AGGREGATED EXPERIENCE WITH A SYSTEM TO PREVENT FIRES ON COMBINES IN SUNFLOWERS

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Outline

- Review of previous findings
- Systems operated in 2014
- Survey results from cooperators
- Next steps

Lab Results on Sunflower Dust

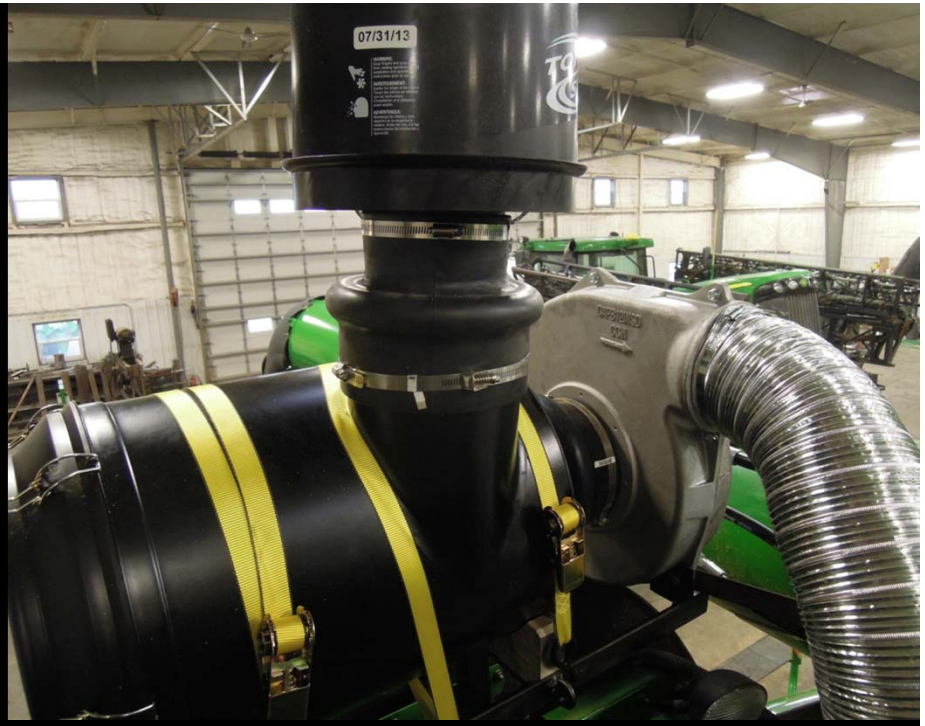
Mesh #	Particle Size (μm)	Ignition Temp. (Deg. F)	
		Corn Stover	Sunflower
50	710-300	608	554
100	300-150	590	536
230	150-63	590	536
500	63-25	572	500
500 Mesh Samples Volatilization Temp.		482	428
Volatilization Energy		67.85 (J/g)	75.11 (J/g)
Total Combustion Energy		12.48 (kJ/g)	13.77 (kJ/g)

2012 Prototype and Field Test

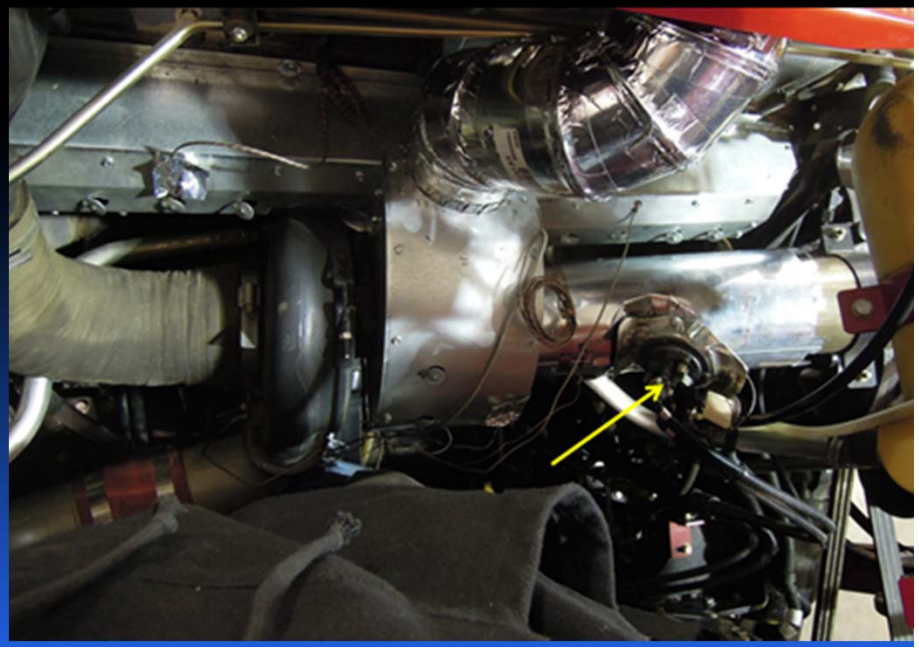
- Prototype developed to fit CaseIH 8120
- System installed on a cooperator's 8120 and operated throughout the fall 2012 season

2013 - New Installations

- John Deere 9770
- Case IH 8230 Tier IV A
  - Twin City Fan mated to Donaldson air filter with Donaldson Spin Top



Case 8230 Manifold & Turbo



Additional Systems in 2014

- Two Deere machines (9770 and 9670)
- Two Case IH 8230s
  - Smaller Donaldson filters and Topspins
  - Slightly smaller Twin City Fan
  - Hard ducting

Systems operated in 2014

- Two Case IH model 8120
  - (One SDSU install and one of producer's making)
- Three Case IH model 8230
- One John Deere model 9770
- One John Deere model 9670
- (A 2nd John Deere 9770 install was removed during servicing in summer 2014 and not re-installed)

Survey Questions and Responses from 2014

How many acres of sunflowers did you harvest in 2014 using the prototype system?

- 4500 Acres (Two Case IH 8120s)
- 1300 Acres (One JD 9770)
- 1200 Acres (One Case IH 8230)
- 2200 Acres (Two Case IH 8230s)
- 1040 Acres (One JD 9670)

How would you rate the 2014 season with regard to the potential of the crop conditions to cause fires?

Highly Volatile year	XX
Volatile year	XX
Typical year	X
Less Volatile Year	
Non Volatile year	

How would you rate the 2014 season with regard to the potential of the crop conditions to cause fires?

Comments:

- “Seed and stalks were extremely dry with moisture testing below 6%. We had no measurable precipitation since July.”
- “Flowers seeds got very dry. (6.5%)”
- “Things really seemed to get dry towards the end of October.”

Did you experience any smoldering fires this year that you do NOT associate with a bearing failure or other mechanical or electrical source?

- "No."
- "None. It was enjoyable to harvest."
- "No smolders or fires"
- "Possibly one." *
- "Yes … as we pushed the speed we had one large … several smoldering areas on a very windy day. Noted that engine temp went up as we pushed. "

**(Operator's version of system that uses an enclosure with a larger exit opening)*

What level of machine capacity were you able to utilize?

- Used full machine capacity XXX
- 85% XX
- 80%
- 75%
- 70%

What level of machine capacity were you able to utilize?

Comments:

- “We were a little cautious. I think we were running nearly at full capacity. “
- “We could push our machines to full capacity if we wanted and never had any problems. We were a little careful when we got started but as we went along and had no smolders we felt comfortable to push them to full capacity when needed.”

What level of machine capacity were you able to utilize?

Comments:

- “Was able to cut 2300 lb/acre flowers at 6 to 6.5 mph”
- We could have increased speed. We were running on average 4 mile per hour. Anytime we increased to 4.5 or above we increased engine temp and choose to slow down.

What level of capacity do you think you would have been able to use WITHOUT this system in place?

Full Capacity	X
85%	
80%	X
75%	X
70%	X
65%	XX*

What level of capacity do you think you would have been able to use WITHOUT this system?

Comments:

- “Likely would have had problems even at low operating capacity I feel. Other(s) that did not have the system did (have problems) on the same model combine”
- “We used to try and stay around 75% of power and not go much over that for very long if we had to”
- “It was most likely below 60%”
- I’m sure we would have cut down on speed just to be safe.

Did you have any problems, or repair, or adjustments that you needed to make to the system this year?

- “No they ran good this year. Had a leaky seal on a hyd fan motor at the end of the season”
- “Had no issues on either machine not even a loose screw.”
- “I replaced the flex tubing with solid tube.”
- “None.”
- “No problems”

How frequently did you have to clean the filter element in the air filter to operate comfortably?

- “About every 2 to 3 days we would blow out filters.”
- “I only cleaned the filter twice but I raised the air intake for the filter above the grain tank so it could get clean air.”
- “I cleaned the filter every day because I was blowing the dust off the combine anyway.”
- “I only cleaned the filter 3 times on 1200 acres.”
- “every day to two days … 8 to 10 hours”

Did this system reduce your stress level with respect to fires while harvesting sunflowers?

- Greatly XXXX
- Moderately X
- Not at all

Comments:

- “Started to take it for granted that we wouldn’t have fires.”
- “I could go to sleep at night knowing that my machine was not going to start on fire.”
- “Still need to be mindful of surroundings.“

How would you compare this approach to other solutions, such as an "air chimney", or frequently cleaning the machine, or running without side shields?

- This system is less effective than other approaches to fire prevention in sunflowers
- This approach helps about like other aids
- This approach seems to be a more complete solution XXXX
- I will no longer operate in sunflowers without this system XXX

How would you compare this approach to other solutions, such as an "air chimney", or frequently cleaning the machine, or running without side shields?

Comments:

- "We did previously run some home made "air chimneys" on our machines which did seem to help. I did notice when running the chimney the engine compartment seemed to stay cleaner which makes sense it's sucking in clean air. We did not run our chimneys with this system and the engines had a lot of residue get stuck on them but much to our surprise we had no smolders or fires. I think for maximum protection and cleanliness this system along with a "chimney" would be very hard to beat."

Would you recommend this system to other producers and custom cutters of sunflowers?

- No
- Possibly
- Absolutely XXXXX

Comment:

"My neighbor is pretty interested in something like this, on his last day of harvest burned his 9670 John Deere up."

"Would like to operate one more year to see more conditions."

If a supplier of combine aftermarket systems could market kits to accommodate combines at a cost of $4000 installed, would you still consider this for your current machine or for your next one?

- Yes XXXXX
- No

Comments:

“I’d say that’s pretty cheap insurance on a combine that costs a couple hundred thousand to replace, plus the time to find one. I would think the insurance companies would want to look at this also.”

“New combines cost over $500,000 at $4000 is a cheap insurance policy at a one-time cost.”

Are there changes or alterations that you recommend if these systems were to be produced for sale as aftermarket kits?

- “I don’t think so. Easier installation maybe.”
- “Have an adjustable air inlet so you can go higher above the cab and be able to lower it to fit in building for storage.”
- “We did move the air filter housing closer to the floor of the combine instead of on the hand rail, gives it more of a factory look we also used nice aluminum pipe and rubber elbows which gives it a more factory look.”
- “Maybe minor adjustments but not really.”

Next Steps

- We have experience with systems for:
- Case IH 8120, and Case IH 8230
- John Deere 9770, and John Deere 9670
- Other models will require more work to accommodate varying engine exhaust system and hydraulic circuit designs
- Have not yet secured a manufacturer but are open to working with them

Questions?

South Dakota Oilseeds Council