Starch degradability and energetic value of maize silage

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Introduction

* Maize silage = main forage in high yielding ruminants' diet

* Accurate evaluation of energetic value in diet formulation
  = important economic stake
  - Amount of starch digested in the rumen → impact on feed efficiency, quality of products and animal health
  - Starch "By-pass" → supply for glucose intestinal production

* Quantification and prediction of starch degradability (Ali *et al.*, 2014)
  = international issue

Objectives

* Objective 1: Analyse factors affecting rumen starch degradability
  - -Stage of maturity (defined by % Whole plant DM)
  - -Type of hybrids (defined by type of grain)

* Objective 2 : Predict rumen starch degradability
  - -Define useful and quantifiable predictors
  - -Prediction of starch contribution in the rumen and in the intestine
  - -Prediction used in feed evaluation systems (INRA)

Materials

* **Maize samples** (*collected in **2011** and **2012, 1 location***)

Hybrid F1
Flint to Flint-Dent grain

Hybrid F2
Flint to Flint-Dent grain

Hybrid FD
Flint-Dent grain

Hybrid D
Dent grain

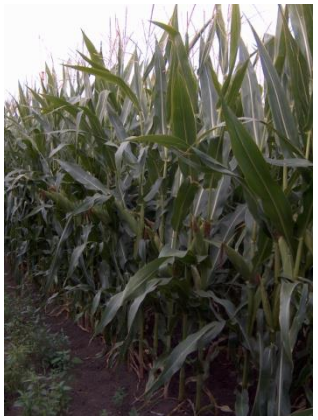
For every Hybrid

Stage 1 (28% DM)

Stage 2 (32% DM)

Stage 3 (34% DM)

Stage 4 (41% DM)



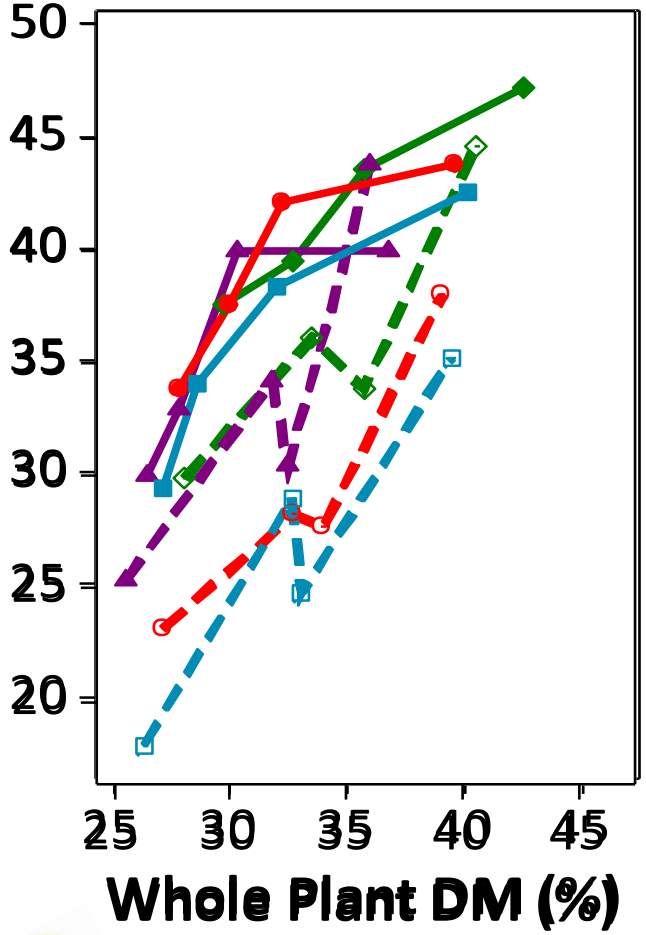
TOTAL =

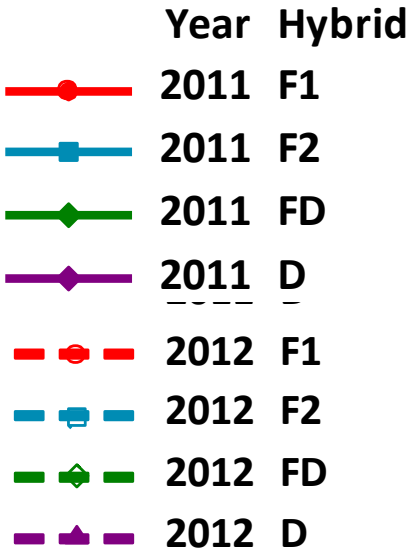
32 maize silages

Materials

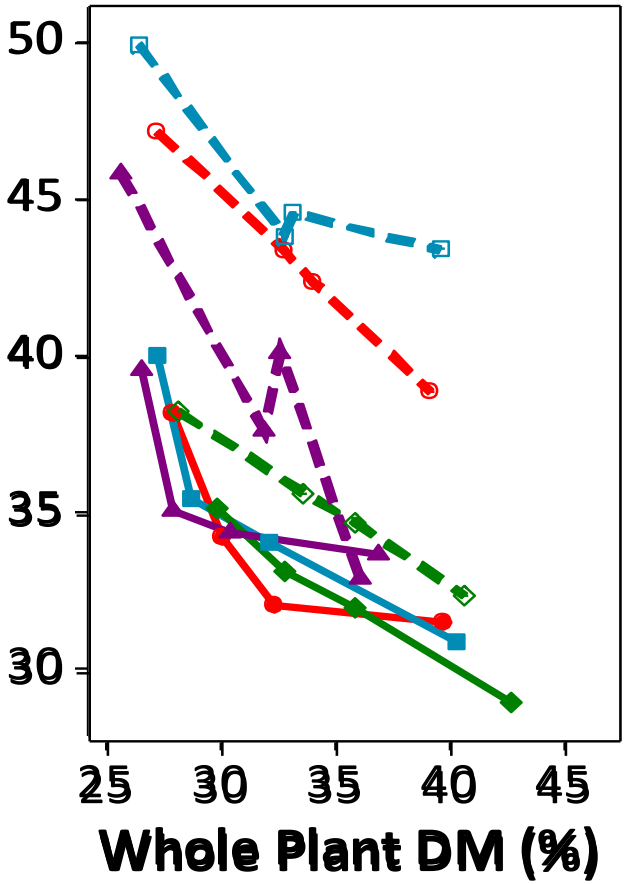
* **Chemical composition of maize silages**

Starch content (%)





NDF content (%)



Method: *in sacco* technique

* **Ruminal incubation**

Sample conditionning
(Peyrat *et al*, 2014. Anim Feed Sci Technol)

Dried at 60°c for 48h + 4mm ground

Incubation times
2h, 4h, 8h, 24h, 48h, 72h

6 Replicates: 3 dry cows and 2 measurements

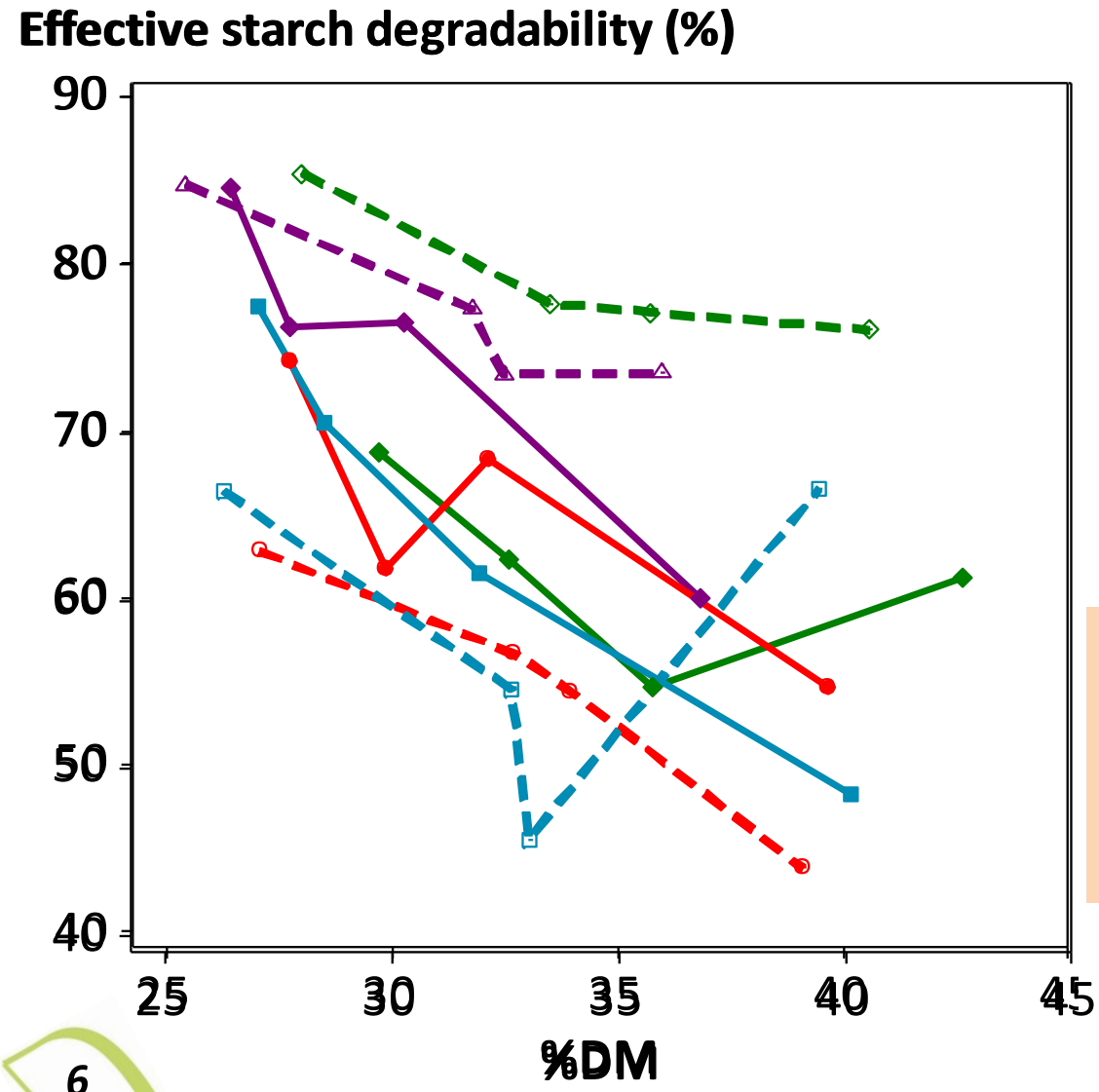
Samples from 2 years in the same trial

Animal feeding:
45% of maize silage,
25% of grass hay,
30% of concentrate

* **Data analysis**
* Effective starch degradability assuming a particulate passage rate of 0.06 h^{-1}
* Effect of hybrid, stage of maturity, year of harvest and their interactions using MIXED procedure of SAS.

Results

* Variability of effective starch degradability (ED6)



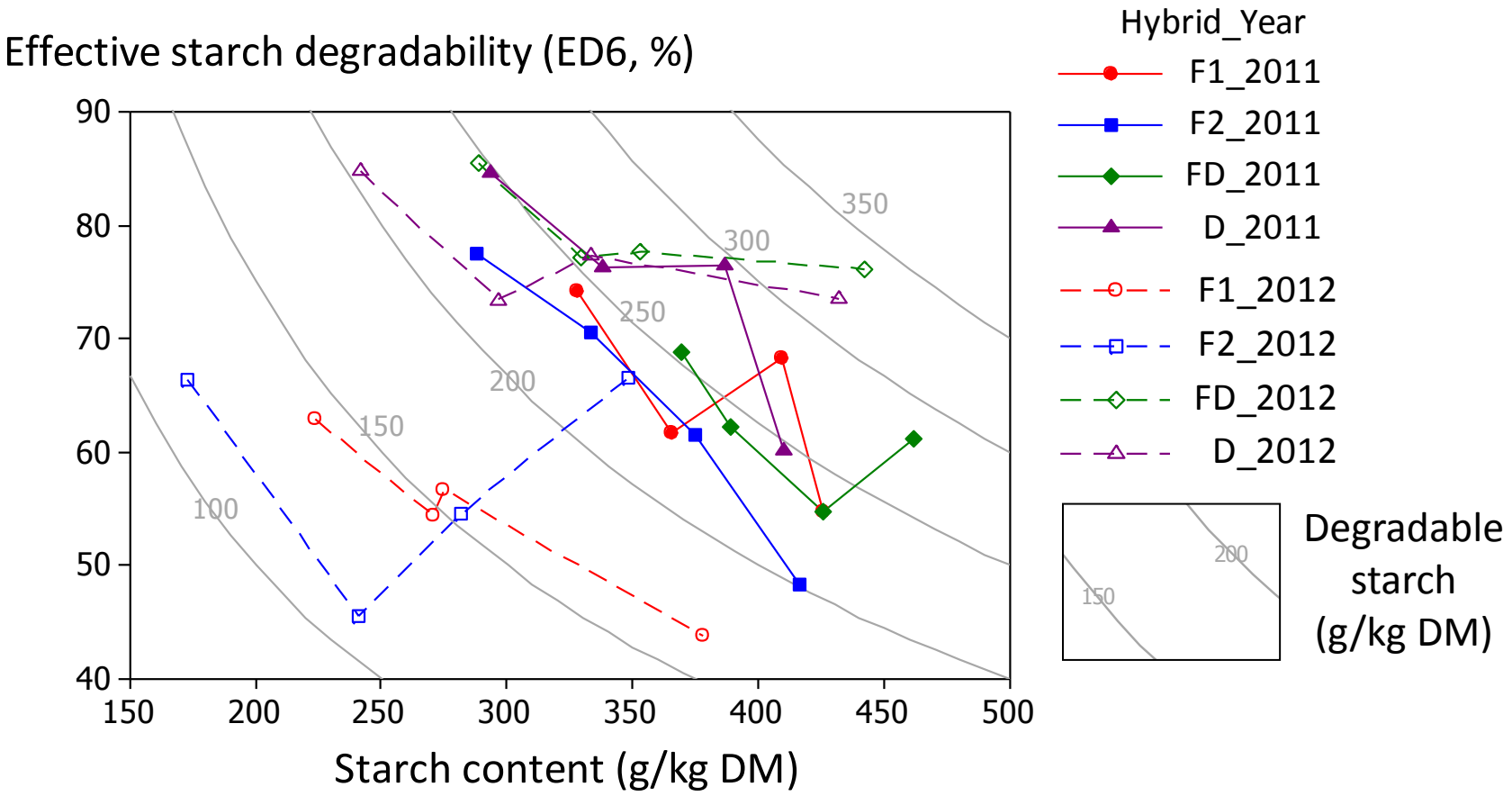
-Maturity stage effect ($p<0.01$)

-Hybrid effect ($p<0.01$)

-Hybrid*Year interaction ($p<0.01$)

Results

* Variability of degradable starch in the rumen

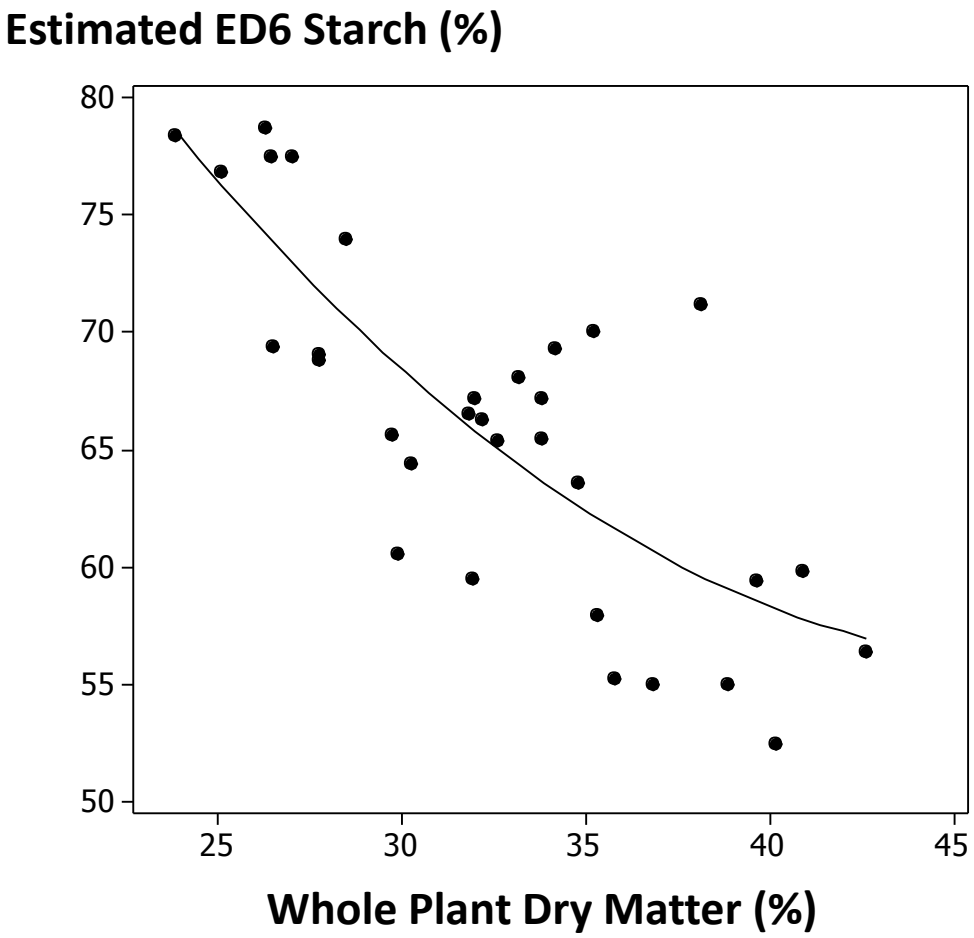


According to type of hybrid, type of maturity stage and climatic conditions :
100g/kg DM<Degradable starch in the rumen<300 g/kg DM

Results

* **Relationship between effective starch degradability (ED6) and maturity stage**

Starch degradability (ED6)= a + b(DM) + c(DM²) + (Hybrid*Year) + ε



N_{H*Y} =8
N=32
R^2 adjust=0.63
RMSE=4.0

Conclusion

Factors affecting rumen starch degradability

* Decrease of starch degradability in the rumen with increase of **maturity stage**
* **Interaction Hybrid*Year** in the same location

Large variations in degradable starch in the rumen

Prediction rumen starch degradability (ED6)

* Significant relationship between ED6 and maturity stage
* Difficulty to predict accurately ED6 due to hybrid*year interaction
* Need to search for parameters that account Hybrid*Year effect

Thank you for your attention !