NORTH DAKOTA– Potassium Alfalfa Fertilization in Seeding Year Did Not Affect Stand Persistence

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Multiple factors determine appropriate potassium (K) fertilization rate in alfalfa, one of which is soil clay mineralogy. When soil smectite-to-illite clay mineralogy ratio is >3.5, K becomes immobile. The study goal was to determine the K rate effect, application timing, varieties, and harvest stress on alfalfa plant density in soils with different clay mineralogy. Experiments were established in 2019. Milnor and Lisbon have soils with a smectite-to-illite ratio >3.5 and <3.5, respectively. Experimental design was a randomized complete design with a split-plot arrangement and four replicates, where the varieties Presteez RR, Stratica RR, and L-450 RR were assigned to the main plots. Subplots were a factorial combination of K rates (0, 150, and 300 lbs K_2O/ac) and two application timings. Two harvest timings were included (stressed; non-stressed).

Table 1. Alfalfa plant density affected by K fertilization, application timing, and time of fall harvest averaged across three varieties and two locations, Milnor and Lisbon, ND.

K rate (lbs/ac)	Fall stand 9-18	Fall stand 10-16	Spring stand		Stand reduction from fall to spring	
	Stressed	Non-stressed	Stressed	Non-stressed	Stressed	Non-stressed
	----------Plants/m²----------				--------% reduction--------	
0	151	100	65	71	51.4	25.6
150-seeding	145	102	68	74	49.4	25.4
150-split	142	106	70	73	47.1	26.9
300-seeding	140	97	68	79	47.7	16.5
150-split	141	113	68	78	47.2	27.8
P<F	NS	NS	NS	NS	NS	NS
Location						
Milnor	121	113	70	75	38.8	17.4
Lisbon	166	94	66	74	58.8	31.6
P<F			NS	NS	0.04	NS

Fall plant stands ranged 140 to 151 plants/m² in alfalfa harvested on September 18 and 97 to 113 plants/m² in alfalfa harvested on October 16. Potassium fertilization or application timing did not have an effect on fall stands. In the spring of 2020, plant density ranged between 65 and 68 plants/m² for the stressed treatment and 71-79 plants/m² for the non-stressed treatment. Alfalfa stand counts decreased from fall to spring in all treatments (Table 1). Alfalfa harvested on September 18 (stress treatment) had a stand reduction of 47.1-51.4%. Alfalfa harvested on October 16 (non-stress treatment) had lower stand reduction than the stressed treatment, ranging 16.5-26.9%. Varieties or K fertilization did not have an influence on stand reduction. In stressed alfalfa, K fertilization, application timings, or varieties did not affect plant stand reduction, but there was a significant effect of location. Stand reduction in alfalfa across all treatments in Lisbon (58.8%) was much higher than in Milnor (38.8%). This could be explained by lower pH and sandy texture of Lisbon soil along with extreme low soil K levels. Alfalfa plants were likely more stressed going into winter in Lisbon than in Milnor, explaining the overall much higher stand reduction.

In conclusion, K fertilization in the seeding year did not affect plant over-wintering. Reduction in plant density between fall and spring was related to an untimely harvest in mid-September.

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