding.**

There are inexpensive alternatives to new equipment and producers should examine these alternatives before making any investments. Often it is possible to adapt existing equipment to seed directly into standing stubble. By using specialized ground openers and mounted packers, only a minimal investment in equipment may be required to begin direct seeding.

A direct seeding system often requires some major changes in management. Consequently it may be best not to convert the whole farm to direct seeding in one year. Start small and then expand direct seeding to more acres, as it feels comfortable. Once the system is working and cash flow permits, the move can then be made to more sophisticated equipment.

Weed Control

The first step toward becoming weed-smart is to rotate herbicides. Reliance solely on groups 1 and 2 herbicides should be avoided. However rotating herbicides is simply a first aid measure against weed resistance. In the long-term, being weed-smart means shifting the cropping system towards an integrated pest management system.

Employ a variety of cultural and crop management techniques to control weeds. These may include the changing the timing of when individual fields are seeded; having a diverse rotation; making use of both post and pre-emergent chemicals for in-crop weed control in the rotation; growing spring seeded and fall seeded crops; or possibly including a short-term forage into the cropping plans. That does not mean abandoning chemical weed control, but rather relying on it less. **The key is to not rely on any one control method as the total solution.** Using an integrated approach to weed control helps keep weeds off balance - hitting them with different management techniques when they least expect it.

Fertility Principles

Soil nutrient deficiencies must be corrected to achieve maximum economic yields. Soil testing should be conducted to determine nutrient requirements. Producers should refer to provincial recommendations and information from fertilizer companies for details on correcting nutrient deficiencies.

There are many types of fertilizer and methods of application. Side banding, seed placing, and mid-row banding are all “one pass” systems that generally result in efficient nitrogen use. One of the disadvantages to these application methods is that all fertilizer requirements are handled at the

time of seeding. Another is the high power requirement needed to place the fertilizer at the lower depth with some openers.

a) Side Banding

Side banding refers to the placement of the fertilizer to the side and below the seed during the seeding operation. High rates of fertilizer can be side banded without damage to germination or emergence provided that adequate separation of seed and fertilizer is maintained. Seedbed quality can be affected by side banding therefore the system must be properly designed and correctly adjusted to minimize seedbed quality problems. Direct seeding openers are available that place both seed and fertilizer at the same depth and rely solely on lateral separation of seed and fertilizer to prevent fertilizer burn. The benefit of these openers is a lower horsepower requirement.

b) Seed Placed Fertilizer

Seed placing fertilizer is an efficient and convenient method of correcting nutrient deficiencies. However the total amount of seed placed fertilizer that can be applied is limited due to the potential for causing damage to the germinating seedlings. Refer to provincial guidelines for the safe rates of seed placed fertilizer.

The most important factor in tolerance to seed placed fertilizer is fertilizer rate. As fertilizer application rate rises, the concentration of fertilizer in the seed row increases, thus increasing the chance of germination and emergence damage. Damage from seed placed fertilizer is very dependent upon conditions in the seedbed. Precipitation shortly after seeding can flush fertilizer out of the area and reduce risk. Very dry conditions increase nutrient concentration in the soil solution and cause much greater damage. For this reason, farmers should be cautious because rates that are safe one year may be very damaging the next.

c) Mid-row Banded

Mid-row banding refers to the banded application of fertilizer between every second seed row. This system allows the application of high rates of fertilizer without risk of damage to the germinating seedlings. Seedbed quality is not affected by this method. However mid-row banding does disturb the soil between the rows and this can stimulate the germination of annual weeds. Where soil nutrient supply is very low, it may be desirable to place some fertilizer with the seed, particularly phosphate, and this typically requires a three tank system. The third tank can be an anhydrous tank or liquid wagon pulled behind existing equipment.

d) Fall Banding

When starting into a direct seeding system, it may be necessary to address nitrogen requirements through a separate operation due to equipment deficiencies. The main consideration is that too much seed-placed fertilizer can reduce crop germination and vigour. However, it should be recognized that a separate fertilizing operation can cause seedbed drying, greater difficulty for the seeding unit to move through loose stubble and can cause increased weed growth in the spring.

Sources

John Clair, Producer in the Radisson area, 2004, personal communication.

Stu Brandt, Agriculture and Agri-Food Canada, 2004, personal communication.

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