FEASIBILITY OF PRODUCING COMFREY (SYMPHYTUM SPP.) PELLET AS A FEED SUPPLEMENT

B. Barl[1], N. Gibson[2], B. Crerar[2], J. Shao[1], and S. Sokhansanj[2]
Department of Plant Sciences' and Department of Agricultural and Bioresource Engineering[2], University of Saskatchewan Saskatoon, Canada

ABSTRACT

Comfrey (Symphytum spp.) is highly valued animal feed supplement which commands premium price in some parts of the world. It is a well documented medicinal plant which is easy to grow, but due to low fiber content, and high moisture and protein contents, is not as easy to dehydrate. The objective of this study was to generate preliminary information on cultivation and chemical composition, with emphasis on toxic pyrrolizidine alkaloids (PAs), of two comfrey species: S. ***officainale*** (common) and S. ***uplandicum*** (Russian). Also, the feasibility of pilot scale dehydration and pelletization of leaves was to be established. It was found that in comparison to alfalfa pellets, comfrey pellets were less durable (73% vs. 89%) and less hard (4.3 MPa vs. 6.84 MPa), but in appearance and some physical properties they met the alfalfa industry standards.

INTRODUCTION

Comfrey (family Boraginaceae) is a coarse perennial herb generally adapted to moist cool places. It was cultivated in Saskatchewan in the 50s and has long been used as a forage crop for livestock giving exceptionally high yields of fodder (50-80 tons per acre). Comfrey contains up to 35 % protein, vitamin B12, and compounds of proven therapeutic value, allantoin, a cell proliferant, and rosmarinic acid, an anti-inflammatory agent. It has a long tradition as a folk medicine and was particularly popular for external use to reduce the swelling around the broken bones. However, PAs, naturally occurring compounds often toxic to the liver and found mainly in the Boraginacae and Asteraceae families of medicinal plants, have also been found in comfrey. Presence of PAs raised the concern of health agencies in some countries over the use of comfrey as a medicinal plant by humans and animals. The quantities of PAs vary significantly between plant populations and some success has been claimed in growing alkaloid-free comfrey (PAs < 5 ppm)

It has been estimated that there is a great potential for a new animal feed made from comfrey leaf and other standard hay-type crops (e.g. alfalfa). Cattle feed market in Japan seems to be the largest and the most attractive. In addition, comfrey was shown to effectively prevent digestive disorders in poultry and livestock, especially scours in

calves. However, studies are needed to prove the safety of using comfrey as supplemental animal feed, before it can be recommended for use in Canada and USA.

MATERIAL AND METHODS

The transplants of S. *officinale* and S. *uplandicum (two types,* Bocking No. 4 and Bocking No. 14) were purchased from Richters Herbs, Ontario, and planted in the first week of June 1996 at three sites: Saskatoon, Shellbrook and Tisdale. Comfrey samples were collected 3 times throughout the season, leaves were separated into old and young, and either dried at 40 °C or immediately frozen and stored at -20 to -40 °C. The PAs were extracted and their presence confirmed by gas chromatography-mass spectrometry (GC-MS).

The dehydration of comfrey leaves was conducted at 26-70 "C. The feasibility of pelletizing comfrey was tested at small and pilot scale at the Department of Agriculture and Bioresource Engineering. Preliminary pilot-scale pelleting trials using 4 kg of dry comfrey grind were performed using California Pellet Mill (CPM CL-5) with a 3/16" (4.76 mm) die under similar conditions used for alfalfa pellets. A single pelleter Instron testing machine setup, as described in Tabil and Sokhansanj (1996a), was used to study the compression characteristics of comfrey grinds.

RESULTS

All comfrey transplants at all 3 sites were easily established. Plants reached height of 50-60 cm by mid September, but none bloomed. The difficulty was experienced in developing reliable assay for PAs, since these are unstable compounds typically present in very low concentration, at 0.1-400 ppm. The lack of standards prevented identification of PAs known to occur in *Symphytum* spp.; total PA content could only be determined semiquantitatively. As expected PA levels in S. *officiale* were found to be lower than in S. *uplandicum,* and small, young leaves contained higher levels of PAs than large, older leaves. Root was found to contain considerably higher content of PAs than leaves.

The protein content in comfrey leaves varied from 17.02 % (Tisdale) to 21.6-28.4 % (Saskatoon) The complete comfrey feed analysis of leaves collected in mid September in Tisdale is shown in Table 1.

The dehydration characteristics of comfrey leaves and pellets were also determined. The steady state moisture content (6 %) of pellet was achieved after 30 hours of drying at 40 °C as compared to 11 hours at 70 °C. No visible differences in colour of pellets dried at 40 °C and 70 °C could be observed.

In comparison to alfalfa pellets, comfrey pellets were found less durable and less hard (Table 2). However, in their appearance (nice green colour) and physical properties, comfrey pellets met the alfalfa industry standards. The tensile strength of various mixes of alfalfa and comfrey pellets were also tested (Table 3) and found to be comparable to low to medium quality alfalfa pellets.

Table 1. Comfrey Feed Analysis.

Analyte	Comfrey	
	As Received	100 % Dry Matter
Moisture (%)	82.51	
Protein (%)	3.05	17.02
Sodium (%)	0.01	0.04
Phosphorus (%)	0.05	0.27
Potassium (%)	0.97	5.54
Sulphur (%)	0.06	0.22
Calcium (%)	0.31	1.75
Magnesium (%)	0.06	0.36
Copper (ppm)	2.65	15.20
Iron (ppm)	96.40	551.00
Manganese (ppm)	10.00	57.30
Zinc (ppm)	8.55	48.60
Molybdenum (ppm)	co.50	co.50
Selenium (ppm)	co.20	co.20
Nitrate (%)	0.07	0.40
A.D. Fibre (%)	7.42	42.39
Est. Energy TDN (%)	9.33	53.35
Est. Energy DE Mcal / kg)	0.41	2.34
Est. NE1 (Mcal /kg)	0.65	1.19
Est. NEm Mcal / kg)	0.59	1.07
Est. NEg (Mcal / kg)	0.28	0.52

Table 2. Comperative Durability and Hardness of Comfrey and Alfalfa Pellets.

Physical Property	Comfrey Pellet	Alfalfa Pellet
Durability'	73 ± 1.0 %	89 ± 0.0 %
Hardness'	4.33 ± 0.79 MPa	6.84 ± 1.24 MPa

[1] Average of three measurements

Table 3. Tensile Strength of Pellets Made by Various Comfrey and Alfalfa Combinations.

Comfrey : Alfalfa ratio (%)	Tensile Strength (mean ± st. dev.) (MPa)
20 : 80	1.06 ± 0.08
40 : 60	1.12 ± 0.14
50 : 50	1.15 ± 0.07
60 : 40	1.13 ± 0.06
80 : 20	1.08 ± 0.07

CONCLUSIONS

1. Comfrey can be easily propagated and grown throughout Saskatchewan.
2. All comfrey leaves samples were found to contain detectable amount of PAs Lack of standards prevented identification and quantification of individual PA compounds.
3. Preliminary feasibility studies on dehydration and pelletization of comfrey leaves suggest that comfrey could be pelleted as successfully as alfalfa.
4. Comfrey pellet was found to be similar to low quality alfalfa pellet in durability and hardness; in appearance and some physical properties it meets the alfalfa industry standards. Comfrey and alfalfa grinds can be mixed at various ratios prior to pelleting.
5. Production of comfrey pellet as animal feed supplement appears promising providing low- or no- PA comfrey can be secured.

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