INTERPRETIVE SUMMARY - 1990

Project: MB-5 Leader: M. Entz

Enhancing the Role of Alfalfa as a Rotation Crop

This study is providing much needed information on the effects of cropping systems and fertilization on the potential for groundwater contamination. Initial results have shown less available water in the soil profile at freeze-up after one year of alfalfa than after wheat, barley or field peas. Analysis of available N, P, K and S throughout the profile will provide data on the deep extraction of plant nutrients and the possible benefits of including short-term alfalfa stands in rotations with annual crops. Alfalfa has a big demand for soil and fertilizer nutrients and could potentially be an important crop in reducing the impact of agriculture on the environment.

INFLUENCE OF CROP ROTATION AND FERTILIZATION ON SOIL NUTRIENT DISTRIBUTION IN MANITOBA

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UPDATE: This study was initiated in the spring of 1990 to determine the influence of time of alfalfa seed-down (1 to 10 years) and nitrogen fertilization on soil nutrient and water distribution. Soil samples were extracted from crop rotation experiments at Winnipeg and Portage la Prairie, Manitoba (crop rotations desribed in original proposal) in the fall of 1990. Soil nutrients under investigation include nitrate-nitrogen, total nitrogen (top 60 cm only), available phosphorous, potassium, and sulfur. The soil was sampled to a depth of 240 cm (in 30 cm increments). Samples are presently being analyzed, and the results should be available in Feb., 1991. Neutron access tubes were also installed in all plots in 1990. Available soil water at freeze-up was lower after one year of alfalfa than after wheat, barley or field pea. This study will provide much need information on the effects of cropping sytems and fertilization on the potential for groundwater contamination in the wetter regions of the Canadian prairies.

Table 1: Volumetric soil water (cm^3/cm^3) at freeze-up for 4 rotation crops. Winnipeg Crop Rotation Study

	Soil Depth Increment (cm)											
1990 Crop	0-10	10-30	30-50	50-70	70-90	90-110	110-130	130-150	150-170	170-190	190-210	210-230
1. Alfalfa (Long Term Stand)	23.7	24.1	25.4	28.6	29.1	31.8	33.2	37.6	41.9	42.8	41.4	41.1
2. Alfalfa (One cut then till)	17.8	23.7	26.1	30.4	31.8	35.8	39.6	41.0	-	-	-	-
3. Barley	23.6	25.2	21.8	28.6	29.9	31.8	36.6	41.4	-	-	-	-
4. Non-Crop	23.6	22.8	26.5	40.2	40.9	40.7	42.2	42.5	40.6	41.6	42.0	43.0
	*	NS	NS	**	**	**	**	**	NS	NS	NS	NS

*, ** Differences between 1990 rotation crops significant at 0.05 and 0.01 probability level, respectively.

depth of root activity after 1 year

1. alfalfa (1. term) 150 cm
2. alfalfa (one cut/till) 110-130 cm
3. barley 130 cm

Table 3: Available soil nutrients by soil depth in the Winnipeg crop rotation study, fall 1990.

Soil depth increment (cm)	Available nutrients (kg ha^{-1})								
	non-crop†			alfalfa			barley		
	N	P	K	N	P	K	N	P	K
0-30	21	170	2134	12	189	1775	31	134	1653
30-60	36	96	2198	5	128	1795	13	74	1693
60-90	47	91	2111	6	54	2009	8	28	1546
90-120	42	58	1924	19	43	1770	33	22	1564
120-150	41	24	1936	47	33	1641	40	19	1417
150-180	37	18	1782	44	23	1585	43	15	1356
180-210	39	17	1953	47	19	1628	48	13	1371
210-240	38	18	1640	42	18	1446	43	12	1423

† 1990 crop

Table 4. Available soil nutrients by soil depth in the Portage la Prairie crop rotation study, fall 1990.

Soil depth increment (cm)	Available nutrients (kg ha^{-1})								
	non-crop†			alfalfa			barley		
	N	P	K	N	P	K	N	P	K
0-30	47	32	1121	11	25	1066	21	41	1147
30-60	27	14	1014	8	19	987	12	23	1117
60-90	17	10	842	6	12	794	10	11	898
90-120	8	4	875	6	9	821	5	7	824
120-150	8	3	736	6	7	724	7	4	963
150-180	6	6	716	4	5	761	3	4	707
180-210	6	3	727	7	5	804	3	4	714
210-240	8	3	665	6	4	702	4	4	721

† 1990 crop