Alberta Farm Machinery
Research Centre

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Evaluation Report 735

Flexi-coil 1720 Air Cart

A Co-operative Program Between

ALBERTA FARM MACHINERY RESEARCH CENTRE

PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

FLEXI-COIL 1720 AIR CART

MANUFACTURER AND DISTRIBUTOR:

Flexi-coil Ltd.
1000 - 71 Street East
P.O. Box 1928
Saskatoon, SK S7K 3S5
Phone: (306) 934-3500

RETAIL PRICE: $36,739.00 (August 1998, f.o.b. Lethbridge Alberta), Flexi-coil 1720 air cart with dual castor tow-behind package, 45 outlet air package, 4-run active manifold with coarse and fine metre roller and remote tillage switch.
Additional $7210.10 for mounted packer/harrow option with 2.5 in (64 mm) v-shape molded plastic packers with rock guards.
Additional $472.50 for 45 narrow seed/banding boots.

Figure 1. Flexi-coil 1720 Air Cart: (1) Tank, (2) Auger, (3) Primary Hose, (4) Centrifugal Fan, (5) Centre Manifold, (6) Metering Drive System, (7) Intermediate Manifold, (8) Hand Crank, (9) Ladder and (10) Rear Platform.

SUMMARY

QUALITY OF WORK

The seed and fertilizer placement of the Flexi-coil 1720 air cart depended on careful levelling of the Flexi-coil 820 cultivator frame and the seed boot or opener used. The band width with the narrow seed/banding boot averaged 2.2 in (56 mm) using the 3 in (76 mm) Nok-On mini-sweep and 2.3 in (58 mm) with the 11 in (279 mm) Nok-On sweep, leaving an average spacing of 6.7 in (170 mm) between rows. Seed and fertilizer depth was uniform when seeding in either tilled or untilled soil.

Soil finishing with the v-shape molded plastic packers was very good for the soil conditions encountered. The packer's downward pressure was set for varying soil conditions by the location of the top pin and spring length of the packer/harrow mounting arm. Coverage by the packers was even with ridge depths ranging from 1.5 to 2.3 in (38 to 58 mm) depending on soil conditions**.** The metering rates for cereal grains, canola, peas and fertilizer were not affected by field variables. The maximum 11-51-0 fertilizer application rate was 280 lb/ac (314 kg/ha) from the rear metre using the coarse metre roller. Higher application rates were possible using both metres. The distribution uniformity was very good in wheat, barley, peas, canola and 11-51-0 fertilizer. Distribution uniformity in 11-51-0 fertilizer was acceptable at application rates below 475 lb/ac (532 kg/ha). Travelling on a 10° uphill slope raised the Coefficient of Variation (CV) from 4.5 to 6.0 percent with wheat and from 4.3 to 8.0 percent with fertilizer. Insignificant seed damage occurred providing proper fan speed settings were used.

EASE OF OPERATION AND ADJUSTMENT

Maintenance of the system was very good. Daily inspection included checking for air leaks, plugged hoses, movement of the spring-loaded chain tension idlers and wheel bolt tightness. Ease of filling and cleaning the applicator was very good. The auger allowed for fast filling and convenient emptying of the tanks. Ease of transporting the applicator was very good. The pivot link mounting brackets mounted on the cultivator frame allowed for easy hook-up of the applicator hitch to the cultivator. The applicator and cultivator were placed into transport position in 5 minutes. The master clutch disabled the metering system for transport.

Monitoring was very good. Fan speed, air velocity speed, metre shaft rotation, bin level and area/ground speed sensors were supplied. Ease of adjusting the arm on the optional packer/harrows was good. Three working positions were supplied for the top pin, while spring length could be varied between 8.5 and 13.0 in (216 and 330 mm). Ease of setting the application rate was very good. The roller speed was set by changing the slide setting. The unit was equipped with a density scale, spring scale, calibration chart and rate check bags used for calibrating the application rate.

POWER REQUIREMENTS

The draft and horsepower requirements depended upon the size and type of tillage unit used. Power take-off horsepower requirements to pull the applicator full of wheat in tilled loam soil ranged from 16.3 to 28.8 hp (12.2 to 21.5 kW). Average and maximum hydraulic horsepower requirements for the centrifugal fan were 9.8 and 17.6 hp (7.3 and 13.1 kW), respectively.

OPERATOR SAFETY

The Model 1720 was safe to operate if normal safety precautions were observed. The rear ladder, side handrails and rear platform provided safe access to the applicator tanks. The front arm lock and rear over-centred latch secured the loading auger into transport position while a safety chain was provided to secure the applicator to the applicator hitch.

OPERATOR'S MANUAL

The operator's manual was very good. The manual contained useful information on safety, operation, maintenance and trouble shooting. Applicator service and assembly manuals were also provided, including a partial parts list.

MECHANICAL HISTORY

The secondary and primary distribution hoses were damaged during the test.

RECOMMENDATIONS

The Alberta Farm Machinery Research Centre (AFMRC) recommends the manufacturer:

1. Modify the tank sight glasses to enable the operator to view when the tanks were full.
2. Supply instructions on the proper routing of the secondary hoses to prevent damage from the depth linkage system.
3. Supply metre rate charts in SI (metric) units as well as Imperial units.
4. Improve routing of the primary hoses to eliminate the wear on the hoses.

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Field Technologist: G.A. Magyar
Manager: R.P. Atkins, P.Eng.

MANUFACTURERS' REPLIES TO RECOMMENDATIONS

The manufacturer states with regards to recommendation number:

1. Sight glass locations will be reviewed, but we have found that the desired position changes greatly with the range of different products applied with the air cart.
2. Instructions for routing secondary hoses are being revised.
3. Metric charts are available from Flexi-Coil parts department.
4. Instructions for routing primary hoses are being revised.

MANUFACTURER'S ADDITIONAL COMMENTS

1. Higher rates can be metered by using the high capacity sprocket ratios designed for row crop applications.
2. A dual fan option is now available to increase air capacity especially for larger double shoot machines.
3. Additional row crop options, including row crop hitches, axle extensions, and adjustable front axles, are available to match the seed cart to row crop applications.

GENERAL DESCRIPTION

The Flexi-coil 20 series air seeder cart is a pneumatic seed and fertilizer applicator designed for use with various makes and models of cultivators or air drills. There are two models available: the 1720 or 2320 applicator with a nominal 170 and 230 bushel tanks, respectively. The seed cart can either be a tow-behind or tow-between unit depending on which hitch package is connected to the front of the seed cart. The tow-behind cart tested is supported by two rear wheels mounted on a solid axle and two optional front castering wheels mounted on the front hitch frame. A front drawbar hitch is used on the tow-between cart. The seed cart is used for seeding, fertilizing, combinations of seeding and fertilizing or in combination with granular herbicide application.

Seed and fertilizer are metered through variable speed fluted metering rollers mounted below each tank. The number of active runs at the metering roller corresponds to the number of manifolds on the tillage unit. The metres are driven by a series of sprockets and chains from the right rear seed cart wheel. A master clutch controls the metering system, while front and rear clutches engage the individual metering shafts. The clutches are electronically controlled by separate switches mounted in the tractor cab. A hand crank allows for manual turning of the metering shafts.

The centrifugal fan air stream conveys the metered material through the distribution system. The fan also pressurizes the tanks to equalize the pressure across the metres. Power to the fan is supplied by the tractor's hydraulics. The divider blades on the metering baffle panel direct the seed and/or fertilizer into the primary tubes below each active run. The primary tubes convey the material to the distribution manifolds. The manifolds distribute the material through delivery tubes to the seed boots.

The monitoring system consists of shaft sensors located at each metering body, bin level sensors located in each tank, front and rear air velocity sensors located in the centre manifold, an acre/ground speed sensor and a fan speed sensor. The console displays accumulated area, fan speed, air velocity speed, bin level, ground speed, metre shaft speed and seeding rate.

The loading/unloading auger is mounted on the left side of the seed cart. A flow control valve directs hydraulic flow to either the fan or auger.

The test machine was a tow-behind Model 1720 seed cart equipped with a 4-run, 45-outlet distribution system. Optional equipment included dual front castors, 3 in (76 mm) Nok-On mini sweeps and 11 in (279 mm) Nok-On sweeps, narrow seed/banding boots, remote tillage switch, optional packer/harrow mounting arms and v-shaped molded plastic packers. The test machine was used with a Flexi-coil 820 Floating Hitch cultivator. The 4-row cultivator was 33 ft (10 m) wide with 45 shanks spaced at 9 in (229 mm). A tractor with three remote hydraulic lines and a case drain line was required to operate the test unit.

Detailed specifications for the air seeder are given in **Appendix I,** while **Figure 1** shows the location of major components.

SCOPE OF TEST

The Flexi-coil 1720 air cart was operated in the conditions shown in **Table 1** for 102 hours while seeding 1809 ac (737 ha). The metering systems were tested in the laboratory for metering and distributing accuracy and the affect of field and machine variables on metering and distribution. Laboratory tests on the distribution system were completed using a 40 outlet distribution package with four, 10-port distribution manifolds. The Flexi-coil air cart was evaluated for quality of work, ease of operation and adjustment, ease of installation, power requirements, operator safety and suitability of the operator's manual.

The machine evaluated by the Alberta Farm Machinery Research Centre (AFMRC) was configured as described in the General Description, **Figure 1**, and the Specifications section in Appendix I of this report. The manufacturer may have built different configurations of this machine before and after AFMRC's tests. Therefore, when using this report be sure to check the machine under consideration is the same as the one reported here. If differences exist, assistance can be obtained from AFMRC or the manufacturer to determine changes in performance.

Table 1. Operating Conditions.

Material	Soil Type and Condition	Field Area		Hours
		ac	ha	
Spring Wheat	Clay*	45	18	4.5
	Sandy Clay Loam **	165	67	10.0
Barley	Clay**	76	31	4.0
	Sandy Loam**	200	81	10.5
	Loam	199	81	9.0
	Silt Loam**	230	93	11.0
Canola	Clay**	59	24	3.0
	Loam**	151	61	8.5
Peas	Loam**	44	22	4.0
Winter Wheat	Loam*	340	138	19.0
	Silt Loam*	200	81	12.0
	Sandy Loam*	100	40	6.5
	Totals	**1809**	**737**	**102**

*Primary
**Secondary

RESULTS AND DISCUSSION

QUALITY OF WORK

Seed and Fertilizer Placement: Seed and fertilizer placement of the Flexi-coil 1720 air cart depended on careful levelling of the cultivator frame and opener selection. The seed and fertilizer were placed together in a single shoot opener furrow. The narrow seed/banding boot, **Figure 2,** was used with both the 3 in (76 mm) Nok-On mini sweep and 11 in (279 mm) Nok-On sweep.

Figure 2. Flexi-Coil Narrow Seed/Banding Boot.

The 3 in (76 mm) Nok-On mini sweep placed most of the seed within 0.6 in (15 mm) of the average seed depth of 2.2 in (56 mm), while the 11 in (279 mm) sweep placed most of the seed within 0.7 in (18 mm) of the average seed depth of 2.3 in (58 mm). The 9 in (229 mm)

cultivator shank spacing and the 2.3 in (58 mm) average band width resulted in an average 6.7 in (170 mm) spacing between rows with the narrow seed/banding boot. Seed and fertilizer depth was uniform when seeding in either tilled or untilled soil.

Soil Finishing: Soil finishing with the v-shaped molded plastic packers was very good for the soils and conditions encountered. Average weight of the 2.5 in (64 mm) packers was 40 lb/ft (584 N/m). The packer's downward pressure was set for varying soil conditions by the location of the top pin and spring length of the packer/harrow mounting arm. **Figure 3** shows the soil surface after seeding into a summerfallow field using a spring length of 11 in (279 mm) and the top pin hole location producing a packer downward pressure of 475 lb (2.2 kN). Coverage by the packers was even, with ridge depths ranging from 1.5 to 2.3 in (38 to 58 mm) depending on soil conditions.

Figure 3. Soil Surface After Seeding into a Tilled Field.

Metering Accuracy: Metering accuracy of the 1720 was very good. The metering rate was changed by varying the slide setting which changed the crank arm to lengthen or shorten its turning radius. The calibration curves obtained by AFMRC and the manufacturer for the 1720 air seeder in wheat, barley, peas, canola and fertilizer are given in **Figures 4 to 8**. Any differences between the calibration curves obtained by AFMRC and those given by the manufacturer are probably due to different seed or granular size, density and moisture content. The densities obtained by AFMRC and supplied by the manufacturer are indicated on the graphs.

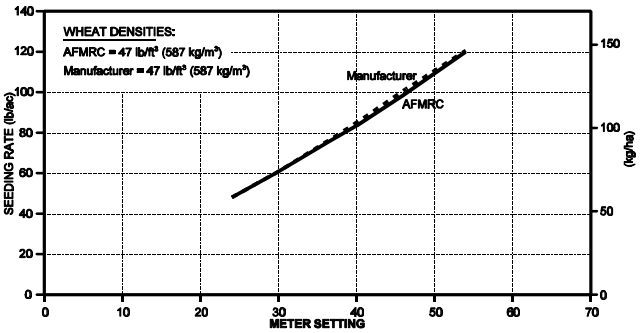

Figure 4. Metering Accuracy in Wheat.

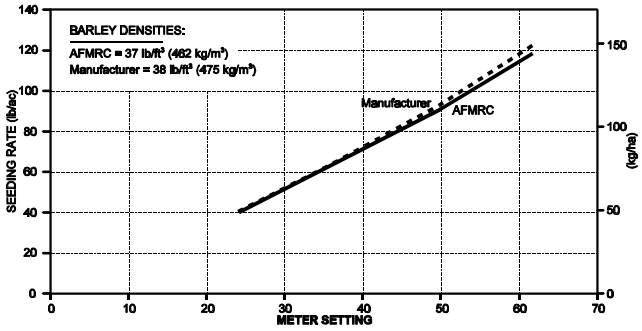

Figure 5. Metering Accuracy in Barley.

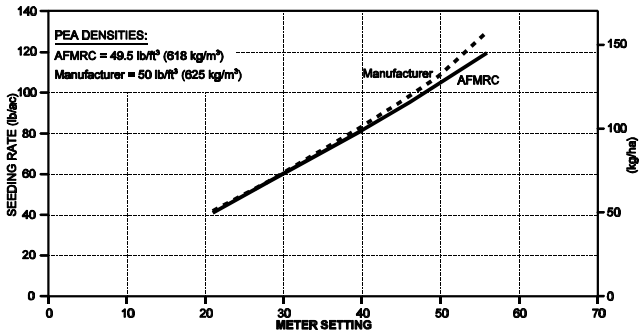

Figure 6. Metering Accuracy in Peas.

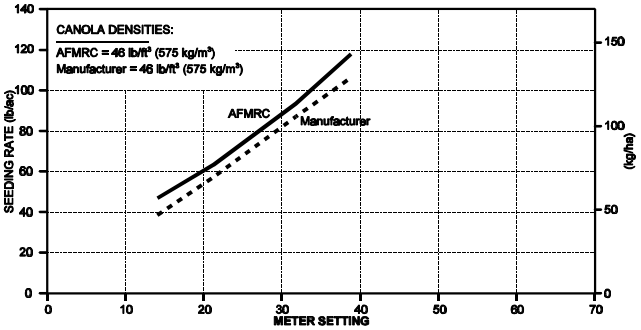

Figure 7. Metering Accuracy in Canola.

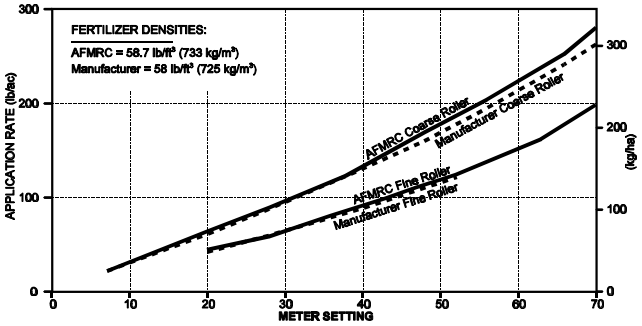

Figure 8. Metering Accuracy in 11-51-0 Fertilizer.

The manufacturer stated the charts are to be used as guidelines and the operator should calibrate the air seeder for the particular product being used. Level of material in the tank, field roughness and variations in fan or ground speed had no effect on metering rates. Operating the 1720 on uphill, downhill or side slopes did not affect the metering accuracy.

The maximum rate for 11-51-0 fertilizer was 280 lb/ac (314 kg/ha) from the rear tank using the coarse metre roller. Higher application rates were possible using both metres (front-fine, rear-coarse). The maximum application rate using both tanks was 475 lb/ac (532 kg/ha).

Distribution Uniformity: Uniformity of distribution for the Flexi-coil 1720 application rates was very good in wheat, barley, peas, canola and 11-51-0 fertilizer. **Figure 9** shows the seeding distribution uniformity of wheat, barley and peas. Distribution was uniform over the full range of seeding rates. For example, for a range

of seeding rates for wheat the average CV[1] was consistent at 2.5 percent. For barley at a seeding rate of 93.6 lb/ac (104.9 kg/ha) the CV was 4.8 percent and for peas at a seeding rate of 122.3 lb/ac (137 kg/ha) the CV was 3.5 percent. **Figure 10** shows a typical seeding distribution pattern obtained in wheat at a seeding rate of 66.8 lb/ac (77.1 kg/ha). The seeding rate for each opener across the width of the air seeder varied from 63.3 to 69.4 lb/ac (73.1 to 80.1 kg/ha). This resulted in an acceptable distribution uniformity with a CV of 2.5 percent. Distribution uniformity was acceptable over the full range of canola seeding rates with CV's varying from 4.5 to 5.0 percent, **Figure 11**.

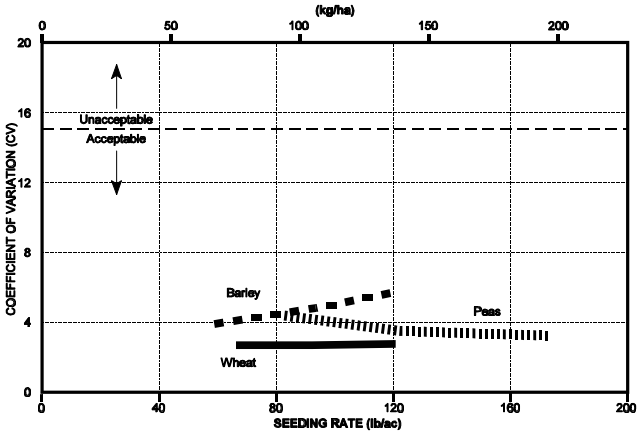

Figure 9. Distribution Uniformity in Wheat, Barley and Peas Over a Range of Seeding Rates.

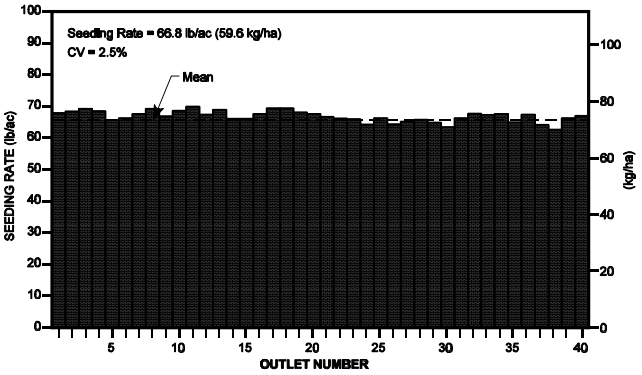

Figure 10. Distribution Uniformity Pattern in Wheat at 66.8 lb/ac (77.1 kg/ha).

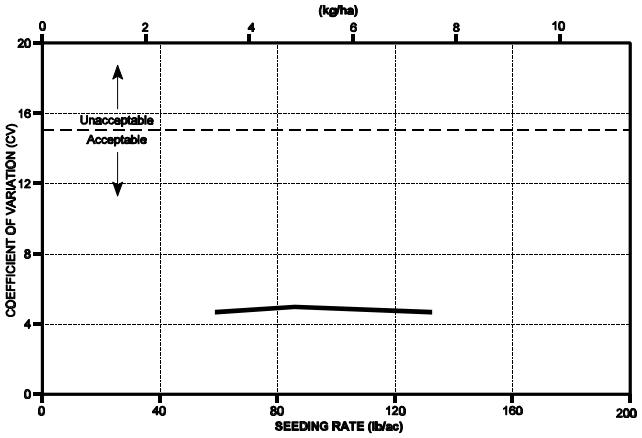

Figure 11. Distribution Uniformity in Canola Over a Range of Seeding Rates.

[1] The CV is the standard deviation of application rates from individual outlets expressed as a percent of the average application rate. A low CV represents uniform application whereas a high CV indicates non-uniform application. An acceptable variation for seeding grain or applying fertilizer is a CV value of not greater than 15 percent.

Distribution uniformity in 11-51-0 fertilizer was acceptable up to the maximum application rate of 475 lb/ac (532 kg/ha) as shown in **Figure 12**. The CV's varied from 3 to 13 percent.

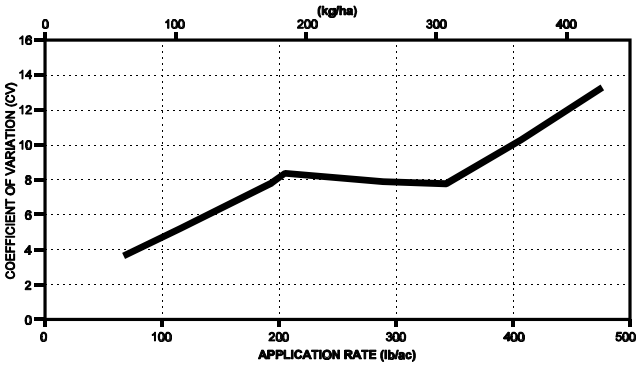

Figure 12. Distribution Uniformity in 11-51-00 Fertilizer Over a Range of Application Rates.

Variations in fan speed and metering rates had little affect on seed distribution uniformity. Operating the 1720 up and down hill slopes had little affect on seed distribution uniformity. Slope did affect distribution uniformity for fertilizer at the higher application rates but was still within acceptable limits. It is important that fan speed be properly adjusted for higher application rates of fertilizer to maintain acceptable distributions.

Seed Handling: Seed handling was very good. Damage by the metering and distribution system in wheat with the fine roller at an average seeding rate of 62.2 lb/ac (69.7 kg/ha) and a fan speed of 2740 rpm was 0.8 percent. Increasing or decreasing fan speed produced no change in seed damage. The damage in peas with the coarse roller at an average seeding rate of 87.0 lb/ac (97.5 kg/ha) and a fan speed of 2720 rpm was 1.1 percent. Increasing the seeding rate to 179.0 lb/ac (200.6 kg/ha) decreased damage to 0.9 percent. The damage in canola at an average seeding rate of 6.6 lb/ac (7.4 kg/ha) and a fan speed of 2250 rpm was 0.4 percent. Increasing or decreasing fan speed produced no change in seed damage.

EASE OF OPERATION AND ADJUSTMENT

Maintenance: Ease of performing routine maintenance on the 1720 air seeder was very good. Grease fittings were provided for the upper and lower cross shaft bearings, fan shaft spline and bearings, auger lock and support arms and the distribution hose support pivot. The cross shaft and fan bearings were greased every 100 hours. The auger lock and support arms and a distribution hose support pivot was greased every 50 hours while the fan shaft spline was greased every 200 hours. The castor pivot and wheel bearings required annual servicing**.** The spring-loaded chain tension idlers were checked daily. Daily inspection also included checking for air leaks, plugged hoses and wheel bolt tightness.

Filling/Cleaning: Ease of filling and cleaning the 1720 was very good. The tank openings were located 9.2 ft (2.8 m) above ground. The 7 in (178 mm) auger allowed for fast filling and convenient emptying of the tanks. It took less than 15 minutes to fill both tanks providing the tractor hydraulics were set for maximum flow. A hydraulic selector valve diverted the hydraulic flow from the fan to the auger motor. A hopper and safety screen were provided with the auger. Auger plugging did not occur during the test.

One person easily placed the auger into transport or working position. Auger clean out was possible by reversing the direction of the hydraulic valve lever. The hopper was inverted to clean out the remaining material in the hopper. A 5-gal (20 L) pail was sufficient to catch the material in the hopper.

The tank lids were held closed by a single over-centred crossbar lever. The 12 x 25 in (305 x 635 mm) lid openings were equipped with rubber seals for an air and moisture tight seal. The front tank capacity was 89 ft^3 (2.5 m^3) and the rear tank capacity was 139 ft^3 (3.9 m^3). During most filling operations the auger spout rested on the tank debris screen, reducing the flow of material into the tank. To improve product flow the operator raised the spout above the debris screen. The operator also directed material flow with the spout

to increase the amount of material augered into the tank. During filling the location of the sight glasses made it difficult for the operator to see when the tanks were full. The AFMRC recommends the manufacturer consider modifying the tank sight glasses to enable the operator to view when the tanks were full.

Removing the inspection cover and baffle panel allowed for inspection of the metering rollers with material in the tanks. Cleaning large amounts of material out of the tanks was convenient using the unloading auger, **Figure 13**. Capacity of the clean out system with wheat was 320 bu/hr (8.7 T/h). It took 13 minutes to empty the front tank. The centre manifold was lowered from the metre box and the hand crank in **Figure 14** turned to empty material remaining in the metre box cavity.

Figure 13. Unloading Material from Flexi-coil Tank.

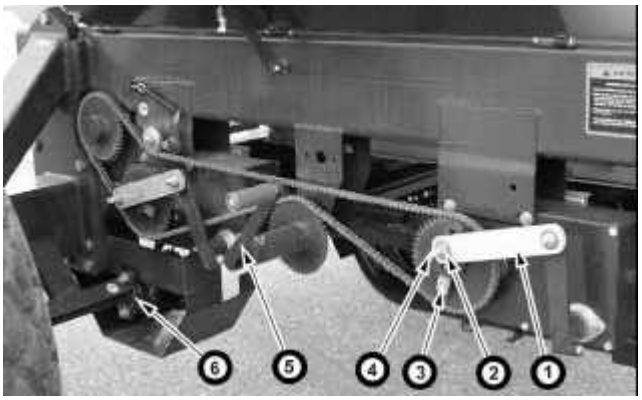

Figure 14. Seed Fertilizer Rate Adjustment: (1) Crank Arm, (2) Lock Nut, (3) Crank Arm Adjustment Gauge, (4) Set Bolt, (5) Hand Crank, and (6) Master Clutch.

Transporting: Ease of transporting the applicator was very good. The pivot link mounting brackets mounted on the Flexi-coil cultivator allowed for easy hook-up of the applicator hitch to the cultivator. A straight drawbar hitch was used to transport the applicator separately. Hook-up of the depth, fan, case drain and wing hydraulic lines and one electrical coupler was required. The loading/unloading auger was easily placed into transport by one person after filling the applicator.

Since the applicator towed behind, visibility of the cultivator was very good. The applicator and cultivator were easy to manoeuvre while backing up. The Flexi-coil applicator and cultivator were placed into transport position in 5 minutes, **Figure 15**. The master clutch disabled the metering system for transport. Overall transport height and width were 15.2 ft (4.6 m) and 17.8 ft (5.4 m), respectively. Care was required when travelling on public roads.

Figure 15. Transport Position.

Monitoring: Monitoring on the Flexi-coil 1720 was very good. The electronic monitoring system monitored fan speed, air velocity speed, front and rear metre shaft rotation, front and rear bin levels, area, ground speed and seeding rate. The console, **Figure 16**, had 13 large touch keys used to program and monitor the applicator's operation. Some keys had multi-functions while some were required to be used together. The digital display area showed the value of the function selected by the touch keys. The function and units of measure being monitored were also shown on the display area. The bar graphs indicated the level of material in the tanks. An alarm sounded and the corresponding bin indicator flashed when product level in a tank was low. Fan speed was shown in increments of 10 rpm and an alarm sounded when the speed exceeded the set fan speed limits. When the metre shaft speed fell below 1 rpm the alarm sounded and the corresponding shaft indicator flashed**.** A "no seed" alarm was indicated when the master clutch was engaged and no ground speed was detected. Other alarm sensors were disabled when the ground speed was less than 2 mph (3 km/h). The audible alarm for the appropriate sensor was cancelled by pressing the alarm key. Some of the alarm functions were optional for the operator. The function indicator continued to flash until the alarm condition was corrected.

Figure 16. Monitor Console.

Wrap spring clutches were mounted on each metre drive while a master clutch was mounted on the main drive. The clutches were controlled by rocker switches located in the switch box attached to the monitor console. A quick double-beep alarm sounded whenever the master clutch was engaged. The turning hand crank also indicated the master clutch was engaged. The optional remote work switch controlled the operation of the master clutch. The remote switch engaged or disengaged the clutch as the tillage implement was lowered or raised.

The monitor was equipped with an electronic acreage metre. The operator entered implement width (feet) and speed calibration for the 1720 seed cart. Total area or area for each tank could be

displayed. The digital display showed values to the nearest acre or tenth of an acre up to a maximum of four digits. The acreage metre was accurate, with values averaging 0.1 percent low. The monitor could be changed between English (Eng) and metric (SI) units.

Packer Adjustment: Ease of adjusting the arm on the optional packer/harrows was good. Packer downward pressure was adjusted by the location of the top pin and spring length. Three working positions were supplied for the top pin, while spring length could be varied between 8.5 and 13.0 in (216 and 330 mm). The manufacturer supplied a spring pressure chart indicating the working pressure for the corresponding pin location and spring length. The supplied spring adjustment wrench was used to adjust the spring length.

Application Rates: Ease of setting the application rate was very good. Seed and fertilizer rates were set by the speed and style of the metering roller. The roller speed was set by the length of the crank arm turning radius, **Figure 14**. The crank arm adjustment gauge was calibrated in increments of 1 ranging from 0 to 70, while the calibration charts supplied rate settings for various products and densities given in pounds per cubic foot. The supplied density scale was used to measure the density of the product being metered. A fine metre roller was used in the front tank while a coarse metre roller was used in the rear tank. Installation and removal of a metering roller required less than 5 minutes**.**

The manufacturer recommended the actual metering rates be checked. The stationary rate check allowed the metres to be calibrated individually or at the same time. A spring scale, calibration chart and rate check bags were supplied to calibrate the applicator, **Figure 17**. To calibrate the applicator, the centre manifold was lowered from the metre and positioned out of the way**.** A rate check bag was then secured to the metre to be calibrated. With the correct metre clutch turned on and the master clutch off, the hand crank was turned the required number of turns as determined from the operator's manual. The rate check bag was then weighed with the spring scale. The material weight was divided by the corresponding acres to give the application rate. The spring scale increments were to the nearest 0.5 lb (250 g).

Figure 17. Rate Calibration: (1) Spring Scale and (2) Rate Check Bag.

EASE OF INSTALLATION

Ease of installing the distribution and monitoring system was good. Installation of the seed and fertilizer distribution system included installing the monitor and clutch switches, mounting the vertical manifolds and seed boots, routing the 2.5 in (64 mm) primary hoses, the 1 in (25 mm) secondary hoses, the hydraulic case drain line and the electrical harnesses. The optional work switch, electrical harness and hydraulic lines on the Flexi-coil 820 cultivator were installed during initial set-up by the manufacturer. The manufacturer supplied an assembly manual indicating the proper routing of the primary hoses and location of the distribution manifolds. Instructions were also supplied indicating the proper installation of the case drain line for various makes and models of tractors. No instructions were supplied indicating the proper routing of the secondary hoses. The AFMRC recommends the manufacturer consider supplying instructions on the proper routing of the secondary hoses to prevent damage from the depth linkage system. The manufacturer supplied metering rollers that matched the number of active runs being used. The initial set-up of the metering assemblies was completed by the manufacturer. Installation of the distribution system took two experienced people 7 hours.

POWER REQUIREMENTS

Draft Characteristics: The draft (drawbar pull) and corresponding tractor horsepower requirements depended on the size and type of tillage implement used. Refer to AFMRC/PAMI reports on cultivators and air drills for estimates of draft and horsepower requirements. The amount of draft depends on field preparation, soil type and moisture content, ground speed and the amount of seed and/or fertilizer in the tanks. Average tank draft with the tanks full of wheat at a normal seeding depth travelling 5 mph (8 km/h), in a tilled loam soil, ranged from 679 to 1198 lb (3.1 to 5.3 kN).

Hydraulic: Maximum hydraulic flow requirements for the centrifugal fan was 11.2 gal/min (51 L/min) at 1800 psi (12411 kPa). This was measured at a fan speed of 4980 rpm. Flow requirements for the centrifugal fan varied according to fan speed. At an average fan speed of 3990 rpm the hydraulic flow requirement was 8.9 gal/min (40 L/min) at 1250 psi (8618 kPa).

Tractor Size: Power take-off horsepower requirements to pull the air seeder full of wheat, in tilled loam soil, ranged from 16.3 to 28.8 hp (12.2 to 21.5 kW). Average and maximum horsepower requirements for the centrifugal fan were 9.8 and 17.6 hp (7.3 to 13.1 kW), respectively.

OPERATOR SAFETY

The 1720 was safe to operate if normal safety precautions were observed. The rear ladder, side handrails and rear platform provided safe access to the applicator tanks. A step secured to the rear tank and railings extending from the side handrails along the top of the seed cart provided access to the tank lids and over-centred crossbar lever. The front arm lock and rear over-centred latch secured the loading auger in transport position. The master and wrap spring clutches were disengaged electronically from the tractor cab. A safety chain was provided to secure the applicator to the applicator hitch. A transport hitch was provided to tow the seed cart separately.

A slow moving vehicle decal was located on the rear of the applicator. Tire loads could exceed the Tire and Rim Association's maximum load rating if the applicator was transported with full tanks at speeds greater than 10 mph (16 km/h). The applicator should not be transported under these conditions at speeds above 10 mph (16 km/h). The manufacturer recommended the applicator should be transported empty. With the remote centrifugal fan location, the operator station noise level in modern cabs was unaffected by fan noise.

OPERATOR'S MANUAL

The operator's manual was very good. The manual contained useful information on safety, operation, maintenance and trouble-shooting. Applicator service and assembly manuals were also provided, including a partial parts list. A calibration chart and metre rate charts were supplied in the operator's manual. The AFMRC recommends the manufacturer consider supplying metre rate charts in SI (metric) as well as Imperial units.

MECHANICAL HISTORY

Table 2 outlines the mechanical history of the Flexi-Coil 1720 air cart during 102 hours of operation while seeding 1809 ac (737 ha). The intent of the test was evaluation of functional performance. An extended durability evaluation was not conducted.

Table 2. Mechanical History.

ITEM	OPERATING HOURS	EQUIVALENT FIELD AREA	
		ac	ha
secondary hose pulled out of seed boot	3.0 5.0 7.5	12 50 88	5 20 6
seed/banding boots not secured to shanks	2.0 3.0 10.0 14.5	5 10 130 230	2 4 53 93
secondary hoses damaged by cultivator depth linkage	3.0 100.0	12 1780	5 721
repaired optional work switch	4.0	38	15
repaired packer rock guard	53.0	831	336
repaired rear air velocity sensor	67.0	1172	474
repaired electrical hitch harness	80.0	1511	612
primary hoses damaged by cultivator depth linkage	end of test		

DISCUSSION OF MECHANICAL PROBLEMS

Seed/Banding Boots Not Secured to Shanks: The seed/banding boots were attached to the implement shanks using the lower plow bolt hole on the shank. It is important the proper bolt package be used to attach the boots.

Secondary and Primary Hoses Damaged by Cultivator Depth Linkage: The movement of the linkage system on the Flexi-coil 820 cultivator caused damage to the primary and secondary hoses. Secondary hoses were pinched and cut by the linkage system when raising or lowering the implement, **Figure 18**. As indicated under Ease of Installation, AFMRC recommends the manufacturer supply instructions on the proper routing of the secondary hoses to prevent damage from the depth linkage system. The movement of the depth linkage also caused excessive wear on the primary hoses, **Figure 19**. Whenever the implement was raised and lowered the hoses rubbed on the linkage system. The AFMRC recommends the manufacturer consider improving the routing of the primary hoses to eliminate the wear on the hoses.

Figure 18. Damage to Secondary Hose by Depth Linkage System.

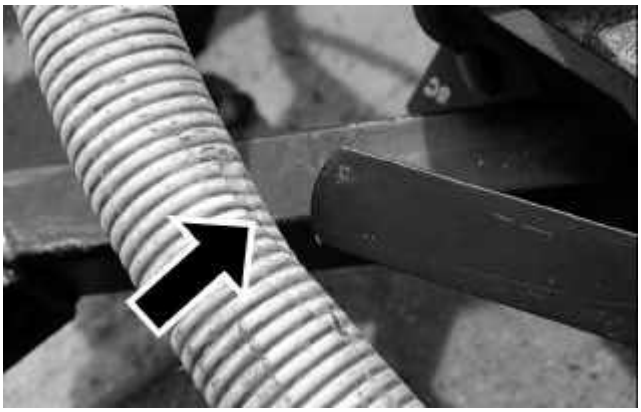

Figure 19. Damage to Primary Distribution Hose.

APPENDIX I
SPECIFICATIONS

MAKE:	Flexi-coil
MODEL:	1720 Air Cart
SERIAL NUMBER:	G1720 A0 R065608
MANUFACTURER:	Flexi-coil Ltd.
	1000 - 71 Street East
	P.O. Box 1928
	Saskatoon, SK S7K 3S5
	Phone: (306) 934-3500

DIMENSIONS:

-width		11.6 ft (3.5 m)
-length	(w/o hitch)	19.3 ft (5.9 m)
	(with hitch)	29.0 ft (8.8 m)
-height		9.6 ft (2.9 m)
-filler opening height		9.2 ft (2.8 m)
-max. ground clearance		19.5 in (495 mm)
-wheel tread		
	-front	2.3 ft (0.7 m)
	-rear	10 ft (3.0 m)

METERING SYSTEM:

-type	polyurethane fluted roller
-front	fine fluted
-rear	coarse fluted
-number of metres	2
-number of active runs	4
-drive	chain drive from right rear applicator tire
-adjustment	adjustable crank arm with rate gauge range of 0-70 in
	increments of 1 in
-airstream loading	pressurized tanks
-transfer to openers	pneumatic conveyance through divider headers and plastic tubes.
-hose sizes	
-primary	2.5 in (64 mm) seed and fertilizer
-secondary	1.0 in (25 mm) seed and fertilizer

TANK CAPACITIES:

-front tank	89 ft^3 (2.5 m^3)
-rear tank	139 ft^3 (3.9 m^3)

FAN:

-type	backward curved centrifugal
-make	Flexi-coil
-operating range	0-5000 rpm
-drive	hydraulically driven from tractor remote
-motor	Ultra 1MR010C, splined shaft, case drainline required

WHEELS:

-front	2, 16.5L-16.1, 6 ply
-rear	2, 18.4-26, 10 ply

WEIGHTS:	TANKS EMPTY	TANKS FULL OF WHEAT
-hitch	260 lb (118 kg)	260 lb (118 kg)
-front casters	2130 lb (966 kg)	4355 lb (1976 kg)
-right rear	2160 lb (980 kg)	6464 lb (2932 kg)
-left rear	2220 lb (1007 kg)	6524 lb (2960 kg)
TOTAL	6770 lb (3071 kg)	17603 lb (7986 kg)

NUMBER OF LUBRICATION POINTS:

12 grease fittings

AUGER:

-size	7 in (178 mm) diameter
-drive	hydraulically driven by tractor

MONITOR:

-model	Version 3.0
-weight	3.7 lb (1.7 kg)
-size (h x w x l)	console- 6 x 3.5 x 8.5 in (152 x 89 x 216 mm)
	switch box- 3 x 3.5 x 8 in (76 x 89 x 203 mm)
-mounting	flexible pedestal mount
-power supply	12-V dc, 10 amp fuse
-controls	13 touch key pads
-display	5 digit data display
	bar graph bin level display
	function area display
	units of measure display
-cables	6.0 ft (1.8 m) power
	25.5 ft (7.8 m) tractor harness
	40.5 ft (12.3 m) seeding tool extension harness

PACKERS:

-type	v-shaped molded plastic
-gangs	6
-number	6
-packers per gang	4-8 packers per gang
	1-7 packers per gang
	1-6 packers per gang
-weights	8-gang packer 230 lb (104 kg)
	7-gang packer 210 lb (95 kg)
	6-gang packer 190 lb (86 kg)
-spacing	9 in (229 mm)
-diameter	18 in (457 mm)
-width	2.5 in (64 mm)
-guards	0.375 x 1 x 11 in (9 x 25 x 279 mm)

OPTIONS INCLUDED ON TEST MACHINE:

- 3 in (76 mm) Nok-On mini sweeps
- 11 in (279 mm) Nok-On sweeps remote tillage switch
- v-shaped molded plastic packers with rock guards packer/harrow mounting arm
- 4-run active manifold
- 1720 tow-behind hitch package with dual castors
- narrow seed/banding boot

OTHER AVAILABLE OPTIONS:

- warning lamp package
- 1720 tow between hitch package
- 1720 tow behind hitch package with single castor
- 2, 3, 5, 6 or 8 run active manifolds
- double shoot option drive sprockets for row crop applications
- extra fine polyurethane metre roller
- granular applicator
- blockage monitoring
- press wheel mud scrapers
- brush flight auger
- broadcast distribution package
- PTO driven hydraulic pump
- 3 point hitch option
- rice tire option

APPENDIX II
MACHINE RATINGS

The following rating scale is used in Alberta Farm Machinery Research Centre (AFMRC) Evaluation Reports:

- Excellent
- Very Good
- Good
- Fair
- Poor
- Unsatisfactory

SUMMARY CHART

FLEXI-COIL 1720 AIR CART

RETAIL PRICE:	$36,739.00 (August 1998, f.o.b. Lethbridge Alberta), Flexi-coil 1720 air cart with dual castor tow-behind package, 45 outlet air package, 4-run active manifold with coarse and fine metre roller and remote tillage switch. Additional $7210.10 for mounted packer/harrow option with 2.5 in (64 mm) v-shape molded plastic packers with rock guards. Additional $472.50 for 45 narrow seed/banding boots.
QUALITY OF WORK:	Seed and fertilizer placement in (58 mm) average band width with narrow seed/banding boot Soil Finishing very good; v-shape molded plastic packers in conditions encountered
-Metering Accuracy	**very good**
-Distribution Uniformity	**very good**; wheat, barley, peas, canola and 11-51-0 fertilizer
EASE OF OPERATION AND ADJUSTMENT:	
-Maintenance	**very good**; 12 lubrication points
-Filling/Cleaning	**very good**; both tanks filled in 30 minutes
-Transporting	**very good**; pivot link mounting brackets allowed for easy hookup of the applicator to the cultivator
-Monitoring	**very good**; fan speed, air velocity speed, metre shaft rotation, bin level, area and ground speed monitored
-Packer Adjustment	**good;** downward pressure set by pin location and spring length
-Application Rates	**very good**; spring scale, rate check bags and calibration charts provided
EASE OF INSTALLATION:	**good;** case drain line for fan required
POWER REQUIREMENTS:	PTO horsepower requirements to pull the applicator ranged from 16.3 to 28.8 hp (12.2 to 21.5 kW); average and maximum hydraulic horsepower requirements for the centrifugal fan were 9.8 and 17.6 hp (7.3 to 13.1 kW)
OPERATOR SAFETY:	**safe**; rear ladder, side handrails and rear platform provided
OPERATOR'S MANUAL:	**very good**; contained useful information
MECHANICAL HISTORY:	secondary and primary hoses damaged during the test

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