A living lab to increase einkorn diversity from field to plate

Gwénaëlle Jard, Marie-Françoise Samson

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A living lab to increase einkorn diversity from field to plate

Gwénaëlle JARD (Purpan)

Marie-Françoise SAMSON (INRAE)

Co-constructing interactive short and mid-tier food chains to value agrobioDIVersity IN healthy plant-based FOOD

Divinfood aims

To facilitate the use of **Neglected and Underutilised Crops (NUCs)** in food value chains to favour healthy diets and sustainable food systems

NUCs considered in the Divinfood project

Cereals

Emmer (*Triticum dicoccum*)
Rivet wheat (*Triticum turgidum)*
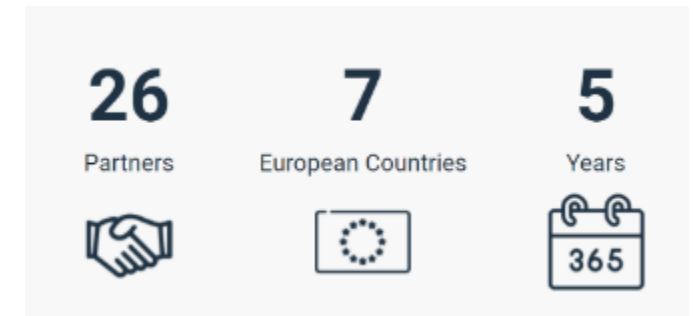Einkorn (*Triticum monococcum*)

Legumes

Beans (Meat bean, Faba bean, Lingot bean, Limabean, common bean)
Lupine (blue and white)
Pea, Chickpea, Cowpea
Lentils

https://divinfood.eu

The Divinfood partners in 9 Living Labs

Leg-Nord
Faba-Nord

Cer-Hung
Leg-Hung

Bean-Lyon
Bean-Cast Leg-ItSwitz

Cer-Occ

Gpea-Port

Living Lab → Innovative participatory approach involving users to co-develop products, services and systems

26	7	5
Partners	European Countries	Years

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The Cer-Occ Living Lab: Focus on einkorn

Triticum monococcum

The main commercial variety available in France is "**IGP Petit Epeautre de Haute Provence**"

↓

Look for **other varieties** in order to increase agrobiodiversity and find adapted varieties to local conditions and for short and mid-tier food chains

Identification of users' expectations for einkorn

Organisation of workshops

5 workshops (2018-2020)

60 participants including farmers, processors, researchers, farm advisors

They need new varieties with high agronomic performances:

→ Productive and stable in organic conditions
→ Competitive against weeds
→ With stiff and tall straws

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Einkorn participatory breeding

Selection of cultivars according to their agronomic performances

112 cultivars sown

Production in 1 location 2018

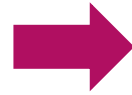**Evaluation criteria co-defined with farmers:**

Germinative capacity, Precocity, Lodging resistance, Colour of the ears
Height, Vigour, Yield, Grain size, Competitivity

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Einkorn participatory breeding

Selection of cultivars according to their agronomic performances

112 cultivars sown

Participatory selection of 19 einkorn cultivars

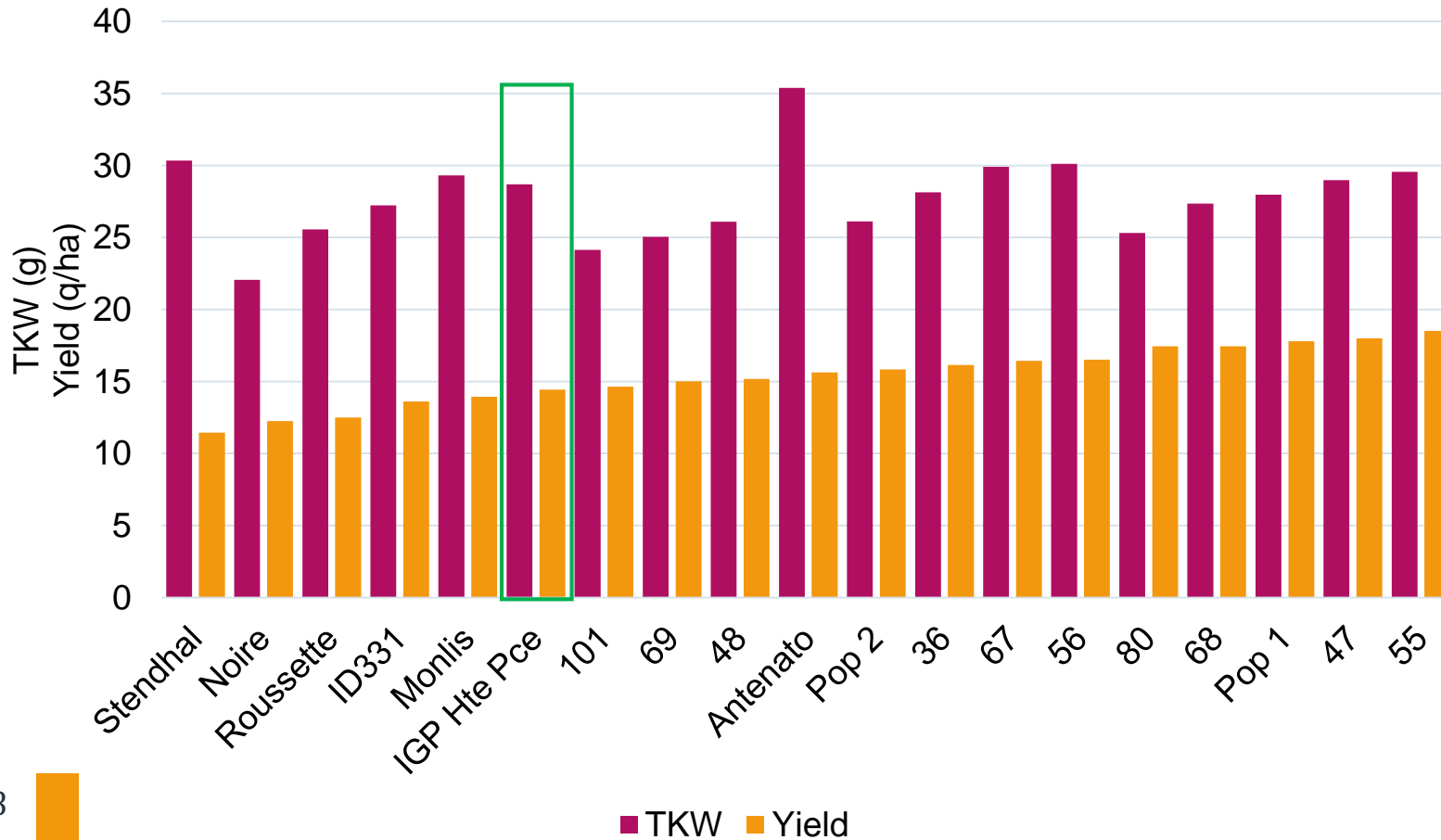Production in 2 to 4 locations from 2019 to 2024

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Evaluation of agronomical performances

Yield and Thousand Kernel Weight
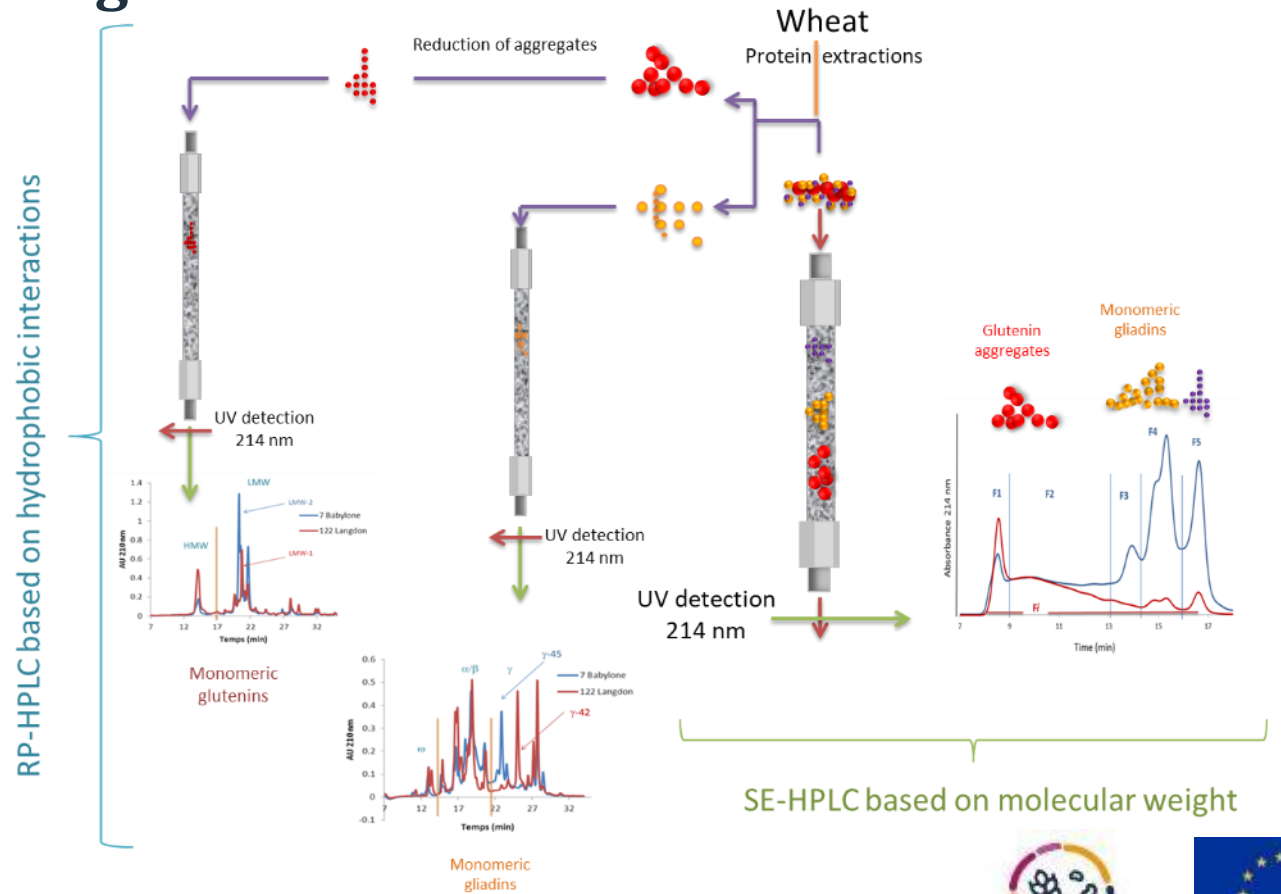

On the basis of 2 years of harvest (2022-2023)

- cvs 55 and 47 have a significantly higher yield than IGP Haute Provence

- Cv Antenato -> highest TKW

Evaluation of technological quality

Protein composition of einkorn grains
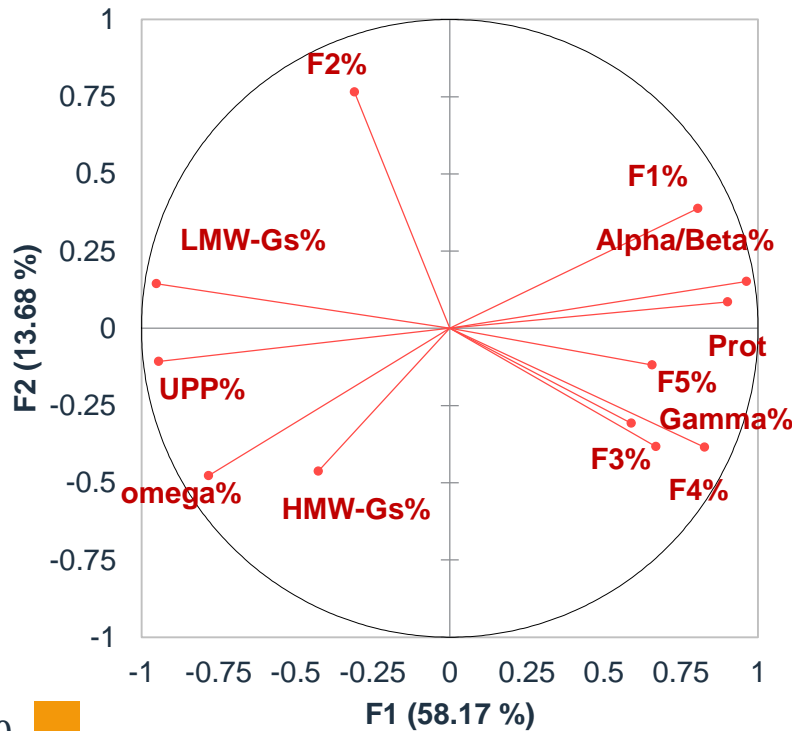
Protein content and profile by HPLC
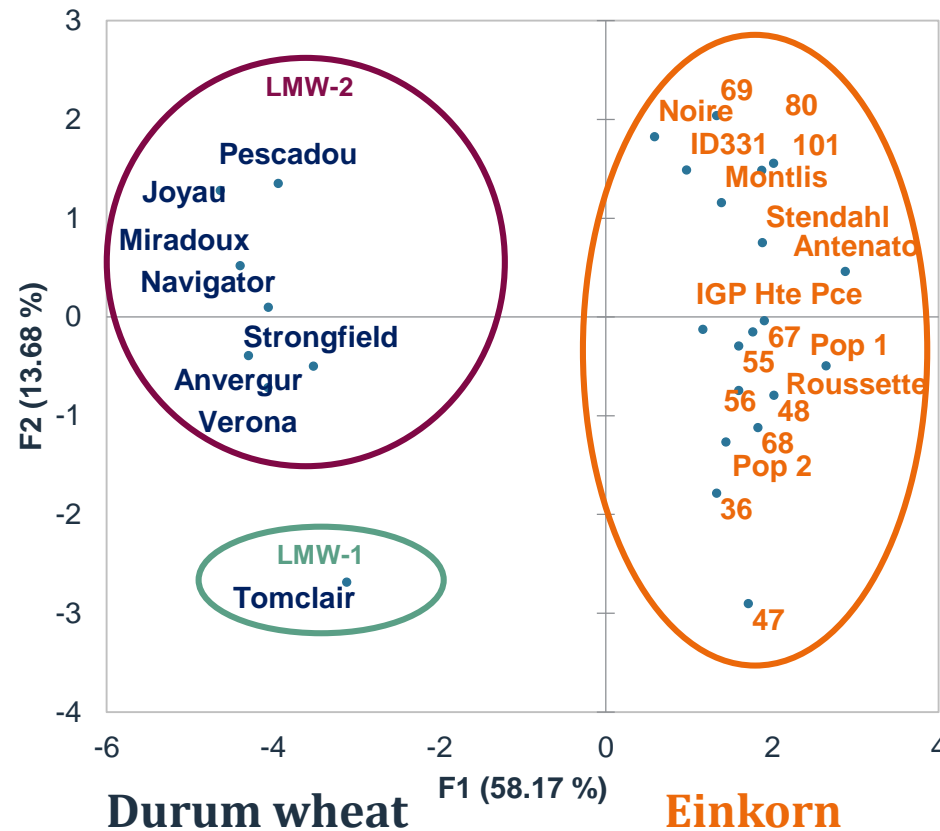
Evaluation of technological quality

🌾 **Protein composition of einkorn compared to durum wheat**

Einkorn protein descriptors

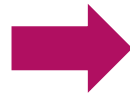**Durum wheat and Einkorn cvs**

- A **higher protein content** in low input conditions

- **Different protein profiles**:
  - UPP% and LMW-GS half as high as for durum wheat
  - Less ω gliadins
  - More α/β and γ gliadins

Evaluation of processing ability of selected einkorns

Flour production and characterisation

112 cultivars sown → **Participatory selection** of 19 einkorn cultivars → **Focus** on 6 einkorn cultivars

Dehulling

↓

Milling

↓

Einkorn flour

GAEC La ferme du SALET

Stone mill (Tyrol)

Protein content and profile
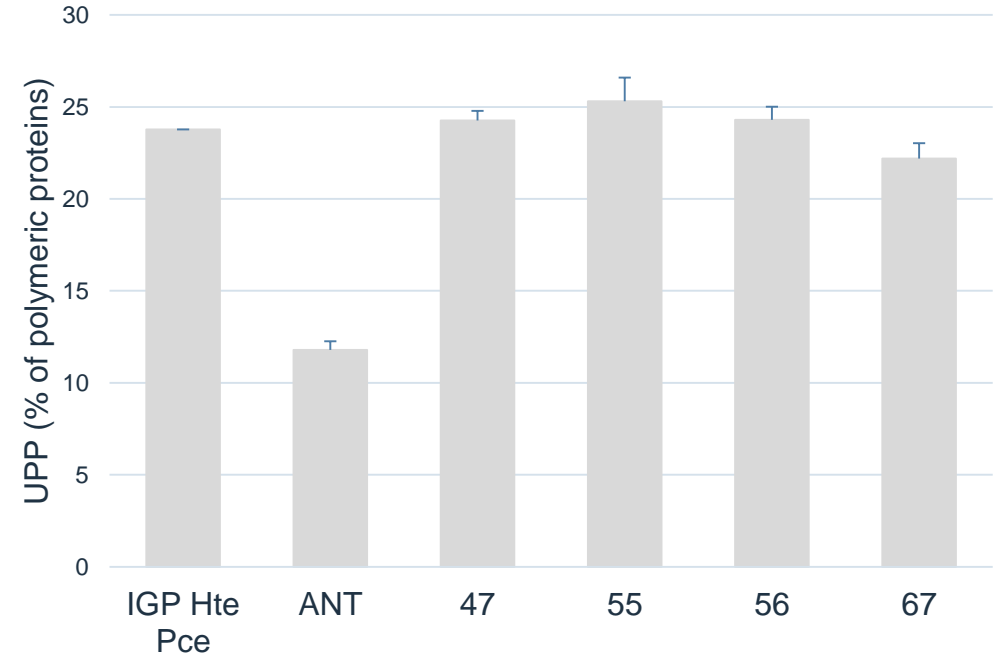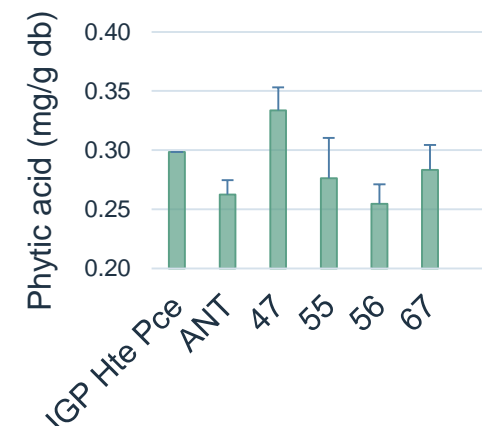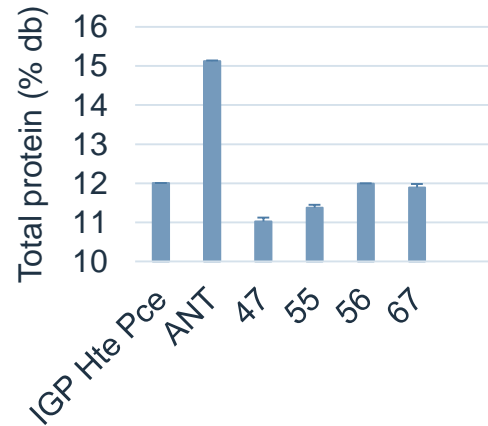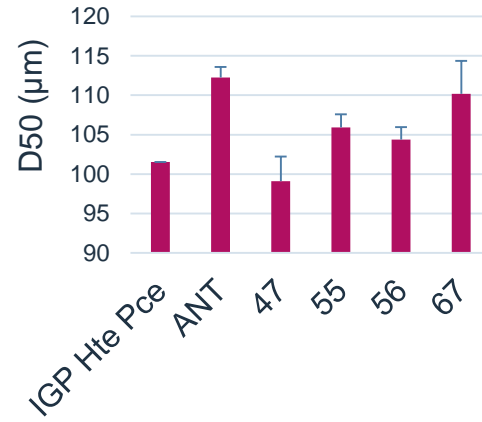Mineral content
Particle size
Phytic acid content

11

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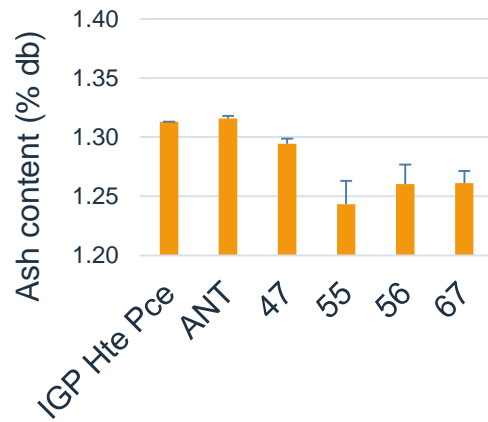# Evaluation of flour quality

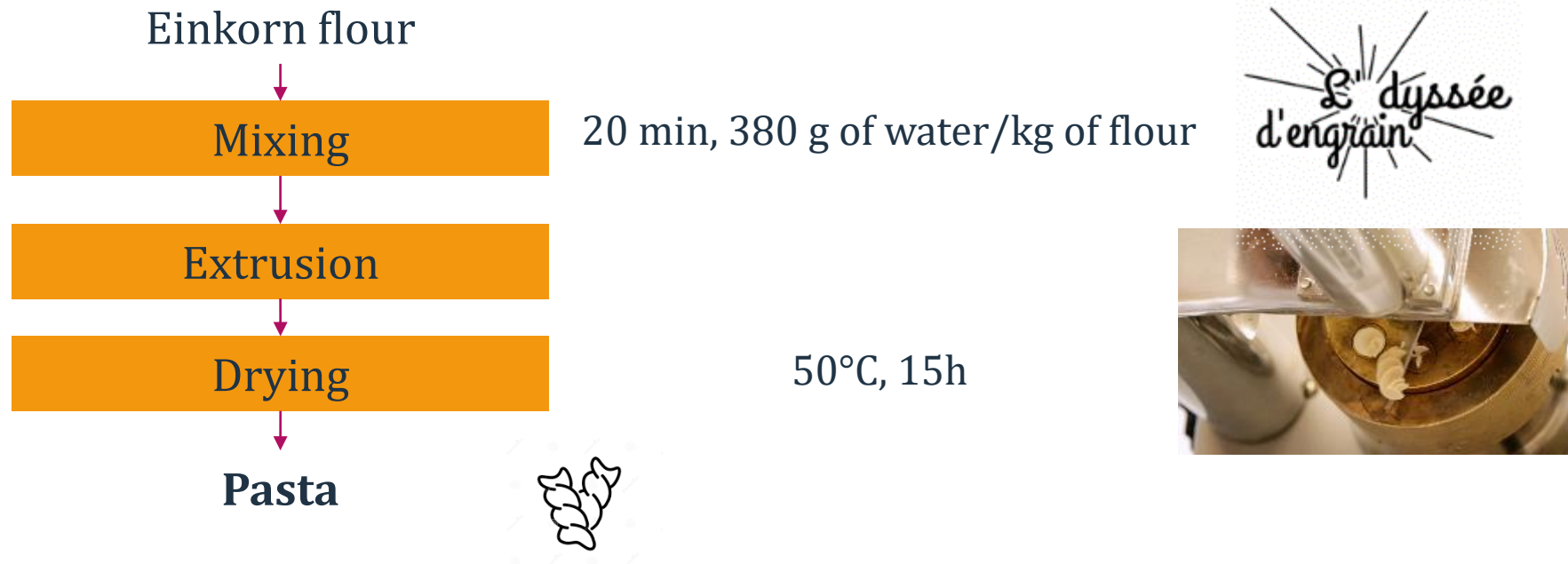## Characteristics of flours

cv. Antenato

- a high Glia/Glu ratio (1.14 vs. 0.97 for other cvs)
- a low proportion of UPP
- a high protein content

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Evaluation of pasta quality

Pasta production (farmer process) and characterisation

Einkorn flour

↓

| Mixing |

20 min, 380 g of water/kg of flour

↓

| Extrusion |

↓

| Drying |

50°C, 15h

↓

Pasta

Evaluation of pasta quality

Physico-chemical and sensorial characterisation of pasta
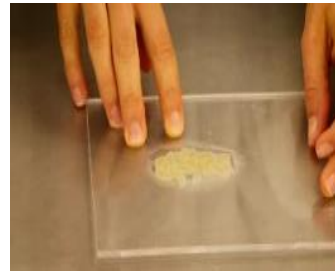
Color (L*a*b*)

Water absorption
Cooking losses

Texture

Optimal
Cooking
Time

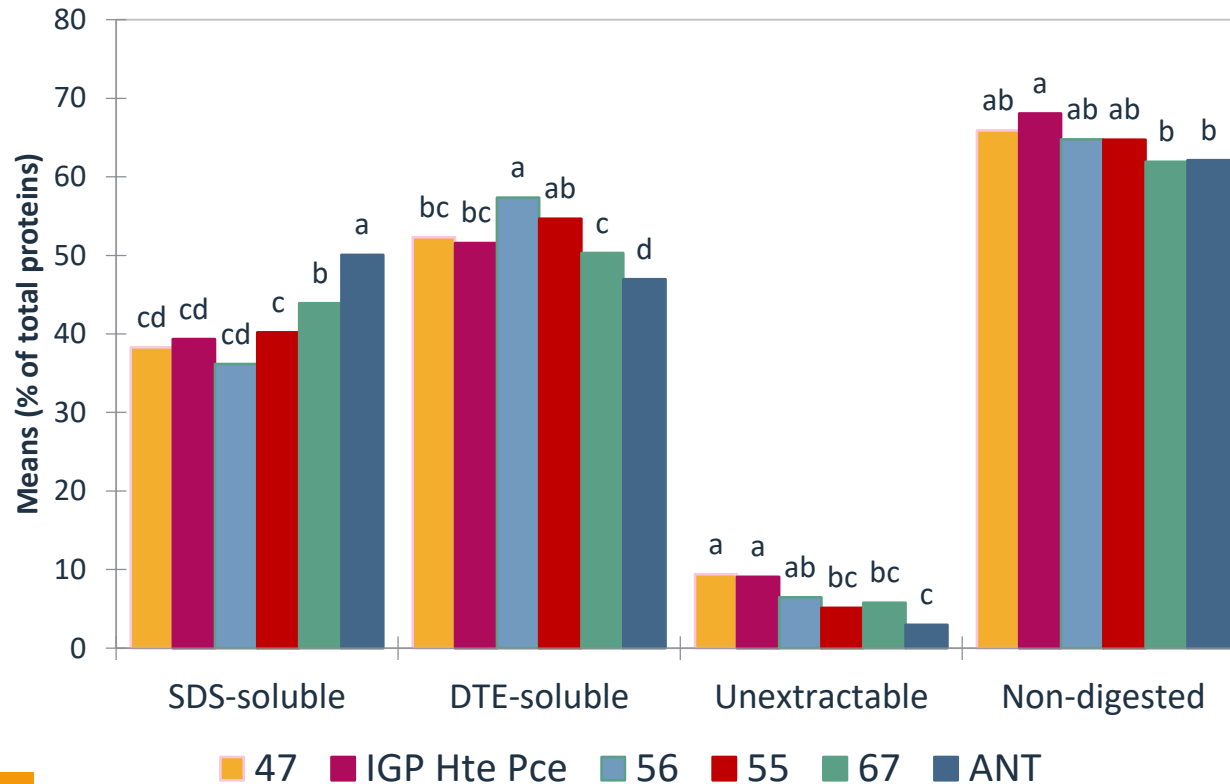Protein
profile and
digestibility

Sensorial
Flash description

Ranking descriptive sensory
(RDA)
14 judges

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Evaluation of pasta quality

**Pasta characterisation: focus on protein solubility and digestibility**

- **More SDS-soluble proteins** (~41%) **for einkorn peasant-type pasta** compared to industrial-type durum wheat pasta (~ 14 %) or peasant-type durum wheat pasta (~ 27%)*

- Differences according to the cv. with **more SDS-soluble proteins** for **the cv. Antenato** -> weaker gluten

- **Few differences in protein digestibility** between cvs.

- **More non-digested protein** after 4 hours of proteolysis than for peasant-type durum wheat pasta (~ 67% after 3h of proteolysis)*

Evaluation of pasta quality

Characteristics of einkorn flour and pasta

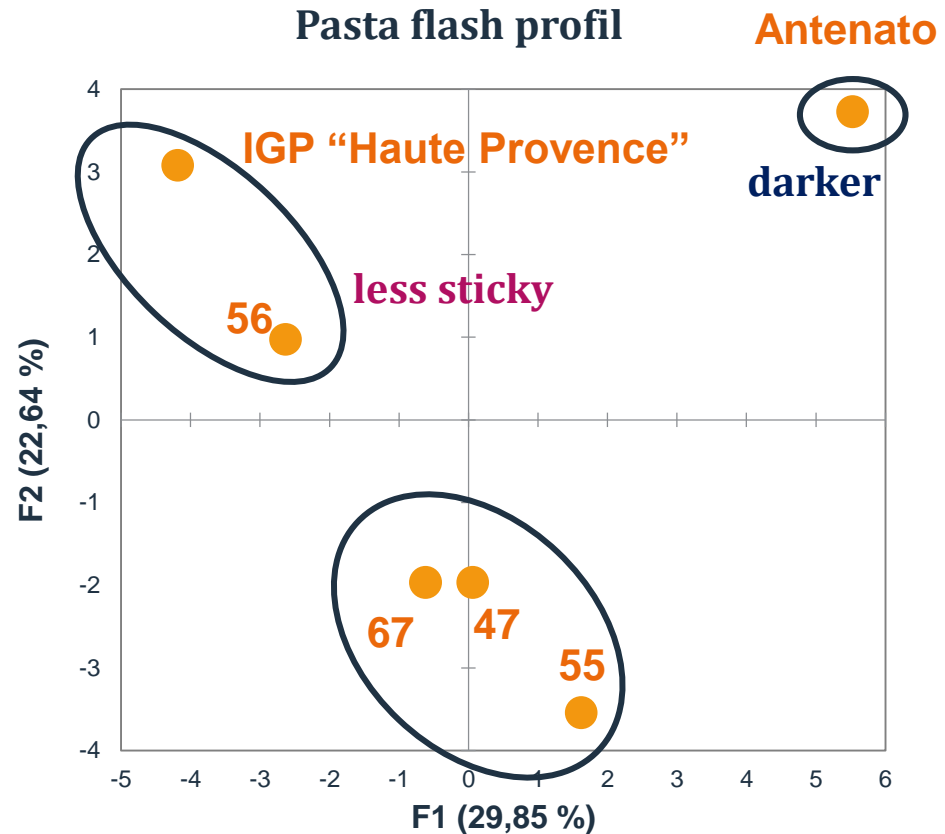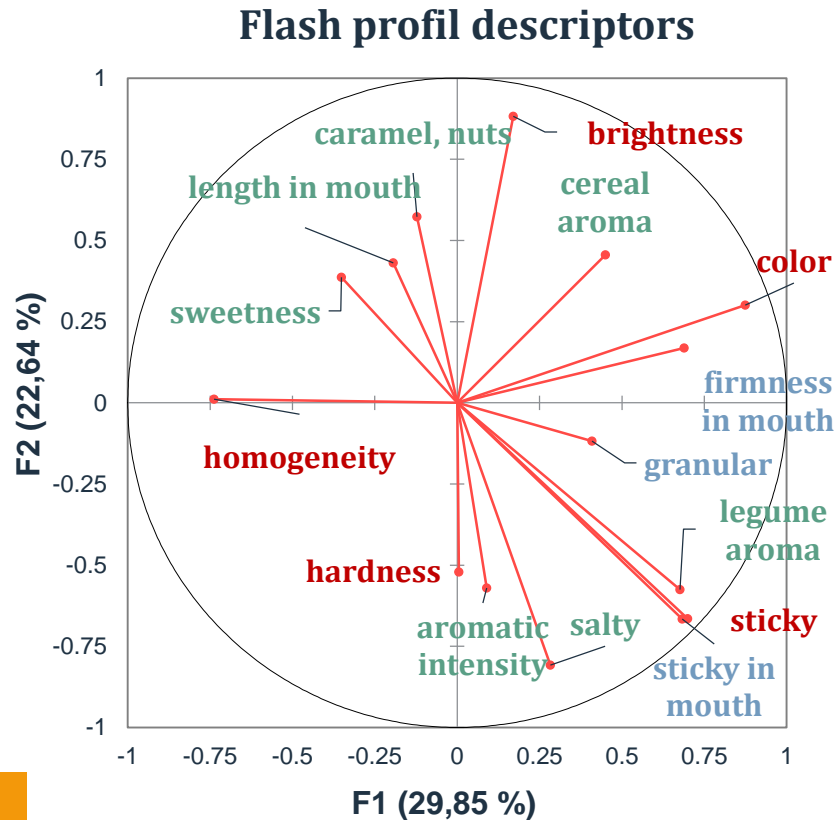Biplot (axes F1 et F2 : 77,77 %)
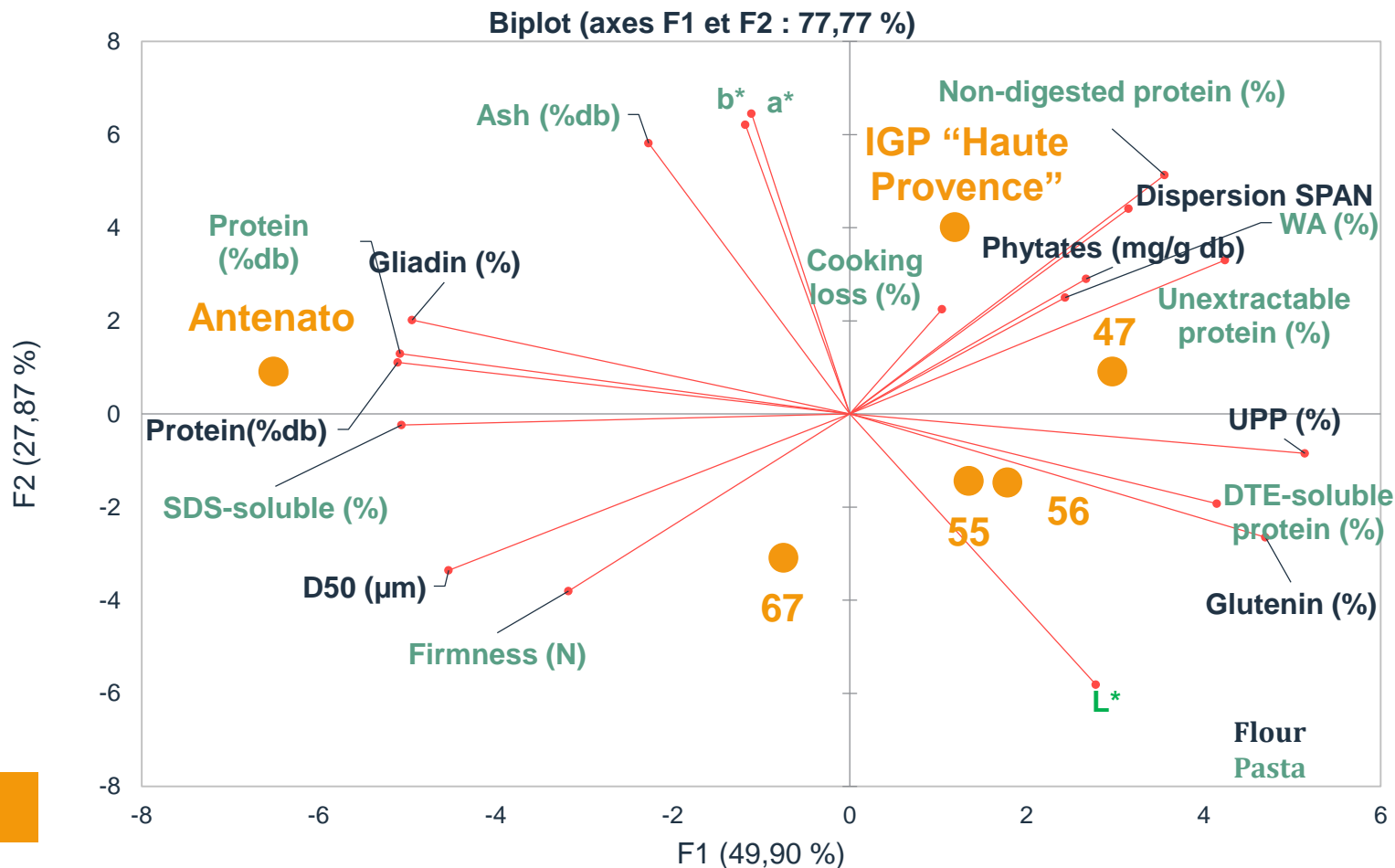
- **Antenato cv.** has different characteristics on protein profile compared to the other cvs

Evaluation of pasta quality

Sensorial characterisation of einkorn pasta

Flash profil descriptors

Pasta flash profil

- Differences observed only on **4 attributes** :
  - Colour
  - Brightness
  - Stickyness
  - Stickyness in mouth

- Antenato cv. is not considered more firmer/harder than the other cvs

GPA and Friedman test for all attributes, p value <0.05

Conclusion and next steps

- From the 112 einkorn cvs, we succeeded to find some varieties that could meet the agronomic needs of farmers but also those of processors and consumers

- The agronomic performances of the 19 selected varieties will be evaluated using new agronomic practices (production in association with legumes)

- These varieties could be used for crosses:
  - to diversify their production
  - to increase the agrobiodiversity from farm to fork
  - for better agronomic performances

- The selected einkorn varieties will be tested for their ability to be processed into other products like bulgur

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Thanks for your attention

gwenaelle.jard@purpan.fr
marie-francoise.samson@inrae.fr

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