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ALBERTA FARM MACHINERY RESEARCH CENTRE
PAMI
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Air Seeding Forage Crops

In 1995 and 1996, PAMI conducted tests with the Bourgault 3165, Morris 6130 and the Flexi-coil 1720 to evaluate their performance when seeding grasses and to determine what, if any, modifications could be made to improve their performance.

On the Prairies, air seeders have become the machine of choice for most crops because of their size and easy handling of seed and fertilizer. However, they are not widely used for forage seeding because of the difficulties often encountered with lightweight grass seed.

Forage seeding problems can include:

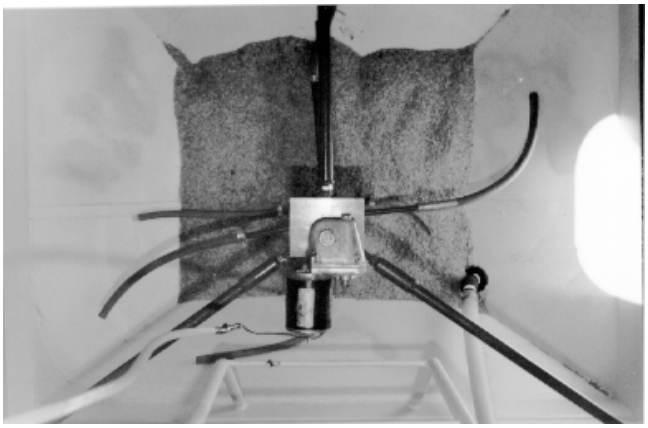
- Bridging in the seed tank.
- Light grass seed may not flow through the metering system
- There may be a high variation in seed flow rates to individual openers,
- The pneumatic system can easily blow the light weight seed out of the ground if the air flow rate is not adjusted properly.
- Variations in seeding depth can affect seed emergence

There is a general lack of information for farmers about seeding grass seed on large acreages using air seeders. There are no clear-cut design guidelines, although three companies in particular—Bourgault, Morris and Flexi-coil—are working to improve the performance of their popular air seeders for use in seeding grasses.

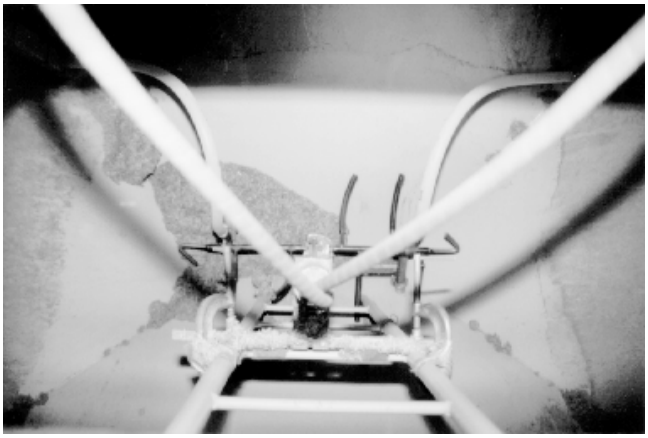
Since it is a common practice is to mix the seed with fertilizer or a material such as vermiculite, to improve the flow of seed through the seeder system, tests were conducted using both a meadow brome-fertilizer mixture and meadow brome seed alone.

Meadow brome was chosen primarily because it is prone to bridging.

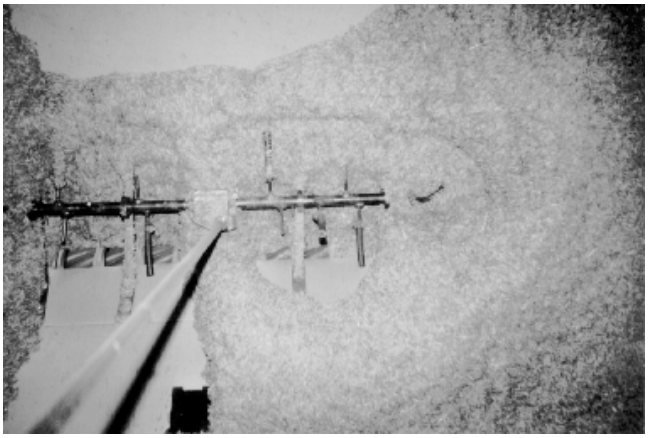
Detailed results of the testing are available by referring to the report RH0793, *Developing Improved Methods of Air Seeding Forages*.



Bourgault 3165 Agitator



Morris 6130 Agitator



Flexi-coil 1720 Agitator

Factors affecting grass seed placement

Many unique problems can arise when seeding grasses. The following discussion provides suggestions to help make the job easier, and more successful.

Seed flow and distribution

Agitation

In order to seed grasses without having to mix the seed with fertilizer or another flowable material, improved seed

tank agitation is necessary on most seeders to prevent seed bridging and improve seed distribution through the system.

Tank shape and meter openings

Different tank shapes and meter configurations will require different agitator designs.

If the tank is square, open, and has a large meter opening, a simple agitator may provide reasonable agitation and allow seeding pure grass seed without problems.

Long, narrow tanks and those with small meter openings or internal baffles may be more difficult to equip with effective agitators. Unless proper agitation can be achieved, these types of designs should be used only when seeding forage seed mixed with fertilizer, vermiculite, or some other material which improves the seed flow. Significant modifications to the metering systems will likely be required to allow them to handle pure grass seed.

Air flow speed

Generally speaking, higher airflows provide more uniformity in seed distribution. However, higher airflows may cause seed blowout at the soil opener.

All manufacturers provide minimum fan speed settings for their air seeders. The lowest possible recommended settings should be used to ensure good seed placement and uniform distribution of the seed through the air delivery system, while at the same time preventing plugging of the lines.

Airflows should be kept lower when seeding pure seed than when seeding a seed-fertilizer mix.

Knife or Spoon?

In trials conducted by PAMI, knife openers provided better emergence than spoon openers. This may have been the result of better seed placement into a narrow row where the packing and moisture use were more effective.

Seed brakes

Based on PAMI field trials, using seed brakes with a vent screen is not recommended for seeding grass seeds, as the screens on certain types of seed brakes will tend to plug.

When not using seed brakes, airflows should generally be set to the lowest flow rate which properly delivers the seed without allowing the system to plug.

A level machine is key

Grass seed must be seeded shallow—about 3/4" (19mm). Even slight changes in seed depth can result in a dramatic variation in emergence across the width of the machine.

Careful setting and adjustment of the cultivator is a critical step in obtaining optimum emergence.

Setting depth is time consuming, as the cultivator must be leveled from side to side and fore-and-aft. Take care when taking depth measurements to ensure the measurements are not taken in wheel tracks. Finding the seed at the set seeding rate to allow measurement of the seeding depth is very time consuming but very necessary.

Seed depth should be regularly monitored across the width of the machine during seeding. Seeding units that control the seed depth with gauge wheels at each opener are likely to have better depth control.

Even with the most diligent attention, some depth variations will occur because of variations in soil hardness and small undulations in terrain.

Use clean seed

Under the best of conditions, some plugging can occur in the seed delivery system when seeding pure grass seed. However, this problem is greatly aggravated if the seed lot contains stems or other foreign matter. Stems and straw can bridge over the outlet ports of the manifolds, and may block several seed rows at one time.

Check all openers regularly to ensure there is seed flow.

A word about coefficients of variation (CV)

For purposes of this report, a coefficient of variation is a technical term used to describe the variability in the metering and distribution of the grass seed from the seed tank through the system to the openers and into the soil. The variation is expressed as a percentage difference across the width of a seeder.

For example, a variation of 50 per cent in the amount of seed placed in the seed rows is quite large — indicating that some openers are receiving considerably more seed than others.

A standard maximum variation generally considered acceptable for seeding cereal grains and oil seeds and fertilizer application is 15%. However, higher variations for grass seed may be acceptable.

Forage grasses are very different from cereals in terms of seed size, seeding rate per unit of area, germination rate and crop development characteristics after germination. In view of the large numbers of seeds placed and characteristically low germination and establishment rate of grasses, a wider range of variation in seeding rate may be acceptable.

The Results

PAMI tested the Bourgault 3165, Morris 6130 and the Flexi-coil 1720 for their accuracy and uniformity in metering and distribution of seed through the system to the openers.

All models were able to handle the grass seed/fertilizer mixtures, the Bourgault without modification, the Flexi-coil with minor agitator revision, and the Morris after

addition of a horizontal agitator.

However, there were considerable differences in the abilities of each machine to handle pure grass seed with the agitators that were developed and tested in this project.

The Bourgault 3165

The Bourgault is equipped with two different augers for metering seed from the seed tank to the delivery system — one double flighted and the other triple flighted. The double flighting auger was used for the tests because it's larger openings are less subject to bridging.

The Bourgault air seeder was able to meter and uniformly distribute both the pure meadow brome seed (with a vertical agitator developed at PAMI), and the seed-fertilizer mix.

The seed/fertilizer mix was metered accurately without extra agitation. The variation averaged about five per cent.

The variation for pure grass seed with the agitator was about nine per cent.

Distribution uniformity tests with pure seed were conducted at various airflows. The uniformity was better at 11.8 m/s (38.7 f/s) than at 6.8 m/s (22.3 f/s). However, the distribution accuracy was still very good at the lower airflow.

The shape of the Bourgault seed tank allowed easy installation of a vertical agitator.

The agitator had seven horizontal arms with rubber hose at the ends and two vertical arms that extended into the transition area of the seed metering auger. The rubber extensions on the horizontal arms helped clean seed from the corners of the tank.

While metering pure seed, some bridging occurred when the lower agitator fingers were too far away from the auger. Lengthening the fingers so that they extended into the square opening of the meter where they nearly touched the auger prevented bridging.

The lowest airflow rate that provided adequate seed distribution while avoiding plugging was 6.8 m/s (from a fan setting of 1260 rpm). However, the manufacturer's recommended minimum fan speeds are higher than this, depending on machine width, and the manufacturer's recommended settings should generally be used to ensure proper distribution.

The Morris 6130

The Morris 6130 air seeder uses six fluted-wheel metering cups located across the bottom of a rectangular tank. As such, the vertical agitator developed for the Bourgault did not keep the longer, narrower seed meter opening clean, so a horizontal agitator was developed.

The prototype agitator consisted of rubber hose arms rotating about a horizontal axis at seven rpm driven by a hydraulic motor. Pairs of arms mounted at 180 degrees to each other provided agitation for each metering cup. An arm was mounted at an angle at each end of the shaft to aid in cleaning out the sides of the tank.

Overall, the agitator was not very effective and required further improvement.

The Morris air seeder could not adequately meter the meadow brome-fertilizer mix without agitation. Bridging occurred over the metering cups, and seed flow from the meters was irregular. With the agitator, variations of 12 per cent were obtained.

Variations for metering pure seed with agitation were also about 12 per cent, or higher.

The initial distribution uniformity tests were conducted using the custom-built agitator and pure meadow brome seed at air flow rates of 10 and 14 m/s (32.8 and 45.9 f/s). Distribution variations were about 30%. Variations of this magnitude mean that some openers will be receiving twice the average seeding rate while others may be receiving only half the intended amount. This level of variation is quite large, but no data is available to suggest that this amount would not be acceptable for grass seeding.

The agitator was redesigned to incorporate two rubber hose fingers extending above each metering cup. The rotation of the agitator was increased to about 15 rpm. The fan speeds used were varied from 3000 to 4500 rpm, which is within the recommended range of settings.

The distribution uniformity did not improve with the improvements to the agitator or with increased airflow.

The Flexi-coil 1720

The Flexi-coil air seeder has six fluted-wheel metering cups located at the base of the tank. There are oscillating roll pin fingers located above each metering cup. This agitator (designed to work primarily with cereals) is very small and only oscillates through a short stroke and would not prevent meadow brome seed from bridging.

Initial tests with the seed-fertilizer mix were conducted using only the existing Flexi-coil agitator. At first, variations were high because the mix was not flowing well into one of the outer seed meters. When extra fingers were added near the ends of the shaft of the stock agitator, variations improved to 6.2% or less.

This agitator was further modified to allow it to rotate 360 degrees by replacing the original cam and fork drive with a chain drive and replacing the roll pin fingers with new, shorter fingers. This new agitator improved seed metering, but further modifications would be required to obtain good performance.

To prevent bridging of the brome above the primary agitator, a second, more forceful agitator was added. This secondary agitator consisted of a hydraulic powered horizontal shaft with a rubber hose arm directed to each seed cup. It was rotated at 7 rpm. However, variations in metering accuracy were still as high as 35 per cent and

some bridging still occurred between the Flexi-coil agitator and the metering cups.

The Flexi-coil air seeder was on loan from the manufacturer, and time constraints prevented further work.

Based on research conducted to date, mixing meadow brome with fertilizer or another material to improve seed flow is the only practical method to accurately meter meadow brome seed with the Flexi-coil air seeder until a more suitable agitator is developed.

Detailed distribution tests were not conducted with this machine when using pure meadow brome seed.

A longer, more detailed engineering report RH0793, *Developing Improved Methods of Air Seeding Forages,* is available A small charge may apply.

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