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Effect of different fodder crops and its combination on quality of silage

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Abstract
The experiment was conducted at Glass House farm, Department of Forage Crops, Tamil Nadu Agricultural University Coimbatore. Treatments includes four grasses and two legumes individually *as* well as in combination. The treatments have recorded silage temperature range from 29.33-30 (˚C), pH range between 4.03- 5.10 and quality parameters *viz.* dry matter, moisture, crude protein, crude fiber range from 28.54- 35.60, 54.40- 61.46, 13.89- 25.57, 31.13- 36.52 per cent, respectively. Higher pH of 5.10 was recorded in *Desmanthus* (T_5) and it was on par with fodder cowpea (4.70). Silage temperature was not varied significantly due to different fodder crops and its combination. Significantly higher dry matter content of 35.51 percent was recorded in multi cut fodder sorghum (T3). Maximum crude fibre content of 36.52 per cent was registered in guniea grass + *Desmanthus* (3:1) (T8) and lower crude fibre content of 31.13 was registered in fodder cowpea alone. *Desmanthus* (T5) also recorded higher crude protein of 25.57 per cent.

Keywords: Silage, fermentation, quality and storage

Introduction

Agriculture and its sub sector plays an imperative role in the rural economy of India by providing employment and additional family income along with its ability to meet out the food and dietary energy necessity of millions of Indians through milk, meat and egg. Past ten years India’s milk and meat production have been increased with proper demand by supply. India ranks first in livestock population (536.76 millions), which is 4.8 per cent increase over previous 19th livestock census. In India, nearly 95 percentage of rural and 4.2 percentage of urban populations are involved in Livestock rearing. However, urban area cattle population increased by 11.19 percent which is almost double when compared to rural areas (4.5 percent) and it clearly illustrates that urban areas also becoming feasible area for cattle rearing (Livestock census,2019) [3].

Though India has made greater quickness in livestock population, the productivity of milk and other livestock products are very low when compared to other countries around the world. Chronic dearth of feeds and forages together with its deprived quality ascribed the lower productive capacity and fertility of Indian livestock. According to Aher *et al.* (2003) [1], nearly 97% of commercially available feed are extremely low grade and hence it have an adverse effect on animal health, physical condition and milk yield. As the gap between the demand and supply of the quality feed for livestock becoming unconquerable, researchers and farmers are in search for an alternative fodder production or preservation method that would restore fodder and livestock production. In this juncture, silage production technology established as the better option for fodder preservation (Wilkinson *et al.*, 2003) [2]. Titterton *et al.* (2002) [3] revealed that silage produced with different crops like grasses, legumes and its combinations in polybags found to be superior in quality and low in cost. Poly bag silage preserving technology become much popular in agricultural sector due to its minimum cost, less human power and reduced aerobic spoilage during storing period (Pariyar, 2005) [4]. Kadham *et al.* (2017) [5] stated that crops *viz*., Bajra napier hybrid grass, Fodder maize, sorghum, oat, barely, cowpea and berseem were found to be suitable for making silage. Keeping these in view, this study was mooted to know the nutrient changes in poly bag silage of different crops produced by air evacuation method.

Materials and method

The experiment was conducted at Glass House farm, Department of Forage Crops, Tamil Nadu Agricultural University Coimbatore.

Treatments includes four grasses and two legumes individually as well as in combination *viz*., T_{1-} Cumbu napier hybrid grass, T_{2-} Guinea grass, T_{3-} Multi cut fodder sorghum, T_{4-} Fodder maize, T_{5-} *Desmanthus*, T_{6-} Fodder cowpea, T $_{7-}$ Cumbu napier hybrid grass + *Desmanthus* (3:1), T_{8-} Guinea grass + *Desmanthus* (3:1), T_{9-} Multi cut fodder sorghum + *Desmanthus* (3:1), T_{10-} Fodder maize + *Desmanthus* (3:1), T_{11-} Cumbu napier hybrid grass + Fodder cowpea (3:1), T_{12-} Guinea Grass + Fodder cowpea (3:1), T_{13-} Multi cut fodder sorghum + Fodder cowpea (3:1), T_{14-} Fodder maize + Fodder cowpea (3:1). The experiment was laid out in completely randomized design (CRD) with fourteen treatments and each treatment was replicated thrice.

Fodder crops were harvested at optimum stage (45-60 days) from planting. After harvesting, crops were dried in the field for 12 -18 hours to obtain optimum moisture content of 60 - 70%. Then crops were chopped into small pieces of 0.5-1inches which was ideally suitable for bag filling due to its enhanced surface area. Chopped fodder crops were filled in the poly bags as per the treatment schedule. Vacuum machine was used for creating anaerobic conditions. Silage poly bags were opened after two months and laboratory analysis were performed to assess the quality of the silage.

Silage temperature was measured by using thermometer probe and reading was taken at 3 foot depth. Dry matter content was estimated by weighed representative samples (of silage) collected from each bag were air dried and then oven dried at 80º ±5ºc for 72 hours and expressed in percentage. The moisture content was calculated by using fresh weight and dry weight data of the sample and expressed in percentage. Total nitrogen content was estimated by micro kjeldahl's method suggested by Humphries (1956) [6] and it was multiplied by the factor 6.25 to obtain the total protein content. It was expressed in percentage. Crude fibre content was estimated gravimetrically by successive digestion and washing of a weighed portion of the plant sample with dilute acid and alkali suggested by Vansoest and McQueen (1973) [7]. The material left undigested was considered as crude fibre and expressed in percentage.

Results and discussion

Different fodder crops and its combination resulted a marked variation in silage pH (Table 1). Higher pH of 5.10 was recorded in *Desmanthus* (T_5) and it was on par with fodder cowpea (4.70) while lowest pH of 3.83 was recorded in fodder maize (T4). The above findings are conformity with the results of Bolsen, 1977 [8]. Webster, 1992 [9] and Reiber *et al.* (2009) [10] also stated that production of acids by anaerobic fermentation resulted the lower pH. Silage temperature was not varied significantly due to different fodder crops and its combination (Table 1). Respiration of anaerobic microbes arrested during final stage of fermentation and it might be resulted no significant variation in temperature of different treatments. This is in line with the findings of Moor and Jung (2001) [11] and Adesogan. (2009) [12].

There was an appreciable difference in dry matter content of silage due to different crops and its combination (Table 2). Among the different treatments, significantly higher dry matter content of 35.51 percent was recorded in multi cut fodder sorghum (T3). It was on par with fodder maize + fodder cowpea (3:1) (T14), fodder maize + *Desmanthus* (3:1) (T10), multi cut fodder sorghum + *Desmanthus* (3:1) (T9) with 35.60, 35.39, 35.16 and 35.03 per cent, respectively. Availability of higher photosynthesizing surface and accumulation of higher photosynthetic assimilates vary with different fodder crops and it might be the reason for variation in dry matter content. Luis Felipe Pereira Borba *et al*. (2012) [13] also reported similar findings. Different crops and its combination had a significant impact on moisture percentage of silage. Significantly higher moisture content of 61.46 percent was recorded in fodder cowpea (T6). It was followed by Gunies grass + *Desmanthus* (3:1) (T8) which recorded the moisture content of 57.20 per cent. It might be due to leguminous crops like fodder cow pea are highly succulent with lesser dry matter when compared to other grass and cereal fodder crops. Similar, views were also expressed by (Al-Karaki and Al-Hashimi, 2012) [14].

Crude fibre content on silage shows significant variation among the fodder crops and its combination (Table2). Higher crude fibre per cent was recorded in guniea grass + *Desmanthus* (3:1) (T8) which recorded the crude fiber content of 36.52 per cent. It was on par with multi cut fodder sorghum (T3) with 35.28 percent and guniea grass (T2) with 35.14 per cent. Lower crude fibre content of 31.13 was registered in fodder cowpea alone. Accumulation of more lignin and polyphenolic compound in cereal and grassy fodders when compared leguminous crops might be the reason for higher crude fibre content in silage of above treatments. Sarmini and Premaratne (2017) [15] also reported higher crude fibre content in grasses due to accumulation of lignin. Crude protein content of silage was varied significantly due to different crops and its combination (Table 2). *Desmanthus* (T5) recorded higher crude protein of 25.57 per cent and it was followed by Bajra Napier hybrid grass + fodder cowpea (3:1) (T11) which registered crude protein content of 19.15 per cent. It might be ascribed due to comparatively higher translocation and storage of nitrogen in leguminous fodders. Similar results were also reported by (Kanani *et al.*, 2006) [16].

Table 1: Bio-chemical effect of pH and temperature studies on silage

Treatment	silage PH	Silage temperature (C)
T1-Cumbu napier hybrid grass	4.07	29.73
T2-Guniea grass	4.03	29.93
T3-Multi cut fodder sorghum	4.37	29.90
T4-Fodder maize	3.83	29.33
T5- *Desmanthus*	5.10	29.87
T6 - Fodder cowpea	4.70	30.00
T7- Cumbu napier hybrid grass + *desmanthus* (3:1)	3.97	29.90
T8 - Guniea grass + *desmanthus* (3:1)	4.43	29.73
T9 - Multi cut fodder sorghum + *desmanthus* (3:1)	4.20	29.70
T10- Fodder maize + *desmanthus* (3:1)	4.33	29.87
T11-Cumbu napier hybrid grass + fodder cowpea (3:1)	3.90	29.83
T12-Guniea grass + fodder cowpea (3:1)	3.87	29.83
T13- Multi cut fodder sorghum + fodder cowpea (3:1)	4.03	29.83
T14- Fodder maize + fodder cowpea (3:1)	4.10	29.83
SEd	0.27	0.29
CD(P=0.05)	0.56	NS

Table 2: Effect of quality parameters of dry matter, moisture, crude fiber and crude protein per cent on silage quality.

Treatments	DM %	Moisture %	Crude fiber %	Crude protein %
T1	32.41	67.59	29.32	11.57
	(34.70)	(55.30)	(32.78)	(19.88)
T2	28.82	71.18	33.17	6.6
	(32.45)	(57.55)	(35.14)	(14.88)
T3	33.44	66.56	33.39	7.63
	(35.31)	(54.69)	(35.28)	(16.03)
T4	32.19	67.81	30.75	8.33
	(34.55)	(55.45)	(33.66)	(16.77)
T5	31.55	68.45	32.54	18.63
	(34.17)	(55.83)	(34.77)	(25.57)
T6	22.84	77.16	26.73	15.63
	(28.54)	(61.46)	(31.13)	(23.29)
T7	31.69	68.31	27.15	9.6
	(34.25)	(55.75)	(31.39)	(18.01)
T8	29.36	70.64	35.43	5.77
	(32.80)	(57.20)	(36.52)	(13.89)
T9	32.97	67.03	28.86	7.33
	(35.03)	(54.97)	(32.49)	(15.69)
T10	33.17	66.83	31.87	8.47
	(35.16)	(54.84)	(34.36)	(16.9)
T11	31.87	68.13	28.72	10.77
	(34.37)	(55.63)	(32.40)	(19.15)
T12	32.36	67.64	31.49	7.9
	(34.67)	(55.33)	(34.13)	(16.32)
T13	33.90	66.10	29.19	6.23
	(35.60)	(54.40)	(32.69)	(14.44)
T14	33.56	66.44	29.83	6.97
	(35.39)	(54.61)	(33.10)	(15.24)
SEd	1.13	1.84	1.21	0.73
CD(P=0.05)	2.32	3.92	2.48	1.50

Figures in parenthesis are original values data subjected to Arcsine transformation

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