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Differences in Response of Rice(*Oryza sativa* L.) Cultivars to Herbicides

Shin, D.H.* K. Moody, F.J. Zapata**, and K.U. Kim***

제초제에 대한 벼 품종간 반응

申東賢* · 키이쓰 무디** · 프란시스코 제이 자파타** · 金吉雄*

ABSTRACT

Three hundred rice(*Oryza sativa* L.) cultivars were screened for tolerance to butachlor [*N*-(buthoxymethyl)-2-chloro-*N*-(2,6-diethylphenyl) acetamide], thiobencarb(*S*-[(4-chlorophenyl)methyl]diethylcarbamothioate), and simetryn [*N,N*-diethyl-6-(methylthio)-1,3,5-triazine-2,4-diamine]. The responses of the rice cultivars to herbicides differed depending upon the herbicides and their concentrations. New Sabarmati(BAS), Gora, PTB 18 were tolerant to butachlor, and Azucena, IR44707-31-1-3-2, ARC 7293 to thiobencarb, while Gora, ARC 7293, and Dudmona were tolerant to both herbicides. Response of rice to simetryn differed from its response to butachlor and thiobencarb. Inhibition of shoot growth and fresh weight increased as the temperature and herbicide concentration increased. There was a higher correlation among rice cultivars response to butachlor and thiobencarb in the greenhouse when laboratory studies were conducted at higher temperatures.

Key words : Herbicide, tolerance, rice, screening method.

INTRODUCTION

Selective herbicides have played an important role in reducing the losses caused by weed competition but they occasionally cause crop injury. Even if yield is not affected by herbicide application, a farmer is reluctant to use a herbicide that is injurious to his crop.

In order to minimize this injury, the crop's tolerance to the applied herbicide should be increased by developing cultivars genetically tolerant to the herbicides or by finding existing cultivars which may already be tolerant to higher herbicide rates.

Differences in response of rice(*Oryza sativa* L.) cultivars to herbicides have been reported by a number of workers. Differential cultivar response can be attributed to differences in ecogeographic race[4,5,11,18,19], depth of seeding[1,16,17], soil moisture[14], growth stage[4,5,10,13,17], root distribution[5,18], herbicide used[2,6,8,9,10,12], and herbicide rate[7,5].

* 경북대학교 농과대학(Department of Agronomy, Kyungpook National Univ., Taegu 702-701, Korea)
** The International Rice Research Institute, P.O. Box 933, Manila, Philippines

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This experiment was conducted to determine rice cultivars tolerant to herbicides and to compare screening methods.

MATERIALS AND METHODS

Greenhouse Trials

A clay loam soil with pH of 6.5, 0.397% organic carbon, 0.046% total nitrogen, and cation exchange capacity of 24.7 meq/100 g was used for all studies. Plastic trays($32 \times 24 \times 11$cm) were filled with 5 kg of air-dried soil which was sieved through a 3 mm sieve. Ten seeds of each rice cultivar were planted in a row on a nylon net stretched over a styroform frame($30 \times 23 \times 1.3$ cm) and there were ten rows in each tray. The seeds were covered with soil to the frame depth (1.3cm) and then the frame was placed on a tray containing soil.

Stock solutions of the desired herbicide concentrations were prepared using commercial formulations of butachlor(EC), thiobencarb, and technical (99.8% purity) grade simetryn. Immediately after seeding, the soil in each tray was wet to saturation with 1,750ml of herbicide solution and the trays were placed inside a greenhouse. Watering was done 3 days after seeding(DAS) with a Teejet 8004 nozzle. The nozzle was held at least 1m away from the tray to prevent compaction of the soil surface. The amount of water was regulated so that saturation was not exceeded

Plant height, fresh and dry weights were used to evaluate the responses of the cultivars to the herbicides. Plant height was taken from the base of the culm to the top of the longest leaf 10 DAS. For fresh and dry weights, 30 plants of each entry were removed from the soil 10 days after treatment(DAT) for butachlor and thiobencarb and 12 DAT for simetryn. Dry weight was measured after oven-drying for 48 h at 80℃. Data were analysed using Duncan's Multiple Range Test(DMRT).

Experiment 1a. Screening for Tolerance to Butachlor, Thiobencarb, and Simetryn

Three hundred rice entries were screened for tolerance to butachlor, thiobencarb, and simetryn. Each entry was assigned a row in one of the trays according to the entry number. Herbicides were applied at 2×10^{-5}M. Treatments were replicated three times and untreated controls were provided for comparision. Plant height and dry weight were measured 10 DAT for butachlor and thiobencarb while fresh weight was measured 12 DAT for simetryn.

Experiment 1b. Responses of Several Cultivars to Herbicides

Seeds of three tolerant and three susceptible cultivars from Experiment 1a were planted using the above-mentioned procedure. Butachlor and thiobencarb were applied at concentrations of 5×10^{-6} M, 1×10^{-5}M, and 2×10^{-5}M. There were five replications. Data on plant height and dry weight were taken 10 DAT.

Experiment 2. Laboratory Screening for Cultivar Tolerance to Herbicides

The experiment was conducted to determine a simple and effective laboratory screening method for evaluating cultivar tolerance to herbicides and to compare responses of rice using different screening methods.

Seeds of three tolerant and three susceptible cultivar from experiment 1 were used in this experiment. Ten seeds that had been sterilized for 15 min. with 0.1% mercuric chloride solution and thoroughly washed three times with sterilized water, were germinated on filter paper in 10 cm petri dishes. Ten ml of 5×10^{-6}M, 1×10^{-5}M, or 2×10^{-5}M butachlor or thiobencarb were added to the petri dishes which were then placed in dark incubation rooms for 5 days at constant temperatures of 25±1, 30±1, 35±1, and 40±1℃. The petri dishes were kept in a lighted incubation rooms for 2 additional days at a corresponding constant temperature to develop primary leaves from the coleoptile. Each treatment were replicated three times. Data on shoot length and fresh weight were taken 7 DAT. Seeds were considered germinated when the coleoptile was 2 mm in length.

RESULTS AND DISCUSSION

Screening for Tolerance to Herbicides

Cultivars such as New Sabarmati(BAS), Gora, BR118-3B-17, IR27095-20-18, PTB18, Dudmona, and FR 13A(Table 1) which when treated with butachlor, had plant heights and dry weights equal to or greater than 60% of the untreated check were regarded to be tolerant to the herbicide. Greater than 80% inhibition in plant growth was observed with IET3257, IR17494-32-3-1-1-3, IR31917-45-3-2-2, IR32829-5-2-2, and Cheriviruppu and these cultivars were considered to be susceptible to the herbicide(Table 1).

Table 1. Plant height and dry weight of rice cultivars tolerant and susceptible to 2×10^{-5}M butachlor

Cultivar	Plant height	Dry weight
	% of control	
Tolerant group		
New Sabarmati(BAS)	71.3	61.4
Gora	71.7	80.2
BR118-3B-17	68.8	68.9
IR9660-50-3-1	60.7	49.0
IR27095-20-18	61.4	63.2
PTB 18	70.5	71.6
Dudmona	67.8	69.6
Kami-Iku 382	58.8	54.9
FR 13A	71.7	76.2
ARC 7293	61.1	68.5
CNA 108-8-42-24-2B	58.9	66.9
Susceptible group		
IET 3257	16.6	13.7
IR17494-32-3-1-1-3	9.0	8.6
IR31917-45-3-2-2	15.0	18.1
IR32829-5-2-2	8.7	13.4
Cheriviruppu	14.8	14.0

Cultivars that were tolerant to thiobencarb were IR9660-50-3-1, IR10198-66-2, Nona Bokra, Kami-Iku 382, Gora, IR44707-31-1-3-2, ARC7293, and Azucena(Table 2) while IR5, IR28, IR46, IR31802

Table 2. Plant height and dry weight of rice cultivars tolerant and susceptible to 2×10^{-5}M thiobencarb

Cultivar	Plant height	Dry weight
	% of control	
Tolerant group		
IR9660-50-3-1	74.0	82.2
IR10198-66-2	75.1	85.9
Nona Bokra	76.6	74.0
Kami-Iku 382	80.0	70.4
Gora	74.7	83.9
IR44707-31-1-3-2	88.2	88.7
ARC 7293	84.7	88.9
Azucena	86.8	89.0
Dudmona	76.7	84.4
CNA 108-8-42-24-2B	83.9	89.5
Susceptible group		
IR5	1.7	2.5
IR28	4.8	2.5
IR46	1.7	1.5
IR31802-48-2-2-2	1.0	3.1
NR 1004-66-3-1	2.0	4.9

Table 3. Fresh weight of rice cultivars tolerant and susceptible to 2×10^{-5}M simetryn.

Cultivar	Fresh weight(mg/plant)		% of
	Simetryn	Control	control
Tolerant group	102.3	120.0	85.3
ITA 235	116.0	164.1	70.7
Kinandang Tinambilok	77.6	108.9	71.3
Talang Besar			
Susceptible group			
Kwang-Lu-Ai 4	19.4	231.4	8.4
Miro-Miro	5.3	120.3	4.4
W 1263	15.3	214.7	7.1
IR21071-53-2-3-2E-P2	25.8	274.0	9.5
K143-1-2	15.0	333.8	4.5

-48-2-2-2, and NR10041-66-3-1 were susceptible (Table 2).

ITA235, Kinandang Tinambilok, and Talang Besar were tolerant to simetryn while Kwang-Lu-Ai 4, Miro-Miro, W1263, IR21071-53-2-3-2E-P2, and K143-1-2 were susceptible(Table 3).

Differences in response of cultivars to herbicides have been reported by a number of workers[5,6,8,9,11,12]. Gora, IR9660-50-3-1, Kami-Iku 382, ARC7293, CNA108-8-42-24-2B, and Dudmona(Table 1 and 2) were tolerant to both butachlor and thiobencarb but the responses of the cultivars to the herbicides were usually different, leading to differential cultivar response to different herbicides. Different responses of rice cultivars to different herbicides were found by Madrid[6]. In his studies, twelve cultivars were tolerant to three chemically-different herbicides-butachlor, thiobencarb, and pendimethalin [*N*-(1-ethylpropyl)-3,4-dimethyl 1-2,6-dinitrobenzenamine]. A large number of cultivars were susceptible to at least one of the herbicides. Eleven of them were susceptible to at least two herbicides while ARC595, Baisbish, and Sungwala were susceptible to all three herbicides.

Different frequency distributions of cultivar response to herbicides were observed with different herbicides(Fig. 1). The greatest difference in response of cultivars was observed with thiobencarb suggesting the potential for existence of thiobencarb-tolerant sources in rice. Genetic variation in herbicide tolerance of plants can be used to modify the crop genotype to tolerate herbicides or raise their level of genetic tolerance to herbicides, and thereby improve herbicide selectivity.

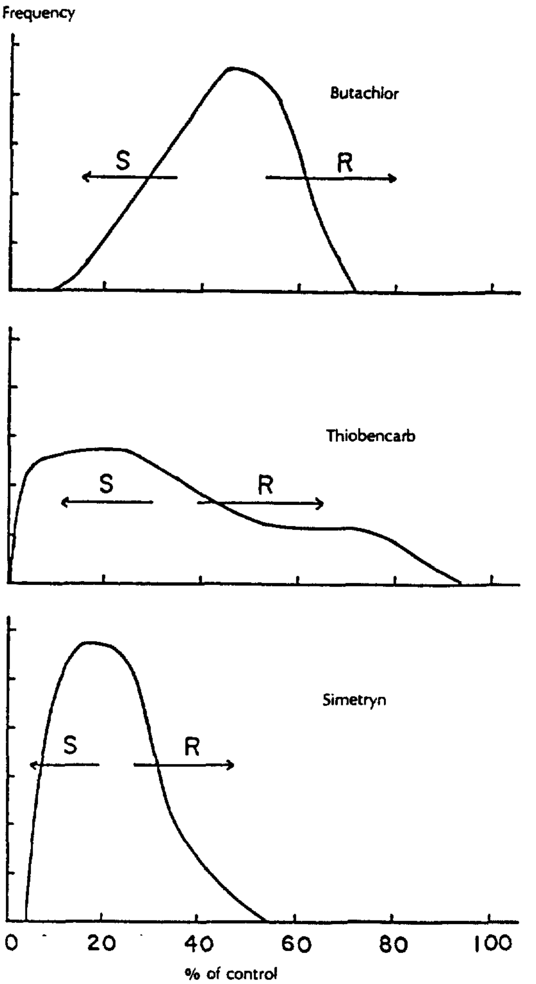

Fig. 1. Frequency distribution of 300 rice cultivars in terms of plant height and fresh weight inhibition as affected by different herbicides. R : Resistance, S : Susceptibility

Response of Cultivars to Different Herbicide Concentrations under Greenhouse Conditions

Usually plant height and dry weight decreased as the herbicide concentration increased regardless of the cultivar and herbicide used. As the concentration of thiobencarb increased, there was greater difference in herbicide phytotoxicity between tolerant and susceptible cultivars. The rate of decrease in plant height was greater with susceptible cultivars such as IR5, Muthumanikam, and NR10041-66-3-1 than with tolerant cultivars such as IR9660-50-3-1, IR10198-66-2, and Kami-Iku 382(Table 4).

A similar trend was observed when butachlor was applied. As the concentration of butachlor increased to 2×10^{-5}M, the rate of decrease in plant height of the susceptible cultivars, IET 3257, 5207, and Cheriviruppu was greater than that of

Table 4. Plant height of rice cultivars as affected by different concentrations of thiobencarb[1)]

Cultivar	Thiobencarb								
	5×10^{-6} M			1×10^{-5} M			2×10^{-5} M		
	10DAT	15DAT	20DAT	10DAT	15DAT	20DAT	10DAT	15DAT	20DAT
	··············· % of control ···············								
Tolerant group									
IR9660-50-3-1	90.7	101.9	95.9	89.0	95.2	100.8	68.1	72.1	85.5
IR10198-66-2	79.6	85.7	89.2	76.9	76.5	98.3	60.2	56.6	69.2
Kami-Iku 382	99.3	99.0	94.5	102.1	105.8	96.4	93.7	95.3	90.0
Average	89.9	95.5	93.2	89.3	92.5	98.5	74.0	74.7	81.6
Susceptible group									
IR5	60.2	62.7	85.8	39.2	57.3	70.0	28.4	25.3	30.8
Muthumanikam	41.2	53.8	69.1	16.0	28.5	40.9	14.4	13.1	22.7
NR 10041-66-3-1	59.1	65.6	79.9	23.8	25.2	62.6	12.4	26.3	41.7
Average	53.5	60.7	78.3	26.3	37.0	57.8	18.4	21.6	31.7
Difference	36.4c	34.8c	14.9d	63.0a	55.5a	40.7bc	55.6a	53.1ab	49.9ab

1) In a row, means followed by a common letter are not significantly different at the 5% level by DMRT.

Table 5. Plant height of rice cultivars as affected by different concentrations of butachlor[1)]

Cultivar	Butachlor								
	5×10^{-6} M			1×10^{-5} M			2×10^{-5} M		
	10DAT	15DAT	20DAT	10DAT	15DAT	20DAT	10DAT	15DAT	20DAT
	··············· % of control ···············								
Tolerant group									
New Sarbamati (BAS)	75.5	101.0	107.3	59.9	66.5	89.3	40.8	59.3	66.0
Gora	96.9	97.5	104.0	94.6	96.3	106.2	79.8	71.4	92.0
IR8866-30-3-1-4-2	89.3	97.3	91.6	69.8	91.8	90.7	47.0	78.3	88.3
Average	87.2	98.6	101.0	74.8	84.9	95.4	55.9	69.7	82.1
Susceptible group									
IET 3257	31.5	46.9	69.4	32.1	38.9	62.1	7.9	36.0	61.2
5207	55.4	78.1	85.3	27.7	45.5	57.7	6.3	13.4	50.0
Cheriviruppu	24.1	57.1	79.3	17.4	44.7	66.1	9.9	29.3	64.3
Average	37.0	60.7	78.0	25.7	43.0	62.0	8.0	26.2	58.5
Difference	50.2a	37.9cd	23.0e	49.1ab	41.9bcd	33.4d	47.9ab	43.5abc	23.6e

1) In a row, means followed by a common letter are not significantly different at the 5% level by DMRT.

the tolerant cultivars, New Sabarmati(BAS), Gora, and IR8866-30-3-1-4-2(Table 5).

Differential cultivar response to different herbicide rates was reported by Mallapa and Hosmani[7)]. They found that IR8 was more sensitive to propanil [*N*-(3, 4-dichlorophenyl) propanamide] than Jaya, and that differences in susceptibility between the two cultivars increased as the concentration increased. In contrast, when MCPA [(4-chloro-2-methylphenoxy) acetic acid] was applied, Jaya was more sensitive than IR8, particularly at low concentrations. As the herbicide concentration increased, differences between the two cultivars decreased.

The rate of decrease in plant height decreased as the sampling time was increased from 10 to 20 DAT regardless of cultivar, herbicide, and concentration used. The greatest difference in phytotoxicity between tolerant and susceptible cultivars was observed at 10 DAT for all concentrations of both herbicides, indicating that 10 DAT is the best time to determine herbicide phytotoxicity to rice in this type of experiment(Table 4 and 5).

Growth Responses of Cultivars to Herbicides under Laboratory Conditions

When thiobencarb was applied, differences in inhibition of shoot length and shoot fresh weight between cultivars which are tolerant and susceptible to the herbicide were the greatest at 2×10^{-5} M(Table 6).

The temperature most suitable for screening of rice cultivars to thiobencarb was 35℃ because the greatest differences in inhibition of shoot length

Table 6. Effect of different concentrations of thiobencarb on the growth of several cultivars at different temperatures.[1)]

Cultivar	Shoot length			Shoot length			
	5×10^{-6}M	1×10^{-5}M	2×10^{-5}M	25℃	30℃	35℃	40℃
Tolerant group							
IR9660-50-3-1	92.0	83.7	69.5	104.5	81.0	80.8	60.6
IR10198-66-2	83.7	80.1	66.2	80.0	95.5	74.3	56.9
Taipei 309	101.1	82.2	74.0	90.1	99.3	79.7	74.1
Average	92.3	82.0	69.9	91.5	91.9	78.3	63.9
Susceptible group							
IR5	84.8	70.1	51.8	90.7	82.5	68.5	33.8
IR28	77.8	69.5	36.4	87.9	68.6	43.0	45.4
IR31802-48-2-2-2	71.0	63.2	36.2	78.1	64.0	41.8	43.2
Average	77.9	67.6	41.5	85.6	71.7	51.1	40.8
Difference	14.4b[2)]	14.4b	28.4a	5.9d	20.2b	27.2a	23.1a

Cultivar	Fresh weight of shoot			Fresh weight of shoot			
	5×10^{-6}M	1×10^{-5}M	2×10^{-5}M	25℃	30℃	35℃	40℃
Tolerant group							
IR9660-50-3-1	88.7	79.3	63.7	83.2	76.2	80.0	70.4
IR10198-66-2	84.9	82.2	70.3	67.0	95.1	79.2	75.0
Taipei 309	96.0	81.6	71.3	75.2	93.4	85.1	78.2
Average	89.9	81.2	68.4	75.1	88.2	81.4	74.5
Susceptible group							
IR5	90.6	75.6	60.3	86.6	83.2	70.7	61.5
IR28	74.7	73.0	43.7	73.6	75.1	47.1	59.3
IR31802-48-2-2-2	69.8	70.3	53.5	73.7	68.1	55.8	60.4
Average	78.4	73.0	52.5	78.0	75.5	57.9	60.4
Difference	11.5b	8.2c	15.9a	−2.9d	12.7bc	23.5a	14.1ab

1) Average of 4 temperatures and 3 herbicide concentrations

2) In a row within a trait, means followed by a common letter are not significantly different at the 5% level by DMRT.

Table 7. Effect of different concentrations of butachlor on the growth of several cultivars at different temperatures.[1)]

Cultivar	Shoot length			Shoot length			
	5×10⁻⁶M	1×10⁻⁵M	2×10⁻⁵M	25℃	30℃	35℃	40℃
Tolerant group							
New Sabarmati (BAS)	50.9	44.7	30.0	47.1	62.2	29.8	28.2
Gora	64.3	55.7	45.6	41.6	64.8	52.5	61.9
BR 118-3B-17	71.6	56.4	41.1	69.3	65.0	51.4	39.7
Average	62.3	52.3	38.9	52.7	64.0	44.6	43.3
Susceptible group							
IR17494-32-3-1-1-3	51.3	47.1	34.0	44.5	52.8	47.8	31.8
IR31917-45-3-2-2	61.4	44.0	30.7	63.3	58.9	37.2	21.8
5207	38.0	31.2	23.6	57.0	25.5	18.5	22.6
Average	50.2	40.8	29.4	54.9	45.7	34.5	25.3
Difference	12.1a[2)]	11.5ab	9.5b	-2.2c	18.3a	10.1a	18.0a
Cultivar	Fresh weight of shoot			Fresh weight of shoot			
	5×10⁻⁶M	1×10⁻⁵M	2×10⁻⁵M	25℃	30℃	35℃	40℃
Tolerant group							
New Sabarmati (BAS)	50.9	43.6	28.2	49.3	44.4	34.1	35.8
Gora	59.3	58.4	39.1	49.8	64.3	59.9	35.2
BR 118-3B-17	71.0	59.8	42.5	61.0	58.9	55.6	55.2
Average	60.4	53.9	36.6	53.4	55.9	49.9	42.2
Susceptible group							
IR17494-32-3-1-1-3	53.3	44.7	32.6	50.3	51.3	43.5	30.3
IR31917-45-3-2-2	52.9	44.9	31.3	58.5	57.7	35.3	20.7
5207	50.0	39.1	36.7	63.6	40.2	22.9	40.9
Average	52.4	42.9	33.5	57.5	49.7	33.9	30.6
Difference	8.0b[2)]	11.0a	3.1c	-4.1d	6.2c	16.0a	11.6a

[1)]Average of 4 temperatures and 3 herbicide concentrations
[2)]In a row within a trait, means followed by a common letter are not significantly different at the 5% level by DMRT.

and shoot fresh weight between cultivars which are tolerant and susceptible to the herbicide were observed at this temperature(Table 6).

The greatest difference in inhibition of shoot growth between tolerant and susceptible cultivars treated with different concentrations of butachlor was observed at 1×10^{-5}M. Generally, as temperature increased, there was greater difference in inhibition of shoot growth between cultivars which are tolerant and susceptible to butachlor(Table 7).

Methods of Screening for Cultivar Tolerance to Herbicides

A simple and effective laboratory screening method for evaluating cultivar tolerance to alachlor [2-chloro-*N*-(2,6-diethylphenyl)-*N*-(methoxymethyl) acetamide] and metolachlor [2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1-methylethyl) acetamide] was reported by Hassan et al.[3)]. They stated that the laboratory screening method correlated well with results from a greenhouse experiment.

In the experiment reported in this paper, there was a higher correlation between the greenhouse screening method and the laboratory screening method when the experiment was conducted at higher temperatures in the laboratory(Table 8 and 9). A significant positive correlation between the two methods was observed for shoot length and

Table 8. Effect of different concentrations of butachlor on shoot length(cm) under laboratory screening conditions and plant height(cm) under greenhouse screening conditions.

Cultivar	5×10^{-6} M					1×10^{-5} M					2×10^{-5} M				
	Green-house screening	Laboratory screening				Green-house screening	Laboratory screening				Green-house screening	Laboratory screening			
		25℃	30℃	35℃	40℃		25℃	30℃	35℃	40℃		25℃	30℃	35℃	40℃
	% of control														
IR17494-32-3-1-1-3	54.4	52.9	52.5	58.7	37.5	20.9	47.1	57.5	45.7	33.3	12.1	29.4	47.5	39.1	20.8
IR31917-45-3-2-2	61.9	85.0	86.0	46.2	32.2	23.8	75.0	41.9	44.2	16.1	9.9	35.0	48.8	21.2	19.4
5207	55.4	79.3	25.9	21.0	27.6	27.7	51.7	27.6	17.7	27.6	6.3	41.4	22.4	16.1	13.8
New Sarbarmati (BAS)	68.2	58.8	74.3	37.3	33.3	56.7	52.9	62.9	31.4	33.3	49.8	35.3	48.6	21.6	16.7
Gora	96.9	45.5	83.3	60.0	57.1	94.6	36.4	66.7	56.0	57.1	79.8	36.4	45.8	40.0	57.1
BR 118-3B-17	69.1	87.2	75.9	70.5	51.4	60.0	64.1	57.4	59.0	45.7	56.7	56.4	61.1	26.2	20.0
Correlation coefficient(r)		-0.481^{ns}	0.601^{ns}	0.413^{ns}	0.812^{ns}		0.508^{ns}	0.678^{ns}	0.496^{ns}	0.878^{ns}		0.20^{ns}	0.481^{ns}	0.436^{ns}	0.717^{ns}

Table 9. Effect of different concentrations of thiobencarb on shoot length(cm) under laboratory screening conditions and plant height(cm) under greenhouse screening conditions.

Cultivar	5×10^{-6} M					1×10^{-5} M					2×10^{-5} M				
	Green-house screening	Laboratory screening				Green-house screening	Laboratory screening				Green-house screening	Laboratory screening			
		25℃	30℃	35℃	40℃		25℃	30℃	35℃	40℃		25℃	30℃	35℃	40℃
	% of control														
IR5	60.2	103.5	102.0	95.1	39.5	39.2	103.5	92.0	47.5	32.6	28.4	78.8	54.0	54.1	30.2
IR28	62.0	110.9	92.2	52.7	55.9	23.1	114.1	74.5	45.5	41.2	17.8	37.5	39.2	30.9	38.2
IR9660-50-3-1	90.7	103.7	92.3	91.1	80.6	89.0	109.3	84.6	76.8	61.3	68.1	98.1	65.4	75.0	38.7
IR10198-66-2	75.5	96.3	106.4	74.6	66.7	69.5	94.4	97.9	74.6	60.6	70.4	70.4	83.0	73.0	45.5
Nona Bokra	85.8	104.9	105.3	84.6	66.0	90.1	90.2	107.0	69.2	51.1	79.7	85.3	105.3	66.7	40.4
Taipei 309	98.6	96.4	109.4	106.9	88.9	90.3	94.6	100.0	69.0	66.7	88.3	38.6	87.5	62.1	66.7
Correlation coefficient(r)		0.527^{ns}	0.354^{ns}	0.608^{ns}	0.938^{**}		-0.508^{ns}	0.675^{ns}	0.905^{*}	0.811^{*}		0.202^{ns}	0.897^{*}	0.797^{ns}	0.680^{ns}

plant height when the temperatures in the laboratory and the herbicide concentrations were 40℃ and 5×10^{-6}M and 1×10^{-5}M butachlor; 40℃ and 5×10^{-6}M, 35 and 40℃ and 1×10^{-5}M, and 30℃ and 2×10^{-5}M thiobencarb.

These results indicate that there was a correlation between temperature and herbicide concentration in the response of rice cultivars to herbicides. In order to get higher correlation with the greenhouse screening method, laboratory screening should be carried out at a temperature which is similar to that in the greenhouse and herbicide concentrations of 5×10^{-6} and 1×10^{-5}M should be used.

摘　要

벼의 제초제에 대한 반응을 조사키 위하여 300 품종 및 계통을 대상으로 제초제 butachlor, thiobencarb, simetryn을 사용하여 선발한 결과는 다음과 같다.

1. 제초제에 대한 벼품종과 계통들의 반응은 사용한 제초제와 그 농도에 따라 다르게 나타났는데, New Sabarmati(BAS), Gora, PTB 18 등은 butachlor에 내성을 보인 반면에 Azucena, IR44707-31-1-3-2, ARC 7293 등은 thiobencarb에 내성을 나타내었고, Gora, ARC 7293, and Dudmona 등은 두제초제에 공히 내성을 보였다. 그러나 simetryn에 대한 벼의 반응은 butachlor과 thiobencarb와는 다른 반응을 나타내었다.
2. 제초제 처리에 의한 신초의 생장과 생체중은 온도와 제초제 농도가 증가함에 따라 더욱 감소하는 경향을 보였다.
3. 제초제에 대한 벼의 반응을 간편하고 효과적으로 검정하기 위해 실내시험을 수행하여 얻은 결과를 온실시험 결과와 비교한 결과 실내시험이 높은 온도(온실의 낮기온)에서 수행되었을 때 두가지 검정방법간에 높은 상관관계를 보였다.

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