LODGING RESISTANCE EVALUATION IN LOLIUM MULTIFLORUM

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ABSTRACT
The objective of this study was to develop a simple technique to evaluate lodging resistance in Italian ryegrass (*Lolium multiflorum*) for genetic improvement. Significant relationships were recognized between the pushing resistance index and actual lodging degree (ALD), and between the breaking resistance index and ALD, at the 0.1 and 5 percent levels, respectively.

KEYWORDS
Lodging resistance, evaluation, *Lolium multiflorum*, Italian ryegrass

INTRODUCTION
Lodging of forage crops is a great problem because of harvesting difficulties, yield loss, decrease of nutritive value and palatability, and so on. Though some lodging resistant varieties were developed recently (Suginobu et al., 1989), most marketed varieties are not resistant to lodging. Because lodging of crops occurs mainly when rainy and windy weather strikes crops in heading stage, it is difficult to evaluate lodging resistance in natural conditions for varieties in different stages of heading. Thus, determining appropriate methods for lodging resistance evaluation is important for genetic improvement of forage crops.

METHODS
Fifteen varieties of Italian ryegrass were sown in rows, 30 cm apart, with 4 replications from 1991 to 1994 in the experimental field of Hokuriku Agricultural Experiment Station. Among 15 varieties examined, 'Takaiku 7', 'Strain A' and 'Strain B' were selection lines developed by Hokuriku Agricultural Experiment Station for lodging resistance. Lodging degrees were scored (1: no lodging, 9: complete lodging) 4 to 8 times a year. The largest score of each year was chosen for each variety and an average score over 4 years was regarded as the actual lodging degree (ALD).

At the heading stage of each variety in 1995, the pushing resistance was measured at a suitable part of the row (2 measurements per plot) where there were about 40 tillers standing, by the method developed by Uemura et al. (1985), then the pushing resistance index (PRI) was calculated by the following formula using pushing resistance, tiller fresh weight and number of tillers.

PRI = (pushing resistance) / (tiller weight x number of tillers)

The breaking resistance of detached tillers was measured by a suspended type letter scale (10 measurements per plot), then the breaking resistance index (BRI) was calculated by the following formula with breaking resistance and tiller fresh weight.

BRI = (breaking resistance of tiller) / (cubic root of tiller weight)

RESULTS AND DISCUSSION
Among 15 varieties examined, 6 varieties showed low ALD (less than 2.7) and were considered lodging resistant varieties. They are 'Nioudachi', Takaiku 7, Strain A, 'Tachiwase', 'Tachimasari' and Strain B. PRI of the 15 varieties examined ranged from 4.2 to 1.8 and those of lodging resistant varieties were greater than 3.5. Correlation coefficient between PRI and ALD was -0.855 which was significant at the 0.1 percent level (Fig. 1). Terashima et al., (1992) reported there was a significant relationship between pushing resistance and lodging degree in hill planting rice. PRI was considered most suitable for forage crops in row planting rather than pushing resistance itself.

On the other hand, the correlation coefficient between BRI and ALD was -0.518 which was significant at the 5 percent level (Fig. 2). BRI was calculated with breaking resistance and cubic root of tiller weight in this study, because breaking resistance did not seem to be parallel with tiller weight directly.

From the results mentioned above, PRI was recognized as a useful index for lodging resistance evaluation, especially for row planted varieties or strains, and BRI was considered a useful index for lodging resistance evaluation in individual planted crops.

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Figure 1
Relationship between Pushing Resistance Index and Actual Lodging Degree

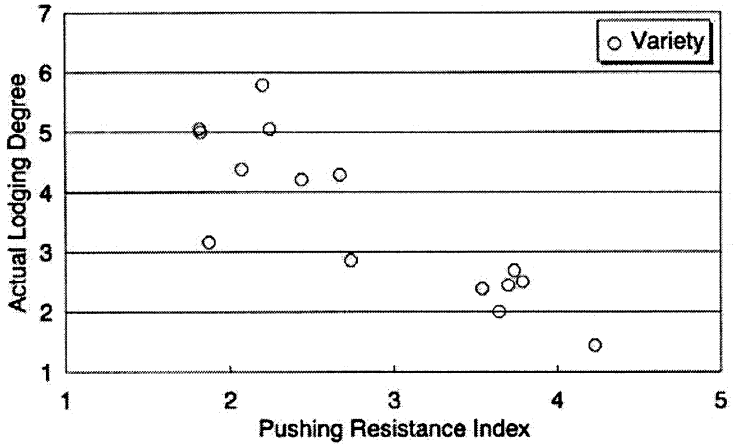

Figure 2
Relationship between Breaking Resistance Index and Actual Lodging Degree