Health promoting compounds promote Fusarium head blight resistance in cereals

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Besides starch, gluten, and fibers, cereal grains also contain compounds which sustain and promote human health. Several breeders develop cereal varieties with enhanced contents of health promoting compounds (HPCs) such as carotenoids and anthocyanins in wheat. The favorable effect is, at least in part, due to antioxidant activities. Yet, antioxidants play also major roles in plant resistance. In the present, we study the impact of HPCs on Fusarium head blight resistance (FHB) in wheat.

Fig 1: Wheat spikes infected with FHB.

Carotenoids/ lutein

Fig. 3: Flour of a variety with low lutein content (left, cv. Lona) and of a lutein rich cultivar (right, cv. Toronit). Lutein is the main carotenoid present in wheat. Lutein confers a yellow coloration to the flour. Lutein content can be measured by colorimetry. The measurement is performed according to the CIE b* standard.

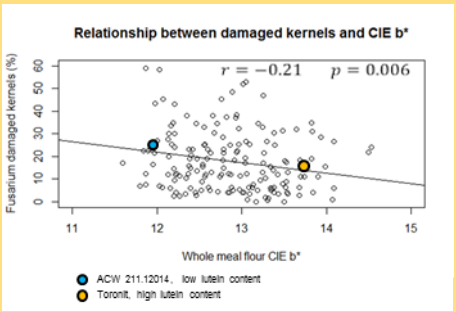

Fig. 4: Relationship between flour yellowness (measured as CIE b*) on resistance against kernels infection. A yellower flour was linked with enhanced resistance against kernel infection, indicating that lutein contributes to resistance against FHB.

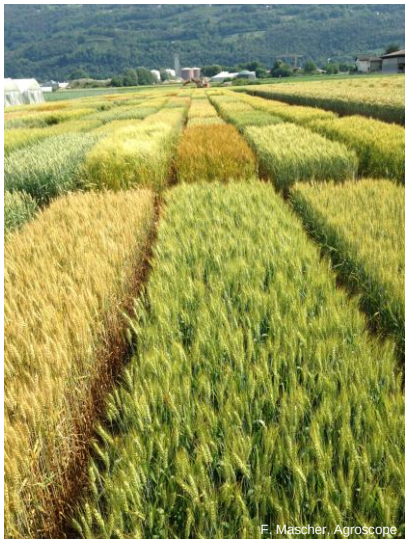

Fig. 2: Agronomic performance test with HPC enriched varieties in Cadenazzo TI.

Anthocyanins

Fig 5: Anthocyanins give blue to dark coloration to grains. Grains with low (a) and elevated antocyanin content (b, c).

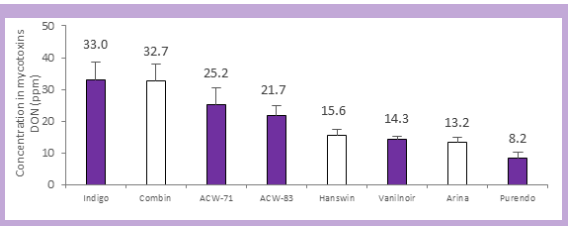

Fig 6: Concentrations of the mycotoxin DON in different wheat varieties. Violet columns design varieties with with elevated anthocyanin content.

Fig 7: Extraction of anthocyanins in wholemeal flour Red colored solutions from wheat varieties with elevated contents in anthocyanins.

Ferulic acid

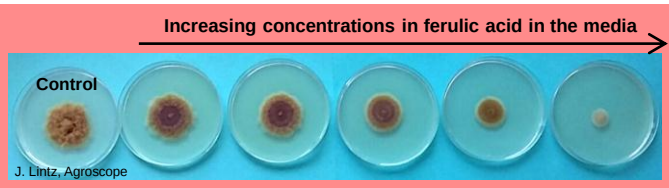

Fig 8: Effect of ferulic acid on the growth of *F. graminearum.* Ferulic acid inhibits fungal growth.

Wheat varieties	FHB resistance	Ferulic acid content in wheat flowers (ng/mg DW)
Royssac	Susceptible	30,608
Rubisko	Moderately resistant	45,008

Fig 8: Concentration of ferulic acid in wheat flowers at flowering stage. Infection takes place at flowering and elevated concentrations may enhance resistance.

Take home messages

- Elevated content in antioxidants in the grain contribute to the resistance against FHB.
- The resistance is always polygenic and resistance is not complete. HPCs contribute to the reduction of the risk of infection and contamination with mycotoxins
- Varieties rich in HPCs may provide benefits for both human nutrition and food safety.

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