

Western Region



Sustainable Agriculture
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Alternative Crops for Dryland Agriculture in the Intermountain Pacific Northwest

GROWER EXPERIENCES WITH SELECTING AND USING NO-TILL DRILLS IN EASTERN WASHINGTON, 1997-1999

by Norm Herdrich, Agricultural Writer

The information for this bulletin was gathered from a seminar on Selecting and Using No-Till Drills held in Washington State in March 1999. Speakers included Ed Deife, Tim Fiez, Ron Jirava, Jon Newkirk, Dennis Roe, and Roland Schirman.

When considering drills for no-till situations and alternate crops, the first consideration is the type of opener. The choices are between disc-type and hoe-type. Each has its advocates, and each has advantages and disadvantages.

The strong points for the disc-type openers are minimum soil disturbance and the ability to handle trashier planting environments. A minimum of soil disturbance can result in fewer weed problems in the crop.

For the hoe-type openers, one of the strong points is the wider band of black soil over the planting row that will warm more quickly and can improve seed germination and emergence. The additional amount of disturbed soil resulting from this black band can cause additional weed problems. Some farmers believe parts of eastern Washington located north of Highway 2 will likely benefit from the use of hoe-type openers. These areas are characterized by colder winters with more snow. The soil warms more slowly in the spring.

Most major equipment manufacturers offer both disc-type and hoe-type drills. Some have models that allow the operator to change the type of opener, although at considerable cost and effort.

DRILL ECONOMICS

Farmers can acquire a no-till drill through buying, leasing, or renting. A fourth option is custom-hire, where the producer hires an operator with a drill and power unit. This may not be an option if a drill is not available when the farmer needs to plant the crop.

To determine which of the first three options is best from a financial standpoint, project the after-tax cash flows for each alternative. Three Washington State University researchers, Gayle Willett, John Burns, and Roland Schirman, examined three alternatives.

While renting appears to offer a clear financial advantage, several risk factors might affect the producer's final decision. One is the availability of a rental drill. The rental agreement is seasonal in nature, and there are no guarantees the drill will be available each year at an optimal seeding date. Additional sources of risk are variations in salvage value under the purchase option, and access of annual drill use.

Financial comparisons are especially sensitive to changes in the rental rate and acres planted annually. Higher rental rates and more acreage work to the disadvantage of the rent option. In their study, researchers analyzed the impact of rental fees of both \$14 and \$15 per acre. They found the annual breakeven acreage at the \$14 and \$15 per acre rental rates is 818 and 877 acres, respectively. Purchase is the best option above these breakeven levels, and renting is best for smaller acreages. The complete study prepared by Willett, Burns, and Schirman is available as *Buy, Lease, or Rent that new Reduced Tillage Grain Drill?* (EB 1879) from WSU Cooperative Extension. You can download this bulletin at <http://farm.mngt.wsu.edu/PDFDocuments/EB1879.pdf>.

The research team cautions growers not to generalize their results. Instead, each producer should use assumptions that may be unique to his or her individual operation. If help is desired, consult an accountant, agricultural lender, or financial management professional. A computer program for analyzing farm machinery financing options is available from WSU. The DOS-based, compiled program and documentation can be ordered from the Bulletin Office, Washington State University, P.O. Box 645912, Pullman, WA 99164-5912. Request BUYORLEA Version 2.0. The cost is \$25. The program can also be ordered from the WSU farm management website at <http://farm.mngt.wsu.edu/>

Jon Newkirk, WSU Cooperative Extension agricultural economist, has found some significant differences in machinery costs for the same make and model of drill, making it worthwhile to shop around. He has found farmers will spend as much as 75% of the list price of a drill for maintenance over the life of the drill. On average, farmers using drills with hoe-type openers can expect 4,000 to 5,000 acres on a set of points.

Another consideration is the power requirement for a new drill. Newkirk notes a tractor rated at 325 hp may not have the power to pull drills like the bigger Concords, if planting on steeper ground. The hydraulic system of the tractor may not be enough to handle some of the newer, bigger drills.

Equipment utilization is a big factor when making purchasing or rental decisions. One way to improve use might be to share equipment, if excess capacity is available. When considering a no-till drill, the producer should look ahead to potential alternative crops and make sure that the drill purchased will handle future needs. Crops being evaluated for the dryland regions of eastern Washington include peas, beans, fababeans, lentils, soybeans, buckwheat, safflower, sunflower, and millet. Crops now grown on relatively large acreages include Canola, yellow mustard, and triticale. Other cereal grain crops, in addition to soft white wheat are hard red wheat, durum wheat, barley, oats, and rye. Various types of corn also are being considered, as are sweet lupine, flax, Linola or edible flax, and other more exotic alternatives.

SEEDING RATES

Dennis Roe, NRCS conservationist at Colfax. The producer needs to know the proper way to set the drills. For safflower, Roe says the appropriate seeding rate is 20 pounds per acre. At about 12,600 seeds per pound, and 20 pounds per acre, drills will plant 252,000 seeds per acre. The recommended seeding rate for yellow mustard is 10 pounds per acre. For Canola, it is 8 pounds per acre.

The most promising type of field peas for dryland areas are the afile, or semi-leafless type. These have strong, upright stems. The seeding rate is 180 pounds per acre. Having a count of 2,300 seeds per pound, and a target population of five plants per square foot, these peas require 373,365 seeds per acre at a 90% germination rate. The seed costs for peas are higher than for wheat.

Barley seed can vary as much as 25% in size. Roe recommends farmers think in terms of seeds per unit area such as an acre or square feet. The number of seeds can also vary as much as 25%. Planting a pound of the smaller seeds would produce a plant population potentially 25% greater than planting the larger seeds.

CALIBRATING DRILLS

The accompanying tables, courtesy of Jim Bauder, Extension Soil and Water Specialist at Montana State University, show common seeding rates for both cereal crops and some of the more common special and alternate crops.

After determining the appropriate seeding rate, the next step is to calibrate the drill. Bauder offers the following calibration method that involves preweighing the amount of seed needed for 100 feet of row. A clear plastic measuring cup or tube will be needed. Bauder says any narrow container will do—even an empty plastic pop container with the top cut off.

Calculate the weight of seed needed for 100 feet of row. Weigh the required amount of seed and pour it into the calibration tube. Mark the tube for future reference in the field.

In the field, hang a bag or collection container on one run of the drill and drive 100 feet. Pour the seed from the collection bag into the calibration tube to see if the drill is delivering the correct amount of seed. Adjust the drill setting and repeat the procedure if necessary. Catching the seed from more than one drill run will increase accuracy.

Bauder offers one other simple conversion: Collect the seed that would be planted in 100 feet of row by placing a bag over one of the openers. Weigh the seed. The seeding rate can be calculated by the formula:

$$\text{Seeding Rate} = \frac{(\text{grams of seed per 100 feet of row}) \times 12}{\text{row spacing}}$$

For example: if the grams of seed per 100 feet of row are 39 and the row spacing is 7 inches, the seeding rate is equal to $(39 \text{ grams} \times 12) \div 7 = 66.8$ lbs./acre.

In this example, the 1,000-kernel weight for seed is used. This is the weight of 1,000 seeds of the crop, and it varies from one variety to another and from one crop to another. Bauder points out that the 1,000-kernel rate of a single variety will vary from year to year and from field to field. Using the 1,000-kernel weight allows a producer to account for these variations when determining seeding rate and calibrating drills.

When using the 1,000-kernel weight, Bauder says seed quality is important. Plump, large seed produces the most vigorous plants, while poor

seed produces weak plants. Use seed from which foreign material and shrunken or misshapen kernels have been removed.

Germination and seedling mortality are considered in calculating seeding rates. Test the seed to determine germination. The 3% seedling mortality, referring to seeds that sprout but do not develop into plants, is one test commonly used.

As the table shows, seeding the same weight of seed every year will not produce the same plant population. Bauder says barley seed can vary by 25% in size and weight, which can dramatically affect the final plant population. Seeds with different shapes also flow at different rates in the drill. Because of this, producers should use the 1,000-kernel weight of their own seed when calculating seeding rates and calibrating grain drills.

Bauder suggests if the 1,000-kernel weight is not known, count out 1,000 seeds and weigh them. If the scale used weighs in ounces, convert ounces to grams. To do this, multiply by 28.3, since 1 ounce equals 28.3 grams. Multiplying the 1,000-kernel weight in ounces by 28.3 will show the weight of the 1,000-kernel sample in grams.

FERTILIZER PLACEMENT

In addition to placing seed in moist soil for good germination, most modern drills can place starter fertilizer either with or very close to the seed. Tim Fiez, former WSU Cooperative Extension water and soil fertility specialist, calls fertilizer placed with the seed “pop-up” fertilizer because it provides nutrients for early plant growth. This should be just enough fertilizer to get the seed started and up. The bulk of fertilizer for the crop should be separated from the seed by 1 to 3 inches. A deep band below the seed row is a common configuration. Other drills place fertilizer in a band below and to the side of the seed row, or put it between seed rows so two rows share the same fertilizer band.

Placement of the fertilizer can influence crop yield. In tests, fertilizer placed 2 inches below the wheat seed row produced a yield of 56 bushels per acre. Fertilizer placed 2 inches below and 8 inches to the side resulted in a yield of 43 bushels per acre. Fertilizer not placed deep enough will not be available for plant uptake as the soil dries out. The plant roots in quest of moisture bypass fertilizer in a shallow placement.

In the early years of shifting to direct seed, no-till conditions may slow plant growth because of cold, compact soil, root diseases, and low soil fertility, especially for the immobile elements such as phosphorus. Starter fertilizer can counteract these conditions.

Some farmers prefer to put phosphorus close to the seed and apply nitrogen in a separate band. This practice may reduce some of the beneficial effects of the N-P relationship.

The bulk of the fertilizer cannot be placed with the seed for reasons of crop safety. High levels of fertilizer placed with the seed can result in fertilizer burn; placing ammonia with the seed can cause ammonia burn.

Fertilizer salts decrease the osmotic potential of the soil-water solution. The salts compete with the plant for available moisture, and if moisture is limited, the result is detrimental to the crop. Also, free ammonia and nitrate are toxic to plants.

To avoid problems like these, apply small amounts N, K_2O , and S with the seed to act as “pop-up” fertilizer. Place the remainder of the crop fertilizer needs 2 inches or more away from the seed.

Row spacing is another concern in applying fertilizer. As row spacing widens, if the per acre fertilizer rate remains constant, more fertilizer will be applied in each band. To avoid damage to the crop, using openers that spread the fertilizer somewhat and mix it with the soil in the band may be a better choice. Fertilizer damage is more likely to occur in dry soils than in moist soils.

Peas, lentils, and dry beans are sensitive to the salt effects of fertilizer. Because of this, do not place fertilizer with these seeds. Instead, keep it at least 2 inches away from the seed row.

Mustard and Canola are less sensitive. Applications of N and K_2O can be placed with the seed. Use up to 10 pounds per acre of N with the seed in these crops. For winter rape, apply up to 25 pounds of N with the seed, and for Canola, the rate can be up to 20 pounds. Canola and mustards have a higher sulfur requirement. Starter fertilizer may improve the quality of these crops. Further tests are needed.

Flax and Linola—the edible flax—are sensitive to fertilizer salts with the seed. Apply up to 18 pounds of P_2O_5 with the seed, but no straight N. Put the N $1\frac{1}{2}$ inches to the side of the seed row.

For sunflowers, which are sensitive, place fertilizer 1 inch away. Safflower can tolerate some fertilizer with the seed. A rate of 15 to 20 pounds is the maximum.

For corn, place the N and P 2 inches below and 2 inches to the side of the seed row.

Millet is sensitive. The maximum amount of fertilizer to apply with the seed is 10 pounds per acre of N and K₂O. Fiez says it is best to use straight P sources with the seed.

Cereals are the most tolerant to starter fertilizer of the crops grown in eastern Washington. However, if the deep band of fertilizer is within 3 inches of the seed row, starter fertilizer probably will be of little benefit.

If the main fertilizer band is more than 3 inches from the seed, starter fertilizer may help the crop. When the main fertilizer is banded in a separate operation from the seeding, starter fertilizer will more likely be beneficial.

Applying starter fertilizer can result in a more vigorous, more competitive crop in the spring, especially when using no-till. If you use conventional tillage, even under ideal conditions, a response to starter fertilizer is less likely.

Two choices that have increased safety for starter fertilizer are 11-55-0 or 10-34-0. Use these at a rate that applies no more than 5 pounds of N per acre.

GROWER EXPERIENCES

Ron Jirava, a wheat producer west of Ritzville, has three seasons of experience with no-till seeding. He suggests farmers who want to try no-till seeding start with the equipment they now have. "Start with what you have and see if you can make that work. If you do, you have the advantage of being familiar with the equipment and do not have to start from scratch." Sometimes expensive, new equipment is not needed. It depends on the soil type of the farm.

Jirava, who has a Flexi-Coil air seeder, says to consider selecting a drill that can handle all sizes of seeds you plant now and those you might consider planting in the future. Some drills will work with very

small seeds to very large ones, such as peas. Round corn will seed through a number of grain drills. The drill chosen also should be designed for fertilizer application at seeding time.

Many alternate crops have seeds about the same size as those for wheat or barley. Others, like mustard and Canola, are quite small. Seeding rate and depth are critical for small-seeded crops.

In his no-till acres, Jirava is still having problems with depth control for some crops. Drills with double-disc openers can have trouble handling residue on narrower row spacing, often throwing the residue over the seed rows.

Depth bands on some drills can help control depth, depending on the type of soil. Farmers should set all the springs at the same tension on the openers. Individual adjustments can compensate for tractor or seed-cart wheel marks. Consider the drill setting charts as starting points. "Don't rely on manufacturers' recommendations," Jirava stresses.

A metered roller is more accurate than a fluted cup for a seed metering device. Growers must make sure that the cup or opening is the same for each opener. If a farmer has summer fallow that was held over until spring because of limited fall moisture, pack it before seeding. Otherwise, there will be loose soil both below and above the seed.

If you are using an air seeder, air pressure is not hard to set. The manufacturers provide fairly accurate guidelines. Jirava adds that he has had some problems with peas.

As for individual crops, Jirava says in his experience, Canola requires a 5:1 S to N ratio when fertilizing. Yellow mustard has about the same N requirement as spring wheat, but a higher S requirement. The N requirement for safflower is not as high as that for small grains.

Ed Deife is the service manager for Walter Equipment Company, where he has had extensive experience with no-till drills. Most of them do a similar job.

His advice to farmers is to do only no-till if they are using a no-till drill. Nothing a farmer can do in the way of tillage will make a no-till drill work any better. The exception to this is if the previous crop was deep-furrowed. Then some tillage to smooth the ground will be beneficial, especially for small-seeded crops.

According to Deife, the first year of transition to no-till "can be a real bear" because of factors such as this. It is easier to seed when the stubble

is standing up. Although he has not had the experience personally, he says growers should not have any problem seeding into the crop residue left after harvesting with a stripper header.

Like Jirava, Deife says farmers have to make sure starter fertilizer applied in the seed row, as well as fillers, has the same density as the seed. When seeding grass and other crops with light-density seed, farmers using air drills must make sure the lid seals are tight since the tanks are pressurized.

Deife advises farmers who are planting Canola to use a variety or filler that is easily seen when setting the depth of their drills. When using paired-row openers, farmers generally find they seed a little deeper than they first thought.

For drills with disc openers, farmers should make sure the slot made by the opener is wide enough to allow large-seeded crops like peas to drop to the bottom.

Take out blockage monitors on drills when seeding big-seeded crops because the seed will not go past the sensor pin. Deife advises not completely filling the seed tanks when seeding grass seed or other crops with light, fluffy seed because the seed may bridge in the tank.

According to Deife, the settings for dry fertilizers are similar to those for seed. He has not had any big moisture problems when working with dry fertilizer.

In Deife's experience, the drill a farmer is using at the start of a conversion to no-till will be different than the drill he uses later. He says it seems the change will be from a high-disturbance type to a low-disturbance type over 4 to 5 years. Also, he points out, rotations are changing. This is another variable to consider when choosing a drill.

The Adams County Conservation District has no-till drills available to farmers in the district. According to Gary DeVore, the district has experience with both the Flexi-Coil and John Deere 750 drills. The Flexi-Coil is a hoe-type air seeder, and the John Deere's, of which they have two, use disc-type openers.

After 2 years, DeVore needed about \$5,000 in maintenance to renovate the 750 drills. Maintenance is actually needed after about 6,000 acres. The main problems they encountered were worn coulters and bearings. DeVore also notes that the marker wheels are being worn out quickly. When turning, DeVore advises pulling the drills out of the ground. It is easier on the equipment.

As for speed, he says not to run the 750 above 5.5 mph. A speed of 4.5 to 5 mph is good, he notes. As for seeding rate, the Adams County Conservation District has found the 750 drills seed 10% to 15% light at the recommended seeding rate. It is necessary to compensate for this.

DeVore, Jirava, and Deife all pointed out that poor straw spreading could create problems. No-till is actually a state of mind that starts with the previous harvest.

Table 1. Common Cereal Seeding Rates for crops being considered for no-till production in the Inland Pacific Northwest.

	<u>Desired plant population</u>		<u>1,000-kernel weight</u>	<u>Seeds per lb.</u>
	— per sq. m	— per sq. ft.	(grams)	(avg)
Wheat—hard red	250	24	30–40	11,000–15,000
Wheat—soft white	210	23	30–40	14,250
Barley	210–250	20–24	30–45	10,000–15,000
Oats	250	24	30–45	10,000–15,000
Rye	250	24	30–35	13,000–15,000
Triticale	310	30	34–35	10,000–13,000
Corn—sweet	5.0	0.5	380	1,200
Corn—grain	6.1	0.6	380	1,200
Corn—silage	7.6	0.7	380	1,200
Pea	75	7	125–300	1,500–3,600
Bean	25	2.4	200–350	1,300–2,300
Fababean	45	4.3	350–425	1,000–1,300
Lentil	105–147	10–14	30–80	5,600–15,000
Soybean	50	5	100–200	2,300–4,500
Buckwheat	150	14	30	15,100
Safflower	50	4.8	35	12,600
Sunflower				
Confection	4.5	0.4	175	2,600
Oil	6.0	0.6	126	3,600

Table Courtesy Jim Bauder, Montana State University Extension soil and water specialist

Table 2. Seed needed at different seed weights to achieve a desired plant population of 15 plants per square foot.

Plants/ft ²	15	15	15	15
Germination	95%	95%	95%	95%
Seedling mortality	3%	3%	3%	3%
Row spacing	7"	7"	11"	11"
1000-kernel weight (grams)	30	40	30	40
Grams of seed per 100 feet of row	27	37	43	58
Seeding rate, lb/acre	47	63	47	63

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College of Agriculture and Home Economics

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