

Study on Possibility of Ensiling Cabbage and Tomato with Rice Straw for Feeding Livestock

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Abstract—Cabbage (*Brassica oleracea*) and Tomato (*Solanum lycopersicum*) are two widely grown vegetables of winter in Bangladesh. During the end of the season the price of both vegetables become low due presence of many other vegetables. Even sometimes farmers prefer to feed those to their livestock instead of marketing. So, those were ensiled with rice straw in polythene bag for three weeks. Six different type of ensiling practiced like - 1(24.0kg straw+6.0kg cabbage), 2(18.0kg straw+12.0kg cabbage), 3(12.0kg straw+18.0kg cabbage), 4(24.0kg straw+3.0kg cabbage+3.0kg tomato), 5(18.0kg straw+6.0kg cabbage+6.0kg tomato), 6(12.0kg straw+9.0kg cabbage+9.0kg tomato). pH of group 3(12.0kg straw+18.0kg cabbage) and 6(12.0kg straw+9.0kg cabbage+9.0kg tomato) reduced gradually till 21 days. Day 21 it was 4.96 and 4.10 respectively indicated good quality silage. Crude protein content was 8.06 and 10.31 in 3 and 6 respectively. The result also reflected that both cases the ratio of straw was similar which is related to moisture content (76.6% in group 3 and 75.56% in group 6) for good quality silage. Further addition of tomato enhances reduction of pH of silage in group 6 than 3. Considering the pH value group 3 and 6 identified good quality silage and was offered to the cattle and found tomato added silage (6) was mostly accepted by the cattle. So it would be concluded that ensiling cabbage and tomato with rice straw maintaining proper ratio would be a good feed source for livestock, which would be further studied for cost effectiveness during later stage of their production.

Keywords: cabbage, ensiling, tomato, straw, livestock.

Introduction

Approximately 45% of the 60 million tons of cabbage produced in the world is wasted or lost during cultivation in the field (FAO, 2011). Thus, the ensiling process may be an alternative to preserve wasted foods in agriculture to use as feed for animal nutrition (Makkar and Ankers, 2014). In case of tomato more than 10% of the total production does not meet consumer requirements, resulting in post-harvest waste (Geisman, 1981). The percentage of waste could be greater in regions where a tomato processing industry is not present, when tomato is produced in open field (Riggi and Avola, 2010). In many countries like Bangladesh during last part of their production the price become low due to presence of other vegetable in the market farmers left their vegetables in the field till spoilage or few farmers feed their cattle.

Dry matter (DM) content of cabbage is below 120 g/kg, and cabbage has a low content of water soluble carbohydrates (Freyman et al., 1991). So, ensiling of cabbage without additives leads to low production of lactic acid and pH reduction is not satisfactory to avoid the action of undesirable microorganisms for silage (Cao et al., 2011), which results in an inefficient fermentative process and low silage quality (Woolford, 1984). In this context reduction of moisture content and addition of additives which would help to reduce pH immediately for better silage.

Addition of rice straw with cabbage would reduce the moisture content for desirable silage making enhancing lactic acid bacteria to grow. Secondly addition of tomato would be a means to incorporate water soluble sugars as well as acidic vegetable for enhancement of rapid reduction of pH for making quality silage. Feasibility of ensiling tomato has tested by a researcher by ensiling 140 days preserving its chemical composition even without the use of additives (Méndez-Llorente et al, 2014).

Above points suggested cabbage and tomato to be conserved during last part of their production, there would be an organized condition which would ensure less wastage of those vegetables, which would be a better option to reduce the scarcity of other fodders and can be a profitable and worth management than wastage. Considering the point's fresh cabbage was ensiled with straw and tomato using different ratio for feeding livestock and offered to the animal for acceptability study.

Materials and Method:

Initially rice straw and cabbage were chopped at three to five inches and tomatoes were mashed. Chopped straw, cabbage and mashed tomato were mixed at the different ratio as 1(24.0kg straw+6.0kg cabbage), 2(18.0kg straw+12.0kg cabbage), 3(12.0kg straw+18.0kg cabbage), 4(24.0kg straw+3.0kg cabbage+3.0kg tomato), 5(18.0kg straw+6.0kg cabbage+6.0kg tomato), 6(12.0kg straw+9.0kg cabbage+9.0kg tomato). Each mixture was packed in polythene bag at 10.0kg and sealed carefully considering three replicate bags. The bags were opened serially at 7 days interval for physical characteristics and chemical analysis. The pH of different

treatment was measured at before ensiling and 7 days interval till day 21. The dry matter content was determined by oven drying for 48h at 60°C. After drying, samples were grounded and proximate components (dry matter, crude protein, crude fiber, ether extract) were determined.

Result and Discussion:

Quality of silage observed from the physical characteristics of the resulting silage. After 21 days of ensiling the group 3 and 6 showed good color, fresh aroma and not slimy. Only a few fungal contaminations were visually observed on the surface of the silage due to aerobic conditions. These physical characteristics indicated a successful fermentation process for ensiling.

When straw and cabbage ratio was 2:3 (group 3) showed decreasing the pH slowly, but when a part of cabbage replaced by tomato (group 6 and ratio 4:3:3) the pH was further decrease due to acidity of tomato, acidity helps rapid ensiling. Optimum pH value for silage range from 3.9 to 4.2 and group 6 and 3 it was 4.10 and 4.96. So, ensiling with tomato found suitable for cabbage silage with rice straw.

Table 1: pH value of silages in different duration

Groups	1	2	3	4	5	6
1st day	6.65±0.05	6.80±0.07	6.85±0.06	5.70±0.06	5.26±0.07	5.06±0.06
7 th day	6.75±0.08	7.16±0.09	7.07±0.09	6.91±0.10	6.77±0.10	4.95±0.06
14 th day	7.42±0.09	6.03±0.10	5.57±0.09	8.34±0.09	8.46±0.09	3.96±0.06
21 th day	7.86±0.05	8.66±0.07	4.96±0.09	8.48±0.09	9.06±0.09	4.10±0.06

Groups; 1-(24.0kg straw+6.0kg cabbage), 2-(18.0kg straw+12.0kg cabbage), 3-(12.0kg straw+18.0kg cabbage), 4-(24.0kg straw+3.0kg cabbage+3.0kg tomato), 5-(18.0kg straw+6.0kg cabbage+6.0kg tomato), 6-(12.0kg straw+9.0kg cabbage+9.0kg tomato).

Initially nutrient content of rice straw, cabbage and tomato were determined and after 21 days of ensiling the nutrient content of the silage of group 3 and 6 were determined (Table 2).

Table 2: Nutrient composition of the raw ingredients and silages

Nutrient (%)	Rice straw	Cabbage	Tomato	3	6
Dry matter (DM)	92.08±0.09	8.63±0.12	4.96±0.15	23.40±0.07	24.44±0.15
Moisture	7.92±0.09	91.37±0.12	95.04±0.15	76.60±0.07	75.56±0.15
Crude protein (CP)	5.51±0.05	12.56±0.27	14.82±0.27	8.06±0.12	10.31±0.27
Crude fiber (CF)	31.41±0.10	11.63±0.15	12.14±0.16	30.63±0.13	28.31±0.13

Ether extract (EE)	1.16±0.06	2.76±0.12	3.38±0.12	2.95±0.15	2.63±0.13
Ash	13.50±0.20	9.16±0.12	9.85±0.13	15.08±0.15	13.20±0.15

Groups: 3=12.0kg straw+18.0kg cabbage, 6=12.0kg straw+9.0kg cabbage+9.0kg tomato.

The silage made with 12.0 kg straw, 9.0 kg cabbage and 9.0 kg tomato contained 10.31% CP (Crude protein) which was near to the range of quality silage. Cabbage and tomato both had contributed to increase CP content in the silage but due to higher CP content in tomato its content found higher in group 6. Rice straw had a great impact on reduction of moisture level of cabbage and tomato and thus contributed to increase dry matter content of group 3 and 6. The crude fiber content in the silages was also influenced by the rice straw. The nutrient characteristics of other groups were not determined as the pH of other silages didn't indicate quality. When the silage offered to the cattle of similar age and feeding condition silage of group 6 found mostly favorable for feeding than others.

Conclusion:

In comparison with different ratio of rice straw, cabbage and tomato a ratio of 4:3:3 found suitable for good quality silage for feeding livestock. So, cabbage and tomato can be conserved by ensiling with rice straw during the end of the season for scarcity period of fodder.

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