Greenhouse gas emissions missions in various cereal fertilization strategies in Conservation Agriculture in Mediterranean climates

F.M. Sánchez-Ruiz[1], M.R. Gómez-Ariza[1], R.J. Gómez-Ariza[1], O. Veroz-González[1], E.J. González-Sánchez[2,1,3]

[1]Asociación Española Agricultura de Conservacion. Suelos Vivos (AEACSV) / IFAPA Centro Alameda del Obispo, Avda. Menendez Pidal s/n. Córdoba, Escuela Técnica Superior de Ingenieros Agrónomos y Montes (ETSIAM), [2]Universidad de Cordoba / Campus Universitario de Rabanales, Córdoba. [3]European Conservation Agriculture Federation (ECAF) / Bruselas

Introduction

Fertilization is one of the most important agricultural activities whose main objective is to maintain and increase crop yields. In this sense, it is very important to know the optimum levels of nutrients that allow to cover the nutritional needs of crops, maximizing their growth and development without increasing greenhouse gas (GHGs) emissions. The type and the timing of fertilization, agricultural management and fertilizer doses are closely linked to GHGs emissions and may give different results depending on the weather conditions of the year, the area and production levels. On the other hand, Conservation Agriculture are known to contribute to the reduction of GHG emissions through reduced energy consumption and increased soil carbon sequestration. The combination of different fertilization strategies with Conservation Agriculture practices can be a good option to reduce GHG emissions due to the synergies that can be achieved by such combinations. The aim of this work is precisely to evaluate GHG emissions in a wheat crop in a Mediterranean climate under direct seeding with various fertilization strategies.

Material and Methods

The trials were carried out on two farms managed under Conservation Agriculture (Figure 1), one in Córdoba (Picture 1) and the other in Las Cabezas de San Juan (Seville) (Picture 2). The treatments were distributed in randomized blocks, with five treatments per block and four replications, with an experimental plot unit of 50 m in length and the width corresponding to one or two passes of the seed drill (depending on the working width of the machine). The different fertilizers used in each treatments are shown in tables 1 and 2.

Figure 1. Location of the trials.

Picture 1. Plots in 'Rabanales' Farm (Córdoba).

Picture 2. Plots in 'La Pluma' Farm (Las Cabezas de San Juan- Seville).

Table 1. Fertiliser thesis. 'Rabanales' Farm.

Treatment	Sowing	Top-Dressing #1	Top-Dressing #2
T1	0	Urea 46% N (42 NFU)	Urea 46% (78 NFU)
T2	0	Urea 46% N (42 NFU)	Blend of Urea and Ammonium Sulphate (33% N) with Ureasa Inhibitor (78 NFU)
T3	Microgranulate 10% N (4 NFU)	Blend of Urea and Ammonium Sulphate 40% N (40.6 NFU)	Blend of Urea and Ammonium Sulphate (33% N) with Ureasa Inhibitor (75.4 NFU)
T4	Microcomplex 11% N (4.4 NFU)		
T5	Microcomplex 11% N (4.4 NFU)		Blend of Urea and Ammonium Sulphate (33% N) with Ureasa Inhibitor (75.1 NFU) + NP liquid biostimulant (5 l/ha)

Table 2. Fertiliser thesis. 'La Pluma' Farm

Treatment	Sowing	Top-Dressing #1	Top-Dressing #2
T1	0	Urea 46% N (49 NFU)	Urea 46% N (91 NFU)
T2	0	Urea 46% N (49 NFU)	Blend of Urea and Ammonium Sulphate (33% N) with Ureasa Inhibitor (91 NFU)
T3	Microgranulate 10% N (4 NFU)	Blend of Urea and Ammonium Sulphate 40% N (47.6 NFU)	Blend of Urea and Ammonium Sulphate (33% N) with Ureasa Inhibitor (88.4 NFU)
T4	Microcomplex 11% N (4.4 NFU)		
T5	Microcomplex 11% N (4.4 NFU)		Blend of Urea and Ammonium Sulphate (33% N) with Ureasa Inhibitor (88.1 NFU) + NP liquid biostimulant (5 l/ha)

Results

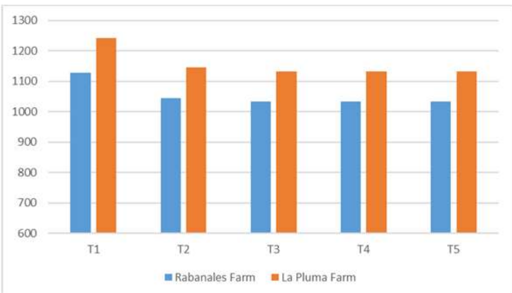

Figure 2. GHG emissions (kg CO_2 eq/ha).

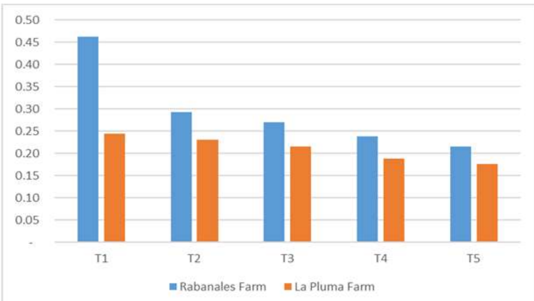

Figure 3. Carbon Footprint (kg CO_2 eq/kg).

Conclusions

Regarding of GHG emissions, treatment T1, with all fertilizer applied in urea form, emits the most, followed by T2. The treatments with starter fertilizers and urease inhibitors (T3, T4, T5) showed similar emission values and between 8.2 and 8.8% lower than the control (T1).

In terms of the product carbon footprint, treatment 5 was the best performer, as it was the case where the highest yield was obtained.

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