An integrated approach project for the revaluation of a traditional sourdough bread production chain

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Abstract

The influence of organic and conventional farming systems on the performance of a panel of old and modern Italian bread wheat varieties has been evaluated, with the aim to individuate an agronomic protocol suitable for the production of a sourdough bread traditionally prepared in a hill zone of Emilia-Romagna. The agronomic and technological characterisation of the wheat samples obtained in organic and conventional farming conditions has been done and the sensorial qualities of the sourdough bread obtained have been evaluated.

Introduction

Several types of traditional Italian bread, that have in common a long-time, sourdough fermentation step, are now re-discovered due to their peculiar nutritional and qualitative traits in comparison with bakery products obtained with breadmaking protocols based on the use of selected yeast and shorter fermentation step. Sourdough fermentation has in fact several documented effects on aroma improvement, delayed firmness and staling, increasing mineral bioavailability and vitamin content and lowering the glycemic response. Moreover, it is well known that a wide spectrum of variability for breadmaking properties exists not only at cereal species level, but even at variety level. The influence of cultivars on technological properties, sensory profile and staling rate has been investigated for durum wheat, einkorn, bread wheat. The bread production is also influenced by growth location, by type of soil and climate and by year of harvest. Moreover, quality for a foodstuff is defined by Peri (2006) as “fitness for consumption”, a complex system of both material and immaterial products requirements that collects safety, nutritional, sensory, guarantee and ethical requirements.

Starting from these remarks, in our project a panel of old and modern Italian bread wheat varieties have been evaluated, through a multi-disciplinary approach, for the production of a sourdough bread traditionally prepared in a hill zone of Emilia-Romagna. The aim of the project has therefore been directed to the revaluation of a low-input cereal production system for this zone, in which several organic farms are active.

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Materials and methods

Starting from previous evaluation work on agronomic, technological and sensorial characteristics of a panel of old and modern bread wheat varieties, the three old varieties Autonomia B, Risciola and Terminillo, together with the modern variety Soissons, has been selected for further studies directed to the individuation of a fertilization protocol suitable for the hill zone of Pellegrino Parmense (Emilia-Romagna, Italy). The bread wheat varieties were sown in a two-years trial, in organic and conventional farms. Two different levels of nitrogen fertilization and a not-fertilized control have been compared (Table 1). Agronomic traits and resistance to biotic and abiotic stress were evaluated for all the samples. The deoxynivalenol content of all bread wheat samples was determined by a commercially available enzyme immunoassay (RIDASCREEN TM FAST DON, R-Biopharm GmbH, Germany).The technological properties of all the samples were evaluated determining protein content and alveographic indices. The sensory evaluation of the sourdough bread prepared from the different samples was done by two independent groups of assessors. The sensory variables taken into account are referred to visual characteristics (outside and inside colours, rusticity, size, crust), aroma, taste, flavour and texture (both of bread and crumbs) attributes.

Tab. 1: Agronomic and qualitative characteristics of the four varieties evaluated in a two years trial.

	ORGANIC FARM					CONVENZIONAL FARM					
	2006			2007		2006				2007	
Preeceding crop	alfa alfa			alfa alfa		sorghum				alfa alfa	
	Borlande (DPI= 46 Kg/he of N)			Borlande (DPI= 41 Kg/he of N)		Ammonium nitrate (DPI= 167 Kg/he of N)				Ammonium nitrate (DPI= 50 Kg/he of N)	
DRESSING	Production (13% of m.)	W.per hectolitre	Fusarium head blight	Production (13% of m.)	W.per hectolitre	Production (13% of m.)	W.per hectolitre	Powdery mildew	Leaf rust	Production (13% of m.)	W.per hectolitre
	t/he	kg/hl	heads/m²	t/he	kg/hl	t/he	kg/hl	(0-9)	(0-9)	t/he	kg/hl
Test	3.98	79.75	0.65	2.42	74.63	2.48 C	80.27	0.00	0.00	3.25	73.53
DPI	3.83	79.47	0.43	2.83	74.06	4.75 A	79.15	0.29	0.21	3.50	73.36
50% DPI	4.48	80.65	0.67	2.55	75.44	4.24 B	79.81	0.08	0.13	3.37	73.62
Significance	n.s.	n.s.	n.s.	n.s.	n.s.	***	n.s.			n.s.	n.s.
CULTIVAR											
Soissons	4.29 B	77.24 C	0.64 A	3.13 A	73.55	4.45 A	80.14 A	0.00	0.11	4.84 A	73.55
Autonomia B	4.11 B	81.72 A	0.42 B	2.26 C	76.78	3.80 B	80.89 A	0.11	0.17		
Risciola	3.26 C	81.40 A	0.57 A	2.30 C	74.03	3.23 C	79.99 A	0.28	0.17	2.41 C	73.53
Terminillo	4.74 A	79.47 B	0.72 A	2.72 B	74.49	3.80 B	77.96 B	0.11	0.00	2.87 B	73.43
Significance	***	**	*	***	n.s.	***	***			***	n.s.
CULTIVAR x DRESSING											
Significance	n.s.	n.s.	n.s.	***	n.s.	***	n.s.			n.s.	n.s.
Means	4.10	79.96	0.59	2.60	74.71	3.82	79.74			3.37	73.50
CV(%)	10.06	2.18	39.31	7.49	4.07	7.98	1.93			11.86	2.13

Results

In table 1 are reported some of the agronomic and qualitative data obtained when the four wheat varieties are grown in different environments with three different level of fertilization during a two years trial. The two years of trial were very different from a meteorological point of view. In fact, during 2006 the autumn was very rainy, during the winter there was snow coverage and during the spring low temperatures were registered. On the contrary, in 2007 the temperatures never fall below 0°C and the rains were limited.

The presence of Fusarium Head Blight and of mycotoxins like deoxynivalenol (DON), that are of great relevance from a safety point of view were investigated in all bread wheat samples. None of the genotypes was found to be heavily affected by Fusarium nor contaminated with DON. Only very few samples have shown symptoms of infection from powdery mildew and leaf rust (Table 1). The yield productions were different, depending from the year, from the treatments and from the genotypes (see Table 1). As expected, the modern variety Soissons gave the best yield results, followed by Terminillo. The weight per hectolitre was very high in 2006 for all the varieties, whereas in 2007 it was probably affected by the climate. In Figure 1 are reported the results obtained after sensory evaluation of sourdough breads prepared from a set of monovarietal flours derived from Autonomia B, Terminillo, Soisson and Risciola varieties grown in organic and conventional farming. For this experiment, it was taken into consideration the varieties grown in 2006 both in conventional (fertilization with ammonium nitrate, 167 Kg/he of N) and organic (fertilization with borlande, 46 Kg/he of N) farming. The bread samples were evaluated for the ten characteristics reported in Materials and Methods, giving to the samples one point for each trait exceeding the mean of all samples.

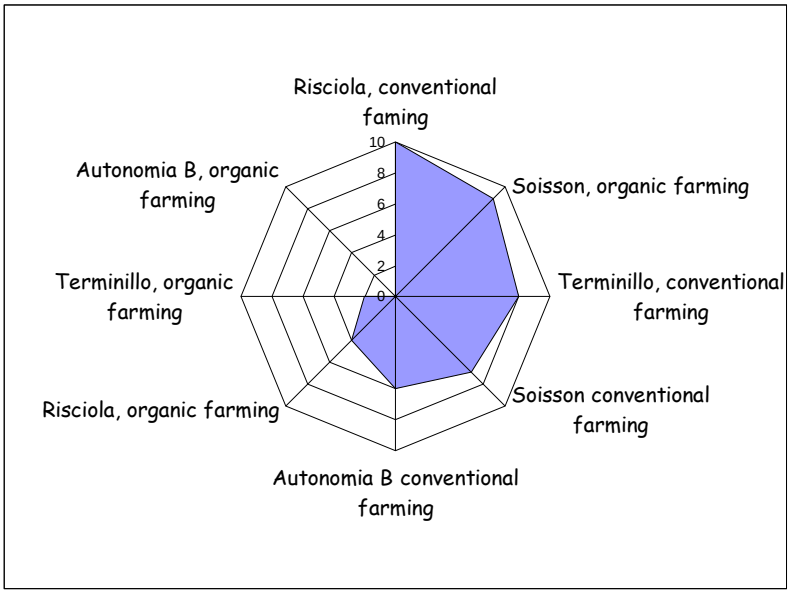

Figure 1: Scores obtained by the sourdough bread samples prepared from flours of the four wheat varieties grown under organic and conventional farming.

Discussion and conclusions

In our project, a multidisciplinary approach has been applied with the aim to revaluate a traditional sourdough bread preparation chain. Moreover, because organic farming system in comparison with conventional one has been found to have significant effect on sensory quality of yeast fermented bread (Kihlberg et al. 2004; Kihlberg et al. 2006; Annett et al., 2007), we have evaluated the farming effect and the different level of fertilization on agronomic and technological characteristics of old and modern bread wheat varieties. We have found significant effects of year, of genotype, of the preceeding crop and of farming system on agronomic performance of the wheat varieties and on their technological traits. Preliminary results obtained after sensory evaluation of monovarietal sourdough breads prepared from wheat samples grown

under organic and farming conditions, indicate the old variety Risciola and the modern one Soisson as the most appreciated. As final results, this project, taking into account several genetic, farming and technological aspects, can help in delineating a sustainable production chain for a traditional italian food.

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