

# Possible measures to reduce impacts of crop residue removal: experiences on wheat harvest in Sweden and France

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# Overview

1) Wheat harvest technologies: Traditional combines vs. hybrid combines

2) Experience of CREA IT on wheat residues collection after harvest with traditional and hybrid Combine in France and Sweden

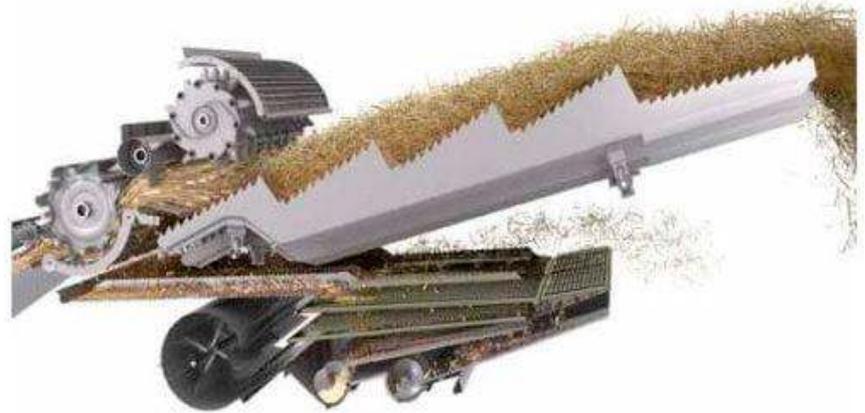
- Methods for quantifications of different biomass fractions (grains, straw and chaff)

3) Observations and Conclusion

# Traditional combines vs. hybrid combines: technical differences

## ***Traditional threshing mechanism:***

consists of a rotating *threshing drum* (commonly called the "cylinder"), to which grooved steel bars (rasp bars) are bolted. The rasp bars thresh or separate the grains and chaff from the straw through the action of the cylinder against the *concave*, a shaped "half drum", also fitted with steel bars and a meshed grill, through which grain, chaff and smaller debris may fall, whereas the straw, being too long, is carried through onto the *straw walkers*



Chaff escapes below the straw and is left in the field (not collected by baler)



Chaff escape below the straw and is left in the field

**The HYBRID SYSTEM threshing technology** represents the combination of two outstanding technologies: the tangential threshing system and the ROTO PLUS residual grain separation system.

In the hybrid system the straw walker are substituted by ROTO PLUS post-threshing grain separation.

The principle behind ROTO PLUS is simple but extremely effective. The impeller of the threshing unit divides the straw into two flows of material and feeds them to the two counter rotating, high performance rotors.

Eccentrically mounted rotors generate centrifugal force to separate the remaining grains from the straw. For example the Claas Lexion has two rotors with a diameter of 445 mm and a length of 4.20 m each, and this provide a huge separation area.

At the same time the system provides also the detaching of the fine parts of the straw

# Differences in the residues generated

## Traditional combine:

-long straw (60-70 cm) easy to be baled



## Hybrid Combine:

-short straw (20-30 cm) difficult baling  
- the upper part of the stem is detached



The combines can be equipped with devices for incorporating or unloading the chaff onto the straw windrows.



# CREA IT Experience on residue collection in FRANCE

**HARVEST TESTS PERFORMED TO EVALUATE THE  
EFFICIENCY OF A TRADITIONAL COMBINE NEW  
HOLLAND CX840.**



# CREA IT Experience on residue collection in SWEDEN

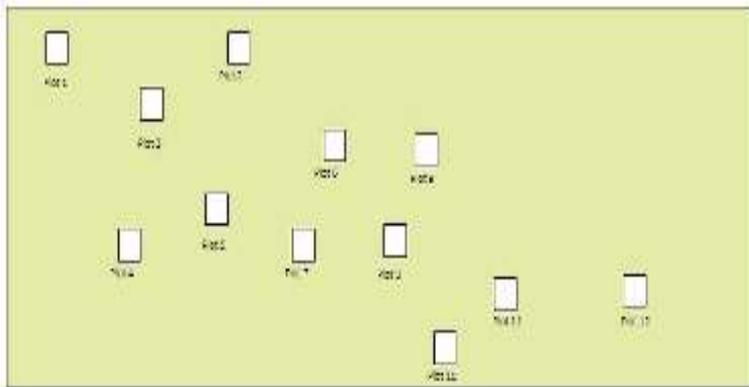
**HARVEST TESTS PERFORMED TO EVALUATE THE  
EFFICIENCY OF A HYBRID COMBINE FENDT 9490 X**



# Wheat residues: amount available of the different fractions

methods used for quantifications

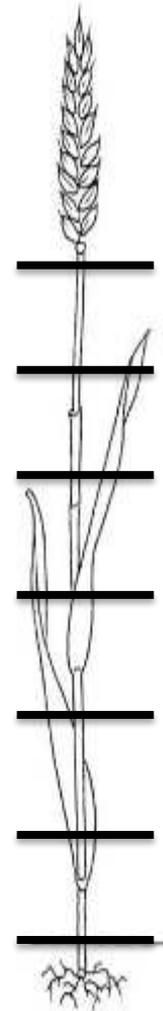
## PLOTTING



### ***Biomass yield of the different fractions:***

separation of seeds, straw and chaf (part in the field and part in laboratory) to determine the yield per ha of each fraction.

***Dry matter partitioning along the stem:*** determined on 100 stem samples, replicated 10 times. Each stem is divided in section of 10 cm and weighed with precision scale. The work allow to understand the amount of straw left as stubble after the passage of the machine (the study is matched with the post harvest measurement of the combine cutting height).





Plot formation and removal of the plant



Field characterization and record of the working times



Sampling before baling to determine straw moisture content at baling



Drying of the material collected



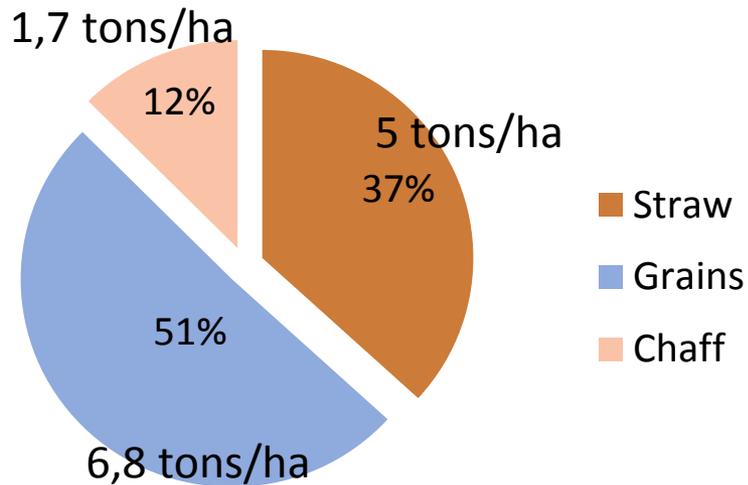
Combine and baler on work



# Productions

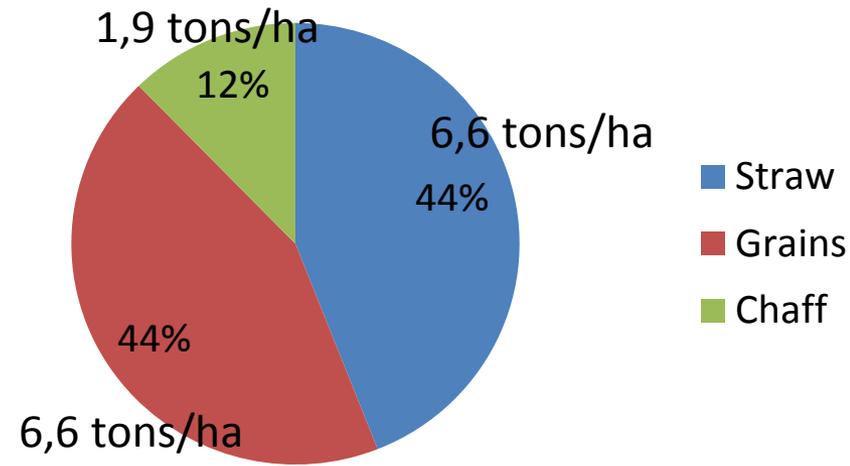
(all productions are reported in d.m)

## Sweden



Sweden: on average 13,8 tons/ha of dry biomass were present in the field. Respectively the 51% was seed (6,8 tons/ha), the 37% was straw (5 tons/ha), and the 12% was chaff (1,7 t/ha).

## France



France: on average 15 tons/ha of dry biomass were present in the field. Respectively the 44% was seed (6,6 tons/ha), the 44% was straw (6,6 tons/ha), and the 12% was chaff (1,9 t/ha).

# Straw: Dry matter partitioning

## SWEDEN - Biomass partitions along the stem:

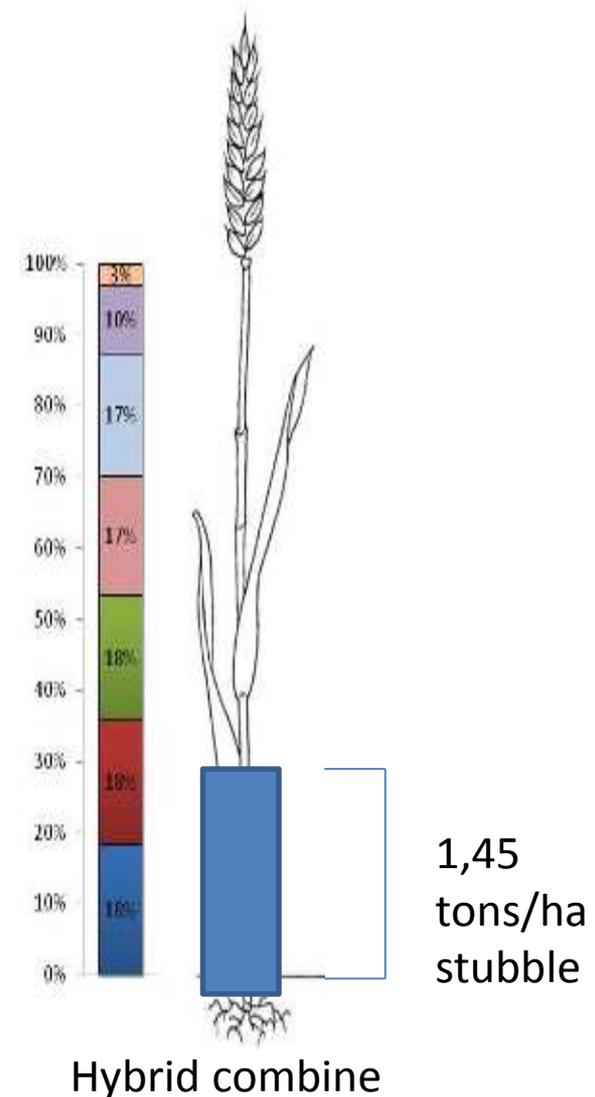
Considering a total amount of 5 tons of straw potentially available in the field, the 29% (1,45 tons/ha) remain in the field due to cutting height of the combine. The amount was calculated considering a mean cutting height of 16,3 cm (mean of 100 measurements) and through the study of the dry matter partitioning.

### Material actually available for collection:

Straw 3,55 tons/h

Chaff 1,7 tons/ha

Total: 5,25 tons/ha



# Straw: Dry matter partitioning

## FRANCE - Biomass partitions along the stem:

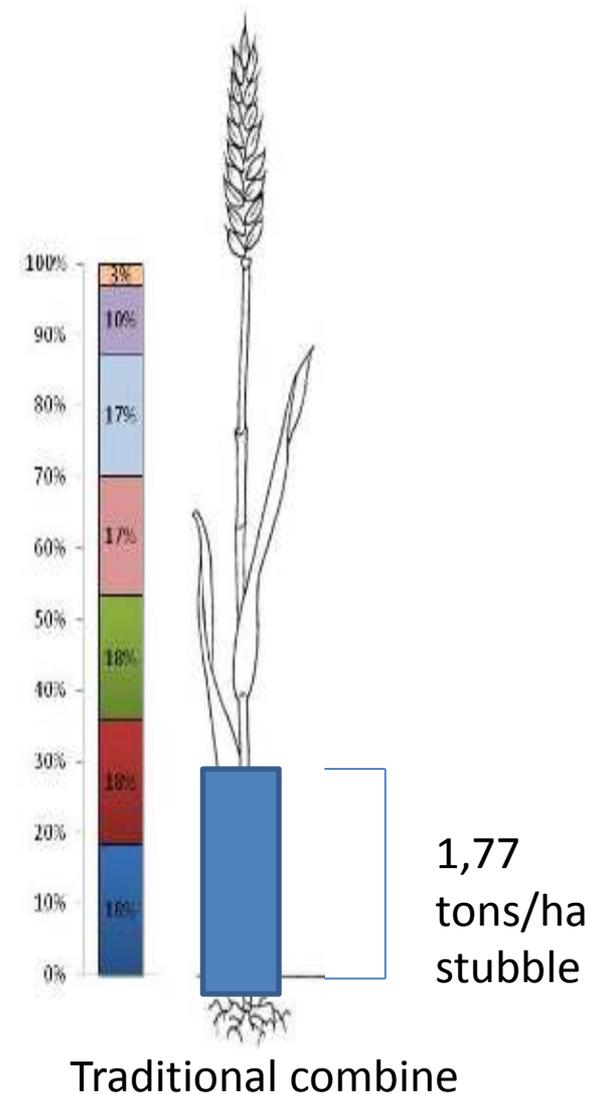
Considering a total amount of 6,6 tons of straw potentially available in the field, the 26,9% (1,77 tons/ha) remain in the field due to cutting height of the combine. The amount was calculated considering a mean cutting height of 16,2 cm (mean of 100 measurements) and through the study of the dry matter partitioning.

### Material actually available for collection:

Straw 4,83 tons/h

Chaff 1,9 tons/ha

Total: 6,73 tons/ha



# Quantification of the residues left in the field after baling



The material left in the field after the passage of the baler was quantified in both France and Sweden.

The combine and the recovery system used have influenced the amount of material effectively collected.

# In Sweden with hybrid combine

## **Biomass left in the field after baling**

On a total amount of 5,25 tons/ha of residues collectable, the biomass left in the field after baling were about 2,5 tons/ha (48%),



48% of the material was left in the field

# In FRANCE with traditional combine and round Baler

## **Biomass left in the field after baling**

On a total amount of 6,73  
tons/ha of residues  
collectable, the biomass left  
in the field was 1,3 tons/ha  
(19,3%),



19,3 % of the material  
was left in the field

# OBSERVATIONS

The combines used influenced the total amount of residues available for collection, with the hybrid system the collected product was only the 52%, while with the traditional combine the collected product was the 80,7%.

Therefore, with the hybrid system a significant amount of straw is left in the field, mainly the upper and thinnest part of the stem that pick up devices are not able to lift up



# CONCLUSION

The collection of the 52% of the residues achieved with hybrid combines can be considered a good compromise between “removed and left” organic matter from the field after wheat harvest and could be the way to balance the impact of residue removal.

Studies are needed to verify that the part left in the field would be the richest in minerals and nutrients to eventually take actions for adjusting the machines to reach this purpose.

# Thank you for your attention

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