



Managing nitrogen fertilisation exclusively through foliar spraying with urea or UAN in common wheat

Manuel Ferrari¹, Cristian Dal Cortivo¹, Anna Panozzo¹, Giuseppe Barion¹, Alberto Di Stefano¹, Giovanna Visioli², Teofilo Vamerali¹

¹ Dipartimento di Agronomia, Alimenti, Risorse Naturali e Ambiente, Università di Padova

Autore corrispondente: manuel.ferrari@phd.unipd.it

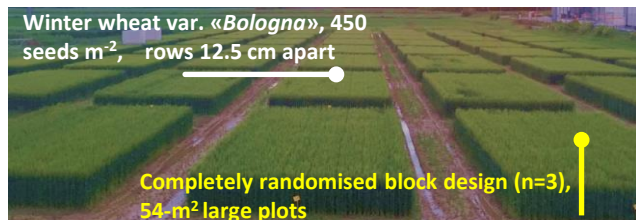
² Dipartimento di Scienze Chimiche, della Vita e della Sostenibilità Ambientale, Università di Parma

Introduction

Nitrogen application through foliar spraying is widely recognised as the most efficient and sustainable practice to improve the protein content in common wheat. The aim of this work was to compare growth, yield and grain quality of a bread-making wheat variety fertilised by low N rates entirely applied by foliar application with UAN or urea, compared to granular soil fertilisation at higher rate as conventional method.

Materials and Methods

Open field trial at the Experimental Farm of Padova University (Legnaro, NE Italy) - 2018-19 season



- 2 SOIL APPLICATIONS (controls):**
- ammonium nitrate (27%)
 - urea (46%)
- FOLIAR APPLICATION (430 L ha⁻¹):**
- urea-ammonium-nitrate (UAN, 26%)
 - urea (46%) (dissolved in H₂O at ambient temp.)

Fertiliser	Treatment	N split					N DOSE	
		Pre-sowing	Tillering (ZDS 26)	Stem elongation (ZDS 37)	Booting (ZDS 40)	Heading (ZDS 58)		
UAN	ON	32 (s)	-	-	-	-	32	-80%
	S	32 (s)	58 (s)	58 (s)	-	12 (f)	160	Ref.
or UREA	F-1	32 (s)	16 (f)	16 (f)	16 (f)	16 (f)	96	-40%
	F-2	32 (s)	8 (f)	16 (f)	32 (f)	16 (f)	104	-35%
	F-3	32 (s)	8 (f)	16 (f)	32 (f)	32 (f)	120	-25%

Table 1. N doses (kg ha⁻¹) of different treatments. S: soil-applied N; F: foliar-applied N

Results

Shoot growth parameters (SPAD and biomass), periodically revealed during the crop cycle (7 dates), were not statistically different among treatments, except for lower SPAD readings at F-1 dose of UREA (Table 2).

At harvest, the highest yield was obtained by F-2 treatment with UAN, whereas TSW (thousand seed weight) was not significantly affected by the method of N supply. Unexpectedly, high productivity were obtained by the absolute control (ON), mainly due to the very high rainfall during April and May, that sustained greenness and plant growth (Table 2).

Fertiliser type	Treatment	Shoot parameters		Grain parameters	
		SPAD	D.W. (g plant ⁻¹)	Yield (t ha ⁻¹)	TSW (g)
UAN	ON	44.3	2.94	6.57	28.9
	S	47.4 a (ref.)	2.95 a (ref.)	6.41 b (ref.)	29.0 a (ref.)
	F-1	45.7 a (-4)	2.92 a (-1)	6.64 ab (+4)	28.8 a (-1)
	F-2	45.3 a (-4)	3.14 a (+6)	6.79 a (+6)	30.3 a (+4)
UREA	F-3	46.8 a (-1)	3.11 a (+5)	6.36 b (-1)	27.8 a (-4)
	S	47.4 a (ref.)	3.16 a (ref.)	6.39 ab (ref.)	27.7 a (ref.)
	F-1	45.7 b (-4)	3.01 a (-5)	6.53 a (+2)	29.4 a (+6)
	F-2	46.5 ab (-2)	3.17 a (=)	6.19 b (-3)	29.1 a (+5)
	F-3	45.9 ab (-3)	3.07 a (-3)	6.52 a (-1)	28.9 a (+4)

Tab 2. In brackets: % variation vs. each conventional management (S). Letters: significance among treatments (Newman-Keuls test; P<0.05).

With both UAN and urea, the grain protein content was slightly reduced with foliar spraying dose F-1 (96 kg ha⁻¹), while with the other N doses there was a moderate improvement (range 13.4-14.5%; P>0.05). Similarly, wet gluten followed the same trend of the protein content (Fig. 1).

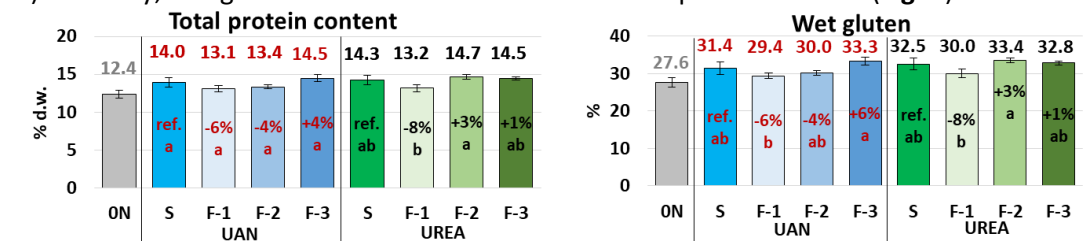


Fig. 1. Inside bars: % variation vs. each conventional management (S). Letters: statistical comparisons among treatments within same fertiliser (Newman-Keuls test, P<0.05).

Conclusions

- Reduced N doses (-35% as maximum) applied by foliar spraying has improved grain quality without compromising wheat growth and yield;
- Urea achieves better results and it is recommended as being cheaper than UAN;
- Foliar spraying improved significantly NUE under the high spring rainfall of 2019, but similar or even better effects would be expected also under drought conditions.

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