

Phosphate and Potassium Fertilization of Irrigated Alfalfa

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Project Objective

To evaluate fertility needs of a new alfalfa seeding.

Demonstration Plan

The demonstration field was divided into six strips: phosphorus alone (P), potassium alone (K), PK together, PK and zinc together PKZn, and a control.

Project Methods and Observations

The demonstration was sown at Miry Creek Irrigation District north of Cabri, SK in spring, 2011. Soil properties for a clay texture were pH 8.5, O.M 2.2%, and CEC 32 meq/100 g. The field was flood irrigated initially after construction in 1977 and converted to wheel line sprinkler irrigation in 1988. Soil test levels were P – 12 lb/ac, K – 322 lb/ac, and Zn 2.0 lb/ac. Fertilizer recs for a target yield of 3 ton alfalfa/ac were: 40 lb P₂O₅, 9 lb S, 1.8 lb Zn, 2.3 lb Mn and 20 lb elemental S/ac. Fertilizer was banded in fall, 2010 prior to seeding alfalfa with a cover crop. Alfalfa tissue was sampled from each strip in mid-June, 2012 (Table 1).

Table 1. Plant tissue analysis of alfalfa samples

Trt (Nutrient/ac)	N	P	K	Zn	Mn
	(%)			ug/g	
None	4.2	0.3	2.2	26	38
100 lb P ₂ O ₅	4.3	0.4	2.2	21	34
120 lb K ₂ O	3.5	0.3	2.3	24	29
100 lb P ₂ O ₅ + 120 lb K ₂ O	4.3	0.4	2.4	20	32
100 lb P ₂ O ₅ + 120 lb K ₂ O+ 4 lbZn	4.4	0.4	2.3	28	34
None	5.1	0.3	2.3	24	32
Threshold	4.5	0.25	2.0	20	20

N content of alfalfa was lower than normal. The seed was inoculated and coated but stored a year before sowing. The grower re-inoculated the seed prior to sowing. P fertilization reduced Zn uptake. Zn in alfalfa tissue was marginal in P alone and PK strips. The higher level of Zn in the PKZn strip was evident by a darker green color. First cut alfalfa hay increased by 0.5 ton/ac on PKZn compared to no fertilizer in 2012. Differences in yield were minor for second cut and in 2013 (Table 2).

Table 2: Total Alfalfa yields in 2012 and 2013 at Miry Creek Irrigation District, Field 13 (2 cuts)

Trt	Rate (lb/ac)	2012 Total Alfalfa Yield ton/ac	2013 Total Alfalfa Yield ton/ac	Relative Feed Value
Control West	None	3.61	--	--
P	100 P ₂ O ₅	3.68	3.55	88
K	120 K ₂ O	3.56	3.07	93
P & K	100 P ₂ O ₅ + 120 K ₂ O	3.87	3.31	95
P, K & Zn	100 P ₂ O ₅ + 120 K ₂ O+ 4 Zn	4.08	3.34	95
Control East	None	-	2.89	99

Conclusion

Soil and plant analysis are important to guide fertilization of irrigated alfalfa. General guidelines are not adequate to meet alfalfa fertility requirements because fields differ in their ability to supply nutrient requirements. Flood irrigated fields are land leveled to control the flow of water. This disturbance introduces variability in depth of topsoil and mimics major soil erosion. Flood project irrigators should consider both yield performance and hay quality in planning fertilizer use.

Several conclusions can be made from this demonstration.

- 1) The largest response to fertilizer on the clay soil was achieved with phosphorus.
- 2) There was yield response to balanced fertilizer application (PKZn) initially, but the response was not observed for all years and forage cuts.
- 3) Phosphate fertilization decreased the mineral contents of the forage but levels were still adequate to meet nutritional requirements for cattle.
- 4) Phosphate fertilization decreased the level of zinc in forage to low or marginal levels for soil with low Zn soil test levels.
- 5) Balanced fertility in accordance with soil testing guidelines produced feed with higher relative feed value than phosphate alone.

Acknowledgement: Viterra, Nexus Ag for fertilizer inputs