

Improving nutrient and water use efficiency in semi-arid cereal production systems; the effect of rainfall, supplementary irrigation, fertiliser type and variety on spelt yield

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Introduction

- There is an increasing consumer demand for spelt wheat products
- Spelt cultivation has become popular in many semi-arid Mediterranean regions
- Lack of information about optimum agronomic protocols
- Lack of information about the performance of available spelt varieties

Research Objectives

- assess the effect of **fertilisers with contrasting water-soluble N and P concentrations** on crop health and grain yield and nutritional quality
- assess the effect of using **supplementary irrigation** in rain-fed winter cereal crops on crop health and grain yield/yield stability and nutritional quality parameters
- compare crop health, yield and quality parameters in **(a)** traditional "pure" Spelt genotypes and **(b)** "modern" varieties based on *T. aestivum* x *T. spelta* crosses
- identify **interactions** between contrasting Spelt varieties and agronomic parameters (irrigation and fertilisation regimes) with respect to crop health, yield, yield stability and grain quality parameters
- assess the effect of **contrasting climatic conditions** on Spelt wheat performance

Key findings

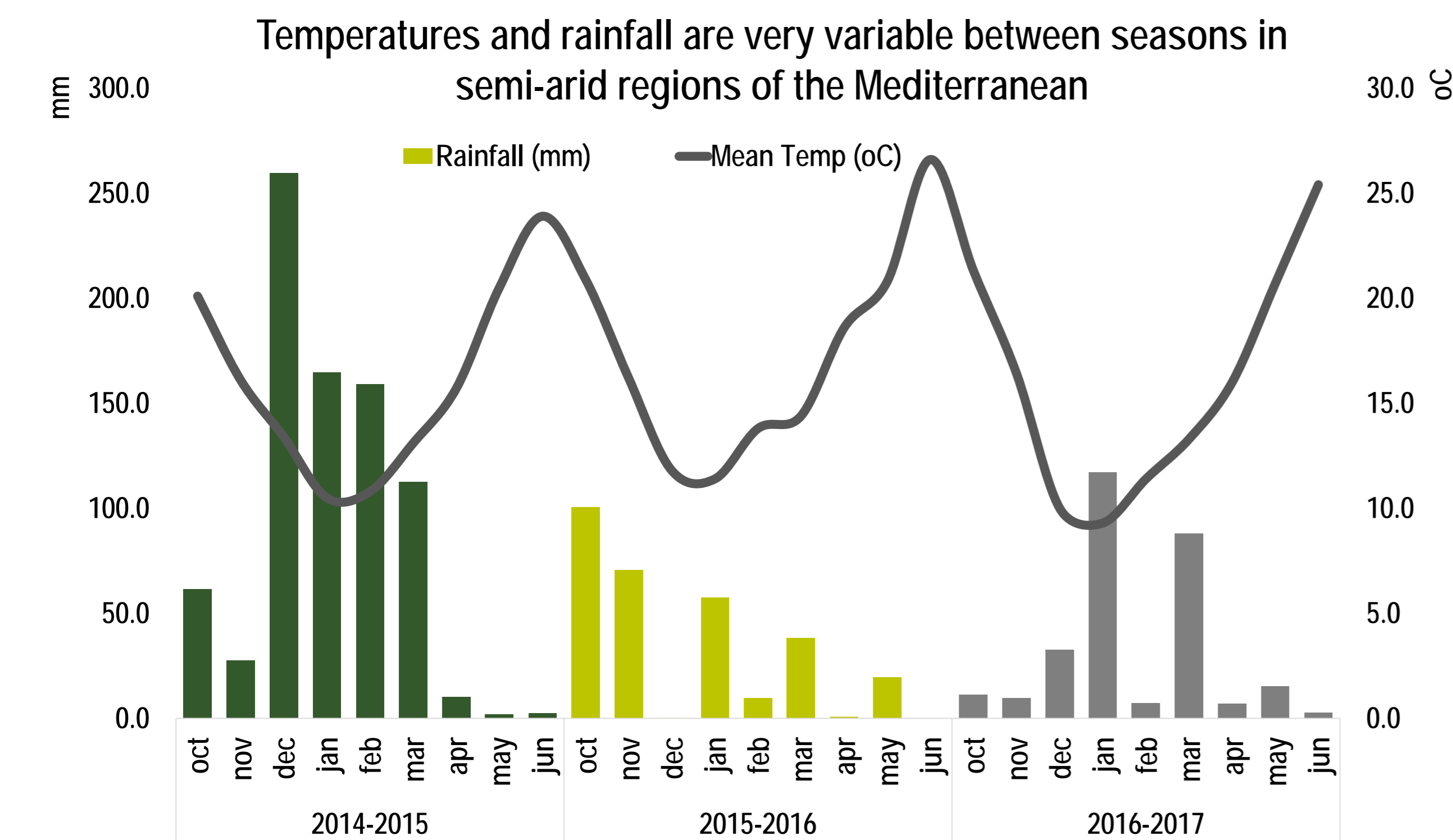


Figure 1 Climatic conditions (rainfall and mean temperature) during the three harvest years

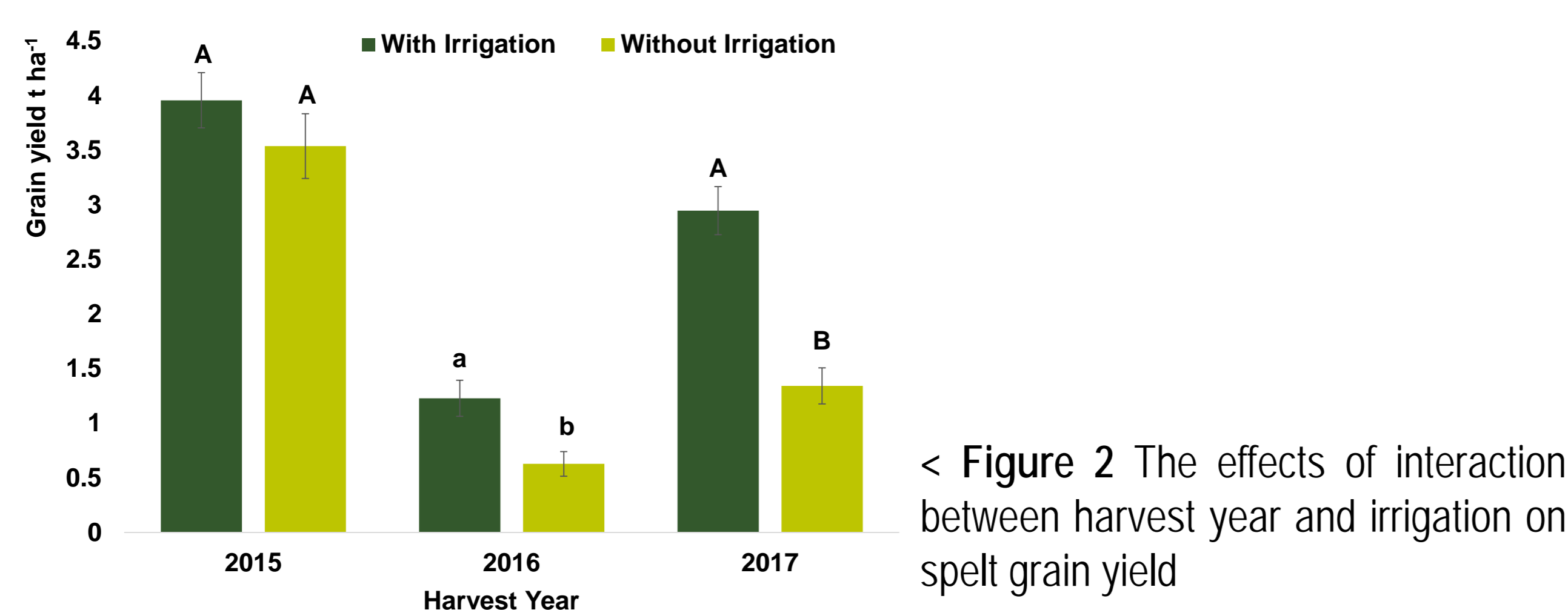


Figure 2 The effects of interaction between harvest year and irrigation on spelt grain yield

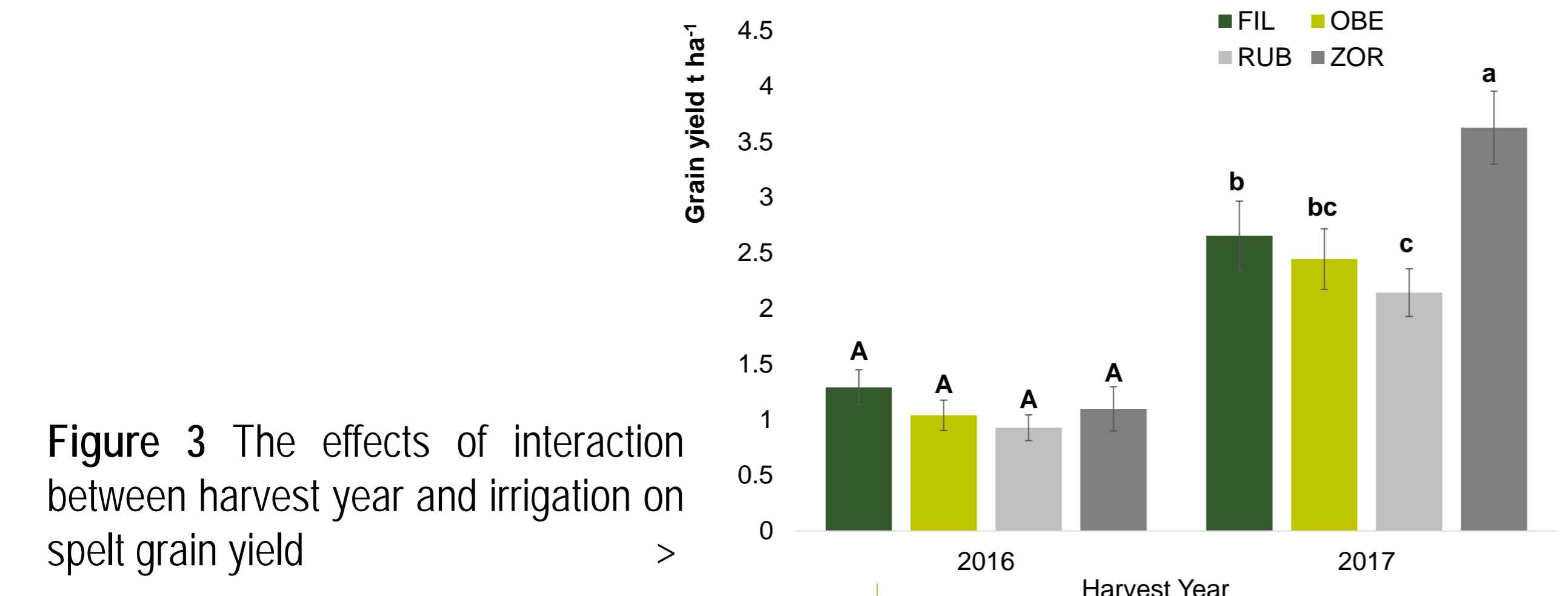


Figure 3 The effects of interaction between harvest year and irrigation on spelt grain yield

Experimental Design



3 Growth seasons

Supplementary Irrigation

+

-

Fertiliser Type

Sheep manure

Chicken pellets

Mineral NPK

Genotype

Rubiota, Oberkulmer, ZOR, Filderstolz

Growth, Yield and NUE

Grain Yield - Harvest Index - NUE

Grain quality

Phenolic content - Antioxidant activity

Protein / Macro-micro nutrient content

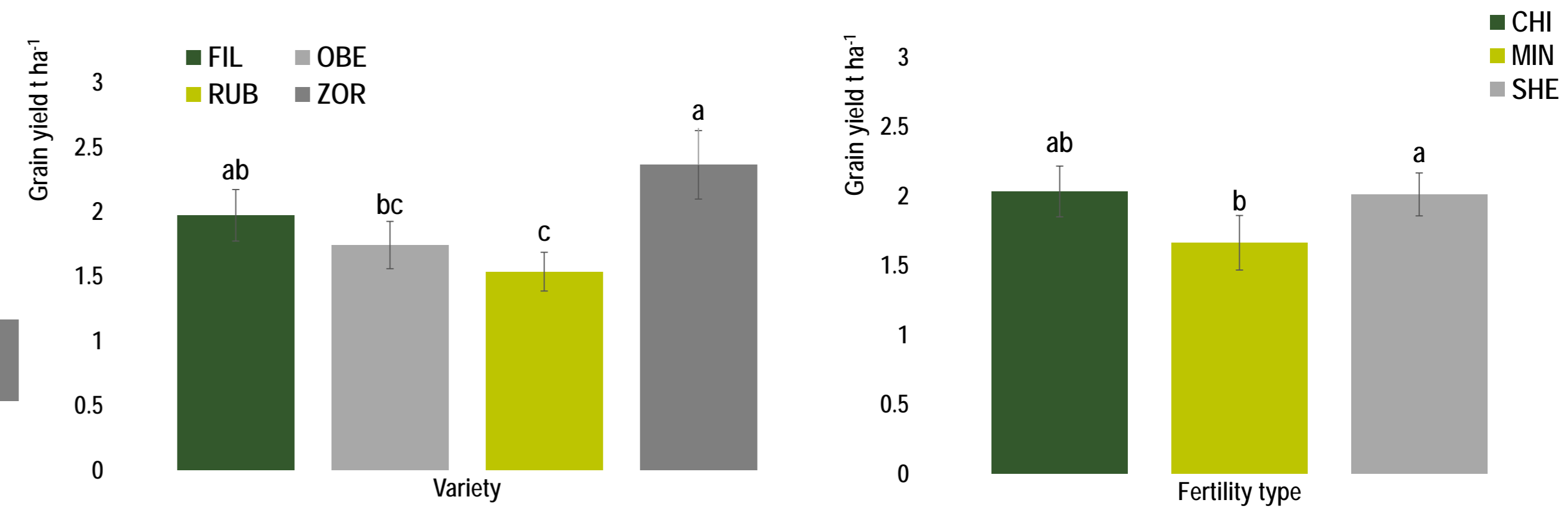


Figure 4 The effects of a. variety and b. fertility input type on Spelt grain Yield

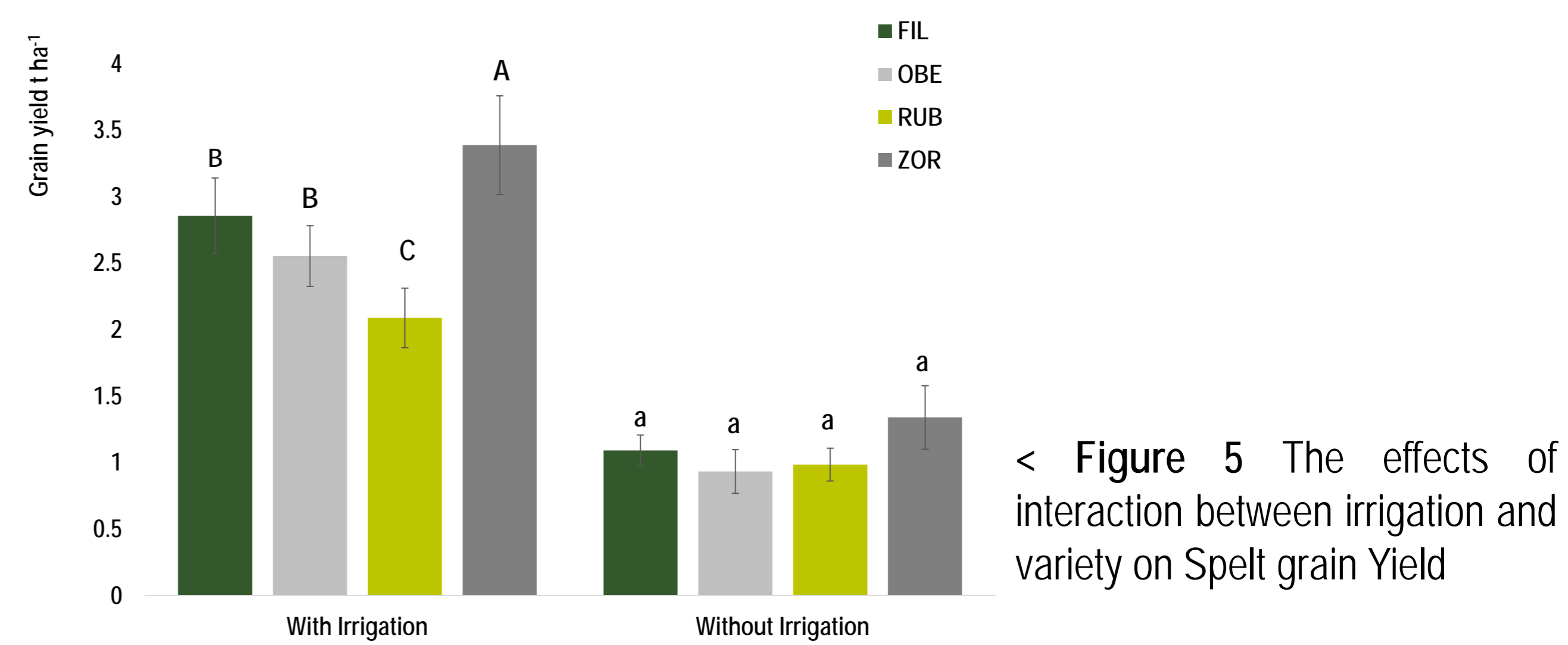


Figure 5 The effects of interaction between irrigation and variety on Spelt grain Yield

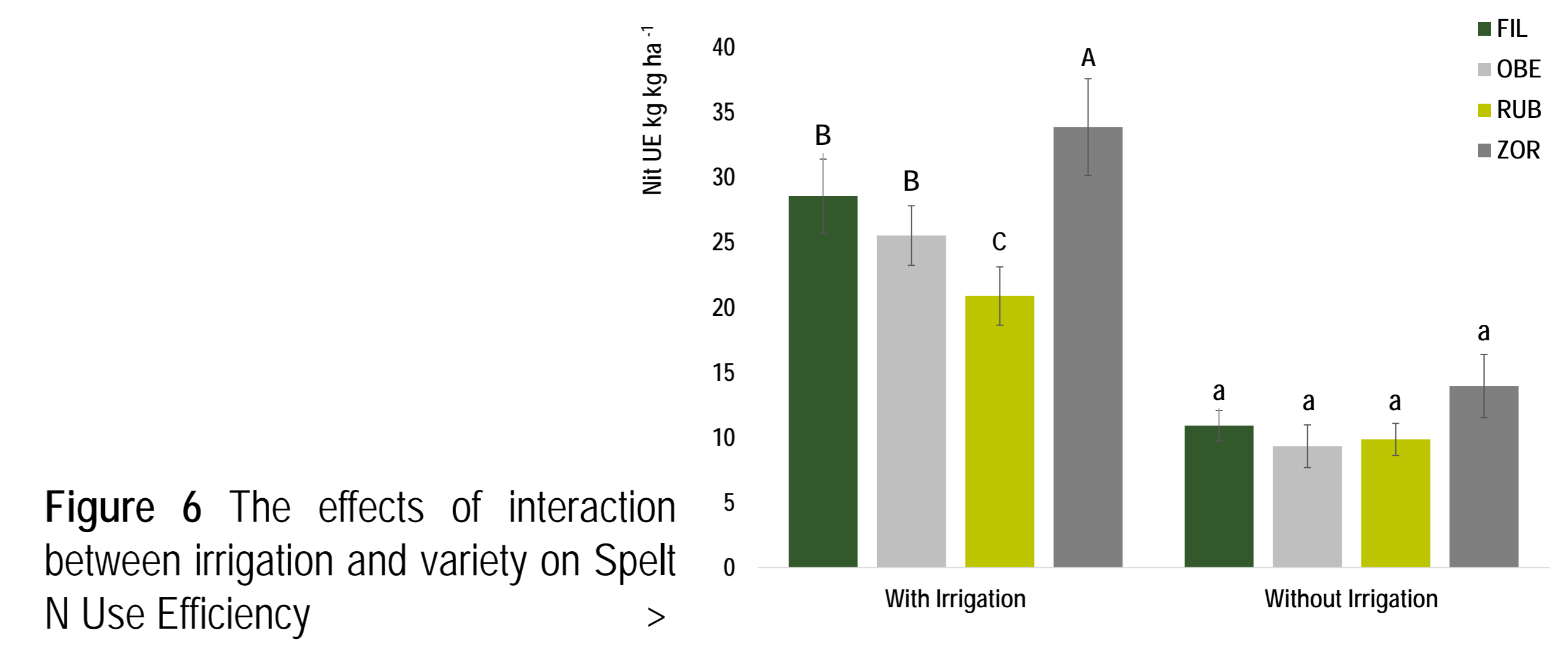


Figure 6 The effects of interaction between irrigation and variety on Spelt N Use Efficiency

Conclusions - Future work

- Chicken and sheep manure resulted in similar or higher grain yields and in lower lodging levels than mineral NPK fertiliser
- Supplementary irrigation significantly increased grain yield only in the seasons with low winter rainfall
- Recently developed spelt varieties (ZOR and Filderstolz) produced higher yields, had higher NUE and lower lodging, but had lower protein concentrations than traditional varieties (Oberkulmer and Rubiota)
- Screening / evaluation of Cretan traditional cereal genotypes
- Farming participatory selection for enhanced abiotic-biotic stress resistance and quality levels