

Evaluation Report 411



Flexi-coil (Friggstad) F420 (47.5 ft) Cultivator

A Co-operative Program Between



FLEXI-COIL (FRIGGSTAD) F420 CULTIVATOR MANUFACTURER AND DISTRIBUTORS:

Flexi-coil Ltd.
P.O. Box 400
Frontier, Saskatchewan
S0N 0W0

Flexi-coil Ltd.
P.O. Box 1928
Saskatoon, Saskatchewan
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RETAIL PRICE:

\$28,200.00 [February, 1985, f.o.b. Humboldt, 47.5 ft (14.5 m) width, with optional harrows and mud scrapers, and McKay Sweeps].

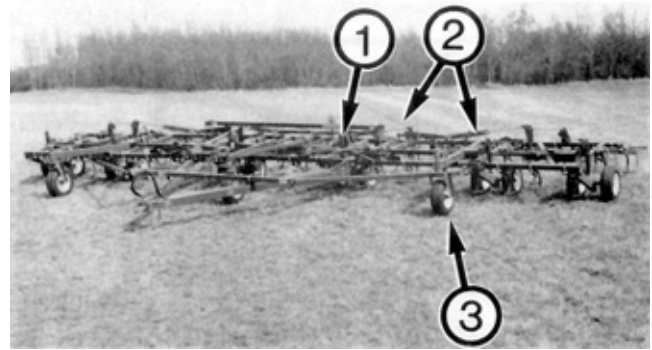


FIGURE 1. Flexi-coil (Friggstad) F420 (1) Depth Control Cylinder, (2) Wing Lift Cylinders, (3) Stabilizer Wheel.

SUMMARY AND CONCLUSIONS

Quality of Work: The Flexi-coil F420 was suitable for secondary tillage and light primary tillage, but not for heavy primary tillage with 11 in (280 mm) sweeps. Thespring cushioned shanks could lift 14 in (356 mm) to clear stones. When equipped with 47 degree sweeps, sweep pitch ranged from 3.5 to 6 degrees over the normal range of secondary tillage draft. Shank cushion spring preload was exceeded at drafts greater than 329 lb/ft (4.8 kN/m), well below the limit of the primary tillage draft range.

Penetration was very good in most conditions. Excessive furrow bottom ridging occurred in heavy primary tillage with 11 in (280 mm) sweeps. The floating hitch and wings allowed the Flexi-coil F420 to follow rolling field contours extremely well. Uniformity of the tillage depth was excellent.

Trash clearance was good. However, plugging occurred near the wheels when damp or large amounts of dry trash were encountered. The field surface left by the Flexi-coil was good, providing fine harrows were used. The harrows left bunches, typical of all mounted harrows, on the field surface in heavy trash. Weed kill was good except in heavy trash conditions where the harrows were less effective.

Ease of Operation and Adjustment: Ease of hitching to the Flexi-coil F420 was very good. The rigid hitch link and hitch jack made one-man hitching easy. Ease of transporting the Flexi-coil F420 was very good. It could be placed into transport in less than five minutes. Maneuverability was very good.

Ease of levelling was very good. Adequate adjustment was provided for fore-and-aft frame levelling and lateral levelling of the wings. Ease of setting tillage depth was very good. A hydraulic depth stop was provided on the single depth cylinder. Ease of installing sweeps and shanks was very good. About 10 minutes was required to install a new shank.

Power Requirements: In light secondary tillage, at 6 mph (9.7 km/h) and 3 in (75 mm) depth, a tractor with 158 hp (118 kW) maximum power take-off rating will have sufficient power reserve to operate the 47.5 ft (14.5 m) wide Flexi-coil F420. In heavy secondary or light primary tillage at the same depth and speed, a 233 hp (174 kW) tractor is required.

Safety: The Flexi-coil F420 was equipped with centre frame and wing transport locks. In transport, the tires of the centre section were overloaded with the added weight of the mounted harrows. A slow moving vehicle sign was provided.

Operator's Manual: The operator's manual provided useful information, was well written and clearly illustrated. It contained very little information on operation and depth adjustment procedures.

Mechanical History: The hex nuts on three shank pivot bolts worked loose. The two front stabilizer springs came unhooked frequently. The adjustment bolts and housing clamps which position and hold the front stabilizer wheels in place had to be replaced because of serious wear. Several other minor mechanical problems occurred during the test.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifications to improve access to the stabilizer wheel height adjustment.
2. Modifications to eliminate the need to adjust the mud scrapers each time the tillage depth is reset.
3. Adding more complete depth adjustment instructions to the operator's manual.
4. Modifications to prevent the shank pivot bolts from loosening
5. Modifications to prevent damage to the guard covering the hydraulic lines on the hitch when the tractor tire contacts the hitch during sharp left turns
6. Modifications to eliminate unhooking of the two springs attached between the front stabilizer wheels and the floating hitch used to keep the cultivator from tipping backwards when raised in field position.
7. Modifications to reduce excessive wear of the bolts and housing clamps used to adjust the height of the stabilizer wheels.

Senior Engineer: G.E. Frehlich

Project Engineer: H.D. Kydd

Project Technologist: M.J. Bennettl

THE MANUFACTURER STATES THAT:

With regard to recommendation number:

1. Modifications to the design of the height adjustment mechanism are being considered.
2. No modifications in the design of the mud scrapers are being considered at this time.
3. A review of the depth adjustment instructions in the operator's manual will be made with the intent of providing more complete instructions in future operator's manuals.
4. The problem has been recognized and modifications will be considered.
5. No modifications are being considered at this time to the placement of the hydraulic lines or the protective guard.
6. The problem has been recognized and modifications are being considered.
7. Modifications to the castor mount are currently being tested, which incorporate features to improve the wear characteristics, as well as to correct the adjustment problem outlined in Recommendation No 1.

GENERAL DESCRIPTION

The Flexi-coil F420 is a trailing, flexible, five section intermediate cultivator suitable for light primary tillage such as first operation summerfallow, or secondary tillage as seedbed preparation, herbicide incorporation, and heavy secondary summerfallow. It is not intended for heavy primary tillage with 11 in (280 mm) sweeps.

It is available in widths from 34 ft (10.3 m) to 58 ft (17.9 m). The test machine has a standard frame which incorporates a three bar design with 9 in (230 mm) spacing. This can be extended to four bars to accommodate the optional 6.75 in (171 mm) spacing. Both the hitch and the wings are hinged to the centre frame of the Flexi-coil F420. This allows all sections to float independent of each other and of the tractor. The test machine is 47.5 ft (14.5 m) wide with a 14.5 ft (4.4 m) wide centre frame, two 9 ft (2.7 m) wide inner wings, and two 7.5 ft (2.3 m) wide outer wings.

The centre frame is carried by four wheels, while each wing is supported by two wheels. A single hydraulic cylinder controls tillage depth. The wings fold into transport position with six hydraulic cylinders connected in parallel. A tractor with dual remote hydraulic controls is needed to operate the Flexi-coil F420. The test machine is equipped with optional three row harrows.

Detailed specifications are given in APPENDIX I, and FIGURE 1 shows the location of major components.

SCOPE OF TEST

The Flexi-coil F420 was operated in the field conditions shown in TABLE 1 for 93 hours while cultivating approximately 1593 ac (645 ha). It was evaluated for quality of work, ease of operation and adjustment, power requirements, safety, and suitability of the operator's manual.

TABLE 1. Operating Conditions

FIELD CONDITIONS	HOURS	FIELD AREA	
		ac	(ha)
Soil Type			
— sand	16	445	(180)
— light loam	61	798	(323)
— loam	5	10	(45)
— clay	11	240	(97)
TOTAL	93	1593	(645)
Stony Phase			
— stone free	23	525	(213)
— occasional stones	45	683	(276)
— moderately stony	10	215	(87)
— very stony	15	170	(69)
TOTAL	93	1593	(645)

RESULTS AND DISCUSSION

QUALITY OF WORK

Shank Characteristics: Many manufacturers use different shank and sweep stem angles (FIGURE 2) when designing their cultivators. Sweeps and shanks must be matched to obtain sufficient sweep pitch to achieve and maintain penetration. Usually manufacturers recommend sweeps with a stem angle from 0 to 5 degrees less than the shank stem angle to result in a slightly positive no-load sweep pitch.

Sweep pitch increases in proportion to draft due to shank flexing. Depending on shank stiffness and cushion-spring preload, sweep pitch may become excessive on some cultivators in normal tillage. A slightly positive sweep pitch results in uniform tillage depth and a smooth furrow bottom while excessive sweep pitch causes furrow bottom ridging, rapid sweep tip wear, and increased draft. Shanks which maintain a low, relatively constant sweep pitch over the normal range of tillage forces, are desirable.

The Flexi-coil F420 was equipped with spring-cushioned shank holders, spaced at 9 in (230 mm) intervals. Spring tension was nonadjustable. The Flexi-coil F420 was used with 11 in (280 mm) sweeps having a 47 degree stern angle. This gave a no-load sweep pitch of 3.5 degrees.

FIGURE 3 shows the pitch characteristics of the shank assemblies on the Flexi-coil F420. The lower sloped line results from shank flexing, while the steep upper line occurs when draft is large enough to overcome cushion-spring preload. Over the normal secondary tillage draft range, sweep pitch varied 2.5 degrees. With the 47 degree sweeps this represents a working sweep pitch range from 3.5 to 6 degrees in secondary tillage

Shank cushion-spring preload was exceeded at a draft of 329 lb/ft (4.8 kN/m), well below the upper limit of the primary tillage draft range. This shows that the Flexi-coil F420 was suitable for both secondary and light primary tillage, but not for heavy, primary tillage.

FIGURE 4 shows the lifting pattern when shanks encountered stones or field obstructions. Maximum lift height was 14 in (356 mm). The two shanks directly in front of the rear centre frame hinges had a maximum lift height of 9 in (229 mm). No problem was encountered with this throughout the test.

Penetration: Penetration was very good in most field conditions. In heavy primary tillage, excessive furrow bottom ridging occurred as the draft exceeded the shank cushion spring preload.

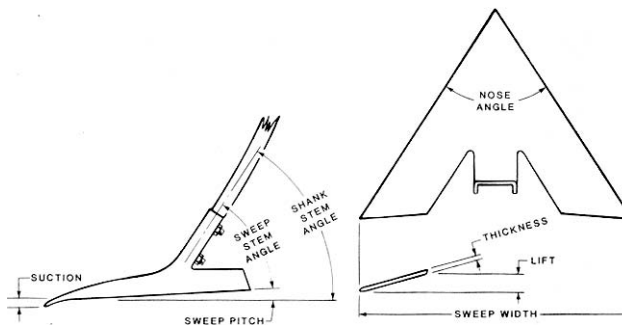


FIGURE 2. Shank and Sweep Terminology.

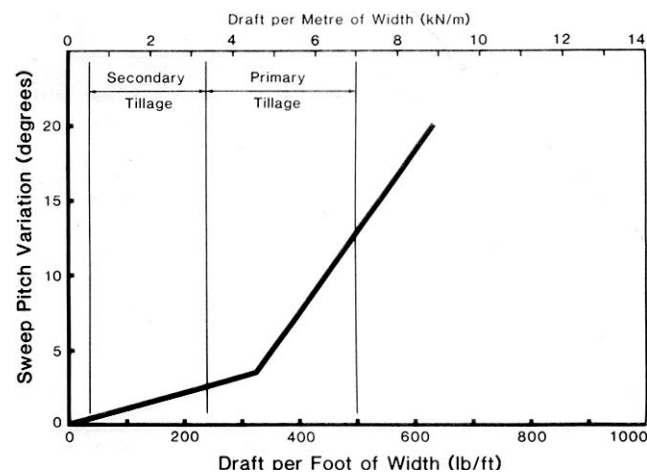


FIGURE 3. Sweep Pitch Variation over a Normal Range of Draft [9 in (230 mm) Shank Spacing].

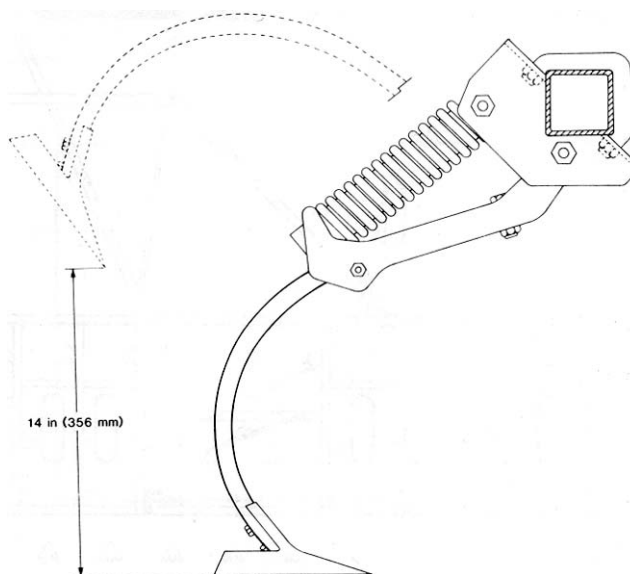


FIGURE 4. Shank Lifting Pattern.

Uniformity of the tillage depth across the cultivator width was excellent provided the frame was properly levelled. The Flexi-coil F420 followed gently rolling field contours very well, maintaining uniform depth across its width. Even with sudden contour changes in a field, depth remained very constant due to the floating hitch and wings. The front stabilizer wheels minimized twisting of the wing frames.

The spring-cushioned shanks of the Flexi-coil F420 held the sweeps level resulting in an even furrow bottom in secondary tillage. Furrow bottom ridging became excessive in heavy primary tillage as the draft exceeded the shank cushion-spring preload causing excessive sweep pitch.

Trash Clearance: Trash clearance of the Flexi-coil F420 was good. The 9 in (230 mm) lateral shank spacing and 24.75 in (629 mm) sweep-to-frame clearance was suitable for clearing large amounts of dry trash. Plugging occurred in damp trash.

Trash Burial and Field Surface: In moderate trash conditions the harrows were effective in distributing the trash evenly. In heavy trash the harrows left bunches on the field surface (FIGURE 5), typical of all mounted harrows. In light trash the harrows were effective in levelling the ridges left by the cultivator to produce a uniform seedbed (FIGURE 6).

Skewing and Stability: The Flexi-coil F420 was very stable and did not skew sideways in any field conditions. The sweep pattern (FIGURE 7) was symmetrical and did not impose any side forces on the cultivator during normal tillage. Skewing was minimal on hillsides or where soil hardness varied across the machine width. With 11 in (280 mm) sweeps, the cultivator had to skew more than 1.4 degrees for weed misses to occur.

Weed Kill: Weed kill was good with the 11 in (280 mm) sweeps and 9 in (230 mm) shank spacing. The finishing harrows were effective in exposing weeds in light trash conditions. The harrows were less effective in exposing weeds in heavy trash conditions.

EASE OF OPERATION AND ADJUSTMENT

Hitching: Ease of hitching to the Flexi-coil F420 was very good. The hitch jack and rigid hitch link made one-man hitching easy. Hitch weight was positive in transport and field position with mounted harrows.



FIGURE 5. Typical Field Surface in Heavy Trash Conditions.



FIGURE 6. Typical Seedbed Preparation.

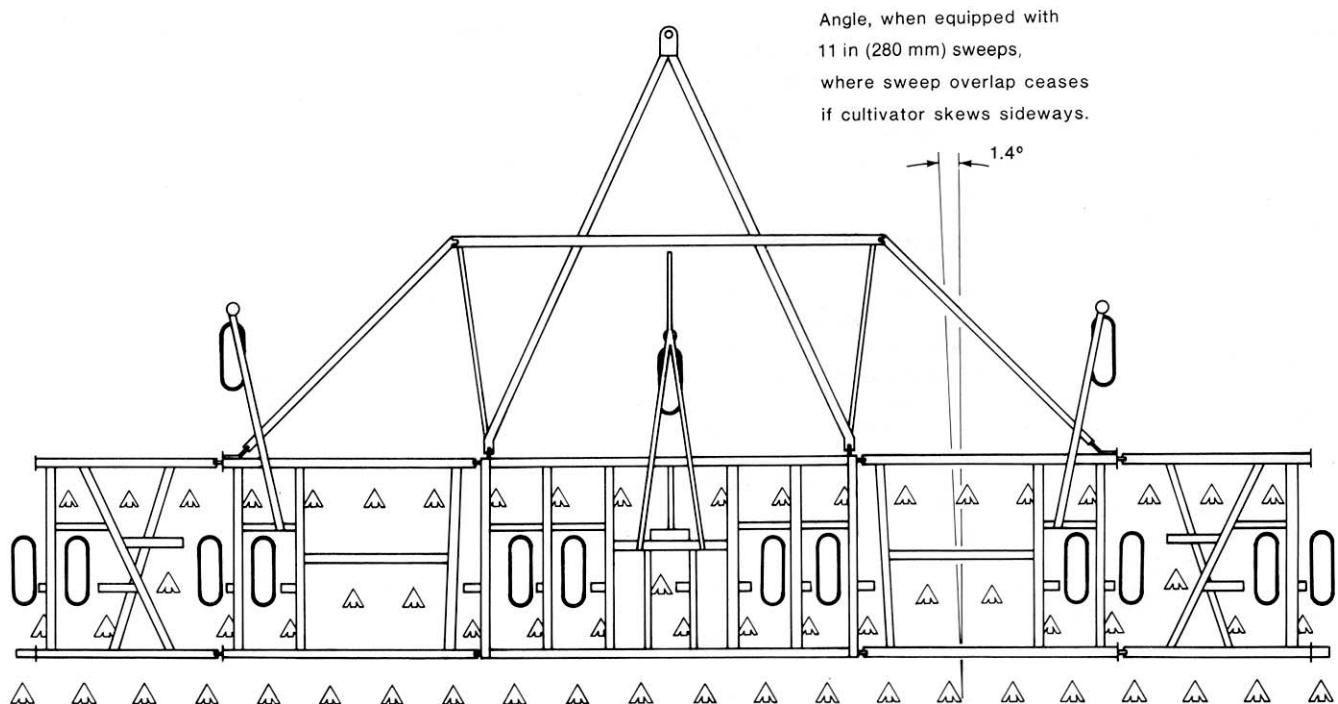


FIGURE 7. Sweep Pattern [9 in (230 mm) Shank Spacing].

Transporting: Ease of transporting the Flexi-coil F420 was very good. It was easily placed in transport position (FIGURE 8) by one person in less than five minutes. Locks were provided for the wings and the centre frame wheels. The transport locks could be inserted without climbing on the cultivator frame.

The harrow locks allowed the harrows to be raised individually for greater ground clearance during transport.

Transport width of the test machine was 18.9 ft (5.7 m) while transport height was 13.4 ft (4.1 m). Care was needed when transporting on public roads, through gates, over bridges, and beneath power lines. A wheel tread of 9.7 ft (2.9 m) provided sufficient field and road stability while in the transport position.

The Flexi-coil F420 towed well without sway at normal transport speeds. A sweep-to-ground distance of 5.9 in (150 mm) provided adequate ground clearance.

Maneuverability: The maneuverability of the Flexi-coil F420 was very good. Care was needed to ensure that the rear tractor wheels did not interfere with the hitch during tight turns. On the test machine there were not enough sweeps beyond the outer wheels to allow moderate overlap without running a wheel on cultivated ground. Extensions are available to eliminate this. Running all wheels on untilled soil helps maintain proper flotation and a uniform tillage depth.

Frame Levelling: Ease of frame levelling was very good. Adjustment was provided for lateral levelling of the main frame and each wing section, as shown in FIGURE 9. Front-to-back levelling was obtained by adjusting the forward mounted stabilizer wheels. This adjustment was time-consuming due to the difficult access to the adjusting bolt. It is recommended that the manufacturer consider modifications to improve access to stabilizer wheel height adjustment.

The floating hitch eliminated the need to adjust the hitch height.

Depth Adjustment: Ease of setting tillage depth was very good. Tillage depth was controlled by a single hydraulic cylinder mechanically connected to each set of depth control wheels (FIGURE 10). A hydraulic stop valve on the control cylinder was adjusted to set tillage depth. Each time the tillage depth was reset, the mud scrapers had to be readjusted. It is recommended that the manufacturer consider modifications to eliminate this frequent adjustment of the scrapers.

Sweep and Shank Installation: It took one person about 3-1/2 hours to replace the 64 sweeps on the Flexi-coil F420. Thread damage to the sweep bolts from soil abrasion was minimal and did not hinder the removal of the nuts. A shank could be replaced in 10 minutes by removing two bolts.

POWER REQUIREMENTS

Draft Characteristics: FIGURE 11 shows draft requirements for cultivators in typical primary and secondary tillage at a speed of 5 mph (8 km/h). This figure gives average requirements based on tests of 27 cultivators and 53 different field conditions. Attempting to compare draft requirements of different makes of cultivators usually is unrealistic. Draft requirements for the same cultivator, in the same field, may vary by as much as 30% in two different years, due to changes in soil conditions. Variations in soil conditions affect draft much more than variations in machine make, usually making it impossible to measure any significant draft differences between makes of cultivators.

In light secondary tillage, such as seedbed preparation and herbicide incorporation, average draft at 5 mph (8 km/h) varied from 55 lb/ft (0.8 kN/m) at 1.6 in (40 mm) depth to 150 lb/ft (2.2 kN/m) at 4 in (100 mm) depth. For the 47.5 ft (14.5 m) wide test machine, this corresponds to a total draft ranging from 2613 to 7125 lb (11.6 to 31.7 kN).

In heavy secondary and light primary tillage, average draft varied from 90 lb/ft (1.3 kN/m) at 1.6 in (40 mm) depth to 250 lb/ft (3.7 kN/m) at 5 in (125 mm), corresponding to a total draft ranging from 4275 to 11875 lb (19.0 to 52.8 kN) for the 47.5 ft (14.5 m) wide test machine.

Increasing speed by 1.0 mph increased draft by 10 lb/ft (90 N/m) draft increase for each 1.0 km/h speed increase). This represents

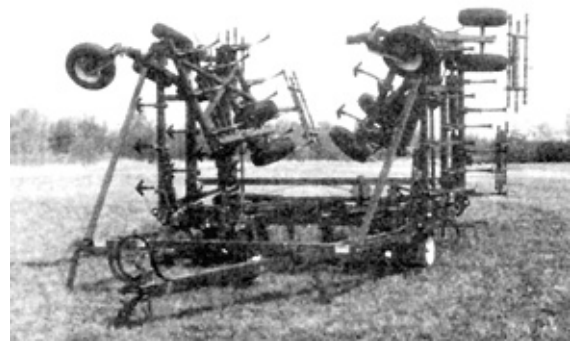


FIGURE 8. Transport Position.

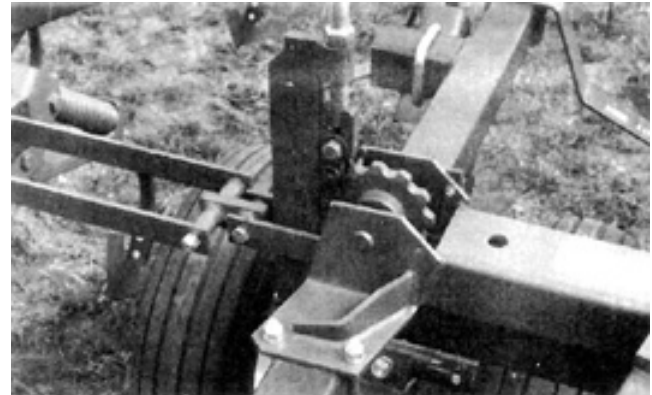


FIGURE 9. Lateral Levelling Adjustment.

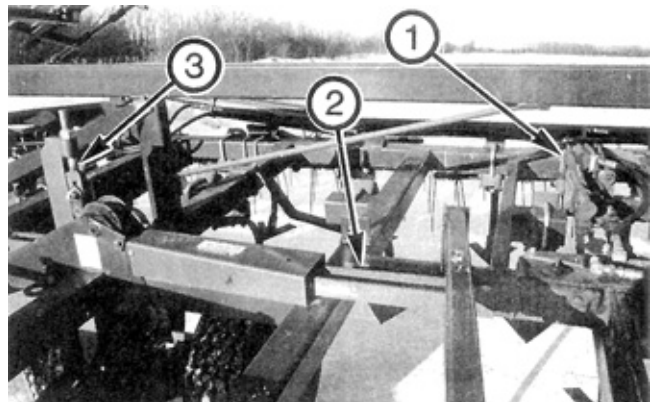


FIGURE 10. Depth Linkage (1) Depth Cylinder, (2) Mechanical Linkage, (3) Thrust Bar Adjustment Bolt.

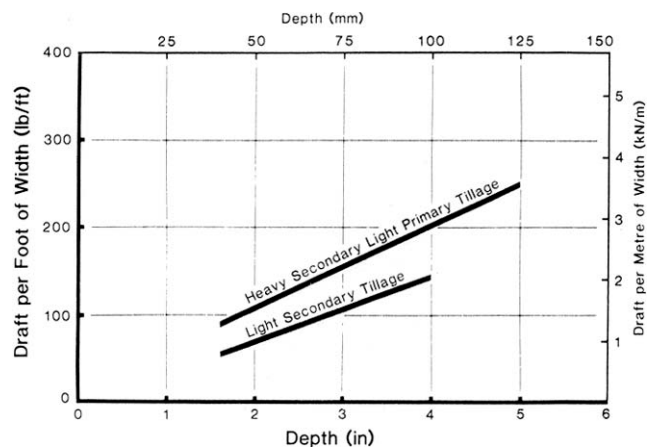


FIGURE 11. Average Draft Requirements for Intermediate Cultivators at 5 mph (8 km/h).

a total draft increase of 475 lbs for a 1.0 mph speed increase (1.3 kN for a 1.0 km/h speed increase) for the test machine.

Tractor Size: TABLES 2 and 3 show tractor size needed to operate the 47.5 ft (14.5 m) wide Flexi-coil F420 in light secondary tillage as well as in heavy secondary or light primary tillage. The Flexi-coil F420 was not suited for heavy primary tillage operations with 11 in (280 mm) sweeps.

Tractor sizes have been adjusted to include tractive efficiency and represent a tractor operating at 80% of maximum power on a level field. The sizes presented in the tables are the maximum power take-off rating, as determined by Nebraska tests or as presented by the tractor manufacturer. Selected tractor sizes will have ample power reserve to operate the Flexi-coil F420 in the stated conditions.

Tractor size may be determined by selecting the desired tillage depth and speed from the appropriate table. For example, in light secondary tillage at 3 in (75 mm) depth and 6 mph (9.7 km/h) a 158 hp (118 kW) tractor is needed to operate the Flexi-coil F420. In heavy secondary or light primary tillage at the same depth and speed, a 233 hp (174 kW) tractor is required.

TABLE 2. Tractor Size: Maximum Power Take-Off Rating hp (kW) Required to Pull the 47.5 ft (14.5 m) Flexi-coil F420 in Light Secondary Tillage.

DEPTH in (mm)	SPEED mph (km/h)		
	5 (8)	6 (9.7)	7 (11.3)
2 (50)	74 (55)	103 (77)	119 (89)
3 (75)	118 (88)	158 (118)	180 (134)
4 (100)	162 (121)	213 (159)	239 (179)

TABLE 3. Tractor Size: Maximum Power Take-Off Rating hp (kW) Required to Pull the 47.5 ft (14.5 m) Flexi-coil F420 in Heavy Secondary or Light Primary Tillage.

DEPTH in (mm)	SPEED mph (km/h)		
	5 (8)	6 (9.7)	7 (11.3)
2 (50)	122 (91)	170 (127)	198 (148)
3 (75)	173 (129)	233 (174)	268 (200)
4 (100)	233 (166)	296 (221)	335 (250)
5 (125)	272 (203)	358 (267)	406 (303)

OPERATOR SAFETY

Extreme caution is needed in transporting most folding cultivators to avoid contacting power lines. Minimum power line heights over farmland or secondary roads vary in the three prairie provinces. In Alberta and Manitoba, lines over roads may be as low as 16 ft (4.8 m). In Saskatchewan, they may be as low as 17 ft (5.2 m). In all three provinces, lines in farmyards may be as low as 15 ft (4.6 m).

Transport height of the 47.5 ft (14.5 m) wide five section test machine was 13.4 ft (4.1 m) permitting safe transport under prairie power lines. The legal responsibility for safe passage under utility lines rests with the machinery operator and not with the power utility or machinery manufacturer. All provinces have regulations governing maximum permissible equipment heights on various types of public roads. If height limits are exceeded, the operator must contact power and telephone utilities before moving.

The test machine was 18.9 ft (5.7 m) wide in transport position and required caution when transporting. A slow moving vehicle sign was supplied.

Transport locks for the centre frame and the wings were provided. The locks could be positioned without climbing on the machine. A lockout bar was provided to secure the frame in the raised position for maintenance. The rigid hitch link and hitch jack allowed safe hitching by one person.

The tires of the cultivator without mounted harrows were adequate for transport speeds of 20 mph (32 km/h). The load on the centre section tires exceeded the Tire and Rim Association maximum load ratings by 14% when the cultivator was fitted with mounted harrows and in the transport position.

STANDARDIZATION

Sweep Bolt Holes: The bolt hole size and spacing on cultivator sweeps and shanks, as well as stem angles, should be standardized to provide some degree of interchangeability of sweeps.

OPERATOR'S MANUAL

The operator's manual supplied instructions on setup, lubrication, maintenance, and safety. It also provided a complete parts listing. It was well written and clearly illustrated. Depth adjustment instructions were incomplete, and it is recommended that more complete instructions be added to the operator's manual.

MECHANICAL HISTORY

TABLE 4 outlines the mechanical history of the Flexi-coil F420 during 93 hours of field operation while tilling 1593 ac (645 ha).

The intent of the test was evaluation of functional performance. The following mechanical problems occurred during functional testing. An extended durability test was not conducted.

TABLE 4. Mechanical History

ITEM	OPERATING HOURS	EQUIVALENT FIELD AREA	
		ac	(ha)
-- hex nuts worked loose from three shank pivot bolts and were replaced at	40	650	(263)
	93	1593	(645)
-- seven shanks were slightly bent while working in severe rock conditions and were replaced			During the test
-- the seal on the depth stop started to leak and was replaced at	78	1250	(506)
-- two flat tires occurred when the rims were damaged while working in severe rock conditions. The rims and tires were repaired at	85	1400	(567)
-- the guard over the hydraulic lines was torn loose by the tractor tire during a sharp turn. It was repaired at	26	375	(152)
-- two harrow tines worked loose and were replaced at	19	300	(121)
	26	375	(152)
-- the two front stabilizer springs fell off and were replaced			Several times during the test
-- the adjustment bolt and housing clamp on each of the stabilizer wheels were replaced			Several times during the test
-- the thrust bar adjustment bolt was replaced at			End of test

Shank and Holder: During testing the hex nuts worked loose from three shank pivot bolts. It is recommended that the manufacturer consider modifications to the shank pivot assembly to prevent this.

Frame: The guard covering the hydraulic lines on the top of the hitch was torn loose by the tractor tire during a sharp left turn. It is recommended that the manufacturer consider modifications to prevent damage to the guard and hydraulic lines.

Two springs were attached between the front stabilizer wheels and the floating hitch to prevent the cultivator frame from tipping back when raised out of the ground in field position. In transport position or when lowered in field position, these springs were not in tension and continuously came unhooked. It is recommended that the manufacturer consider modifications to prevent the springs from coming unhooked.

The thrust bar adjustment bolt on one of the inner wing sections was bent by the outer wing frame when put into transport position. This only occurred when the wings were folded into transport without first fully raising the cultivator.

Stabilizer Wheels: Wear on the bolt and housing clamps for adjusting the height of the stabilizer wheels was excessive. The bolts and clamps had to be replaced several times during the test. It is recommended that the manufacturer consider modifications to reduce this excessive wear.

APPENDIX I

SPECIFICATIONS

MAKE:	Flexi-coil (Friggstad)		
MODEL:	F420		
SERIAL NO.:	420-84-162		
MANUFACTURER:	Flexi-coil Ltd P.O. Box 400 Frontier, Saskatchewan S0N 0W0		
OVERALL DIMENSIONS:	<u>FIELD POSITION</u> <u>TRANSPORT POSITION</u>		
-- width	47.5 ft (14.5 m)	8.9 ft	(5.7 m)
-- length			
-- with mounted harrows	27.6 ft (8.4 m)	7.4 ft	(8.4 m)
-- height	4.9 ft (1.5 m)	3.4 ft	(4.1 m)
-- maximum ground clearance	5.9 in (150 mm)	5.9 in	(150 mm)
-- wheel tread	47.5 ft (14.5 m)	90.7 ft	(2.9 m)
SHANKS:			
-- number	64		
-- lateral spacing	9 in (230 mm)		
-- trash clearance (frame to sweep tip)	24.7 in (627 mm)		
-- number of shank rows			
-- centre section	3		
-- wings	3		
-- distance between rows	28 in (710 mm)		
-- shank cross section	0.75 x 1.75 in (19 x 44 mm)		
-- shank stem angle	50 degrees		
-- sweep hole spacing	1.75 in (44 mm)		
-- sweep bolt size	7/16 x 1.5 in		
HITCH:			
-- hinged	eliminates need for hitch height adjustment		
DEPTH CONTROL:	hydraulic		
FRAME:			
-- cross section	4 in (100 mm) square tubing		
TIRES:			
-- centre section	4, 9.50 x 16.5 LT, 8 ply		
-- wing sections	8, 9.50 x 15, 6 ply		
-- stabilizer wheels	3, 9.50 x 15, 6 ply		
NUMBER OF LUBRICATION POINTS:			
-- grease fittings	91		
-- wheel bearings	15		
HYDRAULIC CYLINDERS:			
-- depth control	1, 5 x 12 in (127 x 305 mm)		
-- primary wing lift	4, 4 x 24 in (100 x 610 mm)		
-- secondary wing lift	2, 4 x 30 in (100 x 760 mm)		
WEIGHTS (WITHOUT HARROWS):	<u>FIELD POSITION</u> <u>TRANSPORT POSITION</u>		
-- right secondary wheels	972 lb (442 kg)		
-- right primary wheels	1936 lb (880 kg)		
-- right centre wheels	3494 lb (1588 kg)	6182 lb	(2810 kg)
-- left centre wheels	3524 lb (1602 kg)	6116 lb	(2780 kg)
-- left primary wheels	1918 lb (872 kg)		
-- left secondary wheels	966 lb (439 kg)		
-- hitch	<u>570 lb (260 kg)</u>	<u>1082 lb (493 kg)</u>	
TOTAL	13,380 lb (6083 kg)	13,380 lb	(6083 kg)
WEIGHTS (WITH MOUNTED HARROWS):	<u>FIELD POSITION</u> <u>TRANSPORT POSITION</u>		
-- right secondary wheels	1159 lb (527 kg)		
-- right primary wheels	2314 lb (1052 kg)		
-- right centre wheels	3597 lb (1635 kg)	7130 lb	(3241 kg)
-- left centre wheels	3637 lb (1653 kg)	7090 lb	(3223 kg)
-- left primary wheels	2464 lb (1120 kg)		
-- left secondary wheels	1096 lb (498 kg)		
-- hitch	<u>603 lb (274 kg)</u>	<u>650 lb (295 kg)</u>	
TOTAL	14,870 lb (6759 kg)	14,870 lb	(6759 kg)
OPTIONAL EQUIPMENT INCLUDED:			
-- mounted finishing harrows (three row)			
wheel mud scrapers			
9.5 x 16.5 LT tires, 8.25 x 16.5 rims			
OPTIONAL EQUIPMENT AVAILABLE:			
-- 4 bar frame design, 6.75 in (171 mm) spacing			
-- 10 width options from 34 to 58 ft (10.3 to 17.9 m)			

APPENDIX II

MACHINE RATINGS

The following rating scale is used in Machinery Institute Evaluation Reports:

excellent	fair
very good	poor
good	unsatisfactory

SUMMARY CHART

Flexi-coil (FRIGGSTAD) F420 CULTIVATOR

RETAIL PRICE	\$28,200.00 [February, 1985, f.o.b., Humboldt, 47.5 ft (14.5 m) width, with optional harrows and mud scrapers, and McKay sweeps].
QUALITY OF WORK	
Shank Characteristics	
-- trip clearance	14 in (356 mm); restricted at centre frame hinge locations
-- spring preload exceeded	329 lb/ft (4.8 kN/m); not suitable for heavy primary tillage with 11 in (280 mm) sweeps
-- working sweep pitch	3.5 to 6 degrees; over normal range of secondary tillage
Penetration	
-- ability	Very Good ; excessive furrow bottom ridging in heavy primary tillage
-- uniformity	Excellent ; due to floating hitch and wings
Trash Clearance	Good ; plugged in damp trash
Trash Burial and Field Surface	Good ; harrows left bunches of straw in heavy trash
Weed Kill	Good ; harrows were less effective in heavy trash
EASE OF OPERATION AND ADJUSTMENT	
Transporting	Very Good ; locks were easily installed
Hitching	Very Good ; hitch weight was always positive
Maneuverability	Very Good
Frame Levelling	Very Good ; a more complete procedure should be in operator's manual
Depth Adjustment	Very Good ; a hydraulic stop valve was provided
Sweep and Shank Installation	Very Good ; approximately 10 minutes required to replace a shank
POWER REQUIREMENTS	
Light Secondary Tillage	158 hp (118 kW) at 3 in (75 mm) depth and 6 mph (9.7 km/h)
Heavy Secondary or Light Primary Tillage	233 hp (174 kW) at 3 in (75mm) depth and 6 mph (9.7 km/h)
OPERATOR SAFETY	Operator does not have to climb on machine to position transport locks Lock out bar provided to lock frame up during maintenance
OPERATOR'S MANUAL	Very Good ; well written and clearly illustrated More complete depth adjustment procedure required
MECHANICAL HISTORY	Hex nuts worked loose on three shank pivot bolts Front transport springs fell off frequently Serious wear of adjustment bolt and housing clamp on each stabilizer wheel



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