

Nutritional and morphological responses of kabuli and desi chickpeas (*Cicer arietinum*) to different water supplies



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Introduction

Pulses can play a key role in food security and human nutrition. They are rich in proteins, minerals, vitamins, and bioactive compounds, being an excellent option for a balanced diet. They are also important for agriculture and the environment, being used for soil nutritional enrichment due to their ability to fix atmospheric nitrogen (N), and reducing the need for N fertilizer application. Amongst the pulses, chickpeas (*Cicer arietinum*) have gained evidence in recent decades, resulting in increased production, whether in monoculture, part of rotations or intercropping systems. The diversity of chickpeas is reflected both in their adaptability to different environmental scenarios and also in their nutritional profile, namely in terms of minerals. Despite their multiple benefits, chickpea consumption is generally low, and diets are reliant on very few varieties. E.g., in Portugal, the most commonly produced and consumed chickpea is the kabuli (white) chickpea, whereas other interesting chickpea types exist. The black chickpea (desi type) is a highly popular type in Asia, but hardly known by Portuguese farmers or consumers. As climate change, in particular drought, can affect chickpea development, impacting productivity and jeopardizing food supplies, it is important to identify genotypes that can combine productivity with an enhanced nutritional profile. As such, the aim of this work was to explore the potential of the black type (desi) chickpea in terms of its nutritional load and tolerance to water scarcity.

Objectives

To valorise the chickpea crop by comparing the nutritional profile of a commercial variety of white chickpeas and a traditional variety of black chickpeas (*C. arietinum*).

Methods

- Two varieties of *C. arietinum*: kabuli chickpeas (white) and desi chickpeas (black) were germinated and cultivated to full maturity in a climatic chamber (photoperiod of 16 hours/day and temperature of 22C/day 20C/night) 60 experimental units of each variety, with 15 replications for each treatment, under different water sources (90%, 75%, 50% or 25% of the field capacity).
- Morphological traits: dry weight (root and shoot)
- Mineral profiling: potassium (K), phosphorous (P), magnesium (Mg), calcium (Ca), iron (Fe), zinc (Zn), sodium (Na), manganese (Mn), copper (Cu), boron (B), nickel (Ni) and molybdenum (Mo), evaluated by microwave acid digestion and Inductively coupled plasma - optical emission spectrometry (ICP-OES)

Results and Discussion



Figure 1 – White/commercial chickpeas (kabuli) and black/traditional chickpeas (desi).

With the reduction in water supply, there was a reduction in root and stem dry mass in both genotypes (up to 48% in roots and 35% in shoots). Nevertheless, at the lowest water provision (25%) the desi chickpeas had higher shoot dry weight (170%) than kabuli (Fig. 2).

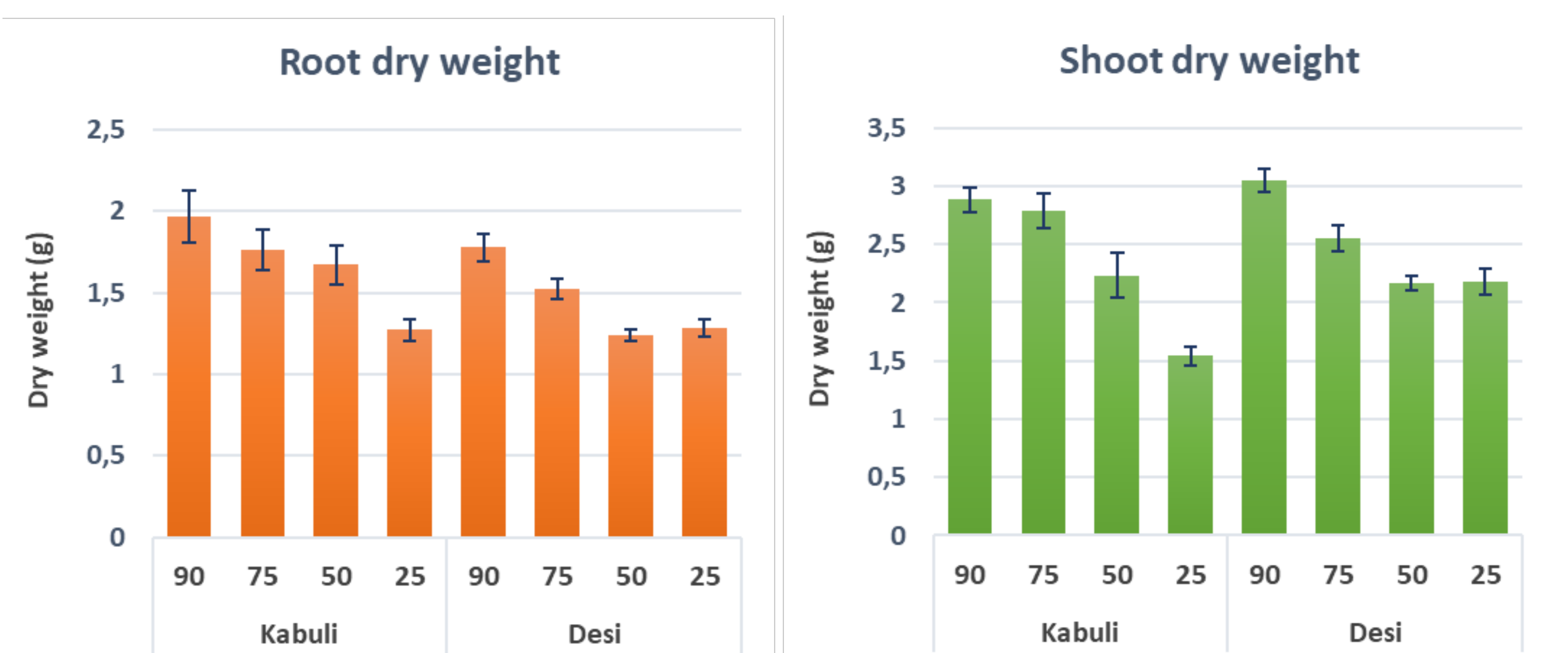


Figure 2 – Root and shoot dry weight.

At low water supply, there was an increase in the concentration of zinc (Zn) and phosphorus (P) in seeds of the desi variety (from 29 to 38%), while kabuli showed a reduction in mineral concentrations as the water supply decreased (Fig. 3). Low water supply did not affect the accumulation of K, Mg, Ca, Fe, Na, Mn, Cu, B, Ni and Mo, regardless of chickpea genotype.

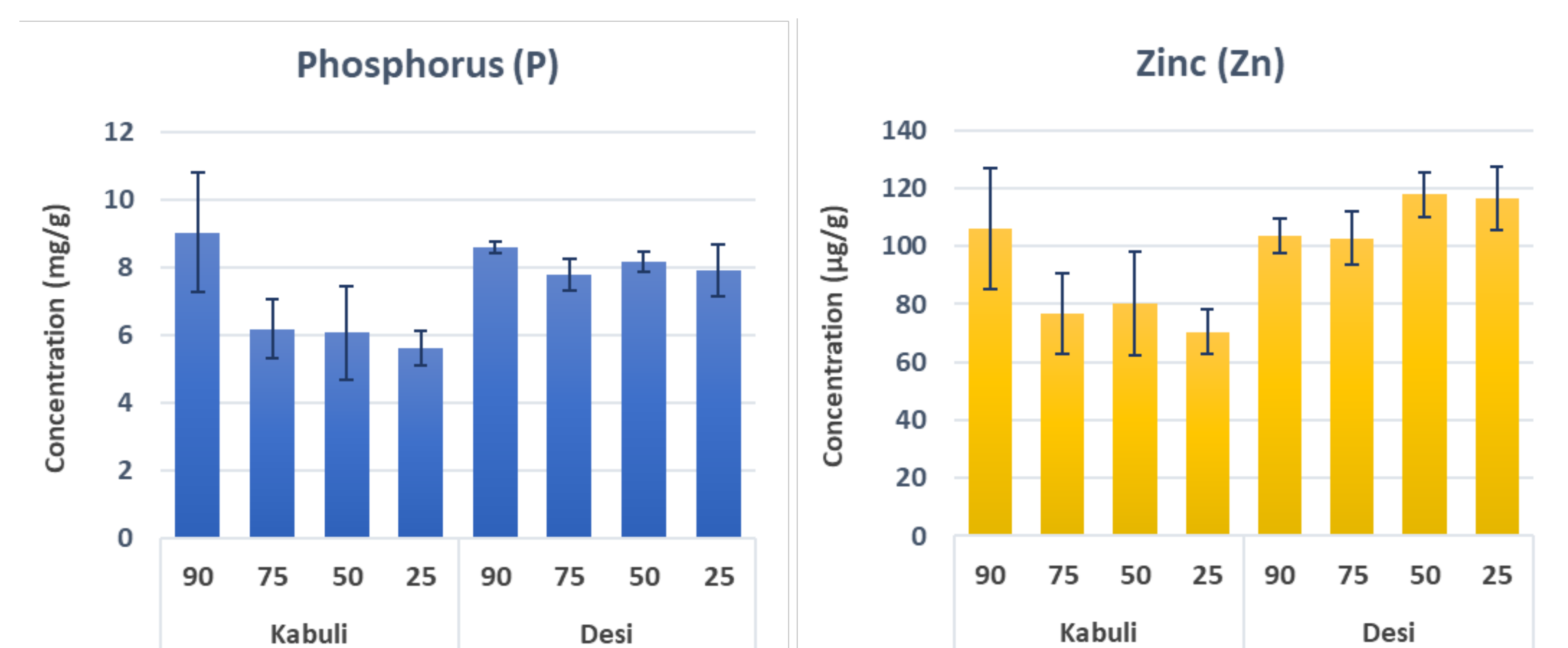


Figure 3 – Zinc and phosphorus concentration in seeds.

Conclusions

- The cultivar desi has a better adaptation to low water availability, showing higher shoot biomass and concentrations of P and Zn than kabuli.
- The production of desi chickpeas could improve agrobiodiversity by providing a higher mineral content even under conditions of low water supply.

Acknowledgments

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