XVI European Society for Agronomy Congress
1-3 September 2020 - Sevilla- Spain

EFFECT OF CROP INTENSIFICATION ON WATER AND NITROGEN USE EFFICIENCY UNDER IRRIGATED CONDITIONS

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INTRODUCTION

Intensification of irrigated agriculture is a need to provide enough food to a growing world population. However, the agrosystems must be able to decrease their environmental impact on air, soil and water resources through an efficient use of water (W) and nitrogen (N).

MATERIAL AND METHODS

24 drainage lysimeters + Two soils (Deep:125 cm & Shallow:50 cm) + Years 2018 & 2019

N rates and irrigation water were managed according to expected crop requirements

Treatments:

- Long season maize monoculture ***(LSM)***
- LSM+Winter leguminous crop cover✷ ***(LSM+CC)***
- Winter barley + Short-season maize ***(B + SSM)***
- Winter peas + Short-season maize ***(P + SSM)***

✷(Cover crop 2018 failed ; cover crop 2019: common vetch)

Evaluated parameters:

- Total aerial biomass ***(TAB)***
- Grain yield ***(GY)***
- Water use efficiency ***(WUE)***
- N use efficiency ***(NUE)***
- N losses by drainage

RESULTS

- ❖ Soil type did not influence the WUE of the different treatments.
- ❖ In both seasons, the B+SSM had higher WUE in terms of TAB (between 17 to 60%) and in terms of GY (between 17 to 38%).
- ❖ The Shallow soil presented much lower NUE than the Deep soil, although the difference was smaller for the double cropping systems.
- ❖ P+SSM presented higher NUE irrespective of season and soil type.
- ❖ B+SSM showed lower N leached than any other treatment; P+SSM presented similar or higher N leached than the LSM rotation.

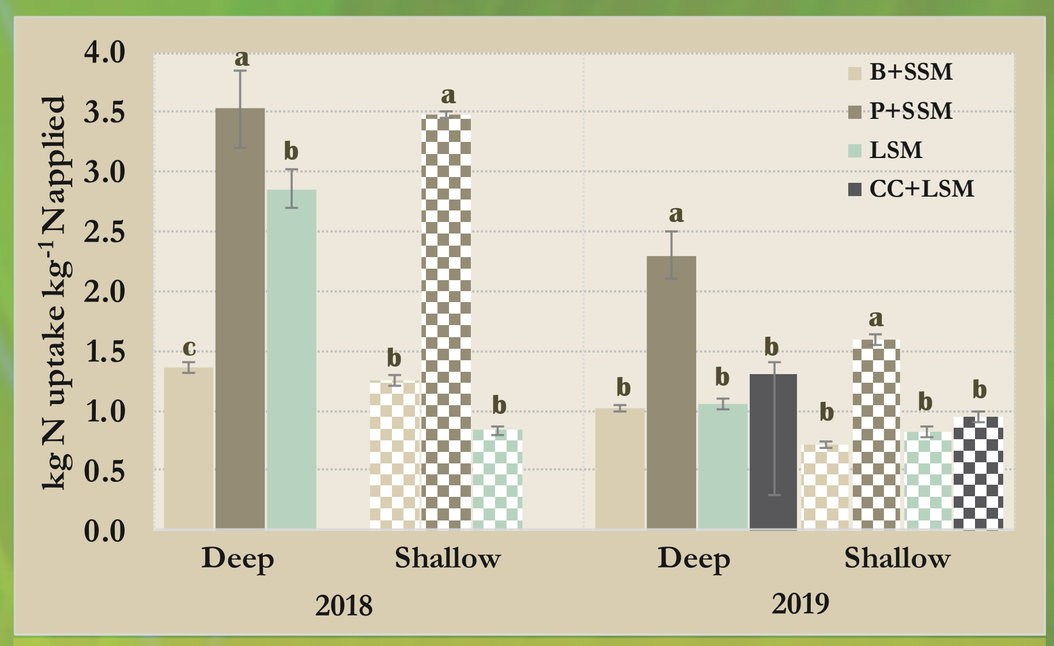

Fig.1: Nitrogen use efficiency (NUE_{TAB}, kg N uptake in the aerial biomass kg^{-1} N applied) for the different treatments. For a given year and soil type, means followed by the same letter were not significantly different (p>0.05, Tukey's test).

Table 1. Water use efficiency (WUE, kg dry matter mm^{-1} evapotranspirated water) for the different rotation and soil type factors on total aerial biomass (TAB) and dry grain yield (GY) basis. For a given year, means followed by the same letter were not significantly different (p>0.05, Tukey's test).

Factors	WUE_{TAB} (kg TAB mm^{-1} ET)		WUE_{GY} (kg grain mm^{-1} ET)	
	2018	2019	2018	2019
Rotation				
B+SSM	34.8 a	35.1 a	18.8 a	15.7 a
P+SSM	26.7 b	29.9 b	13.6 c	13.4 b
LSM	27.7 b	22.7 c	15.4 b	12.2 bc
CC+LSM	-	22.0 c	-	11.6 c
Soil type				
Deep	29.6 a	27.4 a	16.1 a	13.7 a
Shallow	29.9 a	27.4 a	15.8 a	12.7 b
Rot. x Soil Type	ns	ns	ns	ns

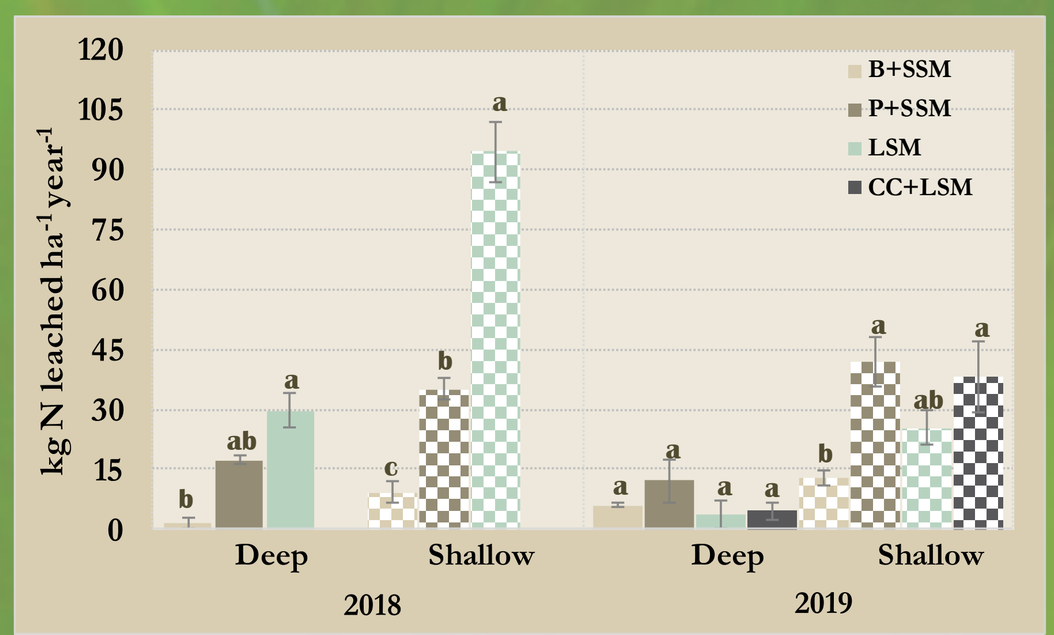

Fig.2: Masses of N leached (kg N ha^{-1} $year^{-1}$) for the different treatments. For a given year and soil type, means followed by the same letter were not significantly different (p>0.05, Tukey's test).

Intensification of crops through inclusion of cover crops or double cropping can improve WUE and NUE but the N inputs (in amounts and time) associated to N fixation by leguminous crops included in the rotation has to be properly considered to avoid unwanted environmental impacts.

Acknowledgements: Spanish Ministry of Economy, Industry, and Competitiveness (AGL2017-84529-C3-1-R and AGL2017-84259-C3-2-R projects).