Storage Capacity for Grains, Forages and Liquids

Terms:
- **Diameter** - distance across a round structure
- **Circumference** - distance around a round structure
- **π** - Constant with an approximate value of 3.1416
- **Density** - pounds of grain, forage or liquid contained in one cubic foot of storage space

1. Round Grain Bin or Crib

Bushels = \(\pi \times \frac{1}{2} \text{diameter} \times \frac{1}{2} \text{diameter} \times \text{average depth of grain} \times \text{density}\), or

Bushels = \((\frac{1}{2} \text{circumference} / \pi) \times (\frac{1}{2} \text{circumference} / \pi) \times \text{average depth of grain} \times \pi \times \text{density}\)

Average depth of grain = height of grain on the outside wall of the bin plus one-third the height of the grain “cone” (from the top of the grain on the outside wall to the highest tip in the center)

Density = 0.8 bushels per cubic foot for corn or soybeans

Density = 0.628 bushels per cubic foot for ear corn

Short versions:
Bushels = 0.628 \times \text{diameter} \times \text{diameter} \times \text{average depth of grain} \times \text{density} for shelled corn or soybeans

Bushels = 0.314 \times \text{diameter} \times \text{diameter} \times \text{average depth of grain} \times \text{density} for ear corn

2. Rectangular Bin or Crib

Bushels = width \times length \times \text{average depth of grain} \times \text{density} (same values as previous)

3. Upright Silo

Bushels = \pi \times \frac{1}{2} \text{diameter} \times \frac{1}{2} \text{diameter} \times \text{depth of grain} \times \text{density} \times (1 - \% \text{moisture}) / .845, for number 2 shelled corn or ground ear corn

Tons of dry matter = \pi \times \frac{1}{2} \text{diameter} \times \frac{1}{2} \text{diameter} \times \text{depth of grain} \times \text{density} / 2,000, for corn silage or haylage

Tons of wet silage or haylage = tons of dry matter / (1 - \% \text{moisture})

Density = 0.8 bushels per cubic foot for corn or soybeans

Density = 0.515 bushels per cubic foot for ground ear corn

Density = 8.0 + (0.15 \times \text{depth of silage}) (in feet) = tons of dry matter per cubic foot for corn silage (density increases with the depth of the silage)

Density = 5.90 + (0.1 \times \text{depth of haylage}) (in feet) = tons of dry matter per cubic foot for haylage (density increases with the depth of the haylage)

Short versions:
No. 2 Bushels = 0.7436 \times \text{diameter} \times \text{diameter} \times \text{average depth of grain} \times (1 - \% \text{moisture}) for shelled corn

No. 2 Bushels = 0.4787 \times \text{diameter} \times \text{diameter} \times \text{average depth of grain} \times (1 - \% \text{moisture}) for ground ear corn

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Tons of dry matter = 0.000393 x diameter x diameter x average depth of silage (all in feet) x (8.0 + (0.15 x depth)) for corn silage

Tons of dry matter = 0.000393 x diameter x diameter x average depth of silage (all in feet) x (5.90 + (0.1 x depth)) for haylage

Tons of wet silage or haylage = tons of dry matter / (1 - % moisture)

4. Bunker (Trench) Silo
Tons of dry matter = Length x width x depth of corn silage (all in feet) x density / 2,000

Density = 7.5 + (0.4 x depth of silage) (in feet) = tons of dry matter per cubic foot for corn silage (density increases with the depth of the silage)

Density = 5.4 + (0.28 x depth of haylage) (in feet) = tons of dry matter per cubic foot for haylage (density increases with the depth of the haylage)

Tons of wet silage or haylage = tons of dry matter / (1 - % moisture)

5. Stack or Storage Shed, Small Square Bales
Tons = length x width x height (all in feet) x density / 2,000

Density = 6 to 8 pounds per cubic foot for hay

Density = 4 to 5 pounds per cubic foot for straw

6. Large Round Bales
Pounds = 3.1416 x (½ diameter / 12) x (½ diameter / 12) x (width / 12) (all in inches) x density

Density = 10 to 12 pounds per cubic foot for hay

Density = 5 to 7 pounds per cubic foot for straw

Density = 9 to 11 pounds per cubic foot for corn stover

Short version:
Pounds = 0.0004545 x diameter x diameter x width (all in inches) x density

7. Large Square Bales
Pounds = (length / 12) x (width / 12) x (height / 12) (all in inches) x density

Density = 10 to 14 pounds per cubic foot for hay

Density = 6 to 8 pounds per cubic foot for straw

Density = 10 to 12 pounds per cubic foot for corn stover

Short version:
Pounds = 0.0005787 x length x width x height (all in inches) x density

8. Water and Fuel Tanks
Cylindrical: Gallons = 3.1416 x ½ diameter x ½ diameter x length (all in feet) x 7.5 gallons per cubic foot

Rectangular: Gallons = length x width x height (all in feet) x 7.5 gallons per cubic foot

Weight = gallons x pounds per gallon

Weight = 8.33 pounds per gallon for water

Weight = 7.15 pounds per gallon for diesel fuel (at room temperature)

Weight = 6.15 pounds per gallon for gasoline

Reference: American Society of Agricultural and Biological Engineers Yearbook.

Decision Tool C6-82, Estimated Storage Capacity for Grains, Forages, and Liquids can be used to estimate storage capacity.