Using Manually-Operated Seeders for Precision Cover Crop Plantings on the Small Farm

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Growing good cover crops begins with planting the seed uniformly and at the right rate and depth to ensure a good stand. This can be especially challenging for small-scale farms that do not have access to tractor-drawn grain drills, which can cost $6,000-8,000 for a 4 to 6 ft wide drill. Manual broadcast seeding is difficult to do uniformly, and can result in thin spotty stands, lower biomass and nitrogen fixation, and poor weed control as well as inefficient use of seed. Raking the seed in by hand is slow, strenuous work for areas larger than a few hundred square feet. Leaving broadcast seeds on the surface invites a crop failure unless several days of mild wet weather follow seeding, and no hungry birds come to eat up the fresh seed.

Spin seeders can broadcast the seed more uniformly, and shallow rototilling can incorporate seed to the right depth. However, growers may need a different tool for precision cover crop seeding of smaller areas such as:

- Individual beds or small blocks that come out of production at a different time from adjacent areas.
- Narrow strips or perimeters planted through or around production fields for beneficial insect habitat.
- Intercrop plantings between established rows of cash crops.
- "Zone planting" in which a legume cover crop is sown in the "grow zone" (e.g. top of raised bed) and the grass component in alleys and sides of beds.
- Test plots to evaluate cover crops.

Manually operated vegetable seeders can sow cover crops uniformly and precisely in small areas. The Earthway Precision Garden Seeder,* an inexpensive (<$100) implement widely used by market gardeners, has given consistent and excellent cover crop stands in four years of field trials. The planter has various plates for different seed sizes, an adjustable planting shoe (0.25 – 2.0 inch depth) and a row marker to assist with uniform row spacing. Although the planter was designed for vegetable crops, we have been able to find a suitable seed plate for most kinds of cover crop seeds.

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Whereas planting cover crops with the push seeder is somewhat labor intensive, it is clearly more time efficient than manually broadcasting and raking. We have seeded 1/8 acre of sorghum-sudangrass in 6-inch rows in less than two hours, and a complex, replicated field trial of six different cover crops covering 1/4 acre in six hours. The stands we have obtained with the push seeder have rivaled those obtained with a Tye* no-till grain drill (Figure 1).

Seed Plates and Seeding Rates for Different Cover Crops

Table 1 shows plate numbers and seeding depths that have given best results thus far, and observed seed delivery rates for different row spacings. Although a 6-inch row spacing often results in higher rates than recommended by cover crop manuals and seed catalogues, we have found that this close spacing promotes early canopy closure and weed suppression, and may enhance cover crop biomass at maturity. Wider spacings of 8 or 12 inches can work for vigorous cover crops in fertile soils with relatively light weed pressure. Seeding rates must be balanced

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against the cost of seed. However, spotty, weedy stands resulting from skimping on seed can be more costly in the long run than using more seed. Grass + legume bicultures can be planted by sowing the two crops separately in alternating rows, or if their seeds are of similar size, they can be mixed in the desired ratio and planted together.

Seeding rate can be increased by leaning the seeder slightly to the right during planting, and keeping the hopper well loaded. Seeding rate can be reduced somewhat by leaning slightly left and keeping the hopper less than half full, or by mixing seed with an inert diluent. Dilute larger seeds like rye, vetch or sunnhemp with white rice, split peas or heat-killed lentils. Fine seed like clover, millet or radish can be diluted with soybean or corn meal. Dilution is recommended for several cover crops listed in the table.

The following cover crops give good stands when planted with the *#22 plate* (beet-chard-okra): oats, rye, barley, wheat, black oats, vetches, cowpeas, soybeans, and buckwheat. Mixtures of small grains + vetch or cowpea + buckwheat do very well with this plate. Field peas, Austrian winter peas and bell beans give the best stands when planted with the *#14 plate* (peas). They also flow well through the #22 plate, which might be sufficient for planting in optimum conditions on a 6 inch row spacing. We use the *#2* and *#4 plates* (corn) for the large seeded lablab bean, and find the higher seeding rates necessary to obtain adequate canopy closure and weed suppression. Crimson clover, radishes and most millets (especially proso and browntop millets) give good stands with the *#5 plate* (radish).

Planting undiluted foxtail millet seed with the #5 plate can result in overcrowded rows and increased rust disease in the crop. Initial tests indicate that diluting one part seed with one or two parts corn meal can give a sufficient stand with less crowding, though the cornmeal does not always flow well through the planter. The #10 plate (lettuce-carrot) cuts rates approximately in half, giving good stands where weed pressure is low. The #24 plate (brassicas) has many small holes that distribute seeds uniformly along the row at rates intermediate between the #5 and #10 plates, yielding uniform stands and early canopy closure. Where soil fertility is good and weed pressure not too high, the #10 or #24 plates are also suitable for pearl millet, which is a very large plant and can give excellent stands from the low seeding rates delivered by these plates.

Sunnhemp should be diluted at one part seed to one or two parts white rice or split peas to make the best use of this relatively expensive seed. Sorghum-sudangrass hybrid can be planted with the #5 plate, which drops seeds singly, about an inch apart. In optimum growing conditions, this results in a good stand of large, stout plants, but in less-fertile soils, stands can be thin, open and weedy. In these conditions we recommend using the #22 plate to sow sorghum-sudan seed diluted 1:1, or even undiluted seed if weed pressure is intense.

Troubleshooting

Sometimes, seeds can jam the planter or get wedged behind the rotating seed plate so that it cannot turn smoothly, and does not deliver the seeds properly. Round seeds, dirt and dust, or legume inoculant can aggravate the problem. Clean plates and hoppers frequently with a damp rag. If sticking or jamming occurs, wash plate and hopper with soapy water, and let them air-dry, or lubricate contact surfaces with a *small* amount of vegetable oil. We have also learned that application of a *dry spray graphite lubricant* (the kind designed to keep locks and keys working smoothly) to seed plates and the inside of the hopper can greatly reduce jamming in most cases. (We thank market gardener and VABF member Amy Johnson for this valuable tip.)

If vetch or pea seeds become really cantankerous, they may be dusty – if so, rinse the seeds in a couple of changes of water, drain and air dry. Mixtures of vetch with oats or other cereal grains seem much less likely to jam the planter than vetch alone.

Very small seed like millet or clover can also get behind the plate and either increase or reduce the flow of seed into the planting shoe. If plates and hopper are kept clean and lubricated, the planter will sow fine seed adequately even if a few do get behind the plate. Lean the planter to the right or left to adjust flow.

In 2006 trials, pearl millet seeds sometimes jammed behind the seed plate so badly that seed delivery suddenly stopped mid-row. This problem was minimized by cleaning plate and hopper thoroughly with soapy water, applying graphic lubricant immediately before planting, and maintaining a low level of seed in the hopper (one to four tablespoons). A few seeds *still* got behind the plate, but seed

delivery rates remained close to those shown in the table, and thick, uniform stands were obtained with seeding rates as low as 8-16 lb/ac (#10 plate, rows 6-12 in apart).

If legume seeds are moistened with sugar-water solution as an adherent for the *Rhizobium* inoculant, let seeds air-dry *thoroughly* before planting. Occasionally, inoculant powder, dust or dried sugar solution can get into the hub and make the plate stop turning altogether. Disassemble the hub, clean all parts with soapy water, dry, and reassemble.

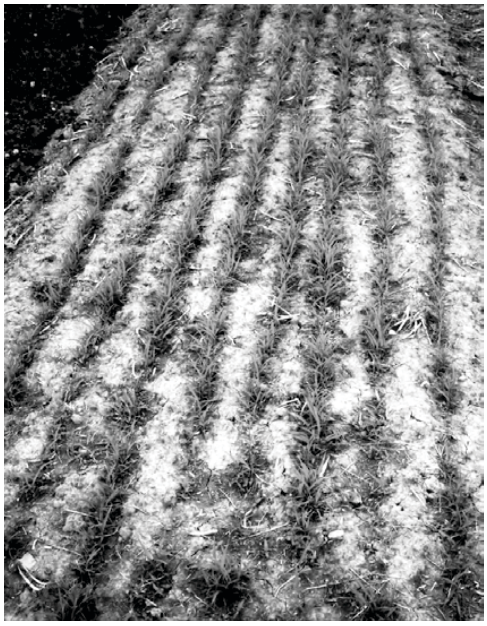
One minor problem with mixed or diluted seed is that one kind of seed may be delivered faster than the other, so that you end up with mostly one kind of seed or diluent in the hopper. Adding small amounts of properly mixed seed to the hopper at frequent intervals will maintain roughly the desired ratio throughout planting. If the problem persists, try a different diluent, or plant grain and legume separately in alternate rows.

Scaling-up to Small Fields: the Spin Seeder

As the area to be seeded at one time approaches a half acre or more, sowing cover crops with the push seeder becomes less practical. Whereas few small vegetable farms operating in the 1-10 acre range own a grain drill, many own and operate a rototiller as one of their main implements. Add an inexpensive hand-cranked spin seeder and the skill to use it well, and the grower can obtain excellent cover crop stands by broadcasting and incorporating the seed. VABF member Charlie Maloney, who grows over ten acres of organic vegetables in King and Queen County, plants most of his cover crops with an Earthway Ev-n-spreader* spin seeder. This simple device, available for just $30-40, consists of a seed bag with a hand-cranked spinner device, and a single lever to adjust the flow-rate of seed from bag to spinner. The operator wears the seeder somewhat like a bagpipe, and spins out seed, while walking at a steady pace across the field. Seeding rates are regulated by the lever adjustment, and by the walking and cranking speeds. Charlie notes that it takes practice to gain the skill to operate the spin seeder precisely. He has found that making successive passes 10-15 feet apart gives the most uniform coverage. A clean seedbed makes it easy to see the swath covered by each pass, and thus facilitates even seeding.

Immediately after broadcasting, Charlie incorporates the seed with a tractor-mounted rototiller, with a skid attachment adjusted so that the tines work at a shallow depth of about one inch. He has consistently obtained excellent stands of winter rye + hairy vetch seeded at just 50 lb rye + 25 lb vetch per acre.

Spin-seeding an acre takes about one hour for a single cover crop, or two hours for rye + vetch, which Charlie normally sows separately. Incorporating with a 72-inch tractor mounted rototiller takes another hour. He reckons that this system is most practical for areas measuring at least 50 ft by 100 ft (~0.1 acre). In smaller areas, tractor turnaround becomes awkward, and in very narrow strips (under 7 ft wide), spin-seeding becomes impractical. However, in the



0.1-5 acre range, the spin seeder and rototiller become much more economical than the push seeder, not only in terms of labor but also cover crop seed (see seeding rates for the push seeder in Table 1).

Tips on Beating the Weeds

Nothing is more disheartening than investing money and time in a large cover crop planting, only to have it come up as mostly crabgrass, pigweed, purslane or chickweed, especially when weed control is one of the farm's major cover cropping objectives. Once they are established, most cover crops are highly competitive against the weeds, but *any* newly-planted crop will suffer if the weeds get the jump on it. In practice, cover crops are often planted in soil with substantial weed seed banks, and it would be nice not to have to till the soil to death in order to get a weed free cover crop. Here are a couple of tips for getting the cover crop ahead of the weeds.

- Prepare the seedbed *immediately* (within a few hours) before sowing the cover crop. Waiting as little as two to five days between tilling the soil and planting a cover crop with a drill or a push seeder allows weed seeds to germinate first, and can result in a weedy stand.
- Another strategy is to spin-seed, then till in an inch deep. This shallow tillage knocks out any germinating weeds present, without further disrupting soil structure or soil life deeper down.
- Where the seed bank is heavy, prepare a stale seedbed. Till the area to incorporate residues of the preceding crop, and wait a couple of weeks. Then till again shallowly to take out emerging weeds just *before* push-seeding or drilling, or just *after* spin-seeding or manual broadcasting.
- Where weed pressure is high, increase seeding rates and (for push seeder) set rows close together – 4-6 inches.
- If soil fertility is limiting, work aged or composted manure into the top few inches. If conditions are dry, irrigate once thoroughly right after seeding. These investments will pay off in a vigorous cover crop that can outcompete most weeds.

Sources for push seeders and spin seeders

Local farm supply stores and Southern States often carry or can order these implements.

Johnny's Selected Seeds, 955 Benton Avenue, Winslow, 207-861-3963, www.johnyseeds.com.

Martin's Produce Supply, 717-532-5918 (no web site) is a Mennonite-operated mail order house in Pennsylvania, carries Earthway seeders and some other production supplies at really good prices, and offers excellent customer service.

This information sheet was written by Mark Schonbeck of Virginia Association for Biological Farming (www.vabf.org) and Ron Morse, Professor of Horticulture at Virginia Tech, as part of a research and outreach effort funded by the USDA Sustainable Agriculture Research and Education (SARE) and Cooperative State Research, Education and Extension Service (CSREES) programs, and by the Organic Farming Research Foundation of Santa Cruz, CA. For more information contact Ron Morse (540-231-6724; morser@vt.edu) or Mark Schonbeck (540-745-4130, mark@abundantdawn.org).

Resources

Contact Information:

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Table 1. Recommended seed plates and resulting seeding rates for cover crops planted with EarthwayTM manually pushed garden seeder operated at different row spacings. Based on several field trials in 2004-05.

Cover crop	Recommended:a rate, lb/ac	depth, inches	Seed plate #	Observed rates (lb/ac) at three row spacings: 12 in	8 in	6 in	Comments
Vetches	20-80	1/2-11/2	22	60-70	90-105	120-140	Heavy rates; dilute or mix w/ small grain.
Crimson clover	15-30	1/4-1/2	5				Good stands, rates not measured.
Field peas &	70-120	1-2	22	40-60	60-90	80-120	Suggest #22 for solid seeding 6 in rows,
Aus. winter peas			14	75-110	110-160	150-220	#14 for intercropping with grain.
Bell beans	80-150	1-2	22	50-65	75-100	100-130	Suggest #22 for solid seeding 6 in rows,
		14	100-125	150-190		200-250	#14 for intercropping with grain.
Soybeans	60-120	1-2	22	48-70	70-110	95-140	Good stands.
Cowpeas	50-100	3/4-1	22	50-75	75-110	100-150	Good stands.
Sunnhemp	30-50	3/4	22	70-85	105-130	140-170	Too thick; dilute 1:1 or 1:2.
Lablab bean	10-50	11/2	2 or 4	35-60	50-90	70-120	High rates recommended for early canopy closure, especially in Appalachian region.
Rye, wheat	60-150	3/4-11/2	22	50-75	75-110	100-150	Rates estimated, based on barley.
Barley	50-125	3/4-11/2	22	50-55	75-85	100-110	Good stands.
Spring oats	80-140	3/4-11/2	22	35-45	52-68	70-90	Suggest #14 plate for “smother” crop.
Black oats	15-50	1/2-3/4	22	27-37	40-55	55-75	May need diluent for 6 inch row spacing.
Radish	10-20	1/2	5	10-12	15-18	20-25	Good stands.
Buckwheat	60-80	1/2-1	22				Good stands, rates not measured.
Millet, foxtail	20-35	1/4-1/2	5	20-26	30-39	40-52	Too crowded within row; dilute 1:1.
		10		8-10	12-15	15-20	Sufficient where weed pressure is low.
		24		10-15	15-22	20-30	Good, uniform stands.
Millet, Japanese	20-30	1/2	5	7-13	10-20	14-26	Good stands.
Millet, pearl	10-30	1/4-1/2	5	16-25	24-38	32-50	Good stands, sometimes a bit crowded.
			10	8-10	12-15	15-20	Good stands unless weed pressure high.
			24	6-8	9-12	12-15	Good stands unless weed pressure high.
Millet, proso	20-30	1/4-1/2	5	14-19	21-28	28-38	Good stands.
Millet, browntop	20-30	1/4-1/2	5				Good stands
Sorghum-sudan	25-50	1/2-1	5	12-18	18-27	24-36	Somewhat thin, good for fertile soils.
			22	75-80	112-120	150-160	Dilute 1:1 unless weed pressure is intense.

* a Ranges recommended in cover crop manuals and seed catalogues. Use minimum depths in cool moist soil, maximum in warm, drier conditions. Use maximum seeding rates where weed pressure is heavy or soil fertility may be limiting.