CHANGES OF WEED COMMUNITIES IN LOWLAND RICE FIELDS IN KOREA

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Summary. Changes of the weed communities in lowland rice fields throughout Korea were determined by sampling 2,459 sites in 1992. In 1971 the dominant weeds were all annuals except for *Eleocharis acicularis*. By 1981 the dominant weeds were *Monochoria vaginalis* > *Sagittaria pygmaea* > *Potamogeton distinctus* > *Sagittaria trifolia* > *Cyperus serotinus* > *Rotala indica*. The dominant weed in 1992 was *Eleocharis kuroguwai*, followed by *S. trifolia* > *Echinochloa crusgalli* > *M. vaginalis* > *S. pygmaea* > *C. serotinus*, of which only *E. crusgalli* and *M. vaginalis* were annuals. Perennial weeds such as *E. kuroguwai* and *S. trifolia* have increasingly become the most predominant weed species in 1992. Unlike 1981, *E. crusgalli* was a particular dominant weed species in lowland rice field.

INTRODUCTION

A recent change of cultural practices in lowland rice field of Korea from machine transplanting of aged seedling (35 days) to that of infant seedling (8-10 days) or direct seeding would evoke different responses from different weed species. Similarly, a change from lowland to upland condition introducing of direct seeding would prevent the emergence of semi-aquatic and aquatic weeds but allow upland weeds to take over. A machine transplanted rice cultivation presently constitutes over 95% of the total rice area in this country, while direct seeded rice has become popular since 1988. Weeds in rice field are mostly controlled by chemicals in Korea. Since 1961, repeated application of butachlor, benthiocarb, nitrofen, and 2.4-D in lowland rice fields resulted in the predominance of *C. serotinus* and *E. kuroguwai* (1). Furthermore, a marked build-up of perennial weeds is observed in lowland rice fields of Korea due to chemical management schemes applied continuously since 1975 (2).

The main objective of this nationwide weed survey conducted in cooperation with the Provincial Rural Development Administrations was to determine recent major weeds in lowland rice field, their distribution and importance as affected by cultural practices.

METHODS

The sampling of weeds (total sampling sites: 2,459) was done at two rice fields within each town in 1992. The weeds were counted at 40-50 days after transplanting in the transplanted rice field and at 60 days after seeding in the direct seeded rice cultivation, respectively. The size of quadrat used was 50x50 cm, sampled randomly over the area. The density, biomass, and frequency of individual weed species in each quadrat were determined. The summed dominance ratio was calculated for each weed based on its absolute and relative density, absolute and relative frequency, and importance value.

RESULTS AND DISCUSSIONS

A nationwide weed survey in 1992 was conducted by the Rural Development Administration in lowland rice field of Korea, following surveys in 1971 and 1981. As shown in Fig. 1, the dominant weed species were *E. kuroguwai* (17.5%), *S. trifolia* (15.2%), *E. crusgalli* (8.6%), *M. vaginalis* (8.5%), *Ludwigia prostrata* (4.3%), *P. distinctus* (3.7%), *Aneilema japonica* (3.5%),

and *Scirpus juncoides* (2.8%). Those weeds were constituted with 76% determined by the summed dominance ratio in lowland rice fields of Korea. There was a marked build-up of perennial weed, in particular *E. kuroguwai* and *S. trifolia*. In addition, the annual weeds *E. crusgalli*, which was not among the 10 major dominant weed species in 1981, had become a major weed species in 1992. This may have been due to changes in cultural practices and herbicides used in lowland rice fields during this period (Tables 1 and 2). Meanwhile, direct seeded rice and infant rice seedling transplanting technology have gradually increased, as labor saving and cost reducing strategies for rice production in Korea. These cultural practices have also changed the weed community. In direct seeded rice cultivation, annual weed species such as *E. crusgalli* and *M. vaginalis* were prominant (Table 1). In the early stages of direct seeded rice culture under dry paddy condition, the paddy field was under upland condition. Annual weeds may take over, while the emergence of semi-aquatic and aquatic weeds is prevented. Flooding is employed to control weed species that cannot germinate under such a condition. As shown in Table 2, in lowland rice field where 2,4-D, nitrofen, propanil and butachlor have been continuously used, perennial weeds such as *E. kuroguwai* and *S. trifolia* had become the most predominant weed species in 1992. Unlike 1981, *E. crusgalli* was a dominant weed species in lowland rice field. This might be due to increased use of herbicide mixtures for controlling annual and perennial weeds at the same time. This may lower the rate of active ingredient in the herbicide mixture for the control of annual weeds.

Table 1. The dominant weed species as affected by cultural practices in lowland rice field in Korea

Cultural practices	1st	2nd	3rd	4th	5th
Direct seeding					
- Dried	E.c.	C.s.	E.k.	S.t.	L.p.
- Flooded	M.v.	E.c.	L.j.	E.k.	A.j.
Machine transplanting					
- Infant seedling (8-10 days)	E.k.	S.t.	M.v.	S.p.	E.c.
- Aged seedling (35 days)	E.k.	S.t.	E.c.	S.p.	M.v.
Hand transplanting	S.t.	M.v.	A.j.	E.k.	S.p.

E.c.: *Echinochloa crusgalli*
M.v.: *Monochoria vaginalis*
E.k.: *Eleocharis kuroguwai*
S.t.: *Sagittaria trifolia*
C.s.: *Cyperus serotinus*
L.j.: *Leersia japonica*
A.j.: *Aneilema japonica*
S.p.: *Sagittaria pygmaea*

Table 2. Major herbicides used in lowland rice fields in Korea

Year	Total consumption of herbicides (Prod., kg)	Portion of herbicide for lowland rice field (%)	Major herbicides		
			1st	2nd	3rd
1961	9,610	-	2,4-D (100)		
1965	25,323	-	PCP (49.1)	2,4-D (31.4)	Propanil (14.3)
1970	4,957,585	97.7	Nitrofen (44.5)	PCP (21.7)	Chloronitrofen (11.3)
1975	28,398,840	88.1	Butachlor (50.0)	Nitrofen (42.9)	Chloronitrofen (11.3)
1980	47,164,924	79.5	Butachlor (66.5)	Alachlor (9.3)	Thiobencarb (8.8)
1985	49,430,965	74.6	Butachlor (53.1)	Alachlor (13.8)	Thiobencarb (7.7)
1990	70,948,000	68.5	Butachlor (27.9)	Alachlor (14.6)	Butachlor + bensulfuron methyl (12.9)

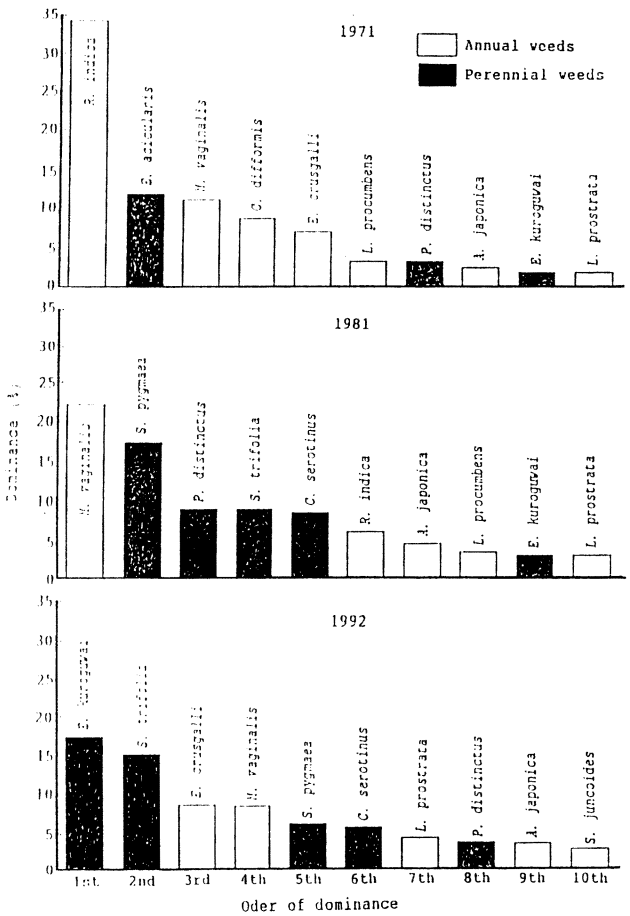

Figure 1. A change of dominant weed species in lowland rice fields of Korea.

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REFERENCES

1. Ahn, S.B., Kim, S.Y. and Kim, K.U. 1975. Proc. 5th Asian-Pacific Weed Science Society Conference. Japan. pp 287-292.
2. Kim, K.U. 1990. Progress of weed control methods and their prospects in Korea. In the 8th Sistership meeting of Korea, Japan, Republic of China's agrochemicals association, Seoul, Korea. p 28.