Effects of Dimepiperate and Daimuron on Inhibition of Seminal Root Elongation by Chloroacetanilide Herbicides*

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Key words : safening effect, chloroacetanilide herbicides, daimuron, dimepiperate

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Introduction

Chloroacetanilide herbicides represented by pretilachlor, 2-chloro-2', 6'-diethyl-*N*-(2-propoxyethyl) acetanilide, have been widely used for control of annual grasses and some broadleaf weeds in transplanted rice in Japan. Usually, these herbicides show good selectivity between rice plant and weeds, however, they may cause rice injury when the transplanting depth and/or flooding water depth is shallow^{6,9)}.

Ikeda and Sugaya⁵⁾ and Yuyama *et al.*¹¹⁾ have shown that dimepiperate, *S*-(α , α -dimethylbenzyl) piperidine-1-carbothioate, reduced rice injury caused by the other rice herbicides such as butachlor, 2-chloro-2', 6'-diethyl-*N*-(butoxymethyl) acetanilide, and bensulfuron-methyl, methyl α -[[[(4, 6-dimethoxy-*xypirimidin*-2-yl)amino]carbonyl]sulfonyl]-*o*-toluate.

The objective of this study was to examine the safening effects of dimepiperate and daimuron, 1-(α , α -dimethylbenzyl)-3-*p*-tolylurea, for pretilachlor and NSK-850, 2-chloro-*N*-(3-methoxy-2-thienyl)methyl-2', 6'-dimethylacetanilide, a new rice herbicide which has been developed by Tokuyama Soda Inc.^{7,8)}, by means of the seminal root elongation test¹⁰⁾.

Materials and Methods

Effects on seminal root elongation of rice (*Oryza sativa* L., cv. Akinishiki) and barnyardgrass (*Echinochloa oryzicola* Vasing.) were examined as reported earlier¹⁰⁾. Four herbicides used in this study were formulated as 10% (w/w) wettable powders.

1. Simultaneous treatment

Rice and barnyardgrass seeds sterilized in 2% sodium hypochlorite solution for 30 min. and rinsed in tap water were germinated at 30°C in the dark for 2 days. Nine germinated seeds were settled in the slits of each polyethylene disc (5 cm i.d., 0.3 cm thick), and the discs were transferred to deep petri dishes (5.5 cm i.d., 8 cm tall) containing 150 ml of test solutions. Herbicide levels were 0, 0.1, 0.3, 1, 3, 10, 30 ppm for dimepiperate and daimuron, respectively. Combinations with pretilachlor (10⁻³ ppm) or with NSK-850 (10⁻³ ppm) were also prepared for dimepiperate and daimuron at the concentrations stated above. The petri dishes were kept at 30°C in the dark for 3 days and then seminal root length of the plants was measured.

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2. Separate treatment

Nine sterilized rice seeds were soaked in 20 ml of pretilachlor (1 ppm) or NSK-850 (0.3 ppm) solution for 2 days, and then rinsed in tap water for 3 hr. The seeds were then placed polyethylene discs (9 seeds/disc) which were subsequently transferred to deep petri dishes containing 150 ml of dimepiperate (0, 0.1, 0.3, 1, 3, 10, 30 ppm) or daimuron (0, 0.1, 0.3, 1, 3, 10, 30 ppm) solutions for 3 days. Alternatively, the sterilized rice seeds were treated with dimepiperate (10^{-1} , 1, 10, 10^2 , 10^3 ppm) or daimuron (10^{-1} , 1, 10, 10^2 , 10^3 ppm) for 2 days, and then the polyethylene discs with 9 seeds were transferred to the deep petri dishes containing 150 ml of pretilachlor (10^{-3} ppm) or NSK-850 (10^{-3} ppm) solution. All treatments were conducted at 30°C in the dark, and seminal root length of rice plants was measured 5 days after the beginning of the first treatment. All experiments were replicated three times and mean values of seminal root length of the plants were obtained.

Results and Discussion

1. Simultaneous treatment

In rice plants, dimepiperate and daimuron

inhibited the seminal root elongation by about 20% at the highest concentration (30 ppm), while pretilachlor and NSK-850 caused 51% and 54% inhibition at 10^{-3} ppm, respectively. When 10^{-3} ppm pretilachlor or 10^{-3} ppm NSK-850 was applied together with dimepiperate, the inhibition decreased linearly with increasing dimepiperate concentration from 0.1 ppm to 3 ppm. Daimuron also reduced the inhibition and the safening effect was significant even at 0.1 ppm (Fig. 1).

In barnyardgrass, the inhibition of seminal root elongation by pretilachlor and NSK-850 was diminished in the presence of dimepiperate, whereas daimuron did not reduce the inhibition (Fig. 2). These results demonstrated that dimepiperate reduced the inhibition of seminal root elongation by pretilachlor and NSK-850 in both the rice plants and the weed, but daimuron was effective as a safener only in the rice plants.

2. Separate treatment

Effects of dimepiperate and daimuron on the inhibition of rice seminal root elongation by the chloroacetanilides were examined by changing the sequence of treatments. When the rice plants were treated with 1 ppm pre-

Fig. 1. Safening effects of dimepiperate and daimuron on pretilachlor and NSK-850 inhibition by simultaneous treatment. Seminal root length of rice plants was measured 3 days after treatment.

Fig. 2. Safening effects of dimepiperate and daimuron on pretilachlor and NSK-850 inhibition by simultaneous treatment. Seminal root length of barnyardgrass was measured 3 days after treatment.

Fig. 3. Safening effects of dimepiperate and daimuron on pretilachlor and NSK-850 inhibition by separate treatment. Pretilachlor and NSK-850 treatments were followed by dimepiperate and daimuron treatments. Seminal root length of rice plants was measured 5 days after treatment.

tilachlor or 0.3 ppm NSK-850, and then with 3 ppm dimepiperate, 54.0% and 47.0% inhibition by pretilachlor and NSK-850 fell to 23.5% and 18.0%, respectively. Similar effects were also observed with daimuron (Fig.

3). These results suggest possibilities that dimepiperate and daimuron act as safeners in rice plants by promoting degradation and/or metabolism of the chloroacetanilides. In fact, Yuyama *et al.* reported that the safen-

Fig. 4. Safening effects of dimepiperate and daimuron on pretilachlor and NSK-850 inhibition by separate treatment. Dimepiperate and daimuron treatments were followed by pretilachlor and NSK-850. Seminal root length of rice plants was measured 5 days after treatment.

ing effect of dimepiperate on bensulfuron-methyl injury to rice plants could be attributed to the increased herbicide metabolism in the plants¹¹⁾.

When altering the sequence of treatments so that the plants were exposed to dimepiperate or daimuron before their contact with pretilachlor or NSK-850, the inhibition by the chloroacetanilides was decreased by daimuron, but not by dimepiperate (Fig. 4), indicating that daimuron may not only enhance the detoxification activity, but may reduce the absorption and translocation of the chloroacetanilides in rice plants.

Extensive studies on herbicide safeners have been reported^{1,2)}. Fuerst and Grownwald found that flurazole, benzyl 2-chloro-4-(trifluoromethyl)-5-thiazolecarboxylate, and CGA-92194, α -[(1,3-dioxolan-2-yl-methoxy)imino] benzeneacetonitrile, protected sorghum from metolachlor, 2-chloro-2', 6'-diethyl-N-(methoxymethyl)acetanilide, injury by enhancing metabolism through conjugation with glutathione³⁾. Hatzios and Hoagland classified the

safening mechanisms of herbicide into three categories : a) promotion of degradation or metabolism of herbicides in plants, b) inhibition of absorption or translocation of herbicides in plants, and c) a process involving all of the above⁴⁾. Although in the seminal root elongation test dimepiperate and daimuron were found to act as safeners for pretilachlor and NSK-850, further study is needed to clarify the safening mechanisms.

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埼玉県の桑園におけるパラコート抵抗性ヒメムカシヨモギの 分布実態について*

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キーワード：ヒメムカシヨモギ，パラコート抵抗性，
分布

Key words: *Erigeron canadensis* L., resistant to paraquat, distribution

パラコート抵抗性ヒメムカシヨモギは，1980年に大阪府下のブドウ園で初めて観察され³⁾，その後羽曳野市，柏原市および神戸大学構内圃場等，関西を中心に分布が確認されている。しかし，関東地方における分布状況は佐藤ら⁵⁾の報告がある程度である。

筆者は1986年に埼玉県内の桑園等においても抵抗性ヒメムカシヨモギの分布を確認し，その分布実態を1986年および1988年に調査したのでその概要を報告する。

材料および方法

分布実態調査：調査は10 a 前後の桑園を1地点として，1986年5月(235地点)および1988年6月下旬～7月上旬(243地点)の2回実施した。対象地域は埼玉県内の主な養蚕地帯5地域，即ち，熊谷市近辺，吹上町・大里村河川敷，川本町・江南町，児玉町・美里町(1986年のみ)，東松山市丘陵地(1988年のみ)，秩父市・皆野町山間地を選定した。

各地点では，観察により発生が多い順に10位までの草種を記録し，ヒメムカシヨモギの発生地点を調査地点数で除して出現率を求めた。また，平均順位は出現した地点での発生順位の平均を示した。ヒメムカシヨモギが出現した地点では，葉を採取して抵抗性の検定を行った。

試料の採取と検定方法：ヒメムカシヨモギの抵抗性検定方法はおおむね渡辺ら⁶⁾の方法によった。即ち，桑園1地点あたり無作意に5～20個体を選び，各個体から1葉ずつ採取し，直径8mmのリーフパンチで打ち抜いた後，10 ppm のパラコート溶液(10ml/直径9

* 一部は日本蚕糸学会第57回講演会(1987年4月)において発表した。

** 埼玉県蚕業試験場

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