INFLUENCE OF PLANTING LOCATION AND GROWING SEASON ON THE NUTRITIONAL QUALITY OF LUPIN

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OVERVIEW & INTRODUCTION

Lupins are a nutritious legume crop; certain accessions possess up to 40% of protein, while they are also rich sources of zinc (Zn), magnesium (Mg), iron (Fe), potassium (K) and more (Bryant et al., 2022). Currently not enough data is available to understand the effect of climate in the nutritional profile of legumes, therefore this research seeks to determine if planting location and growing season will indeed result in seeds with a different nutritional profile.

The aim was to record climacteric conditions along two growing seasons to help understand if the resulting differences were statistically significative. It was possible to conclude that there was significant difference of nutrient accumulation in lupins that were grown over season 1 (S1) resulting mainly in seeds with higher levels of protein and phosphorus (P).

METHODS

1 Seeds were planted, grown and harvested in Spain.

- Two growing seasons: season 1 (S1) 2017-2018, and season 2 (S2) 2018-2019.
- Two distinct locations: Córdoba, location 1 (L1) and Huelva, location 2 (L2).

2 Seed protein concentration was determined.

- Bradford methodology, using the Pierce Coomassie Plus Assay Kit (Thermo Fisher Scientific, Massachusetts, USA.)

3 Mineral content in seeds was also determined.

- Microwave-assisted digestion through inductively coupled plasma - optical emission spectrometry (ICP-OES, Optima 7000 DV, PerkinElmer, USA.)

RESULTS

- S1 grains had **higher protein accumulation** in Loc 1 (Figure 1 A), which was also the location where the crop yield was reduced. This trait aligns with previous research linking lower yields and higher protein content in lupin seeds (Reckling et al., 2018).
- The **low protein levels** found in S2 at both locations could also be related to the specific climacteric conditions during this season, resulting in a warmer year (+2C°) with less rainfall than S1 (-1,266 mm) (*data not shown*).
- The significant **decrease in P** accumulation in S2 is attributed to drought stress, as it has been shown that climate alterations may disturb the nutrient accumulation in crops. Particularly drought stress limiting P accumulation and translocation to the seed in soybean (Jin et al., 2015).
- In S1, **P was higher** in Loc 2 (Figure 1.B), while **Mn, K and Zn had similar levels** in both locations (Figure 1, C and D).
- Lastly, **K** accumulation displayed only a **statistical difference** during S2 in Loc 2 (Figure 1E). This could be a result of K fixation to some particles of clay present in the soil, conditioning the plant's ability to absorb the mineral (Solangi et al., 2019).

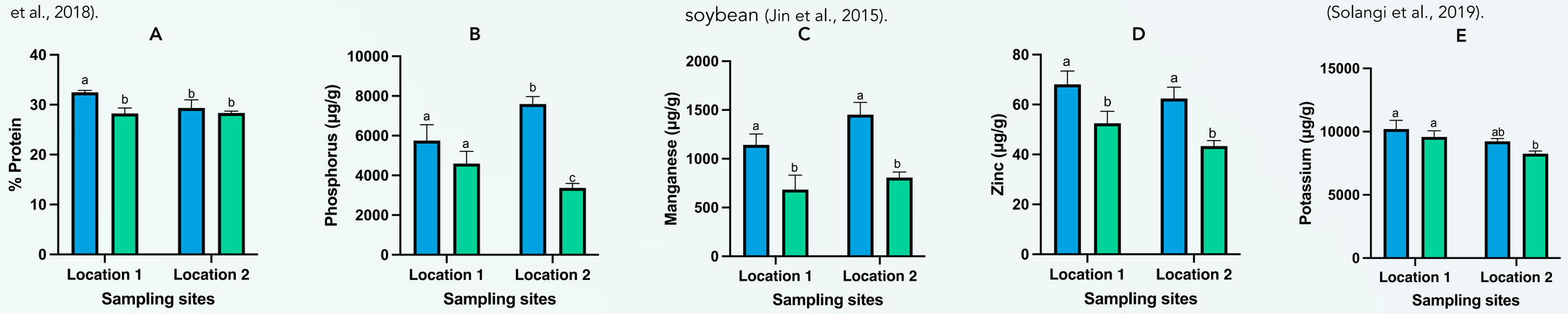

Fig. 1. Results of the effect of growing season and location on nutritional composition of lupin grains for protein (A), phosphorus (B), manganese (C), zinc (D) and potassium (E).

- Lastly, levels of **Fe, Mg and Ca** did **not show significant variation** on their nutrient accumulation amongst seasons and locations (*data not shown*), a result that aligns with the expected resilience in mineral uptake of lupins that have been harvested in different environments (Ruiz-López et al., 2019).

CONCLUSION

Nutrient accumulation was more variable between seasons that between locations, this behaviour is associated with the very distinct climacteric conditions of the two seasons.

This was expected since temperature and water availability can influence greatly the outcome of any given crop, even when conditions for both trials varied a lot.

Growing conditions of S1 (2017-2018) seemed to provide a more advantageous context for nutrient accumulation in lupin crops.

Linking the data on water availability and temperature changes with the final outcome.

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