Effect of Apple Pomace Based Silage on Lactation Performance of Crossbred Cows

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Abstract

The present study was conducted to evaluate the effect of inclusion of apple pomace based silage on milk performance of crossbred cows at Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India. In a feeding trial of 90 days duration, 12 crossbred cows were selected on the basis of their milk yield and were divided into two groups of six animals each. Animals in the control group were fed with the standard feeding practices of the farm i.e., concentrate @ 4kg d^{-1}, wheat straw @ 5 kg d^{-1} and *Grewia optiva* tree fodder @ 10 kg d^{-1}. Whereas each animal in the treatment group were given 5 kg silage d^{-1} consisting of maize, apple pomace (AP) and mulberry leaves in the ratio of 80:10:10 in addition to the standard feeding practices adopted. The daily milk yield of the animals in both the groups were taken at fortnightly interval for analysis of milk composition viz. milk fat, specific gravity, milk acidity, solid not fat (SNF) total solids and milk protein. Feeding of apple pomace based silage resulted in 9.95 per cent higher average peak mean milk yield than that of the control group. The average fat, SNF, total solids and protein content in the treatment group were 4.06, 9.19, 13.26 and 3.38 per cent while in the control group, it was 3.89, 8.98, 12.87 and 3.30, respectively. However, no significant difference in the milk acidity and specific gravity were observed. The study concluded that the incorporation of apple pomace based silage @ 5kg $animal^{-1}$ day^{-1} improved the milk productivity and quality of milk in lactating crossbred cows.

Introduction

Livestock has remained as an indispensable part of the traditional agricultural systems playing a major role in generating cash income through the production of milk, butter, meat, egg, hides, skin, wool and manure. According to FAO, livestock contribute 40 per cent of the global value of agriculture output; providing 15 per cent of the total food energy and 25 per cent dietary protein. Rural economy's mainstay has been through livestock farming and is an important sub sector of the agriculture in Indian economy with a contribution of about 4.9 per cent of the total GDP of the country (Anonymous 2020). India supports about 16 per cent of earth's human population and 10.71 per cent of the world's livestock population in 2.29 per cent of the land area in the world. Being an agricultural country and with nearly 70 per cent of the population living in rural areas, India rely on agriculture and animal husbandry for sustenance. As per 20th livestock census in India, there are about 192.49 million cattle, 302.79 million bovines, 74.26 million sheep, 148.88 million goats and about 9.06 million pigs and a total of 535.78 million livestock population in the country (Anonymous 2018). Livestock sub-sector plays a vital role in the Indian economy and also in the socio-economic development of millions of rural households. In 2020, the global milk production was nearly 906 million tonnes with highest production from Asia followed by Europe and North America. India's output for the same period of year was 195 million tonnes making them the highest producer of milk in the world (FAO 2021).

The total area under fodder cultivation in India accounts for only 4 per cent (8.4 million ha.) of the total cultivated land and has remained static over the last few decades (Meena et al. 2018). Availability of fodder in India is low with net deficiency of 35.6 per cent green fodder, 10.95 per cent dry fodder and 44 per cent concentrate feed materials (IGFRI 2015). In Himachal Pradesh, there is a deficit of 26.57 and 53.99 per cent green and dry fodder respectively (Dev et al., 2006) and therefore, to overcome this deficit, apple pomace which is a by-product after extraction of apple juice can be a good substitute to meet out the nutritional demands of livestock during lean periods. Himachal Pradesh is the second largest producer of apple (*Malus domestica* Borkh.) in India with an annual production of 0.446 million tonnes under an area of 0.112 million hectares (Anonymous 2018 and 2019). Using apple pomace for livestock feeding through ensiling is a way to mitigate the problem (Crawshaw 2004) which benefits not only the environment but also fulfils the nutrient requirement of livestock although only a small fraction is used due to its rapid spoilage of the wet pomace.

Methods

The study was conducted at the dairy farm of Department of Silviculture and Agroforestry, Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh during the year 2018-2019 to evaluate the effect of feeding apple pomace based silage on milk performance of lactating crossbred cows (Jersey x Local cattle). In the study, silage was incorporated in the diets of lactating Jersey crossbred cows maintained at the university dairy farm to study the milk performance of cows. In the experiment of 90 days duration, twelve crossbred cows were selected based on their milk yield and were divided into two equal groups of six animals each. Animals in the control group were fed with the standard feeding practices of the farm i.e., concentrate (18% CP; 70% TDN) @ 4 kg d^{-1}, wheat straw @ 5 kg d^{-1} and *Grewia optiva* tree fodder @ 10 kg d^{-1}. Whereas, each animal in treatment group was given 5 kg silage d^{-1} consisting of maize, apple pomace (AP) and mulberry leaves in the ratio of 80:10:10 (table 1) in addition to the standard feeding practices adopted in the farm. The daily milk yield of the animals in both the groups were recorded and the representative milk samples were taken at fortnightly interval for analysing the milk composition *viz*. milk fat, specific gravity, milk acidity, solid not fat (SNF), total solids and milk protein.

Table 1: Nutritive value of apple pomace based silage.

	pH	DM	CP	EE	CF	NDF	ADF	NFE	TA	AIA
80% Maize + 10% AP + 10% mulberry leaves	3.84	29.20	8.73	4.10	25.67	48.38	25.55	55.36	6.15	1.55

DM: Dry matter; CP: Crude protein; EE: Ether extract; CF: Crude fibre; NDF: Neutral detergent fibre; ADF: Acid detergent fibre; NFE: Nitrogen free extract; TA: Total ash; AIA: Acid insoluble ash.

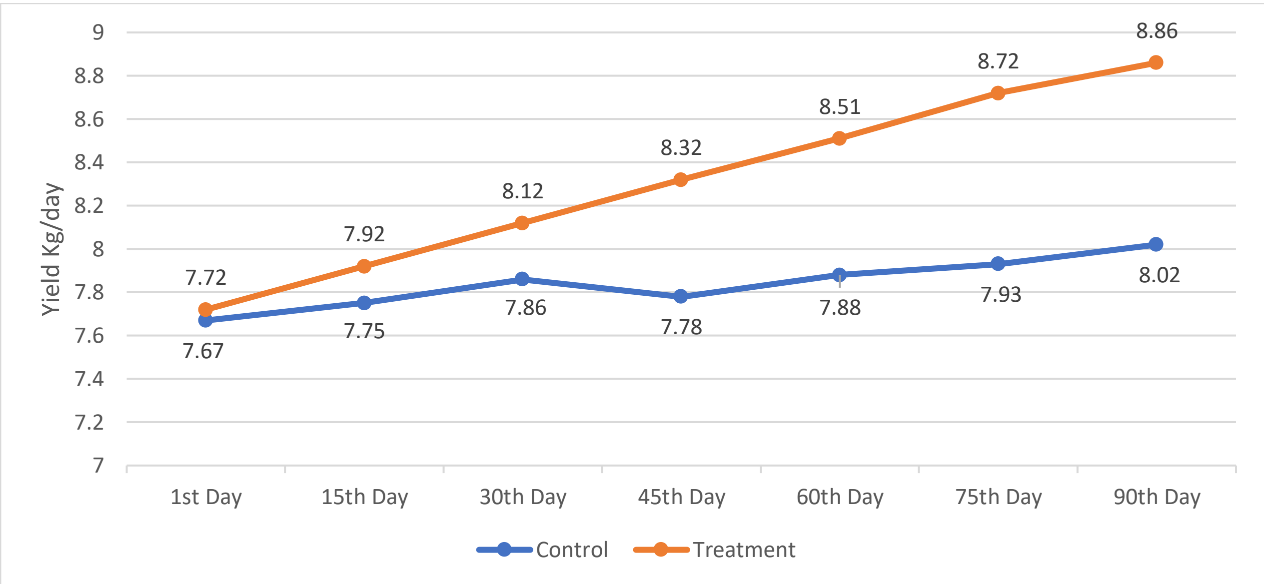
Results and Discussion

Effect of apple pomace based maize silage feeding on milk yield of crossbred cows

In the study, comparisons were drawn in lactating crossbred cows fed with standard practices against those that were fed with silage to evaluate the changes in milk productivity and composition. It was observed that feeding of silage to the crossbred cows (Fig 1) resulted in significantly higher average peak mean milk yield than that of control group (Fig 1). Feeding of silage to the crossbred cows in the treatment group resulted in 9.95 per cent higher milk yield as compared to the control group.

Supplementation of apple pomace resulted in the increase in the milk yields of dairy cows in late lactation (Edwards and Parker 1995). Anrique and Dossow (2003) also reported that inclusion of apple pomace in cow's diet resulted in 9 and 5.9 per cent increase in standardized (4% fat) and non-standardized milk production respectively.

Fig 1: Effect of apple pomace based silage on milk yield (animal kg^{-1} day^{-1}) of crossbred cows.



Effect of silage on milk composition

The data pertaining to the milk composition of the treatment and control group of animals are presented in Table 2. The average milk fat, SNF, total solids and milk protein per cent were significantly higher in the treatment group which were fed on silage. The average fat, SNF, total solids and protein content in the treatment group were 4.06, 9.19, 13.26 and 3.38 per cent, respectively. However, no significant difference in milk acidity and specific gravity was observed. Milk fat had an average of 4.28 per cent difference among the control and the treatment groups. In the same way, SNF, total milk solids and protein per cent had an average difference of 2.31, 2.99, 2.40 per cent, respectively. Inconsistencies in the control groups of milk fat, SNF, total solids and protein per cent were observed during the different time intervals of the 90 days feeding trial whereas in the treatment groups, there were consistent increase in the milk composition for the same which may be due to improved efficiency of nutrient utilization by supplementing apple pomace based silage which contained maize, apple pomace and *Morus alba* leaves.

Previous study of Dhiman et al. (2000) and Anrique and Dossow (2003) reported that inclusion of apple pulp silage resulted in higher milk fat and protein content of early lactating dairy cows, which are in conjunction with the findings of the present study. Earlier studies of Edwards and Parker (1995) also reported an increase in milk protein and total solids contents on feeding of apple pomace in lactating animal diets.

Table 2: Effect of feeding of apple pomace based silage on milk composition of crossbred cows.

Parameters	Days/Groups	I	II	III	IV	V	VI	VII	Mean
		1st day	15th day	30th day	45th day	60th day	75th day	90th day	
Milk fat (%)	Control (C)	3.83	3.92	3.86	3.98	3.85	3.90	3.88	3.89[a]
	Treatment (T)	3.86	3.91	3.93	4.07	4.19	4.22	4.27	4.06[b]
Solid not fat (%)	Control (C)	8.96	9.03	8.93	8.83	9.09	9.11	8.94	8.98[a]
	Treatment (T)	9.01	9.14	9.18	9.24	9.26	9.26	9.27	9.19[b]
Total milk solids (%)	Control (C)	12.79	12.94	12.79	12.81	12.94	13.01	12.81	12.87[a]
	Treatment (T)	12.87	13.05	13.11	13.31	13.45	13.48	13.54	13.26[b]
Protein (%)	Control (C)	3.24	3.25	3.31	3.30	3.31	3.36	3.35	3.30[a]
	Treatment (T)	3.25	3.33	3.36	3.40	3.42	3.45	3.47	3.38[b]
Milk acidity (%)	Control (C)	0.137	0.135	0.136	0.138	0.140	0.142	0.141	0.138[a]
	Treatment (T)	0.129	0.138	0.138	0.137	0.138	0.138	0.141	0.137[a]
Specific gravity	Control (C)	1.029	1.028	1.030	1.028	1.030	1.029	1.028	1.029[a]
	Treatment (T)	1.029	1.030	1.030	1.029	1.029	1.030	1.029	1.029[a]

*Means bearing different superscripts in column for individual parameters differ significantly.

Conclusions and/or Implications

Feeding of this silage @ 5 kg d^{-1} in addition to standard feeding practices resulted in 9.95 per cent higher milk yield with better milk composition in lactating crossbred cows. It is evident from the study that apple pomace can be effectively incorporated to maize during ensiling and can be given to animals for improving their milk productivity with better quality.

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