



Dairy Update

TABLES FOR DETERMINING FEED
STORAGE CAPABILITY

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Table 1. Estimated Corn Silage Capacity (In Tons) For Tower Silos *

Depth of Settled Silage (feet)	Silo Diameter (feet)											Av. Wt. Per. Cu. Ft. (Pounds)
	12	14	16	18	20	22	24	26	28	30	36	
20	39	54	70	89	110	133	158	186	216	248	356	34.9
22	45	67	80	101	126	152	181	215	247	283	404	36.3
24	51	70	91	113	142	172	204	240	278	320	452	37.7
26	57	78	101	128	159	192	228	269	312	358	512	39.0
28	64	86	115	146	177	214	254	300	347	398	584	40.2
30	70	96	125	158	195	236	280	330	382	440	632	41.4
32	77	106	135	172	215	260	309	364	422	483	688	42.6
34	84	114	150	190	234	284	336	396	458	527	742	43.8
36	92	124	161	205	254	308	365	430	499	572	820	45.0
38	99	135	176	222	274	332	394	463	537	617	888	46.0
40	106	145	189	239	295	358	423	500	578	663	956	47.0
42	114	155	203	255	317	384	455	537	620	713	1020	48.0
44	122	166	217	274	339	410	487	573	665	763	1096	49.0
46	130	177	230	292	361	437	518	610	706	813	1168	50.0
48	139	187	246	311	384	465	552	650	753	865	1244	51.0
50	147	200	261	330	407	492	583	688	795	913	1320	52.0
52	155	212	277	350	431	522	620	730	845	970	1400	52.8
54	163	224	293	370	455	550	655	770	890	1020	1480	53.6
56	171	236	309	390	480	580	690	810	940	1080	1560	54.4
60	188	260	341	430	529	640	760	910	1030	1190	1720	56.0
65	---	---	391	483	593	716	855	1017	1161	1339	1934	57.6
70	---	---	416	539	660	790	948	1123	1292	1488	2148	59.2
75	---	---	---	---	716	867	1040	1230	1423	1637	2162	60.8
80	---	---	---	---	784	948	1137	1337	1554	1785	2376	62.4
85	---	---	---	---	---	---	---	1443	1685	1935	2790	64.0
90	---	---	---	---	---	---	---	1567	1816	2084	3004	65.6

* Capacities are estimated for corn in dough or early-dent stage. Use the correction factors in Table 2 when hay silage is being stored.

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Current information available from University of Minnesota Extension: <http://www.extension.umn.edu>.

1. How Do You Determine The Amount Of Silage Present In the Silo?

Corn silage: Refer to Table 1.

Hay crop silage: Refer to Table 1. and multiply times the appropriate correction factor in Table 2.

Example Calculation:

What is the estimated tonnage in a 20 x 50 ft. upright silo that contains 44 ft. of settled hay silage containing 40% dry matter?

$$\frac{339}{\begin{array}{l} \text{(Table 1, line 44)} \\ \text{(column 20)} \end{array}} \times \frac{.90}{\text{(Table 2)}} = 305.1 \text{ tons}$$

Table 2. Correction Factors For Determining Hay Crop Silage Capacity In Tower Silos.

<u>Percent Dry Matter</u>	<u>Multiply Appropriate Figure in Table 1 by:</u>
25	1.10
30 - 35	1.00
40	.90
50	.75

Table 3. Silage Capacity of Horizontal Silos*

<u>Average Silo Width (ft.)</u>	<u>Tons per Foot of Silo Length</u>		
	<u>Depth 6 ft.</u>	<u>Depth 8 ft.</u>	<u>Depth 10 ft.</u>
8	0.96	1.28	1.60
12	1.44	1.92	2.40
16	1.92	2.56	3.20
20	2.40	3.20	4.00
24	2.88	3.84	4.80
32	3.84	5.12	6.40

* Based on packed silage density of 40 lb/cu. ft.

Example Calculation: What is the silage capacity of a fully filled silo that is 16 ft. wide, 50 ft. long and 10 ft. deep?

$$50' \times 3.20 \text{ (from Table 3)} = 160 \text{ Ton}$$

II. How Do I Determine The Silo Capacity For Whole Shelled Corn or Ground Corn?

1. Multiply height of silo (feet) times the appropriate figure in Table 4.

A) Example Calculation:

How much wet ground ear corn will a 12x36 ft silo hold when filled to capacity?

$$\underline{36} \text{ ft.} \times \frac{\underline{2.83} \text{ tons}}{\text{(Table 4)}} = 101.88 \text{ Tons}$$

B) Example Calculation:

How many pounds would I feed per day if I had 150 cows and wanted to feed at least 4 inches per day from the silo?

$$1. \frac{\underline{472} \text{ lb}}{\text{(Table 4)}} \times \underline{4} \text{ inches} = 1888 \text{ pounds}$$

$$2. \frac{\underline{1888} \text{ pounds}}{\text{(line 1)}} \div \underline{150} \text{ cows} = \underline{12.6} \text{ lb.}$$

Note: Minimum removal rate is: Winter = 2-3 inches per day
Summer = 4-6 inches per day

Table 4. Silo Capacity For Whole Shelled Corn, Ground Whole Corn or Ground Ear Corn¹

Type of Corn	Silo Diameter (Feet)					
	10	12	14	16	18	20
Approximate tonnage per foot of silo height						
Whole shelled: wet basis ^a	1.65	2.37	3.23	4.22	5.34	6.59
Whole Shelled: dry matter ^b	1.16	1.66	2.26	2.95	3.74	4.61
Ground, either shelled or ear corn: wet basis ^c	1.96	2.83	3.85	5.02	6.36	7.85
: Dry matter ^d	1.27	1.84	2.50	3.26	4.13	5.10
Approximate pounds per inch of silo height						
Whole shelled: wet basis ^a	275	395	538	703	890	1098
Whole shelled: dry matter ^b	193	277	377	492	623	769
Ground, either shelled or ear corn: wet Basis ^e	327	472	642	837	1060	1308
: dry matter ^d	212	307	417	544	689	850

a Based on 42.2 lb./cu. ft.

b Based on 30% moisture

c Based on 50.0 lb./cu. ft.

d Based on 35% moisture

¹ Developed from Table IV - 10, Dairy Reference Manual, Pennsylvania State University

III. Is Special Reinforcement Needed Before High Moisture Grains Can Be Stored in Conventional Tower Silos?

Many current conventional silos can be conveniently adapted to store high-moisture corn. Concrete staves, poured concrete, wood, and various other types of silos that are in good condition are satisfactory. However, additional reinforcing may be needed because ensiled high-moisture corn grain creates more pressure on the walls than whole stalk silage. Table 5 shows the reinforcing generally recommended by manufacturers to make concrete stave silos safe for ensiled high-moisture corn grain. Whenever possible, specific recommendations should be obtained from the company that erected the silo.

Table 5. Recommended Reinforcement for Concrete Stave Silos Used to Store High Moisture Corn.

Distance from top	Diameter of silo (feet)					
	10	12	14	16	18	20
	Distance between rods*					
(ft)	(in)	(in)	(in)	(in)	(in)	(in)
0-5	30	30	30	30	30	30
5-10	30	30	30	30	15	15
10-15	30	15	15	15	15	15
15-20	15	15	15	15	10	10
20-25	15	15	15	10	10	10
25-30	15	15	10	10	10	7½
30-35	15	10	10	10	7½	7½
35-40	10	10	7½	7½	7½	6
40-45		10	7½	7½	6	6
45-50		7½	7½	6	6	6**
50-55			6	6	5	6**
55-60			6	5	5	5**

* 9/16-inch round steel bars with rolled threads.

** 5/8-inch round steel bars with rolled threads.

1/ Agricultural Engineering 885 (Rev.), Iowa State University.

IV. How Do I Determine the Amount of Hay or Bedding That Is Stored?

1. Determine cu. ft. of material stored by multiplying length x width x height (in feet).
2. Line 1 times appropriate figure in Table 6.

Example calculations:

How much baled straw is there in a shed 12 ft wide and 20 ft. long when the straw is stacked 10 ft. high.

$$(a) \frac{20}{(\text{length})} \text{ ft.} \times \frac{12}{(\text{width})} \text{ ft.} \times \frac{10}{(\text{height})} \text{ ft.} = \underline{2400} \text{ cu. ft.}$$

$$(b) \frac{2400}{(\text{line 1})} \text{ cu. ft.} \times \frac{8.0}{(\text{Table 6})} = 19200 \text{ lb. or 9.6 Tons}$$

V. How Do I Determine the Cubic Foot Capacity of a Round Bin?

$$3.1416 \text{ Times } \left(\frac{1}{2} \text{ diameter}\right)^2 \text{ Times height}$$

Example calculation:

How much whole shelled corn is there in a bin having a 20 ft. diameter and the corn is 12 ft. deep?

$$1. 3.1416 \times \frac{100}{\left(\frac{1}{2} \text{ diameter}\right)^2} \times \frac{12}{(\text{height})} \text{ ft.} \times \frac{42 \text{ lb./cu. ft.}}{(\text{Table 6})} = 158,337 \text{ lb. or 79.17 Tons}$$

Table 6. Estimating Storage Capacity's For Hay and Bedding.

<u>Material</u>	<u>(lb/cu ft)</u>	<u>(cu ft/ton)</u>
Loose hay		
Shallow mow	3.9	510
Deep mow	4.7	425
Baled hay		
Loose bales, random pack	6.2	325
Loose bales	7.2	275
Tight bales	10.0	200
Chopped hay		
Lone (approximately 3 in)	6.5	305
Short (1-2 in)	8.9	225
Silage in horizontal silos	40.0	50
Straw, baled	8.0	250
Shavings, baled	20.0	100
Grains:		
Shelled corn, whole	42.0	48
Shelled corn, ground	50.0	40
Ear corn, whole	28.0	72
Ear corn, ground	50.0	40
Barley	38.0	53
Oats	26.0	77
Soybean oil meal	43.0	47
Mixed Dairy Feeds	28.0	72

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