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Eliseu Maciel Agronomy Faculty
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Dissertation

Effect of enhanced CO_2 atmospheric concentration on rice and weedy rice

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“*Every dream that you leave behind, is a piece of your future that will no longer exist.”*
Steve Jobs

ABSTRACT

BALBINOT, Andrisa**. Effect of enhanced CO_2 atmospheric concentration on rice and weedy rice**. 2020. 115f. Dissertation (Doctor) – Crop Protection Program. Federal University of Pelotas, Pelotas.

Global climate change causes stresses that can limit crop productivity and threaten food production in the future. Increased production implies an increase in the demand for water, with irrigation being the activity that most uses fresh water today. The culture of rice represents an important staple food and effects of the increase in atmospheric CO_2 atmospheric can affect development and production, in addition to affecting weedy rice, the most important weed in flooding rice system. Therefore, the present research aimed to evaluate the effect of increasing CO_2 atmospheric associated with different water regimes on rice and weedy rice. For this, experiments were carried out to evaluate development and water use efficiently in rice crop and also, quantify the total concentration of arsenic and cadmium in grains; the effects in weedy rice growth, development, seed shattering and longevity of seed bank; the gene expression to genes to be related to involve on seed shattering in rice, and to evaluated on the quality of grains and physicochemical proprieties in rice and red rice. The results allowed indicated that increase in CO_2 affects the growth, development and water use efficiency in rice. In addition, in the assessment of total arsenic, intermittent regime decreased the absorption of the element. Considering the studies development with weedy rice, the effect of increase CO_2 was observed for growth and development, in addition to increasing the seed shattering and seed viability at seedbank. In addition, gene expression demonstrated that the genes *OsCPL1*, *qSH1*, *SHAT1*, *OsXTH8*, *OSH15* and *SH5* are affected by the increase in CO_2, making the characteristic more complex because involver several metabolic pathways. Contemplating the grain yield analysis, white rice had a decrease in head rice yield in high CO_2, in addition an increase in the chalkiness area and a decrease in crude protein, with changes in cooking parameters. These results contribute to characterization of increase CO_2 in rice crop, being the basis for future studies, which continue in search to elucidate the effects of climate change in agriculture, assisting in the planning of the adoption of sustainable management, in order to minimize the negative effects.

Key-words: Climate change, water regimes, water use efficiently, rice shattering, phenolic compounds, head yield rice.

RESUMO

BALBINOT**,** Andrisa**. Efeito do aumento da concentração de CO_2 atmosférico na cultura do arroz e no arroz daninho**. 2020. 115f. Tese (Doutorado) – Programa de Pós-Graduação em Fitossanidade. Universidade Federal de Pelotas, Pelotas.

As mudanças climáticas globais causam estresses que podem limitar a produtividade das culturas e ameaçar a produção de alimentos no futuro. Aumento da produção implica no aumento da demanda por água, sendo que a irrigação é a atividade que mais utiliza água doce atualmente. A cultura do arroz (*Oryza sativa*) representa importante alimento básico para população mundial e os efeitos do aumento de CO_2 atmosférico podem afetar seu desenvolvimento e produção, além de afetar o arroz daninho, uma das principais plantas daninhas na cultura do arroz. Diante disso, a presente pesquisa teve como principal objetivo avaliar o efeito do aumento da concentração atmosférica de CO_2 (400 e 700 µmol mol^{-1}) associada a diferentes regimes hídricos (contínuo e intermitente) em arroz e arroz daninho. Para isso, estudos foram desenvolvidos para avaliar parâmetros de crescimento e produtivo, eficiência no uso da água pela cultura do arroz e quantificar o total de arsênio e cádmio nos grãos; efeito nos parâmetros de crescimento e produtivo de arroz daninho, bem como o degrane e a viabilidade de sementes no banco de sementes; expressão gênica de genes associados ao processo de degrane; e avaliar o rendimento de grãos e propriedades físico-químicas de arroz branco e vermelho. Os resultados permitiram inferir que o aumento do CO_2 afeta o crescimento, desenvolvimento e a eficiência do uso da água em arroz. Além disso, na avaliação de arsênio total, o regime intermitente diminuiu a absorção do elemento. Considerando os estudos realizados com arroz daninho, o efeito do CO_2 foi observado para crescimento e desenvolvimento, além de aumentar a taxa de degrane e a viabilidade de sementes no banco de sementes do solo. Em adição, a expressão gênica demonstrou que os genes *OsCPL1*, *qSH1*, *SHAT1*, *OsXTH8*, *OSH15* e *SH5* são afetados pelo aumento do CO_2, tornando a característica ainda mais complexa, visto que o CO_2 tem ação em diversas rotas metabólicas. Contemplando a análise de rendimento de grãos, o arroz branco teve diminuição no rendimento de inteiros em alto CO_2, além de aumento na área gessada e diminuição da proteína bruta, com alterações nos parâmetros de cocção. Estes resultados auxiliam na caracterização das implicações do aumento de CO_2 na cultura do arroz sendo base para estudos futuros, que seguem na busca em elucidar os efeitos das mudanças climáticas na agricultura, auxiliando no planejamento da adoção de manejo sustentável, de modo a minimizar os efeitos negativos.

Palavras-chave: Mudança climática, regimes hídricos, eficiência do uso da água, degrane de arroz, compostos fenólicos, rendimento de grãos.