Wild Oat Nutrient Uptake and Release From Residue

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Key Words: weed control, nutrient competition, residue, wild oat

Introduction

Wild oat is a common weed in annual crops on the prairies. Continuous cropping of annual cereals like wheat may quickly lead to serious infestation of grassy weeds such as wild oats, quack grass, green foxtail, foxtail barley, and barnyard grass. This is also true in other regions of the world like Mongolia, where wheat monoculture predominates. The wild oat competes with the crop for water, nutrients and space. Post-emergence spraying, by allowing maximum germination to take place, is effective in controlling wild oats. Pre- or early post emergence treatment, by removing the competitive early- germinating wild oats, may reduce competitive effects and give a better yield response. Anecdotally, it is recommended that weeds be controlled early to reduce competitive effects. However, the effect of the age of the weed at the time of control on competition specifically for soil nutrients has received little attention. The research described in this paper addresses this gap by providing information on wild oat nitrogen and phosphorus uptake as a function of growth stage in the field.

Herbicides can be used to control wild oats in wheat crops at different growth stages. This results in death of wild oats and addition of the dead wild oat residue to the surface of soil at different growth stages of both the wild oat and the wheat crop. The age (growth stage) of the wild oat when herbicide is applied will determine the extent to which nutrient that would otherwise have been available for crop use has instead been utilized by the wild oat plant. This nutrient is tied up in wild oat biomass, but upon plant death by herbicide, there is potential for some of the nutrient in the dead wild oat residue to be made available to the crop. It is postulated that the growth stage of control, by affecting residue nutrient forms, concentrations, and composition (C:N; C:P ratios) following plant death, will affect the rate at which nitrogen and phosphorus in the residue may be released back into plant available forms following death of the wild oat plant. Therefore we conducted a controlled environment (growth chamber) experiment to determine the extent to which nutrient in dead wild oat residue is conserved and recycled for crop uptake.

Methodology and Results

A. Field study

In spring of 2008, a location of approximately 10 meters by 10 meters was selected on the Crop Development Center Kernen farm at the University of Saskatchewan in a field location with high wild oat population. The soil is mapped as a Dark Brown Chernozem (Sutherland association clay loam). In April of 2008 before wild oat growth commenced, 10 soil cores (0-30 cm, 30-60 cm) were taken diagonally from across area in a transect. Ten soil cores were taken again in the same manner in the same locations along the transect in September of 2008.

The basic soil properties and nutrient contents for the spring and fall soil cores are shown in Table 1. The soil moisture contents for the spring and fall sampling are shown in Table 2. Soil samples were air dried and analyzed for moisture, 0.01 M $CaCl_2$ extractable nitrate and sulfate, and Modified Kelowna (MK) extractable P and K. Extractable nutrient levels reveal a site with reasonably good N, P and K fertility. Soil profile nitrate concentrations and available water were lower in the fall following growth of the wild oats compared to the initial spring levels. This is a result of the wild oats utilizing soil available nitrogen and water for growth. The decrease in soil moisture in the root zone indicates significant water consumption by the wild oat plants. Soil extractable available P and K concentrations, as determined by modified Kelowna (MK) extraction, were less affected by the wild oat growth, possibly due to a high ability of the soil to buffer or replenish the labile pools of these nutrients.

Table 1. The basic soil properties and nutrient contents for the spring and fall soil cores.

Core	Depth cm	NO_3-N, ug/g spring	NO_3-N ug/g fall	MK-P ug/g spring	MK-P, ug/g fall	MK-K ug/g spring	MK-K ug/g fall
1	0-30	8.3	6.3	14.3	12.3	611	602
	30-60	4.4	3.2	4.4	6.8	463	442
2	0-30	5.9	6.2	6.0	27.5	507	758
	30-60	3.4	1.6	3.5	5.5	419	444
3	0-30	11.5	8.1	29.1	21.8	770	708
	30-60	4.0	2.6	4.6	6.3	467	481
4	0-30	8.9	5.7	20.1	20.9	731	655
	30-60	3.2	3.6	4.5	8.7	419	452
5	0-30	8.2	6.1	14.8	16.3	627	636
	30-60	3.2	1.7	3.4	5.7	408	396
6	0-30	9.3	7.9	11.4	15.3	613	603
	30-60	3.2	5.9	3.6	8.4	402	430
7	0-30	10.2	6.8	12.9	17.1	647	646
	30-60	3.1	3.0	4.4	7.9	385	465
8	0-30	10.8	4.4	12.6	15.7	668	625
	30-60	2.7	1.7	3.1	3.6	374	338
9	0-30	13.7	5.5	9.8	16.5	621	597
	30-60	5.5	1.9	3.5	5.7	389	419
10	0-30	17.6	6.5	14.2	13.8	679	610
	30-60	7.1	2.2	6.6	7.1	450	424

Table 2. Gravimetric soil moisture (% water by weight).

Core	Depth,cm	Moisture % spring	Moisture % fall	Reduction of moisture
1	0-30	37.9	27.7	10.2
	30-60	33.7	25.5	8.2
2	0-30	34.8	30.1	4.7
	30-60	27.6	24.5	3.1
3	0-30	43.4	25.6	17.9
	30-60	33.5	21.4	12.2
4	0-30	32.7	29.6	3.1
	30-60	33.5	25.7	7.7
5	0-30	34.5	32.4	2.1
	30-60	32.2	25.8	6.4
6	0-30	30.3	28.4	1.9
	30-60	28.9	23.4	5.5
7	0-30	29.3	30.0	-0.7
	30-60	26.8	19.4	7.5
8	0-30	29.4	27.9	1.5
	30-60	30.2	21.8	8.4
9	0-30	29.8	22.3	7.5
	30-60	29.1	19.1	10.0
10	0-30	27.63	25.36	2.27
	30-60	26.99	18.46	8.52

Beginning one week after emergence (1-2 leaf) of the wild oats, and every week thereafter for a total of ten weeks, a square meter sample of wild oats was obtained from the study location. A description follows:

Wild Oat Age (Weeks After Emergence)	Date	Plant Stage BBCH	Plant Stage Descriptive	Height(cm)	Number of Wild Oats per m2
1	2-Jun-08	13	3 leaf	5 - 15	1171
2	9-Jun-08	14,21	4leaf, 1 tiller	5 - 21	645
3	16-Jun-08	14,22	4leaf, 2 tiller	5 - 23	1665
4	23-Jun-08	15,22	5 leaf, 2 tiller	5 - 28	1504
5	2-Jul-08	16,53	6 leaf, heading	10 - 57	872
6	7-Jul-08	17,61	7 leaf, flowering	12 - 79	705
7	14-Jul-08	65	flowering	11 - 95	2355
8	21-Jul-08	73	milk	8 - 100	2286
9	28-Jul-08	79	milk to maturing	13.5 - 82.5	2478
10	5-Aug-08	86	mature	12.5 - 88	1350

The samples were dried and the dry weight (biomass) was recorded. Above ground biomass yields (kg/ha) are shown in Table 3. The greatest biomass was observed at eight weeks.

Table 3. Wild oat biomass yield and element ratios.

Wild Oat Age (Weeks After Emergence)	**Harvested Wild Oat Biomass Dry wt kg/ha**	**Residue C:N**	**Residue C:P**
1	294	15.3	156
2	356	12.8	191
3	1048	18.8	229
4	1496	13.6	159
5	2496	20.1	144
6	3854	21.0	190
7	5535	31.5	222
8	8853	35.5	378
9	5365	57.5	379
10	4941	78.9	441

Subsamples of the wild oat biomass collected from the field were ground and analyzed for C, N, P and K content using digest, and combustion analyzer. This data was used to calculate the C:N and C:P ratios shown in Table 3. Dry wild oat biomass weight multiplied by nutrient concentration in the biomass was used to calculate wild oat uptake of N, P and K as shown in Table 4.

Table 4. Uptake of nutrients by the wild oats (kg/ha).

Wild Oat Age (Weeks)	**Harvested Wild Oat Biomass Dry wt kg/ha**	Biomass N concentration %	**Wild Oat Uptake of N kgN/ha**	Biomass P concentration %	**Wild Oat Uptake of P kgP/ha**	Biomass K concentration %	**Wild Oat Uptake of K kgK/ha**
1	**294**	2.75	**8.1**	0.269	**0.8**	3.21	**9.4**
2	**356**	3.24	**11.5**	0.217	**0.8**	3.46	**12.3**
3	**1048**	2.20	**23.1**	0.180	**1.9**	2.98	**31.2**
4	**1496**	3.02	**45.2**	0.257	**3.9**	4.15	**62.1**
5	**2496**	2.13	**53.2**	0.298	**7.4**	3.34	**83.4**
6	**3854**	2.03	**78.2**	0.224	**8.6**	3.23	**124**
7	**5535**	1.38	**76.4**	0.196	**10.8**	2.25	**125**
8	**8853**	1.22	**108**	0.114	**10.1**	2.00	**177**
9	**5365**	0.74	**39.6**	0.112	**6.0**	1.46	**78.3**
10	**4941**	0.56	**27.7**	0.100	**4.9**	1.64	**81.0**

The peak uptake of nitrogen, phosphorus and potassium by wild oat occurred by weeks 7 and 8, with about 100 kg N / ha, 10 kg P / ha and 180 kg K / ha contained in the above ground biomass at this stage. The nutrient uptake by wild oat follows a pattern similar to that observed for cereal crops by Malhi et al (2006) on a Black Chernozem in east-central Saskatchewan. It was observed that maximum rate of uptake occurred at tillering to stem elongation, while maximum uptake occurred at flowering to medium milk stages, similar to that observed above for wild oat. Similarly, Malhi et al (2006) observed a peak of N uptake for several wheat, barley and oat varieties after about 7 to 8 weeks of growth with stabilization thereafter. A decline in uptake after about 8 weeks was noted in one year of their study. It seems likely that with wild oat, the reduction in nutrient contained in the above ground biomass after week 8 is due to seed shed. A similar peak amount of N uptake, P uptake and K uptake by wild oat was observed in this study compared to the wheat, barley and tame oats in the study by Malhi et al. Similar to the present study with wild oats, Malhi et al. also observed high K uptake by tame oats, with a peak of 140 kg K/ha one year, and over 200 kg K/ha the second year.

B. Phytotron (Growth Chamber) study

In the fall of 2008, approximately 200 kg of loam textured soil was obtained from a wheat stubble field 160 km south of Saskatoon in the Brown soil zone near Central Butte, SK. The soil is mapped as an Orthic Brown Chernozem (Ardill association loam). The soil was mixed and sub-sampled for nutrient analysis prior to initiation of the growth chamber experiment. The extractable nitrate content of this soil was 11.3 ug/g, ammonium was 5.8 ug/g, the MK extractable P was 8.2 ug/g, the extractable K was 587 ug K/g and the pH, % organic matter and EC (mS/cm) were 7.8, 4 and 0.2 respectively. Based on these results, the soil may be considered to have moderate N and P fertility and sufficient K fertility. Nine hundred grams of this soil was placed into each pot. Above-ground wild oat samples, harvested from the field study that were used for biomass yield and nutrient assessments in part A, were cut into pieces of approximately 3 cm in length using scissors to allow placement onto the surface of soil in the pots. A rate of wild oat residue equivalent to that produced and measured in the 2008 field trials at each of ten sampling periods was then added to the surface of the soil in the pots (Table 5). Therefore wild oat residue age, amount added and composition is the treatment evaluated in this study. Each treatment was replicated four times. The dry weight of the wild oat residue, the N concentration of the residue and the amount of nutrient added as residue (mg nutrient/pot) is shown in Table 5, and the C:N and C:P ratios of the residue are provided in Table 3. Each treatment was replicated 4 times plus 4 controls without residue equals a total of 44 pots used in the study.

Table 5. Nutrient added as residue (ug/pot).

Wild Oat Residue Age (Weeks)	Dry wt Wild Oat residue added g/pot	Residue Total N Concentration ug N / g	ug N added to each pot as residue	Residue Total P Concentration ug P / g	ug P added to each pot as residue
1	0.52	27500	14300	412	214
2	0.63	32400	20412	559	352
3	1.85	22000	40700	1273	2355
4	2.64	30200	79728	1968	5196
5	4.41	21300	93933	1983	8745
6	6.81	20300	138243	1559	10617
7	9.78	13800	134964	1455	14230
8	15.63	12200	190686	934	14598
9	9.47	7400	70078	802	7595
10	8.73	5600	48888	554	4836

Ten seeds of spring wheat (HRSW variety Prodigy) were planted in the amended soils on 19 of September, 2008. Six days later the pots were thinned to 6 wheat plants in each pot. The plants were watered daily to field capacity: (900 g soil +180 g water+60 g pot and saucer=1140 gr total weight & field capacity). The growth chamber temperature was +22^0 C day and 13 ^{0}C night. The wheat plants growing in the chamber are shown in Figure 1.

At the end of 6 week period, the above ground portions of the wheat were harvested, dried at 50 degrees C and weighed. The dry matter yield of the above ground wheat plants are shown in Figure 2.

Figure 1. Spring wheat growing in wild oat residue amended soil.

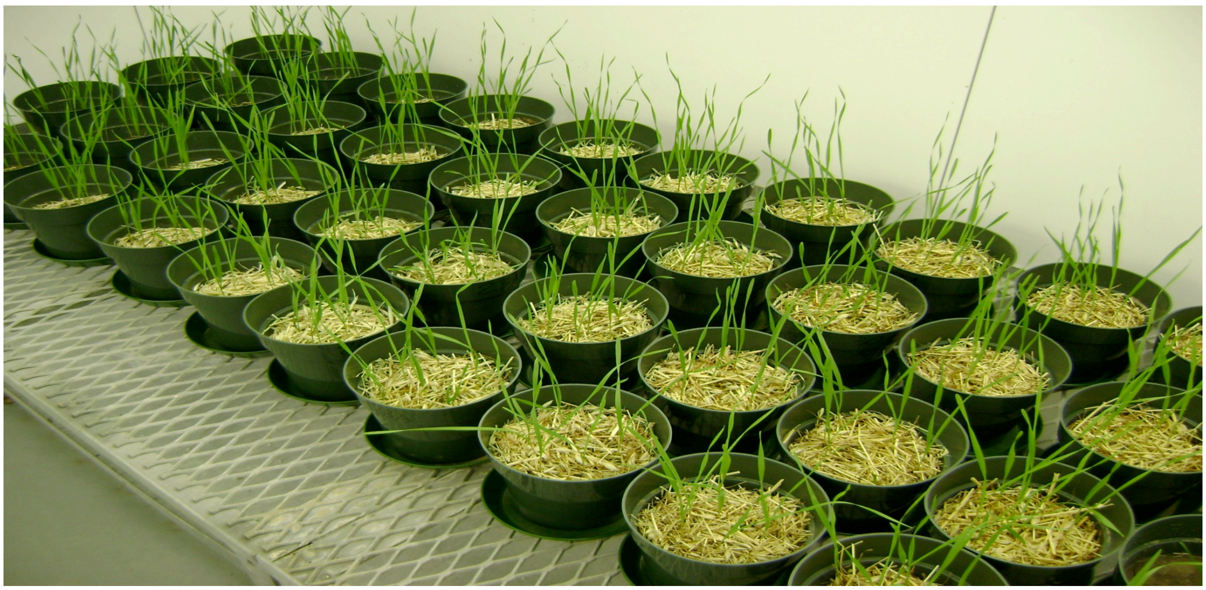


Figure 2. Wheat above ground biomass yield after six weeks growth in a controlled environment chamber with treatments of wild oat residue added that was harvested at different growth stages (weeks) in the field. LSD 0.05 = 0.097 g

It is noteworthy that the unamended control had the highest wheat biomass yield, with all treatments that received wild oat residue amendment having lower wheat yield, especially those that received wild oat residue harvested at an advanced growth stage. Lesser amounts of younger wild oat residue, as represented by 1 and 2 week old wild oat residue additions, had little effect on yield. This is likely due to less nitrogen immobilization, as the wild oat residue applied in the week 1 – 4 treatments had C:N ratios less than 20:1 (Table 3). Lower yields in the 7 to 10 week old wild oat residue treatments may be explained partly by reduced nutrient availability compared to the young wild oat residue. Despite relatively large amounts of N and P added with the old wild oat residue treatments (ex: weeks 5-8), the C:N and C:P ratios were greatly above the critical levels of C:N and C:P that are considered to represent the boundaries for net mineralization (C:N<20;C:P<200) and instead favor immobilization (C:N>30; C:P>300) of available nutrient (Havlin et al, 2005).

The above ground wheat biomass that was harvested from each pot was digested and analyzed for nitrogen and phosphorus concentration. The N and P concentration in the wheat tissue harvested multiplied by the dry matter yield was used to calculate N and P uptake by the wheat. The apparent percentage recovery of nutrient added in the wild oat residue by the wheat plants (above ground biomass) in the pot was calculated as follows:

$$\frac{\text{Nutrient uptake by wheat in treatment (week)} - \text{Nutrient uptake by wheat in control}}{\text{Nutrient added as residue}} \times 100$$

This data is shown in Tables 6 and 7.

Table 6. The nutrient content and uptake of nutrient by the wheat plants.

LSD 0.05 = 0.098 g/pot for wheat dry matter yield; 684 ugN/g for total N conc., 165 ugP/g for total P conc. 337 ug N/pot for N uptake, 123 ug P/pot for P uptake.

Wild Oat Residue Age (Weeks)	Wheat dry matter wt (g/pot)	Total N concentration in wheat dry matter ugN/g	N uptake by wheat ug N / pot	Total P Concentration in wheat dry matter ugP/g	P uptake by wheat ug P / pot
1	0.75	3934	2960	600	451
2	0.76	4296	3244	513	387
3	0.73	3950	2874	558	406
4	0.73	5290	3875	775	568
5	0.68	3880	2619	1005	678
6	0.65	4470	2916	1135	740
7	0.67	4019	2672	800	532
8	0.72	3587	2564	511	366
9	0.66	2937	1945	349	231
10	0.73	2772	2031	468	343
control	0.79	2677	2122	341	270

A significant enhancement in N uptake by wheat with added wild oat residue treatments up to seven weeks of age indicates that the residue is having a positive effect on N availability, especially the young wild oat residue (Table 6). The N uptake by wheat was greatest at week 4. This is consistent with the narrow C:N ratios of the wild oat residues (less than 30:1) up to week 7, after which they widen appreciably. A similar trend is observed with phosphorus, with enhanced uptake shown in the younger residue age treatments in particular. These effects are evident in the apparent percentage recoveries calculated and shown in Table 7. The greatest apparent % recoveries by the wheat of the nitrogen and phosphorus in wild oat residue are observed in the youngest residues, with the narrowest C:N and C:P ratios. At best, only five to six percent of the wild oat residue N was apparently recovered by the wheat plants. This indicates that N tied up in wild oat biomass is unlikely to make a great contribution to early wheat N nutrition following herbicide application, even when an early application is made. For delayed wild oat kill, it seems unlikely that much, if any, of the N contained in the residue would benefit the crop that season. Considering that 1) the competition has already occurred in the early growth stages in the field, 2) that any release of N later in the season would mainly go to protein rather than yield, and 3) that for old residues of high C:N, there is limited N made available even when the residues are all added at the start of the growth period as in the current study, suggests that the N tied up in the dead above ground wild oat residue will be of little value to the crop that season.

It is important to note that any contribution from the roots of the dead wild oat plant in the field is not considered in this study, nor is recovery of nutrient from the wild oat residue that is present in the roots of the wheat plants grown in the growth chamber.

For phosphorus, the uptake by wheat was highest at weeks 5 and 6, due to the relatively low C:P ratio and the large amount of P added as residue. The apparent percent recovery by wheat of the small amount of phosphorus contained in the wild oat residue was quite high for the youngest wild oat residue (one and two weeks). Recovery of residue K was also greatest from young residue (data not shown), with a maximum of about 10% recovery in the young residue. Similar to N and K, for P these results suggest that very early control of wild oat could benefit crop P nutrition. This benefit may come not only by reducing uptake competition, as half of the total nutrient uptake by wild oat has taken place by weeks 4 – 6, but also in promoting the ability of the P contained in the dead wild oat to be recycled back into forms available for crop use. A low C:P ratio in young residue and perhaps a greater proportion of P in soluble forms that can be leached from the residue may explain the high recovery with one week old residue and which quickly decreases to less than one percent recovery with old (>7weeks) wild oat residue.

Table 7. Recovery of N, P from wild oat residue by wheat grown in pots.

Wild Oat Residue Age (Weeks)	**N uptake by wheat ug N / pot**	**ug N added to each pot as wild oat residue**	**Apparent % recovery of residue N by wheat plant**	**Wheat P uptake ug P/pot**	**ug P added to each pot as wild oat residue**	**Apparent % recovery of residue P by wheat plant**
1	2960	14300	5.9	451	214	84.6
2	3244	20412	5.5	387	352	33.2
3	2874	40700	1.8	406	2355	5.8
4	3875	79728	2.2	568	5196	5.7
5	2619	93933	0.5	678	8745	4.7
6	2916	138243	0.6	740	10617	4.4
7	2672	134964	0.4	532	14230	1.8
8	2564	190686	0.2	366	14598	0.7
9	1945	70078	- 0.3	231	7595	-0.5
10	2031	48888	- 0.2	343	4836	1.5
Control	2122			270		

Support for the hypothesis that a significant proportion of P contained in young wild oat residue may be released is found in Table 8. There was a large decrease in the P contained in the residue at the end of the 6 week growth chamber experiment compared to what was present at the start. In the case of P, the soluble inorganic or organic P already present in the residue or produced by microbial decomposition would be leached out into the mineral soil beneath where it may undergo further transformations. The young residue with a narrow C:P ratio had the highest proportion of the total residue (i.e one week old 95% of P added released) released. The proportion released decreased with residue age, while the total amount increased up to week 6 or 7.

Table 8. Net release or loss of P from residue over five weeks.

Wild Oat Residue Age (Weeks)	Dry wt residue g/pot at start	P added to each pot as residue ug/pot	Dry weight residue g/pot at end	P left as residue at end ug/pot	P released or lost from residue ug/pot
1	0.52	1400	0.15	60	1340
2	0.63	1360	0.2	110	1250
3	1.85	3330	1.36	1730	1600
4	2.64	6790	2.14	4210	2580
5	4.41	13120	3.79	7520	5600
6	6.81	15270	5.67	8840	6430
7	9.78	19160	8.03	11690	7470
8	15.63	17880	13.4	12520	5360
9	9.47	10580	8.67	6960	3620
10	8.73	8740	8.33	4620	4120

For nitrogen in residue, there was also a significant proportion of residue N that was added initially that was not present in the residue on the soil surface at the end, and therefore was presumably released or lost (Table 9). With N there are additional potential gaseous loss mechanisms that do not exist for phosphorus, including ammonia volatilization and denitrification to nitrous oxide and dinitrogen gas. The proportion of added N released or lost followed a pattern similar to P, with the greatest proportion released or lost from the young residue. This may be explained by narrower C:N ratio and therefore greater net N mineralization, as well as more soluble N in the young wild oat residue.

Table 9. Net release or loss of N from residue over five weeks.

Wild Oat Residue Age (Weeks)	Dry wt residue g/pot at start	N added to each pot as residue ug/pot	Dry wt residue g/pot at end	N left as residue at end ug/pot	N released or lost from residue ug/pot
1	0.52	14300	0.15	2000	12300
2	0.63	20412	0.2	2400	18012
3	1.85	40700	1.36	21000	19700
4	2.64	79728	2.14	49500	30228
5	4.41	93933	3.79	44300	49633
6	6.81	138243	5.67	49700	88543
7	9.78	134964	8.03	54300	80664
8	15.63	190686	13.4	78400	112286
9	9.47	70078	8.67	25100	44978
10	8.73	48888	8.33	17900	30988

The soil in the pots at the end of the 6 week growth period after wheat harvest all had very low levels of available nitrogen (NO_3-N + NH_4-N) and extractable P (Table 10). The nitrate concentrations were not significantly different among treatments (p=0.05). There was a slight trend towards the young residue ie week 1 having slightly higher residual ammonium than the other residue treatments, and the extractable P was higher than the control. These results support the findings with wheat N and P uptake, that the older residues contribute little to supplies of plant available N in the short term.

Table 10. Nutrient content of soil in phytotron study after wheat growth.

Wild Oat Residue Age (Weeks)	**NO_3-N ug/g**	**NH_4-N ug/g**	**Extractable P ug/g**	**Extractable K ug/g**
1	1.1	6.0	4.5	282
2	1.2	3.1	3.7	283
3	1.1	4.5	3.3	298
4	1.3	4.4	2.2	333
5	1.1	4.4	2.5	322
6	1.2	4.6	2.5	346
7	1.2	4.7	2.8	341
8	1.3	5.5	2.9	359
9	1.3	6.2	2.9	308
10	1.2	6.2	2.7	315
Control	1.2	7.4	2.9	251

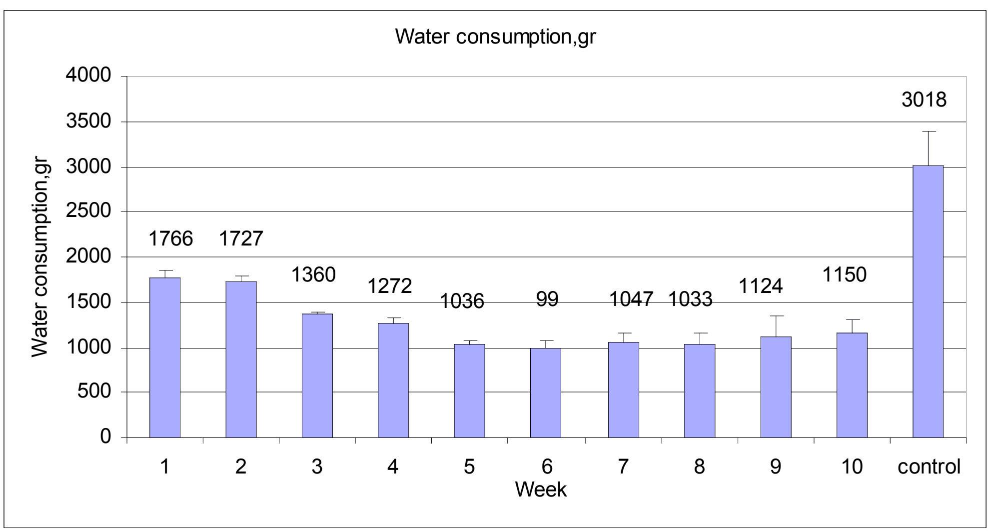
A nitrogen balance was constructed for each of the treatments (Table 11). The balance calculations assume that nitrogen is neither gained in or lost from the soil organic matter (humus) or microbial biomass in the mineral soil. The balance also does not account for nitrogen contained in the wheat roots and therefore likely overestimates the nitrogen not accounted for and/or apparently lost from the system. It is noteworthy that there is a significant amount of nitrogen that was apparently lost in these treatments. Given the high moisture content of the soil, especially in the old residue treatments where addition rates were high and the residues reduced evaporation (Figure 3), it is conceivable that some of the nitrogen may have been lost in gaseous forms from denitrification in anaerobic microsites.

Table 11. Nitrogen balance.

Wild Oat Residue Age (Weeks)	A Initial soil inorganic (NH4+NO3) N, ugN/pot	B Nitrogen added as wild oat residue ugN/pot	C Wheat N uptake in biomass ugN/pot	D Nitrogen balance (A+B-C)	E Final inorganic N left in soil, ugN/pot	F Nitrogen not accounted for (D-E) ugN/pot	G Nitrogen left in residue ugN/pot	H Nitrogen apparently lost (F-G) ugN/pot
1	15426	14300	2960	26766	6417	20349	2000	18349
2	15426	20412	3244	32594	3879	28715	2400	26315
3	15426	40700	2874	53252	5013	48239	21000	27239
4	15426	79728	3875	91279	5103	86176	49500	36676
5	15426	93933	2619	106740	4950	101790	44300	57490
6	15426	138243	2916	150753	5130	145623	49700	95923
7	15426	134964	2672	147718	5265	142453	54300	88153
8	15426	190686	2565	203547	6075	197472	78400	119072
9	15426	70078	1945	83559	6714	76845	25100	51745
10	15426	48888	2031	62283	6714	55569	17900	37669
control	15426		2122	13304	7758	5546		5546

Water consumption (evapotranspiration) in the treatments was also measured throughout the experiment (Figure 3). The highest water consumption was observed in the control (no residue treatment). Treatments with higher amounts of residue added such as treatments 6, 7, 8, 9 and 10 had the least water consumption. The effect of the residue addition on reducing water loss by evaporation was therefore clearly evident.

FIGURE 3. Water consumption (evapotranspiration)



Conclusions

• About one half of the total uptake of soil nitrogen, phosphorus and potassium by wild oat plants has occurred in the first 4 weeks after emergence. The patterns and amounts of nutrient uptake by wild oat are similar to that observed for annual cereal crops (wheat, barley, tame oats) in Saskatchewan.
• The proportion of nitrogen, phosphorus and potassium in dead above-ground wild oat residue that is released back and made available in the short-term for uptake by a crop decreases with wild oat age. The highest proportion of nutrient in the wild oat residue was recovered by wheat from the youngest wild oat residue (1 week old), with apparent recoveries of 6% of residue N and 85% of residue P in the above ground wheat biomass. Recoveries of residue nutrient decreased to less than 1% with old wild oat residue.

Implications

• These findings indicate that time of peak wild oat nutrient demand coincides with nutrient demand by cereal crops, and that early wild oat control will significantly reduce competition for nutrient with the cereal crop.
• Some nitrogen and phosphorus is liberated and made available for crop uptake from above ground dead wild oat residue. However, the release of nutrient from residue, particularly older residue from a delayed kill, is likely to result in little benefit to the crop as only a small proportion would be released and it would come too late for yield recovery. Early wild oat control will promote more rapid recycling of N and P contained in the residue back into available forms for crop use.

Acknowledgements

The support of Arysta LifeSciences Canada is gratefully acknowledged. The assistance of Gerry Stuber, Cory Fatteicher and Tom King in field and lab is much appreciated.

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