1083

Sabreen, Shamima, Suguru Saiga, Mikinori Tsuiki, and Henry F. Mayland. 2002. Mineral uptake of high-Mg cultivars of Italian ryegrass and tall fescue grown under different level of potassium. p. 314-315. Proc. Japan Grassland Science Meeting, 21-23 September. Fukuoka, Japan.

6 – 6

Mineral Uptake of High-Mg Cultivars of Italian Ryegrass and Tall Fescue Grown Under Different Level of Potassium.

Shamima Sabreen, Suguru Saiga, Mikinori Tsuiki and Henry F. Mayland

(Faculty of Agriculture, Iwate University)

Introduction:

Magnesium and potassium interactions affect the concentration of Mg in forages. By evaluating the performance of high-Mg cultivars under different nutrient levels it is possible to understand interrelationships of nutrients as well as to find out optimum K level for screening forage plants. For this purpose, Italian ryegrass and tall fescue cultivars were studied using nutrient solution culture to evaluate the growth and mineral uptake under different K levels.

Materials and Methods:

The experimental materials including one high-Mg cultivar, viz, Magnet, HiMag; and two commercial cultivars viz, Tachiwase, Waseyutaka, Ky-31 and Fawn of Italian ryegrass and tall fescue were studied in controlled environment growth chamber (day/night 14/10 hours; 25/15℃). The experiment was conducted during October 12-22, 2001 (Expt. 1) and November 9-19, 2001 (Expt. 2). Pre-germinated seeds were transplanted into 3.5-L plastic pots containing Hoagland and Arnon No. 2 solution. After 30 days, 18 seedlings of uniform growth were selected for each cultivar, and used for mineral absorption test. Bunches consisting of 3 seedlings were transplanted into individual glass beakers containing solution with K treatments of 1.0, 5.0 and 25.0 m*M*, and were allowed to grow for 10 days. Each cultivar was replicated three times for each K level. The dry weights of shoots were obtained after drying at 70℃ for 48 h. Concentrations of magnesium (Mg), calcium (Ca), and potassium (K) in the solutions were analyzed by atomic absorption spectrophotometer.

Results and Discussion:

An increase in K level was accomplished by an increase in shoot weight (Table 1). High-Mg cultivars of both species showed higher Mg uptake than the reference cultivars under all K levels (Fig. 1). There was consistent trend in Mg uptake among the cultivars across the experiments. Magnesium uptake of High-Mg cultivars was highest in the K level of 5.0 m*M* across the experiments. Under 25.0 m*M* K level, Mg uptake by all cultivars of both species was lowest. Calcium uptake by the cultivars under different K levels is shown in Table 2. Italian ryegrass cultivars showed no significant differences among each other for Ca uptake. In case of tall fescue, HiMag always showed higher Ca uptake but the values are not always statistically significant. Potassium uptake was drastically increased with increasing K levels across the experiments (Table 3). Magnet showed significantly lower K uptake under all solution K levels than the other two cultivars. HiMag showed significantly lower K uptake than Ky-31. Low vegetative growth of Fawn often confused the differences in mineral uptake among tall fescue cultivars within the K levels.

Conclusion:

Highest level of K (25.0 m*M*) in nutrient solution culture decreased the Mg uptake by the cultivars of both species. There was no effect of K on Ca uptake while K uptake was drastically increased with solution K levels. It can be concluded that the K level of 5.0 m*M* is the best for screening forage plants.

Key words: Mineral uptake, K level, Italian ryegrass, Tall fescue, Solution culture.

Table 1. Shoot dry weight of plants (g).*

Species	Cultivars	Solution K concentration, mM					
		1		5		25	
		Expt. 1	Expt. 2	Expt. 1	Expt. 2	Expt. 1	Expt. 2
Italian ryegrass	Magnet	1.9 a	1.4 a	2.1 a	1.6 b	2.3 a	1.8 c
	Tachiwase	2.5 a	1.6 a	2.9 a	2.0 a	3.0 a	2.5 a
	Waseyutaka	2.0 a	1.6 a	2.3 a	1.7 b	2.6 a	2.2 b
Tall fescue	HiMag	1.3 a	1.0 a	1.6 a	1.2 a	1.8 a	1.6 a
	Fawn	0.6 c	0.5 c	0.7 c	0.6 c	0.9 c	0.8 c
	Ky-31	0.9 b	0.7 b	1.2 b	1.0 b	1.5 b	1.2 b

*Values within column and species with the same letters are not significantly different at P<0.05.

Table 2. Calcium uptake by cultivars across two experiments (mg/plant).*

Species	Cultivars	Solution K concentration, mM					
		1		5		25	
		Expt. 1	Expt. 2	Expt. 1	Expt. 2	Expt. 1	Expt. 2
Italian ryegrass	Magnet	4.1 a	3.6 a	6.4 a	4.1 a	6.6 a	3.6 a
	Tachiwase	4.1 a	3.6 a	6.4 a	3.7 a	6.6 a	3.8 a
	Waseyutaka	4.1 a	3.6 a	6.4 a	3.6 a	6.5 a	3.8 a
Tall fescue	HiMag	4.2 a	3.6 a	6.5 a	3.7 a	6.7 a	3.7 a
	Fawn	3.3 b	2.8 b	4.9 b	3.1 b	3.3 b	3.1 b
	Ky-31	4.3 a	3.5 a	6.5 a	3.6 a	6.6 a	3.6 a

*Values within column and species with the same letters are not significantly different at P<0.05.

Table 3. Potassium uptake by cultivars across two experiments (mg/plant).*

Species	Cultivars	Solution K concentration, mM					
		1		5		25	
		Expt. 1	Expt. 2	Expt. 1	Expt. 2	Expt. 1	Expt. 2
Italian ryegrass	Magnet	4.9 c	4.1 c	19.4 c	17.5 c	69.7 c	45.9 c
	Tachiwase	8.0 a	5.4 a	23.2 b	27.3 a	77.8 b	71.8 a
	Waseyutaka	6.9 b	4.8 b	25.3 a	24.7 b	98.6 a	68.5 b
Tall fescue	HiMag	5.5 b	4.6 b	15.2 b	13.4 b	51.1 c	35.8 b
	Fawn	4.5 c	5.4 a	10.8 c	9.1 c	58.3 b	27.2 c
	Ky-31	6.3 a	5.3 a	18.7 a	16.3 a	67.5 a	47.3 a

*Values within column and species with the same letters are not significantly different at P<0.05.

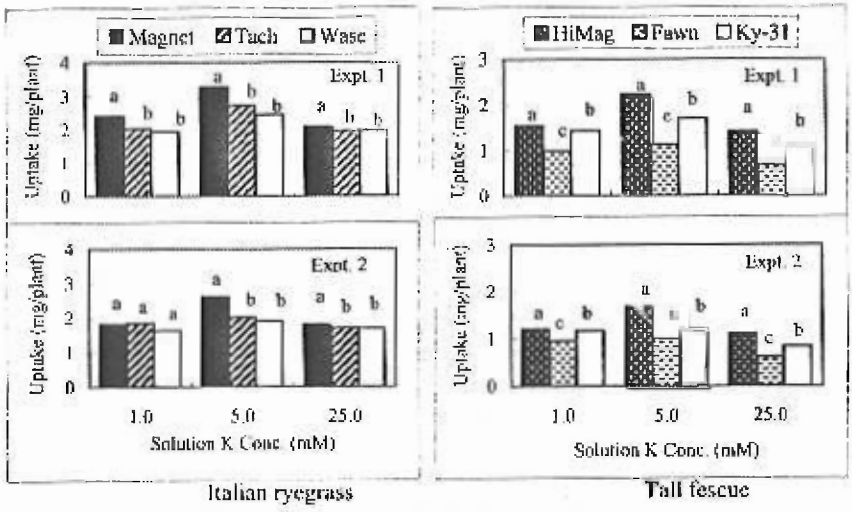

Fig 1. Magnesium uptake by cultivars under different K condition. Bars within solution K concentrations with the same letter are not statistically different at P<0.05.