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Effect of Ensiling Time on the Quality of Banana Peelings and Pea Pod Silage

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Silage was prepared from banana peelings (BP) as such (100%), BP + *Lactobacillus*, BP (with 70% moisture), BP 70% moisture + *Lactobacillus*, BP (50%) + pea pod (PP) 50%, BP (50%) + PP (50%) + *Lactobacillus*, PP (70% moisture) + *Lactobacillus* and PP with 70% moisture by mixing them and packed in plastic bags at ambient temperature (28-35 °C) for 60 days of fermentation. Dry matter and protein contents showed gradual increase during the ensiling period.

Key words: Silage, Banana peeling, Pea pod, Ensiling time.

Introduction

Pakistan is an agricultural country in which various crops like cereal grains, sugar cane, oilseed and fodders are cultivated for food and feed. The production of these crops is anticipated to increase because of increase in livestock population. The increasing trend in livestock population (Economic Survey, 1998-99) has ultimately resulted in shortage of animal feed. Fifty million tones of crop residues and large amount of fruits and vegetables wastes are annually available in Pakistan. These wastes contain considerable amount of nutrients like protein fat, fibre ash and carbohydrates. Utilization of these wastes is limited due to high fibre and low protein. After proper treatment and processing these agro wastes can be utilized, (Ali *et al* 1989, 1992-a, 1992-b, 2000; Niazi *et al*., 1998 and Zia *et al* 1994) all have utilized fruits and vegetable waste in poultry feeding successfully. Due to high fibre contents these agro wastes can be incorporated in the poultry feed at low level, but ruminants can utilize well at larger quantity. Through silage process these agro wastes can be preserved and improvement in the nutritional value can be achieved. Earlier, Rasool (1991); Shaver *et al* (1984) and Bodine *et al* (1983) have reported the role of microbes, moisture, temperature, pH, ensiling time and sugar contents of the quality of silage prepared from different fodders.

The present investigations were carried out to prepare silage from banana peelings and pea pods discarded by fruits and vegetable processing units in and around Lahore city.

Materials and Methods

Fruits and vegetable wastes i.e. banana peelings and pea pods were collected from local market and Shezan fruit juice factory, Lahore respectively.

Processing. Banana peelings and pea pods were chopped in Hobart Disc Chopper. Banana peelings and pea pods were mixed with 37% and 25%wheat bran respectively in order to adjust the moisture level to 70%. The fruits and vegetables wastes were mixed in different proportions as detailed in Table 1. In some cases growth promoter (*Lactobacillus*) was also added. The samples (1 kg each) were packed in air tight 18 gauge plastic bags (30 cm x 30 cm) and silage was prepared from them by storing under anaerobic conditions at ambient temperature (28 – 35 °C) for 60 days.

The fermented samples were taken after 0, 30 and 60 days. Biochemical changes in pH, dry matter, fat, crude protein and ash contents during silage process were determined according to A.O.A.C methods (1984). Data collected were subjected to analysis of Variance and Duncan's multiple range

Table 1
Composition of silage

Sr. No.	Components
1	Banana peeling as such
2	Banana peeling as such + *Lactobacillus*
3	Banana peelings* (70% moisture)
4	Banana peelings* (70% moisture) + *Lactobacillus*
5	Banana peelings* 50% + peapods* 50%
6	Banana peelings* 50% peapods* 50% + *Lactobacillus*
7	Peapods as such
8	Peapods as such + *Lactobacillus*
9	Peapods (70% moisture) + *Lactobacillus*
10	Peapods (70% moisture)

* 70% moisture added by mixing with wheat bran.

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Table 2

Proximate composition of silage prepared from banana peelings and pea pods

Sr. No.	Components ** (%)	Moisture	pH			Dry matter (%)			Fat (%)			Protein (%)			Crude fibre (%)			Ash (%)		
			O hr	30 days	60 days	O hr	30 days	60 days	O hr	30 days	60 days	O hr	30 days	60 days	O hr	30 days	60 days	O hr	30 days	60 days
1	Banana peelings as such	95	5.0	3.9 [b]	4.0 [b]	13.10	13.13 [b]	11.85	1.23	3.96 [a]	2.96	9.66	6.16 [b]	4.19	10.20	14.30 [b]	15.81	2.57	3.45 [b]	3.60
2	Banana peelings + *Lactobacillus*	95	5.1	3.9 [b]	4.1	13.05	13.10	13.34	1.29	3.74 [a]	2.66	10.26	6.25 [a]	5.61	10.31	13.32	15.70	2.58	3.20	4.10
3	Banana peelings**	70	5.1	3.9 [b]	4.3	29.48	30.58	22.05	0.72	1.69 [b]	0.26	5.71	3.19 [b]	3.91	31.41	39.11	35.22	4.38	4.50	5.22
4	Banana peelings**+ *Lactobacillus*	70	5.2	3.6 [a]	4.1	36.18	36.10	34.49	0.80	0.92 [b]	0.51	5.20	3.44 [b]	2.74	37.17	39.18	35.50	4.54	3.68	3.39
5	Banana peelings** 50% + pea pods** 50%	70	5.2	3.6 [b]	4.0	32.18	32.05	32.07	1.68	1.79 [b]	1.69	7.06	5.61 [b]	6.24	35.52	37.21	38.40	3.29	5.01	4.28
6	Banana peelings** 50% + pea pods** 50% +*Lactobacillus*	70	4.5	3.8 [b]	4.1	34.56	35.30	32.39	1.54	1.69 [b]	0.95	6.68	6.63 [b]	6.19	36.31	40.21	36.50	4.41	4.49	4.66
7	Pea pods as such	85	5.1	3.5 [a]	3.9	15.40	17.72	15.98	2.75	2.79 [b]	1.93	11.79	7.55 [a]	6.20	28.50	23.12	25.71	0.90	0.99	1.19
8	Pea pods as such + *Lactobacillus*	85	5.5	3.9 [a]	4.4	15.84	15.94	16.04	2.08	2.52 [b]	1.48	12.38	6.63 [a]	6.19	28.33	24.35	25.82	1.20	2.10	2.29
9	Pea pods** + *Lactobacillus*	70	5.5	3.8 [a]	4.1	35.40	34.31	32.01	2.75	2.69 [b]	1.67	9.58	5.01 [a]	4.68	34.30	30.74	29.50	2.26	2.48	3.23
10	Pea pods**	70	5.3	3.8 [a]	4.3	35.30	36.55	34.22	0.95	1.69 [b]	1.55	8.96	4.90 [a]	4.60	34.92	31.71	30.02	2.40	3.28	3.30

* : Dry matter basis**; Moisture level adjusted after mixing with wheat bran; a = Significant at P<0.05, b = Non-significant

test was applied for the comparison of treatment means (Steel and Torrie 1980).

Results and Discussion

The effect of ensiling time on the proximate composition of banana peelings and pea pods silage prepared after mixing them is shown in Table 2. The pH of all the samples ranged in between 4.5 to 5.5, 3.6 to 3.9 to 4.4 at 0 hr, 30 days and 60 days. The results showed that pH of different samples significantly ($P<0.05$) decreased (1.1 to 1.7) at 30 days followed by slight increase of 0.1 to 0.5 at 60 days. The decrease in pH at 30 days seemed to be due to oxidation of sugars in banana peeling or pea pod to carboxylic acids e.g. lactic acid, acetic acid propionic acid as reported by Bodine *et al.* (1983) and Shaver *et al.* (1984) who observed similar changes in pH of silage prepared from alfalfa, corn, after 30 days. A slight increase in pH at 60 days might be due to partial biodegradation of carboxylic acid into CO_2, H_2O etc. pH 4 or less was considered best for a silage product as observed by Van Scot (1970). Dry matter contents of all the samples showed non-significant change upto 30 days. The decrease in dry matter content or in other words increase in moisture contents of different silage at 60 days appeared due to biodegradation of carboxylic acids into water and carbon dioxide as reported earlier (Scot 1970; Handerson *et al* 1972). The fat contents of silage samples were in between 0.80 to 2.75% at 0 hr. It increase significantly $P<0.05$ (3.74 to 3.96%) in case of banana peelings containing 95% moisture at 30 days. In case of all other silage samples the increase in fat contents was non-significant. The protein contents of different silage samples ranged between 5.20 to 12.38% maximum being in pea pod inoculated with *Lactobacillus* at 0 hr. Ensiling upto 30 days, significantly $P<0.05$ decreased the protein content (3.16 to 7.55%) followed by further decrease (2.74 to 6.24%) at 60 days. Maximum degradation of protein occurred when pea pods were inoculated with *Lactobacillus*. The decrease appeared due to acid hydrolysis of proteins into amino acids followed by their further biodegradation into nitrogen by aerobic and non-aerobic microbes for their consumption at 30 and 60 days respectively. These results are in accordance with followings of Handerson *et al* (1972).

The crude fibre contents of silage sample containing banana peelings as such or at 70% moisture in combination with the pea pod (50:50) with or without *Lactobacillus* (samples 1-6) showed an increase at 30 days as compared with 0 hr. The pea pod as such, with lower moisture content (70%), with or without *Lactobacillus* (samples 7-10) showed decrease in crude fibre contents at 30 days which is in agreement with the findings of other researcher on fodder, fruit and vegetable waste (Handerson *et al* 1972). Increase in ensiling time to 60 days further decreased the crude fibre contents. The decrease at 30 days and 60 days could be due to biodegradation by microbes. The each contents of silage samples containing banana peeling and pea pods mixed in different proportions contained 0.90 to 4.54% ash at zero hour, which increased to 0.99 to 5.01% at 30 days and further increased to 1.19 to 5.00 at 60 days.

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