

Fertilizer Requirement of Irrigated Alfalfa 1994-96

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Introduction

In 1994, an experiment was set out to determine the phosphorus, potassium and nitrogen fertilizer response of irrigated alfalfa on six fields. The initial fields were all established pure alfalfa stands in their first or second year of production. The project is funded by the Alberta Agriculture Research Institute, Potash and Phosphate Institute of Canada, Sherritt Fertilizers, Tirol Alfalfa and Westco Fertilizers. R.H. McKenzie of AAFRD, Lethbridge, and L. Kryzanowski of AAFRD, Edmonton, assisted with the project.

A previous survey indicated 70% of 99 irrigated alfalfa fields in southern Alberta were deficient in soil phosphorus while only 43% were deficient in tissue phosphorus. This survey also indicated 12% of fields were marginal and no fields were deficient in soil potassium while 79% of the same fields were deficient in tissue potassium. These discrepancies left a question as to which fields would respond to phosphorus and potassium fertilizers. An experiment was established to answer this question.

The same survey indicated amounts of fertilizer applied to alfalfa fields were much less than the crops' use. Only 29% of farmers added sufficient phosphorus during the life of the stand to supply one year's crop requirements. Another 7% applied manure to the field. Potassium fertilizer was supplied to 15% of fields but only 2% received more than 50 kg/ha of potassium. Nitrogen was used by 34% of farmers at the time of seeding but only 9% used it in subsequent years.

In 1996, three new fields were added. These fields were in their first production year and received both phosphorus and potassium treatments. Three of the original fields from 1994 remained in the project at the beginning of 1996. These were the three that had both phosphorus and potassium treatments. Stand counts for potassium treatments were taken on one original field. This field was subsequently plowed down in May leaving five fields for the 1996 study.

Methods

Five fields which received phosphorus, potassium and nitrogen treatments were studied during 1996. Two harvests were taken from each field. Soil samples were collected in the fall of 1996 from broadcast treatments. Miller Axley phosphorus, Kelowna phosphorus and Ammonium Acetate Potassium were determined on the soil samples. Tissue samples were also taken at the time of harvest from all treatments N, P, K, Ca, Mg, S and Micronutrients were determined on tissue samples.

Results (1996)

- Phosphorus fertilizer give from 8% increase in yield for lower applications of 20 to 40 kg/ha P to about 18% for higher applications, eg. 120 kg/ha P.
- Shallow banding of 2 cm with a zero till disc drill gave similar yields as broadcast phosphorus.
- Tissue phosphorus contents in 1996 was similar on all phosphorus treatments. This is in contrast to 1994 and 1995 where tissue phosphorus was slightly higher $\pm 0.03\%$ on those treatments receiving higher rates of phosphorus as compared to the controls.
- Potassium fertilizer treatments were applied on all 5 experimental sites in 1996. There was no response to any of the experimental sites in 1996.
- Tissue potassium was below the American Society of Agronomy sufficiency level of 0.22% K at all sites and on all treatments.
- One site commenced in 1994 was plowed down in May of 1996 because of winter killing. Counts made indicated no significant differences in stand of alfalfa on the K fertilizer treatments as contrasted to the control.
- Nitrogen fertilizer gave small yield increases over similar treatments which did not receive nitrogen.
- A comparison of Kelowna P soil test response to phosphorus fertilizer levels will be completed later in 1997 when laboratory results are available.

Soil analysis of irrigated alfalfa new plot sites, Autumn 1995

Producer: G ● Duchess		E.C.	(ppm)								
Depth (m)	pH	mS/cm	NH ₄ -N	NO ₃ -N	PO ₄ -P ‡	K ∞	Zn	B	Cu	Mn	Fe
0.00-0.15	7.7	0.63	6	4	3	163	0.37	0.36	0.79	5.63	7.73
0.15-0.30	7.8	0.65	4	3	0	107	0.25	0.34	0.82	3.49	7.84
0.30-0.60	8.0	2.13	4	2	0	84					

Producer: M * Hays		E.C.	(ppm)								
Depth (m)	pH	mS/cm	NH ₄ -N	NO ₃ -N	PO ₄ -P ‡	K ∞	Zn	B	Cu	Mn	Fe
0.00-0.15	7.7	0.70	4	6	5	197	0.43	0.29	0.88	5.38	10.01
0.15-0.30	7.9	1.43	4	3	0	118	0.19	0.25	0.74	2.96	9.08
0.30-0.60	7.9	1.70	5	3	0	106					

Producer: N ■ Rosemary		E.C.	(ppm)								
Depth (m)	pH	mS/cm	NH ₄ -N	NO ₃ -N	PO ₄ -P ‡	K ∞	Zn	B	Cu	Mn	Fe
0.00-0.15	7.5	0.68	3	0	19	360	0.74	0.78	2.19	7.48	20.13
0.15-0.30	8.2	0.98	2	0	9	382	0.20	1.13	2.67	2.89	17.47
0.30-0.60	8.3	2.05	2	0	18	461					

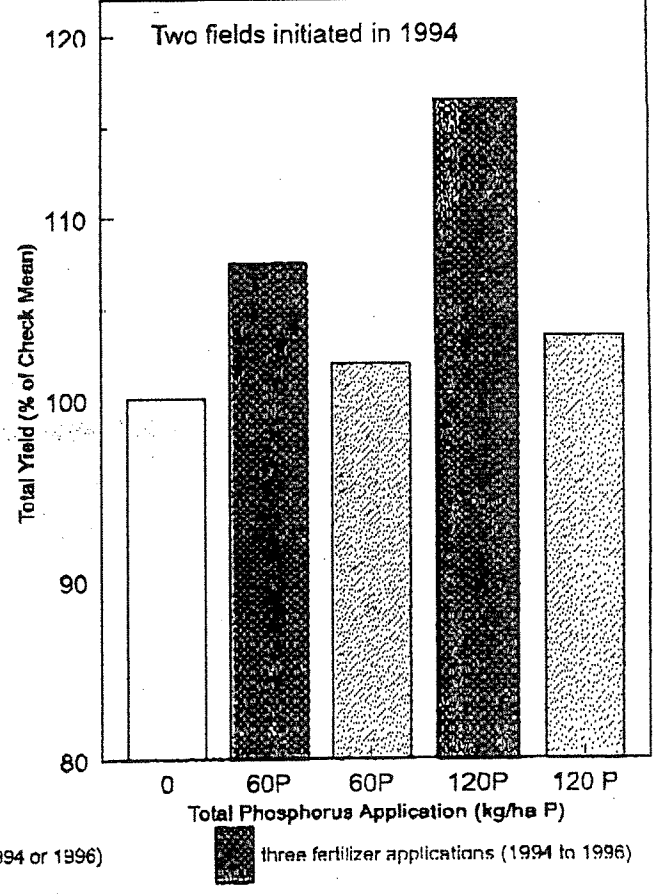
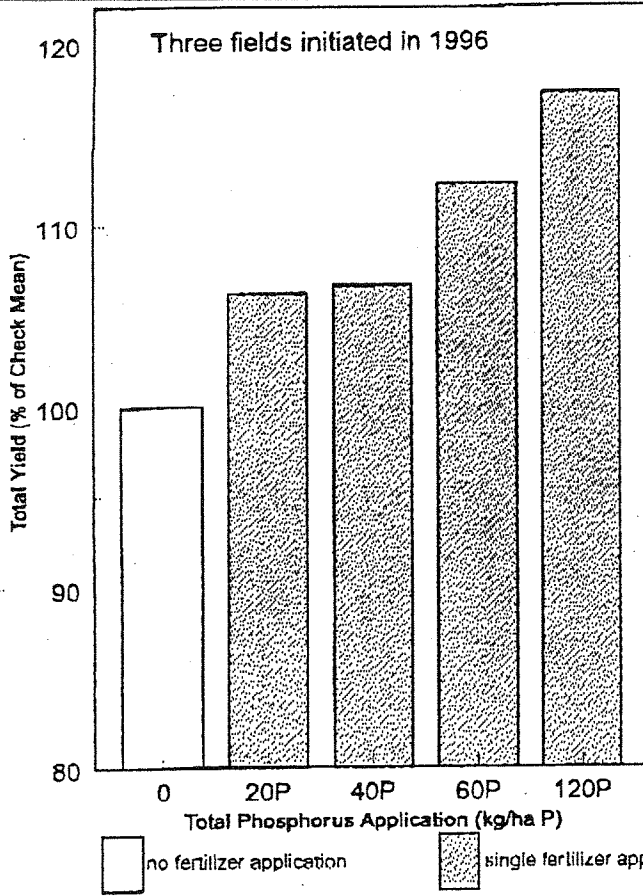
‡ Miller Axely

∞ Ammonium acetate

Average 1998 yield (%) response of alfalfa forage to phosphorus fertilizer on three fields initiated in 1996 and two fields initiated in 1994.

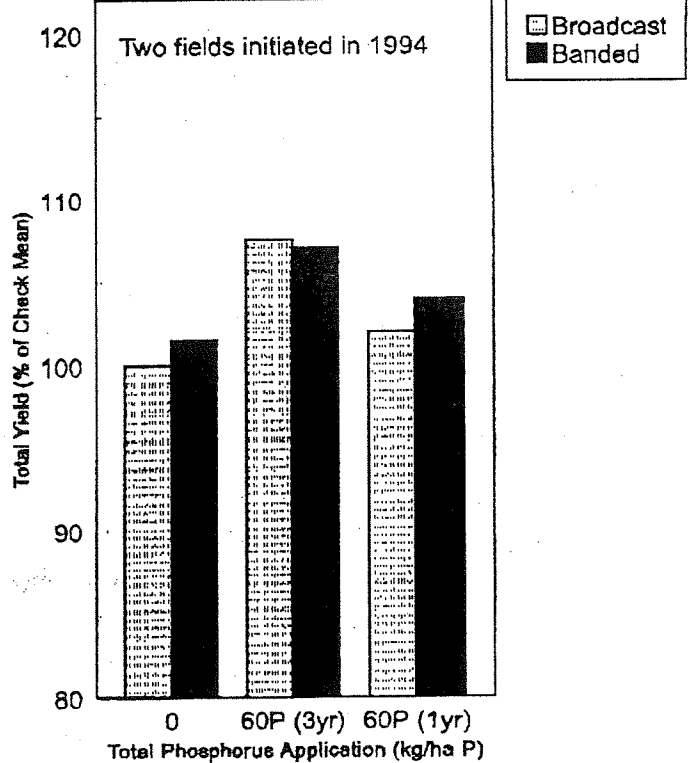
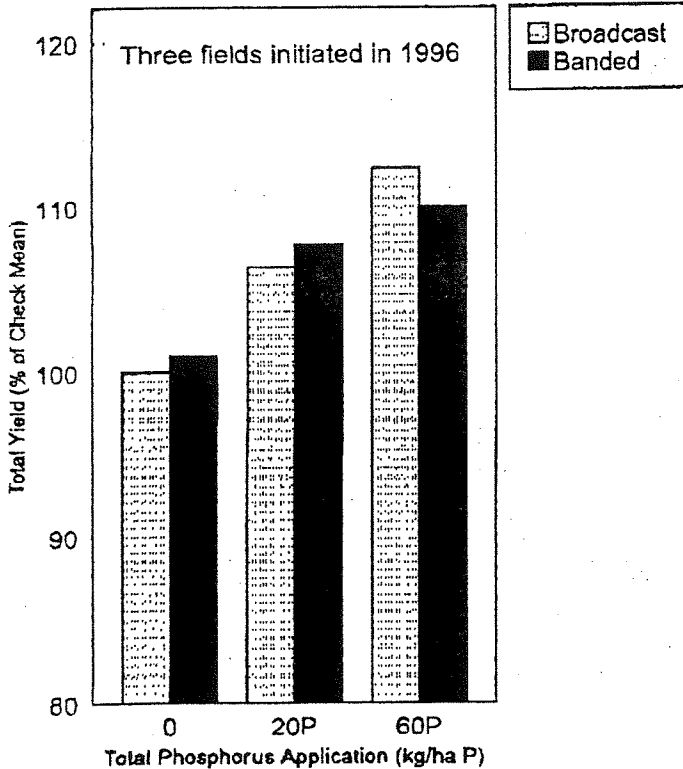
a) Relative total yield for rates of broadcast phosphorus

b) Relative total yield for rates of broadcast phosphorus

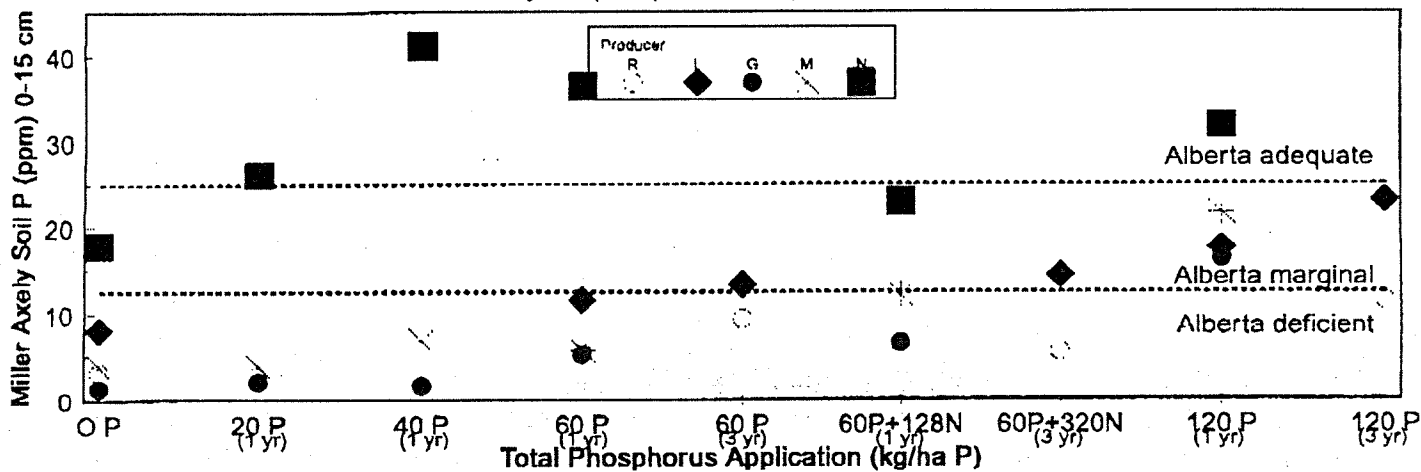


c) Relative total yield for rates of broadcast and banded phosphorus

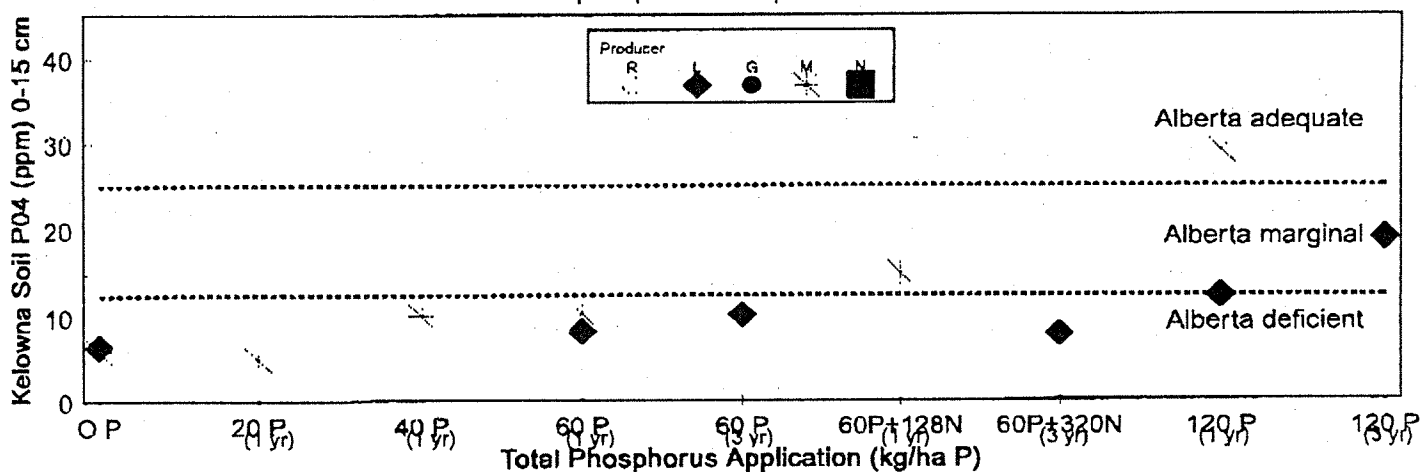
d) Relative total yield for rates of broadcast and banded phosphorus



1996 Miller Axley soil phosphorus compared to Alberta standards

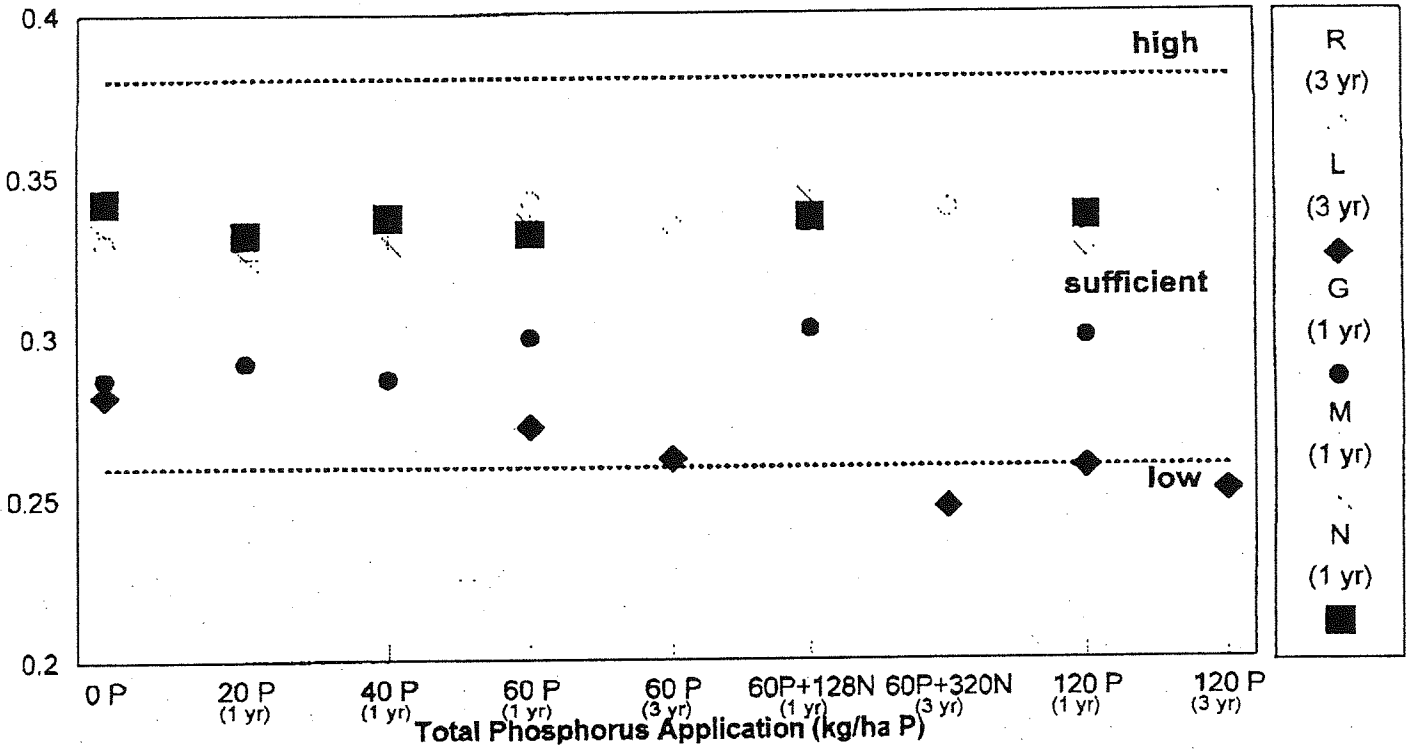


1996 Kelowna soil phosphorus compared to Alberta standards



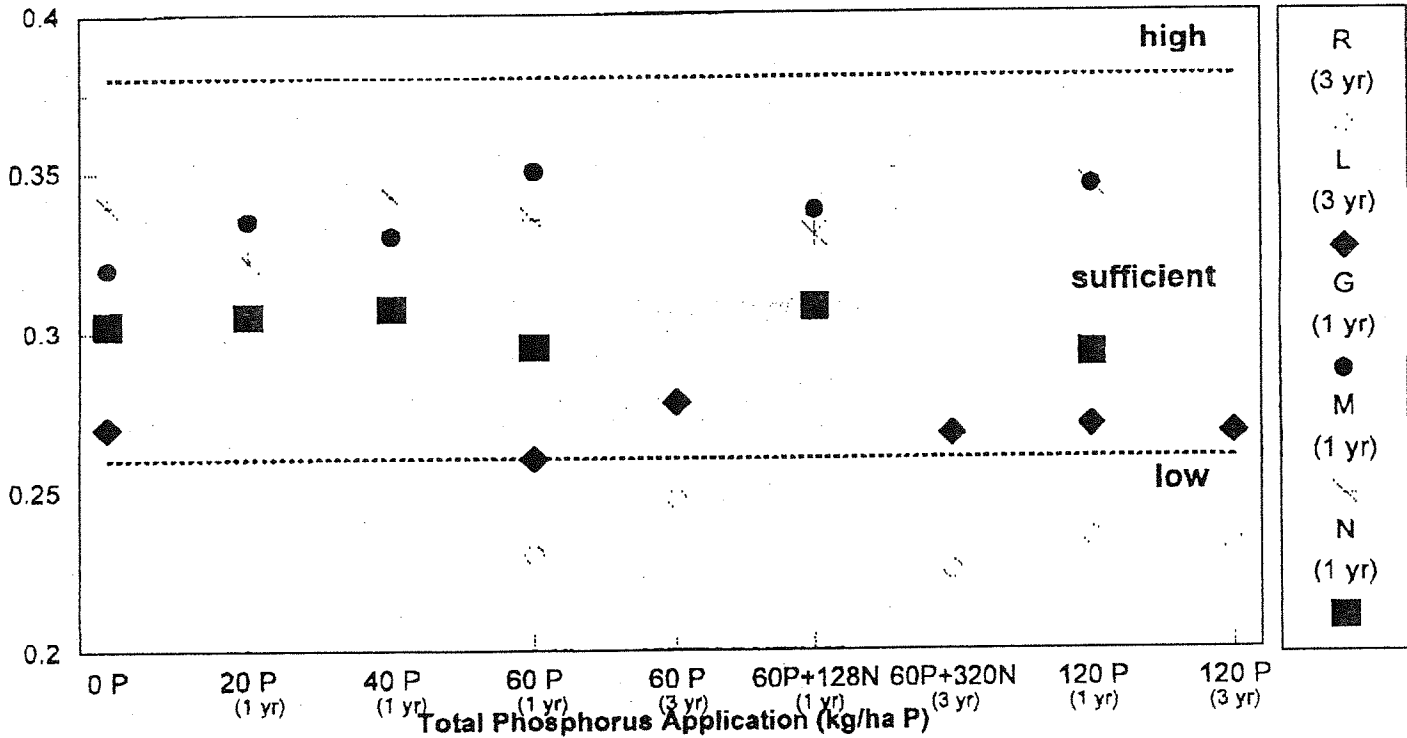
**1996 Alfalfa tissue phosphorus levels as compared to USA standards
(first harvest)**

Tissue Phosphorus (%)

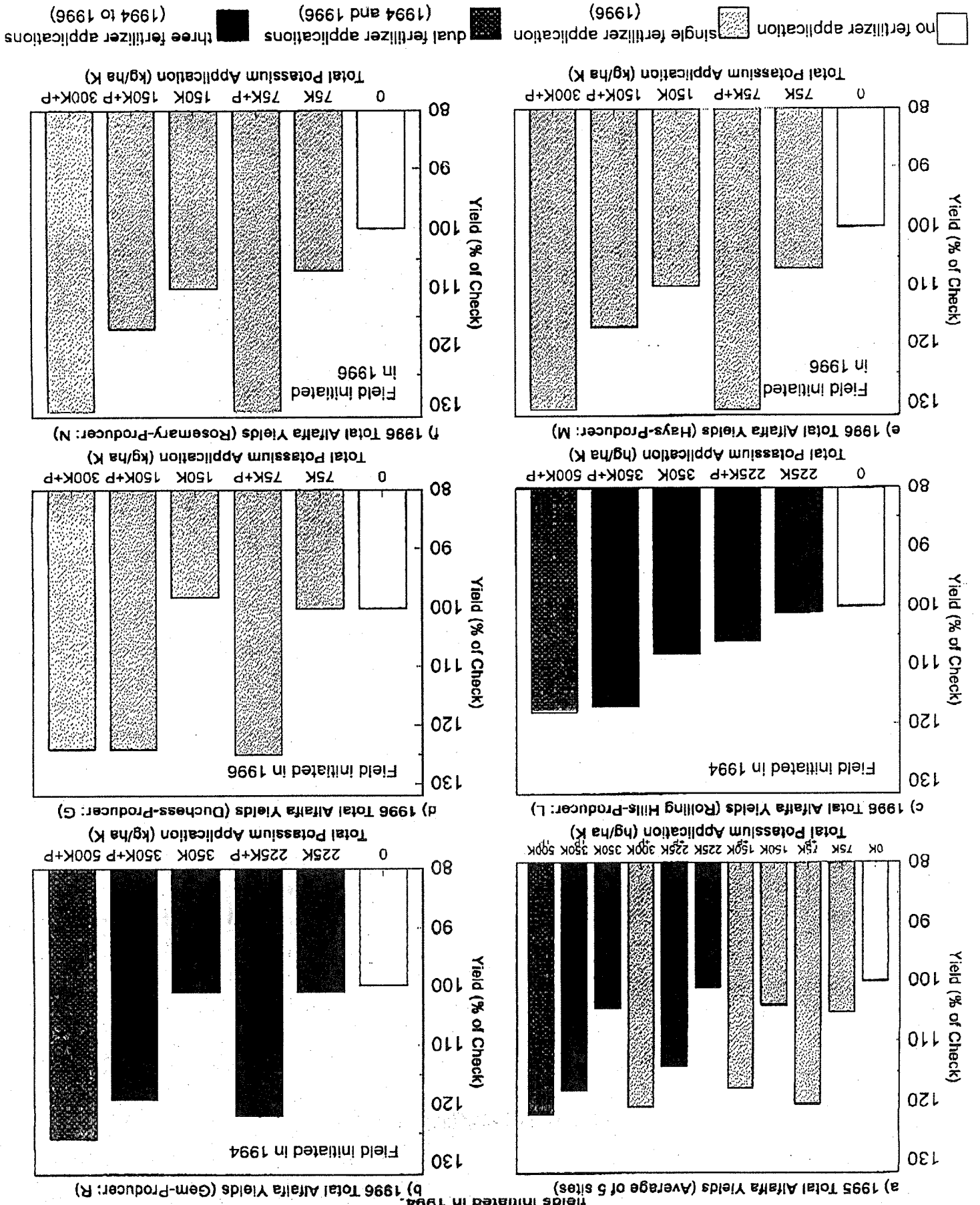


**1996 Alfalfa tissue phosphorus levels as compared to USA standards
(Second Harvest)**

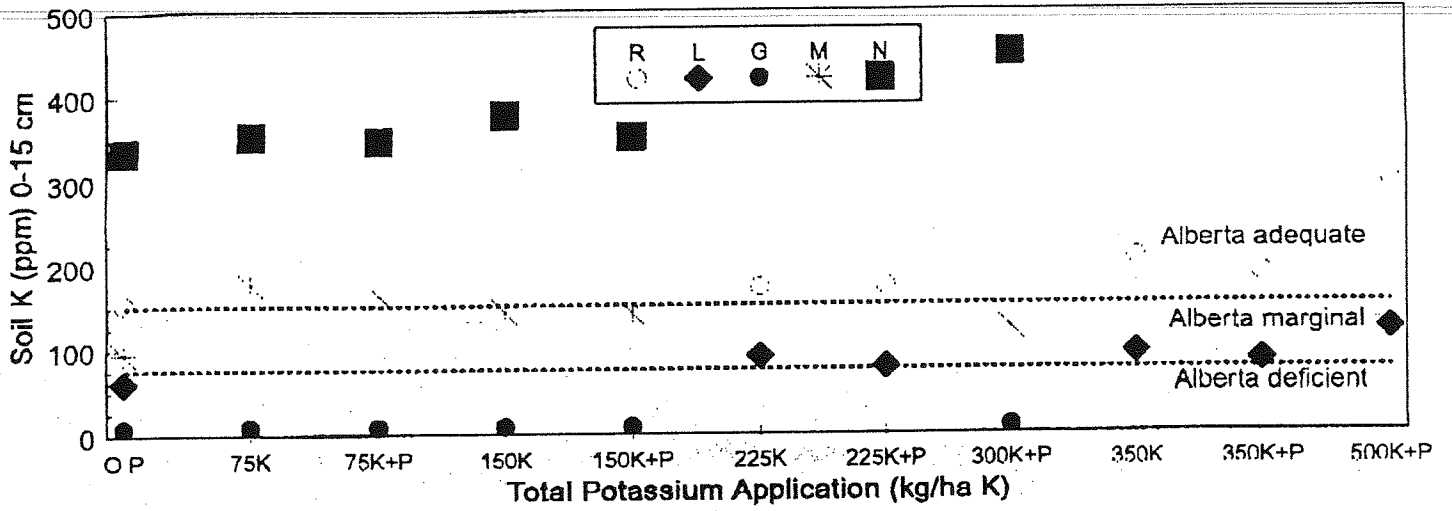
Tissue Phosphorus (%)



Average 1996 yield (%) response of alfalfa forage to potassium fertilizer on three fields initiated in 1996 and two fields initiated in 1994.

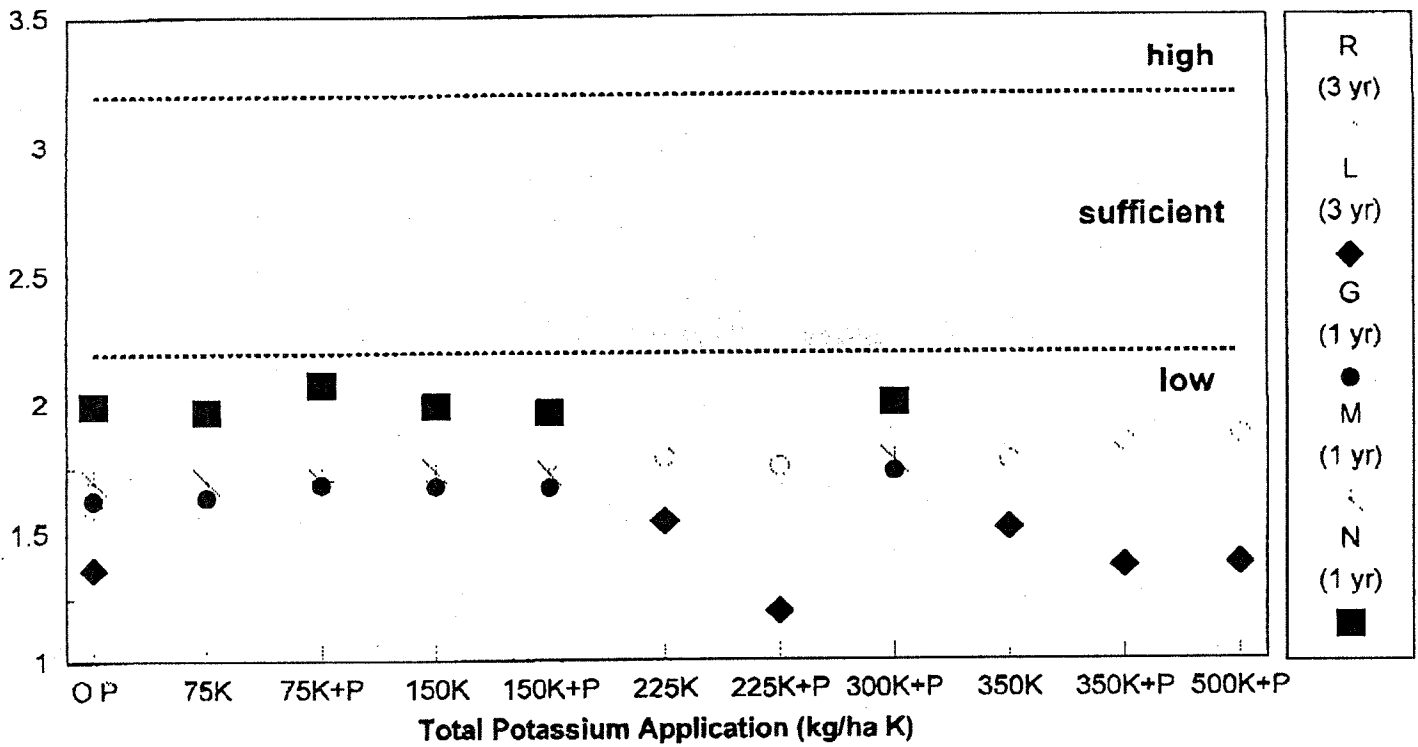


1996 Soil ammonium acetate potassium levels as compared to Alberta standards



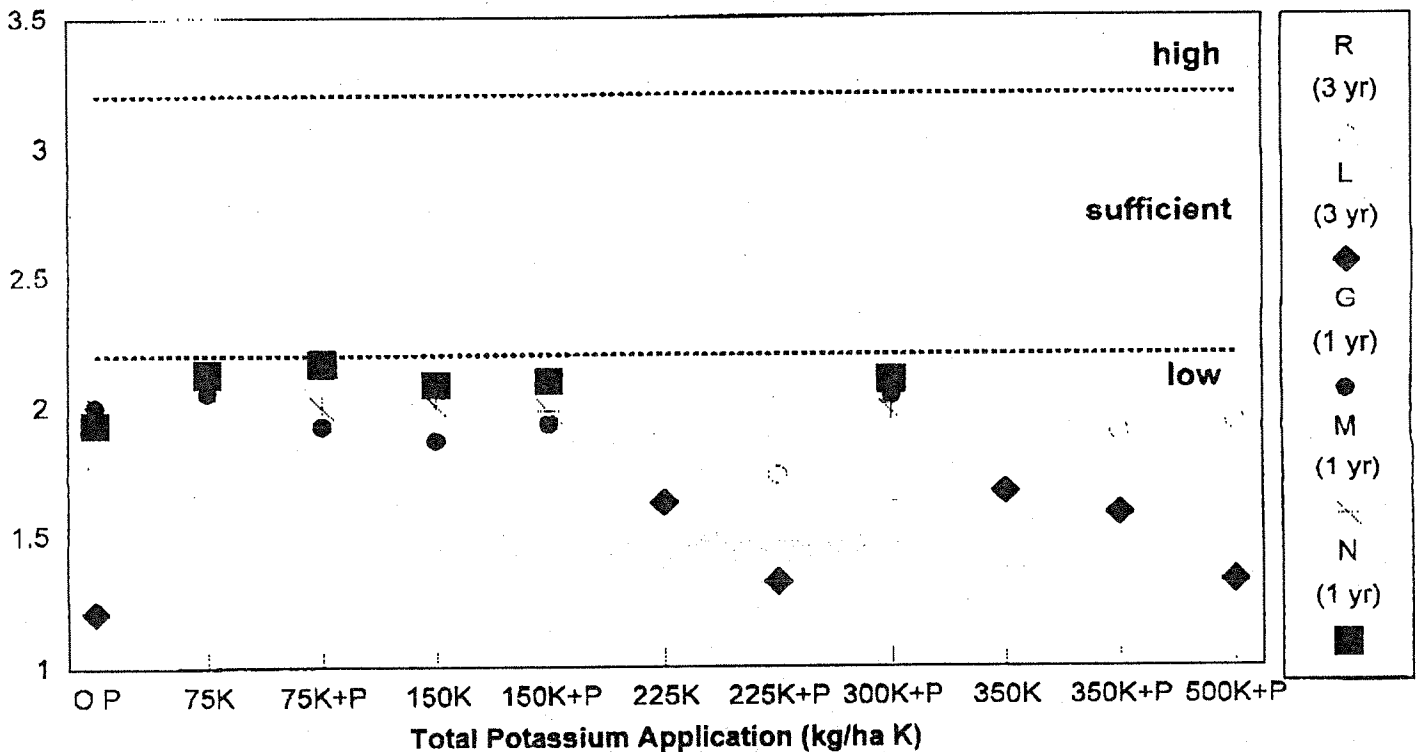
**1996 Alfalfa tissue potassium levels as compared to USA standards
(First Harvest)**

Tissue Potassium (%)

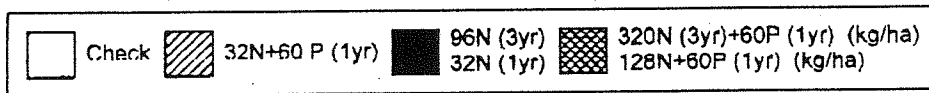
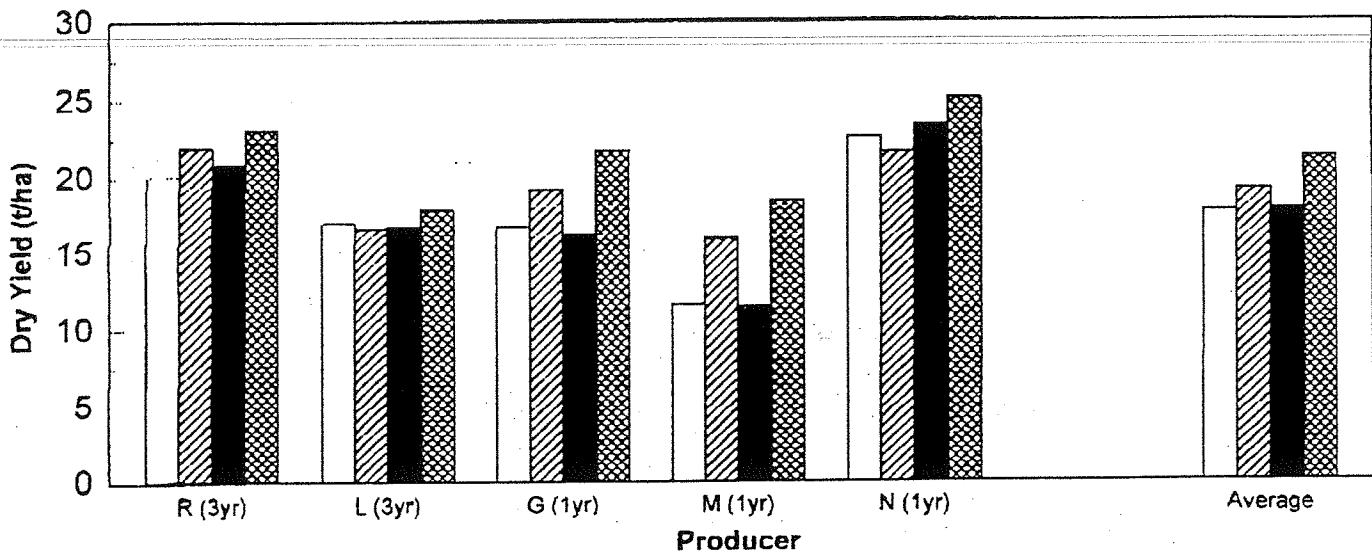


**1996 Alfalfa tissue potassium levels as compared to USA standards
(Second Harvest)**

Tissue Potassium (%)

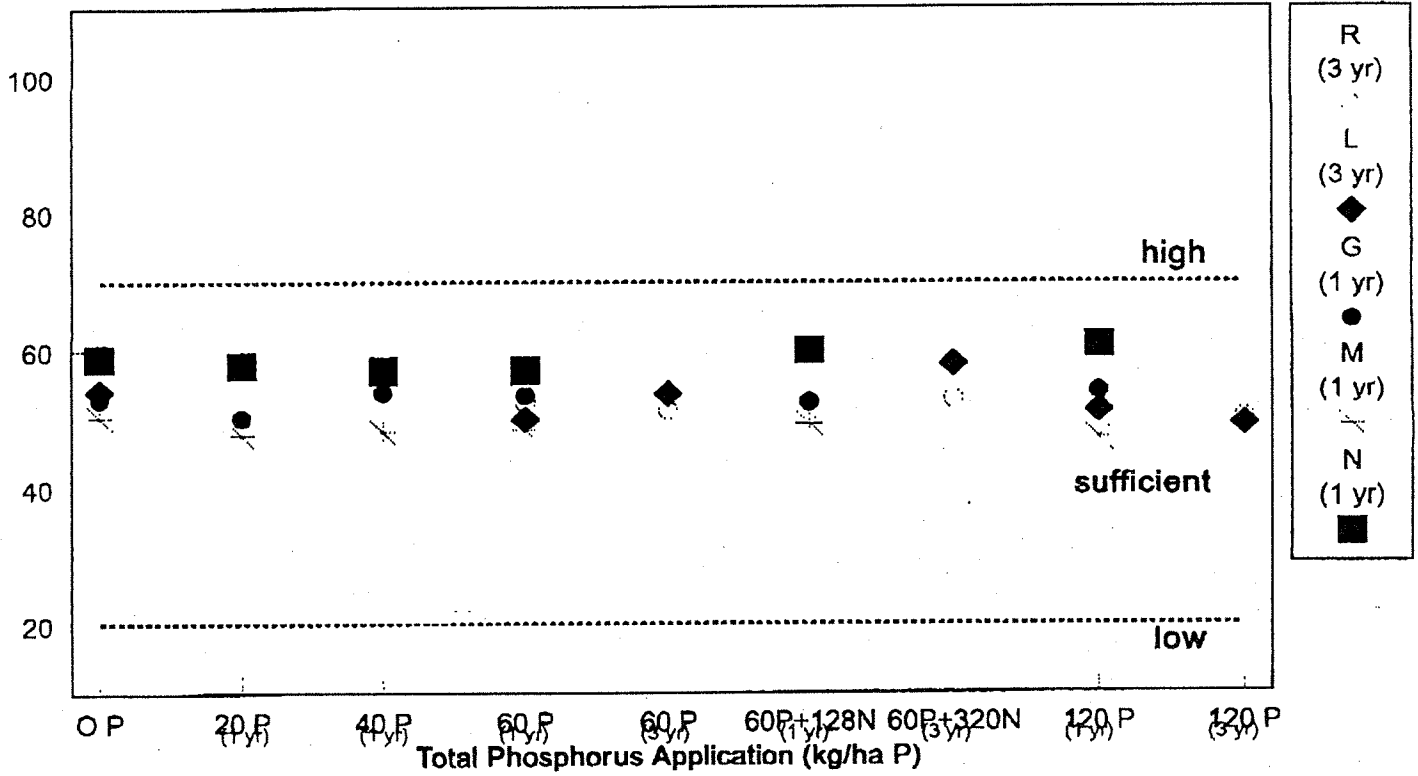


Nitrogen response of 1996 irrigated alfalfa (first harvest)



1996 Alfalfa tissue zinc levels as compared to USA standards
(First Harvest)

Tissue Zinc (%)



1996 Alfalfa tissue zinc levels as compared to USA standards
(Second Harvest)

Tissue Zinc (%)

