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COMPARATIVE ANTIOXIDANT ACTIVITY IN SEEDS OF IRRIGATED AND NON-IRRIGATED FLAX (*LINUM USITATISSIMUM* L.) CULTIVAR ALEXIN

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ABSTRACT

Flax from cultivar Alexin was grown on three different water regimes: non-irrigated, half dose and full-dose irrigated. Seeds were harvested, extracted in 70 % ethanol solution and analyzed for antioxidant activity, using the DPPH method.
Results show an extreme variation of antioxidant activity with irrigation regime, from just 3.18 % in non-irrigated flax, to 48.24 % in full-dose irrigated one, with 18.08 % at half dose irrigation, corresponding to IC50 values of 45.68–106.88. Irrigation, even with half dose raised linseed tissue extract potential to strongly antioxidant and to very strongly antioxidant at full dose..
These results can be linked to data showing a major increase in concentrations of some key compounds, especially of phenolic compounds.

INTRODUCTION

Flax (*Linum usitatissimum* L.) is an important and widespread crop throughout the temperate areas of the world. An herbaceous, annual plant, it is grown for producing textile fibers, but also for its seeds.

The main product derived from flax seeds is linseed oil, a mixture of fats that can reach 26-45 % of seed dry weight. Apart from its rich inventory of fatty acids (mostly α-linoleic acid), these seeds are known to contain other valuable organic nutrients, such as lignans, flavonoids and hydroxycinnamic acids, compounds that are antioxidant, antimicrobial, antidiabetic while also supporting cardiovascular system health (Popa et al. 2012; Gai et al. 2023; Simion et al. 2024)

The objective of this paper was to determine the way different irrigation regimes affect the radical scavenging activity in linseed extracts.

MATERIAL AND METHODS

Flax (cultivar Alexin) was grown on the experimental farm of the "Ovidius" University of Constanța, under three types of hydric conditions: non-irrigated, irrigated with half dose and irrigated with full dose.

The experimental field was prepared for cultivation by removing any plant wastes and levelling soil.

Due to the high temperatures within the growth period, irrigation was done by aspersion when soil humidity approached the minimal level.

The three experimental variants of irrigation were zero dose (as control), half dose (250 m^3/ha) and full dose irrigation (500 m^3/ha). Harvesting was done at the end of July, when qualitative analyses were performed. Seeds were collected and taken for laboratory analyses.

Analysis of antioxidant activity required grinding flax seeds in an electric grinder, until the material was reduced to a fine powder. Extraction was made by mixing the powder with 70 % ethanol solution up to a final concentration of 10% plant material and filtering.

Antioxidant activity was determined using the DPPH method. Samples were 10-fold diluted and 0.1 mL of each one were incubated for 60 minutes (in the dark) with 2.9 mL 2,2-diphenyl-1-picrylhydrazyl (DPPH).

Spectrophotometric absorbance was read at 517 nm using a Cecil 2021 spectrophotometer. A calibration curve was previously made using gallic acid. Results were expressed percentage of DPPH radical scavenging (Brand-Williams et al. 1995). IC50 was derived by linear regression

RESULTS AND DISCUSSIONS

The percentual radical scavenging activity of corn grain extracts is shown in Figure 1. Table 1 shows the average half maximal inhibitory concentrations (IC50) of studied corn extracts against free radicals.

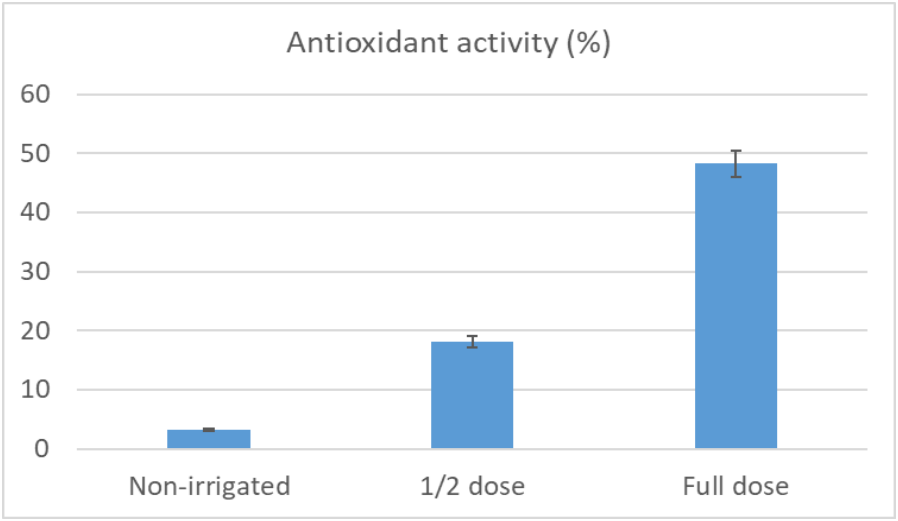

Figure 1. Radical scavenging activity in 10% ethanolic linseed extracts (%).

Table 1.

Average IC50 in 10% ethanolic linseed extracts (mg/L)

Irrigation regime	Non-Irrigated	½ dose	Full dose
IC50 (mg/mL)	106.88	86.64	45.68

Results show an extreme variation of antioxidant activity with irrigation regime, from just 3.18 % in non-irrigated flax, to 48.24 % in full dose irrigated one.

The results are in line with other findings in literature. Al-Temimi et al. 2020 found 48.67-71.24 % scavenging activity in ethanolic extracts, while an extensive study on 15 cultivars found a wide array of scavenging rates, from 10 to 80 %, with an IC50 of 1.89-6.03 mg/L (equivalent to 18.90-60.33 mg/L in 10 % extracts; Koçak 2024). Another study found an average of 20.8 mg/L (Alawlaqi et al. 2023).

Generally, an extract with IC50 above 100 mg/L can be considered as medium antioxidant, while one below 50 mg/L as very strongly antioxidant (Sinay et al. 2022). In this case, irrigation, with full dose raised antioxidant status of linseed extracts from weak to very strong radical scavenging activity, while a half water dose led to strongly antioxidant extract. Reported to dry biomass, seed tissue can be considered as very strongly antioxidant at all water regimes.

This variation of antioxidant activity can easily be linked to an increase in concentrations of (potentially) antioxidant compounds, shown by Simion et al. 2024 in a study conducted on the same cultivar.

Especially an increase of total phenolic content by 132 % in fully irrigated plants, from 3,106 to 7,211 mg/kg DW, but also to specific fractions, such as flavonoids, hydroxycinnamic acids or stilbenes.

The same study showed that full irrigation also led to significant increases in concentrations of carotenoid compounds and, to a lesser extent, of ascorbic acid (Simion et al. 2024).

CONCLUSIONS

The results of this study show an extreme variation of antioxidant activity with irrigation regime, from just 3.18 % in non-irrigated flax, to 48.24 % in full dose irrigated one, with 18.08 % at half dose irrigation, corresponding to IC50 values of 10.36–157.18.

Irrigation, even with half dose raised linseed tissue extract potential to strongly antioxidant, and to very strongly antioxidant at full water dose. The increase was higher from half dose to full dose.

These results can be linked to data showing a major increase in concentrations of some key compounds, namely total phenolic compounds (and subclasses such as flavonoids and phenolic acids.

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