Hemp, Tropical Corn and Other Alternative Annual Forages: Opportunities for Beef Cattle in Five Easy Lessons!

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Improving Forage Options

Following the forage shortage and high prices seen in 2012 OMAF staff and University of Guelph researchers are investigating more forage opportunities for Ontario livestock producers. One direction within this area was the repurposing and characterization of a number of existing and novel crops for the purpose of stored forage. Of those investigated in 2013, each shows some potential for this purpose. Lesson #1: If it can be cultivated (if it grows on a farm) there is a good chance cattle can eat it!

The annual crops investigated included hemp, which is currently grown for biomass and fibre, specialty biofuel and sweetener cultivars being trialed (high-sugar Millet and high-sugar Sorghum) and a two specialty long-season Tropical Corn varieties developed by Dr. Fred Below at the University of Illinois. This Tropical Corn was tested in each its biofuel and forage variety variants. Many point out that corn is a tropical plant, so ask ‘what is tropical corn?’ The key here is that Tropical Corn has not been bred for photoperiod adaptation and is exceptionally long-seasoned. The millet, sorghum and corn variety were grown at Canada’s Outdoor Farm Show location (Woodstock) and the hemp on private plots near Kemptville. It should be noted that plots were also seeded near Elora but due to late seeding and lack of timely weed control these were abandoned. Lesson #2: planting dates and weed control are key to success with annual forages. Agronomics matter!

Figure 1 shows the trend in percent total digestible nutrient (TDN) in these various crops. As evident, the crops that will develop grain (e.g. sorghum, millet) have different TDN curves than those that would not, such as perennial grasses, which show a classic and degrading feed quality response to maturity. NDF data was not included in the graph but was as follows:

- **Hemp:** NDF ranged from 40 to 59% in three repeated samplings, but not in progression.
- **Sweet Millet:** NDF ranged from 55 to 65% in repeated samplings with a general upward trend as it matured
- **Sweet Sorghum:** NDF ranged from 46 to 60% in repeated samplings, but no real trend associated with maturity
- **Tropical Corn:** NDF ranged from 56 to 62% in three repeated samplings, and also not in any progression.

As a reference, the TDN and NDF of Ontario wheat straw which was included in many beef, dairy and sheep rations in 2012 and 2013 is often seen at about 45 and 75% respectively. Lesson #3: Many existing and emerging crops have greater feed value then we give them credit for!
Figure 1. Total digestible nutrient (TDN) content of the 4 forages in the 2013 growing year. These species are Hemp, Sweet Millet, Sweet Sorghum, and Tropical Corn. As a reference, the baseline for the graph is 52% well above the 45% TDN which is typical of Ontario wheat straw when used in a ration. The lowest TDN observed which was Millet at 57% is equal to many first cut hays in Ontario.

Potential Species for Ontario

The remainder of this article contains information on the species represented by this sampling and discussed thus far. In the future simple palatability and intake checks may need to be performed to match the chemical analysis as seen in the 2013 year plots. **Lesson #4: Other jurisdictions already have information on the forage potential of crops which we don’t yet realize can be forages!**

Hemp

High quality hemp is cultivated throughout Canada. It is possible to cut hemp for silage to mix with corn silage (Mosjidis et al, 2012), and by mixing hemp in with corn silage, cows had improved weight gains. Hemp is common crop in the Netherlands as it is an alternative to straw as it is low in dust and is very absorbent, taking on up 4 to 5 times its weight in moisture (Small & Marcus, 2002; Agrisorb, 2010). It has been suggested there that cows fed hemp give a little more milk and seem to be really healthy (Dutch Daily News, 2011). There is some concern due to the fact that hemp does contain small levels of THC, the psychoactive drug component found in cannabis, and one study in Europe has discovered that the THC can be transferred into milk (European Food Safety Authority, 2011). These levels of THC seem to
be lower than the maximum tolerance, but research is limited. When considering hemp, it is important to realize that all hemp growers need to obtain a licence from the government of Canada.

**Sweet Pearl Millet**
Sweet pearl millet is commonly used as a biofuel crop, and the residues produced are often used in livestock feed (LeBlanc et al., 2012). In addition to sweet pearl millet regular (RMR) and brown midrib (BMR) pearl millet varieties are also available. Although BMR shows improved quality through increased digestibility, BMR yield is lower which offsets value so that both BMR and RMR are approximately equal in overall value (Hassanat et al., 2006) per unit area grown. Sweet millet differs from regular pearl millet in that the plant has longer and narrower leaves, profuse nodal tillering with asynchronous maturity, short thin spikes, and very small grains. Sweet millet has been found to have twice the amount of soluble sugar in comparison to regular pearl millet varieties (Appa Rao et al., 1982), and hence its name. In the past millet has been grown for forage and grain in areas of Africa, Asia, and the Southern US. However and in the 1990’s the hybrid Pearl millet was developed for use in the sandy soils of Eastern Canada (OMAF, 1998).

**Sweet Sorghum**
Sweet sorghum is a very efficient crop to grow in areas prone to droughts due to its water use efficiency and enlarged root system. Under drought stress, sorghum is able to maintain similar physiological activity to well watered sorghum, unlike drought stressed corn. Total biomass production in sorghum under drought stress is reduced by about 40% compared to an almost 50% reduction in drought stressed corn (Zegada-lizarazu et al., 2012). Di Marco et al (2009) compared sweet sorghum with both brown mid-rib (BMR) and grain type sorghum varieties. The study found that lignin content was lower in the sweet sorghum than both of the other varieties; and consequently, sweet sorghum was found to have higher digestibility than either BMR or grain varieties.
Figure 2. Ron Lackey (OMAF) with sweet sorghum stalks grown at the Canada’s Outdoor Farm Show site as photographed in October of 2013. These stalks were being processed into mini-silos to determine potential on a pilot level.

Sweet sorghum silage has been shown to be a suitable substitute for corn silage when feeding growing calves. In a study by Aclewakun et al (1989) Herford and Angus calves were fed either sorghum silage, corn silage, of fescue hay and the feeds were determined to be comparable in terms of dry matter intake, crude protein, and gross energy. Sweet sorghum silage may also be a suitable substitute for alfalfa silage when feeding lactating cows. Amer et al. (2012) demonstrated that although milk yield was lower for sweet sorghum fed cows, dry matter intake, energy corrected milk yield, and feed efficiency were similar between the two feeds.

Tropical Corn
There is currently very little knowledge about growing tropical corn in the mid to northern USA and Southern Ontario. However, Hoffman et al (2001) did produce tropical corn silage at 45°N latitude and found that tropical corn grown in Wisconsin was earless and did not produce any grain. The earless corn silage was included at 50% of DM in the diet fed to Holsteins heifers and did not appear to have any
significant effect. Having less grain content than conventional or temperate corn hybrids, Tropical Corn may have applications in things like beef cow rations as it has the massive yields of corn silage, but at much lower or zero grain content.

Figure 3. Ron showing forage variety Tropical Corn grown in the Canada’s Outdoor Farm Show plots. Note the immature ear in this photo taken October 4th, 2013. This variety was developed and provided courtesy of Dr. Fred Below at the University of Illinois.

When planted in mid-summer in the southern USA tropical corn produces higher DM and grain yields than temperate hybrids planted at the same time. This is because temperate hybrids have been developed for spring plantings and are not as productive when planted later in the summer (Overman & Gallher, 1989; Johnson et al., 1997). This indicates potential for Tropical Corn as a second crop grown later in the season.
Figure 4. Ron holding another variety of Tropical Corn developed by Dr. Below, this one a biofuel variety. This photo also taken October 4th; note the immense size of the plant and lack of a cob.

Figure 5. Making mini-silos of Tropical Corn (2 varieties), Sweet Millet and Sweet Sorghum in 20 litre pails. This is done using a hydraulic ram as packing matters in all silos, especially little ones. Photos of their feed-out were posted to Twitter under @CtophWand in December of 2013.
Increased Forage Options for Cattle Producers

The focus of this article has been select annuals only (and there are many other annuals and perennials to discuss) but the point is this: there may be a number of feeds available that have been planted for industrial or forage purposes which can serve as feed in a beef system. Some of these have been piloted in Ontario as shown in Figures 2, 3, 4, and 5. They may be purposeful, opportunity, salvage, or emergency feeds but remain options outside of the regular crop options should the need arise. Lesson #5: the forage options are many and this article only scrapes the surface when it comes to options for feeding the versatile beef animal!

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