

Gianni LICHERI¹, Nicolò FRANGUELLI¹, Federico COLOMBO¹, Martina GHIDOLI¹, Matteo DELL'ANNO²,
Stefano SANGIORGIO¹, Elena CASSANI¹, Luciana ROSSI², Roberto PILU^{1*}

¹Department of Agricultural and Environmental Sciences - Production, Landscape, Agroenergy, University of Milano, Via Celoria 2, 20133 Milano (Italy)

²Department of Veterinary Sciences for Health, Animal Production and Food Safety, University of Milano, Via Dell'Università 6, Lodi; Via Trentacoste 2 - Milano (Italy)

*Corresponding author: salvatore.pilu@unimi.it

Keywords: Rye, Wheat, Agrobiodiversity, Terraced environment

Background

In the frame of the SOCIAALP (Reti Sociali per Agroambienti Alpini) project granted by CARIPLO foundation we reintroduced rye and wheat in Antrona Valley (Piemonte) with the aim to resume the historic rye bread production chain that had been abandoned several years ago. Rye bread is a type of bread made with different proportions of rye/wheat flour. Rye bread was considered a staple through the middle ages and in mountain areas the use of rye bread was a tradition until the beginning of the second half of the last century when it was abandoned following the depopulation of the mountain areas. In recent years, a renewed interest in this product has been growing due to the nutritional properties of rye flour. In this project, we selected in randomized block designs the best rye and wheat varieties for the Antrona valley terraced environment. We also carried out nutritional analysis on flour collected for each varieties.

Adaptation to climate change is a very difficult breeding goal because of its complexity, its location specificity and unpredictability. However, one possible solution in small scale is based on dynamic use of agrobiodiversity in agriculture through the cultivation of evolutionary populations. In fact in this project we used pure line, mixed and populations. In this work we will show the results obtained in last two years of trials.

Results

Experimentation was performed on the fields of Viganella, Valeggia and Varchignoli (Fig 1), where we followed the complete productive cycle (Fig 2).

In Viganella we tested two varieties of rye: a landrace *Tradizionale Piemonte* (TP), a commercial variety *Stanko* (SK) and a mixed of *Stanko-Tradizionale Piemonte* (SKTP50). In Varchignoli we tested the same varieties and mixed of rye plus the varieties of wheat *Mentana* (MT), *Giorgione* (GG), *Wiwa* (WW), *Tengri* (TG), a mix *Wiwa-Tengri* (WWTG50), a mix of wheat *7 Grani* (7G) and a population *Solibam* (SB). In Valeggia we tested wheat *San Pastore* (PS).

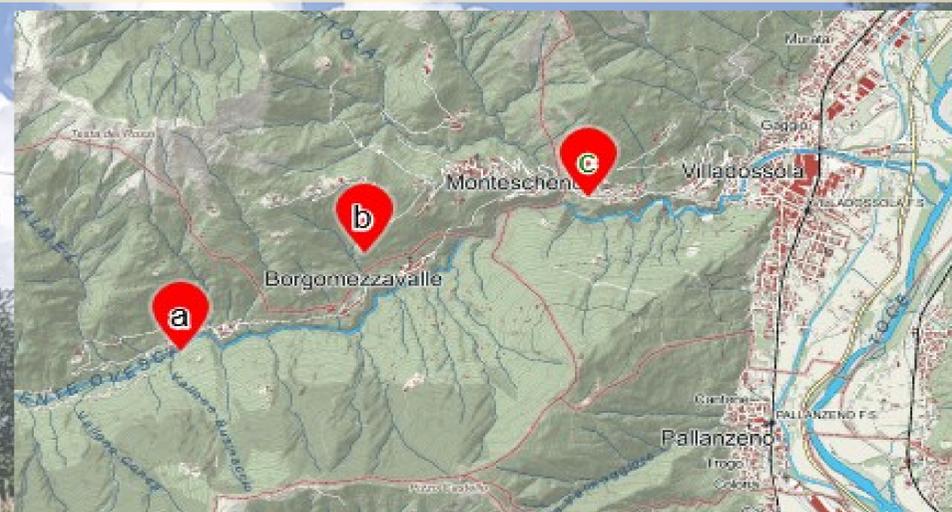


Fig 1: Field's Localization in Antrona Valley: Viganella (a), Valeggia (b) and Varchignoli (c)

Fig 2: Field steps: drywalls rearrangement(a); field's fencing against animals(b); milling(c); sowing(d); tillering(e), data collection(f), harvesting (g).

Bromatological analysis were performed and among them the most interesting parameter to produce bakery's flour is the content of crude protein showed in Fig 3.

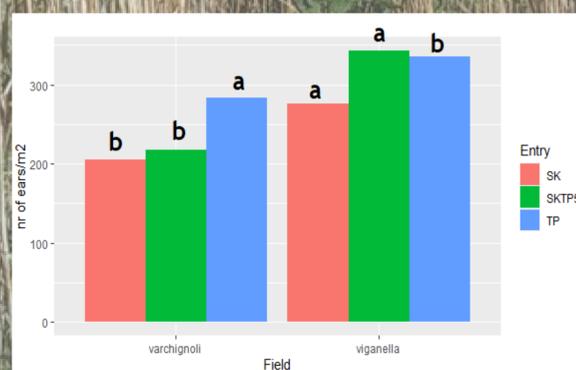
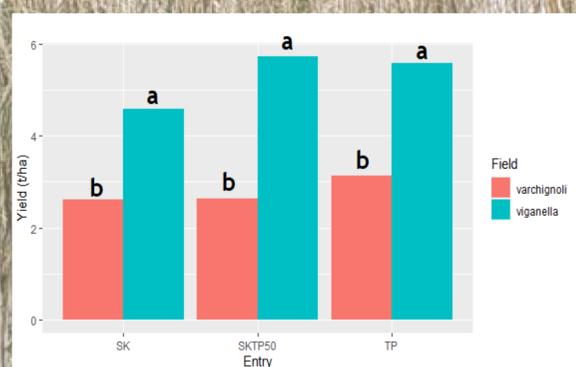
We measured the yield and morphological parameters like "nr of ears for square meter", "nr of seeds for ears", "Average weight of seeds", "Plant height", "Seed moisture". In Fig. 4 we report the most interesting results related to the comparison between rye varieties cultivated in Viganella and Varchignoli. For what concern wheat the highest yields that we found regards the field of San Pastore in Valeggia. There, wheat performed better than all the entries cultivated in Varchignoli. So, we compared its yield with the national average yield of 2020 (Fig 5).

Crop	Variety	Crude Protein
Fumento	San Pastore	14.14 ± 0.498 ^{ab}
Fumento	Giorgione	12.35 ± 0.310 ^c
Fumento	Solibam	14.69 ± 0.124 ^a
Fumento	Tengri	12.21 ± 0.087 ^c
Fumento	Mentana	10.93 ± 0.293 ^d
Fumento	WWTG50	14.00 ± 0.217 ^{ab}
Fumento	Wiwa	12.10 ± 0.141 ^c
Fumento	7 Grani	13.66 ± 0.256 ^b
Segale	SKTP50	11.13 ± 0.450 ^b
Segale	Alpina	12.40 ± 0.087 ^a
Segale	Tradizionale Piemonte	11.50 ± 0.267 ^b
Segale	Stanko	11.05 ± 0.377 ^b

Fig 3: Crude protein for wheat and rye entries. The most interesting parameters to produce bakery's flour is the content of crude protein. Regarding wheat varieties we found the highest crude protein in Solibam, followed by San Pastore and WWTG50. For rye, the highest crude protein resulted in Alpina.

Conclusions

Adaptation to climate change is a very difficult breeding goal because of its complexity, its location specificity and unpredictability. However, one possible solution in small scale is based on dynamic use of agrobiodiversity in agriculture through the cultivation of evolutionary populations. In fact in this project we used pure line, mixed and populations. The positive results that are being achieved in this project suggest that the reintroduction of rye and wheat in Val Antrona is possible and can allow the relaunch of small food chains in this marginal area



	Yield (t/ha)
Valeggia wheat "San Pastore"	5.12 ± 0.45
National wheat average 2020	5.37

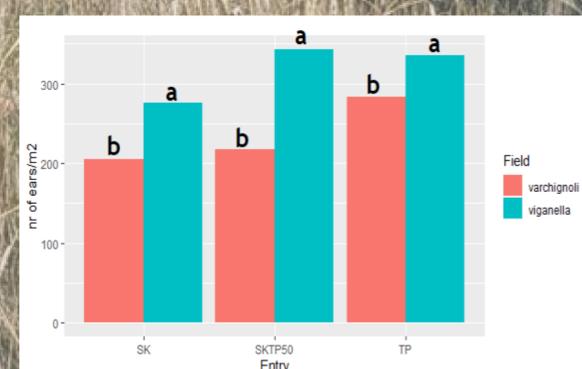


Fig 4: Comparison among rye entries in Viganella and Varchignoli: yield doesn't change significantly among entries, but it is significantly higher in Viganella compared to Varchignoli. This difference is due to the higher N° of ears for square meter. The only significant difference observed among varieties is the number of ears (nr/m2). For this parameter, the variety Tradizionale Piemonte resulted greater than the others, but this was not enough to increase significantly the yield.

Fig 5: Comparison between the yield of wheat "San Pastore" in Valeggia, with respect to national wheat yield of 2020.

References

- Belligiano A, De Rubertis S. «Le filiere corte agroalimentari nei processi di sviluppo locale» (2012)
- Ceccarelli S. and Grando S. «Le Popolazioni Evolutive ICARDA». 2020.
- Ceccarelli S. and Grando S. «Evolutionary plant breeding as a response to the complexity of climate change" *Iscience* (2020): 101815.