USE OF RINSKOR™ ACTIVE IN ANDEAN, CARIBBEAN, AND CENTRAL AMERICAN RICE COUNTRIES

Nelson Carranza[1], Alejandro Cedeño[2], Mauricio Morell[3]

Key words: Broad-spectrum, herbicide-resistance, alternative MOA, arylpicolinate

INTRODUCTION

There are an abundance of broadleaf, grass, and sedge weeds that interfere with rice production systems in tropical regions (PANTOJA et al., 1997). Weed management programs in Latin America rely on extensive use of several herbicides in tank mixtures or in sequential applications. Rapidly expanding herbicide-resistance limits their effectiveness and threatens sustainability of rice production in these areas.

Most of the herbicides available for use in rice belong to ALS and ACCase inhibitor modes of action. This situation imposes a high selection pressure that accelerates the evolution of herbicide resistant biotypes that become prevalent in a short number of cropping cycles (VENCILL et al., 2012). As resistance increases, less products remain useful and farmers seek new alternatives to preserve rice production.

Dow AgroSciences is developing Rinskor™ active, a member of the arylpicolinate family of chemistry, a new structural class of synthetic auxin herbicides. Rinskor has broad spectrum activity on important grass, sedge, and broadleaf weed species with global utility in rice and other crops. The objective of these studies was to evaluate the weed spectrum of control of Rinskor in tropical areas of Latin America. Several trials were conducted during the 2015 to 2016 rice cropping seasons in Colombia, Ecuador, Peru, Costa Rica, Panama and Dominican Republic to characterize the weed control spectrum and crop response on common planted rice varieties in the region to Rinskor.

MATERIALS AND METHOD

Sixty-three trials were carried out on farms located in rice production areas in Colombia (29 trials), Ecuador (12 trials), Costa Rica (10 trials), Dominican Republic (7 trials), Peru (3 trials) and Panama (2 trials) between 2015 and 2016. Trials were conducted in fields of direct seeded rice (flooded or upland) or transplanted rice, on 10 to 18 m^2 plots arranged in a randomized complete-block design with four repetitions. Treatments were made with grass weeds between three leaves and 2-3 tillers and sedge and broadleaf weeds were 5 to 10 cm in height. Treatments were sprayed using CO_2 backpack equipment, flat fan nozzles (XR-8002), spray pressure 30 to35 PSI, and delivering between 150 to 300 L/ha according to local practice in each country.

Assessments were performed at 7, 14 and 28 days after application (DAA), of visual percentage weed control by species and crop selectivity (injury) compared to a non-treated check. Data were subjected ton analysis of variance (AOV) and comparison of treatment means with Tukey's at 5% probability.

Rinskor, in a 25 g ai/L NeoEC™ formulation with built-in adjuvant, was tested at rates from 20 to 40 g ai/ha and compared to the commercial standards at the following field rates: bispyribac-Na at 50 and100 g ai/ha; cyhalofop at 270 g ai/ha; and propanil plus quinclorac at 1920 + 375 g ai/ha. A non-ionic adjuvant, Cosmo-in at 0.125% V/V, was added to the commercial standard treatments, but not to Rinskor™ active treatments.

[1] Agr. Eng. c.Ph.D. Dow AgroSciences/CO, ncarranza@dow.com
[2] Agr. Eng. Dow AgroSciences/CR
[3] Agr. Eng. Msc. Dow AgroSciences/USA

RESULTS AND DISCUSION

Echinochloa species are considered the most important weeds in rice productions systems globally. In tropical areas of Latin America *E. colona* (ECHCO) and *E. crus-galli* (ECHCG) are the two species most common in rice. These species are present almost anywhere rice is planted and have a high ability to interfere with rice causing significant yield losses. These grasses are considered the most prone to evolve resistance to herbicides (VALVERDE et al., 2000). To date, resistance is reported to the most commonly used herbicides including ALS-inhibitors, ACCase-inhibitors, quinclorac and propanil (HEAP, 2017).

Rinskor consistently provided excellent control (>94%) of *E. colona* and *E. crus-galli* when applied post-emergence when the grasses were at the 3 leaf to 2 tiller growth stages (Figure 1).

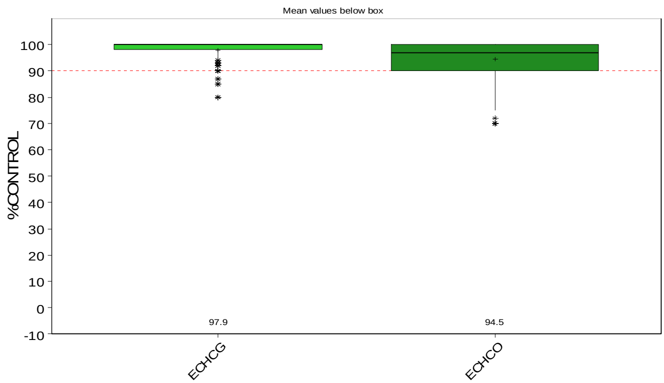

Figure 1: Percentage of control on *E. colona* (ECHCO) and *E. crus-galli* (ECHCG) at 28 DAA with Rinskor™ active at 25-30 g ai/ha. Summary of 53 trials across countries.

Secondary grass weed species contribute to the high complexity of weed management in tropical rice-growing regions (PANTOJA et al., 1997). Their control is based on ACCase-inhibitors and propanil. Rinskor provided good control (>87%) on *Leptochloa filiformis* (LEFFI) in Ecuador and Dominican Republic, *Eragrostis curvula* (ERACU) and *Paspalum pilosum* (PASPI) in Colombia, and *Rottboellia cochinchinesis* (ROOEX) in Ecuador and Colombia (Figure 2). This finding supports the use of Rinskor as an alternative MOA to effectively control secondary grasses in tropical areas.

At least one sedge species is usually present in rice areas, most of them belong to the *Cyperus* genus. Rinskor provided effective control of *C. iria* (CYPIR)*, C. difformis* (CYPDI)*, C. esculentus* (CYPES) and *C. rotundus* (CYPRO) at levels of >97% control, with high consistency across locations (Figure 3).

Another group of weeds commonly found in rice are terrestrial and aquatic broadleaf species. Rinskor provided excellent control (>96%) of *Eclipta alba* (ECLAL), *Ludwigia linifolia* (LUDLI), *Ipomoea hirta* (IPOHI), *Portulaca oleracea* (POROL), *Murdannia nudiflora* (MUDNU), *Commelina diffusa* (COMDI), and *Heteranthera reniformis* (HETRE) (Figure 4).

Rinskor™ active outperformed commercial treatments demonstrating it will become an alternative to control *E. colona* and *E. crus-galli* herbicide-resistant biotypes in rice (Figure 5). Similar results were obtained for the control of sedge and broadleaf weeds that have evolved resistance to ALS-inhibitors (data not shown).

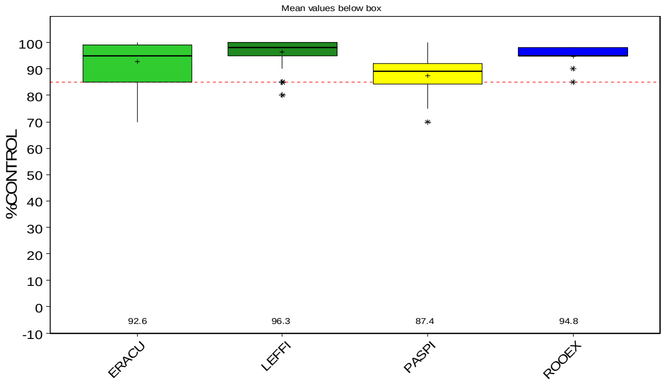

Figure 2: Percentage of control of secondary grass weeds at 28 DAA with Rinskor™ active at 25-30 g ai/ha. Summary of 25 trials across countries.

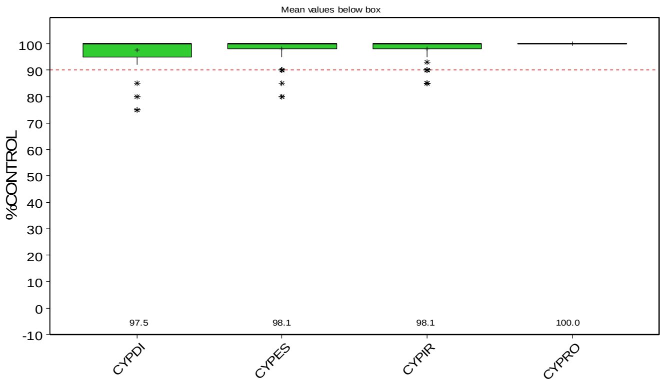

Figure 3: Percentage of control of sedge weeds at 28 DAA with Rinskor™ active at 25-30 g ai/ha. Summary of 54 trials across countries.

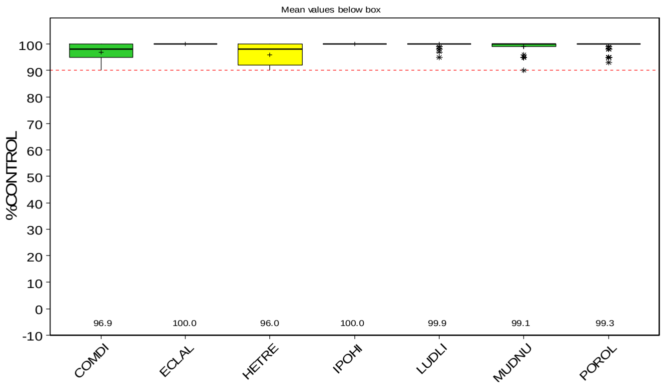

Figure 4: Percentage of control of broadleaf and aquatic weeds at 28 DAA with Rinskor™ active at 25-30 g ai/ha. Summary of 42 trials across countries.

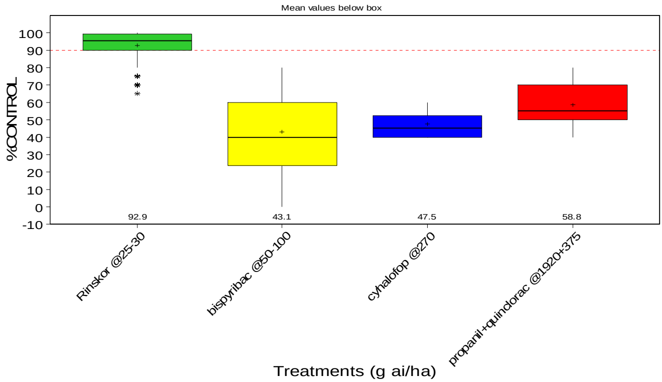

Figure 5: Percentage of control on *Echinochloa* spp. with resistance to commercial herbicides in rice at 28 DAA. Summary of 7 trials across countries.

Crop selectivity is essential for a post-emergent herbicide in rice. Rinskor caused less than 3% injury at 14 DAA direct seeded rice (ORYSA) or transplanted rice (ORYSP) with the use of most common planted rice varieties in this region (Indica type) (Data not shown).

CONCLUSIONS

Rinskor applied post-emergence at 25 or 30 g ai/ha provided excellent control of:

- Grasses: *Echinochloa colona, Echinochloa crus-galli, Paspalum pilosum, Rottboellia cochinchinensis, Leptochloa filiformis* and *Eragrostis curvula.*
- Sedges: *Cyperus difformis, Cyperus iria, Cyperus rotundus* and *Cyperus esculentus.*
- Terrestrial and aquatic broadleaf species: *Ludwigia linifolia, Eclipta alba, Ipomoea hirta, Portulaca oleracea, Murdannia nudiflora, Commelina diffusa,* and *Heteranthera reniformis.*

Rinskor provides broad spectrum control of grass, broadleaf and sedge weeds that often have evolved resistance to ALS, ACCase, propanil, and quinclorac herbicides and will be an excellent contributor to weed management programs in Latin America. To ensure Rinskor longevity and sustainability, this herbicide must be used in integrated weed management programs designed to mitigate herbicide resistance.

LITERATURE

HEAP, I. The International Survey of Herbicide Resistant Weeds. Available in: www.weedscience.org, Accessed: may 2. 2017.

HRAC. Classification of Herbicides According to Site of Action. http://www.hracglobal.com/Education/ClassificationofHerbicideSiteofAction.aspx Accessed: May 5. 2017.

PANTOJA, A. et al. **MIP en Arroz**. Manejo Integrado de Plagas, Artrópodos, Enfermedades y Malezas. CIAT, 1997.

VALVERDE, B. et al. Prevención y manejo de malezas resistentes a herbicidas en arroz: experiencias en América Central con *Echinochloa colona*. Ed. Teresa Oñoro, San José, Costa Rica. 118 p, 2000.

VENCILLI, W. et al. Herbicide Resistance: Toward an Understanding of Resistance Development and the Impact of Herbicide-Resistant Crops. **Weed Science** 60 special edition, p. 2-30, 2012.