Cereals for Emergency Forage Production

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Introduction

When winterkill reduces the acreage of perennial forage available for harvest, cereal crops can be used as an emergency source of forage. They can be grazed, but are more commonly preserved as silage, either in chopped form or in round bales. When deciding on an emergency forage crop, producers need to decide on the species of cereal to grow, whether to seed it pure or in mixture with field peas, and when the crop should be cut to provide the best combination of yield and quality for the livestock to be fed. A study addressing these questions was conducted at New Liskeard and Emo research stations in 1995 and 1996. The key findings related to forage yield and quality are reported in this update.

Methods

The treatments, seeding rates and cutting information are shown in Table 1. Two cereal species, oats and barley were compared in pure stand and in mixture with field peas. Four harvest stages were examined: late boot stage, heads emerged stage, milk stage, and soft dough stage. Forage yield, crude protein, ADF, and NDF were measured and total digestible nutrients (TDN) were estimated based on the ADF values.

Table 1. Emergency forage treatments evaluated at New Liskeard and Emo in 1995 and 1996.

A) Cereal Species 1) Oats - AC Rigodon 2) Barley - OAC Kippen	Both cereals sown at 350 seeds/m^2 pure and 200 seeds/m^2 in mixture Tests sown in NL June 3/95 & May 17/96; in Emo May 29/95 & May 8/96
B) Peas 1) With Peas - Trapper 2) Without Peas - none	Sown at 100 kg/ha, mixed with cereal before seeding
C) Harvest Maturity 1) Late Boot 2) Heads Emerged 3) Milk 4) Soft Dough	harvested in NL July 21/95 and July 8/96; in Emo July 13/95 and July 3/96 harvested in NL July 26/95 and July 12/96; in Emo July 20/95 and July10/96 harvested in NL Aug.08/95 and July 23/96; in Emo July 29/95 and July25/96 harvested in NL Aug.17/95 and Aug.07/96; in Emo Aug.11/95 and Aug.02/96

Note: all treatments received 70 kg/ha actual N preplant; P and K applied based on soil test.

Results

i) Forage Yield

Averaged over all other treatments, barley tended to yield equal to or greater than oats (Table 2). The exception to this was in 1995 at New Liskeard. In that year, seeding was delayed by a very wet spring and the seedbed was relatively poor, which seemed to favour the oats. In this study, pure cereals consistently outyielded cereal-pea mixtures. This is similar to other data from New Liskeard, but limited data from Kemptville and Elora have shown mixtures to yield equal to (or sometimes greater than) pure stands. It seems that in moist, cool areas where cereals thrive, the presence of peas hinders cereal growth. As expected, the most significant effect on forage yield was the stage of maturity at harvest. From the late boot stage to the soft dough stage, dry matter yield increased from 70% to 140%. Absolute maximum yields were as high as 8735 kg/ha. Absolute maximum yields occurred in pure oats at the soft dough stage. Interactions between main effects occurred primarily in the 1996 Emo data, but the interactions did not substantially change the interpretation of the main effect results.

Table 2. Dry matter yield of emergency forage crops at New Liskeard and Emo in 1995 and 1996.

Treatment	NL - 1995	NL - 1996	Emo - 1995	Emo - 1996
A) Cereal Species				
Oats	5720	6058	4173	3808
Barley	5328	6349	4221	5539
	*	*	NS	*
B) Peas				
With	5148	6017	3881	4280
Without	5899	6389	4513	5067
	*	*	***	*
C) Harvest Maturity				
Late Boot	3238	4606	3429	3189
Heads Emerged	4569	5618	3041	4287
Milk	6482	6630	4153	5420
Soft Dough	7806	7958	6165	5799
	***	***	***	***
Absolute Max. Yield	8735	8272	6784	6297
Interactions				
Species x Peas	NS	NS	NS	NS
Species x Maturity	NS	NS	*	***
Peas x Maturity	NS	NS	NS	**
Species x Peas x Maturity	**	NS	NS	*
Test Average	5524	6203	4197	4673
C.V. (%)	14.3	13.8	14.0	19.6

*,**,*** significant at the 0.05, 0.01, and 0.001 levels respectively, NS not significant

ii) Forage Quality

Barley had higher crude protein in two of the four site-years, with no difference between barley and oats in the other two (Table 3). Cereal-pea mixtures consistently increased crude protein as compared to pure cereals. On average, crude protein was increased by 0.7 to 3.4 percentage units. This effect seems to be very consistent, having been observed in several other trials in northern Ontario. However, this effect is not likely to be seen at low pea seeding rates (perhaps less than 50% of mixture by weight). Crude protein content drops dramatically as the cereals mature. In our studies, protein levels were almost cut in half between the late boot and soft dough stages. While the protein content was greater in mixtures, the drop in protein with maturity was only slightly less in mixtures as compared to pure cereals (data not shown). The absolute maximum protein ranged from 15% to 22% over sites and years and always occurred in the mixtures harvested at the late boot stage. Absolute minimum crude protein levels ranged from 6.5% to 8% at the soft dough harvest stage.

Total digestible nutrient (TDN) levels showed little difference between oats and barley (Table 4). Similarly, pure cereals and mixtures did not vary in TDN content. Although not shown here, mixtures consistently had lower neutral detergent fibre (NDF) levels than pure cereals, which agrees with other studies. There was remarkably little reduction in TDN levels with increasing maturity of the cereal. Overall, TDN dropped by only 4 to 6 percentage units from the late boot to the soft dough stage. There was a consistent species by maturity interaction (data not shown) which revealed higher TDN levels at the milk stage with barley as compared to oats, but no difference in TDN at the soft dough stage. Absolute maximum TDN levels were near 67%, while absolute minimum TDN levels ranged from 58% to 60%. The relatively small decline in TDN with advancing cereal maturity is quite significant as it indicates that energy yield per acre should continue to increase up to the soft dough stage.

Table 3. Crude protein of emergency forage crops at New Liskeard and Emo in 1995 and 1996.

Treatment	NL - 1995	NL - 1996	Emo - 1995	Emo - 1996
A) Cereal Species				
Oats	13.8	12.3	10.6	11.9
Barley	15.4	11.2	11.5	11.0
	*	NS	**	NS
B) Peas				
With	16.3	12.6	11.4	12.5
Without	12.9	10.8	10.7	10.4
	***	**	*	**
C) Harvest Maturity				
Late Boot	19.2	15.7	13.3	14.5
Heads Emerged	15.6	13.4	12.7	12.0
Milk	13.2	9.9	10.7	10.9
Soft Dough	10.5	7.9	7.3	8.4
	***	***	***	***
Absolute Max. CP	22.0	17.4	14.6	16.2
Absolute Min. CP	8.2	6.6	6.4	7.6
Interactions				
Species x Peas	*	NS	NS	NS
Species x Maturity	NS	NS	***	NS
Peas x Maturity	NS	NS	NS	NS
Species x Peas x Maturity	NS	NS	NS	NS
Test Average	14.6	11.8	11.0	11.5
C.V. (%)	10.7	11.7	12.3	13.3

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Interpretation

Cereal crops can be used as an emergency source of forage. Little difference in yield should be expected between oats and barley, except where poor seedbed conditions are present or the site is clearly better suited to oats (ie: poorly drained, low pH). Cereal-pea mixtures generally yield less than pure cereals in cooler areas, but there is evidence of the opposite trend in southern areas. Forage yield can be doubled by delaying harvest from the late boot stage to the soft dough stage of cereal development. Some concerns with palatability have been expressed when mature cereals are made into round bale silage. This is less of a concern with chopped silage. For animals at maintenance (dry beef cows), the palatability issue should not be of great concern.

Forage crude protein is almost always increased by 2 to 4 percentage units in cereal-pea mixtures as compared to pure cereals, but a high seeding rate of peas (100 kg/ha in this trial) is necessary. From this and other studies, we recommend at least 50% by weight of the mixture be peas and a minimum of 50 kg/ha peas be sown. At lower rates, crude protein may not be improved in mixtures. Crude protein declines dramatically as cereals mature. Where high crude protein levels are necessary, cereal forage would have to be harvested at least by the heads emerged stage of development, preferably with peas added. Adding peas at the rates suggested here will approximately double seed costs over pure cereals. Producers should consider the end use of the forage and check seed prices before deciding on whether to plant pure stands or mixtures.

TDN levels are not affected by cereal species or addition of peas. Increasing maturity has a relatively minor effect on TDN (energy) levels. While the stem is maturing, more grain is being formed which tends to moderate the drop in TDN. Very high energy silage can be obtained by cutting the cereals 15 to 20 cm above the ground. In this study, a harvest height of about 6 to 8 cm was used. If energy per acre is the most

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