

A combine harvester is shown in a field, moving from right to left. The sky is filled with falling money, including various denominations of banknotes and coins. The scene is set against a sunset or sunrise background with a warm, orange glow. The overall image conveys a message of financial success and investment in agriculture.

Combine Adjustment: Don't Set it and Forget it!

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Facts:

- SK = 33 million acres of grain harvested per year
- SK Production is about 1 billion plus bushels per year



Estimations:

- 2,500 acres / combine = 13,200 combines to adjust in SK!
- About 76,000 Bushels / combine
- Just 1 bu/acre less loss = 33 million bushels
- At an average of \$7 / bushel = \$231 million



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Western Canada Harvest Challenges

- Short harvest window
- Weather
- Variety of crops and conditions
- Inexperienced combine operators
- Experienced operators (owners) busy managing the operation
- Shortage of farm labor
- Crop Variability



Common Misconceptions:

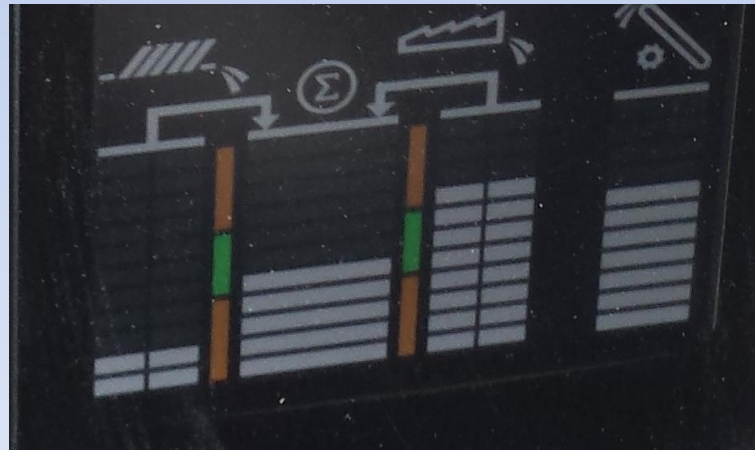
- Mph = capacity
- More power = More capacity
- Keeping the machine full (driving faster) = less loss
- The losses can't be that bad



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Common Misconceptions:

- If I can't find much on the ground the losses are ok
- I 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
- My loss monitor tells me my loss



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!



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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



High Losses! 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



Source: travelpod.com

High Losses! 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



How do you end up with high loss?

Maladjustment and or driving too fast

You are used to going 4 mph

Yield increases from 50 to 60 bu/ac = 20% increase

Harvest speed should now be 3.2 mph

You switched from a 30 ft header to a 36 ft = 20% increase

Harvest speed should now be 2.5 mph

You are still going at 4 mph = **60% over target feedrate!**



Previously if you were going at 4 mph and increased it by 60% you would have been going **6.4 mph!**

It is not unreasonable to expect losses could increase by **5 Times!**

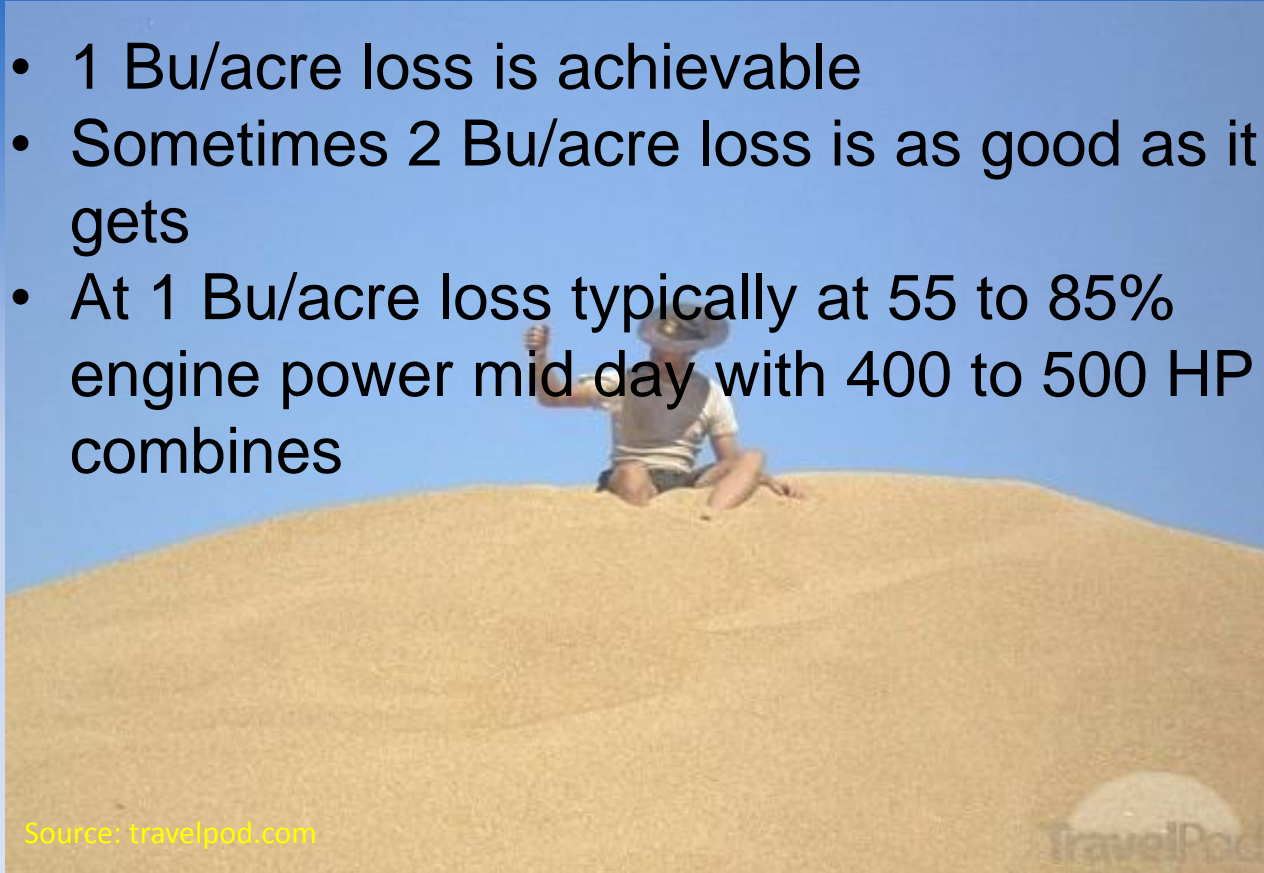
What's the cost of loss?

- 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**
- @ 4mph 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**



What should be my 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



What is Combine Productivity?

Sustained average work rate

- Expressed as Bushel or tonnes per hour at a loss level

Incorrectly identified as productivity:

- Acres per hour
- Mph



What is Combine Capacity?

Feedrate @ a specific loss

- Expressed as Tonnes per hour MOG @ 1.5%, 2% ...10% loss
- Incorrectly identified as capacity:
 - Acres per hour
 - Mph



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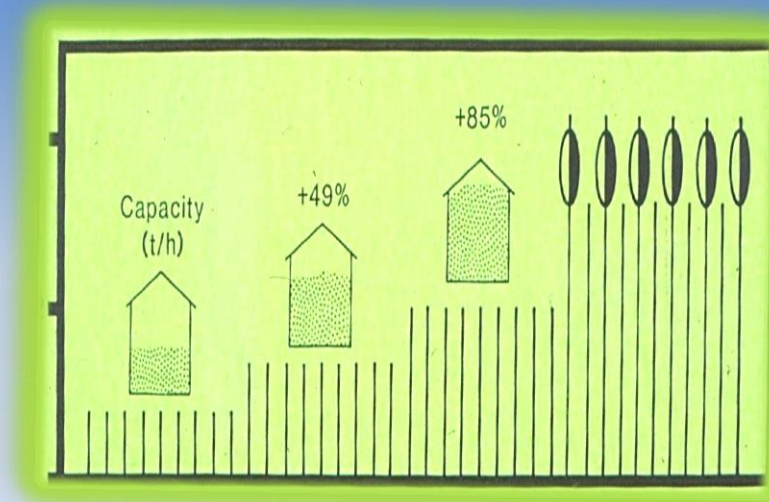
What Affects Combine Capacity?

MOG Feedrate

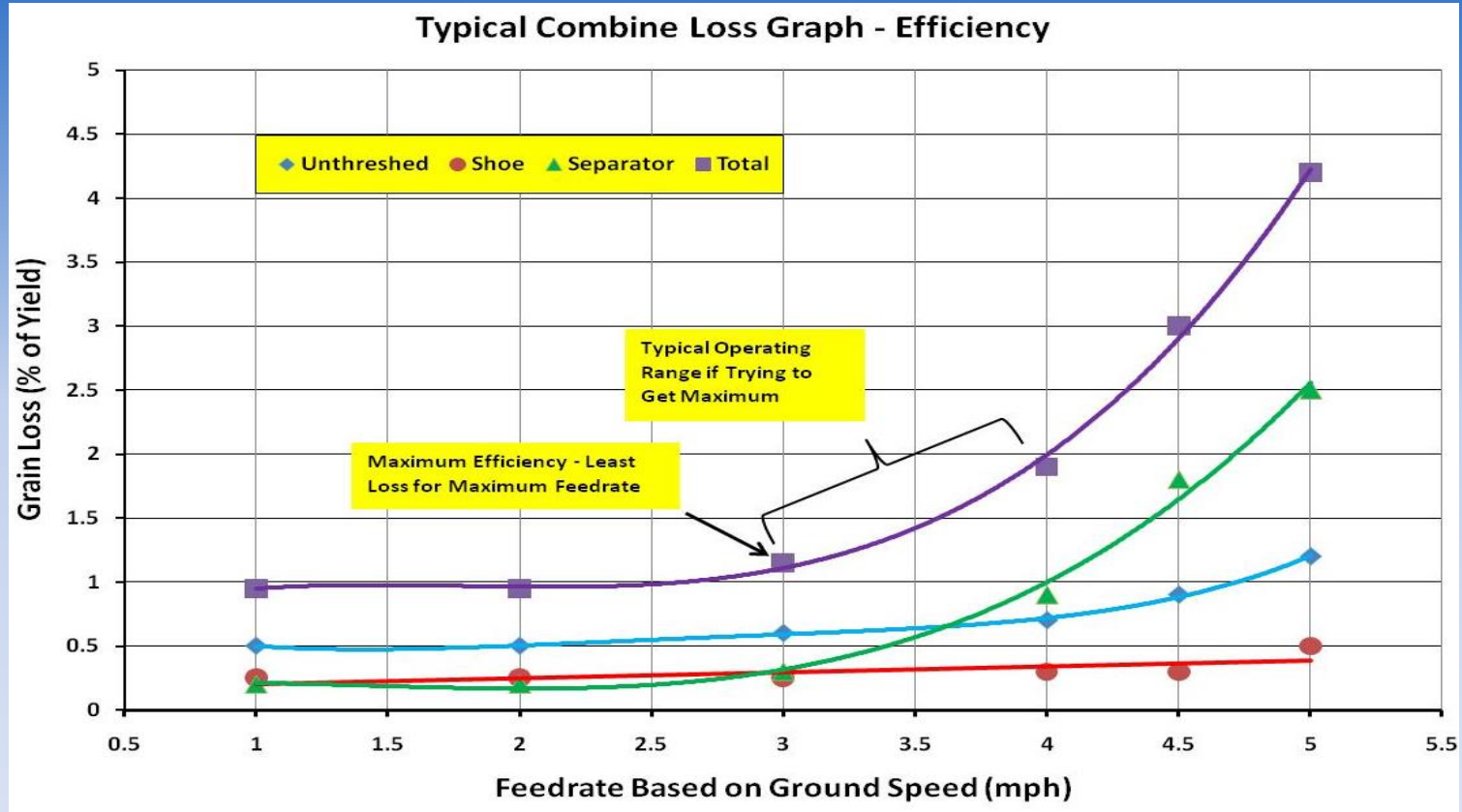
- As feedrate increases loss increases

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



A closer look at loss



How do you keep losses low?

**First you have to look
and quantify the loss!**



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Better yet, catch the loss in a pan!

Know the pan area

Recommend chopper and spreaders disengaged

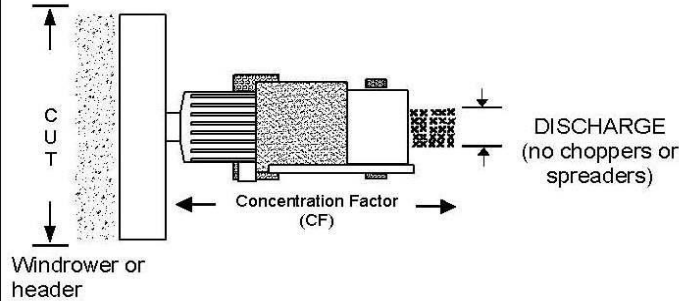


Tools Needed



Combine Seed Loss Guide

A method for determining seed loss from your combine based on weight, volume, or kernels.



STEP 1
Find your CF—in this table

Width of Cut (ft)	Width of Discharge from Rear of Combine (ft)				CF (X)
	3	4	5	6	
12	16	20	24	4	
15	20	25	30	5	
18	24	30	36	6	
21	28	35	42	7	
24	32	40	48	8	
27	36	45	54	9	
30	40	50	60	10	

STEP 2
Collect a Sample from discharge of known area

Be Careful
Be Safe

Continue steps on next page



STEP 3 Clean seed from catch

- Sieve using a screen
- Blow out chaff

Hint can use leaf blower and 85 L tub

STEP 4 Weigh, measure (volume), or count seeds (use scale, test tube), see guide.

STEP 5 Calculate loss on per ft² basis (divide results by ft² of collection pan)

STEP 6 Select Table 2, 3, 4, or 5 to find loss on a per acre basis

Cut width compared to windrow dropped behind combine (Concentration Factor = CF)		CF						Loss lb/ac
		4	5	6	7	8	9	
Loss Collected Behind Combine in 1 square foot Grams/ft ²	0.4	0.5	0.6	0.7	0.8	0.9	1.0	10
	0.6	0.8	0.9	1.1	1.2	1.4	1.6	15
	1.0	1.3	1.6	1.8	2.1	2.3	2.6	25
	2.1	2.6	3.1	3.6	4.2	4.7	5.2	50
	3.1	3.9	4.7	5.5	6.2	7.0	7.8	75
	4.2	5.2	6.2	7.3	8.3	9.4	10.4	100
	5.2	6.5	7.8	9.1	10.4	11.7	13.0	125
	6.2	7.8	9.4	10.9	12.5	14.1	15.6	150
	7.3	9.1	10.9	12.8	14.6	16.4	18.2	175
	8.3	10.4	12.5	14.6	16.7	18.7	20.8	200

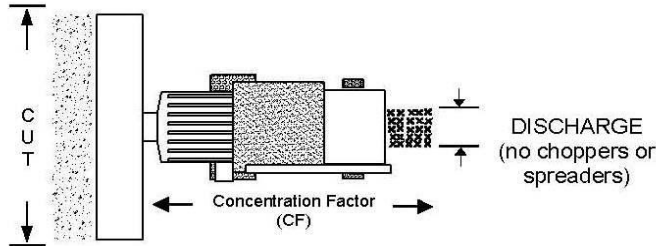
For bigger collection pans multiply the values in the grey zone by the number of ft² in the collection
Calculations are based upon 0.010413 grams/ft² over each ft² in an acre = 1 lb/ac

Cut width compared to windrow dropped behind combine (Concentration Factor = CF)		CF						Loss bu/ac
		4	5	6	7	8	9	
Loss Collected Behind Combine in 1 ft ³ in Millilitres (ml)	0.8	1.0	1.3	1.5	1.7	1.9	2.1	0.25
	1.7	2.1	2.5	2.9	3.3	3.8	4.2	0.50
	2.5	3.1	3.8	4.4	5.0	5.6	6.3	0.75
	3.3	4.2	5.0	5.8	6.7	7.5	8.3	1.00
	4.2	5.2	6.3	7.3	8.3	9.4	10.4	1.25
	5.0	6.3	7.5	8.8	10.0	11.3	12.5	1.50
	5.8	7.3	8.8	10.2	11.7	13.1	14.6	1.75
	6.7	8.3	10.0	11.7	13.4	15.0	16.7	2.00
	8.3	10.4	12.5	14.6	16.7	18.8	20.9	2.50
	10.0	12.5	15.0	17.5	20.0	22.5	25.0	3.00
	11.7	14.6	17.5	20.5	23.4	26.3	29.2	3.50
	13.4	16.7	20.0	23.4	26.7	30.1	33.4	4.00
	15.0	18.8	22.5	26.3	30.1	33.8	37.6	4.50
	16.7	20.9	25.0	29.2	33.4	37.6	41.7	5.00

For bigger collection pans multiply the values in the grey zone by the number of ft² in the collection
Calculations are based upon 0.8348875 ml/ft³ over each ft² in an acre = 1 bu/ac

Combine Seed Loss Guide

A method for determining seed loss from your combine based on weight, volume, or kernels.



Windrower or header

STEP 1
Find your CF—in this table

Common Ratios of Width of Cut to Width of Discharge (Concentration Factor)					
Width of Cut (ft)	Width of Discharge from Rear of Combine (ft)				CF (X)
	3	4	5	6	
12	16	20	24	4	
15	20	25	30	5	
18	24	30	36	6	
21	28	35	42	7	
24	32	40	48	8	
27	36	45	54	9	
30	40	50	60	10	

STEP 2
Collect a Sample from discharge of known area
Be Careful Be Safe

Continue steps on next page



Table 4 Kernels Method - Wheat

Cut width compared to windrow dropped behind combine (Concentration Factor = CF)

CF	4	5	6	7	8	9	10	Loss bu/ac
20	25	30	35	40	45	50	0.25	
40	50	60	70	80	90	100	0.50	
60	75	90	105	120	135	150	0.75	
80	100	120	140	160	180	200	1.00	
100	125	150	175	200	225	250	1.25	
120	150	180	210	240	270	300	1.50	
140	175	210	245	280	315	350	1.75	
160	200	240	280	320	360	400	2.00	
200	250	300	350	400	450	500	2.50	
240	300	360	420	480	540	600	3.00	
280	350	420	490	560	630	700	3.50	
320	400	480	560	640	720	800	4.00	
360	450	540	630	720	810	900	4.50	
400	500	600	700	800	900	1000	5.00	

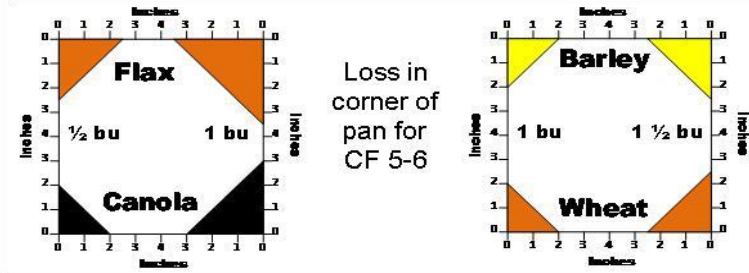
For bigger collection pans multiply the values in the grey zone by the number of ft² in the collection
Calculations are based upon 20 kernel/ft² over each ft² in an acre = 1 bu/ac

Table 5 Kernels Method - Barley

Cut width compared to windrow dropped behind combine (Concentration Factor = CF)

CF	4	5	6	7	8	9	10	Loss bu/ac
14	18	21	25	28	32	35	0.25	
28	35	42	49	56	63	70	0.50	
42	53	63	74	84	95	105	0.75	
56	70	84	98	112	126	140	1.00	
70	88	105	123	140	158	175	1.25	
84	105	126	147	168	189	210	1.50	
98	123	147	172	196	221	245	1.75	
112	140	168	196	224	252	280	2.00	
140	175	210	245	280	315	350	2.50	
168	210	252	294	336	378	420	3.00	
196	245	294	343	392	441	490	3.50	
224	280	336	392	448	504	560	4.00	
252	315	378	441	504	567	630	4.50	
280	350	420	490	560	630	700	5.00	

For bigger collection pans multiply the values in the grey zone by the number of ft² in the collection
Calculations are based upon 14 kernel/ft² over each ft² in an acre = 1 bu/ac



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Online Calculator - Use your smartphone!

<http://farmpro.ca/ref/CombineLoss>

Crop	Wheat	▼
Density (lbs/bu)	60.0	
Yield (bu/ac)	50	
Catch area (ft ²)	3	
Cut width (ft)	29	
Discharge width (ft)	5	
Loss weight (g)	6	
	Compute	
Total loss (bu/ac)		
Relative loss (%)		

By Weight

Crop	Wheat	▼
Density (lbs/bu)	60.0	
Seed size (mg)	40	
Yield (bu/ac)	50	
Count area (ft ²)	1	
Cut width (ft)	29	
Discharge width (ft)	5	
Kernel count	20	
	Compute	
Total loss (bu/ac)		
Relative loss (%)		

By Seed Count

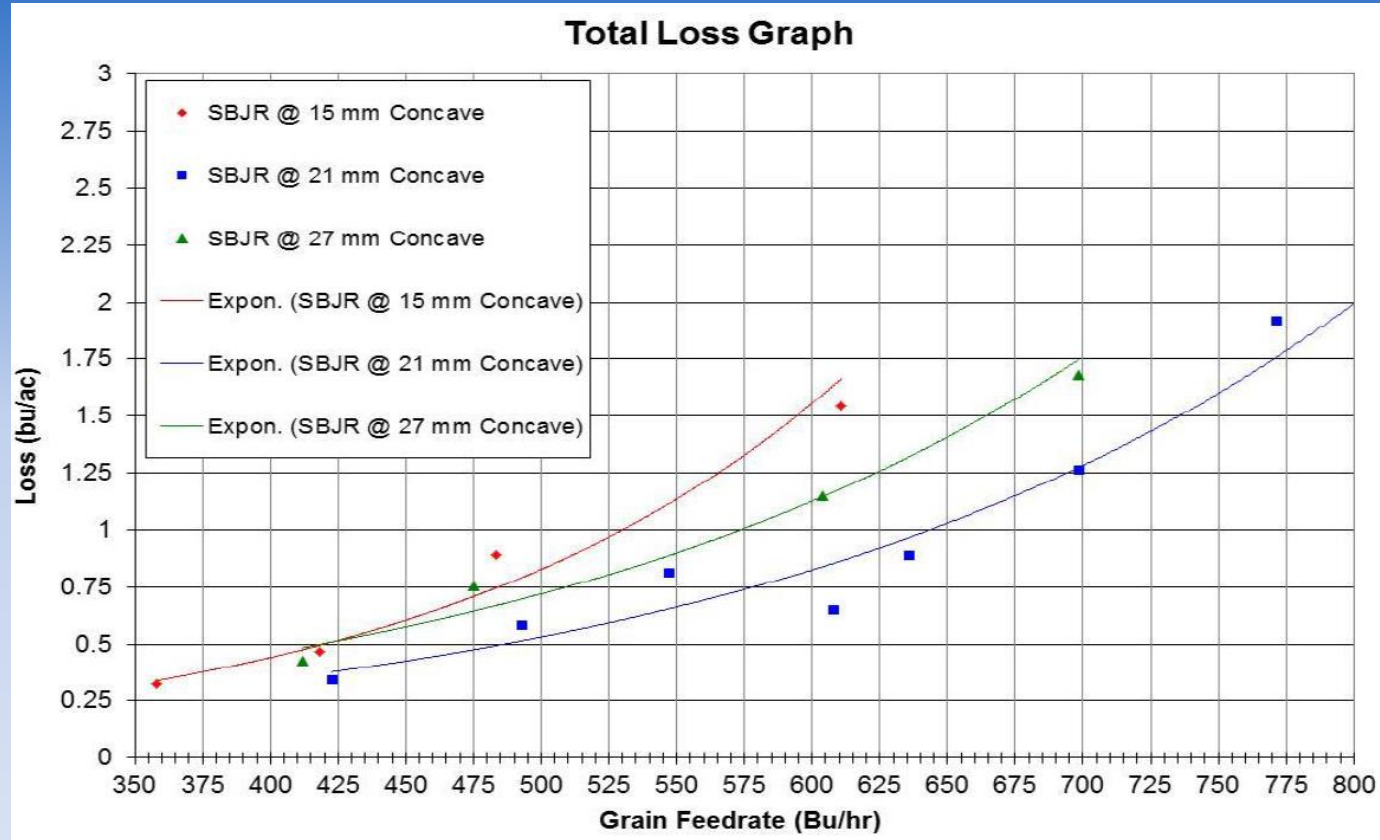
Operating cost (\$/hour)	200	
Width of cut (ft)	29	
Crop price (\$/bu)	10.00	
	Option A	Option B
Speed (mph)	4	3
Loss (bu/ac)	2	0.8
Workrate (ac/hr)		
Total cost (\$/hr)		
Savings (\$/ac)		

Cost Calculator

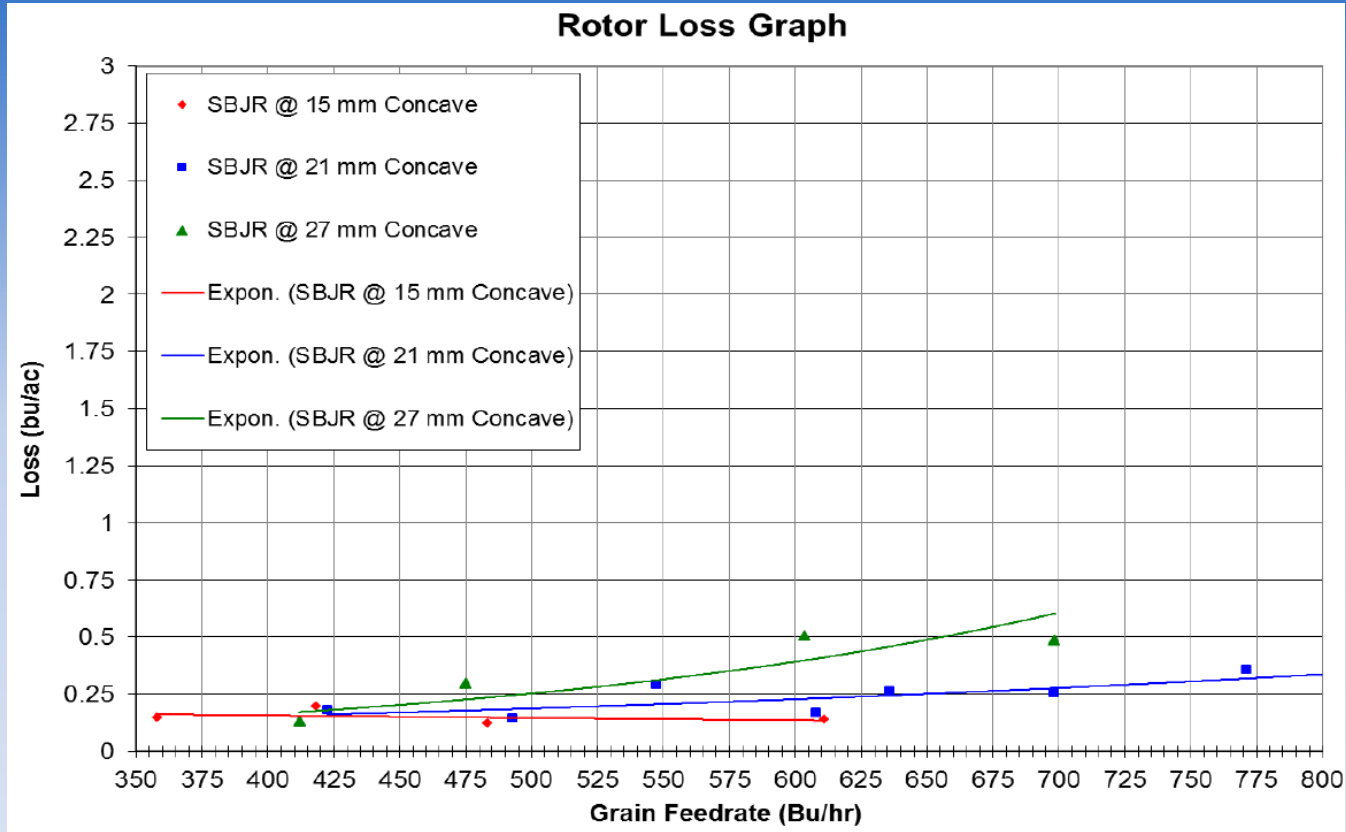


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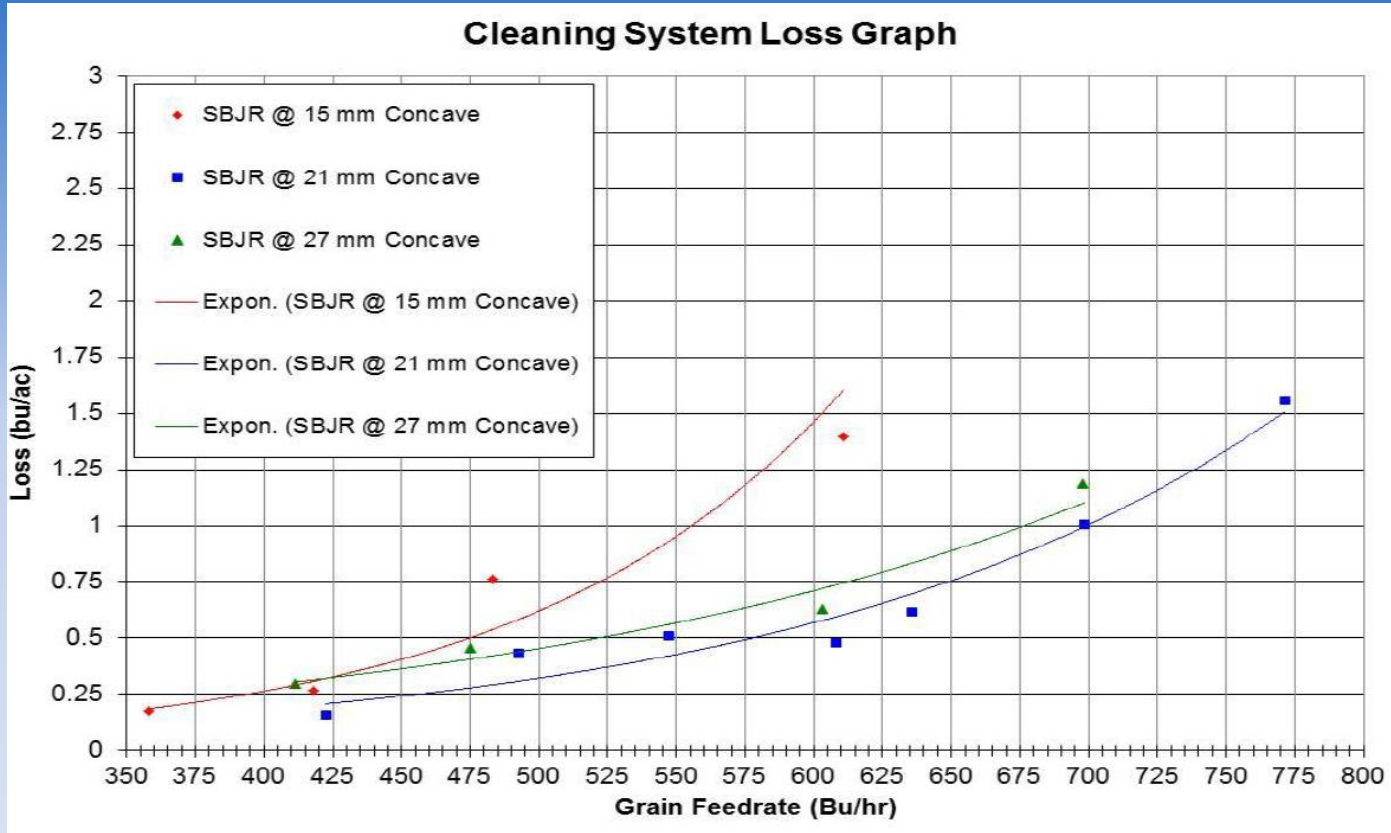
Can combine settings reduce loss?



Can combine settings reduce loss?



Can combine settings reduce loss?



Got to get my crop harvested so what are my options?

- Slow down
- Live with it
- Train operators
- Automation
- Hire a specialist
- Fewer acres
- More combines



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Technology that could help

- Operator feedback of what's happening inside the combine – cameras and sensors
- Sensors under the rotor and sieves to indicate how far back the seed is getting
- Indication of amount of clean grain in returns
- Normalize settings and indications across combines
 - Cleaning settings in m/s rather than rpm
 - Rotor / Cylinder speed in m/s rather than rpm

Technology that could help

- Straw and chaff MOG feed rate monitor
- On board cost benefit analysis of various feed rates and corresponding loss levels
- Air velocity at different points of the cleaning system to better set fan and sieves
- More accurate loss monitors in actual Bu/acre

Key Indicators:

- High amount of grain in tailings may indicate improper cleaning system settings
- A very clean grain tank sample may indicate high losses



Key Indicators:

- Stick your hand in the grain tank sample – damaged grain will sometimes stick to your hand
- Condition of the straw coming out of the combine
- Watch your yield monitor (in consistent fields)
- Kill stalls – you can learn a lot!



Recommendations

- Don't make it a race!
- Don't use all of the available power all of the time
- Learn about your combine
- Invest time in checking losses and optimizing settings



Recommendations

- Do comparisons side by side in same conditions
- Correlate loss with your loss monitor
- Don't use the same settings for one crop all year
- Don't use the same settings all day
- Be safe!



A surreal scene of money falling from the sky over a field at sunset. The sky is a mix of purple and orange, with numerous US dollar bills of various denominations (including 20s and 100s) falling from the top. In the foreground, there is a field of golden wheat. In the middle ground, a yellow and black structure, possibly a piece of farm machinery, is partially visible. The overall atmosphere is one of abundance and financial success.

**Combine Adjustment:
Don't Set it and Forget it!**

Questions?

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