Effect of Ensiling Sudax Fodder with Broiler Litter and Candida Yeast on the Changes in pH, Lactic Acid and Nitrogen Fractions

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ABSTRACT : Sudax fodder *(Sorghum sudanense* × *Sorhum vulgare)* was ensiled in laboratory silos with or without 20, 30, or 40 percent broiler litter and 6 percent molasses with or without Candida yeast. The samples were analyzed for pH, lactic acid and nitrogen fractions at the start of the experiment and at 5 days interval, thereafter till 40 days. A sharp decline in pH and increase in lactic acid content was observed on fifth day of ensiling. Thereafter, the rate of pH decline decreased till 20 days and that of lactic acid increase till 25 days and then remained constant. Increasing levels of broiler litter had adverse effect on pH drop and lactic acid increase of silages. Total-N content of the silages had little variation throughout the ensiling period. A sharp decline in protein-N and increase in ammonia-N content was observed on day 5 of ensiling. Thereafter, the content of protein-N increased till 20 days and that of ammonia-N decreased till 15 days, but these changes were very small compared to that occurred during the first 5 days of ensiling. The level of broiler litter had inverse relationship with protein degradation and direct relationship with ammonia production. The yeast inoculum failed to produce any significant effect.
(Key Words : Sudax Fodder, Broiler Litter, Yeast, Silage)

INTRODUCTION

The chemical changes occurring during ensiling forage crops have been intensively studied. However, the information on such changes during fermentation of non-legume fodders with poultry litter is scanty.

During ensiling, microbial proteolytic enzymes cause plant proteolysis and feeding value of nitrogen is adversely affected by its conversion to ammonia (Woolford, 1984; Much, 1988) but proteolytic activity decreases with time during fermentation (Muck, 1988). Proteins and amino acids are lost while nitrates also decompose during the course of preservation (Knotek and Zilakova, 1980; Ataku et al., 1982). The use of molasses has been recommended (Flynn, 1980; Esperance et al., 1983) as the most effective way of ensuring low pH and to prevent proteolysis and formation of ammonia which adversely affect silage quality. Particularly the addition of increasing amounts of poultry litter in silage has been reported to adversely affect the fermentation characteristics of silage but addition of molasses significantly improved it (Deswysen et al., 1982).

In recent years a number of microbial inoculums have been introduced as fermentation stimulants but their response under practical conditions varies from no (Bucknan Smith and Yao, 1981; Faber et al., 1989; Cleale et al., 1990; Bolsen et al., 1992; Rasool et al., 1996) to a positive influence (Harrison et al., 1989; Kung Jr et al., 1987), yet the information about the use of Candida yeast as microbial inoculant is scanty (Ely et al., 1982; Moon et al., 1981).

This project was conducted to study the changes in pH, lactic acid and different nitrogen fractions occurring during ensiling sudax fodder and broiler litter with and without yeast inoculant.

MATERIALS AND METHODS

The yeast (Candida utilus) was grown on nutrient media, under optimum growth conditions (Khan, 1990) in which the quantity of dried broiler litter was increased progressively form 0.25 to 0.5, 0.75, 1.00, 1.50 and 2.00 gm/100 ml. Each time the test tubes containing media were incubated at 35℃ for 5 to 7 days and when sufficient growth appeared, it was transferred to medium containing next higher level of broiler litter, and were incubated under optimum growth conditions (Khan, 1990). When the microbes were adapted to the highest level of broiler litter, it was propagated in 250 ml conical flasks.

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After 7 days incubation, the microscopic examination of the flasks revealed 3.7 to 5.2 × 10^{10} cell counts per ml. The culture was preserved in refrigerator for inoculation in sudax poultry litter (SPL) silage.

Broiler litter was obtained from a commercial broiler house where birds were fed a standard commercial ration and reared on floor having saw dust as litter. The litter was removed from the house after the crop was disposed. It was sun dried, ground in a hammer mill and stored in bags for use in silage making. A representative sample of the litter was analyzed for total-N, protein-N, non-protein-N, organic matter, ash (AOAC, 1984), fiber fractions, lignin and silica (Van Soest and Robertson, 1985). The non-fibrous carbohydrates were calculated by the method of Mertens (1988). The chemical composition is shown in table 1.

Table 1. Percent chemical composition of broiler litter and sudax fodder used for silage making (on DM basis)

Description	Broiler litter	Sudax fodder
Dry matter	90.16	22.75
Organic matter	79.78	94.31
Neutral detergent fiber	38.97	60.39
Acid detergent fiber	35.48	33.17
Hemicellulose	3.49	27.22
Cellulose	18.10	28.55
Non-fiber carbohydrates	16.01	22.66
Lignin	2.82	3.51
Silica	14.56	1.10
Total-N	3.84	1.61
Protein-N	1.28	1.44
Ammonia-N	0.29	0.09
Non-Protein-N	2.56	0.17

Sudax fodder *(Sorghum sudanense × Sorhum vulgare)* was harvested at mid bloom stage and chaffed to 2-3 cm pieces. Dry matter content of the fodder was determined, by drying till constant weight at 100℃ in an oven. The representative samples of fresh fodder was also analyzed for different nitrogen fractions as stated above. Dried broiler litter was mixed with fodder at Zero, 20, 30 or 40 percent levels along with 6 percent cane molasses. These treatments were designated as A, B, C and D. Another set of the above four silage treatments was prepared by inoculating the yeast culture @ 3.7 to 5.2 × 10^8 yeast cells per gm fresh material. These treatments were designated as E, F, G and H (table 2).

About a kilogram of the material for each silage treatment was sealed in a separate polythene bag, after removing maximum possible air, with the help of vaccume pump, to maintain anaerobic conditions. These bags were kept in laboratory silos in a room at temperature around 30℃.

Table 2. Composition (DM %) of various silage treatments

Ingredients	Treatment			
	A/E	B/F	C/G	D/H
Sudax (sadabahar) fodder	94	74	64	54
Dried broiler litter	–	20	30	40
Molasses (cane)	6	6	6	6
Total	100	100	100	100

Silage bags of each treatment were removed in triplicate from silo at 5 days interval from zero to 40 days. The samples were ground in a specially designed electric grinder. Fresh samples were analyzed for pH, lactic acid and various nitrogen fractions viz; total-N, protein-N and ammonia-N (AOAC, 1984). Representation samples were dried at 70℃ to determine its DM content. Results were subjected to statistical analysis using analysis of variance technique (Steel and Torrie, 1981) and significant differences were compared by Duncan's multiple range test.

RESULTS AND DISCUSSION

Composition of broiler litter and Sudax fodder used in silage making is shown in table 1. The average values of pH, lactic acid and various nitrogen fractions of silages containing different level of broiler litter at various periods of ensiling with and without inoculum are shown in tables 3 to 7.

pH changes :

The increasing levels of broiler litter resulted in increase ($p < 0.01$) of pH of the silage (table 3) The differences among pH values of silages at various ensiling periods were significant ($p < 0.01$). However, the yeast inoculant did not exert any significant influence on the pH of silages. A sharp decline in pH of all silages was observed on day 5 of ensiling. Thereafter, the rate of decline decreased till 20 days, then it remained constant. For wetter silages, pH usually drops within first 5 days of ensiling (Muck, 1988), but it was also observed (Morrison, 1988) that pH had the greatest drop during first 2 days and at a significant rate till 20 days. Similarly Mayne (1990) analyzed rye grass silage at 7 days interval and reported highest decrease till 7 days of ensiling. There was linear increase in pH of silage with increasing levels of broiler litter, indicating an adverse affect, yet all silages were within the limits of good silage pH (Langston et al., 1958). The addition of molasses even improved it (Deswysen et al., 1982) and thus brought it within the range of good quality silage. Our findings are also supported by Nowar (1984) who ensiled maize at 20 percent DM without or with urea or poultry litter added to increase CP content by 1.25, 2.50 or 5.0 percent and noted increased pH with increasing rate of additive.

Table 3. Average pH of different silages at various ensiling periods

Days post-ensiling	Inoculant	Level of broiler litter			
		Zero	20	30	40
Zero	−	5.027^{d}	5.573^{c}	6.010^{b}	6.160^{a}
Zero	+	5.033	5.577	6.063	6.160
5	−	4.293^{o}	4.623^{jk}	4.760^{g}	5.560^{c}
5	+	4.313	4.633	4.747	5.540
10	−	4.170^{p}	4.547^{m}	4.703^{gh}	4.910^{e}
10	+	4.167	4.547	4.730	4.930
15	−	4.100^{p}	4.443^{n}	4.573^{kj}	4.800^{f}
15	+	4.107	4.447	4.570	4.797
20	−	3.967^{q}	4.300^{o}	4.467^{mn}	4.700^{ghi}
20	+	3.933	4.300	4.500	4.700
25	−	3.933^{q}	4.233^{o}	4.467^{n}	4.667^{hij}
25	+	3.933	4.267	4.433	4.667
30	−	3.967^{q}	4.267^{o}	4.500^{mn}	4.667^{hij}
30	+	3.967	4.300	4.467	4.667
35	−	4.000^{q}	4.267^{o}	4.467^{n}	4.633^{ijk}
35	+	4.000	4.233	4.467	4.633
40	−	3.967^{q}	4.300^{o}	4.500^{mn}	4.633^{ijk}
40	+	3.967	4.333	4.500	4.633

Same superscripts on mean values represent non-significant ($p < 0.05$) differences.

Lactic acid :

Significant ($p < 0.01$) effect was observed on lactic acid content of silages (table 4). The silage without litter had significantly ($p < 0.01$) higher lactic acid content compared with those containing broiler litter. However, the lactic acid content of silage containing 20 or 30 percent broiler litter did not show significant differences. The lactic acid content of silage containing 40 percent broiler litter had significantly lower lactic acid content than control as well as silages containing 20 and 30 percent litter. A sharp increase in lactic acid content of all silages was observed at day 5 of ensiling. Thereafter, the rate of increse in lactic acid content decreased till day 25. Beyond this the lactic acid concentrations in silages remained almost constant. Yeast inoculation did not influence the lactic acid content of silage without or with broiler litter.

Table 4. Average lactic acid content (% DM) of different silages at various ensiling periods

Days post-ensiling	Inoculant	Level of broiler litter			
		Zero	20	30	40
Zero	−	0.330^{d}	0.352^{k}	0.384^{k}	0.408^{k}
Zero	+	0.319	0.363	0.358	0.401
5	−	4.107^{h}	3.449^{i}	3.311^{ij}	3.256^{j}
5	+	4.096	3.441	3.305	3.241
10	−	4.548^{g}	4.116^{h}	3.985^{h}	3.954^{h}
10	+	4.540	4.096	4.077	3.925
15	−	5.178^{e}	4.858^{f}	4.835^{f}	4.638^{g}
15	+	5.232	4.836	4.821	4.666
20	−	6.140^{a}	5.951^{bc}	5.838^{c}	5.626^{d}
20	+	6.151	5.961	5.860	5.661
25	−	6.152^{a}	6.164^{a}	6.157^{ab}	5.991^{abc}
25	+	6.157	6.174	6.118	6.026
30	−	6.125^{ab}	6.146^{a}	6.127^{a}	6.003^{ab}
30	+	6.125	6.181	6.159	6.051
35	−	6.041^{ab}	6.117^{a}	6.158^{a}	6.075^{ab}
35	+	6.122	6.190	6.174	6.058
40	−	6.126^{a}	6.165^{a}	6.179^{a}	6.083^{ab}
40	+	6.179	6.165	6.189	6.164

Same superscripts on mean values represent non-significant ($p < 0.05$) differences.

There is large variation in the concentration of lactic acid in well preserved silages reported in earlier work. Dominguez et al. (1982) ensiled king grass without or with 1 or 2 percent molasses and observed 0.96, 1.04 and 1.45 percent lactic acid in respective silages. While Nandra et al. (1982) ensiled maize forage at milk stage at 33.5 and 26.7 percent DM and found that respective silages had 5.2 and 7.1 percent lactic acid. So, it seems to be more affected by DM content of the crop than any other factor (Garcia et al., 1989; Faber et al., 1989).

Prigge et al. (1976) reported that lactic acid content of corn silage increased up to 21 days of storage. Garcia et al. (1989) reported modest increase in lactic acid concentration from 7 to 21 days in low temperature silages. Our findings are also in agreement with the work of Mayne (1990) who ensiled rye grass (16% DM) without or with microbial inoculant and reported that pH decreased till 7 days but lactic acid continued increasing till 14 days. Similarly Bolsen et al. (1992) ensiled corn hybrids without or with microbial inoculant and found that pH decreased during first 3 days but lactic acid continued increasing till 120 days of fermentation.

Nitrogen fractions :

The increasing levels of broiler litter significantly ($p < 0.01$) increased the total-N content of silages due to high nitrogen content of the litter. However, variations in total-N contents of silages at different ensiling periods were found to be non-significant (table 5).

Table 5. Average total-N content (% DM) of different silages at various ensiling periods

Days post-ensiling	Inoculant	Level of broiler litter			
		Zero	20	30	40
Zero	–	1.607^{d}	2.023^{c}	2.233^{b}	2.421^{a}
Zero	+	1.579	2.016	2.188	2.463
5	–	1.563^{d}	2.013^{c}	2.221^{b}	2.402^{a}
5	+	1.553	2.046	2.182	2.478
10	–	1.577^{d}	2.030^{c}	2.234^{b}	2.421^{a}
10	+	1.626	1.999	2.134	2.437
15	–	1.592^{d}	2.008^{c}	2.239^{b}	2.444^{a}
15	+	1.504	1.893	2.152	2.454
20	–	1.604^{d}	2.001^{c}	2.231^{b}	2.434^{a}
20	+	1.600	2.107	2.271	2.372
25	–	1.602^{d}	2.036^{c}	2.254^{b}	2.495^{a}
25	+	1.620	2.015	2.251	2.464
30	–	1.618^{d}	2.027^{c}	2.203^{b}	2.452^{a}
30	+	1.614	2.024	2.273	2.454
35	–	1.580^{d}	2.032^{c}	2.232^{b}	2.463^{a}
35	+	1.608	2.004	2.276	2.462
40	–	1.587^{d}	2.044^{c}	2.261^{b}	2.414^{a}
40	+	1.601	2.022	2.272	2.362

Same superscripts on mean values represent non-significant ($p < 0.05$) differences.

At the time of ensiling the silage containing broiler litter had significantly ($p < 0.01$) lower protein-N content as compared to the control. However, relatively little variation in protein-N content of silages were observed due to different levels of broiler litter (table 6). The Protein-N content of all the silages was the highest at the time of ensiling. It decreased significantly at the day 5 of ensiling in silages containing broiler litter and till 10th day in case of silage without litter. Thereafter, the values increased till day 20 and then remained almost constant till 40th day. But these improvements were so small as compared with the initial degradation that the final values of protein-N content were still significantly lower compared with the initial protein-N content of all silages. The degradation of protein-N also had inverse relationship with the level of broiler litter. Thus the protein-N in silages containing broiler litter varied in such a way that the final protein-N content was similar for all the three levels of broiler litter.

Table 6. Average Protein-N content (% DM) of different silages at various ensiling periods

Days post-ensiling	Inoculant	Level of broiler litter			
		Zero	20	30	40
Zero	–	1.448^{a}	1.369^{b}	1.337^{bc}	1.303^{cd}
Zero	+	1.431	1.389	1.340	1.300
5	–	0.992^{kl}	1.087	1.117^{jk}	1.154^{hi}
5	+	1.150	1.117	1.166	1.172
10	–	1.042^{m}	1.184^{ghi}	1.176^{ghi}	1.176^{fghi}
10	+	0.968	1.168	1.170	1.215
15	–	1.088^{lm}	1.244^{efg}	1.199^{fgh}	1.195^{fghi}
15	+	0.996	1.211	1.203	1.202
20	–	1.093^{jkl}	1.263^{de}	1.259^{def}	1.219^{def}
20	+	1.090	1.257	1.239	1.276
25	–	1.093^{jkl}	1.262^{de}	1.279^{de}	1.267^{de}
25	+	1.088	1.267	1.260	1.279
30	–	1.106^{jk}	1.263^{de}	1.280^{de}	1.279^{de}
30	+	1.110	1.270	1.285	1.255
35	–	1.095^{jkl}	1.291^{de}	1.255^{de}	1.260^{de}
35	+	1.098	1.238	1.280	1.270
40	–	1.088^{jkl}	1.293^{de}	1.273^{de}	1.258^{de}
40	+	1.086	1.269	1.259	1.282

Same superscripts on mean values represent non-significant ($p < 0.05$) differences.

Significant ($p < 0.01$) effects of various levels of litter were observed on ammonia-N content of silages. The silages containing broiler litter had significantly higher ammonia-N as compared with control (table 7). However, the differences in ammonia-N content of silages containing 30 or 40 percent broiler litter were non-significant. The ensiling period also had a significant ($p < 0.01$) effect on ammonia-N content of silage. The ammonia-N content of all silages was the minimum at the time of ensiling. In silages containing broiler litter, ammonia-N rose to a significantly higher level at day 5 of ensiling, thereafter, decreased till 15th day of ensiling and then remained almost constant. The content of ammonia-N was significantly high in silages containing broiler litter with non-significant difference between two higher levels of the litter. In addition, silage without litter had the highest ($p < 0.01$) ammonia-N at 10th day of ensiling. At day 15 there was a significant drop, with little variation, thereafter. Although, the ammonia-N content increased in the beginning and then dropped, yet the final ammonia-N of all silages were significantly higher than initial lowest level. The addition of yeast inoculum, however, did not show any significant effect on ammonia-N content of the silage.

Table 7. Average Amonia-N content (% DM) of different silages at various ensiling periods

Days post-ensiling	Inoculant	Level of broiler litter			
		Zero	20	30	40
Zero	−	0.103^{q}	0.175^{p}	0.275^{o}	0.263^{no}
Zero	+	0.108	0.169	0.219	0.275
5	−	0.402^{k}	0.453^{d}	0.566^{a}	0.565^{b}
5	+	0.329	0.446	0.599	0.555
10	−	0.360^{j}	0.455^{edfg}	0.483^{c}	0.447^{defg}
10	+	0.420	0.384	0.496	0.421
15	−	0.294^{j}	0.414^{hij}	0.432^{efgh}	0.458^{d}
15	+	0.315	0.402	0.415	0.450
20	−	0.302^{lm}	0.406^{hij}	0.426^{def}	0.445^{def}
20	+	0.288	0.408	0.447	0.431
25	−	0.275^{mn}	0.408^{ghij}	0.424^{rfgh}	0.451^{d}
25	+	0.272	0.412	0.421	0.449
30	−	0.276^{no}	0.412^{fghi}	0.422^{efgh}	0.456^{d}
30	+	0.262	0.414	0.419	0.451
35	−	0.279^{xo}	0.396^{ghij}	0.428^{efgh}	0.442^{de}
35	+	0.272	0.424	0.416	0.443
40	−	0.276^{mn}	0.393^{ij}	0.436^{defg}	0.444^{de}
40	+	0.268	0.397	0.428	0.435

Same superscripts on mean values represent non-significant ($p < 0.05$) differences.

The broiler litter used in our study contained 3.84 percent total-N whereas Sudax fodder had only 1.61 percent nitrogen content. The addition of broiler litter at 20, and 30 and 40 percent of ensiled mass thus, resulted in significant ($p < 0.01$) increase in total-N content at each level of the litter (table 5). At the time of ensiling 90.33 percent of total-N percent in sudax fodder was in the form of protein-N while the remaining 9.66 percent was in the form of non protein-N. The sun dried broiler litter, on the other hand had only 33.33 percent of its total -N content in the form of protein-N while the remaining major part was in the form of non protein-N. Since urine and faeces of bird are voided together through the cloaca, the dried poultry excreta accounts for two third of its total -N as non protein-N (Makkar et al., 1983). The fodder ammonia-N accounted for 6.65 percent of its total-N content while dried broiler litter had about 10 percent. In chicken, four-fifth of the metabolized nitrogen is excreted through urine along with ammonia nitrogen accounting for 10-15 percent of total urinary nitrogen (Makkar et al., 1983).

Total-N content of SPL-silage containing graded levels of broiler litter increased significantly ($p < 0.01$) at each level of litter due to inherent high nitrogen content of litter. Total-N content of the control and SPL silages (percent of DM) increased slightly with ensiling time. Little variations in total-N content of alfalfa, ensiled at 46 and 62 percent DM, had been reported by Garcia et al. (1989). According to them it was more affected by DM content than any other factors, the less being at high DM of silage. In the present study the DM content of all silages were less than 30 percent. Similarly the experiment of Harrison et al. (1989) on grass legume silage indicated an increase in total-N from 1.88 percent on the day of ensiling to 2.05 percent on 57th day of ensiling. The work of Johnson et al. (1982) on ensiling of corn also showed an increase in total-N content with ensiling time and they attributed this increase in total-N content of silage to loss of carbon dioxide during fermentation.

In the present study the silage without or with 20, 30 or 40 percent broiler litter had 90.30, 68.26, 60.56 and 53.31 percent of its total-N in the form of protein-N, respectively. The analysis of silage samples at day 5 of ensiling showed considerable ($p < 0.01$) proteolysis due to plant and microbial enzymes (Muck, 1988; Woolford, 1984) and these values fell to 68.7, 54.5, 51.9 and 47.7 percent of total-N, for respective silages. There was a simultaneous significant ($p < 0.01$) increase in the ammonia-N concentration of all silages. The concentration of ammonia-N in silage without or with 20, 30 or 40 percent broiler litter rose to 23.5, 22.2, 26.4 and 22.9

percent of total-N at 5th day of ensiling compared with 6.6, 8.5, 11.2 and 11.0 percent, respectively at the time of ensiling. The highest proteolysis occurred in control silage where the concentration of ammonia-N increased to about 4 times.

Although soluble-N and ammonia-N are not the same, but both may be indicative of proteolysis (Faber et al., 1989). Soluble-N has been shown to increase in ensiled shelled corn (Prigge et al., 1976; Baron et al., 1986) however, bacterial fermentation does not play a major role in solublization of nitrogen in high moisture corn, rather it is due to chemical and physical process occurring in high moisture corn during ensiling and as pH decreases, conditions are though to be more favorable for enzymatic degradation of corn silage (Prigge et al., 1976). These enzymes convert protein-N to non protein-N forms such as peptides and free amino acids where as further reduction to ammonia and amines are largely caused by microbial activity (Ohshima and McDonald, 1978). When microbial proteolytic enzymes cause plant proteolysis the feeding value of nitrogen is adversely affected by its conversion to ammonia (Woolford, 1984). Proteolytic activity decreases with time during fermentation in silo (Muck, 1988). For both whole corn plant (Bergen et al., 1974) and alfalfa (McKersie and Buchanan-Smith, 1982; Muck, 1987) the greatest proteolysis occured during the 1st day in the silo, declining to little proteolysis after 5th day of fermentation. For wetter silages, pH usually drops within the first 5 days of ensiling. So, interaction between initial number of lactic bacteria and DM content on pH time course may cause a large variation in the amount of proteolysis (Muck and Speckhard, 1984). Generally the drop in pH caused by fermentation comes too late (> 5 day of fermentation) to be of any use in proteolysis (Muck, 1987). But low final pH is not a guarantee that proteolysis was minimized. It can only be guaranteed by a rapid attainment of low pH (Muck, 1988) and it can be attained by addition of sugars. Garcia et al. (1989) also ensiled alfalfa wilted to 46 or 62 percent DM and found that ammonia-N accounted for less than 15 percent of non protein-N in all silages, suggesting low deaminating microbial activity, but more ammonia was present in low DM silage than in high DM silages. The remainder of non protein-N was not identified but probably was amino acid, low molecular weight peptides, amines, amides and other compounds (McDonald, 1981).

The increase in the concentration of ammonia-N was also significant ($p < 0.01$) in silage containing various levels of broiler litter (table 6). However, the difference among them were non-significant. When dried broiler litter was mixed with fodder the DM content of the resultant mass increased to some extent and there might be a corresponding decrease in proteolysis. Moreover, the initial high ammonia-N concentration of SPL-silage might also have inhibitory effect on proteolysis and deamination of amino acid (Johnson et al., 1982). The loss of insoluble nitrogen during ensiling of maize fodder alone or with 40 percent poultry droppings without or with 5 percent molasses have been found 9, 10 and 25 percent, respectively (D'Urso et al., 1979).

At 10th day of ensiling there was a significant ($p < 0.01$) drop in the concentration of ammonia-N in all silages with a corresponding increase in protein-N and thereafter the variation was small but the values never became comparable to the initial level. This drop in ammonia-N and increase in the protein-N may be attributed to loss of carbon dioxide and soluble sugars and utilization of ammonia-N by microbes for protein synthesis. Ullrick (1982) had analyzed the corn silage nitrogen and found that it contained 71 percent plant-N, 22.6 percent microbial-N and 6.3 percent ammonia-N.

The addition of yeast inoculant, however, could not produced any significant effect on fermentation characteristics of silage without or with any level of broiler litter. Although microbial inoculants have been used extensively and conclusions of previous workers about their effects varied from no response (Buchanan Smith and Yao, 1981; Faber et al., 1989; Cleale et al., 1990; Rasool et al., 1996) to a positive influence (Harrison et al., 1989; Kung, Jr. et al., 1987), yet very little information is available on the use of Candida yeast (Ely et al., 1982; Moon et al., 1981; Rasool et al., 1996) as silage inoculant. Even in these studies the beneficial effect of addition of yeast inoculant could not be established. According to Kung Jr. et al. (1984) microbial inoculant tended to stimulate fermentation only in silage of high DM content (50 and 60 percent). But the suitability of microorganism, availability of adequate nutritional substrate and suitable physical environment seems to be the most important factors affecting fermentation patterns (Whittenbury et al., 1967). Done (1986) and Seale (1986) suggested that inoculants may be ineffective as silage preservatives when used with herbage containing low DM and WSC concentrations.

It may be inferred from the results of the present study that the proteolytic activity of plant and microbial enzyme resulted in considerable loss of proteins. The pH drop, lactic acid formation and the degradation of proteins not only had inverse relationship with the level of litter but also had an extended fermentation process, keeping it at a low pitch during the course of ensiling. The addition of yeast inoculant, however, did not produce any significant effect.

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