Straw quality control

February 8th - 2022

Generally

This document is to ensure:

- The correct raw material is used on the line delivered by Cormall
- The necessary information on how to produce and deliver correct raw material
- How to detect and reject bad and wrong material, as good as possible

Cormall machines are developed to handle and overcome many situations with "bad bales" as they come from time to time, slipping through delivery control. These systems are developed for incidental failures in the straw quality, - but they cannot solve in case of a permanent material supply failure, due to pure supplies and lack of quality control.

Straw quality can depend on many different parameters:

- Straw type; wheat, barley, rye, oat, … etc.
- Seasonal happenings; dry or wet straw-year
- The soil from where the straw has been harvested:
    - Light sandy soil or rich fat soil
    - Stones in the fields or no stones
    - Mineral in the ground
- Coast near climate or inland climate
- Harvest/baling equipment with or without cutting knifes, baled density kg/m^3..
- Impurities and contamination added to the straw during baling: steel, stones, strings etc.
- Impurities added to the straw bale during handling: steel from lifting equipment.
- Storage of the straw outdoor/indoor, during period before delivery to factory
- Delivery method to factory, - distance driving if it's on a rainy day
- …

In the following document you will find most of the above parameters described more in detail

Production without human presence:

Above mentioned differences and parameters of the raw material and possible impurities related here to, does not allow working without any human presence at all, - at least there has to be a line call system organized, and daily line observation and service maintenance must be performed as well.

Line capacity

The capacity throughput is based on:

- Wheat straw, of good quality.
- Moist percentage in average of normal stored straw 9-12%
- Up to 15% moist - when specified
- Machines can work with up to
    - 18% moist with reduction for straw mill capacity
    - 20-25% for bale breaking only, - must be specified and agreed
- Straw that has been harvested dry

The differentiation between wheat straw as 100% and other straw types than wheat straw, is calculated as kW/1000 kg for the mill, the rest of the machines are added to the kW below, approx. +/-:

kW/T - wheat straw index: 1									
LSM mill – Wheat		Barley	Oat	Ray	Rape	Rice	Hay	Misch.	Corn
Screen size	kW/T	75%	65%	60%	110%	55%	55%	65%	90%
6	65	87	100	108	59	118	118	100	72
8	50	67	77	83	45	91	91	77	56
10	40	53	62	67	36	73	73	62	44
12	35	47	54	58	32	64	64	54	39
15	30	40	46	50	27	55	55	46	33
20	26	35	40	43	24	47	47	40	29
25	23	31	35	38	21	42	42	35	26
30	21	28	32	35	19	38	38	32	23
40	20	26	30	33	18	35	35	30	22
50	19	25	29	32	17	35	35	29	21
70	18	24	28	30	16	33	33	28	20

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Straw contamination

The Cormall machines are designed and made to be resilient and robust against the influence from possible contaminations in the straw. To achieve this, we have developed our MTX_H & SBB machines to work at low rpm 50-70 rpm, to break up bales rather than shredding them, like with old system, working at 1000-3000 rpm. The bale breaker system can experience a blocking of the machine and you may have to remove the contamination out of the machine, but it will not course the machine to break down, as it most likely will with a high RPM system.

Stone trap/contamination trap

The stone trap works by gravity combined with pneumatic transport. Air suction takes the light density products out of the trap and leaves behind the heavier particles in the trap. This straw contamination is something that is added to the straw during baling on the field.

		
Normall stone trap situation	*Larger stones generaly, record holder is 38 Kg*	*Stone trap at client (Easy Agricare)*

Straw baling – foreign obstacles and objects

The most common reason for seasonal contamination, is when the harvest conditions has made it necessary to rake the fields for drying the straw after a rainy period. If the person who rakes the field is setting the rake to low, then the rake will pick up many stones and other obstacles that end up on top of the straw, and will be baled together with the straw.
Another reason can also be the bale press itself, here the operator can also set the pickup rake to low, thus coursing that not only straw is picked up into the baler, but also stones and other foreign object from the field, a third reason can be uneven field with stones raised up:

POS	Description	Obstacle
1	**Stones** Most common found obstacle that can course problems during daily operation, is larger stones, up to 38 kg has been found in our stone trap. The stones shown on this picture will normally not course any problem at all	

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POS	Description	Obstacle
2	**Steel** The steel objects that can be found inside a bale can be huge, this larger part in the top of the picture is a part that has fallen off from inside the baler itself	
3	Most commonly steel parts found in the bales are parts from field machines, the top part on this picture is from the combined harvester, the lover part is from a field rake. Also, parts from the plough and field harrow can be found inside the straw. So far, the record steel part inside straw has been a shopping wagon from Aldi	
4	**Broken fork** It happens that a fork from the bale loader brakes off and is first detected after the truck has left the farm. It is difficult to see on a bale, if there is a broken fork inside. We have seen forks inside our machines, they will course blocking in the machine and have to be removed, but there is normally no other problems on the machine here after, other than bended steel, and production can be started again	 
5	**2 crops in one bale** Reason can be bad winter season for winter wheat, here after crop change in spring to autumn barley. Bottom picture showing: - Left side: wheat straw - Right side: barley straw Barley straw will reduce the capacity compared to wheat straw.	 

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Straw bale harvest/baling – bale strings

POS	Description	Obstacle
6	Every now and then the operator of the baler has to set in new rolls of strings to continue baling. There is always some leftover strings when this is done, and all these strings end up being thrown into the baler and inside the straw bale, - even when you remove 100 % of the strings on your bales, you can still find strings in your end product, unless you have a bale supplier who is trusted and can guarantee you that this is not he's practice.	
7	These strings from inside the bale will end up inside machinery, even though all strings where removed from the outside of the bale, the enclosed pictures show build-up from a period of 1 month at a production site. We recommend to inspect the bale breaker once a week, and remove build-up. This can take approx. 15-20 minutes, and can be done from the outside of the SBB 1800 through side doors.	 

Straw bale harvest – moist percentage

POS	Description	Obstacle
8	**Early morning baling** Straw baled in the early morning from 5-9:00 will be with dew on the straw. The moist from the dew combined with the hard-pressed straw will provoke fermenting/heating of the straw during storage, up to 70 degree inside the bale, this is, - bio thermal drying process. If they are packed into a **"field hose"**, then heating of the bale and condensing on the inside, will course wet straw on the outside corners of the bale. Some of the bale stamps will be very hard and ridged in structure, almost like a MDF plate	

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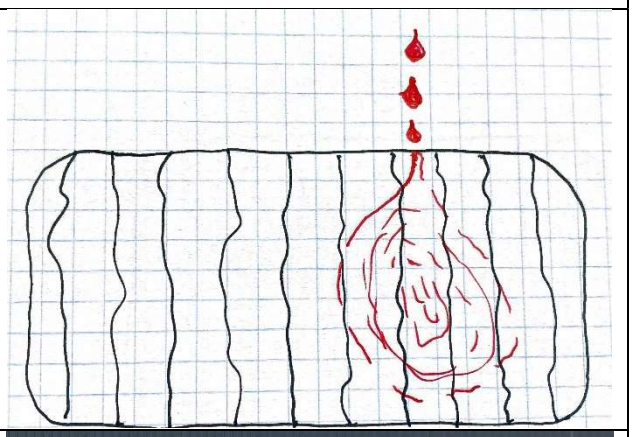
POS	Description	Obstacle
9	**Ditches** Some straw should just not be harvested, like straw in ditches, even after a very small rain period, that may not seem as much, but the rain is all collected in the ditch and end up in the bale.	
10	**SR STRINGREMOVER:** **Deformed bales** Even with bale detection to the center of the conveyer bales can be to deform as in this picture thus coursing incorrect measure if the bale length when using for automatic de-string/ twine remover. **Field stacking deformation** Bales can also be deformed, not only in the ends but also on the top of the bale. Particularly the low field stack bales, that have been turned and sundried upside down, can be out of level thus coursing the string hook to pass through without catching the strings.	 
	Bale handling Pictures are showing the result from using a normal forklift for handling bales, the bale was good until the fork lift was used, here after it was deformed/bend from its own weight on the forks. The bale top is not parallel with the string hook, and it is not possible to make correct bale top detection. On bales like this will the hook not be deep enough to catch the string and take it of Use only professional lifting equipment	

Straw bale storage and delivery – Moist percentage

POS	Description	Obstacle
11	**Closed barn is best** The best straw storage quality is obtained from closed barns. But there is allot of field stacks also. Straw from field stacks must be proper closed from the top and down the sides. The lover straw bales on the outside of a field stack, cannot be used, it will be wet and moist percentage will be high. It is important to observe the normal wind direction when placing a stack, so the long stack-side is not in the direction where the wind and rain, comes from.	
12	**UV proof field hose?** Recent discovery has shown that the tube stacking is not made with UV resistant plastic, even though plastic producer promises, - the UV radiation will over time break down the strength in the strings and will not hold the bale together during handling. **Condensing:** This is another problem with field hose see “early morning baling” pos8	
13	**Hole in the cover or barn roof** It is important that the plastic cover from the field stack is without any holes where rain can come into the straw stack, these bales can easily go through the moist inspection, without being detected, since the moist in inside the center of the bale, and they can course complete production stop. Holes can be made by birds/crows.	
14	**Transport in rain – long distance** When getting deliveries by truck, it should be observed that there is not to long distance on rainy days, long distance delivery during raining, can course allot of moist in the straw	

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POS	Description	Obstacle
15	**The straw colors** At the bottom of the picture is all the raw material from the latest harvest, on top is the raw material from previous year. The straw on the top should normally have been rejected at delivery, depending on purpose and reason	
16	**Straw from last year or older:** Old straw is easy to detect on the color, the surface and the smell from the mold. **Field dried in the sun** On warm and sunny days, it is possible to place bales in the field and dry them out, enough to pass moist inspection. The bales in the pictures went through moist inspection without being detected **Straw and string "melted together"** This 2nd picture is showing a field stack bale that has been dried. During the wet period has the string gone deep into the bale and almost melted together with it. De-stringer: Bales like this can break the string when the hook from the string remover goes across and not be removed, or course the winder to block.	  

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POS	Description	Obstacle
17	**Toxic mold level** It is easy to detect bad straw from the mold smell. Hi mold content in the straw storage hall can be above the values acceptable by workers health and safety inspector. Air-born mold in these levels are toxic and dangerous for the health and safety of workers breathing it, and correct mask's must be used for workers protection. The picture is showing small dead mouse puppies. Finding mouse and rats inside old moldy field bales is not unusual	
18	**<u>Not possible to measure correct</u>** It is difficult to dry out a field stack bale completely, just by placing it in the sun. Some bales seem ok, and can even show acceptable moist percentage, however in this picture, was made a hole into the bale, and the moist measuring spear was pushed deeper into the bale, here it was found that the bale was 41% moist. Hidden moist percentage is better to detect with microwave measuring system: System C (see below)	

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Straw bale – moist measuring systems

POS	Description	Obstacle
A	The simplest way to measure the moist is with a small hand terminal working on batteries, this is time consuming and needs many penetrations into the straw bale.	
B	Another system on the marked is integrated with the fork lift and can communicate with a tablet or smartphone, and give a direct delivery reference to the receiving storage management system.	 
C	For big daily consumption we recommend portal cranes with build in moist measurement equipment using microwave. Disadvantage with this system, is when two bales are placed side by side, it will detect average of two bales, this can be one bad and one very good.