Farm Structures
FACTSHEET

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PLANNING A HORIZONTAL SILO FOR BEEF OPERATIONS

This factsheet outlines the essential considerations in planning a horizontal silo including location and site preparation, sizing the storage, structural requirements and typical costs.

INTRODUCTION

Silage is an effective and economical method of harvesting and storing forage. It is especially suited to areas of the Province where weather conditions are not favourable to quality hay harvesting.

Horizontal silos can be economical to build and use. A well constructed and managed horizontal silo can be used to store and supply high quality feed throughout the feeding period.

LOCATION AND SITE PREPARATION

Consider the following points and Figure 1 when determining the location of a horizontal silo (see Figure 1)

- Access to feeding areas.
- Access from croplands during harvest.
- Integration of the silo within the overall farmstead plan – recommend drawing a farmstead plan prior to any construction
- Provide flexibility for expansion. Don't box yourself into a corner.
- Well drained, preferably south facing site to permit a 1 to 2% floor slope to the front face.
- Sited to prevent drainage of silo juices into natural watercourses.

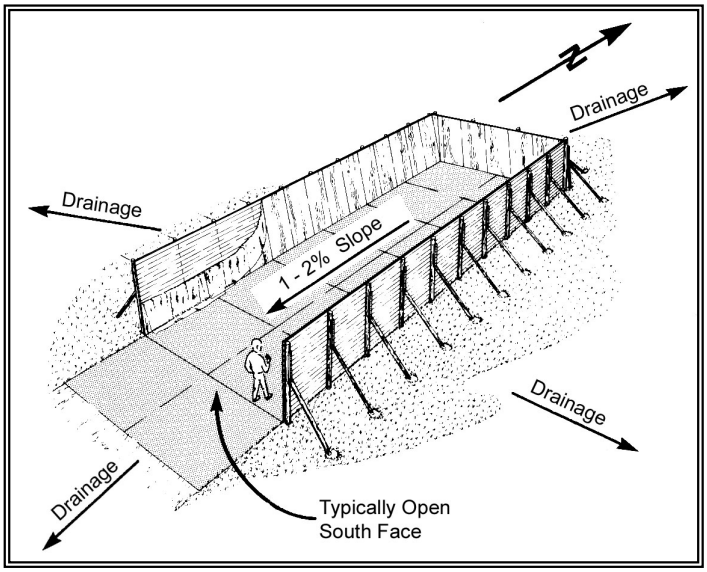

Figure 1 Well Sited Horizontal Silo

SIZING THE SILO

A silo is usually sized to store the maximum volume of feed required for the feeding season. Alternatively, the silo may be sized on the expected crop yield to be stored.

Plan for expansion either by allowing room for construction of a second silo or by allowing for extension of the silo towards the front. Extending the silo towards the back adds extra expense in removing and reconstructing the back wall. In sizing the silo to store feed necessary for animal consumption, the guidelines in Table 1 can be used for silage (without hay) feed consumption rates for beef cattle.

Once the daily consumption is known, the total storage capacity can be calculated. Add a 20% safety factor for storage losses and feed wastage. See Engineering Note ***"Forage Harvesting, Storage and Feeding Losses".*** Order No. 240.100-4.

Table 1 TYPICAL SILAGE FEEDING RATES FOR BEEF CATTLE

	Feed Requirement	
	Silage	Grain
LIVESTOCK	**(lbs per day)***	
1100 lb MATURE COWS		
- MID PREGNANCY	75.0	0.0
- LATE PREGNANCY	73.0	2.1
- LACTATION	66.9	4.2
800 lb YEARLING HEIFERS		
- MID PREGNANCY	38.4	7.2
850 lb YEARLING HEIFERS		
- LATE PREGNANCY	48.5	6.3
900 lb FIRST CALF HEIFERS		
- LACTATING	44.0	9.8
700 lb STEER CALVES		
- GAINING 1.5 lb/day	36.6	8.1
600 lb HEIFER CALVES		
- GAINING 1.0 lb/day	27.3	7.2

* 30% dry matter silage; 90% dm grain

Example 1:

A ranch in Quesnel is overwintering an 80 cow herd. Calculate the silage requirements assuming no hay is fed. Feed is required from October 15 to April 30 (200 days) and calving begins March 1.

Silage required	=	45 days MID PREGNANCY (Oct 15 – Dec 1)	x	75 lbs/days	=	3,375 lbs per head
	+	90 days LATE PREGNANCY	x	73 lbs/day	=	6,570 lbs per head
	+	60 days LACTATION (Mar 1 – Apr 30)	x	67 lbs/day	=	4,020 lbs per head
				Total intake requirement	=	13,965 lbs per head

Total Silage Required = $13{,}965 \frac{\text{lbs}}{\text{Head}}$ x 80 head = 1,117,200 lbs or 559 tons

Add 20% for losses = 670 tons

Example 2:

A rancher in Kamloops is backgrounding 200 beef calves from 500 lbs/head to 850 lbs/head through the winter (about 200 days). Average weight of the calves is 700 lbs and average daily gain, 1.5 lbs.

$$\text{Silage Required} = 200 \text{ head} \times \frac{36.6 \text{ lbs}}{\text{day}} \times 200 \text{ days} = 1{,}464{,}000 \text{ lbs or } 732 \text{ tons}$$

$$\text{Add 20\% for losses} = \underline{878 \text{ tons}}$$

MINIMIZE SPOILAGE AT THE FACE

Once the silo is opened for feeding, the silage is exposed to the air. During the warmer periods of the feeding season, it can spoil, otherwise, it may freeze in mid-winter.

To minimize spoilage and freezing, size the silo face area (i.e., the vertical cross section) to permit a minimum 4 inches/day silage removal rate from the face.

Example 1:

The maximum silo face area for the 80 cow herd in Quesnel is calculated as follows:

$$\text{Maximum face area (sq ft)} = \frac{80 \text{ head} \times \frac{70 \text{ lbs}}{\text{day/head}} \text{ (avg.)}}{\frac{40 \text{ lbs}}{\text{cu ft}} \times \frac{4 \text{ in}}{\text{day}} \times \frac{1 \text{ ft}}{12 \text{ in}}} = 420 \text{ sq ft}$$

Example 2:

The maximum silo face area for the 200 head backgrounding operation in Kamloops is calculated using the feeding rate of 37 lbs per day/head.

$$\text{Maximum face area (sq ft)} = \frac{200 \text{ head} \times \frac{37 \text{ lbs}}{\text{day/head}}}{\frac{40 \text{ lbs}}{\text{cu ft}} \times \frac{4 \text{ in}}{\text{day}} \times \frac{1 \text{ ft}}{12 \text{ in}}} = 555 \text{ sq ft}$$

SELF FEEDING

ilage may be self-fed from the face. A self-feeding fence or electric wire is used to limit access and minimize feeding wastage. The vertical face of the settled silo should be no more than 8 feet. The feeding face width at the floor should be 6" to 8" per cow provided the cattle have access to the feeding face 24 hours per day.

DETERMINE FINAL SILO DIMENSIONS

Once the total storage capacity and maximum silo face area have been determined as outlined above, the silo dimensions can be finalized. Use Table 2.

Table 2: **CAPACITY OF PACKED HORIZONTAL SILO (tons)**
(Based on packed density = 40 lbs/cu ft)

Silo width (ft)	Silage depth (ft)	Silage Face area (sq ft)	Length of Silo (ft)										
			56	**64**	**72**	**80**	**88**	**96**	**104**	**112**	**120**	**136**	**152**
20	6	120	120	139	158	178	197	216	235	254	274	312	350
20	8	160	154	179	205	230	256	282	307	333	358	410	461
20	10	200	184	216	248	280	312	344	376	408	440	504	568
30	8	240	230	269	307	346	384	422	461	499	538	614	691
30	10	300	276	324	372	420	468	516	564	612	660	756	852
30	12	360	317	374	432	490	547	605	662	720	778	893	1008
40	8	320	307	358	410	461	512	563	614	666	717	819	922
40	10	400	368	432	496	560	624	688	752	816	880	1008	1136
40	12	480	422	499	576	653	730	806	883	960	1037	1190	1344
40	14	560	470	560	650	739	829	918	1008	1098	1187	1366	1546
50	10	500	460	540	620	700	780	860	940	1020	1100	1260	1420
50	12	600	528	624	720	816	912	1008	1104	1200	1296	1488	1680
50	14	700	588	700	812	924	1036	1148	1260	1372	1484	1708	1932
50	16	800	640	768	896	1024	1152	1280	1408	1536	1664	1920	2176
60	10	600	552	648	744	840	936	1032	1128	1224	1320	1512	1704
60	12	720	634	749	864	979	1094	1210	1325	1440	1555	1786	2016
60	14	840	706	840	974	1109	1243	1378	1512	1646	1781	2050	2318
60	16	960	768	922	1075	1229	1382	1536	1690	1843	1997	2304	2611

N.B. This table gives actual wet matter capacity in tons assuming the silo is filled and packed to the top of the sidewall with no crowning. The table takes into account a 1:2 sloping front face.

Example 1

The 80 cow herd operation:

- storage volume = 670 tons
- maximum silo face area = 420 sq ft face area

From Table 2, we can select several options that meet these requirements.
For example:

1. 30’ wide x 12’ high x 108’ long, or
2. 40’ wide x 10’ high x 96’ long.

Example 2:

The 200 head backgrounding operation:

- storage volume = 878 tons
- maximum silo face area = 555 sq ft face area

From Table 2, we can select several options that meet these requirements.
For example:

1. 40’ wide x 12’ deep x 104’ long, or
2. 50’ wide x 10’ deep x 100’ long.

STRUCTURAL REQUIREMENTS

Engineering drawings must be prepared and followed in constructing a horizontal silo. Figure 2 shows many critical points to which attention must be given; amongst others, these are:

- Sloping silo walls to permit tractor packing up to the wall.
- The silo wall must be designed with foundations and bracing to resist the tremendous pressures.
- The wall should be lined with plastic to establish an airtight seal and thus improve silage preservation.
- Use pressure treated wood. (CCA not PCP).
- Earth may be used as a backfill to minimize silage freezing. If the silo is constructed below grade, the walls must be designed as retaining walls to resist earth pressures. Perimeter drains will also be necessary.

A concrete floor is designed to reduce feed losses. This floor must be properly reinforced to carry heavy tractor loads. Use quality concrete.

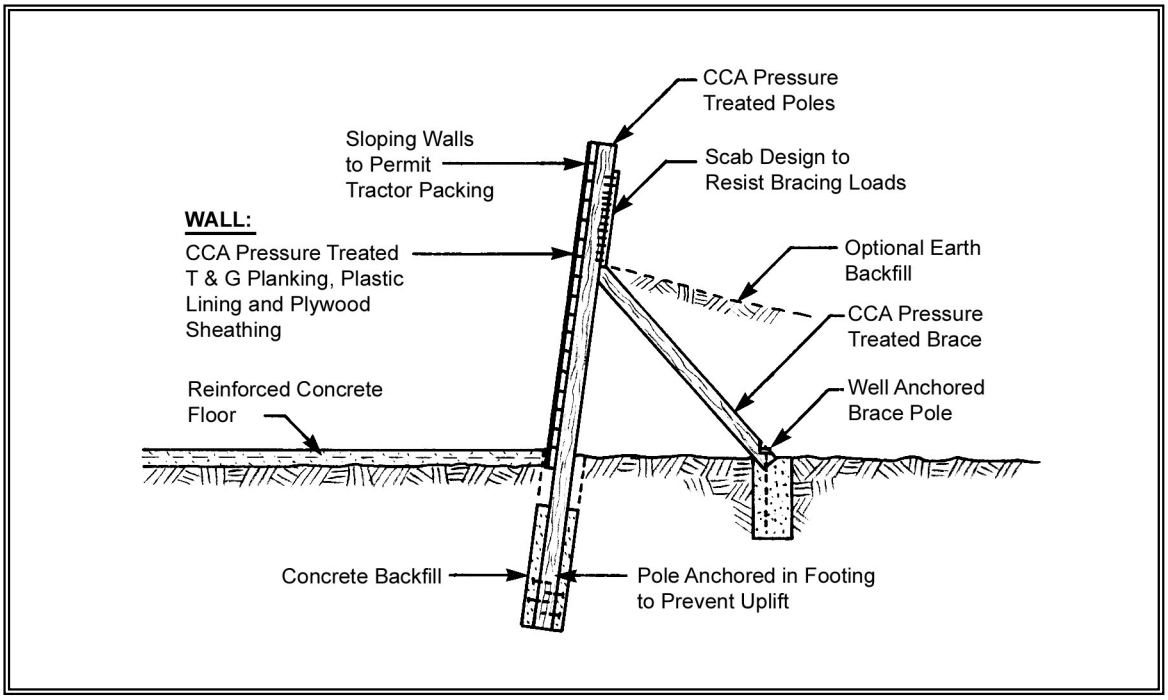

Figure 2 **Typical Structural Requirements - Pole Type Horizontal Silo**

TYPICAL COSTS TO CONSTRUCT A HORIZONTAL SILO

The cost of a structure can vary greatly depending on the site preparation requirements, local supplies, materials used, type of structure to be erected, manpower costs and construction techniques used.

A typical 40 ft wide x 96 ft long x 8 ft high structure would involve the following costs:

Site Preparation:	$ 1,500	or	$0.40/ sq ft
Materials:	15,360	or	4.00/ sq ft
Labour:	4,200	or	1.10/ sq ft
Total:	$21,060	or	$5.50/ sq ft

FOR FURTHER INFORMATION CONTACT
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