



International Journal of Research in Agronomy

E-ISSN: 2618-0618

P-ISSN: 2618-060X

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www.agronomyjournals.com

2024; SP-7(10): 544-547

Received: 03-08-2024

Accepted: 06-09-2024

Sutar SB

M.Sc, Agri Student, Department of
Animal Husbandry and Dairy
Science College of Agriculture,
Dhule, Maharashtra, India

Vasave VM

Assistant Professor, Department of
Animal Husbandry and Dairy
Science College of Agriculture,
Dhule, Maharashtra, India

Desale RJ

Professor, Department of Animal
Husbandry and Dairy Science
College of Agriculture, Dhule,
Maharashtra, India

Chaudhari DM

Subject Matter Specialist, Krishi
Vigyan Kendra, Dhule,
Maharashtra, India

Corresponding Author:

Sutar SB

M.Sc, Agri Student, Department of
Animal Husbandry and Dairy
Science College of Agriculture,
Dhule, Maharashtra, India

Study of the physical properties and palatability of silage prepared from maize, multicut sorghum and Hybrid Napier (Phule Gunwant)

Sutar SB, Vasave VM, Desale RJ and Chaudhari DM

DOI: <https://doi.org/10.33545/2618060X.2024.v7.i10h.1839>

Abstract

The present investigation entitled, to study physical properties and palatability of silage prepared from maize, multicut sorghum and Hybrid Napier (Phule Gunwant) was carried out at division of Animal husbandry and dairy science, college of agriculture, Dhule. During study silage made from three different crops treatment viz. T₁-Maize (African tall), T₂-multicut sorghum (COFS 29) and T₃- Hybrid Napier (Phule Gunwant), respectively. This all treatment fodder were grown on fodder production unit at division of AHDS itself and used for silage production. Maize was harvested at 50% flowering i.e. milking stage or dough stage and multicut sorghum and Hybrid Napier grass are harvested/cut after 45 to 60 days each and all the treatment fodder crops were ensiled with bag method. Fodder crops are chopped at size of 4-5 cm piece with the help of chaff cutter. Chopped fodder was filled into each bag layer by layer compacted every layer by continuous treading to remove air and the silo bags were sealed immediately with an air-tight rubber/ rope once it was filled and stored the same at cool and dry place for 60 days. After 60 days of fermentation period, all the bags filled with the different treatment fodder were opened and samples were analyzed to assess its physical quality and palatability of the same. As physical parameters point of view, we seen the colour, texture and odour of the silage of each treatment. The results revealed in colour, texture and odour other than moisture where treatment T₁ (Maize) was found significant 73.35% followed by treatment T₃ and T₂ with 70.01% and 67.32%. Moreover, the results about palatability test treatment T₁ i.e. maize silage found superior with 86.5% followed by T₃ Hybrid Napier silage with 84.7% and T₂ multicut sorghum silage with 83.7%.

Keywords: Silage, maize, multicut sorghum, Hybrid Napier (Phule Gunwant), physical properties, palatability etc.

Introduction

Livestock sector in India is not only a significant contributor to the national economy but also plays a crucial role in ensuring food security, providing livelihoods to millions, and supporting sustainable agriculture practices. Its continued growth and development are essential for the overall economic and social well-being of the country.

In India, the demand and supply of fodder are crucial for sustaining its vast livestock population, which includes approximately 30% of the world's cattle and 20% of its small ruminants. The country's livestock sector heavily relies on fodder for dairy production, draught power, and meat production, among other uses. The demand for fodder is immense, driven by the significant livestock population and increasing meat and dairy consumption. For instance, India is the largest milk producer globally, with over 190 million tonnes of milk production annually, necessitating substantial quantities of fodder to maintain productivity. The total area under cultivated fodders in India is 8.4 mha on individual crop basis. India is maintaining about 15% of total livestock population of the world in 2.29% of the global land area. At present, the country faces a net deficit of 35.6% green fodder, 10.95% dry crop residues and 44% concentrate feeds.

The supply and availability of fodder however, face several challenges. Fodder production is predominantly rain-fed and subject to seasonal variations, with shortages often occurring during dry periods. Accordingly, The ICAR- Indian Grassland and Fodder Research Institute (IGFRI),

Jhansi has estimated that there is deficit of 11.24 percent in green fodder respectively, in the country. Majorly green fodder deficit in the summer season as compare with the rainy and winter season. To overcome this problem to make an availability of green fodder throughout year, preservation or conservation techniques of green fodder is the one of the solutions.

Silage making is one of the cost effective methods for the preservation of forage, nutrient and also a form of treatment. A demand of maize crop for silage-making is more but demand of maize grain increased day by day as population of globe increases, we to find the Suitability Or even better alternatives for silage-making. Accordingly, we planned the work on the same with the use of multicut fodder sorghum, Hybrid Napier with maize and to find out its physical characteristics and palatability.

Methodology

The present investigation entitled, to study physical properties and palatability of silage prepared from maize, sorghum and Hybrid Napier (Phule Gunwant) was carried out at division of Animal husbandry and dairy science, college of agriculture, Dhule. During study silage made from three different crops treatment viz. T₁-Maize (African tall), T₂-multicut sorghum (COFS 29) and T₃- Hybrid Napier (Phule Gunwant), respectively. This all treatment fodder were grown on fodder production unit at division of AHDS itself and used for silage production. Maize was harvested at 50% flowering i.e. milking stage or dough stage and multicut sorghum and Hybrid Napier grass are harvested/cut after 45 to 60 days each and all the treatment fodder crops were ensiled with bag method. Fodder crops are chopped at size of 4-5 cm piece with the help of chaff cutter. Chopped fodder was filled into each bag layer by layer compacted every layer by continuous treading to remove air and the silo bags were sealed immediately with an air-tight rubber/rope once it was filled and stored the same at cool and dry place for 60 days.

After 60 days of fermentation period, all the bags filled with the different treatment fodder were opened and samples were analyzed to assess its physical quality in particular colour, texture and odour of silages were determined described by Kilic (1986) [3].

Colour of the silage samples were determined with the help of Munsell colour chart, the scale 1- 4 was used on the basis of change in green colour from dark brown, dark green to pale yellow for its factual representation. Odour of the samples was determined by sensory evaluation i.e. smell, the scale 1-7 was used on the basis of repugnant putrid smell to acidic sweet pleasant smell its representation. For evaluation of texture, the scale 1 to 4 was used on the basis of softness of leaves and stem as well as its ability to remain intact after squeezing the silage tightly in hand and then opening from breaking into small pieces to break into two or three pieces.

The same person scored the silages for smell, colour and structure to avoid any biasness. The overall silage quality was classified into categories as poor, medium, good and very good on the basis of cumulative score obtained from colour, smell and structure.

Palatability was assessed as a feeding of the silage to three cow heifers, who were around a year old, were given the prepared silage two hours prior to feeding in order to assess its palatability and voluntary intake during a five-day period. Each day, 10 kg of silage is supplied to each heifer, which is regarded as 100%. After the heifer has finished eating, the residual silage is weighed to determine how much quantity of silage is

consumed and what remains from the offered quantity (in terms of both amount and percentage). The data generated during the experimental period were subjected to statistical analysis of variance (ANOVA) by completely randomized design as described in Snedecor and Cochran (1989) [10] with three treatments and seven replications.

Results and Discussion

The observations recorded during the experiment were analyzed statistically and the results obtained are discussed underneath.

Physical Properties of Silage

Colour

It is revealed from table 1 that the colour score of silages was significantly not affected due to treatments. Whereas, the colour score of silages prepared from treatment T₁ (Maize), T₂ (Multicut sorghum) and T₃ (Hybrid Napier) were 3.67, 3.73 and 3.59 respectively which were comparable with the colour score of (3.63), (3.66) and (3.63) observed from Maize, Super Napier and Sorghum silages respectively reported by Paidi L. P. *et al.*, (2022) [8], Rafiuddin *et al.* (2016) [9] also observed that colour scores for maize silages was 3.70 and for Sorghum silage was 3.36 respectively corroborated the present findings. Similar to the present findings Noordeen N. *et al.*, (2021) [7] found that colour scores for Maize, Sorghum and Hybrid Napier grass is (1.65), (1.43) and (1.23) respectively.

The colour score of silage prepared from multicut sorghum (T₂) was comparatively highest i.e. (3.73 out of 4) among all treatments. However, colour score of silage prepared from T₃ (Hybrid Napier) treatment was comparatively lowest i.e. (3.59 out of 4).

The colour of all silages was light green to brownish but the silage prepared from Multicut sorghum was slightly better i.e. pale brown in colour than other two treatments. The pale green to brownish colour found in this study was consistent.

Texture of Silage

From table 2 shown that the texture score of multicut sorghum silage was slightly affected due to treatments, Whereas, texture score of Maize (T₁), multicut sorghum silage (T₂) and Hybrid Napier (T₃) were recorded as 3.49, 3.57 and 3.41 respectively. which were comparable with the texture score Maize silage (3.46), Super Napier silage (3.43) and Sorghum silage was (3.53) reported by Paidi L. P. *et al.*, (2022) [8], Noordeen N. *et al.*, (2021) [7] also found that texture score of Maize silage, Sorghum silage and Hybrid Napier grass silage was (3.6), (3.3) and (3.05) respectively. Similar to the present findings Rafiuddin *et al.* (2016) [9] also reported that texture scores of maize silage was (3.90) and for Sorghum silage was (3.88) respectively, which verifies the present findings.

The texture score of silage prepared from multicut sorghum(T₂) was slightly highest i.e. (3.57 out of 4) among all the treatments. However, texture score of silage prepared from Hybrid Napier (T₃) treatment was slightly lowest i.e. (3.41 out of 4). The results were shown by, Andrews D. O. *et al.*, (2018) [2] revealed that after 60 days of ensiling, the firm texture of the Napier grass silage is observed. Markos F. D. *et al.*, (2015) [6] also reported that after adding 3% sugar cane molasses, the Hybrid Napier and maize silage textures are firm for both treatments.

Odour/Aroma of Silage

It is revealed from table 3 that, the aroma score of maize silage was slightly affected due to treatments. Whereas, the aroma score of silage prepared from Maize (T₁), Multicut sorghum (T₂)

and Hybrid Napier (T₃) were recorded as 5.60, 5.40 and 5.37 respectively. Consistent to the present findings Paidi L. P. *et al.*, (2022) [8] noted that the odour/ aroma scores for Maize, Super Napier, Sorghum silages was (5.46), (5.26) and (5.36) respectively. Compare to this results Rafiuddin *et al.* (2016) [9] also reported that odour or aroma score for maize silage was (5.27) and for Sorghum silage was (4.91) respectively endorses the present findings.

The aroma score of silage prepared from T₁ (Maize) treatment was slightly or numerically highest i.e. (5.60 out of 7) among all the treatments. However, aroma score of silage prepared from T₃ (Hybrid Napier) treatment was slightly lowest i.e. (5.37 out of 7).

The typical aromatic smell was observed due to high concentration of lactic acid suggesting that all silages were well fermented. Present findings were corroborated with, Noordeen N. *et al.*, (2021) [7] found that odour score of Maize silage (11.85) Sorghum silage (10.59) and Hybrid Napier grass silage was (8.12) respectively. Markos F. D. *et al.*, (2015) [6] also found that after adding 3% sugar cane molasses, the Hybrid Napier and maize silage's aroma or odour had a nice, alcoholic scent for both treatments. Andrews D. O. (2018) [2] revealed that after 60 days of ensiling, the fragrance of Napier grass silage is noticed to be ethanol-like. L. Kung and Shaver *et al.*, (2018) [4] suggested that good or well-made silage is acknowledged to have a pleasing scent.

Palatability of Silage

The data regarding the palatability of silage prepared from different treatments were presented in table 4 and it is revealed that palatability was found to be comparatively different in all treated silages. The average palatability was 86.5%, 83.7% and 84.3% for treatment T₁ (Maize), T₂ (Multicut sorghum) and T₃ (Hybrid Napier) respectively.

From the obtained result it was concluded that the treatment T₁ (Maize) silage having high crude protein content along with good quality well fermented aroma and texture, mainly this factors are responsible for more preference and even more palatable nature of silage followed by other two treatments i.e. treatment T₃ (Hybrid Napier) silage and then treatment T₂ (Multicut sorghum) silage. In contrast to the present findings

Manyawu G. J. *et al.* (2003) [5] concluded that maize treated silage were more palatable and preferable as compare to Hybrid Napier grass silage.

Table 1: Physical parameter/Organoleptic parameter - Colour of Silage

Treatments	Physical Parameter : Colour							Mean
	R _I	R _{II}	R _{III}	R _{IV}	R _V	R _{VI}	R _{VII}	
T ₁	3.8	3.5	3.8	3.5	3.6	3.8	3.7	3.67
T ₂	3.6	3.9	3.6	3.8	3.7	3.8	3.7	3.73
T ₃	3.6	3.4	3.6	3.7	3.6	3.8	3.4	3.59
SEm(±)								0.05
CD (5%)								0.15
Result								N.S

Table 2: Physical parameter/Organoleptic parameter -Texture of Silage

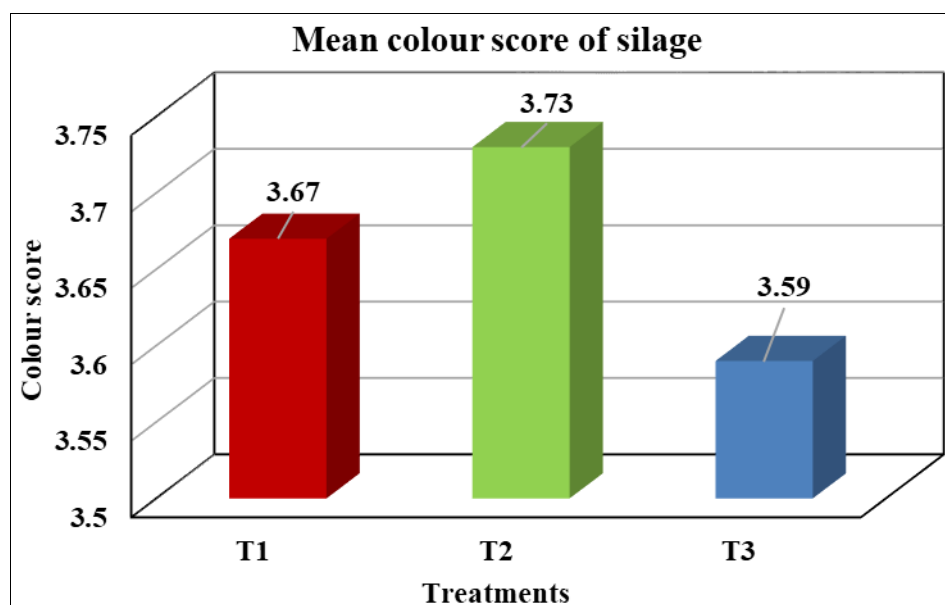
Treatments	Physical Parameter : Texture							Mean
	R _I	R _{II}	R _{III}	R _{IV}	R _V	R _{VI}	R _{VII}	
T ₁	3.6	3.3	3.7	3.3	3.5	3.4	3.6	3.49
T ₂	3.4	3.8	3.4	3.6	3.5	3.7	3.6	3.57
T ₃	3.4	3.2	3.7	3.3	3.2	3.6	3.5	3.41
SEm(±)								0.06
CD (5%)								0.19
Result								N.S.

Table 3: Physical parameter/Organoleptic parameter - Odour/Aroma of Silage

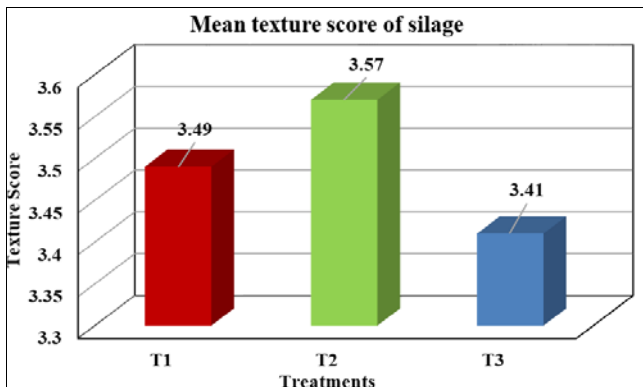
Treatments	Physical Parameter : Odour/ Aroma							Mean
	R _I	R _{II}	R _{III}	R _{IV}	R _V	R _{VI}	R _{VII}	
T ₁	6.1	5.2	5.9	5.2	6.1	5.3	5.4	5.60
T ₂	4.9	5.7	5.2	5.7	5.2	5.6	5.5	5.40
T ₃	5.2	5.1	5.8	5.0	5.1	5.8	5.6	5.37
SEm(±)								0.14
CD (5%)								0.40
Result								N.S.

Table 4: Palatability of Silage made from Maize, Multicut Sorghum and Hybrid Napier

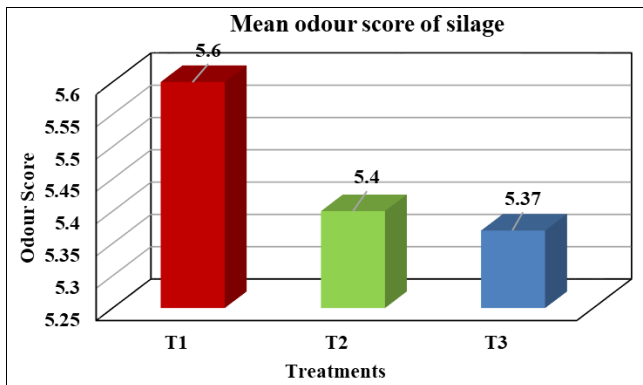
Sr. No	Particulars	Percent Palatability
1	Silage of Maize (African Tall)	86.5%
2	Silage of Multicut sorghum (COFS 29)	83.7%
3	Silage of Hybrid Napier (Phule Gunwant)	84.3%



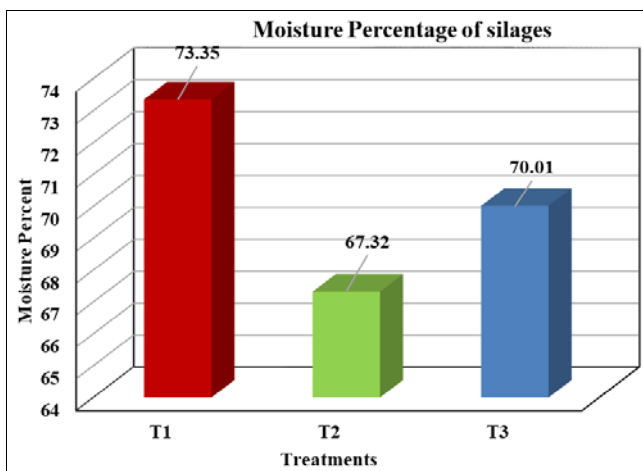
Graph 1: Mean colour score of silage



Graph 2: Mean texture score of silage



Graph 3: Mean odour score of silage



Graph 4: Moisture percentage of silage

Conclusion

The overall sensory score and in the physical properties like colour, odour and texture significant difference was not observed within treatments, other than moisture percentage where treatment T₁ (Maize) found significantly differ from other treatments. In the palatability test showed insignificant difference in the acceptance of silage made from maize, multicut sorghum and Hybrid Napier. All the silages were equally preferred by heifers but silage made from maize has more preference than other silages.

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