Effects of Spring Applications of K Fertilizer on Early Growth of Tall Fescue (*Festuca arundinacea* Schreb.)

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Introduction

- Tall fescue is a common turf grass in northern China, and is widely used in lawn and low-maintenance area for soil and water stabilization.
- Previous research have found that potassium (K) has a very important role in the growth of turf grass (Christians et al., 1979; and Jiang, 2009; Zhang et al., 2008).
- However, K effect on early spring green-up of tall fescue turf is not well documented.

Objectives

- In this experiment, the effect of different levels of K fertilization on the early growth and green-up of tall fescue are studied.
- Treatment effect on tall fescue plant height, leaf length, chlorophyll content, alive shoot number, leaf number and green leaf biomass is investigated.

Materials and Methods

Figure 1. Design of Experiment

Figure 2. Fertilization

Experimental Field:

- The experimental field is outside of the north gate of Northwest A&F University`s North Campus. It is located at the top side of the Wei river plain, north of Qinling Mountains (N34°21', E108°10'; Altitude:458m).

Materials :

- Tall fescue (*Festuca arundinacea* Schreb.), a cool-season turf grass, was planted in 2006 in a multi-species mixed stand. Except the first mowing before winter, no additional maintenance was applied.

The Design of Experiments:

- The trial used monopotassium phosphate (containing K_2O 34%) as the source of potassium, with sequential applications of K fertilizer at the rate of 0, 4, 8, 12, and 16g K_2O/m^2 (Table 1). Field experiment was designed as a completely randomized block with 4 replications. There is total 20 plots with each $1m^2$ (1m×1m).
- The tall fescue began to turn green in early March. Fertilization was initially applied on March 3, 2010 followed by a proper irrigation. After 7 days, three random samples were taken within each 10×10cm^2 quadrant for each plot. Five sequential K fertilizations were made at 10 days apart. Data were collected at seven days after each K fertilization.

Table 1. Field Treatments

Date(2010)	K Application(g/m^2)	Measurements(10×10cm^2, 3 replications)
March 3	0, 4, 8, 12, 16	
March 10		Height, Leaf Length, Chlorophyll, Alive Stems, Green Leaves, Biomass
March 13	0, 4, 8, 12, 16	
March 20		Height, Leaf Length, Chlorophyll, Alive Stems, Green Leaves, Biomass
March 23	0, 4, 8, 12, 16	
March 30		Height, Leaf Length, Chlorophyll, Alive Stems, Green Leaves, Biomass
April 3	0, 4, 8, 12, 16	
April 10		Height, Leaf Length, Chlorophyll, Alive Stems, Green Leaves, Biomass
April 13	0, 4, 8, 12, 16	
April 20		Height, Leaf Length, Chlorophyll, Alive Stems, Green Leaves, Biomass
April 23	0, 4, 8, 12, 16	
April 30		Height, Leaf Length, Chlorophyll, Alive Stems, Green Leaves, Biomass

Results

Figure 3. Chlorophyll Content Measurement.

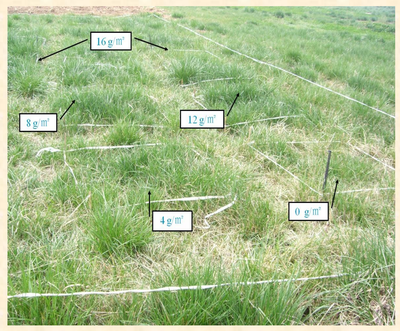

Figure 4. Treatment Effects on tall fescue (April 30, 2010).

Table 2. Effects of K fertilization on plant height (cm)

	K fertilization (g/m^2)				
	0	4	8	12	16
March 10	12.1±3. 6 ^{a}	12.4±0.7 ^{a}	12.4±2.3 ^{a}	10.0±0.8 ^{a}	13.8±3.6 ^{a}
March 20	13.9±1.5 ^{a}	14.6±1.8 ^{a}	15.4±3.7 ^{a}	15.9±4.1 ^{a}	17.9±2.9 ^{a}
March 30	18.7±1.9 ^{a}	21.0±3.6 ^{a}	24.2±1.2 ^{a}	21.3±1.1 ^{a}	24.1±4.1 ^{a}
April 10	21.4±3.4 ^{b}	27.7±6.8 ^{ab}	29.4±3.8 ^{a}	26.6±2.6 ^{ab}	33.5±5.0 ^{a}
April 20	27.0±3.9 ^{b}	37.4±7.3 ^{b}	37.5±3.0 ^{b}	37.6±0.6 ^{b}	46.6±3.1 ^{a}
April 30	64.4±3.1 ^{d}	79.7±4.9 ^{c}	78.0±5.6 ^{c}	89.5±8.6 ^{b}	105.3±4.5 ^{a}

Note: Means in the same column with different letters are significantly different (*P<0.05*).

Table 3. Effects of K fertilization on leaf length(cm)

	K fertilization (g/m^2)				
	0	4	8	12	16
March 10	8.5±2.3 ^{a}	9.2±0. 7 ^{a}	8.0±1.8 ^{a}	7.5±1.8 ^{a}	9.9±4.4 ^{a}
March 20	11.4±1.3 ^{a}	11.6±3.0 ^{a}	12.8±4.1 ^{a}	12.6±4.5 ^{a}	13.6±4.4 ^{a}
March 30	17.1±2.1 ^{a}	17.4±4.0 ^{a}	22.6±1.1 ^{a}	19.8±1.1 ^{a}	22.3±4.7 ^{a}
April 10	20.9±5.6 ^{b}	27.3±7.0 ^{ab}	29.2±3.9 ^{a}	26.8±2.4 ^{ab}	33.4±5.0 ^{a}
April 20	26.8±4.0 ^{c}	37.3±7.2 ^{b}	37.5±2. 9 ^{b}	37.5±0.6 ^{b}	46.4±3.4 ^{a}
April 30	63.7±3.4 ^{c}	75.4±8.4 ^{b}	75.5±6.1 ^{b}	83.7±4.7 ^{b}	101.5±4.8 ^{a}

Note: Means in the same column with different letters are significantly different (*P<0.05*).

Table 4. Effects of K fertilization on shoot biomass ($g/100cm^2$)

	K fertilization (g/m^2)				
	0	4	8	12	16
March 10	3.13±4.40 ^{a}	0.90±0.05 ^{a}	0.92±0.08 ^{a}	0.93±0.14 ^{a}	1.00±0.12 ^{a}
March 20	1.53±1.41 ^{a}	1.36±1.55 ^{a}	1.17±1.46 ^{a}	1.19±1.39 ^{a}	1.32±1.11 ^{a}
March 30	2.00±0.25 ^{c}	2.47±1.55 ^{b}	3.03±0.18 ^{a}	3.07±0.18 ^{a}	3.19±0.41 ^{a}
April 10	3.60±0.84 ^{c}	6.10±0.32 ^{b}	6.88±2.22 ^{b}	6.16±1.57 ^{b}	9.49±2.21 ^{a}
April 20	6.13±3.25 ^{c}	10.78±3.57 ^{b}	12.43±3.80 ^{ab}	13.68±1.06 ^{ab}	16.43±1.75 ^{a}
April 30	13.58±1.39 ^{c}	23.75±12.78 ^{b}	39.25±12.78 ^{a}	43.40±3.19 ^{a}	44.38±0.73 ^{a}

Note: Means in the same column with different letters are significantly different (*P<0.05*).

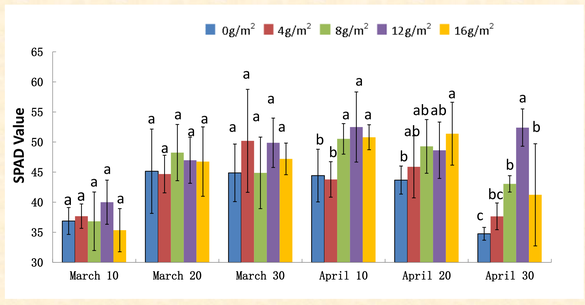

Figure 5. Effects of K fertilization on chlorophyll content

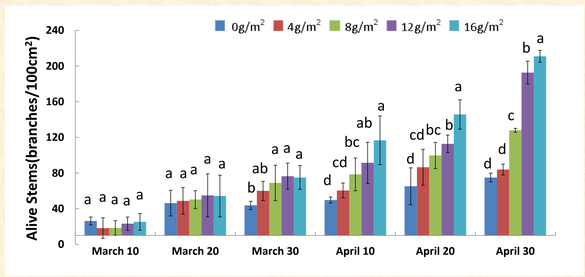

Figure 6. Effects of K fertilization on Alive Stems

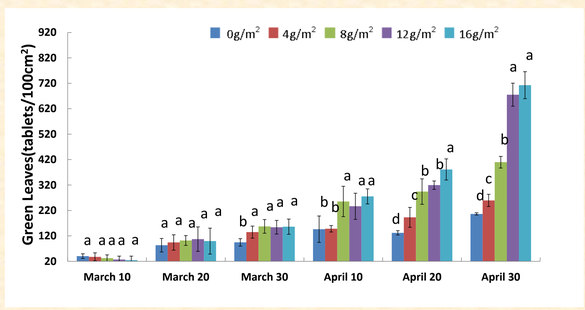

Figure 7. Effects of K fertilization on Green Leaves

Conclusions

- Potassium fertilizer can significantly promote the growth of tall fescue and enhance the green color after winter. The plant height and leaf length were the highest in the treatment of $16g/m^2$. Higher rates of potassium fertilizer resulted in higher number of alive stem with the best rate was $16g/m^2$. Higher rates of potassium fertilizer also increased the chlorophyll content. However, when potassium fertilizer rate exceeded $8g/m^2$, there was no additional chlorophyll content increasing.
- Collectively, our results suggested that application of K fertilizer following spring green-up increases tall fescue growth. The ideal K rate is 8g K_2O $/m^2$, which provides the best color and shoot density yet avoids excessively stimulation of shoot growth during the spring.

References

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Acknowledgements

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