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UTILIZATION OF DELAYED HARVESTED HYBRID NAPIER IN SILAGE

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SUMMARY

The present experiment was conducted to utilize delayed harvested hybrid napier cv. Phule Gunwant for silage making. The green forage of hybrid napier (BxN) harvested late at 60 and 70 days was utilized to prepare silage with 2 % and 3% jaggery. The physical and nutritional parameters of silage such as pH, colour, flavour and fodder quality parameters *viz*., dry matter, crude protein, ammonical-N, acid detergent fibre, neutral detergent fibre and *in vitro* dry matter digestibility were compared with the silage prepared from maize and sorghum forage. Although, maize and sorghum silage exhibited superior silage quality, the silage prepared from hybrid napier harvested at 70 days + 2% jiggery was of sufficiently good quality as it exhibited acceptable light yellow colour, light acidic smell with pH, ammonical-N, dry matter, crude protein, acid detergent fibre, neutral detergent fibre content and *in vitro* dry matter digestibility.

Key words: Silage, BxN hybrid, dry matter, nutritional quality, ammonical-N

India has larger population of livestock but productivity milk is very low as compared to world average and much lower than the developed countries. Lack of proper quality and quantity of forage is one key constraints of productive livestock population in the country. Inadequate green forage availability to livestock adversely affects the productivity and reproductive performance. Increased livestock productivity is largely determined by the availability of feed both in terms of quality, quantity and continuity (Tahuk *et al.*, 2020). India has a net deficit of 61.1% green fodder, 21.9% dry crop residues and 64% concentrate feeds. Better productivity of milk could be achieved by supplying green forage throughout the year particularly during gaps between seasons. In order to bridge this gap, growing of perennial source of green fodder is necessary. The Bajra x Napier hybrid (BxN hybrid) is one of the such principle forage crop, gives frequent cuttings, supplies green forage continuously for 3-5 years with higher yield potential, save expenses on labour, preparatory tillage and planting material. This crop is best suited to high rainfall areas, drought-tolerant and grows almost well in tropical and subtropical areas. The Mahatma Phule Krishi Vidyapeeth (M.P.K.V.), Rahuri has made breeding efforts, released BxN hybrids *viz*., RBN-9, RBN-13 and recently RBN 2011-12 (Phule Gunwant). These varieties are becoming popular among dairy farmers. During rainy season surplus quantity of green forage is available from many source, hence farmer avoids harvesting of B×N hybrids at proper stage (45-55 days after regrowth) keeping in mind that it could be utilized further at the time of deficit period. Adoption of such practice by the farmers, the green forage of the B×N hybrid becomes over matured and nutritionally poor, affects performance of animals in terms of milk yield. It is therefore, necessary to find out an alternative solution in order to utilize delayed harvested hybrid napier, so that quality of forage could be improved and feed remains guaranteed available throughout the year. The utilization of delayed harvested B×N hybrid in silage making could be one of the options to improve their palatability and acceptability by the animals. Generally most of the napier, B×N hybrids or grasses contains very low (less than 2-4%) sugar or WSC (water soluble carbohydrates) (Agrawal, *et al*., 2015) as compared to maize or sorghum green forage required for anaerobic fermentation in silage making. Hence the WSC content could be increased by adding jaggery solution externally for making better fermentation of silage. Therefore, present research work was undertaken to prepare silage from BxN hybrid with addition of jaggery in different concentrations as source of WSC and compared it with maize and sorghum silage.

MATERIALS AND METHODS

The silage was prepared from green forage of hybrid napier (BxN) cv. Phule Gunwant harvested late at 60 or 70 days stage. Whereas, maize (cv. African Tall) and sorghum (cv. Phule Godhan) were harvested at proper stage required for silage making i.e. milking stage. The harvested green forages were allowed to reduce moisture level approximately to 65-70 % by keeping in the field for 4-6 hrs. Thereafter, the harvested forage was chopped in small pieces of 2-3 inch size using machine. Two and three per cent jaggery solution was prepared in the proportion of 1:2 with water and evenly sprinkled over only on the hybrid napier chopped pieces. These chopped pieces were filled in air tight plastic bags. Air inside the bags was removed completely by pressing thoroughly and using vaccum pump. The bags were air tied with rope and kept it for 45 days under rodents and moisture free shed for fermentation. The same trial was repeated thrice in a year. The treatment details were T_1-Phule Gunwant +60 days+1% jaggery, T_2-Phule Gunwant +60 days+2% jaggery, T_3-Phule Gunwant +70 days+1% jaggery, T_4- Phule Gunwant +70 days+2% jaggery, T_5-Maize: African Tall (C) cutting at milking stage and T_6-Sorghum: Phule Godhan (C) cutting at milking stage.

After 45 days, samples from each replication were collected and divided in to two part for fresh and dry sample analysis. From the fresh silage, the quality parameters *viz*., pH, colour, flavour and ammonical-N were determined. The second part of sample was dried completely in a hot air oven at 55^0C. The dried samples were ground to fine power and analysed for fodder quality parameters. The crude protein was carried out by standard A.O.A.C. (1990) method. The acid detergent fibres (ADF) and neutral detergent fibres (NDF) were evaluated from oven dried samples using method developed by Van Soest (1963). The *in-vitro* dry matter digestibility was evaluated by standard procedure of Tilley and Terry (1963). The statistical analysis of the present experiment was carried using the Randomized Block Design (RBD) using three replications (Panse and Sukhatme, 1995).

RESULTS AND DISCUSSION

Physical characteristics

The Pooled mean of physical characteristics *i.e.* colour, flavour and pH of silage is depicted in Table 1. Among the silage treatments, significant differences were observed in various parameters studied. The colour of silage observed in the present investigation was light yellow, yellowish and greenish brown. The control treatment T_6-Sorghum: Phule Godhan cutting at milking stage showed excellent greenish brown colour, while another control treatment T_5-Maize: African Tall cutting at milking stage recorded yellowish green colour. The silage prepared from late harvested green forage of Phule Gunwant added with 1% or 2% jaggery and harvested at 60 or 70 days recorded light yellow colour (T_1, T_2, T_3 and T_4). Differences in colour may be due to differences in chlorophyll content at the time of harvest.

The variation in flavour was recorded in treatments varied from light acidic, medium acidic and strong acidic. All treatments showed acceptable flavour. The flavour of BxN hybrid cv. Gunwant silage with 1% or 2% jiggery, harvested at 60 or 70 day recorded light acidic, while medium acidic in sorghum silage and strong acidic in maize silage, it may be due to differences in rate of fermentation. The quality silage can be judged from its physical characteristics. The most important one of them is value of the degree of acidity (pH). The rate at which pH of silage decreases is largely determined by the number of lactic acid bacteria formed. The significant differences were observed in pH of the silage. The pH is categorised in to excellent, good, fair and poor grades (Prasad and Tyagi, 1999) to judge quality of silage. The pH of the all silage treatments were of good to excellent in grade. The lowest pH of 3.94 (excellent grade) was recorded in maize silage (T_5), followed by pH of 4.04 in treatment T_4- Phule Gunwant harvested at 70 days+ 2% jaggery of excellent grade which is statistically at par with maize silage. The pH of silage prepared from sorghum (T_6) also of excellent in grade. The treatments i.e. T_1, T_2 and T_3 showed pH in the range of good grade. Thus, silage from delayed harvested BxN hybrid could be utilized efficiently.

Forage quality of silage

The Pooled mean of dry matter, crude protein, ADF, NDF content and IVDMD of silage is depicted in Table No. 2. The dry matter content was ranged between 26.38-33.54%. The highest dry matter content of 38.33% was recorded in sorghum silage (T_6), followed by maize silage with 30.15%. Among the silage prepared from hybrid napier, the treatment (T_4) recorded highest dry matter content than rest of the treatment (T_1, T_2 and T_3).

TABLE 1
Pooled mean of colour, flavour and pH of silage

Treatments	Colour	Flavour	pH
T_1–Phule Gunwant+60 days+1% jaggery	Light yellow	Light acidic	4.32
T_2–Phule Gunwant+60 days+2% jaggery	Light yellow	Light acidic	4.22
T_3–Phule Gunwant+70 days+1% jaggery	Light yellow	Light acidic	4.14
T_4–Phule Gunwant+70 days+2% jaggery	Light yellow	Light acidic	4.04
T_5–Maize: African Tall cutting at milking stage (C)	Yellowish green	Strong acidic	3.94
T_6–Sorghum: Phule Godhan cutting at milking stage (C)	Greenish brown	Medium acidic	4.15
		G M	4.13
		SEm(+)	0.04
		CD @5%	0.10
		CV (%)	1.50

Grade	Quality standards for silage		
	pH	Flavour	% Ammo.-N
Excellent	3.5-4.2	Acidic	Below 10
Good	4.2-4.5	Acidic	10 to 15
Fair	4.5-4.8	Slightly	15-20
Poor	>4.8	Pungent	>20

(Prasad, J and Tyagi, A. K., 1999).

Crude protein and ammonical-N

The crude protein content was ranged between 6.37-7.71%. The highest crude protein content of 7.71% was recorded in sorghum silage (T_6), followed by maize silage with 7.44% crude protein. Among the silage prepared from hybrid napier, the treatment T_1 recorded the highest crude protein content of 7.17 % and the lowest was recorded in treatments T_4 (6:37%). As regards to ammonical-N (%) content in all treatments were below 10 indicating silage prepared were of excellent in grade. The lowest ammonical-N of 5.38% was recorded in treatment T_5, followed by treatment T_6 and T_4 etc. The results showed that ammonical-N content was comparable with maize or sorghum silage. It is generally recognized that protein is degraded into amino acids by microorganisms and plant enzymes, and further broken down into ammonia or amines, resulting in a loss of silage protein (Widiyastuti *et al.,*2014).

Fibre constituents

The acid detergent fibres (ADF) fraction was ranged between 39.1-48.2%.The lowest ADF content of 39.1% was recorded in maize silage (T_5), followed by sorghum silage with 41.4% (T_6). Among the silage prepared from hybrid napier, the treatment T_2 recorded the lowest ADF content of 44.7% and the highest was recorded in treatments T_3 (48.20%). The neutral detergent fibres was ranged between 60.68-67.60%.The lowest NDF content of 60.68% was recorded in maize silage (T_5), followed by sorghum silage with 61.68% (T_6). Among the silage prepared from hybrid napier, the treatment T_2 recorded the lowest NDF content of 65.60% and the highest was recorded in treatments T_3. Desta *et al.* (2016) reported that molasses addition resulted in reduction of lignocellulosic concentration except ADL. The molasses treatment is effective in hydrolyzing NDF, ADF, hemicelluloses and cellulose contents during the silage.

***In vitro* dry matter digestibility**

The *in vitro* dry matter digestibility was ranged between 51.87-58.07%.The highest IVDMD of 58.07% was recorded in maize silage (T_5), followed by sorghum silage with 56.27%. Among the silage prepared from hybrid napier, the treatment T_2 recorded the highest IVDMD of 53.61% and the lowest was recorded in treatments T_3. These results are in agreement with Rambu *et al*. (2017) that additives were effective in improving the quality of Napier grass silage leading to improved ruminal degradability, with molasses treatment yielding the best silage quality. Widiyastuti *et al.* (2014) also reported the addition of molasses additive produces silage with better quality than the addition of *L. Acidophillus* inoculants.

TABLE 2
Pooled mean of dry matter, crude protein, ammonical-N, ADF, NDF and IVDMD of silage

Treatments	Dry Matter (%)	Crude Protein (%)	Ammo-nical-N (%)	ADF (%)	NDF (%)	IVDMD (%)
T_1–Phule Gunwant+60 days+1% jaggery	26.38	7.17	5.96	46.0	65.77	52.65
T_2–Phule Gunwant+60 days+2% jaggery	26.90	6.90	5.76	44.7	65.60	53.61
T_3–Phule Gunwant+70 days+1% jaggery	28.50	6.62	6.09	48.2	68.83	50.84
T_4–Phule Gunwant+70 days+2% jaggery	28.99	6.37	5.59	46.9	67.60	51.87
T_5–Maize: African Tall cutting at milking stage (C)	30.15	7.44	5.38	39.1	60.68	58.07
T_6–Sorghum: Phule Godhan cutting at milking stage (C)	33.54	7.71	5.54	41.4	61.68	56.27
GM	29.08	7.04	5.72	44.38	65.03	53.88
SEm(+)	0.46	0.15	0.11	0.62	0.47	0.49
CD @5%	1.32	0.43	0.32	1.77	1.33	1.39
CV (%)	2.76	3.70	3.45	2.42	1.24	1.57

ADF - Acid Detergent Fibre, NDF - Neutral Detergent Fibre, IVDMD - In vitro Dry Matter Digestibility.

Kaewpila *et al*. (2020) reported that silage fermentation quality and *in vitro* dry matter digestibility of Napier grasses harvested at the late maturity stage is better by adding additive.

CONCLUSION

The green forage of hybrid napier (BxN) cv. Phule Gunwant harvested late at 60 and 70 days with 1 or 2 % jaggery could be utilized for making good quality silage. The physical and nutritional parameters of silage such as pH, colour, flavour, dry matter, crude protein, ammonical-N, acid detergent fibre, neutral detergent fibre and *in vitro* dry matter digestibility were comparable with silage prepared from maize and sorghum forage. Within treatments applied to hybrid napier for silage preparation, Phule Gunwant harvested late at 70 days + 2% jaggery was exhibited highly acceptable silage quality parameters.

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