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Environmental Impact of the Adoption of Imidazolinone-Resistant Rice in Contrasting Production Systems in Latin America

Néstor E. Saldain [1][2][3]*, Fernando B. Pérez de Vida [3][4]**, Pedro Blanco [3][5], Fabían Capdeville [6], Andrés Lavecchia [7], Victoria Bonnecarre [6], Raul Bermudez [3], Julio Méndez [7], Claudia Marchesi [7], Aída Ortiz [8][9], Cástor Zambrano [9], Catalina Ramis [9], José V. Lazo [9], Marjorie Cásares [9], Thaura Ghneim [10], Álvaro Anzalone [11], Zaida Lentini [12], Luis A. Avila [13], Aldo Merotto [14], Martín Piríz [15] and Artides Leal [16]

ABSTRACT – Some of the local rice breeding programs in Latin America countries are incorporating genes that confer tolerance or resistance to the imidazolinone herbicides, so it is critical to have clear information for farmers and for farmer advisers in order to use this technology properly. In the medium run, no adequate use of it will induce that weeds populations including red rice became uncontrollable by imidazolinone herbicides.

KEY WORDS – imidazolinone-resistant rice; weedy rice; red rice; carry-over effects; herbicide-resistant weeds; gene flow

I. INTRODUCTION

Clearfield® technology will became more simple weeds control. It will allow the treatment of important acreage in the same way with herbicides that are very potent, wider spectrum of weed control and are more persistent in the soil than those used in rice.

(1) Project Leader. (2) Project Coordinator of Uruguay. * correspondence to nsaldain@inia.org.uy
(3) Instituto Nacional de Investigación Agropecuaria. INIA Treinta y Tres. Ruta 8 Km. 281, Treinta y Tres. Uruguay.
(4) Project Assistant. ** corresponding poster presentation.
(5) Head of Rice Program INIA. (6) INIA Las Brujas. Ruta 48 Km. 10, Rincón del Colorado, Canelones. Uruguay. (7) INIA Tacuarembó. Ruta 5 Km. 386, Tacuarembó. Uruguay. (8) Project Coordinator of Venezuela, (9) Universidad Central de Venezuela (UCV). Av. Universidad El Limón. Maracay, Edo Aragua. Venezuela. (10) Instituto Venezolano de Investigaciones Científicas (IVIC). Carretera Panamericana, km 11. Vía San Antonio de Los Altos. Edo. Miranda. Venezuela. (11) Universidad Centroccidental "Lisandro Alvarado". Barquisimento, Edo. Lara. Venezuela. (12) Centro Internacional de Agricultura Tropical (CIAT). Apartado Aéreo 6713. Cali, Colombia. (13) Universidad Federal de Santa María (UFSM). Santa Maria, RS 97105-900. (14) Universidad Federal de Porto Alegre (UFRGS). Av. Bento Goncalves, 7712 Porto Alegre, RS. Brazil. CEP 91501-970. (15) BASF Ltda Uruguay. Cno Ariel 4620. Montevideo. Uruguay (16) BASF Venezolana S.A. Torre Sindoni, Piso 11. Ave. Bolivar y Miranda Este con calle 1. Maracay-Edo. Aragua. Apdo 423, Venezuela.
This project was approved by FONTAGRO 2006 call for projects (acronyms in sp) and it will be receive financial support from the World Bank.

The availability of imazethapyr and imazapyr generics in the market will probably determine lower prices so it will be expected a greater use of them.

II. GENERAL OBJECTIVE

To generate recommendations for a rational management of imidazolinones herbicides and resistant rice in order to maintain Clearfield® technology sustainable over time.

III. SPECIFIC OBJECTIVES

SO1 To establish dissipation response for imazethapyr, imazapyr and imazapic in soil and water. To determine half life of them in the soil using a bioassay.

SO2 To prevent and detect resistance induced by ALS inhibitors in weedy rice (red rice) and other weeds of rice crop.

SO3 To study the maximum hybridizing rate between Clearfield® rice and weedy rice (red rice) biotypes. To determine frequency of plants that escapes to control in fields with contrasting intensity of use of imidazolinones. To study life cycles of F1 and F2 hybrids.

SO4 To reinforce the skill of technical personnel in specific methods that will be used in the project.

IV. CONSULTANTS

Ph. D. Albert J. Fischer. Associate Professor. Dept. of Plant Sciences. University of California (UCD). Mail Stop 4. One Shields Ave. Davis. CA 95616-8780 ajfischer@ucdavis.edu

Ph. D. David Gealy. Plant Physiologist. Dale Bumpers National Rice Research Center. Agricultural Research

Service. United State Department of Agriculture. 2890 HWY 130 E. Stuttgart. AR, 72160.
dgealy@spa.ars.usda.gov

V. MATERIALS AND METHODS

SO1

(i) Field experiments will be conducted to study carry-over effect of imazethapyr, imazapyr and imazapic on crops after Clearfield® rice when imidazolinone herbicides were applied in postemergence.

(ii) Plots treated with 1X rate **(i)** will be used to determine the dissipation curve of herbicides on soil and water.

(iii) Soil from plots treated with 1X rate will be sown with indicator species in individual pots and soil without treating will be used to fit standard curves.

SO 2

(i) Fields with different Clearfield® rice uses and fields where never was used before will be selected to take samples from weedy rice (red rice) populations and to detect individuals that survive.

(ii) At the same fields, when treatment with Clearfield® technology will be repeated, weed plants sampling procedures will be done.

(iii) Fields where other herbicides ALS inhibitors different from imidazolinone herbicides were used heavily, weed populations more relevant that are controlled by those herbicides will be selected for collect 10 accessions of every species.

(iv) At the same fields where Clearfield® technology was used heavily and moderately, seeds will be collected from plants that survive to the treatment. Every time that this technology will be used, the sampling procedure will be done.

(vi) Seeds from those population and those collected in (i) will be used to conduct plant bioassays to estimate mean lethal dose and resistance rate.

(vii) An experiment will be conducted to detect drift species composition changes by the repeated use of Clearfield® technology.

(viii) With the information obtained from genetic and gene flux studies, with those that already exist of rice and weedy rice (red rice) biology a prediction model will be constructed and validated.

(ix) The knowledge and the activities that will be coming up in this Project will be used to teach through local and national farmers and millers associations.

SO 3

(i) The maximum hybridization rate will be measured between local material Clearfield® (donors) and red rice biotypes dominants (receptors) at two contrasting sites.

(ii) Putative hybrids will be made between local varieties Clearfield® and red rice biotypes. The cycle of life will be studied for F1 and F2 generations.

(iii) Transects at the same sites that those of **SO2** will be established to estimate plants of weedy rice (red rice) frequency that escape to the Imidazolinones application. Plants will be collected to further studies of resistance.

(iv) At the transects, where weedy rice (red rice) soil seed bank will be sampled intensively to study genetic diversity.

(v) Plant materials confirmed to be resistant will be storaged and will be determined by means of molecular techniques if resistance comes from hybridizing or from mutation.

SO 4

(i) Two short scholarships have been planned to train technical personnel on detection of herbicide resistance methods. Albert J. Fischer (UCD).

(ii) Four places have been provided for training technical personnel in molecular markers use. Zaida Lentini (CIAT).

VI. DURATION

Thirty six months will be the project duration.

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