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7. **Progress to Date**

Provide a brief and concise overview of work conducted during the year on the project addressing the objectives that year. If any of the objectives were omitted or changed, provide reasons. If appropriate, cite preliminary results or conclusions. One page may be added to this section if required.

Changes to project

Team leader changed from A.M. Johnston to M.J. Clapperton. A.M. Johnston has moved from Lethbridge to Agriculture Canada Research Station in Melfort, Saskatchewan. However, he will continue to be involved in the evaluation of agronomic data from the project.

The variables initially proposed for the project included the historic fertilizer phosphorus application. In addition to this the influence of previous crop in the rotation is also going to be considered. The wheat in 1992 was grown on stubble of the previous corn, faba bean, and alfalfa crops.

Soil samples were collected in depth increments of 0-15, 15-30, and 30-60 cm, rather than the 0-10, 10-20, and 20-30 cm increments initially proposed. The reason for this change was to provide a soil sampling profile which more accurately characterized that used in related research projects at Lethbridge Research Station.

Nitrogen mineralization experiment will be conducted over a period of 8 weeks, rather than the 20 weeks previously suggested in the action plan. This decision reflects a change in the laboratory method used for soil quality evaluation being carried out in Lethbridge.

Progress to date

The 1992 growing season proved to be a difficult year for annual crops in southern Alberta. The open winter, with very low levels of overwinter and spring precipitation, resulted in fields requiring irrigation prior to seeding. This was followed by poor germination and emergence under these variable soil moisture conditions. Soil samples were collected on May 15 for determination of baseline nitrogen, phosphorus and potassium levels, as well as for N mineralization determination by incubation. The analysis of these samples will be carried out this winter.

Plant biomass samples were collected at six harvest dates: May 28, June 4, 11, 18 and 25, and July 13. These samples were collected to determine the pattern of dry matter production and tissue nitrogen, phosphorus and potassium concentration. The analysis for tissue nutrient content will be conducted this winter.

On August 2 the irrigated area of the Lethbridge Research Station was devastated by a hailstorm. Field estimates of hail damage ranged from 50-100% crop loss. As a result, we harvested our wheat crop (at the late milk stage) in the form of silage in an attempt to obtain the best estimate of total biomass production. These harvest samples will be processed for determination of nitrogen, phosphorus and potassium concentration this winter.

Analysis of dry matter yield and tiller response to manure and historic fertilizer phosphorus application are shown in Table 1. Historic P application had no effect on either dry matter or tiller production during the 1992 growing season. Manure application in the fall of 1991 increased dry matter yield by an average of 30%, and tiller number by 25%, over the unmanured portion of the field. The absence of a significant difference for dry matter yield or tiller number to manure appliation at the first two sampling dates reflects the small size of the plants at this time. However, once dry matter started to accumulate the influence of the additional nutrients supplied by the manure were recorded. A phosphorus by manure interaction was recorded for dry matter yield at harvest (Table 2). While historic phosphorus application increased dry matter yield by 23% over the unamended check (no P or manure), application of manure increased yields by 39%, with or without P addition. This response to recent manure application reflects the influence of manure in meeting crop nutrient requirements, both nitrogen and phosphorus. While no phosphorus fertilizer had been applied since 1986, some residual response can still be recorded in harvest dry matter yield.

Soil Microbiological Response

Individual wheat plants were collected on June 4, when plants were at the three fully expanded leaf stage and on July 4, when the majority of the plants had reached antheisis. Plants were individually cored from the soil to a depth of 15 cm. Wheat plants were collected from plots that had previously grown corn, faba beans, or alfalfa. Ten plants were sampled from each of the 0 and 100 kg/ha nitrogen treatments and the no added phosphorus and historical phosphorus treatments. Three of the plants from each treatment were subsampled and root samples were taken to determine the number of rhizosphere inhabiting bacteria from plate counts on nutrient agar. The shoots and the roots of all the plants were then separated, dried, and weighed. The roots of 5 randomly selected plants from each treatment and each plot were then subsampled, stained, and mounted on microscope slides for assessment of root length colonized by VAM.

The data from the plate counts that estimate the number of colony-forming bacteria from the rhizosphere of wheat grown in the different plots and under different fertilizer regimes is given in Table 3. An analysis of variance exposed a number of significant interactions which we presently trying to understand and illustrate. Briefly, in most cases there is an interaction between the number of rhizosphere organisms isolated from wheat and previously grown crop. At both sampling dates the greatest number of rhizosphere organisms were isolated from wheat grown in soil that had grown faba beans the previous year. There was also variation with respect ot N treatment which will require further analysis.

All the roots appear to be colonized by VAM fungi. However, we have not yet completed the assessments of VAM colonization. VAM spore counts will be performed during the winter. Greenhouse experiments to determine the rate of VAM colonization in soft white wheat grown in soils collected from the different plots are their sixth week. Both spore counts and rate of colonization are necessary to assess differences with respect to VAM inoculum density.

After preliminary analysis of the July 1992 shoot and root dry weight data (Table 4), it was obvious that there was a negative interaction between root growth, N, P, and previous alfalfa and faba bean crop history. More analysis is required to quantify and illustrate the too numerous interactions between plant biomass, crop history, N, and P treatments.

Table 1. Dry matter yield and tiller response of irrigated soft wheat to historic phosphorus and recent manure application at Lethbridge.

	Dry matter yield (kg/ha)		Tillers/meter square	
	P	**no P**	**P**	**no P**
May 28	37	36	284	296
Jun 4	117	105	175	186
Jun 11	343	317	535	497
Jun 18	595	597	636	601
Jun 25	1692	1795	721	686
Jul 13	4736	4389	808	744
Aug 10	8039	7418	770	711
	manure	**no manure**	**manure**	**no manure**
May 28	39	34	297	296
Jun 4	117	106	180	180
Jun 11	376	285*	570	462**
Jun 18	684	508*	679	558**
Jun 25	2144	1343**	784	624**
Jul 13	5048	4077**	845	705**
Aug 10	8615	6897**	798	690

*,** = significant difference between amended and unamended treatments at the 0.05 and 0.01 levels of probability, respectively.

7. Progress to Date (Continued)

Table 2. Irrigated soft wheat harvest dry matter yield response to historic P and recent manure application, Lethbridge.

	Dry matter yield ---- kg/ha -----
no P, no manure	6195
no P, manure	8642
P, no manure	7599
P and manure	8587

Table 3. The relationship between previous crop history, nitrogen treatment (100 kg/ha) and historical phosphorus application and the mean number of colony-forming bacteria on nutrient agar from the rhizosphere of irrigated soft white wheat (cfu/g dry root weight). Plants harvested in June and July 1992.

	No Nitrogen		Nitrogen	
Crop History	No P	P	No P	P
Corn				
June	238	128	506	848
July	$1.1x10^6$	$1.4x10^6$	$2.3x10^6$	$4.3x10^5$
Faba beans				
June	32	24	45	37
July	$1.7x10^5$	$5.1x10^5$	$1.2x10^5$	$1.2x10^6$
Alfalfa				
June	211	288	164	311
July	$3.3x10^5$	$3.2x10^5$	$2.7x10^5$	$2.5x10^5$

Table 4. The effects of nitrogen, residual phosphorus, and previous crop history on the mean shoot and root dry weight (g) of irrigated soft white wheat. Plants harvested July 1992.

	No Nitrogen				Nitrogen (100 kg/ha)			
	No P		P		No P		P	
	Shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root
Corn	8.19	0.322	7.78	0.208	5.89	0.382	5.92	0.374
Faba beans	6.36	0.262	8.28	0.270	5.19	0.158	6.94	0.171
Alfalfa	7.00	0.320	5.80	0.314	7.37	0.261	5.52	0.254