Should High Potash Prices Change Alfalfa Fertilization Practices?

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Should high potash prices change alfalfa fertilization practices? This question has been on producers minds recently. An evaluation of previous research using current economics suggests that some producers might want to consider adjusting their potash fertilization rates.

A study assessing the effects of soil pH and potassium (K) application rate on alfalfa yield was conducted at Hancock, Marshfield, and Spooner Agricultural Research Stations from 1998-2001 (Table 1). The ideal soil pH for alfalfa is near 6.8. However, some producers may have soil pH levels that are somewhat lower than ideal. Thus, Table 1 presents the results of this study for soil pH levels in the 6.5-6.8 range and 6.0-6.3 range. At all locations the soil test level was in the optimum category where the recommended K_2O fertilizer rate is about equal to crop removal of K_2O. A second study completed at the Arlington Agricultural Research Stations from 1993-1997 assessed the effect of K application rate at various initial soil test K levels on yield of alfalfa (Table 2). In the Arlington study, initial soil test levels were in the low, optimum, and excessively high categories. The dry matter yield, tissue K content, and K removal data in Tables 1 and 2 are the average annual data over the study period.

For both studies, the economic return to applied potash was calculated based on $100/T of hay and $0.20/lb K_2O. When soil test levels were low (Table 2), the economic optimum K rate (EOKR) was 280 lb K_2O/a or approximately the rate recommended by UW in "Soil test recommendations for field, vegetable, and fruit crops" (UWEX bulletin A2809). When soils tested in the optimum range, the EOKR is somewhere between 0 and 100 lb K_2O/a which is roughly half the recommended rate for the yield levels attained. When the soils test excessively high, the EOKR was 0 lb K_2O/a which is the recommended rate. Under current economic conditions producers may want to consider reducing the potash application rates for fields that test in the optimum, high, and very high categories to improve profitability.

Reducing potash application rates relative to UW recommendations is not without consequence. Generally when crop removal of K exceeds the amount of K applied soil test K levels will decrease. This is shown in Table 2 where the 200 lb K_2O/a rate is approximately equal to crop removal and soil test levels remain relatively stable throughout the study period. At Arlington (Table 2) soil test K levels did not drop as much as expected when K removals exceeded applications. Kelling and Speth (1998) explained that this is an example of the subsoil supplying K such that topsoil was not depleted of K. Applying less potash than crop removal (~60 lb K_2O is removed per ton) can result in reducing soil test K levels. This is not necessary bad if soil test levels are above optimum. However, if soil test levels are at optimum, producers run the risk of soil test levels dropping into the low category which would require larger potash applications in the future.

Another potential consequence of reducing potash applications is winter survival/stand longevity. The data in Table 1 show that the amount of potash applied on soils testing optimum, provided soil pH is adequate for alfalfa production, does not greatly influence the final crown count. The final crown counts provided in Table 2 are the result of four years of consecutive applications of a given rate of potash. So one year of a reduced application rate may not cause significant stand loss under these conditions. If soils test less than optimum for K and/or have a pH that is below 6.0, then potash application is essential for maintaining stand.

Potash mines in Saskatchewan (our major supplier) are bringing more mining capacity online this year, which means we may see somewhat lower potash prices for next growing season. Thus, reducing or postponing potash applications could be a viable management tool for some producers provided the pros and cons are weighed against their tolerance to risk.

Table 1. Effect of topdressed potash and soil pH on average annual total dry matter yield, final crown count, average tissue K content, annual K_2O removal, final soil test K level, and economic return to potash application at Hancock, Marshfield, and Spooner (1998-2001).

Soil pH	Annual K_2O Application Rate	Average Annual Total Dry Matter Yield	Final Crown Count	Average Tissue K	Annual K2O Removal	Final Soil Test K	Economic Return to K_2O
	lb K_2O/a	T/a	plants/ft^2	%	lb K_2O/a	ppm	$/a
Hancock - initial soil test K level 110 ppm (optimum)							
6.5-6.8	0	3.42	4	2.15	176	51	342
	100	3.53	5.1	2.58	219	72	333
	200	3.54	4.1	2.78	236	110	314
	400	3.48	4.5	2.95	246	136	268
6.0-6.3	0	3.24	4.5	2.12	165	43	324
	100	3.45	4.5	2.56	212	63	325
	200	3.54	4.3	2.85	242	100	314
	400	3.44	3.7	2.93	242	112	264
Marshfield - initial soil test K level 136 ppm (optimum)							
6.5-6.8	0	3.47	6	1.93	161	69	347
	100	3.95	6.5	2.52	239	84	375
	200	3.96	7.2	2.94	279	123	356
	400	4.22	9.7	3.23	327	266	342
6.0-6.3	0	3.39	6.1	2.04	166	76	339
	100	3.72	6.3	2.53	226	83	352
	200	3.44	6.6	2.96	244	125	304
	400	3.93	7	3.22	304	205	313
Spooner - initial soil test K level 117 ppm (optimum)							
6.5-6.8	0	3.47	7.5	2.05	171	54	347
	100	3.77	7.9	2.64	239	101	357
	200	3.74	8.2	2.85	256	107	334
	400	3.79	7.5	2.79	254	237	299
6.0-6.3	0	3.6	7.5	2.14	185	67	360
	100	3.75	6.6	2.61	235	95	355
	200	3.81	8	2.91	266	175	341
	400	3.85	7.2	2.98	275	233	305

From Peters et al. 2003.

Table 2. Effect of topdressed potash on average annual total dry matter yield, average tissue K content, annual K_2O removal, final soil test K level, and economic return to potash application at Arlington (1998-2001).

Annual K_2O Application Rate	Average Annual Total Dry Matter Yield	Average Tissue K	Annual K_2O Removal	Final Soil Test K	Economic Return to K_2O
lb/a	T/a	%	lb K_2O/a	ppm	$/a
		Initial soil test level 69 ppm (low)			
0	2.95	2.43	172	76	295
70	3.26	2.26	177	68	312
140	3.34	2.62	210	79	306
210	3.36	2.71	219	76	294
280	3.72	3.08	275	119	316
350	3.86	3.54	328	133	316
		Initial soil test level 85 ppm (optimum)			
0	3.27	2.58	202	83	327
70	3.34	2.9	232	94	320
140	3.37	2.99	242	100	309
210	3.6	3.19	276	114	318
280	3.63	3.36	293	165	307
350	3.64	3.75	328	174	294
		Initial soil test level 166 ppm (excessively high)			
0	3.55	3.36	286	106	355
70	3.51	3.51	296	119	337
140	3.47	3.94	328	140	319
210	3.61	4.1	355	174	319
280	3.52	3.93	332	213	296
350	3.58	3.93	338	198	288

From Kelling and Speth, 1998.