Western Canada Combine Performance Gaps Represent Opportunities for Aftermarket Component Suppliers

Presented by:

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Innovative Solutions for Agriculture and Beyond
WHAT ARE WE TALKING ABOUT?

• The Problem = Combine performance issues (typically high loss) in Western Canada crops and conditions

• The Background
  • Challenges
  • Misconceptions
  • Performance measures

• The Solution = Opportunity for Aftermarket Suppliers
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BACKGROUND

Facts:
• SK = 33 million acres of grain harvested per year
• SK Production is about 1 billion plus bushels / year

Estimations:
• 2,500 acres / combine = 13,200 combines in SK!
• About 76,000 Bushels / combine
• Just 1 bu/acre less loss = 33 million bushels
• At an average of $7 / bushel = $231 million
W CAN HARVESTING CHALLENGES

• Short Harvest Season
• Shortage of Experienced Manpower
• Wide Variety of Crops
  • Canola – small, light seeds, high MOG to grain ratio
  • Tough threshing crops like wheat and flax
  • Easy threshing crops like dry canola, peas, and lentils
• Wide variety of conditions
  • High variability in some areas
  • Long, green straw
  • Lodging
  • Short crops that pod low
• Weather!

Source: Claas.com
COMMON MISCONCEPTIONS

- Mph = capacity
- More power = More capacity
- Keeping the machine full (driving faster) = less loss
- The losses can’t be that bad
COMMON MISCONCEPTIONS

- If there’s not much on the ground the losses are ok
- Operator can go the same speed with a wider header
- Same settings for one crop will be fine for the entire season
- Same settings for one crop will be fine for the entire day
- Loss monitor tells the amount of loss
PERFORMANCE MEASURES

- Productivity in Bu/hr
- Loss Level in Bu/acre or % of yield
- Dockage in % foreign material
- Efficiency in Bu/gal
SOURCES OF LOSS

• Nature – shatter (ripening, wind, rain, hail, wildlife, heat)
• Cutting – windrowing or straight cutting
• Combine Leakage – feeder, separator, grain tank, elevators, shoe seals
• Combine Processing
  • Feeding
  • Threshing
  • Separating
  • Cleaning
HOW BAD CAN LOSS BE?

- Easily 1-2 Bu/acre
- Commonly 2-5 Bu/acre
- Worst case 5-15 Bu/acre! We’ve Seen it!

10 Bu/acre!
WHAT’S HAPPENING?

• More power! Since 1990 combine HP has more than doubled
• Significant material handling improvements
• Maximum throughput is greater than capacity of the processing and cleaning systems in some conditions.
• Modern spreaders and choppers hide the loss
• Improper settings or non optimum configuration for W Canada crops and conditions

Source: strawchopper.com
WHAT’S HAPPENING?

• Assumption that the latest combine has X% more capacity than the previous model in all conditions.
• Assumption that if the combine can send it through the grain will end up in the tank
• Similar ground speeds with wider headers
• Yields have increased
• Non-informative loss monitors
WHAT’S THE COST OF LOSS?

- Canola at $10/bu
- 160 acres
- 40 ft header
- @ 3 mph (14.5 ac/hr) loss = 1 bu/acre over 11.0 hrs
- @ 4 mph (19.4 ac/hr) loss = 3 bu/acre over 8.2 hrs
- Reduced harvest time by 2.8hr @ $300/hr = +$840
- @ 3 mph cost of loss = $1,600 or $145/hr
- @ 4 mph cost of loss = $4,800 or $585/hr
- Loss Increased by $440/hr by going 1 mph faster
- Cost $2,360 to go 1 mph faster for 160 acres
- Plus the cost of dealing with the volunteer plants
REASONABLE EXPECTATIONS

- 1 Bu/acre loss is achievable
- Sometimes 2 Bu/acre loss is as good as it gets
- At 1 Bu/acre loss typically at 55 to 85% engine power mid day with 400 to 500 HP combines

Source: travelpod.com
WHAT IS COMBINE PRODUCTIVITY?

- Sustained average work rate
- Expressed as Bushel or tonnes per hour at a loss level
- Not Mph or Acres per hour
WHAT IS COMBINE CAPACITY?

- Feedrate @ a specific loss
- Expressed as Tonnes per hour MOG @ 1.5%, 2% ...10% loss
- Not Mph or Acres per hour
WHAT AFFECTS COMBINE CAPACITY?

MOG Feedrate
• As feedrate increases loss increases

MOG to Grain Ratio
• Tests from 1985 on conventional combine in wheat:
  • Reducing MOG to Grain ratio from 1.20 to 0.85 = 49% capacity increase
    • 6” higher cut height
  • Reducing MOG to Grain ratio from 1.20 to 0.64 = 85% capacity increase
    • 12” higher cut height
COMBINE TEST EQUIPMENT

• Collector takes a 7m collection of the crop material and grain loss behind the test combine.
• Processor separates grain loss from crop material.
• Grain loss from the cleaning shoe and separator is weighed separately.
TYPICAL LOSS CURVE

- Test data is entered into a spreadsheet and graphed to analyze combine performance and efficiency.

Typical Combine Loss Graph - Efficiency

- Maximum Efficiency - Least Loss for Maximum Feedrate
- Typical Operating Range if Trying to Get Maximum
SHOWING DIFFERENCE IN CAPACITY

Total Loss Graph

- SBJR @ 15 mm Concave
- SBJR @ 21 mm Concave
- SBJR @ 27 mm Concave

Expon. (SBJR @ 15 mm Concave)
Expon. (SBJR @ 21 mm Concave)
Expon. (SBJR @ 27 mm Concave)

Loss (bu/ac)
Grain Feedrate (Bu/hr)
EXPLAINING DIFFERENCE IN CAPACITY

Rotor Loss Graph

- SBJR @ 15 mm Concave
- SBJR @ 21 mm Concave
- SBJR @ 27 mm Concave

Expon. (SBJR @ 15 mm Concave)
Expon. (SBJR @ 21 mm Concave)
Expon. (SBJR @ 27 mm Concave)

Loss (bu/ac) vs. Grain Feedrate (Bu/hr)
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EXPLAINING DIFFERENCE IN CAPACITY

Cleaning System Loss Graph

- SBJR @ 15 mm Concave
- SBJR @ 21 mm Concave
- SBJR @ 27 mm Concave
- Expon. (SBJR @ 15 mm Concave)
- Expon. (SBJR @ 21 mm Concave)
- Expon. (SBJR @ 27 mm Concave)

Loss (bu/ac) vs. Grain Feedrate (Bu/hr)

3.0
2.75
2.5
2.25
2.0
1.75
1.5
1.25
1.0
0.75
0.5
0.25
0
350 375 400 425 450 475 500 525 550 575 600 625 650 675 700 725 750 775 800
OPPORTUNITIES

Poor performance in canola

- 400 - 600 HP Combines currently running at 55-85% engine power to keep losses at acceptable levels
- W Can crops and conditions not the highest priority for major Ag corps
- Concaves, separator grates, sieves, cleaning fan diverters, shoe shake = all opp’s for improvement
OPPORTUNITIES

Poor Threshing in Hard Threshing Crops

- White caps in wheat
- Unthreshed losses
- Manufacturer solution is to add concave blanks and utilize rethreshers which can limit capacity
- Best solution is to properly thresh at the rotor / cylinder with aggressive concaves and rotors
OPPORTUNITIES
Outdated Grain Loss Sensing and Monitors

• No advancement in approx. 30 years
• Current bar graphs do not quantify loss unless operator gets out of cab to check
• bu/acre readout of loss integrated with telematics
• Loss sensor locations questionable
• Loss sensing improvement needed for automation in the future
OPPORTUNITIES

Loss Pan Dropper to Quantify Loss

• Why don’t operators check for grain loss?
  • Lack of understanding
  • Lack of proper methods and tools
  • Dusty, dirty, not safe
  • Loss pan dropper addresses issues
OPPORTUNITIES

Header Height Sensing for older headers

- Draper headers especially
- Auger headers
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OPPORTUNITIES

Compaction Concerns

• Modern Combines are 35,000 – 50,000 lb
• Wide headers are 7,000 – 12,000 lb
• Opportunity to implement lighter weight materials in headers and components
• Major Ag Corps focused on cost reduction so more expensive materials are not attractive to them
OPPORTUNITIES

Residue Management

• Reduced tillage has increased demands on crop residue management equipment
• Includes chop quality and spread distribution
• Spreading chaff across 40 plus feet is a challenge!
• Manufacturers have improved their residue systems over the past 5 years
• Some combines still have poor residue management
OPPORTUNITIES

Alternative Harvest Methods

• Expectation is for combines to take in all of the straw, maintain high productivity, keep grain loss low, and chop and spread residue evenly over 40 ft plus

• Example of alternative: New Holland twin knife dual stream header – Claimed 15% more productivity and 15% less fuel use
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Straight Cutting Canola

• Shatter resistant varieties and knitted together
• Take up is slow, but interest is growing
• Variable cutter bar headers appear to be well suited to straight cut canola
• Adapting existing headers to better straight cut canola = opportunity
• Side knives
• Extended cutterbars
• Extended reel arms
• Top cross augers
OPPORTUNITIES
Operator Feedback Improvements

• Operator feedback of what’s happening inside the combine – cameras and sensors
• Seed sensors under the rotor and sieves to indicate how far back the seed is getting
• More accurate indication of returns levels and clean grain in returns
OPPORTUNITIES
Operator Feedback Improvements

• Air velocity at different locations to set fan and sieves
• Normalize settings and indications across machines
  • Fan speed in m/s rather than rpm
  • Rotor / Cyl speed in m/s rather than rpm
OPPORTUNITIES

Automation

• Major Ag corps in progress. Some have released portions of automation on combines
• Significant productivity gains and loss reduction possible with automation
• Ground Speed (feed rate)
• Settings
• Optimal route planning
OPPORTUNITIES

Other Ideas

• Device to analyze crop conditions to generate suggested settings
  • Seed and crop material moisture level
  • Terminal velocity of grain
  • Threshing difficulty
  • Grain damage threshold
• Straw and chaff MOG feed rate monitor
• On board cost benefit analysis of various feed rates and corresponding loss levels.
EXPLOIT YOUR ADVANTAGES

Size

• Smaller size allows more flexibility than major Ag corps
• Quick response to opportunities
• Quicker to market
• Better suited to lower volume, specialty products

Source: ASME.org
EXPLOIT YOUR ADVANTAGES

Location

- Center of W Can market
- Customers in your backyard = better connected
- Can test in W Can crops and conditions in your backyard
- Reduced shipping costs
EXPLOIT YOUR ADVANTAGES

Existing sales channels

• You all have existing dealers and direct sales channels
• Diversify your product line
• As one product gets phased out another can replace it

Source: Dayglocom
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EXPLOIT YOUR ADVANTAGES

Minimal Restrictions on Innovation

• Large Ag corps have many layers of systems to navigate before a project even gets considered for funding

• Lower risk – Can learn quicker and on a smaller investment

• Internal knowledge is more easily retained

• No complication of shareholder value

Innovation
SUCCESSES

Redekop Crop Residue Management
Saskatoon, SK

• Built a business on residue management

Source: Strawchopper.com
SUCCESES

Sunnybrook Welding, Sunnybrook, AB

• Hundreds of aftermarket concaves, cylinders, beaters sold since 1979

Source: SunnybrookWelding.com
SUCCESES
Michels Industries, St. Gregor, SK

- Has sold hundreds of crop catchers for over the past few years
Questions?