

## **UPDATE ON THE PROVISION OF BROWSE AT TORONTO ZOO**

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### **Abstract**

The importance of browse in the diet programs of captive managed herbivores has been well established throughout the zoological community. It is considered good for the health and wellbeing of the animals. Examples are a better expression of the consumer's natural behaviours and less repetitive or unnatural behaviours when browse is fed. There is now reported evidence of health benefits of feeding browse to zoo animals. However, it is not clear to what degree browse should be provided for nutriment and/or enrichment.

In many zoological institutions browse is still seen as an added/occasional enrichment, and the amounts given are normally not weighed. Further, it is difficult to determine the actual edible material for the various types of browse.

Providing browse regularly throughout a zoological institution is generally a laborious task, even when it is available from designated farms, gardens or green houses.

There are several methods currently practiced for harvesting, preparing/processing, packing, preserving, and storing browse material that require different input of staff engagement, time, and cost.

Currently, the Toronto Zoo harvests material for the provision of fresh, ensiled and frozen browse from two off-site locations – a dedicated willow and poplar plantation with 10,000 trees and a retired apple orchard with approximately 2,000 trees. The fresh browse from these areas is cut with loppers, bundled, labelled and weighed as accurately as practically possible. In the summer of 2016 well over 10,000 kg of fresh browse was supplied. In addition, a significant (but not measured) amount of browse from variable plant species is supplied from prunings from the zoo grounds, pavilions and/or green houses and some browse is bought from third parties

To provide browse outside of the growing season the Toronto Zoo has established a silage production system that incorporates a mechanized and mobile hydraulic press which compresses whole browse branches (15-100 cm in length and with highest diameter of approx. 2 cm) into large food-grade polyethylene barrels (30 L and 120 L). All filled barrels are labelled (date, plant species, and ID #) and weighed and stored outside but out of direct sunlight. Barrel lids are tightly shrink wrapped to help avoid air entry and preserve the anaerobic state of the silage.

This browse silage is typically stored for 5-8 months before being fed off, however when there are surplus barrels some may be fed off in the next winter season at 16 or more months post-harvest without any problem. A barrel delivery schedule has been established to efficiently and effectively deliver, store, and maintain browse silage inventory, as well as to ensure that priority browsers (e.g. giraffe, moose, gorillas, orangutans) receive adequate amounts.

When opening the silage barrels, yeast growth is often found on the top first 5-10 cm. of silage. This is considered harmless, but animal care staff are advised to remove and dispose of the layer of yeast growth and to feed off remaining material. Toronto Zoo recommends their staff feeding off barrels within 3-5 days once opened if ambient temperatures are between 0°C and 10°C. However, if temperatures are below freezing the opened barrels and silage material remains safe to feed off over a longer period. Keeping opened barrels in coolers is recommended.

Nutrition and animal care staff are trained to assess barrels for quality (smell and appearance). One aspect of measurable quality control is to test silage pH as well as fermentation end products such as lactic acid, butyric acid, etc. Silage safety can also be assessed by microbiologic or mycotoxin analyses.

Throughout the last two years, many enhancements have been made to the browse press and production system to optimize the amount harvested and improve safety. Updates include safety shields around the press arm, an emergency stop button, pressure gauge, and a folding branch stand for material breakdown by chainsaw.

The weights of packed small (30 L) barrels range from 13 - 16 kg. Whereas packed large (120 L) barrels range from 35 - 50 kg. Approximate totals of silage produced in 2015 and 2016 were 4,500 kg and 5,700 kg respectively; compared to the first two years (2010 and 2011) of press use – averaging approximately 3,275 kg per year.

Browse silage can be core sampled using the specially designed core-sampler that attaches to the hydraulic arm of the press. However, this type of sampling is not the best representation of what the animal eats.

To supplement browse silage stores, browse sticks (approximately 100-150 cm in length and with diameter of 2-5 cm) are stored off the ground outside and used for a variety of ungulate and primate species. Browse sticks (approximately 20 cm length and with a diameter between 1-5 cm) are frozen and used to supplement diets for various (mainly smaller) rodent and primate species.

While browse silage is produced as efficiently as possible using the mechanized press, labour costs and sourcing fresh plant material continue to be the main limiting factors to operational scaling at the Toronto Zoo. It is not clear how to value browse financially and it is not clear which food or enrichment type to compare it to. Demand for browse (fresh and ensiled) is high and increasing and plans for additional dedicated browse plantations are currently being developed.