TECHNICAL NOTE

A modified round bale haylage harvesting system for peat soils

G.A. Bishop

Agriculture and Agri-Food Canada, Atlantic Cool Climate Crop Research Centre, P.O. Box 39088, St. John's, Newfoundland and Labrador A1E 5Y7, Canada. Contribution no. 167. Email: bishopg@agr.gc.ca

Bishop, G.A. 2005. **A modified round bale haylage harvesting system for peat soils**. Canadian Biosystems Engineering/Le génie des biosystèmes au Canada 47: 2.1 - 2.3. Peat soils have been proposed as a land base for forage production in Newfoundland and Labrador, but have not been utilized because modern forage equipment is too heavy to operate without some modification. A front wheel assist farm tractor and a variable chamber round baler were modified for use on peat soils by installing dual wheels on each axle. Dual wheels can be mounted or removed by two people in 2.5 h to allow the equipment to be used on either mineral or peat soil. A single cut harvesting system has been used for five seasons to produce forage crops at an average dry matter yield of 5 t/ha. Total cost of modifications for peat soil operations was approximately $5000. **Keywords:** harvesting system, peat soil, round bale haylage, equipment modification.

Bien que les sols organiques aient été ciblés pour la production de fourrages à Terre-Neuve et au Labrador, les équipements modernes utilisés pour cette production sont trop lourds pour être utilisés directement sans modification. Un tracteur à traction avant assistée et une presse à balles rondes ont été modifiés pour être utilisés sur les sols organiques en installant des roues jumelées sur chaque essieu. Une équipe de deux personnes peut monter ou enlever ces roues supplémentaires en deux heures et demie; de cette façon, les équipements peuvent être utilisés sur des sols minéraux ou organiques. Un système de récolte à une seule coupe a été utilisé durant cinq saisons pour produire des fourrages à un rendement moyen de 5 t/ha sur une base sèche. Le coût total des modifications apportées au tracteur et à la presse à balles rondes pour les adapter à la culture sur les sols organiques est d'environ 5 000 $. **Mots clés**: système de récolte, sol organique, presse à balles rondes, modification d'équipement.

INTRODUCTION

In Newfoundland and Labrador mineral soils suitable for agricultural use are widely dispersed and often require substantial improvement to be developed as farm land. Rayment and Penney (1977) described how the abundant peatlands can be used to supplement mineral soils in the production of several crops, including forages. However, forage harvesting has not been accomplished on a practical level due to the lack of a proven system which can assure harvest and storage of the crop comparable to a conventional system. A project was started in 1997 to adapt a farm's existing round bale forage equipment for use on peat soil. This paper describes the harvest system and modifications needed to operate on peat.

DESCRIPTION

A peatland forage harvesting system was developed in cooperation with Haricot Farms Limited. Peatland forage was intended to supplement the farm's supply and was harvested as a one cut system after the mineral soil forage crop. Bishop (2003) outlined procedures for acquiring peatland sites in Newfoundland and Labrador for agricultural use and criteria for establishing a forage harvesting system.

The site

A 2.5 ha test site located at Haricot, Newfoundland and Labrador (47° 10' N; 53° 32' W) was selected for the project. Pollett and Wells (1977) characterized the soil as a blanket bog, usually less than 3 meters in depth with few trees and ponds. The drainage system consists of open ditches at 15 m spacings. The test site was limed to raise soil pH to a minimum of 5.5 and seeded with a mixture of timothy and red clover.

The equipment

Equipment used in the forage harvesting system consisted of a Kubota model M5400 tractor (Kubota Tractor Corporation, Osaka, Japan) equipped with a front end loader and bale grapple, a 1.85 m wide PZ model CM185 drum mower (P.J. Zweegers en zonen, Geldrop, The Netherlands), a Gehl model 1470 round baler (Gehl Company, West Bend, WI) and a farm wagon. The tractor was fitted with dual wheels, wheel spacers, and tires matching original sizes (front: 9.5-22; rear: 16.9-28) to improve floatation on the peat soil (Fig. 1). Addition of dual wheels on the tractor allowed it to be used to rotovate, seed, and apply fertilizer. Dual wheels and spacers were also fitted on the baler using matching tires (31x13.5x15). Spacers were sized to provide a space of about 25 mm between tires to keep overall machine width as narrow as possible. Mounting and removing dual wheels was done by two people, requiring 1 h for the front tractor axle, 0.5 h for the rear axle and 1 h for the baler. Operating experience showed that the rear duals were not required and were not used after the second season. The wagon was equipped with standard floatation tires (11-L-15) and a wooden deck long enough to accommodate three round bales. The single piece of extra equipment purchased for the peatland harvesting system was the three point hitch mounted mower. The used mower was purchased because the farm's existing trailed mower conditioner was too difficult to turn between the

Fig. 1. Round baler and tractor fitted with dual wheels.

15-m ditches. The mower was not equipped with a conditioner. A 4.5 m long forestry trailer (Hardy model 5200ST, Hardy Company, QC) equipped with a loader boom and bale grapple was also evaluated as a carrier for haylage bales. However, its use was abandoned after the first season due to the excessive weight of the trailer. Relevant equipment dimensions and ground pressures are summarized in Table 1.

The harvesting system

The forage was mowed and allowed to wilt in the field for 24 h until reaching a moisture content of 65 - 70%. The mower swath width was adjusted to minimize pressing the edges of the forage swath into the ground with the wider wheels on the tractor and the baler. The additional weight of the mounted mower did not create problems since most of the mower weight was distributed over the ground while in operation.

The round baler formed bales measuring 1.2 m in length and approximately 1.2 m in diameter. Individual bale mass was not determined. On reaching the desired bale diameter the bales were tied and left in the field for collection. It was found that backing up and dropping the bale to one side cleared a path for baling subsequent windrows. Even with dual tires installed, the baler had the highest ground pressure which was compounded by the additional mass of the bale in the chamber. A full bale would increase the baler ground pressure to a level in excess of 80 kPa, creating a situation where the field surface could be damaged. In the event that ruts were being created by the baler tires, the operator was instructed to tie off and eject the bale and start a new one, however this situation did not occur during the project.

The bale grapple was used to load bales onto the wagon for removal from the field. The route taken on each trip from the field was changed slightly to avoid repeated passes over any one area. Up to three bales at a time were loaded onto the wagon (depending on soil conditions) and hauled off the field to a loading area adjacent to the site. Here the bales were transferred to a larger wagon for transport to the storage area where they were individually wrapped using a stretch plastic silage wrap and stacked.

Dry matter forage yields were determined from random cuttings using a 0.6 m wide plot harvester (Swift Machine & Welding Ltd., Swift Current, SK). The first season the 2.5 ha site produced a yield of 3.3 t DM/ha (32 bales). In 1998 production increased to 5.0 t DM/ha (48 bales). Additional land was brought into production in 1999 and since then the farm has produced approximately 150 bales annually from 7.5 ha of peat soil.

Table 1. Comparison of peatland forage equipment dimensions and ground pressures with single and dual wheels.

	Dimension	Width (mm)	Ground pressure (kPa)
Kubota M5400 tractor	Mass 1850 kg		
	Front axle (singles)	1581	56
	Front axle (duals)	2399	32
	Rear axle (singles)	1854	38
	Rear axle (duals)	2758	21
	Free axle width (front)	1130	-
	Free axle width (rear)	965	-
Gehl 1470 baler	Mass 1722 kg		
	Axle width (singles)	2178	131
	Axle width (duals)	2898	70
	Free axle width	1473	-

CONCLUSIONS and RECOMMENDATIONS

The round bale haylage system can be extended for use on peat soils with only minor modifications to existing equipment and provides a convenient method of handling the crop for off-farm sales. Forage yield and quality are comparable to similar forage mixtures produced on mineral soils. However, the successful development of peatlands for forage production requires some stringent selection criteria and unique management practices. Specialized equipment is also required to perform the initial land development work.

A peatland site should be relatively close to the farm's base of operation to minimize transport concerns. The site must be carefully evaluated to design a drainage system which will provide adequate drainage to support farm implement traffic and provide a large enough area to be useful as a forage production site. Drainage improvements and establishment of a grass sod on the peat soil increases the load bearing capacity of peatland but will still not support the same loading and traffic patterns as on mineral soils. Specific bearing capacity data for Newfoundland and Labrador peatlands are not available, however observations during this project indicate that equipment ground pressures in excess of 80 kPa are approaching the upper limit of use.

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