

## Agronomic practices reducing asparagine content of 'old' common wheat cultivars

Q. Soofizada <sup>(1)</sup>, A. Pescatore <sup>(1)</sup>, L. Guerrini <sup>(2)</sup>, C. Fabbri <sup>(1)</sup>, M. Mancini <sup>(1)</sup>, S. Orlandini <sup>(1,3)</sup>, M. Napoli <sup>(1,\*)</sup>

<sup>(1)</sup> Department of Agriculture, Food, Environment and Forestry (DAGRI), University of Florence, Piazzale delle Cascine 18, 50144 Florence, Italy

<sup>(2)</sup> Department of Land, Environment, Agriculture and Forestry (TESAF), University of Padua, Viale dell'Università, 16, 35020 Legnaro, Italy

<sup>(3)</sup> Fondazione per il Clima e la Sostenibilità, Via G. Caproni 8, 50145 Florence, Italy

\* Corresponding author: [marco.napoli@unifi.it](mailto:marco.napoli@unifi.it)

Since the Green Revolution, there has been a substantial increase in common wheat production (*Triticum aestivum*, L.) owing to the intensive use of fertilizers and the development of cultivars characterized by enhanced disease and pest tolerance, improved nutrient use efficiency, higher protein production per hectare, and a gluten composition suitable for industrial processing. Traditionally, common wheat cultivars registered before the late 1960s are termed 'old', while those registered during the Green Revolution are labeled as 'modern'. While wholegrain bakery products derived from 'old' common wheat varieties have demonstrated positive health effects in numerous epidemiological studies, these varieties often exhibit poor rheological properties, posing challenges in producing high-quality products. Moreover, limited information exists on their free asparagine (ASN) content, a crucial precursor to acrylamide formation during the baking process. This study aimed to assess whether agronomical treatments, specifically sulfur (S) fertilization, nitrogen (N) fertilization, and seeding density (SD), could improve the grain yield, protein content, rheological characteristics, and ASN content in kernels of 'old' common wheat varieties grown on S deficient soils. The investigation focused on 14 'old' common wheat varieties released between 1900 and 1960 in Italy. Employing two SD (200 and 350 seeds m<sup>-2</sup>), three NL levels (NL: 35, 80, and 135 kg N ha<sup>-1</sup>), and two S levels (SL: 0 and 6.4 kg S ha<sup>-1</sup>), the study assessed their combined effects. Results indicated that both SL and SD significantly increased grain yield without compromising protein content, while NL significantly enhanced protein content without adversely affecting yield. Dough strength exhibited a significant increase with higher SL and NL but was notably reduced with increased SD. Notably, there was a 111% increase in ASN content as NL rose from 35 to 135 kg ha<sup>-1</sup>, while the increased SL led to a significant 85.1% reduction in ASN content. The findings suggest that a combination of 135 kg N ha<sup>-1</sup> and 6.4 kg S ha<sup>-1</sup> can enhance the technical performance of 'old' wheat wholegrain flours while maintaining low ASN levels, addressing a critical concern in reducing acrylamide formation during baking. This research provides valuable insights into the intricate relationships between agronomic practices and the quality attributes of 'old' common wheat varieties. Optimizing nitrogen and sulfur levels, along with seeding density, emerges as a promising strategy to enhance both yield and rheological characteristics, mitigating potential health risks associated with elevated asparagine content in bakery products. These findings contribute to ongoing efforts to balance the health benefits of 'old' common wheat varieties with the technological challenges faced by the baking industry, with potential implications for promoting sustainable and health-conscious wheat production.

Keywords

Old common wheat varieties; Agronomic treatments; Sulphur fertilization; Free asparagine; Rheological properties.

Reference: Soofizada, Q., Pescatore, A., Guerrini, L., Fabbri, C., Mancini, M., Orlandini, S., Napoli, M. (2022). Effects of nitrogen plus sulfur fertilization and seeding density on yield, rheological parameters, and asparagine content in old varieties of common wheat (*Triticum aestivum*, L.). *Agronomy*, 12, 351. <https://doi.org/10.3390/agronomy12020351>