

AC 322,140 - A NEW HERBICIDE FOR USE IN  
TRANSPLANTED PADDY RICE IN JAPAN

S. Murai<sup>1</sup>, H. Hasui<sup>2</sup>, K. Kawai<sup>2</sup>, M. Kimpara<sup>2</sup> and M. Suzuki<sup>2</sup>

<sup>1</sup> Cyanamid (Japan) Limited, Tokyo, Japan

<sup>2</sup> Cyanamid (Japan) Limited, Tahara Agricultural Center, Aichi, Japan

*Summary.* AC 322,140 is a new broad-spectrum herbicide being developed for weed control in transplanted rice in Japan as well as other rice growing countries. In field trials in Japan, AC 322,140 showed good selectivity to rice cultivars and provided excellent persistent control of major annual weed species including *Cyperus difformis*, *Monochoria vaginalis*, *Elatine triandra*, *Lindernia procumbens*, and perennial weeds such as *Eleocharis acicularis*, *Scirpus juncooides*, *Sagittaria pygmaea*, *S. trifolia* and *Cyperus serotinus* with both pre-emergence and post-emergence applications at rates of 45 to 60 g a.i./ha. The persistent and consistent performance demonstrated in field testing is also well supported by several findings in greenhouse studies illustrating the unique properties of AC 322,140.

#### INTRODUCTION

AC 322,140 (1-[O-(cyclopropylcarbonyl)phenyl]sulfamoyl)-3-(4,6-dimethoxy-2-pyrimidinyl)-urea) is a new selective herbicide belonging to the sulfamoylurea class of herbicides. This broad-spectrum herbicide was discovered and is being developed by American Cyanamid Company. It has unique chemistry and mode of action, and is active against a wide variety of broad-leaved weeds and sedges with good selectivity to rice plants (1). AC 322,140 is now under development for weed control in transplanted paddy rice in Japan as well as other rice growing countries. The present paper describes the biological performance of AC 322,140 through field trials conducted in Japan, and some in Korea, Taiwan, Indonesia and Thailand since 1990. Also, several findings in greenhouse studies at Tahara Agricultural Center relating to its performance are presented.

#### METHODS

Field Trials. AC 322,140 0.15% extruded clay granule (G) and 0.2% G formulations were field tested in transplanted paddy rice from 1990 to 1992. All treatments were replicated three times with a plot size of 2x3 m. Treatments were made by hand post-transplanted to rice at Pre-emergence to Post-emergence from 0 to 15 DATR (days after transplanting). Appropriate commercially available products were used as references. Plots were visually assessed at various times during the growing season.

Greenhouse Test. Greenhouse testings were carried out at Tahara Agricultural Center usually using loam soil in pots to clarify the biological properties of AC 322,140 as a rice herbicide.

#### RESULTS AND DISCUSSION

Field Trials. In Japan, field trials have been conducted under different climatic conditions during three seasons. The results presented here summarize 6 trials carried out in the cool area of Hokkaido, in the moderately warm area of Aichi on Honshu and in the warm area of Kagoshima on Kyushu in 1991 (Table 1).

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AC 322,140 at the rates of 45 to 60 g/ha provided excellent control of annual and perennial broad-leaved weeds and sedges tested such as *Monochoria vaginalis*, *Lindernia procumbens*, *Sagittaria pygmaea*, *S. trifolia*, *Scirpus juncooides* and *Cyperus serotinus*. AC 322,140 partially suppressed annual grass, *Echinochloa crus-galli*, however, control was not sufficient. Crop tolerance of AC 322,140 at the rate of 45 to 60 g/ha was excellent in these trials.

Table 1. Average weed control of AC 322,140 treated at Pre-emergence, Early post-emergence and Post-emergence in paddy rice fields, 1991/Japan

Treatment	Rate (g a.i./ha)	Application Timing	% Control at 2 MAT							Phyto- toxicity %	
			ECHCR	CYPDI	MOOVA	LIDPY	SAGPY	SAGTR	CYPSE		SCPJU
AC 322,140	45	2 to 5 DATR	64	95	99	89	92	97	94	99	0
	60		68	95	99	91	93	93	95	99	0
Bensulfuron /mefenacet/dymron	51/1,050/450	"	97	97	91	91	94	97	94	97	0
Pyrazosulfuron /mefenacet	21/1,050	"	95	97	76	86	94	100	94	98	2.5
AC 322,140	45	5 to 10 DATR	70	97	99	99	98	100	95	95	0.2
	60		76	98	98	99	99	99	94	97	0.6
Bensulfuron /mefenacet/dymron	51/1,050	"	97	98	92	93	97	100	98	92	0.5
Pyrazosulfuron /mefenacet	21/1,050	"	93	97	77	84	91	100	96	93	0.5
AC 322,140	45	7 to 15 DATR	64	98	99	98	99	95	95	99	0.8
	60		74	99	100	99	99	93	95	99	0
Bensulfuron /mefenacet/dymron	51/1,050/450	"	98	98	99	95	99	90	95	95	0
Pyrazosulfuron /mefenacet	21/1,050	"	97	98	99	89	97	100	92	96	0.5

ECHCR: *Echinochloa crus-galli*  
 LIDPY: *Lindernia procumbens*  
 CYPSE: *Cyperus serotinus*

CYPDI: *Cyperus difformis*  
 SAGPY: *Sagittaria pygmaea*  
 SCPJU: *Scirpus juncooides*

MOOVA: *Monochoria vaginalis*  
 SAGTR: *Sagittaria trifloria*

Under poor growing condition, however, some growth retardation was observed, but this symptom is transient and further growth is not affected.

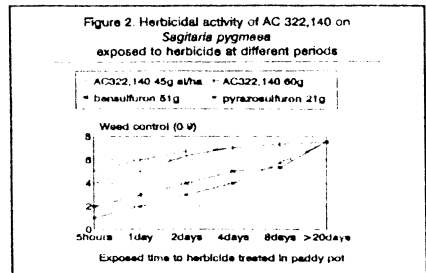
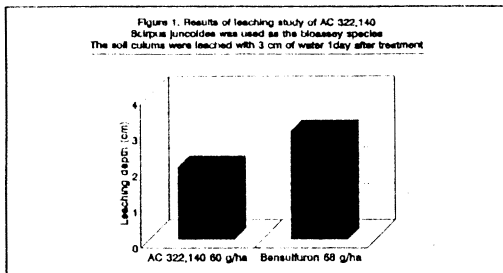
At different application timings, AC 322,140 showed consistently effective weed control at pre-emergence stage of weeds (2 to 5 DATR), early post-emergence (5 to 10 DATR, 1 leaf stage of rice) and post-emergence (7 to 15 DATR, 2 leaves stage of rice).

In these trials the assessments were done at about 2 months (56 to 67 days) after treatment and at these later timings, standard products like bensulfuron-methyl/mefenacet/dymron and pyrazosulfuron-ethyl/mefenacet showed some regermination of annual weeds and *S. juncooides* by earlier application while AC 322,140 gave almost perfect efficacy at any application timing. These results suggest the excellent persistent weed control of AC 322,140 is superior to these standard products.

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AC 322,140 also showed excellent to good herbicidal activity against *Rotala indica*, *Lindernia angustifolia*, *Ludwigia prostrata*, *Elatine triandra* and *Eleocharis kuroguwai* in Japan. Similar promising results have been found in other Asian countries such as Taiwan (tested at 20-50 g a.i./ha), Korea (20-60 g a.i./ha), Indonesia (20-60 g a.i./ha) and Thailand (wet-sown rice, 20-60 g a.i./ha).

**Greenhouse studies.** Results of a leaching study using soil columns being leached with 3 cm of water at 1 day after treatment indicate low mobility of AC 322,140 in soil (Figure 1).



In a test designed to measure speed of uptake, just germinated *S. pygmaea* tubers were exposed to herbicide treatment on a paddy soil for different lengths of time. The results demonstrate a faster uptake of AC 322,140 by weeds than bensulfuron or pyrazosulfuron (Figure 2).

AC 322,140 also provided excellent activity against *S. pygmaea* and almost completely inhibited the reproduction of tubers for 7 months after treatment. In contrast, bensulfuron and pyrazosulfuron treated *S. pygmaea* produced high numbers of tubers (Table 2).

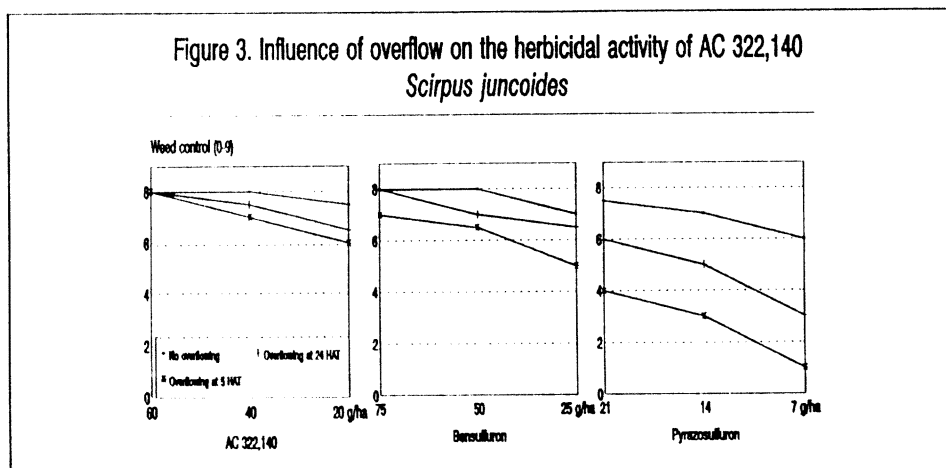
Table 2. Herbicidal activity of AC 322,140 on *Sagittaria pygmaea* /Effect on the reproduction of tubers

Treatment	Rate (g/ha)	Averaged numbers of tubers at 7 months after treatment
AC 322,140	40	0
	60	0
Bensulfuron	68	31
Pyrazosulfuron	28	43
Untreated	-	56

Treatment: October 25, 1991. Assessment: May 25, 1992  
 4 tubers/plot were planted on October 28 1991 Replication:2

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To examine the influence of overflow of paddy water after treatment on weed control, a simulated overflow test was carried out according to the method developed by H. Morita (2). Results suggested that AC 322,140 performs better under overflow condition than bensulfuron or pyrazosulfuron (Figure 3).



In pot tests using 8 kinds of Japanese paddy soils, AC 322,140 showed consistent selectivity to rice and efficacy in *S. juncoides* (Table 3).

Table 3. Crop selectivity and herbicidal activity of AC 322,140 (60 g/ha) in 8 different paddy soils in Japan

Soil	Selectivity (% of control)		Weed control (0 - 9)* <i>Scirpus juncoides</i>
	Plant height	Dry weight	
Naganuma: Alluvium/Clay loam	101	96	8
Furukawa: Alluvium/Clay loam	104	100	8
Tochigi: Volcanic/Loam	99	99	8
Shiga: Alluvium/Loam	103	94	8
Kagawa: Alluvium/Sandy loam	104	95	8
Kagoshima: Alluvium/Sandy loam	99	95	8
Toyokawa: Deluvium/Loam	98	97	8
Tahara: Alluvium/Loam	96	95	8

Selectivity - Variety: KOSHIHIKARI      Application: 2 DATR      Weed control - Application: Pre-emergence  
 Leaching: 3 cm/day x 2 days      Assessment: 25 DAT      Leaching: No leaching  
 Assessment: 30 DAT

\* Visual assessment score: 0 (no effect) - 9 (completely killed)

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These results from both field and greenhouse tests indicate AC 322,140 is a promising new rice herbicide with improved consistency and persistent weed control on a wide range of annual and perennial broad-leaved weeds and sedges. AC 322,140 has the potential to be combined with *E. crus-galli* herbicides and further research and development in that regard is underway in many rice-cultivating countries.

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