

# Evaluation Report

# 517



## **New Idea 406 and 407 Side Delivery Rakes With 410 Hitch**

A Co-operative Program Between



## NEW IDEA 406 AND 407 SIDE DELIVERY RAKES WITH 410 HITCH

### MANUFACTURER AND DISTRIBUTOR:

New Idea Farm Equipment Corp.  
Coldwater, Ohio  
USA  
45828

### RETAIL PRICE:

\$9,944 (December 1986, f.o.b. Portage la Prairie, Manitoba) with optional flow control valve.

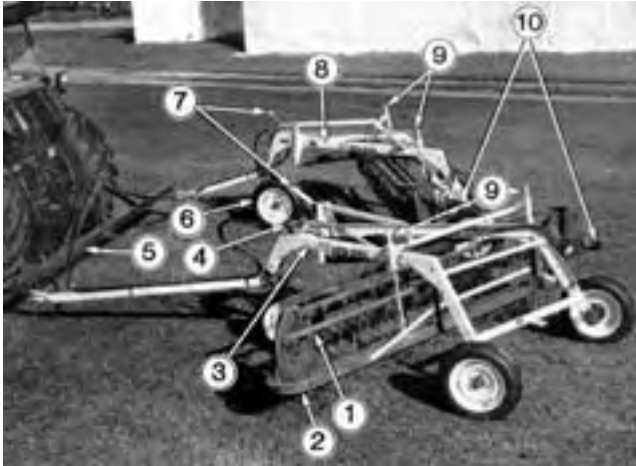


FIGURE 1. New Idea 406 & 407 Side Delivery Rakes: (1) Tooth Bar, (2) Rake Basket, (3) 406 Rake, (4) Flow Control, (5) 410 Hitch, (6) Castor Wheel, (7) Height Adjuster, (8) 407 Rake, (9) Levellers, (10) Orbit Motors.

### SUMMARY

**Rate of Work:** The New Idea 406 and 407 hay rakes combined windrows effectively at speeds up to 8 mph (12.9 km/h). When using a single rake to roll or move windrows onto dry ground, slightly slower speeds gave the best results.

**Quality of Work:** The performance of the New Idea 406 and 407 side delivery rakes was excellent in all crops used for the evaluation. The rakes were very effective in bringing two light windrows together to form a larger heavier windrow. In dry field conditions losses were not measurable and in moist or damp conditions the losses were slight.

**Ease of Operation:** The New Idea 406 and 407 hay rakes were easy to operate. Placing the rakes in field position was easily accomplished by one person and took approximately 10 minutes. The rakes were hydraulically driven, and moving the remote tractor hydraulic lever to the rear, was all that was required to set the rake beds in motion.

**Ease of Adjustment:** The New Idea 406 and 407 hay rakes were easily adjusted for height, width, level, and condition of resulting windrow. Rake bar rotation was adjusted by a pressure compensated flow control, which was mounted on the 406 rake. Width adjustment was made on the 410 3-point hitch bar.

**Power Requirements:** A 40 hp (30kW) tractor with a 3-point hitch and one hydraulic circuit capable of 10 gpm (0.6 L/s) at 1500 psi (10.3 Mpa) was adequate to safely operate the 406 and 407 hay rakes.

**Operator Safety:** The New Idea 406 and 407 hay rakes were safe to operate if normal safety precautions were followed.

**Operator's Manual:** The operator's manual was well written, organized and contained information on assembly, operation, maintenance and safety. It also included a complete parts catalogue.

**Mechanical History:** Problems with the bearings that support the tooth bars became apparent after about 10 hours of operation.

Bushings that support the optional castor wheels wore out at 40 hours.

A bolt that supports the basket frame fell out and allowed the rake bars to come in contact with a tire on the main frame, destroying the tire and damaging 19 rake teeth.

### RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Ensuring better quality control of the bearings that support the tooth bars.
2. Providing a hydraulic lift, so the rake bars could be lifted when desired from the operator's position.

Senior Engineer -- G.M. Omichinski

Project Technologist -- R.K. Harris

### THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. Bearing failure has not been recorded as a problem. Warranty records show a minimal bearing replacement history. Failures in this test unit indicate inadvertent omission of bearing snap rings when assembled. New Idea attributes these failures as unique assembly errors. Stringent quality control will be implemented on the tooth bar assembly process.
2. New Idea has in the past offered such an option, but due to lack of demand it is no longer available.

### MANUFACTURER'S ADDITIONAL COMMENTS

1. Concerning the castor wheel failure, New Idea states that more frequent lubrication will extend the useful life of the bushings. Also the current castor wheel is presently under reevaluation.
2. Concerning the loss of bolt K4831 (rake basket adjustment), New Idea states that this bolt is held in place by a castellated nut (K3943) and cotter pin (010217). Placement of the cotter pin through drilled hole in bolt and castle nut slot will eliminate failures.

### GENERAL DESCRIPTION

The New Idea 406 and 407 hay rakes with 410 hitch are actually two machines coupled together with a common hitch. The 406 is a left hand delivery, hydraulically driven hay rake while the 407 has a right hand delivery. Together with the 410 hitch they provide an effective raking system for combining two windrows into one. The 406 and 407 can also be used separately without the 410 hitch for turning or fluffing a single windrow. Each rake consists of five tooth bars that are attached at each end to reel heads. The bars are spaced equally around the circumference of the reel heads and are attached by sealed bearings that allow the bars to rotate at an angle to the face of the reel head. The reel is supported by a triangular shaped frame with wheels at each apex. The front wheel is mounted on a castor while the two rear wheels are fixed in position. Both the 406 and 407 are adjustable for height and reel angle of attack. Width adjustment is made on the 410 hitch.

The 410 3-point hitch has mounting pins that allow for attachment to Category I or II tractor hitches. The 410 hitch is constructed of 4 x 4 in (100 mm x 100 mm) tubing for the main hitch bar while 3-1/2 in x 3-1/2 in (90 mm x 90 mm) square tubing slides into each end to provide for raking width adjustment and rake attachment points. The 406 and 407 have different length hitch bars attached to the castor wheels so that when the rakes are in field position one rake will trail the other.

The dual rake system was outfitted with an optional pressure compensated flow control valve to regulate reel speed. It was mounted on the frame of the 406 rake. This flow control ensured that reel speed did not exceed 140 rpm on a closed centre hydraulic system by limiting the flow of oil to the driving hydraulic orbit motors.

Detailed specifications are presented in APPENDIX I for the test equipment.

### SCOPE OF TEST

The New Idea 406-407 and 410 hitch hay raking system was operated under typical prairie field conditions as shown in TABLE 1 for 82 hours while raking 820 ac (328 ha). It was evaluated for quality of work, rate of work, ease of operation and adjustment, power requirements, operator safety and suitability of the operator's manual.

TABLE 1. Operating Conditions.

Crop	Hours	Equivalent Field Area	
		ac	ha
Alfalfa	47	475	192
Brome & Timothy	18	180	73
Native Grasses	12	115	47
Millet	5	50	20
Total	82	820	332

## RESULTS AND DISCUSSIONS

### RATE OF WORK

The New Idea 406-407 and 410 hitch raking system worked best when a reel speed of 120 rpm and a ground speed of 6 to 7 mph (9.6 to 11.2 km/h) was used. When bringing two light windrows into one heavier windrow about 10 ac (4 ha) per hour could be achieved. Smoothness of the field was also a factor that determined ground speed.

When two heavy windrows were combined into one, a slower ground speed and faster reel speed seemed to work best.

Rate of work was affected by breakdowns, which seriously limited the test time allotted to these rakes. Bearing failures of the parallel tooth bars sometimes caused complete separation of the bars from the reel heads. It is recommended that the manufacturer consider more rigid quality control in the assembly of tooth bar bearings.

**Quality of Work:** The New Idea 406-407 and 410 hitch raking system was effective in raking two windrows into one. The 406 was also effective in turning a very heavy swath of millet to expedite drying. Curing time was significantly reduced as a result of raking two windrows together as the rakes fluffed the windrows and allowed air to pass more freely through. In addition, combining windrows allowed the hay to be placed on drier ground.

Leaf loss in alfalfa was negligible if raking was timely and the crop not allowed to get too dry before raking. Because the tooth bars were hydraulically driven, the speed of the bars remained constant and allowed positive pickup when going slow or around a corner.

Crop losses were minimal as the rakes were adjustable for width, height, and sensitivity to rough fields.

### EASE OF OPERATION

**Hitching:** The 410 hitch was attached to the tractor using either the Category I or II hitch pins. The top links of the 3-point hitch were perpendicular to the ground when raised about 18 inches (460 mm) from the ground. The 406 rake was attached to the right side of the 410 hitch and the 407 rake was attached to the left side of the 410 hitch using properly sized hitch pins and suitable locking devices.

Hook-up was completed by attaching two hydraulic hoses to the tractors remote outlets. In general, hook-up was quite easy and took one person about five minutes. FIGURE 2 shows the basic hydraulic hose hook-up for the 406 and 407 rakes. To further simplify hook-up, we stamped corresponding numbers on the quick couplers at point "A" on the drawing to ensure proper hose hook-up every time.

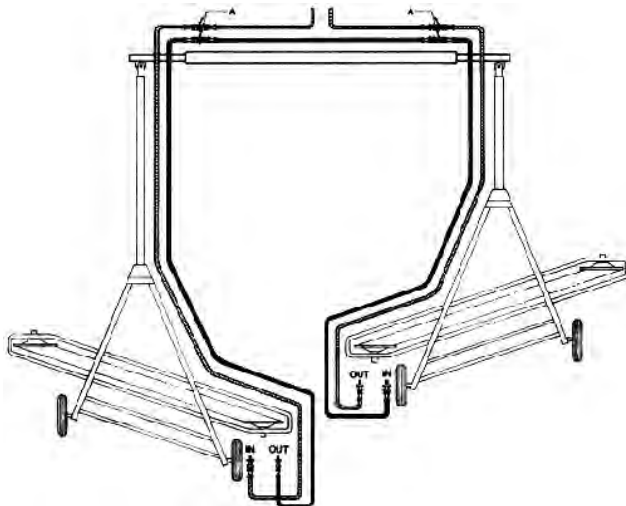


FIGURE 2. Hydraulic Hose Hook-up.

**Raking:** To rake two windrows into one, all that was required was to initiate tooth bar rotation by pulling the remote hydraulic lever to the rear and securing it in position with a rubber tarp strap. The tractor moves ahead in between the two windrows at the desired speed and the two windrows are drawn together into one heavy windrow.

To roll one windrow over onto new ground or to fluff it, only one rake was used. The 410 hitch was not used and the single rake was attached to the tractor's drawbar. The tractor was driven straddling the windrow at about 7 mph (11.2 km/h). The highest point on the reel angle adjustment was used to achieve high fluffy windrows.

It is recommended that the manufacturer consider a modification that would allow the rake basket to be lifted hydraulically when required to pass over previously raked windrows.

**Transporting:** The New Idea 406 and 407 were easily placed in transport position and took one person about five minutes. To place the rake baskets in transport position, the rake baskets were raised to their highest position to allow maximum ground clearance. Hydraulic hoses were then disconnected and the 406 and 407 rakes were attached in tandem to the transport attachment lug in the centre of the 410 hitch. At the beginning of the test the 406 and 407 rakes were stable at highway speeds, but as the bushings on the castor wheels wore, speed had to be reduced to prevent swaying.

### EASE OF ADJUSTMENT

The New Idea 406-407 and 410 hitch raking system was easily adjusted to suit all conditions encountered. Width adjustment was made on the 410 hitch to suit the swath width and was accomplished by sliding the telescoping tubing out of or into the main frame bar to the desired width. Once the desired width was established, the tubing was locked in place with a pin.

Height adjustment was achieved by turning the crank handles (FIGURE 3) provided on the 406 and 407 until the required height was reached. The 406 and 407 were cranked to their maximum height to place in transport position. The rake basket was suspended on twin spring threaded rods (FIGURE 4) to provide floatation, and leveling of the rakes was carried out by turning the nut attached to the tops of these rods. The tilt of the basket was also adjustable and was accomplished by positioning and tightening the retaining bolt (FIGURE 3) in the slot at whatever position was desired. If loose fluffy windrows were desired the bolt was positioned to the upper notch in order to tilt the teeth forward. If a tightly rolled windrow was desired then the retaining bolt was positioned in the lower notches.



FIGURE 3. Height Adjustment Crank (top) Basket Adjustment Bolt (bottom).



FIGURE 4. Suspension of the Rake Basket.

**POWER REQUIREMENTS**

A 40 hp (30 kW) tractor with 3-point hitch and one hydraulic circuit capable of a 10 gpm (0.6 L/s) at 1500 psi (10.3 MPa) was adequate to safely operate the 406 and 407 hay rakes. Tractors with either open centre or closed centre hydraulic systems could be used.

**OPERATOR SAFETY**

The 406 and 407 hay rakes were safe to use if normal safety precautions were followed. Both the 406 and 407 were equipped with reflectors for transporting at night and had provisions for mounting a slow moving vehicle sign although none was provided.

**OPERATOR'S MANUAL**

The operator's manual was well written and illustrated. It contained useful information on assembly, adjustment, transporting, safety and maintenance. The manufacturer provides as an option a flow valve (FIGURE 5) to limit rake reel speeds to a maximum of 140 rpm.



FIGURE 5. Optional Flow Control Valve to Limit Rake Reel Speed.

**MECHANICAL HISTORY**

Problems with the bearings that support the tooth bars became apparent after 10 hours of operating on the 406 rake. Bearing failure allowed complete separation of the tooth bars from the reel heads (FIGURE 6). Inspection of the failed bearings revealed that in some bearings, snap rings used to hold the bearings into their races, were never installed. In addition, the 406 rake was identified to have been manufactured at an earlier date than the 407 and stored outside where moisture was allowed to enter the bearing.

At 40 hours, the bushings in the support arm for the castor wheels on both the 406 and 407 had to be replaced (FIGURE 7).

At 46 hours, the bolt that locks the reel basket in place fell out and allowed the reel to fall to the ground and came in contact with the rear tire (FIGURE 8). In addition to destroying the tire, 19 reel teeth had to be replaced.



FIGURE 6. Bearing Failure.



FIGURE 7. Castor Wheel Bushings.



FIGURE 8. Bolt Failure on Reel Basket.

**APPENDIX I  
SPECIFICATIONS**

<b>MAKE:</b>	New Idea
<b>MODEL:</b>	406 & 407 410 hitch
<b>SERIAL NUMBER:</b>	406: R179170 407: R179190 410: R178318
<b>OVERALL DIMENSIONS:</b>	
-- height	56.5 in (1.4 m)
-- width	10.5 ft (3.2 m)
-adjustment range	
-maximum	25.5 ft (7.7 m)
-minimum	20.0 ft (6.1 m)
-- corresponding hitch width	
-maximum	15.0 ft (4.6 m)
-minimum	9.5 ft (2.9 m)
-- length	
-field position	18 ft (5.5 m)
-transport position	30 ft (9.1 m)
<b>WHEEL TREAD:</b>	5.3 ft (1.6 m)
<b>TIRE SIZE:</b>	5.00 x 15
<b>NUMBER OF TIRES:</b>	3 per rake
<b>TIRE TYPE:</b>	Ribbed Implement

**TIRE WEIGHTS:**

-- rear wheels	594 lb (270 kg)
-- castor wheels	409 lb (186 kg)
total	1003 lb (456 kg)
-- 410 hitch	215.6 lb 98 kg)

**MAIN FRAME MATERIAL:**

Channel 1/4 in x 4 in (6 mm x 100 mm)

**BASKET MATERIAL:**

Angle 1/4 in x 2-5/8 in (6 mm x 70 mm)

**DRIVE:**

Hydraulic orbit motors

**DISPLACEMENT PER REV.:**

17.9 in<sup>3</sup> (294 cc)

**RECOMMENDED RPM:**

Never exceed 140 rpm

**TOOTH BARS:**

5 per rake

**NUMBER OF TEETH:**

20 per bar/100 per rake

**GREASE FITTINGS:**

3 per rake

**APPENDIX II  
MACHINE RATINGS**

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

Excellent	Fair
Very Good	Poor
Good	Unsatisfactory

**SUMMARY CHART  
NEW IDEA 406 and 407 SIDE DELIVERY RAKES WITH 410 HITCH**

<b>RETAIL PRICE:</b>	\$9,944 (December 1986 f.o.b. Portage la Prairie, MB)
<b>RATE OF WORK:</b>	<b>Very Good</b> up to 10 acres (4 ha) per hour.
<b>QUALITY OF WORK:</b>	<b>Excellent</b> negligible leaf loss if raking is timely.
<b>EASE OF OPERATION:</b>	<b>Very Good</b>
<b>POWER REQUIREMENTS:</b>	40 hp (30 kW) with Category I or II, three point hitch and one remote hydraulic circuit (open or closed centre)
<b>OPERATOR SAFETY:</b>	Safe to operate if normal safety precautions are followed.
<b>OPERATOR'S MANUAL:</b>	<b>Very Good</b>
<b>MECHANICAL HISTORY:</b>	Bearing failures on the 406 rake Bushing failures on the castor wheel mounting.



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