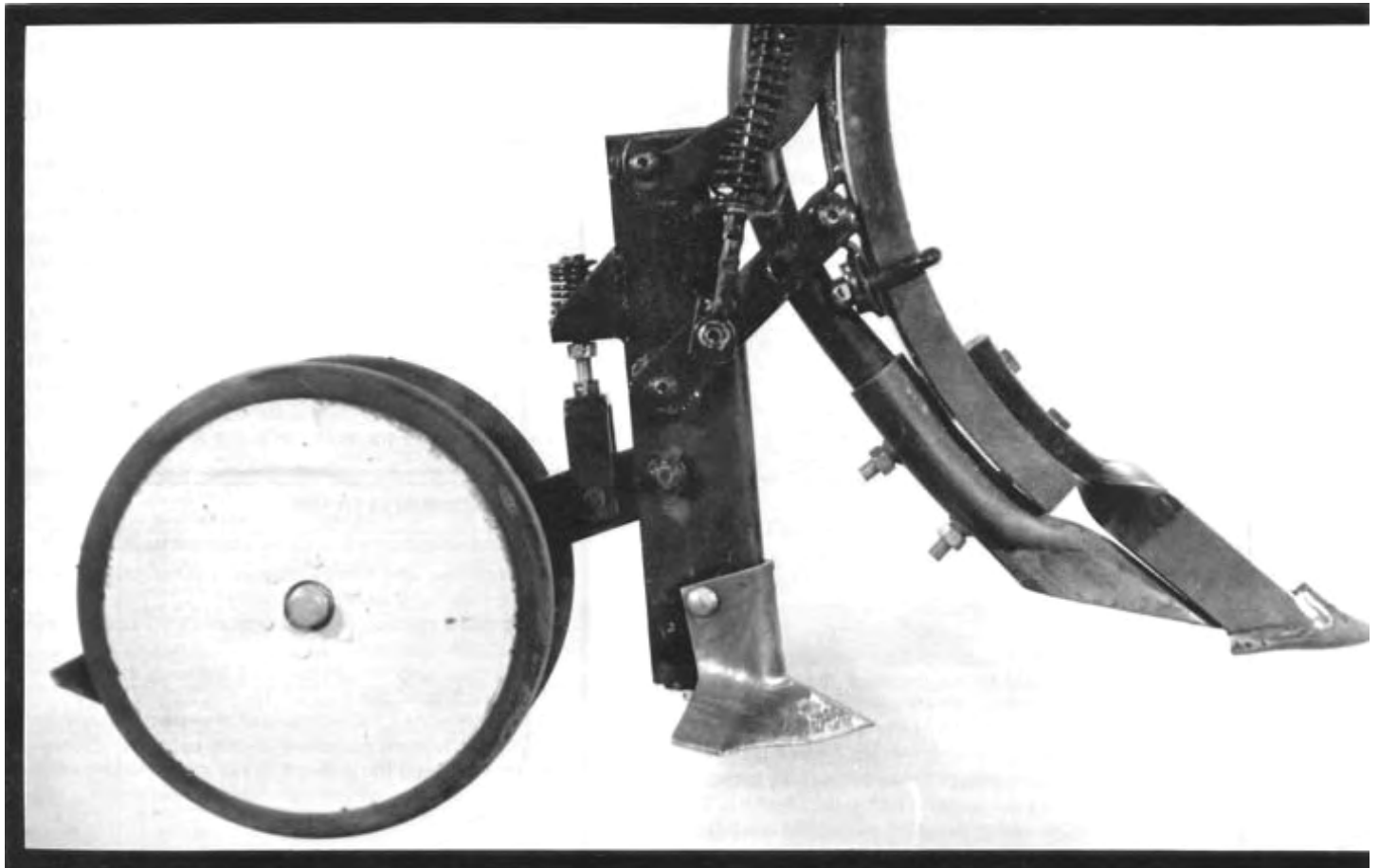


# Evaluation Report

# 571



**Morris Air Hoe Packer Attachment**

A Co-operative Program Between



## MORRIS AIR HOE PACKER ATTACHMENT

### MANUFACTURER AND DISTRIBUTOR:

Morris Rod Weeder Co. Ltd.  
85 York Road  
Yorkton, Saskatchewan  
S3N 2X2

### RETAIL PRICE:

\$245.00 (March, 1988, f.o.b. Lethbridge, Alberta).

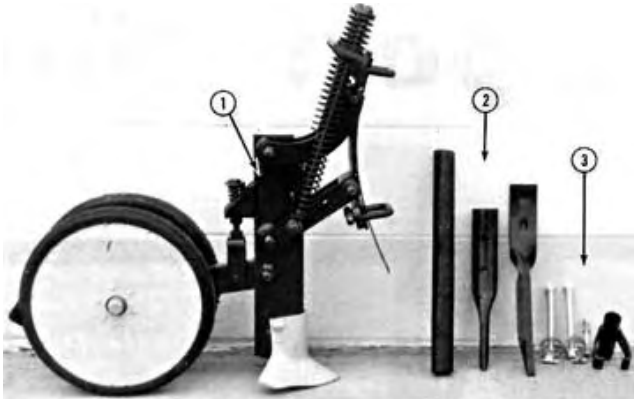


FIGURE 1. Morris Air Hoe Packer Attachment: (1) Hoe Opener and Packer Assembly, (2) Knife Opener and Boot, (3) Attaching Hardware.

## SUMMARY AND CONCLUSIONS

### Quality of Work

Penetration of the Morris Air Hoe Packer Attachment was good. Penetration of the hoe opener in primary conditions depended on the depth of the knife opener and the packing force. Secondary soil conditions improved penetration.

Seed placement of the air hoe packer attachment was good. With the wide sweep, the seed was split evenly into two rows 5 in (127 mm) apart. The rows were distinct with the bandwidth a little wider than that of a hoe drill. With the narrow sweep, the seed was placed in a row with an average bandwidth of 4 in (102 mm). The two rows were not distinct.

The seed depth was difficult to set when operating in summerfallow conditions because the softer soils allowed the seed depth to be affected by changes in the packing force and the depth of the cultivator.

Fertilizer placement of the knife opener was very good. The fertilizer was placed below and directly between the paired rows of seed in a row with a bandwidth of 0.5 in (13 mm). Depth of the fertilizer below the seed was variable.

Soil finishing of the packer attachment was good. Ridge depths left by the narrow spaced packers were an average of 3 in (76 mm) compared to 2 in (51 mm) ridge depths left by the wide spaced packers.

Trash clearance of the Morris Air Hoe Packer Attachment with the 5 in (127 mm) spacing was good and with the 3 in (76 mm) spacing was very good. The only plugging that occurred was in weed patches of fields or in stubble fields with large accumulations of trash.

Operation of the Morris Air Hoe Packer Attachment in stony conditions was very good. No damage occurred to the attachments from operation in stony conditions.

**Ease of Operation and Adjustment:** Ease of transporting the test cultivator with the Morris Air Hoe Packer Attachments mounted was fair. The cultivator had to be raised up to allow for more ground clearance.

Ease of setting the seed depth was fair. Seed depth was controlled by the vertical distance between the packer and the hoe opener. Ease of setting the packing force was poor. Packing force was controlled by the spring length or tension. Changing the tension required a small pry-bar to compress the spring.

The fertilizer boots did not plug during the test. The seed deflectors with the 3 in (76 mm) spaced packers would plug with soil when their packers stopped turning in very moist conditions.

This was caused by a lack of clearance between the packer and the packer arm.

**Power Requirements:** Draft (drawbar pull) requirements depended on depth, field preparation, ground speed, soil type and moisture content. The Morris Air Hoe Packer Attachment pulled an average of 110% heavier than a 16 in (406 mm) sweep at the same seeding depth. This was with the fertilizer set 2 in (51 mm) deeper than the seed depth on the attachment. Maximum tractor power requirements in primary conditions for one air hoe packer attachment ranged from 4.8 hp to 8.6 hp (3.6 to 6.5 kW).

**Ease of Installation:** Ease of installing the Morris Air Hoe Packer Attachment was fair. Access to the nuts of the top U-bolts were obstructed by the springs. The entire test cultivator had to be raised up to accommodate the air hoe packer attachments.

**Operator Safety:** The Morris Air Hoe Packer Attachment presented two safety hazards during testing. Caution had to be taken when adjusting the spring tension on the packers and hitching the test cultivator was difficult due to the negative hitch weight on the cultivator.

**Operator's Manual:** The operator's manual was rated as good. It contained useful information on set up, operation and maintenance.

**Mechanical History:** Three of the wide sweeps broke during spring seeding. The top jam nuts on the seed adjustment bolts loosened during field operation. The knife openers were worn out at the end of the test.

## RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifying the narrow spaced packer assembly to provide more packer clearance.
2. Correcting the error in the Operator's Manual on seed depth adjustment.
3. Investigating the problem of the wide hoe opener sweeps breaking.
4. Modifying the top jam nut on the depth adjustment bolt to prevent loosening during field operation.
5. Investigating the problem of the misalignment of the fertilizer boots behind the knife openers causing wear on the boots.

Station Manager: R. P. Atkins

Project Engineer: L. Papworth

## THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. This will be investigated to see if it is possible to provide more packer clearance when assembled for narrow spaced rows.
2. The Owner's Manual will be corrected to properly indicate how to adjust the seed depth.
3. The wide hoe opener sweeps breaking was a case of improper heat treatment. Improved quality control will be conducted in this area.
4. The possibility of a lock nut replacing the top jam nut will be investigated as a solution.
5. Tolerances have been tightened on all components to prevent the possibility of any misalignment and subsequent wear on the banding boot.

## GENERAL DESCRIPTION

The Morris Air Hoe Packer Attachment is a combination banding knife, seed hoe opener and packer attachment designed to mount on a conventional cultivator shank and used in conjunction with double shoot air distribution system. The seed is placed in paired rows and deep-bands the fertilizer between and at various depths below the paired seed row. The seed can be placed at 3 in (76 mm) and 5 in (127 mm) spacings. The seed is packed with rubber tire packers located directly behind the hoe opener. The hoe opener and packers are mounted on parallel links connected to the shank. Seed depth is adjusted by the vertical distance between the hoe opener and the rubber tire packers. Packer force is adjusted by the compression on two springs.

The system includes a knife opener and boot, mounted on

the end of the shank, and the hoe opener and packer assembly mounted on the rear of the shank with U-bolts. The knife opener can be used alone but the hoe opener and packer assembly must be used with the knife opener.

FIGURE 1 shows the components of the attachment while detailed specifications are given in APPENDIX I.

## SCOPE OF TEST

Each Morris Air Hoe Packer Attachment was operated in the conditions shown in TABLE 1 for 124.5 hours while seeding 58.6 ac (23.4 ha) per attachment. Soil conditions during the test varied from dry to very moist. The attachments were evaluated for quality of work, ease of operation and adjustment, power requirements, ease of installation, operator safety and suitability of the operator's manual.

The attachments were mounted on a Morris CP 725 chisel plow for the test. The wide sweeps and deflectors were used to seed the spring crops and the narrow sweeps and deflectors were used to seed the fall crops.

TABLE 1. Operating Conditions

Material	Soil Type and Condition	Stone Conditions	Field Area		Hours
			ac	ha	
Wheat	Silt Loam - Secondary	Stone Free	9	3.6	20.5
	Silt Loam - Primary	Stone Free	6.4	2.6	14.5
Barley	Silt Loam - Secondary	Occasional Stones	1.8	0.7	3
	Loam - Secondary	Stone Free	1.8	0.7	4
Oats	Silt Loam - Secondary	Occasional Stones	3.6	1.7	4
Winter Wheat	Silt Loam - Secondary	Occasional Stones	4.8	1.9	10
	Silt Loam to Heavy Loam - Primary	Moderately Stony	10.4	4.1	18
	Loam to Silty Clay Loam - Primary	Occasional Stones	4	1.6	10
	Silt Loam - Primary	Occasional Stones	3.2	1.3	7
	Heavy Loam to Clay - Primary	Occasional Stones	11.2	4.5	21.5
Total			58.6	23.4	124.5

## RESULTS AND DISCUSSIONS

### QUALITY OF WORK

**Penetration:** Penetration of the Morris Air Hoe Packer Attachment was good. Penetration of the hoe opener in primary conditions depended on the depth of the knife opener and the packing force. The hoe opener was held in the ground by compression springs. Spring force could be increased by increasing the packing force or by increasing the depth of the knife opener. It was important to keep a reasonable knife opener depth and packing force in primary conditions. Secondary soil conditions improved penetration. The attachment allowed the depth of the hoe openers to be set deeper for shanks running in tractor tire tracks.

**Seed Placement:** Seed placement of the Morris Air Hoe Packer Attachment was good. When the hoe opener was equipped with the wide sweep and deflector, the seed was split evenly into two rows 5 in (127 mm) apart. The rows were distinct with the bandwidth a little wider than that of a hoe drill.

When the hoe opener was equipped with the narrow sweep and deflector, the seed was placed in a row with an average bandwidth of 4 in (102 mm) as the emerged winter wheat crop shows in Figure 2. The two rows were not distinct with the narrow sweep and deflector.

Variation in seed depth was uniform when seeding with both the wide and narrow sweeps. At an average seeding depth of 1.8 in (45.7 mm) most of the seeds were placed within 0.5 in (13 mm) of the average seed depth.

It was found that the seed depth was difficult to set when operating in summerfallow conditions. The seed depth was controlled by the vertical distance between the sweep and the packers. Pressure on the packers was supplied by the two springs on either side of the hoe opener. The same springs also supplied the force to keep the hoe opener in the soil. The seed depth in summerfallow conditions was affected by changes in the packing force because the packers would sink down. Changes in the depth of the cultivator

also affected the seed depth in summerfallow conditions. This was because an increase in fertilizer depth increased the packing force and increased the seed depth.

Once the depth was set in summerfallow conditions, the variation in seed depth, as mentioned before, was uniform. Seed depth in harder soils, such as stubble conditions, was not significantly affected by changes in the packing force or the depth of the cultivator.



FIGURE 2. Emerged Winter Wheat Seeded with Narrow Spacing.

**Fertilizer Placement:** Fertilizer placement of the Morris knife opener was very good. The fertilizer was placed in a narrow row, below and directly between the paired rows of seed, with an average bandwidth of 0.5 in (13 mm). Depth of the fertilizer below the seed was adjustable.

Variation in the depth of the fertilizer was uniform. Most of the fertilizer was placed within 0.4 in (10.2 mm) of the average fertilizer depth.

**Soil Finishing:** Soil finishing of the Morris Air Hoe Packer Attachment was good. Figure 3 shows the soil surface of a summerfallow field seeded with the wide spacing and Figure 4 shows the soil surface of a stubble field seeded with the narrow spacing. Ridge depths left by the narrow spaced packers were an average of 3 in (76 mm) compared to 2 in (51 mm) ridge depths left by the wide spaced packers.

At knife opener depths of 5 in (127 mm) or greater the soil surface was left excessively lumpy.



FIGURE 3. Soil Surface After Seeding Into Summerfallow With Wide Spacing.

**Trash Clearance:** Trash clearance of the Morris Air Hoe Packer Attachment with the 5 in (127 mm) spacing was good and with the 3 in (76 mm) spacing was very good. The only plugging that occurred was in weed patches or in stubble fields with large accumulations of trash.

The packer attachments reduced the effective distance between the rows of the cultivator. This reduced the ability of the cultivator to clear trash. The 5 in (127 mm) spacing attachments also reduced the effective run spacing of the cultivator by 5 in (127 mm). This further inhibited the ability of the cultivator to clear trash.

Figure 5 shows a stubble field surface after seeding with the 5 in (127 mm) spacing attachments and Figure 6 shows a stubble field surface after seeding with the 3 in (76 mm) spacing attachments.

Trash was trapped between the packers (Figure 7) at the 3 in

(76 mm) spacing when operating in stubble conditions during the test. The reason for the plugging was a lack of clearance between the packers and the scraper.



FIGURE 4. Soil Surface After Seeding Into Stubble With Narrow Spacing.



FIGURE 5. Stubble Field Seeded with Wide Spacing.



FIGURE 6. Stubble Field Seeded with Narrow Spacing.

**Stony Conditions:** Operation of the Morris Air Hoe Packer Attachment in stony conditions was very good. No damage occurred to the attachments from operation in stony conditions.

#### EASE OF OPERATION AND ADJUSTMENT

**Maintenance:** Ease of maintenance of the Morris Air Hoe Packer Attachment was very good. The manufacturer recommended to periodically check bolts for tightness. To inhibit rust the sweeps and knife openers should be coated with oil or grease when stored outside for extended periods. The bushings on the parallel linkage and the packer bearings should also be checked periodically for wear.

**Transporting:** Ease of transporting the test cultivator with the Morris Air Hoe Packer Attachment mounted was fair. The cultivator had to be adjusted to allow for additional ground clearance during road transport.

**Depth/Packing Adjustment:** Ease of setting the seed depth on the Morris Air Hoe Packer Attachment was fair. Seed depth was controlled by the packer and was set by loosening the jam nut

and turning the adjusting bolt shown in Figure 8. Turning the bolt clockwise increased the depth and counter clockwise decreased the depth. A jam nut secured the adjusting bolt. Fertilizer depth was controlled by the cultivator.

Ease of setting the packing force was poor. Packing force was controlled by the spring length. The spring length was adjusted by the spring clip in one of four different positions as shown in Figure 9. Moving the spring clip to another position required a small pry-bar to compress the spring.



FIGURE 7. Trash Trapped Between Packers at Narrow Spacing.

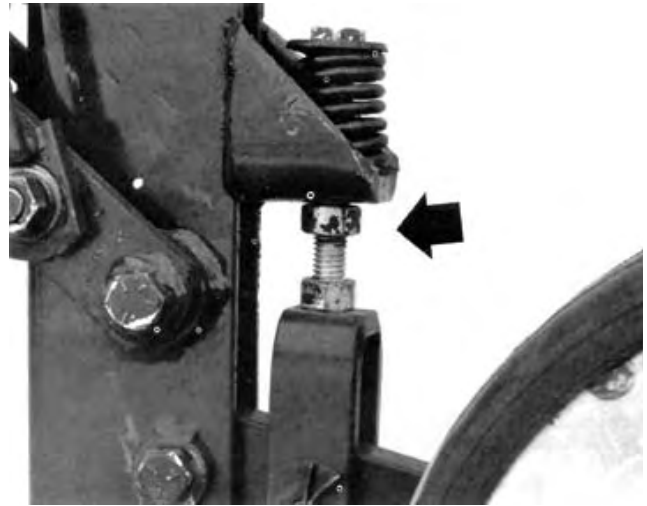


FIGURE 8. Adjustment Bolt for Seed Depth.



FIGURE 9. Spring Tension Adjustment for Packing Force.

**Plugging:** The fertilizer boots did not plug during the test. The seed deflectors with the 3 in (76 mm) spaced packers would plug with soil when their packers stopped turning in very moist soil. When the soil was cleaned out of the deflectors, the seed would not fall down the shank through the deflectors. The openings on the deflectors were very small as shown in Figure 10. The shank had to be shaken or the deflectors removed to clean out the accumulated seed. This was time consuming.

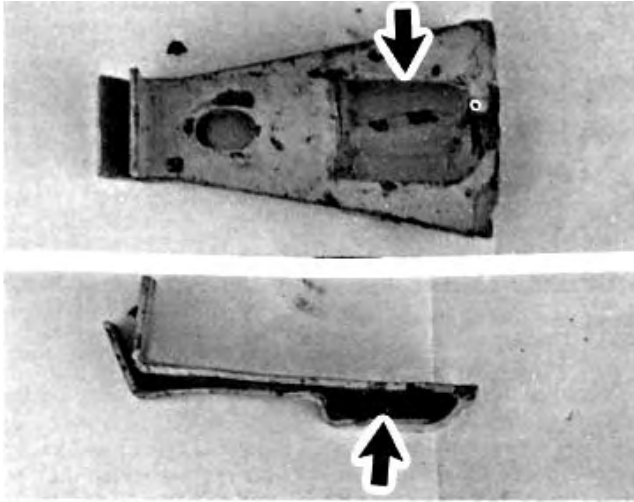


FIGURE 10. Opening on Seed Deflectors.

The seed deflectors were checked in the lab with high rates of oats to see if the small openings would plug. No plugging of the seed deflectors occurred. It should be noted that the seed deflectors required the seed to be conveyed by air and not by gravity.

The seed deflectors also required the use of clean seed. Any material larger than the openings on the deflectors must be cleaned out before seeding.

At the 3 in (76 mm) spacing the packers would stop turning in very moist soil conditions. The reason for this was a lack of clearance between the packers and the packer arm as shown in Figure 11. The spring washers for the packer bolts were moved from the outside of the packers and placed between the packers and the packer arm during the test. This increased the clearance but the packers would still occasionally stop turning. It is recommended that the manufacturer consider modifying the narrow spaced packer assembly to provide clearance between the packers and the packer arm.

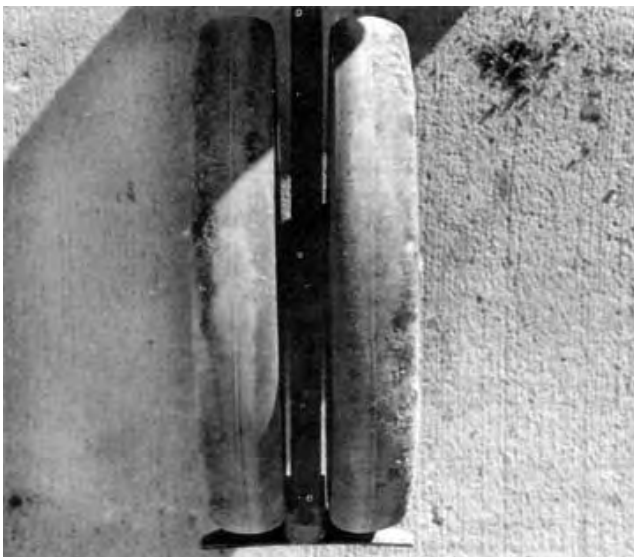


FIGURE 11. Lack of Clearance Between Packer And Packer Arm With Narrow Spacing.

## POWER REQUIREMENTS

**Draft:** Draft (drawbar pull) requirements depended on depth, field preparation, ground speed, soil type and moisture content. Draft measurements were done with a single attachment in primary

silt loam soil at 5 mph (8 km/h). Figure 12 shows the draft of a 16 in (406 mm) sweep (reference) and a Morris Air Hoe Packer Attachment. The attachment was run with the fertilizer depth set 2 in (51 mm) deeper than the seed depth and the packers set on 100 lbs (445 N) force. The attachment pulled an average of 110% heavier than the sweep in the seeding depth range of 2 to 3 in (51 to 76 mm).

Figure 13 shows the draft of a 16 in (406 mm) sweep (reference), a Morris knife opener and a worn knife opener. The knife opener pulled an average of 150 lbs (668 N) less than the sweep at the same working depths. The worn knife opener pulled an average of 50 lbs (223 N) less than a new one at the same working depths.

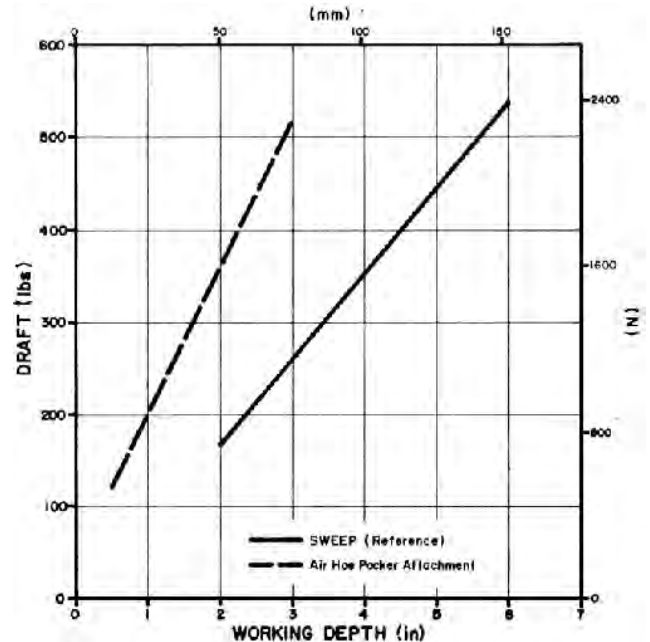


FIGURE 12. Average Drawbar Pull at 5 mph (8 km/h) of Morris Air Hoe Packer Attachment.

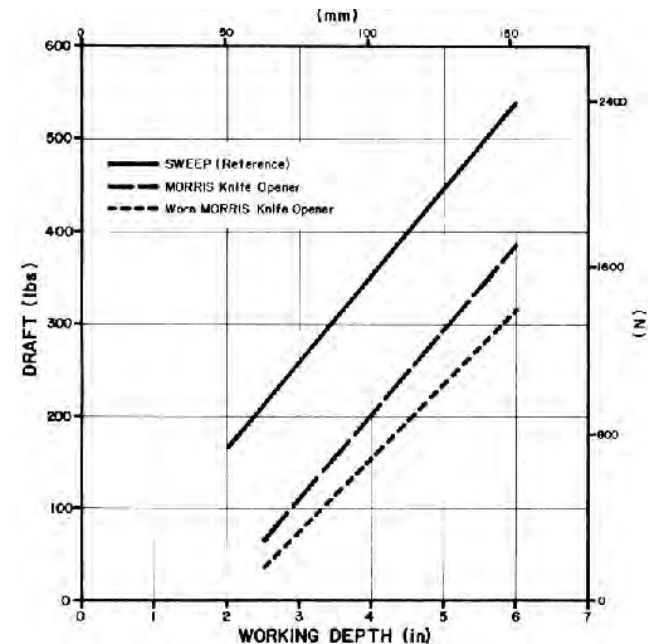


FIGURE 13. Average Drawbar Pull at 5 mph (8 km/h) of Morris Knife Opener.

**Tractor Size:** Maximum tractor power requirements in primary conditions for one Morris Air Hoe Packer Attachment ranged from 4.8 to 8.6 hp (3.6 to 6.5 kW) in the seeding depth range of 1 in to 2 in (25 to 51 mm). This compares to 4.0 hp (3 kW) for sweep seeding at a depth of 2 in (51 mm) in primary conditions.

Maximum tractor power requirements in primary conditions for one Morris knife opener ranged from 2.7 to 7.1 hp (2.0 to 5.3 kW) in the working depth range of 3 in to 5 in (76 to 127 mm). This

compares to 6.1 to 10.7 hp (4.6 to 8.0 kW) for the sweep working in the same depth range in primary conditions.

The above tractor sizes have been adjusted to include tractive efficiency and represent a tractor operating at 80% of maximum power take-off ratings as determined by Nebraska tests or as represented by the tractor manufacturer. The tractor sizes given will have ample power reserve to operate in the stated conditions.

**EASE OF INSTALLATION**

**Installation:** Ease of installing the Morris Air Hoe Packer Attachment was fair. The procedure involved putting a bolt in the top hole of the shank. This was used as a guide to rest the attachment on while installing and tightening the two U-bolts. Access to the nuts of the top U-bolt were obstructed by the springs and required the use of a socket wrench. The knife opener and fertilizer boot were installed last.

The delivery hoses firmly slid inside the fertilizer spout and the hoe opener. No clamps were required. Maximum size delivery hoses that could be used were 1.25 in (32 mm) outside diameter.

**Cultivator Modifications:** One major modification was made to the test cultivator to accommodate the Morris Air Hoe Packer Attachment. The entire cultivator was raised up using spacers on the depth linkages and additional spacers were required on the depth linkages during road transport.

**OPERATOR SAFETY**

The Morris Air Hoe Packer Attachment presented two safety hazards during testing. Caution had to be taken when adjusting the spring force for the packers to avoid pinching your fingers. Caution also had to be taken when hitching the test cultivator because of the negative hitch weight caused by the attachments.

**OPERATOR'S MANUAL**

The Operator's Manual was good. It contained useful information on set up, operation and maintenance. A parts section was also provided. The Operator's Manual had a error in the operation section on seed depth adjustment. It is recommended that the manufacturer consider correcting the error in the Operator's Manual on seed depth adjustment.

**MECHANICAL HISTORY**

The Morris Air Hoe Packer Attachment was operated for 124.5 hours while each seeding 58.6 ac (23.4 ha). This corresponds to 1465 ac (593 ha) for a 25 ft. (7.6 m) cultivator. The intent of the test was evaluation of functional performance and an extended durability evaluation was not conducted. Table 2 outlines the mechanical problems that did occur during the functional testing.

TABLE 2. Mechanical History

Item	Hours	Field Area	
		ac	(ha)
-Rubber tire came off packers while turning sharp corners and replaced at	38, 74	17.2, 35.5	(6.9, 14.2)
-Packer arm pin fell out, replaced at	74, 78	35.5, 37.8	(14.2, 15.1)
-Three hoe opener sweeps broke during		Spring Seeding	
-Straightened rubber tire scrapers		Throughout test	
-Retightened the top jam nut on the seed depth adjustment bolt		Throughout test	

**DISCUSSION OF MECHANICAL PROBLEMS**

**Rubber Tires:** The operator had to exercise caution when turning sharp corners or the rubber tires would come off the packers, as shown in Figure 14.

**Broken Sweeps:** Three of the wide sweeps broke during spring seeding. All of the breaks were on the upper part near the attachment bolt as shown in Figure 15. This problem did not occur with the narrow sweeps. It is recommended that the manufacturer consider investigating the problem of the wide hoe opener sweeps breaking.

**Top Jam Nut On Depth Adjustment Bolt:** The top jam nut on the seed depth adjustment bolt was tightened on the end of the threads of the bolt. These nuts loosened during field operation and had to be checked and retightened throughout the test. These nuts also showed some wear at the end of the test. It is recommended that the manufacturer consider modifying the top jam nut on the

depth adjustment bolt to prevent loosening during field operation.



FIGURE 14. Rubber Tire Off Packer.



FIGURE 15. Broken Sweep.

**Knife Opener Wear:** Figure 16 shows the average wear on the knife openers at the end of the test. The tips on these knife openers should be replaced. Several of the fertilizer boots showed wear on the sides as shown in Figure 17. This wear was caused by the misalignment of the boot behind the knife opener. It is recommended that the manufacturer consider investigating the problem of the misalignment of the fertilizer boots behind the knife openers causing wear on the boots.



FIGURE 16. Average Wear of the Knife Opener.

**Sweep Wear:** Figures 18 and 19 show the average wear on the narrow and wide sweeps at the end of the test. Most of the wear occurred on the outside edges of the sweeps. The sweeps were still useable at the end of the test.



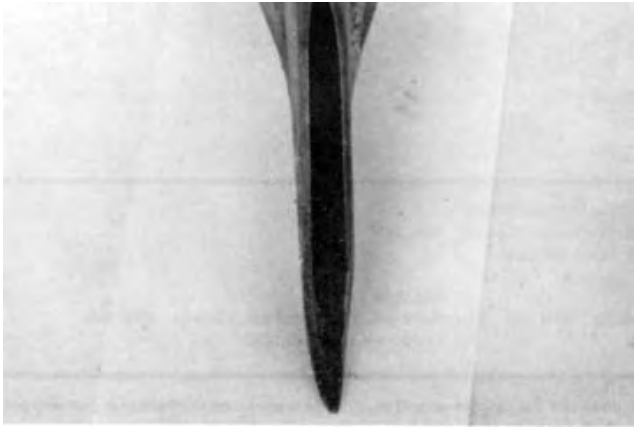


FIGURE 17. Wear on the Fertilizer Boot.

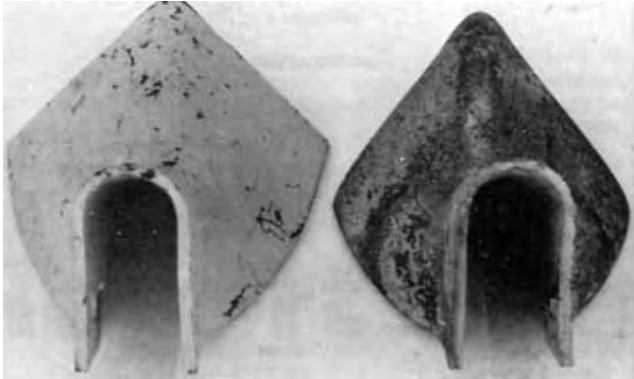


FIGURE 18. Average Wear of the Narrow Sweep.



FIGURE 19. Average Wear of the Wide Sweep.

**APPENDIX I  
SPECIFICATIONS**

**DIMENSIONS:**

- width 8.5 in (216 mm) - Wide Spacing  
5.75 in (146 mm) - Narrow Spacing
- height 26.5 in (673 mm)
- length 24.3 in (617 mm)

**MOUNTED DIMENSIONS:**

- Cutting Width
  - sweep 5.4 in (137 mm) and 7.25 in (184 mm)
  - knife opener 0.5 in (13 mm)
- Cutting Depth Below Shank
  - to sweep variable
  - to knife opener 4.25 in (108 mm)
- Knife Tip to Frame Bottom (Morris Shank) 31 in (787 mm)

**PACKERS:**

- type rubber tire
- diameter 13 in (330 mm)
- width 1.8 in (46 mm)
- spacing between pair 3.1 in (79 mm) and 5 in (127 mm) center to center
- packer pressure 40 to 100 lbs (178 to 445 N) per wheel

**INSTALLATION:**

- Attaching Bolts
  - knife opener two - 1/2 x 5 in (13 x 127 mm) Hex. Bolts
  - hoe opener and packer attachment two - 1/2 x 2-3/4 in (13 x 70 mm) U-Bolts
  - sweep one - 3/8 x 2 in (9 x 51 mm) Carriage Head Bolt with Locknut

**FEED TUBES:**

- number 2
- size 1.25 in (32 mm) I.D.

**WEIGHT:**

- knife opener 5.6 lbs (2.5 kg)
- fertilizer boot 2.6 lbs (1.2 kg)
- hoe opener and packer attachment 63 lbs (28.0 kg)
- TOTAL 71.2 lbs (32.0 kg)

**KNIFE OPENER POINT HARDNESS:** 57 Rockwell "C"

**OPTIONS:**

- paired seeding widths wide and narrow
- to fit 43° or 50° shank

**APPENDIX II  
MACHINE RATINGS**

The following rating scale is used in PAMI Evaluation Reports:

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

# SUMMARY CHART

## MORRIS AIR HOE PACKER ATTACHMENT

<b>RETAIL PRICE:</b>	\$245.00 (April, 1988, f.o.b. Lethbridge, Alberta)
<b>QUALITY OF WORK:</b>	
Penetration	<b>good</b> ; depended on packing force and depth of cultivator
Seed Placement	<b>good</b> ; 2 rows 5 in (127 mm) apart with wide sweeps, 4 in (102 mm) wide band with narrow sweeps
Fertilizer Placement	<b>very good</b> ; 0.5 in (13 mm) wide band
Soil Finishing	<b>good</b> ; 2 to 3 in (51 to 76 mm) ridge depths
Trash Clearance	<b>good</b> ; wide spaced packers very good; narrow spaced packers
Stony Conditions	<b>very good</b> ; no damage
<b>EASE OF OPERATION AND ADJUSTMENT:</b>	
Transporting	<b>fair</b> ; had to raise up cultivator
Depth/Packing Adjustment	<b>fair</b> ; seed depth poor; packing force, required small prybar
Plugging	narrow spaced packers stopped turning in very moist soil
<b>POWER REQUIREMENTS:</b>	4.8 to 8.6 hp (3.6 to 6.5 kW) per opener at seeding depths
<b>EASE OF INSTALLATION:</b>	<b>fair</b> ; adapted to any cultivator shank
<b>OPERATOR SAFETY:</b>	safe; provided normal safety precautions were used
<b>OPERATOR'S MANUAL:</b>	<b>good</b> ; useful information
<b>MECHANICAL HISTORY:</b>	three wide sweeps broke; jam nuts on adjustment bolts loosened



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