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AIR SEEDERS FOR SMALL GRAIN SEEDING--Seedbed Preparation Needs, Plant Stands, Yields, Design and Operation Needs

Abstract: An air-seeder was compared with a Melroe No-Till drill and a conventional double disc press drill in seeding spring wheat and barley in grain stubble prepared for planting by three methods: spring plowing, spring cultivation and no-tillage in 1978. Comparative yields showed the air-seeder to be equal to or better than other seeders and that "no-till" was equal to spring plowing or field cultivation.

In the fall of 1978 winter wheat and winter rye were seeded in wheat stubble with an air-seeder. Winter wheat planted on adjacent fallow suffered 95% winter kill but that in the stubble had 70% survival and yielded 35 bushels/acre.

In 1979 the air-seeder was compared with a conventional press drill in planting spring wheat and durum in stubble prepared for planting by spring plowing, field cultivator and no-till. Yields were greatest from plantings made with the press drill on spring plowed and/or cultivated land. However, on the no-till treatment the air-seeder yields were about 6 bushels/acre greater than from the press drill.

Two year's results suggest the air-seeder is capable of appropriate placement of seed under a wide range of crop residue and soil conditions if land surface is relatively smooth and if depth control is effective.

Air-seeders were introduced several years ago as a tool that could combine tillage and seeding of small grains in one operation. Basically the units consist of a seed holding chamber, a seed metering device and an air operated seed distribution system that conveys seed through flexible tubing to a boot attached to the back side of the shanks of a chisel plow or a field cultivator. On some machines the seed holding chamber and transfer system in independently supported and coupled to the front of the tillage tool. On others it is piggy-backed on top of the cultivator. Though there are differences in design, the basic concepts are essentially the same on all air-seeders currently available.

Sales claims made for these machines include in addition to combining tillage and seeding in one operation: a) capability for seeding without prior treatment of crop residue; b) a seeder with the portability and flexibility of a wing-type field cultivator; c) relatively low initial and maintenance costs as compared to conventional press drills and thus reduction in capital investment for the reason one tool does the work of two.

In the spring of 1977 Wil-Rich Manufacturing Inc. demonstrated a prototype of the air-seeder they planned to manufacture and market. It is of the design

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that piggy-backs the seeding system on a Wil-Rich field cultivator having 7-inch shank spacing. In 1978 one of their machines was made available to the Carrington Station for use in experimental plantings. It has been used each year since in seeding the tillage experiments with data collected in 1978 and 1979 but lost in 1980 due to hail. Results obtained are summarized as follows:

Spring Planting - 1978

A combination spring tillage and seeding method experiment was designed to allow comparative evaluation of three kinds of seeding equipment on three different spring tillage treatments in a replicated planting. The drills used were the Wil-Rich Air-Seeder, Melroe No-Till and a conventional Kirschmann double disc press drill. The pre-plant tillage treatments included no-tillage (direct seeding into stubble), spring plowing and packing, and spring cultivating with 7-inch sweep shovels spaced seven inches. The no-till treatment was sprayed with Paraquat after seeding to kill growing vegetation. Bronate+ was sprayed across all of the plot area during the growing season for broadleaf control.

Yield data was collected and is assembled in tables 1 and 2. Yield results suggest that the Wil-Rich seeder was as effective in placing seed at the proper depth as other seeding equipment used in this experiment. The excellent soil moisture at seeding allowed the standard press drill to achieve penetration and establish the most uniform stands. The Melroe No-Till drill which did not have any covering or closing device behind the furrow opener produced the poorest stands. It appeared that some of the seed germinated but then dried out and perished.

Three different shovels 7", 4" and 2" were used on the Wil-Rich seeder with two different covering tools--spring tine harrow attachment and trailing press wheels. The latter was the most effective. Also, they eliminated the residue/soil bunching problem that is associated with the tine harrow. The 2" shovel appeared to be the most satisfactory furrow opener of the three shovels used.

Of the spring tillage methods the no-till direct seeding in stubble generally produced the highest yields. The poorest yields were produced on plots worked once with a field cultivator before planting.

Because of the dry season (75% of normal precipitation) yield levels were lower than longtime averages and this may have influenced results. However, results suggest that the field cultivator with seeder attachment demonstrated potential as an acceptable method of planting small grain seeds in a range of seedbed conditions. Depth control was found to be a problem particularly on irregular surfaces and in soft seedbeds.

Table 1. Spring Seedbed Preparation and Seeding Methods Using Glenn Barley-1978

Planting Method	Pre-Planted Tillage Treatment					
	No-Till		Moldboard Plow		7" Shovels	
	Harrow	Press	Harrow	Press	Harrow	Press
Wil-Rich - 7"	36.9	32.2	26.3	26.8	33.0	31.9
Wil-Rich - 4"	29.1	30.6	27.9	28.5	29.9	28.9
Wil-Rich - 2"	31.4	35.7	29.1	29.6	32.9	34.1
Average	32.5	32.8	27.8	28.3	31.9	31.6
Melroe	28.7		21.5		20.3	
Kirschmann	30.6		24.2		30.3	

Table 2. Spring Seedbed Preparation and Seeding Methods Using Coteau Wheat-1978

Planting Method	Pre-Plant Tillage Treatment					
	No-Till		Moldboard Plow		7" Shovels	
	Harrow	Press	Harrow	Press	Harrow	Press
	(Bus/Ac)		(Bus/Ac)		(Bus/Ac)	
Wil-Rich - 7"	30.6	30.0	31.4	34.0	17.4	15.0
Wil-Rich - 4"	30.7	31.4	32.6	33.2	16.6	18.5
Wil-Rich - 2"	31.3	30.1	29.0	30.7	19.0	18.4
Average	30.9	30.5	31.0	32.6	17.7	17.3
Melroe	19.1		17.6		10.7	
Kirschmann	25.0		24.7		17.3	

Fall Planting - 1978

In the fall of 1978 the Wil-Rich air-seeder was used to make a replicated seeding of winter wheat and winter rye in heavy wheat stubble. The Wil-Rich seeder, because it is basically a four-rank field cultivator, does not require special treatment of the crop residue to allow plantings as do some no-till seeders that have a tandem arrangement of rolling coulter followed by double disc furrow opener. The only equipment variable in this experiment was a comparison between a mounted flex-tine harrow and trailing V-shaped hard rubber press wheels for closing the furrow openings made by 2-inch shovels. Yields obtained from this planting are shown in Table 3.

Table 3. Flex-tine Harrow vs Press Wheels on Wil-Rich Seeder Plantings of Winter Wheat and Winter Rye

Wil-Rich Seeder Equipped with	Crop Yield--Bus/Acre	
	Roughrider Winter Wheat	Rymin Winter Rye
Flex-tine Harrow	31.9	46.9
Press Wheels	35.6	47.1

The long, cold winter of 1978-79 was very severe on fall planted winter wheat and winter rye. Little, if any, winter wheat planted on adjacent fallow with a hoe drill survived and stands of winter rye were reduced markedly on the Carrington Station. In this planting the stands of winter wheat were reduced 30 to 40% by winter kill. Rymin rye which often suffers some winter kill at this location survived the winter with very adequate population. Stand reduction of winter wheat resulting from winter kill obviously reduced its yield potential. It is believed the greater yield of winter wheat planted with the press wheel attachment was due to a greater winter survival resulting from less disturbance of the crop residue when planting. The flex-tine harrow tended to break down and bunch crop residue which may have resulted in less winter protection.

Though neither winter wheat or winter rye are grown on much acreage in this area, the results of this trial suggest that using air-seeders equipped with 1½-2" or no-till shovels and a press wheel attachment is an effective method of fall seeding of winter wheat in stubble without prior seedbed preparation.

Spring Planting - 1979

A spring planting of two varieties of hard red spring wheat and one durum was made with the Wil-Rich air-seeder and the Kirschmann press drill on three different spring tillage treatments imposed on undisturbed stubble. The tillage treatments included no-till, moldboard plow and one field cultivation with 9-inch shovels spaced seven inches apart. All treatments were replicated four times. Fertilizer and herbicide were uniformly applied to all treatments except for Paraquat applied to only the no-till treatment just before emergence of the planted crop. Soil moisture at planting and during the season was adequate to produce a better than average crop. Yield data collected are summarized in Table 4.

Table 4. Yields in Bushels/Acre by Seeding and Tillage Treatment

	Wil-Rich Air-Seeder				Kirschmann Press Drill			
	Solar*	Len*	Vic**	Avg.	Solar	Len	Vic	Avg.
No-Till	48.9	35.3	46.7	43.6	49.7	28.5	35.6	37.9
Spring Plow	40.7	34.4	34.6	36.6	54.6	47.5	41.5	47.9
Field Cultivator	47.8	34.8	44.2	42.3	57.2	40.9	45.3	47.8
Average	45.8	34.8	41.8	(40.8)	53.8	39.0	40.8	(44.5)

* Hard red spring wheat
** Durum wheat

Yields from all treatments are well above wheat yields anticipated on "old" ground (land cropped the previous year). This suggests that soil moisture supply and other environmental factors were very favorable for wheat production at Carrington in 1979. The variety Solar, a semi-dwarf hard red spring wheat, was the highest yielding entry in most treatments.

Wil-Rich seeded no-till plots yielded more than Kirschmann press drill seeded no-till. This was no doubt due to the inability of the Kirschmann equipped with double disc furrow openers to uniformly penetrate the soil on non-tilled land. Reduced stands resulted and thus the crop yield. On tilled plots Kirschmann yields exceeded Wil-Rich yields. Inadequate depth control on the Wil-Rich allowed wheat seeds to be placed too deeply on tilled soil which again resulted in reduced stands and thus reduced yields. It should be noted that the lowest yields were produced with the Wil-Rich on spring plowing. This was the softest seedbed and thus most susceptible to excessive planting depth despite raising of the seeder when crossing the spring plowing. The need for more precise monitoring and control of planting depth with this type of seeder appears essential particularly on deep tilled seedbeds. However, on no-till or shallow tilled land such as that achieved with the field cultivator, precise depth monitoring is not as critical because the seeder is traversing a relatively firm seedbed.

Weed control in these plantings was accomplished with an application of Hoelon for pigeon grass and Bromoxynil with MCPA for broadleaf weeds. The use of Hoelon or some other effective herbicide appears essential on shallow tilled land for control of pigeon grass. Populations can be very high and must be controlled if traditional yield levels are to be achieved. On the no-till treatment an application of Paraquat was made to eliminate all spring growth in the stubble just before emergence of the planted wheat.

Conclusions and Observations:

Results from 1978 and 1979 plantings indicate that the air-seeder does have the potential for proper placement of seed in a wide range of seedbeds. Though air-seeders may differ somewhat in design, each seeder must accomplish placement of seed and/or fertilizer at a preset uniform rate at an easily controlled uniform depth under a variety of soil and seedbed conditions. It would appear that some manufacturers have designs that have nearly achieved this level of development. Optional attachments for air-seeders that may not be available on equipment from some manufacturers but believed highly desirable based on experience at Carrington include:

1) Automatic depth monitoring and control mechanism. Such are available and should be a standard feature. The rigid frame mounting of the furrow opening shanks on a field cultivator or chisel plow does not allow for indivdual shanks to follow ground surface irregularities.

2) Availability of trailing packer wheels instead of flex-tine harrow teeth for closing and firming the soil over the seed placement. Wheels of the V-shape design and manufactured from high density rubber appeared to be the most satisfactory. Such wheels are commonly used in the hard red winter wheat areas of the southern plains.

3) Narrow shovels that would allow placement of seed with a minimum of soil displacement. The advocacy of wide shovels to accomplish tillage at the time of seeding is questionable because working depth is limited to two inches or less for proper seed placement. This is not always an effective working depth for weed control.

When producers begin use of the air-seeders, it may be necessary for them to amend some traditional tillage and seeding practices to take full advantage of the options this kind of seeding equipment offers. For example, if a producer opts for use of the no-till practices using one of these seeders, it is likely that he will find it necessary to change his weed control practices to compensate for the lack of weed control that would be achieved by traditional tillage methods. With time and use of no-till this need may be erased. However, in the transistion stage weed control problems and management will be somewhat different from those experienced in the past and must be compensated for if no-till is to be practiced with a degree of success. Also, it will be necessary when using air-seeders to avoid causing irregularities in the field surface as the furrow openers on the field cultivator or chisel plow do have individual ground following suspension capability. Hence, to obtain uniform seed depth placement a level field surface is desirable. It is also necessary to keep the fore and aft tool bars of the chisel plow or field cultivator level otherwise the shanks on the forward tool bar could be much deeper or shallower than those on the aft tool bar of the tillage tool.