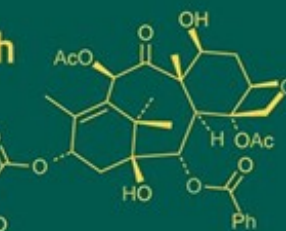
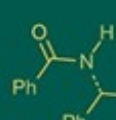


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
Indexing: Embase
IJABR 2026; 10(10): 216-218
www.biochemjournal.com
Received: 12-08-2026
Accepted: 24-09-2026
Published: 08-10-2026

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Assessment of physical characteristics and quality of maize silage

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DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i10c.10351>

ABSTRACT

The present investigation was undertaken to examine the physical quality and storage stability of maize silage and to observe its use in diets of growing Osmanabadi kids. Eighteen healthy kids between 4 and 7 months of age, with broadly comparable initial body weights, were allotted at random to three dietary groups (T0, T1 and T2). Maize silage was included at 0, 50 and 75% of dry matter intake, respectively. Body weight observations were recorded weekly during the experimental period. The physical condition of the silage was monitored using the German Agricultural Society (DLG) scoring approach, with attention to odour, structure, colour and the resulting quality class. The observations showed that the DLG method could be used to follow changes in maize silage from opening through 90 days of storage and use. The silage retained good physical characteristics during the earlier observations, while gradual changes in odour, leaf structure and colour were apparent with longer storage. The findings indicate that routine physical assessment using the DLG key is a practical way of monitoring maize silage quality during storage and feeding.

Keywords: Maize silage, Physical characteristics, DLG scoring, Silage quality, Osmanabadi goats

Introduction

Goat production contributes substantially to the livelihood of small and marginal farmers in India. Goats are valued because they can be maintained with comparatively modest initial and recurring expenditure and provide several useful products, including milk, meat, fibre, hide and skin. One of the recurring difficulties in goat husbandry, particularly in areas where rainfall is limited, is maintaining a dependable supply of green fodder during periods of feed scarcity.

Maintaining an adequate quantity of good-quality forage throughout the year therefore requires methods that allow surplus green fodder to be conserved. Silage is one such option. Properly prepared silage preserves green forage through controlled anaerobic fermentation and can provide a useful source of feed when fresh forage is less available. Crops such as maize and sorghum are commonly considered suitable for ensiling because of their relatively high carbohydrate content.

Osmanabadi goats originated in the Marathwada region of Maharashtra but are now maintained in different parts of India. The breed can be managed under several production systems, with semi-intensive management being reported as a suitable system for productive goat keeping (Motghare *et al.*, 2004; Rathod, 2018) [1]. Feed management remains an important component of the cost of goat production. Ouin (1995) [2] reported that feeding may account for approximately 50–85% of total production cost, highlighting the importance of using available feed resources efficiently.

The physical condition of silage provides useful information about its preservation status. Changes in smell, colour and plant structure can occur during storage, particularly when the material is exposed to air or when storage conditions are not maintained adequately. For this reason, physical examination can complement laboratory assessment when silage is being monitored during storage and feeding.

The present work was therefore designed to document changes in the physical characteristics of maize silage over a 90-day period. The study focused on the practical assessment of odour, structure and colour using the DLG scoring system and on the resulting quality classification of the silage at different observation periods.

Materials and Methods

The study was conducted at Livestock Farm Complex, Unit No. 3, Aarey Colony, Mumbai Veterinary College, Goregaon (East), Mumbai 400065, Maharashtra. The experimental work extended for 90 days, from November 2023 to February 2024.

Physical assessment of the maize silage was carried out at monthly intervals. The material was examined with reference to the physical examination key developed by the German Agricultural Society (DLG, 1997) [3]. Odour, structure and colour were considered, and the individual observations were used to assign an overall silage quality class.

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After 45 days of storage, the maize silos were weighed and opened for sampling. Approximately 1 kg of silage was collected from a depth of 15 cm, including material from the centre and parallel samples from either side. The collected material was combined and thoroughly mixed. It was then divided into three portions of approximately 300 g each. One portion was used on the same day for pH, moisture and physical observations, whereas the remaining two portions were kept at -18°C for subsequent chemical analysis.

DLG physical quality assessment

The physical examination followed the DLG (1997) [3] scoring key. The assessment considered three observable characteristics—odour, plant structure and colour. The scores were then interpreted according to the corresponding DLG quality classes.

Table 1. DLG-based physical examination criteria used for classification of maize silage.

Parameter	Physical description	Score
Odour	No butyric-acid odour; slightly sour, fruity and aromatic	14
Odour	Small amount of butyric acid; strong sour odour with slight escalation	8
Odour	Moderate butyric-acid odour with strong, escalating musty odour	4
Odour	Strong butyric-acid or ammonia odour with very little sour odour	2
Odour	Strong decomposition, ammonia or musty odour	0
Structure	Leaves and stems remain intact	4
Structure	Leaves show slight deterioration	2
Structure	Leaves and stems deteriorated; material is musty and dirty	1
Structure	Rotten leaves and stalks	0
Colour	Colour retained from the ensiling stage (brown in withered silage)	2
Colour	Colour slightly altered, from yellow towards brown	1
Colour	Colour completely altered (reseda green)	0

Observations and results

The physical characteristics of the maize silage were followed on days 1, 30, 60 and 90. The observations showed a gradual change in the physical condition of the material as storage progressed.

Table 2. DLG quality classes based on the combined physical score.

DLG quality class	Description	Score range
I	Very good	20–18
II	Good	17–14
III	Medium	13–10
IV	Low (low value)	9–5
V	Corrupted (useless)	4–0

Discussion

The early observations indicated that the maize silage retained the characteristic features associated with well-preserved material. On days 1 and 30, the odour remained slightly sour, fruity and aromatic, while the leaves and stems were largely intact and the original colour was retained. These observations resulted in DLG scores of 20 and 19, respectively, placing the material in quality class I.

By day 60, a small decline in physical quality was evident. The structure score decreased from 4 to 3 and the odour score also declined. The combined score of 17 corresponded to the DLG category described as 'good'. At 90 days, further changes were recorded: the structure became slightly more deteriorated, the colour showed a change towards brown, and the odour score fell to 10. The resulting total score was 13, placing the silage in the medium-quality category.

Table 3. Changes in physical characteristics and DLG quality classification during storage.

Characteristic	Day 1	Day 30	Day 60	Day 90
Odour score	14	13	12	10
Structure score	4	4	3	2
Colour score	2	2	2	1
Overall DLG quality	Very good (20)	Very good (19)	Good (17)	Medium (13)

These changes are consistent with the practical importance of limiting oxygen entry into stored silage. Maize is commonly ensiled at about 65–70% moisture, and losses of dry matter and nutrients may occur during harvesting, ensiling, storage and feeding. Maintaining appropriate

storage conditions is therefore important for preserving the physical and feeding quality of the material.

The gradual decline observed in the present study also agrees with the general findings reported in earlier work on silage characteristics.

Ferreira and Mertens (2005) examined physical and chemical characteristics of maize silage in relation to in-vitro disappearance, while De Boever *et al.* (2002) evaluated the physical characteristics of different maize silages and chewing activity in cattle. Their work illustrates the importance of crop maturity and physical form when considering the feeding characteristics of silage.

Mader *et al.* (1997) reported that alfalfa ensiled at 40–60% moisture could have a feeding value comparable with hay and silage, while also noting the risk of heating when storage is not adequately sealed, particularly under low-moisture conditions. In the present investigation, the gradual reduction in physical quality over the observation period may similarly reflect the influence of storage conditions and progressive exposure to oxygen.

Overall, the observations demonstrate that simple physical indicators can provide useful, readily visible information about silage condition. Regular checks of odour, plant structure and colour can help identify deterioration before the material is used extensively for feeding.

Conclusion

The DLG physical scoring approach provided a practical means of following the quality of maize silage during storage. The material showed very good physical quality during the early observation periods, followed by a gradual decline with increasing storage duration. Changes were most evident in odour, leaf and stem structure, and colour by day 90. Regular physical examination can therefore be used as a simple monitoring step to assess the condition and storage stability of maize silage.

Acknowledgement

The authors sincerely acknowledge the Hon'ble Vice Chancellor, Maharashtra Animal and Fishery Sciences University, Nagpur (MS), and the Associate Dean, Mumbai Veterinary College, Mumbai (MS), for providing the facilities and support required to conduct the study.

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How to cite this article: Chikankar R, Ghorpade P. Assessment of physical characteristics and quality of maize silage. *International Journal of Advanced Biochemistry Research*. 2026;10(10):216-218. doi: <https://www.doi.org/10.33545/26174693.2026.v10.i10c.10351>