



Silencing the α -Gliadins in Wheat *

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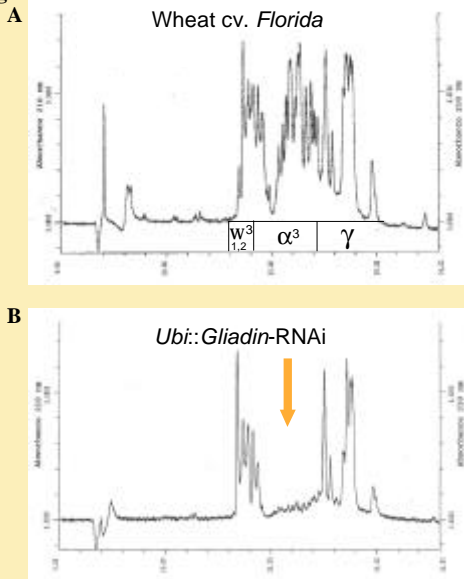
Background

The wheat gliadins belong to the major seed storage proteins and determine the viscosity of dough from wheat flour [1]. The superior baking qualities of wheat are overshadowed by its potential to cause coeliac disease, an inflammatory condition of the gastrointestinal tract which is thought to be induced in susceptible patients most likely by the gliadin proteins [2]. These gliadins are divided into different subtypes (α, γ, ω) each encoded by multiple genes [3][4].

The utilisation of a RNAi-silencing approach was chosen to investigate the potential of this technology to silence an entire gene family in hexaploid wheat. Such a wheat with a reduced α -gliadin component can be part of the development of wheat variety usable in the production of gluten free food.

Results

Fig. 1

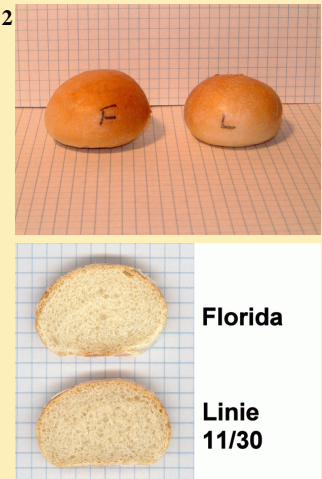


HPLC chromatograms of ethanol extracts of endosperm proteins from wheat cv. Florida (wildtyp) and a transgenic plant

³ including secalines due to 1B/1R translocation in wheat cv. Florida

We knocked out completely the α -gliadins in wheat (Fig. 1B). Analysis of the protein composition revealed a higher Albumin and Glutenin content in α -gliadin free wheat (Tab. 1). The investigation of the rheological properties showed an increase in gluten extensibility resistance (Tab. 2 B) and a reduced pastry volume (11%) (Fig. 2, Tab. 2 C).

Fig. 2



Tab. 1

	FLOw		FLOt	
	AU/mg	%	AU/mg	%
ALGL	243 ± 1	16.9	325 ± 4	23.1
GLIA	818 ± 18	57.0	686 ± 1	48.8
GLUT	375 ± 6	26.1	396 ± 1	28.2
Gluten	1193 ± 13	83.1	1082 ± 3	76.9
GLIA/GLUT	2.2 : 1	-	1.7 : 1	-

AU = Absorbance unit of the HOLC, ALGL = Albumin/Globulin, GLIA = Gliadin, GLUT = Glutenin subunits

Tab. 2

	A) dough		B) gluten		C) pastry
	DW (N)	DB (cm)	DW (N)	DB (cm)	BV (ml)
	X	X	X	X	X
FLOw	0.117	9.7	0.819	8.15	33.6
FLOt	0.117	9.75	1.782	6.9	29.75

DW= max. extensibility resistance; DB= extensibility, BV= pastry volume (7g of flour)
Mean average (x) from two independent measurements.

Conclusions

For the first time the application of the RNAi-technology is shown to be successfully used for reducing the expression of a gene family in wheat opening the possibility for creating non coelic toxic wheat. In addition we were able to generate a transgenic wheat which produce a gluten with an increased extensibility resistance, but the dough extensibility resistance was unchanged.

References

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