

Design of Circular Silo Structure for Fodder Storage

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Abstract- When fodder production falling, the rates of fodder increases. This has forced farmers to ask the government to start fodder camps and every time setting of fodder camps would not be complete solution. In this view study is undertaken at Cattle Cross Breeding Project Vasantrao Naik Marathwada Krishi Vidyapeeth Parbhani for determination of moisture content and density of maize silage and also design circular silo structure for cattles which would feed animals for three months in summer. Density and moisture content of maize silage is found to be 660.00 kg/m³ and 7.53% respectively. For C.C.B.P project three circular silo of diameter workout is 4.60 m and 9-meter depth which would be feed 171 animals for 90 days.

I. INTRODUCTION

The Marathwada region, a drought-prone area having eight districts in Maharashtra, received 534 mm rainfall against the average of 768mm in 2017-2018. Thus, the area received 22% lesser rainfall than it generally gets. The Maharashtra government declared 26 out of all the 36 districts as drought-affected and all the eight districts of Marathwada are included in the list. A total of 151 talukas have been declared drought affected, of which 47 are in Marathwada. In all, 44 out of these 47 talukas are 'severely' drought affected, while the remaining three falls in the category of 'medium' drought affected.

Due to lack of water, farmers could only manage only 50% production in the Kharif season and could not sow in the Rabi season. Generally, farmers in the region use the remaining part of millets and maize as fodder for animals. But due to production falling, the rates of fodder have shot up. Besides, the availability of fodder is also at a low. This has forced farmers to ask the government to start fodder camps. The problem is that many people, who want to sell their animals for want of fodder, are not getting buyers even

at lower rates. That is why farmers have been demanding setting up of fodder camps

As per the Department of Animal Husbandry, Dairying and Fisheries, Maharashtra, the region has over 36 lakh big cattle, such as cows, bulls and buffaloes, over 19 lakh goats and sheep and over 11 lakh small animals, such as chicken. Thus, there are over 67 lakh animals in the region. Big animals require 6kg fodder per day, medium ones need 3kg and smaller ones need 600 grams per day. Overall, animals in the region require 26,330 tonnes of fodder per day. As per calculations based on figures of sowing given by the State Agriculture Department, 55.9 lakh tonnes of fodder is needed till June, when the rains are expected to begin. However, the region can provide only 41.69 lakh tonnes of fodder. To avail the remaining fodder is a huge challenge as received lesser rainfall this year.

Preserving feed for livestock doesn't always means putting in sun dried hay silage is also made as chopped, fermented feed sources primarily from annual crops like corn barley, sorghum, millet and occasionally canola and wheat. Silage must be made from plant material with a suitable moisture content of about 50% to 60% depending on the means of storage, the degree of compression, and the amount of water that will be lost in storage, but not exceeding 75%. Preserving crops as silage seems to be the most logical approach to the solution of this problem. If they can be preserved as silage and stored irrespective of weather, the common haymaking losses will be reduced to a marked extent. Silage can also be used to feed animals in situations where grazing is prohibited or discouraged, such as in urban environments.

Silage can be one component of zero-grazing, a practice in which livestock are contained and food is brought to them. Keeping animals contained minimizes their exposure to disease and injury and can

minimize the damage wandering livestock cause to growing trees and gardens. The pit silo resembles a well in circular shape. Such use is popular in semi-arid areas where the water table is low enough to prevent the silo structure from becoming filled with water. Circular pit silos have been proposed as an economic alternative to ground storage. In this view study is undertaken at Cattle Cross Breeding Project Vasantrao Naik Marathwada Krishi Vidyapeeth Parbhani for determination of moisture content and density of silage and also design silo structure for cattle population 171 which would feed animals for three months during summer.

II. MATERIALS AND METHODS

Maize silage obtained from the dairy barn of VNMKV Parbhani under the supervision of Weight of silage is 7 kg and this silage is distributed in three containers which each container has volume of $3.3758 \times 10^{-3} \text{ m}^3$. The weight of empty container is 7.186kg. Animal population is as shown in table no.1.

Table 1. Animal population of C.C.B.P

Sr.No	Categories	Holden strength	Body weight (kg)	Deni strength	Body weight (kg)	Avg. animal Feed per day(kg/animal)	Total strength
1	Cow	23	500	36	450	20	59
2	Heifer	25	250	32	200	15	57
3	Male	20	200	17	150	15	37
4	F1-female	11	300	-	-	15	11
5	F1-male	3	250	-	-	10	3
6	Breed	2	800	2	600	20	4

	bull ock						
	Total	84		87			171

- Moisture content and density

$$\text{Moisture content} = \frac{\text{initial weight of silage} - \text{final weight of silage}}{\text{initial weight of silage}}$$

$$\text{Density} = \frac{\text{mass of silage}}{\text{volume of container}}$$

- Determination of diameter of silo

Total quantity silage per day = m kg per day

$$\text{Volume of silage} = \frac{\text{mass}}{\text{density}}$$

The daily consumption be 10 cm.

If the d is the dia of the silo in meter

The volume of silage removed per day from a silo

$$= \frac{\pi}{4} \times d^2 \times 0.1 = 0.7858 \times d^2 \times 0.1 \text{cu metre}$$

Allowing 15% for losses the actual volume obtained

$$\text{Volume} = 0.7858 \times d^2 \times 0.1 \times 1.15$$

Equating above the volume of silage removed per day

$$\text{Diameter} = \sqrt{\frac{\text{volume}}{0.7858 \times 0.1 \times 1.15}}$$

If the diameter is more than 6 m.

Considering more than one pits silo of diameter d

The animal are fed silage for 90 days a year

$$\text{Depth of silo} = 0.1 \times 90 = 9\text{m}$$

III. RESULT AND DISCUSSION

Table 2. Density and Moisture content of Maize Silage

Sample No	Moisture content (wet basis %)
M ₁	7.68
M ₂	7.42
M ₃	7.5

Average moisture content of silage found to be 7.53 percent

Table 3. Density of Maize Silage

Sample No	Density(kg/m ³)
D ₁	687.52
D ₂	634.22
D ₃	659.55

Average density of silage found to be 660.00 kg/m³

- Total Quantity of Silage per day
 - Cow
 - Total feed to cow per day =59×20=1180kg per day
 - Heiffer
 - Total feed to heifer per day =57×15=855kg per day
 - Male
 - Total feed to heifer per day =37×15=555kg per day
 - F1 Female
 - Total feed to heifer per day =11×15=165kg per day
 - F1 Male
 - Total feed to heifer per day =3×10=30kg per day
 - Breeding Bullock
 - Total feed to heifer per day =4×20=80kg per day
- Total quantity silage per day =2865kg per day

$$\text{Volume of silage} = \frac{\text{mass}}{\text{density}}$$

From our experiment we consider the average density=660kg/m³

$$\text{Volume} = \frac{2865}{660} = 4.341\text{m}^3$$

The daily consumption be 10 cm.

If the d is the dia of the silo in meter

The volume of silage removed per day from a silo

$$= \frac{\pi}{4} \times d^2 \times 0.1 = 0.7858 \times d^2 \times 0.1 \text{cu metre}$$

Allowing 15% for losses the actual volume obtained = 40341×1.15

Vol.=4.992

Approx. 5 m³

Equating above the volume of silage removed per day

$$0.07854 \times d^2 = 5$$

$$d^2 = 63.629$$

$$d = 7.9768 \text{ m}$$

Since the dia. is more than 6 m.

Considering the three pits of

$$d^2 = \frac{63.629}{3}$$

$$d = 4.6 \text{ m}$$

The animal are fed silage for 90 days a year

Depth of silo = 0.1×90 =9m

CONCLUSION

From the present study Density and moisture content of maize silage is found to be 660.00 kg/m³ and 7.53% respectively. For Cattle Cross Breeding Project Vasantrao Naik Marathwada Krishi Vidyapeeth

project three circular silo of diameter workout is 4.60 m and 9-meter depth recommended which would be feed 171 animals for 90 days in summer season.

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