**INTRODUCTION**

Flucetosulfuron is a sulfonylurea herbicide for paddy rice developed by LG Life Sciences, Ltd. Unlike other sulfonylurea rice herbicides, the herbicide controls barnyardgrass very effectively as well as other annual and perennial weeds. The herbicide can be applied both foliarily and on soil from pre-emergence to post-emergence timings. When flucetosulfuron was foliarily applied, selectivity ratio calculated by GR_{50} comparison was 49-fold (GR_{50} for rice divided by that for barnyardgrass). In terms of biochemical mode of action, flucetosulfuron inhibited acetolactate synthase similar to other sulfonylurea herbicides. \( I_{50} \) values in \textit{in vitro} ALS assay were 83.8 and 93.8 \( \mu \)M for rice and barnyardgrass, showing little difference. In \textit{in vivo} ALS assay, ALS activity was inhibited strongly within 24 h after application in both the plants; however, ALS activity in rice began to recover after 24 h reaching about 70% of that of the untreated plants. These results suggested that rice selectivity could be due to faster detoxification.

In the present study, we further investigated physiological basis of selectivity between the plants in terms of absorption, translocation, and metabolism using radiolabelled flucetosulfuron.

**MATERIALS AND METHODS**

- **Radiolabelled herbicide**
  - \([\alpha-^{14}C]\text{-pyridine}]\text{flucetosulfuron} with a specific activity of 57.18 mCi mmol\(^{-1}\) and purity of >98% (Korea radiochemical research center, Korea)

- **Plant materials**
  - Plant: Rice (\textit{Oryza sativa} cv. Ipum), 3.2-leaf stage
  - Barnyardgrass (\textit{Echinochloa crus-galli}), 3.2-leaf stage
  - Glasshouse condition: 30/23 (day/night) ± 3°C

- **Foliar absorption and translocation study**
  - Herbicide: 4.34 kBq in 50% acetone solution (0.1% Tween20®)
  - Treatment: 10 droplets of 10 \( \mu \)l on the third leaf surface
  - Harvest time: 1, 6, 12, 24, 48, 72 hours after treatment
  - Plant separation: treated leaf surface
  - Washing: 5ml of acetone: water solution (20:80, v:v), 20 seconds, 3 times
  - Analysis: 1) wash solution (liquid scintillation counter)
  - 2) dried plant part (sample oxidizer, Model307, Packard)

- **Metabolism study**
  - Herbicide: 0.52 MBq (field use rate of flucetosulfuron) in 50% acetone solution with 0.1% Tween20®
  - Treatment: foliar application (\( \text{CO}_2 \)-pressurized sprayer, 500 L ha\(^{-1}\))
  - Harvest time: 1 hour and 1, 3, 6 days after treatment.
  - Washing: 5ml of acetone: water solution (20:80, v:v), 20 seconds, 3 times
  - Extraction: 1) homogenizing in 20ml of acetone using POLYTRON®
  - 2) centrifuging at 10,000g for 30 min
  - 3) extracting with 20ml of acetone, 10ml of 50% acetone (pH 4), and acetone:water:10% HCl solution (35:35:1, v:v)
  - Analysis: 1) wash and extract solution (liquid scintillation counter)
  - 2) dried pellet (sample oxidizer)
  - 3) metabolite (radioisotope detector equipped with HPLC, 610TR, PerkinElmer)
  - column: Capcell Pak-C18, 4.5 mm i.d. x 250 mm
  - temperature: ambient
  - flow rate: 1 ml min\(^{-1}\)
  - wavelength: 254 nm
  - retention time: flucetosulfuron (19.3min), Metabolite-1 (16.3), Metabolite-2 (3.3), Metabolite-3 (8.1)
  - mobile phase: A = acetone, B = water (0.1% trifluoroacetic acid)

- **RESULTS**

**Foliar absorption and translocation**

- Flucetosulfuron was absorbed from the 3.2-leaf stage of rice and barnyardgrass. The absorption rate of rice was lower than that of barnyardgrass. The absorption rate of barnyardgrass was about 70% of that of the untreated plants. These results suggested that rice selectivity could be due to faster detoxification.

**Metabolism**

- The metabolism of flucetosulfuron was investigated in rice and barnyardgrass through 72 h. The metabolism was similar in both plants, and the rate of metabolism was similar in both the plants. Flucetosulfuron was metabolized very rapidly to metabolite-1 (herbically active) and metabolite-3 in the both plants.

- The selectivity to flucetosulfuron between rice and barnyardgrass may be primarily due to the differential absorption rates between rice and barnyardgrass.

**CONCLUSION**

Flucetosulfuron is a sulfonylurea herbicide that controls barnyardgrass (\textit{Echinochloa crus-galli}) in paddy rice. In the present study, we investigated the physiological basis of selectivity between the two species in terms of absorption, translocation, and metabolism of foliar-applied flucetosulfuron. Initial absorption of \([\text{C}]\text{flucetosulfuron} at 6 hours after treatment (HAT) was >70% in barnyardgrass, while that in rice was only about 20% of the applied radioactivity. At the prolonged period, barnyardgrass absorbed 3.6, 2.8, 1.7, and 1.6-times more than in rice at 12, 24, 48, and 72 HAT, respectively. Due to greater absorption, translocation out of the treated leaf was about 3-fold greater in barnyardgrass than in rice. \([\text{C}]\text{Flucetosulfuron} was metabolized rapidly to metabolite-1 (herbically active) and metabolite-3 in both plants and the rate of metabolism was similar in the both plants. Flucetosulfuron and metabolite-1 remained <3% of the applied at 144 HAT in the both plants. These results indicate that the selectivity to flucetosulfuron between rice and barnyardgrass may be primarily due to the differential absorption rates between rice and barnyardgrass.

**REFERENCES**

