Cultural Control of Swinecress (*Coronopus didymus*) in Italian Ryegrass (*Lolium multiflorum*) Sward by Dense Sowing*

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Introduction

Swinecress (*Coronopus didymus* (L.) J.E. Smith) is a winter annual weed in the *Brassica* family which widely infests Italian ryegrass (*Lolium multiflorum* Lam.) swards in the Kyushu District. The weed is thought to have been introduced in imported feeds and/or forage crop seeds⁷⁾. The weed reaches only 20 to 30 cm in height and has little negative influence on the growth of the forage grass in terms of competition. However, when cows ingest the grass contaminated by this weed, they often produce the feed flavor milk having a strong odor of the weed^{4,7)}. Swinecress plants are often overlooked because they slip into the ryegrass sward, so that control of the weed is not often successful.

Several investigators^{1,2,5,6)} have shown the response of swinecress to some pre- and post-emergence herbicides. Hawton and Johnson²⁾ reported that a 2,4-D/dinoseb mixture performed well in terms of both swinecress control and tolerance of sward species, i.e. clover, ryegrass and oats. Although the above post-emergence herbicides are considered useful, they are not registered for Italian ryegrass in Japan; therefore, alternative methods are desired to control the weed.

The objective of this study was to clarify the relationship between the sowing density of Italian ryegrass and the growth of swinecress in the ryegrass sward in order to control the weed culturally.

Materials and Methods

A field experiment was conducted from October 1993 to April 1994 at the Kyushu National Agricultural Experiment Station, Nishigoshi, Kumamoto. Soil type was thick high humic Andosols (Melanudands). On October 20, 1993, Italian ryegrass (cv. Tachiwase) was sown at three different densities: 50 (LD), 250 (MD) and 500 g/a (HD), in three 3×6 m plots, for low, medium and high density, respectively. MD (250 g/a) is the density conventionally applied by farmers in the Kyushu District. On the same day, swinecress was sown in each plot at a density of 50 g/a. Prior to sowing, swinecress seeds were

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treated to promote their germination by Kobayashi's method³⁾; they were immersed in concentrated sulfuric acid for 20 min., then washed with tap water and immersed in 200 ppm gibberellic acid solution for 24 hr. Plots were amended with fused phosphatic fertilizer and dolomitic calcium carbonate at 2 and 15 kg/a, respectively, and were fertilized at a rate of 5 kg N/a with a 16-16-16 N-P₂O₅-K₂O compound fertilizer before sowing. Two 50×50 cm quadrates were placed in the middle of each plot and the growth of Italian ryegrass and swinecress within the quadrates was monitored on November 25, 1993 and February 2, 1994 (36 and 105 days after sowing). All plants within the quadrates were harvested on April 11, 1994 (174 days after sowing) and were sorted into Italian ryegrass and swinecress (no other species were observed). The number and plant height of both species were recorded 36 days after sowing. Plant height and number of total and flowering weeds were measured 105 days after sowing and at harvest time. All the harvested plants were dried at 75°C for 48 hr. and were weighed. Plots were arranged as a randomized complete block design with two replications of three treatments (LD, MD and HD). The data from two quadrates in each plot were combined and all data were analyzed using Duncan's multiple range test.

Results and Discussion

Thirty-six days after sowing, swinecress height increased with increasing sowing density of ryegrass; the increase was caused by spindly growth due to the dense taller ryegrass plants around the weed plants (Table 1). There was no clear relationship between the number of swinecress seedlings and sowing density of the ryegrass (Table 1).

The number of total and flowering plants of swinecress were fewer and plant height

Table 1. Initial growth of swinecress and Italian ryegrass at different sowing densities 36 days after sowing (Nov. 25, 1993).

Sowing density	Swinecress		Ryegrass	
	Plant height	No. of seedlings	Plant height	No. of seedlings
g/a	cm	plants/m ²	cm	plants/m ²
50(LD)	1.2 ^a	36 ^a	19.2 ^a	97 ^a
250(MD)	2.8 ^b	41 ^a	24.5 ^b	486 ^b
500(HD)	4.0 ^c	21 ^a	28.5 ^b	1132 ^c

Values with different superscript letters in the same columns are significantly different ($P < 0.05$).

Table 2. Growth of swinecress and Italian ryegrass at different sowing densities 105 days after sowing (Feb. 2, 1994).

Sowing density	Swinecress			Pyegrass
	Plant height	No. of plants	No. of flowering plants	Plant height
g/a	cm	plants/m ²	plants/m ²	cm
50(LD)	7.3 ^a	24 ^a	18 ^a	33.6 ^a
250(MD)	6.4 ^{ab}	28 ^a	1 ^b	34.1 ^a
500(HD)	3.8 ^b	17 ^a	0 ^b	36.1 ^a

Values with different superscript letters in the same columns are significantly different ($P < 0.05$).

was smaller 105 days after sowing in HD than in LD and MD, although the differences were not significant (Table 2). Swinecress plants in LD and MD began to flower (18 plants and 1 plant/m², respectively), while those in HD did not. There was no significant difference in plant height of the ryegrass among the sowing densities (Table 2).

On hundred seventy four days after sowing (at harvest time of the ryegrass), both plant height and weight of the weed decreased with increasing sowing density of the ryegrass (Table 3). The number of weed plants was greatest in MD, and least in HD, although the difference was insignificant. In HD, the number of flowering plants was significantly

Table 3. Growth of swinecress and Italian ryegrass at different sowing densities at harvest (Apr. 11, 1994).

Sowing density	Swinecress					Ryegrass		
	Plant height	Weight of plants	No. of plants	No. of flowering plants	No. of flowers	Plant height	No. of tillers	Fodder yield
g/a	cm	g/m ²	Plants/m ²	plants/m ²	flowers/m ²	cm	tillers/m ²	g/m ²
50(LD)	34.5 ^a	138.8 ^a	33 ^a	33 ^a	562 ^a	74.2 ^a	1,172 ^a	621 ^a
250(MD)	12.5 ^b	5.9 ^b	39 ^a	23 ^a	40 ^b	72.5 ^a	1,950 ^b	925 ^b
500(HD)	5.8 ^c	0.7 ^b	18 ^a	2 ^b	2 ^b	63.5 ^a	2,426 ^c	923 ^b

Values with different superscript letters in the same columns are significantly different ($P < 0.05$).

less than in LD and MD, and total number of flowers was only 2/m², although the difference from that in MD was not significant. Thus, high sowing density of Italian ryegrass may achieve suppression of not only existing swinecress plants but also future infestation by inhibition of the seed production. The yield of forage grass in HD was almost equal to that in MD (Table 3).

Swinecress content in Italian ryegrass sward in DD was 0.075% on a dry weight basis (Table 3). A sensory test was carried out to ensure that cows which ingest the forage containing 0.075% of swinecress never produce feed flavor milk under usual feeding management. A cow was fed with the hay containing 0.15% of swinecress which was twice as much as that in DD (0.075%) because control of swinecress in DD can vary depending on cultural conditions. In the sensory test, panel members did not recognize the swinecress odor in milk collected from the cow fed with the hay containing the swinecress (data not shown). Thus, dense sowing of Italian ryegrass was viewed as an effective method of preventing feed flavor milk.

In our experiment, it was concluded that dense sowing of Italian ryegrass is an effective cultural method for the control of swinecress in ryegrass sward, when lodging resistant cultivars such as Tachiwase are used.

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