

**FEDERAL UNIVERSITY OF PELOTAS**  
**Faculty of Agronomy Eliseu Maciel**  
**Crop Protection Graduation Program**

**Dissertation**



**Transgenerational effect of sublethal doses of glyphosate and quizalofop and drought stress on *Eragrostis plana* response to both herbicides**

**Marcus Vinícius Fipke**

**Pelotas, 2020**

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In the end everything works out,  
and if it didn't work  
it's because it's not over yet.

Fernando Sabino

## Resumo

Fipke, Marcus Vinícius. Efeito transgeracional de doses sub-letais de glifosato e quizalofop e estresse por déficit hídrico na resposta de *Eragrostis plana* a ambos os herbicidas. 2020. 105f. Tese (Doutorado) - Programa de Pós-Graduação em Fitossanidade. Universidade Federal de Pelotas, Pelotas, Brasil.

*Eragrostis plana* é uma das principais plantas invasoras dos campos do Bioma Pampa. Esta se caracteriza por ser uma espécie altamente invasiva e competitiva com o campo nativo, pela capacidade de tolerar diversos estresses abióticos e pelo difícil controle. Plantas submetidas a estresses abióticos e herbicidas podem desenvolver mecanismos que aliviam ou reduzem os danos causados por estressores e transmitem essa capacidade às progênies. Os objetivos deste trabalho foram: 1) investigar o efeito da aplicação recorrente de dose sub-letal dos herbicidas (quizalofop-p-ethyl ou glyphosate) com ou sem estresse por seca por duas gerações no desenvolvimento de maior tolerância aos herbicidas; 2) investigar se as enzimas antioxidantes estão envolvidas nesse processo de tolerância aprimorada; e 3) investigar os principais mecanismos de tolerância aprimorada no desenvolvimento de resistência ao glyphosate e quizalofop. Plantas da geração **F2** submetidas ao estresse combinado (estresse por seca e sub-dose de glyphosate - DRYxGLY) apresentaram a maior tolerância ao glyphosate. As enzimas antioxidantes conjuntamente com a superexpressão de *EPSPS* e do transportador ABC *MRP10* estão envolvidos no aumento da tolerância da população DRYxGLY ao glyphosate. Plantas da geração **F2** submetidas ao estresse por seca (denominada DRY) desenvolveram a maior tolerância ao quizalofop. O aumento da atividade enzimática antioxidante conjuntamente com a superexpressão dos genes *CYP72A31*, *CYP81A12* e *GSTL2*, estão envolvidos na redução do estresse oxidativo e possível metabolização do herbicida, desenvolvendo a tolerância na população DRY ao quizalofop.

Palavras-chave: capim-annoni, memória a estresse, resistência.

## Abstract

Fipke, Marcus Vinícius. Transgenerational effect of sublethal doses of glyphosate and quizalofop and drought stress on *Eragrostis plana* response to both herbicides. 2020. 105f. Thesis (doctorate degree) – Crop Protection Graduate Program. Federal University of Pelotas, Pelotas, Brasil.

*Eragrostis plana* is the main invasive plant in the fields of the Pampa Biome. It is a highly invasive and competitive species with the native grassland, that tolerates several abiotic stresses and is difficult control. Plants subjected to abiotic stresses and herbicides can develop mechanisms that alleviate or reduce the damage caused by stressors and transmit this ability to the progenies. The objectives of this work were: 1) to investigate the effect of recurrent application of sub-lethal rate of herbicides (quizalofop-p-ethyl or glyphosate) with or without drought stress for two generations may have developed reduction in sensitivity to the herbicide; 2) to investigate whether antioxidant enzymes are involved in this enhanced- reduction in sensitivity process; and 3) to investigate the main enhanced- reduction in sensitivity mechanisms in the development of resistance to glyphosate and quizalofop. **F2** generation plants subjected to combined stress (drought stress and glyphosate sub-dose - DRYxGLY) showed the highest tolerance to glyphosate. Antioxidant enzymes in conjunction with the overexpression of *EPSPS* and the ABC *MRP10* transporter are involved in increasing the tolerance of the DRYxGLY population to glyphosate. Generation **F2** plants subjected to drought stress (named DRY) developed the highest tolerance to quizalofop. The increase in antioxidant enzyme activity together with the overexpression of the genes *CYP72A31*, *CYP81A12* and *GSTL2*, are involved in the reduction of oxidative stress and possible metabolization of the herbicide, developing of reduction in sensitivity in the DRY population to quizalofop.

Keywords: south African lovegrass, stress memory, resistance.