



Double or Single Shooting Seeding Systems: The Pros and Cons

The needs of direct seeding have caused a change in technology for placement of seed and fertilizer. The practice of single shooting has been around since commercial fertilizers have been used in agriculture. Single shooting is simply the placement of both seed and fertilizer in the same seed row. Over time, developments to air carts and openers have allowed double shoot capability. A double shoot system provides a separate delivery of seed and fertilizer from the air cart and the opener is designed to place each product into the soil in a separate band. This separation of seed and fertilizer by a layer of soil, usually by at least an inch, allows much higher amounts of fertilizer to be applied with safety at the time of seeding.

Single Shooting

Traditional seed drills and discers, as well as early direct seeding equipment, were designed as a single shoot system. Many modern drills still use single shoot systems and some drills can switch from single to double shoot. Single shoot systems are simpler than double shoot systems in that there is a single air delivery system from the air cart through to the seed opener. Knock-on types of openers offer producers more options with respect to opener styles and levels of soil disturbance. For example, a producer can switch from a knife, spoon or spreader tip style of opener to a sweep type opener for a different set of conditions such as when weed control is desired.

The risk of single shoot systems involves placing fertilizer too close to the seed. When nitrogen is placed with the seed, the seed can be damaged by ammonia toxicity and by the salt effect. Some crops, like oilseeds and pulses, are much more sensitive to seed placed fertilizer than cereals. While pulse crops require relatively low amounts of fertilizer, oilseeds



20 lb N/ac Single Shoot. Note the thin, chlorotic leaves with evidence of leaf disease.



100 lb N/ac Double Shoot. Note the wider, darker coloured, healthier leaves.

like canola have high demands for fertilizer, especially nitrogen. Most single shoot openers simply cannot safely place the level of fertilizer required for the crop with the seed. Additional fertilizer must then be applied by another method.

Although many single shoot openers such as knives and spreader tips can accurately place the seed, some such as spoons and sweeps, mix the seed and fertilizer throughout the seed trench. While this can increase the safety factor of fertilizer with the seed, the seed is not situated on the bottom of the seedbed on firm moist soil. As a result, there tends to be more issues in crop establishment when using these types of openers. When using sweeps, the technology challenge is to spread the seed and fertilizer across the entire seedbed while providing adequate packing. Although the spreading of the seed and fertilizer across the width of the sweep can be accomplished, packing the seedbed has not been very effective.

A recent study of four single shoot openers ranging from very low disturbance to complete seedbed disturbance, indicated that over time, sweeps produced the lowest yields when compared to a spoon, knife or angle disc (Table 1). In addition, weed densities also were consistently higher with the sweep (Table 2).

Single shoot openers are generally less expensive than double shoot openers and usually require less draft. However, the largest drawback of a single shoot system is the limited amount of nitrogen that can be placed with the seed when trying to maintain a narrow seed row. The amount of fertilizer that can be safely placed with the seed will depend on the width of the opener, row spacing (seed bed utilization) and soil

texture. For more information on amounts of nitrogen that can be safely seed placed, refer to Saskatchewan Agriculture and Food's fact sheet "Guidelines for safe rates of fertilizer applied with the seed."

When converting from a conventional to a direct seeding system, many producers who have traditionally used low levels of fertilizer will often opt for a single shoot system, as it is similar to the system used previously. However, if more than the safe rate of nitrogen is required, then double shooting is more appropriate or some other alternative option must be utilized. These alternatives include split application or using a slow release fertilizer. Another option is to use liquid fertilizer with the dribble banding nozzle attached to the shank with the fertilizer stream directed to the side of the seed row to create a type of low tech sidebanding.

Double Shoot

Double shoot systems deliver seed and fertilizer separately placing both products in separate bands in the soil. This allows for the biggest advantage of double shoot systems over single shooting - that being able to apply a very high level of nitrogen at the time of seeding without injuring the seed or seedling. In addition, all forms of fertilizer - granular, liquid and anhydrous ammonia fertilizer - are suited to a single pass double shoot system.

Double shoot systems also allow for higher fertilizer efficiencies than single shoot systems such as spreader tips or shovels. There is less nutrient loss and more uptake of the nutrients by the crop when the fertilizer is applied in a concentrated band as opposed to the fertilizer spread throughout the seedbed. As a result, double shoot systems tend to result in higher crop yields. There may be little or no difference in yields when low levels of fertilizer are used, such as 20 lb/ac of nitrogen. This is likely due to not enough nitrogen being supplied to the crop by either system. However, comparing yields above that level generally shows an advantage to double shooting.

Disadvantages to double shoot bolt-on openers include higher opener costs and higher draft and soil disturbance than most

Table 1: Opener/Rotation Study - 1998 to 2001 yield means (bu/ac), Aneroid, SK.

Crop	Opener Treatment			
	Angle Disc	Knife	Spoon	Sweep
Chickpeas	22.43	20.47	18.92	17.42
Peas	35.82	31.49	31.46	31.59
Barley	30.59	28.02	24.26	24.82
Durum	21.40	19.91	17.53	18.37

Table 2 : Opener/Rotation Study - 2000 - 2001 first weed count means (weeds/m²), Aneroid SK.

Crop	Opener Treatment			
	Angle Disc	Knife	Spoon	Sweep
Chickpeas	85.18	115.15	132.44	145.71
Peas	116.61	136.55	165.00	212.30
Barley	83.33	108.66	187.63	191.98
Durum	94.96	144.76	153.30	173.95

single shoot openers (except for sweeps). However, the yield advantage to double shoot openers more than compensates for these. Another consideration is that although there are a wide variety of double shoot openers available to producers, not all are effective in all soil conditions or soil types, particularly in heavy clays. Openers must be selected on the basis of their ability to perform in a given soil type.

Summary

Single shoot systems will be less expensive than double shoot, but are severely limited in the amount of nitrogen fertilizer that can be placed with the seed. If more fertilizer is needed, other options must be employed. These options may include a separate banding operation, split application, slow release fertilizers, or creating a low tech sidebanding system to the single shoot opener using liquid fertilizer. Double shooting allows high levels of fertilizer to be safely applied in a single pass seeding system. Although double shooting has higher initial capital costs and draft, it provides excellent safety to the seed and will generally provide higher yields.

For More Information

1-800-213-4287 or www.ssca.ca

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