J. Agric. Sci. Mansoura Univ., 29 (1): 11 - 26, 2004

# EFFECT OF USING DIFFERENT SOURSES OF DIETARY ENERGY FOR MAKING BERSEEM SILAGE ON PERFORMANCE OF LACTATING COWS

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## ABSTRACT

Eighteen crossbreed Friesian cows in the $2^{nd}$-$3^{rd}$ season of lactation and weighing an average of 450 Kg in their early lactation stage were assigned to three balanced groups according to body weight and milk yield (six animals each). The first group was received a diet containing concentrate feed mixture (CFM) + silage with molasses + rice straw, $2^{nd}$ group received a diet containing CFM + silage with yellow corn + rice straw and the $3^{rd}$ group received a diet containing CFM + silage with chips of sweet potato + rice straw. The diets were formulated to be iso-caloric and iso-nitrogenous according to NRC (1988).

The tests of silages indicate that, pH values, TVFA's, lactic acid and $NH_3$-N concentrations were in normal values and could be classified as good quality silage. Intake of CFM, RS, silages and total dry matter kg/h/d of cows was nearly similar among tested groups. The highest ($P<0.05$) digestibility values of all nutrients were shown when feed BS-Y and BS-P, while the values of ration containing BS-M appeared to be the lowest. Similar trend was noticed for the NDF, hemicellulose and TDN values of experimental rations. However, no significant difference was detected among different experimental rations for ADF and ADL digestibility.

No significant effects on ruminal pH values among different experimental rations were observed. Concentrations of TVFA's were significantly differed with feeding BS-P and BS-Y compared with feeding BS-M. The overall mean values of acetic, propionic, butyric, Iso-butyric and valeric acid were not affected significantly when feeding different types of berseem silage. On the other hand, proportions of iso-valeric acid increased with feeding BS-Y and BS-P compared with feeding BS-M. The overall mean of total nitrogen (TN) was significantly higher ($P<0.05$) with feeding BS-Y and BS-P than those of BS-M silages. However, the values of NPN and $NH_3$ were taken the reflected trend with feeding BS-Y and BS-P compared to BS-M. The true protein nitrogen (TPN) was significantly decreased when fed BS-M compared with either BS-P or BS-Y at different times and also with overall mean. The microbial protein nitrogen (MPN) was decreased only after feeding BS-Y, however no significant ($P<0.05$) difference was found post feeding also among overall mean of the experimental diets in this respect.

Plasma constituents were increased ($P< 0.05$) for total protein and glucose with added BS-Y and BS-P compared to BS-M group. Feeding BS-M, BS-Y or BS-P had no significant effects on the albumin, globulin albumin/globulin ratio. It is interest to observe that, feeding BS-P and BS-Y decreased significantly ($P<0.05$) urea nitrogen, aniline transaminase (ALT) and aspartate transaminase (AST) in serum compared with feeding BS-M. Milk production and fat corrected milk were increased significantly ($P<0.05$) when feeding BS-P and BS-Y compared to BS-M. However, fat, protein, lactose, total solid and solid not fat were not significantly differed among experimental tested groups.

In conclusion, these results indicated that added sweet potato tubers compared to use of either corn and El-Mufeed as sources of energy for making berseem silage could improve silage quality and could narrow the gap between caloric and protein ratio. Also such situation could improve feed efficiency for lactating cows.

**Keywords:** Sweet potato, Berseem silages, rumen fermentation, Digestibility, Feed intake, Blood parameters.

# INTRODUCTION

During the first period of the summer after winter season there is a gape in animal nutrition in Egypt. Berseem (*Trifolium alexandrinum*) is the main forage crop fed ad libitum as a common practice. Recently, according to the national policy, the berseem areas must be decreased to increase the cultivated areas of wheat. Furthermore, feeding berseem with its narrow caloric/protein ratio usually covers about 96% of energy and 177% of protein requirements of animals (Youssef, 1978). Consequently, animals would cover their energy requirements through hepatic gluconegenesis and excretion of excessive N as urea. In usual, for making berseem silage molasses or corn must be added as source of energy (Salem 2003). On the other hand, large quantities of tuber of sweet potato (SP) (about 60.000 ton in year according to Agriculture Economics and Statistics, Egypt, 2000) do not use for consumption of human being. Sweet potato could be used as a satisfactory source of energy in rations for ruminants because it containing equal energy content as that of corn (Makkar, *et. al.* 1984). Sweet potato is a creeping plant with perennial vines and roots swollen tubers. Low protein, fat and fiber were found in the roots, but the high nitrogen-free extract fraction in this tuber is indicative of its potential value, mainly as an energy source (Zaza 1997). Carbohydrates generally make up between 80 to 90% of the dry weight of sweet potato roots but the uncooked starch of the sweet potato is very resistant to the hydrolysis by-amylase (Dominguze 1992). In view of these facts, it seemed desirable to study the effect of using SP as source of energy for making berseem silage balanced in energy and protein content compared when using El-mufeed and yellow corn as different types of energy.

The main objectives of this study were to investigate the effect of utilization of sweet potato tubers as a untraditional source of dietary energy for making berseem silage compared with the traditional source e.g. El-mufeed or yellow corn in rations of lactating cows on their productive performance in terms of milk production and its composition. Ruminal fermentation, microbial nitrogen synthesis, nutrient digestibilities as well as some blood constituents were also studied.

# MATERIALS AND METHODS

This study was conducted at El-Serw Experimental Station belonging to the Animal Production Research Institute, Agriculture Research Center, Ministry of Agriculture. Egypt. Tuber of sweet potato was chipped then sun dried to 86.25 % DM, thereafter it was kept to make berseem silage (*Trifolium Alexandrinum*). Three types of berseem silage 3$^{rd}$ cut as whole were conducted to narrow caloric/protein ratio in berseem. First type of silage was made with added El-Mufeed (liquid feeding containing molasses + 1% urea) as source of energy (45 kg / ton) as described by El-Emam (2001) and

Broderick and Mairgan (1997), 2nd type was made with added ground yellow corn (35kg /ton) to equalized the energy in El-Mufeed and the 3rd type was made with added dried chips of sweet potato (35kg /ton) to equalized the energy in corn and El-Mufeed. Color and odor were examined and samples were taken from each silage for chemical analysis before starting digestibility trails. Silage samples were extracted using 20g homogenized wet sample with 100 ml distilled water for 10 minutes in blender (Waldo and Schultz, 1956). The homogenate was filtered through double layers of cheesecloth, and then the filtrate was used to determine silage pH directly by using HANNA pH-meter (model HI 8424), ammonia-N (AOAC, 1995) and TVFA's (Warner, 1964). Lactic acid concentration was determined by methods of Analytical Chemistry of Foods (1995).

Eighteen crossbreed Friesian cows in the 2nd-3rd season of lactation and weighing an average of 450 Kg in their early lactation stage were used in this study. The experimental cows were assigned to three balanced groups according to body weight and milk yield (six animals each). Animals were housed indoors and fed in groups and adapted (after parturition directly) on their experimental rations for 10 days before starting of the feeding trail that lasted for 90 days. Fresh water was offered free daily. The concentrate feed mixture (CFM) was offered during feeding trail three times daily just before milking at 5:00 am, 12:00 am and before the second milking at 5.00 p.m. The amount of berseem silage and rice straw was divided into two equal parts and offered at 9.00 a.m. and 3.00 p.m. The animals were assigned to one of three tested diets. The first group was received a diet containing CFM + silage with El-Mufeed + rice straw, 2nd group received a diet containing CFM + silage with yellow corn + rice straw and the 3rd group received a diet containing CFM + silage with dried chips of sweet potato + rice straw. The diets were formulated to be iso-caloric and iso-nitrogenous according to NRC (1983). The diets were adjusted biweekly according to body weight, milk production and fat percentage.

Animals were machine milked twice daily at 5.00 a.m. and 5.00 p.m. and individual morning- and evening-milk yield were daily recorded. Every tow weeks, composite milk samples were taken from composted evening and morning samples and stored at -20°C for analysis. Milk samples were analyzed for fat, protein, lactose; solid not fat (SNF), total solids (TS) and ash contents by milk SCAN 133 BN Foss Electric, Denmark.

The digestion trials were carried out at the end of the feeding trial and lasted for 10 days. Nutrient digestibilities were estimated by acid insoluble ash (AIA) method (Van Keulen and Young 1977). Fecal samples were collected twice daily at $6^{00}$ am and $18^{00}$ pm. Composite feed and fecal samples were chemically analyzed according to A.O.A.C. (1995). Chemical composition of ingredients and the experimental rations are presented in Tables (1 and 2).

**Table (1) : Chemical composition of different ingredients composed of tested rations.**

| Items | Ingredients | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | CFM | RS | BS-M | BS-Y | BS-P | Corn | Potato | El-mufeed |
| **Chemical compositions (%).** | | | | | | | | |
| DM | 92.50 | 90.45 | 28.80 | 30.00 | 29.50 | 90.02 | 86.25 | 65.66 |
| OM | 90.20 | 83.50 | 87.20 | 88.41 | 88.30 | 88.57 | 96.09 | 89.97 |
| CP | 16.20 | 3.50 | 15.35 | 15.56 | 15.60 | 9.33 | 6.75 | 8.22 |
| CF | 10.30 | 35.20 | 20.20 | 20.40 | 20.22 | 2.16 | 2.03 | - |
| EE | 3.50 | 2.10 | 3.20 | 3.50 | 3.35 | 3.99 | 0.86 | - |
| NFE | 60.20 | 42.70 | 48.45 | 48.95 | 49.13 | 73.09 | 86.45 | 81.75 |
| Ash | 9.80 | 16.50 | 12.80 | 11.59 | 11.70 | 11.43 | 3.91 | 10.03 |
| **Cell wall constituents (%).** | | | | | | | | |
| NDF | 38.76 | 77.53 | 55.30 | 55.40 | 55.40 | 18.22 | 20.31 | - |
| ADF | 29.22 | 56.42 | 39.21 | 39.42 | 39.50 | 15.74 | 16.02 | - |
| ADL | 4.03 | 11.02 | 5.60 | 5.40 | 5.50 | 1.98 | 2.00 | - |
| Cellulose | 25.19 | 45.40 | 33.61 | 34.02 | 34.00 | 13.76 | 14.02 | - |
| Hemicellulose | 9.54 | 21.11 | 16.09 | 15.98 | 15.90 | 2.48 | 4.29 | - |
| **GE Mcal / kg** | 3.901 | 1.502 | 3.340 | 3.350 | 3.351 | 4.306 | 4.501 | 3.598 |
| **Caloric/protein** | 240.80 | 429.14 | 217.59 | 215.30 | 214.81 | 461.52 | 666.81 | 437.71 |

**CFM: - Concentrate feed mixture, composed of (cottonseed meal 29%, yellow corn 26%, wheat bran 35%, molasses 6%, limestone 3% and common salt 1%). RS: - Rice straw. BS-M: - Berseem silage with El-mufeed. BS-Y: - Berseem silage with yellow corn. BS-P: - Berseem silage with sweet potato.**

**Table (2): Percentage of ingredients and chemical composition of different rations on DM basis.**

| Items | BS-M | BS-Y | BS-P |
|---|---|---|---|
| **Ingredients (%).** | | | |
| CFM | 44.73 | 45.64 | 45.62 |
| RS | 14.54 | 14.82 | 14.84 |
| BS-M | 40.73 | 0.00 | 0.00 |
| BS-Y | 0.00 | 39.54 | 0.00 |
| BS-P | 0.00 | 0.00 | 39.54 |
| **Chemical composition (%).** | | | |
| DM | 66.26 | 67.49 | 69.28 |
| OM | 88.00 | 88.53 | 88.45 |
| CP | 14.01 | 14.10 | 14.08 |
| CF | 17.95 | 17.98 | 17.92 |
| EE | 3.17 | 3.29 | 3.23 |
| NFE | 52.87 | 53.16 | 53.22 |
| Ash | 12.00 | 11.47 | 11.55 |
| **Cell wall constituents (%).** | | | |
| NDF | 51.14 | 51.10 | 51.10 |
| ADF | 37.24 | 37.28 | 37.32 |
| ADL | 5.69 | 5.61 | 5.65 |
| Cellulose | 31.55 | 31.67 | 31.67 |
| H-Cellulose | 13.90 | 13.82 | 13.78 |
| **GE Mcal / kg** | 3.324 | 3.328 | 3.328 |

Neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) were determined according to Goering and Van Soest (1970). Hemi-cellulose and cellulose were calculated as the difference between NDF and ADF, ADL orderly. Gross energy concentration (GE) was determined for both feed ingredient and feces by using Gallen Kump ballistic bomb calorimeter (Catalog No. (CBB: 330-1010), however, GE in the whole rations were calculated from ingredients which used in formulation the whole rations.

Rumen samples were taken individually from three cows of each group by using stomach tube before and at 4hr post feeding at the end of the digestion trial. Ruminal liquor pH was immediately measured by using the HANNA pH-meter (model HI 8424). Total VFA's concentration was analyzed according to Eadie *et al.* (1967). Molar proportions of VFA's were determined according to Erwin et al. (1961). Ruminal total nitrogen (TN) and non-protein nitrogen (NPN) were determined by using the modified Semi-Microkjeldahl digestion technique of A.O.A.C. (1995). True protein nitrogen (TPN) was estimated by the difference between TN and NPN. Microbial protein nitrogen was determined according to the method suggested by Shultz and Shultz (1970) and $NH_3$-N concentrations were determined using microdiffusion technique of Conway (1978).

Serum blood samples were taken from the same three animals at the end of digestion trail before feeding and being best frozen at -20C for later analyses. Total protein, albumin, glucose, urea-N, aniline transaminase (ALT) and aspartate transaminase (AST) were determined calorimetrically using (Biomeriex Lab. Kits 69280 Marcy-1, Etoile, France®). Globulin was calculated as the difference between total protein and albumin. Albumin / Globulin ratio was calculated.

Data were statistically analyzed using the general linear model program of SAS, (1996). The differences among means were tasted using Duncan's multiple range test (Duncan, 1955).

## RESULTS AND DISCUSSION

### Chemical composition

Composition of concentrate feed mixture (CFM), BS-M, BS-Y, BS-P, rice straw and the experimental rations are presented in Tables (1 and 2). The results showed that the chemical composition as well as cell wall constituents of different experimental rations were practically similar.

### Quality characteristics of silage

Concerning silage quality (Table, 3) it was noticeable that, all tested berseem silages were free from any moldy, characterized with suitable fermentation characteristics, yellowish green color and good smell. The results indicated that, pH values of the different tested silages ranged between 4.11 to 4.31, which seems to be in the normal ranges of the good quality silage as reported by Mcdonald *et al.* (1995).

Total VFA's concentration in all kinds of tested silages ranged 1.82 to 1.92 that indicated acceptable silage fermentation. The highest acetic acid concentration was observed in BS-M, while lowest butyric acid concentration was recorded in silages made from BS-Y or BS-P. The lowest value of propionic acid was recorded with BS-M. In all prepared silages confirmed that the good quality silage was recorded with added different sources of energy. The molar proportions (%) of the individual VFA's (acetic, propionic and butyric) are within the range reported by Bendary *et. at.* (2001).

**Table (3): Chemical characteristic of different types of silage.**

| Items | Silage type | | |
|---|---|---|---|
| | **BS-M** | **BS-Y** | **BS-P** |
| pH | 4.31 | 4.11 | 4.16 |
| TVFA's (%of DM) | 1.82 | 1.90 | 1.92 |
| TN (g / Kg DM) | 24.56 | 24.90 | 24.96 |
| $NH_3$-N (% of DM) | 0.17 | 0.15 | 0.19 |
| $NH_3$-N (% of TN) | 6.92 | 6.02 | 7.61 |
| **VFA's fractions as % of DM** | | | |
| Lactic acid | 6.27 | 7.01 | 7.00 |
| Acetic acid | 1.02 | 0.93 | 0.91 |
| Propionic acid | 0.02 | 0.06 | 0.05 |
| Butyric acid | 0.12 | 0.04 | 0.06 |

**TN = Total nitrogen (total protein / 6.25).**

Obtained values of lactic acid concentration ranged between 6.27 to 7.01% of DM). These results indicated that the obtained silages could be classified as a good quality silage recommended by Mcdonald *et. al.* (1995) and Bendary *et. at.* (2001). There was an inverse relationship between silage pH value and lactic acid concentration for different silages, which agreed with those obtained by Abd El-Malik (1972).

Ammonia nitrogen concentration ranged between 0.15 to 0.19% of DM and 6.02 to 7.61% of total nitrogen in the different types of berseem silage. These data are in good agreement with those of Shepard and kung (1996) and Chen *et. al.* (1994), where, showed that $NH_3$-N concentration for corn silage ranged between 0.04 and 0.15% of DM. Also, McDonald *et. al.* (1995) recommended that $NH_3$-N% of total nitrogen for good quality silage should be less than 10% of total nitrogen.

**Dry matter intake**

Data presented in Table 4 showed that, intake of CFM, RS, silages and total dry matter intake kg/h/d of cows was nearly similar. Schneider *et. al.* (1985) reported that addition of potato meal for berseem ensiling did not significantly affect feed intake. However, cows fed silage with SP produced 8.6 % more milk than the control.

Digestibility data in Table 4 shows that ration containing BS-Y and BS-P had the highest ($P<0.05$) digestibility values for all nutrients, while those of ration containing BS-M appeared to be the lowest. The enhanced effect on nutrient digestibilities may be due to improvement in pattern of fermentation and nitrogen metabolism in the rumen (Table 6) where TN and TPN were increased with feeding BS-Y and BS-P. The digestibility of rations containing silage could largely affected by silage quality, presence of concentrates, length of adaptation period and feeding system (Abd El-hamid and Topps 1991). Markkar *et. al.* (1984) reported that the higher quality of silage significantly improved digestibilities of DM and OM of the whole mixture diet feeding

**Table (4): Average daily dray matter intake, nutrient digestibility, cell wall constituent digestibility and nutritive values of different experimental rations with cows.**

| Items | BS-M | BS-Y | BS-P | ±SE | Sign. |
|---|---|---|---|---|---|
| **Ingredients (kg/h/d on DM basis).** | | | | | |
| CFM | 6.37 | 6.65 | 6.61 | --- | --- |
| RS | 2.07 | 2.16 | 2.15 | --- | --- |
| BS-M | 5.80 | 0.00 | 0.00 | --- | --- |
| BS-Y | 0.00 | 5.76 | 0.00 | --- | --- |
| BS-P | 0.00 | 0.00 | 5.73 | --- | --- |
| Total DMI | 14.24 | 14.57 | 14.49 | --- | --- |
| **Nutrient digestibility (%).** | | | | | |
| DM | $70.01^{b}$ | $73.02^{a}$ | $73.00^{a}$ | 3.025 | * |
| OM | $73.80^{b}$ | $76.86^{a}$ | $76.53^{a}$ | 4.561 | * |
| CP | $65.25^{b}$ | $68.48^{a}$ | $68.25^{a}$ | 4.023 | * |
| CF | $60.60^{b}$ | $63.12^{a}$ | $63.00^{a}$ | 3.682 | * |
| EE | 79.85 | 79.98 | 78.90 | 4.561 | ns |
| NFE | $80.18^{b}$ | $83.54^{a}$ | $83.13^{a}$ | 6.032 | * |
| GE | $86.00^{b}$ | $90.01^{a}$ | $90.00^{a}$ | 7.235 | * |
| **Cell wall constituents digestibility (%).** | | | | | |
| NDF | $60.52^{b}$ | $62.36^{a}$ | $62.14^{a}$ | 4.325 | * |
| ADF | 56.89 | 56.90 | 56.84 | 4.002 | ns |
| ADL | 4.00 | 4.00 | 4.11 | 1.002 | ns |
| Cellulose | 66.43 | 66.27 | 66.25 | 6.020 | ns |
| H-Cellulose | $70.25^{b}$ | $77.09^{a}$ | $76.49^{a}$ | 5.468 | * |
| **Nutritive values (%).** | | | | | |
| TDN | $68.11^{b}$ | $71.33^{a}$ | $70.88^{a}$ | 4.687 | * |
| DCP | 9.14 | 9.66 | 9.61 | 2.030 | ns |
| GE Mcal / kg | $40.707^{b}$ | $43.721^{a}$ | $43.418^{a}$ | 3.528 | * |

a and b: Means in the same row with different superscripts are significantly different (P<0.05).
±SE- Standard error

Similar trend was noticed for the NDF and hemi-cellulose values of experimental rations. However, no significant difference was detected among different experimental rations for ADF, ADL and cellulose digestibility. In agreement with the results of this study, Markkar *et. al.* (1984) in trail with buffalo calves found that the digestibility coefficient of DM, EE and CF did not differ significantly between the control and the other groups fed on diet contained potato wastes. Feeding values as TDN% and DE (Mcal/kg) were increased significantly (P>0.05) with feed BS-Y and BS-P compared to BS-M, however, no significant differences were found among experimental diets for

DCP values. Theses results are in good agreement with those reported by El-Emam (2001) and Abd El-Baki *et. al.* (1995).

**Rumen parameters**

Results in Table (5) clearly show that, no significant difference on ruminal pH values among different experimental rations was observed.

**Table (5): Effect of using different types of berseem silages on pH, TVFA's and VFA's fractions (%) with cows.**

| Items | Time | BS-M | BS-Y | BS-P | ±SE | Sign. |
|---|---|---|---|---|---|---|
| pH | 0 | 6.40 | 6.40 | 6.43 | 0.021 | ns |
| | 4 | 6.72 | 6.66 | 6.68 | 0.015 | ns |
| **Overall means** | | 6.56 | 6.53 | 6.56 | 0.023 | ns |
| TVFA's (meq/dl) | 0 | $10.5^{c}$ | $11.85^{b}$ | $12.32^{a}$ | 1.153 | * |
| | 4 | $15.2^{b}$ | $16.35^{a}$ | $16.85^{a}$ | 1.236 | * |
| **Overall means** | | $12.85^{b}$ | $14.10^{a}$ | $14.59^{a}$ | 1.178 | * |
| **VFA's fractions (%).** | | | | | | |
| Acetic acid | 0 | 57.18 | 57.16 | 57.46 | 0.365 | ns |
| | 4 | 57.50 | 57.34 | 57.74 | 0.356 | ns |
| **Overall means** | | 57.34 | 57.25 | 57.60 | 0.568 | ns |
| Propionic | 0 | 26.25 | 26.04 | 25.52 | 0.361 | ns |
| | 4 | $27.00^{a}$ | $26.04^{ab}$ | $25.94^{b}$ | 3.201 | * |
| **Overall means** | | 26.63 | 26.04 | 25.73 | 0.631 | ns |
| Butyric acid | 0 | 11.80 | 11.70 | 11.10 | 0.021 | ns |
| | 4 | 12.15 | 11.90 | 11.30 | 0.023 | ns |
| **Overall means** | | 11.98 | 11.80 | 11.20 | 0.102 | ns |
| Iso-butyric acid | 0 | 1.90 | 1.71 | 1.90 | 0.015 | ns |
| | 4 | $1.03^{b}$ | $1.62^{a}$ | $1.33^{b}$ | 0.103 | ns |
| **Overall means** | | 1.47 | 1.67 | 1.62 | 0.053 | ns |
| Valeric | 0 | 1.40 | 1.40 | 1.30 | 0.063 | ns |
| | 4 | 1.20 | 1.40 | 1.60 | 0.123 | ns |
| **Overall means** | | 1.30 | 1.40 | 1.45 | 0.01 | ns |
| Iso-Valeric | 0 | $1.47^{b}$ | $1.99^{ab}$ | $2.72^{a}$ | 0.421 | * |
| | 4 | $1.12^{b}$ | $1.70^{ab}$ | $2.09^{a}$ | 0.321 | * |
| **Overall means** | | $1.30^{b}$ | $1.85^{ab}$ | $2.41^{a}$ | 0.352 | * |

**a and b: Means in the same row with different superscripts are significantly different (P<0.05).**
**±SE- Standard error**

Concentrations of TVFA's were higher significantly (P<0.05) with feeding BS-P and BS-Y compared with feeding BS-M. These results are in a good agreement with those reported by Salem (2003). The molar proportions (%) of the individual VFA's (acetic, propionic, butyric iso-butyric, valeric, iso-valeric and acetic: propionic ratio) are within the range reported by Abou-Akkada and Blackburn (1963) and Abdel Rahman *et. at.* (2001) when fed sheep either berseem or ryegrass. The values of acetic acid, butyric and valeric acid were not significantly affected with feeding different types of berseem silage. On the other hand, proportions of propionic acid were increased with feeding BS-Y and BS-M compared with feeding BS-P at 4hr post feeding, however no differences were found at zero time and among overall means of treatments. The highest values of iso-valeric were found with feed BS-P compared to the lowest values with control diet at 0 and 4 hr post feeding. The values were highly significant with feed BS-P at 0, 4 hr post feeding and overall mean, however, the values were not differed significantly with feeding BS-M compared BS-Y and between BS-Y compared with BS-P. The improvement of rumen fermentation with fed BS-p and BS-Y might be due to increasing the number of rumen cellulolytic bacteria and/or its high quality as juicy, palatable feed, higher energy, protein and vitamins contents (Dominguez 1992 and Salem 2003).

Results of TN, NPN, $NH_3$-N, TPN and MPN are shown in Table (6) and Fig (1).

Feeding on SB-Y and BS-P significantly increased (P<0.05) total nitrogen (TN) before feeding compared with BS-M ration, but the reverse picture was true at 4 hr post feeding since TN was significantly higher in case of BS-M than those of BS-Y and BS-P. The overall mean of TN was significantly higher (P<0.05) with feeding BS-y and BS-P than those BS-M silages. On the other hand, the values of NPN and $NH_3$ were behaved the reflected trend with feeding BS-Y and BS-P compared to BS-M.

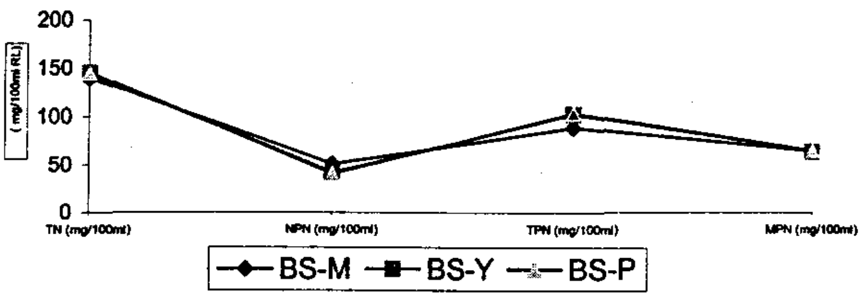
**Table (6): Effect of using different types of berseem silages on nitrogen fractions in the rumen liquor (mg/dl) of cows.**

| Items | Time | BS-M | BS-Y | BS-P | ±SE | Sign. |
|---|---|---|---|---|---|---|
| Total nitrogen | 0 | $107.23^{b}$ | $122.13^{a}$ | $124.54^{a}$ | 2.135 | * |
| mg/dl | 4 | $172.97^{a}$ | $168.62^{b}$ | $165.66^{b}$ | 5.023 | * |
| **Overall means** | | $140.1^{b}$ | $145.38^{a}$ | $145.10^{a}$ | 6.021 | * |
| Non-protein nitrogen | 0 | $45.33^{a}$ | $38.98^{b}$ | $37.45^{b}$ | 5.654 | * |
| mg/dl | 4 | $56.57^{a}$ | $45.82^{b}$ | $44.56^{b}$ | 2.031 | * |
| **Overall means** | | $50.95^{a}$ | $42.40^{b}$ | $41.01^{b}$ | 2.530 | * |
| Ammonia nitrogen | 0 | $14.21^{a}$ | $10.30^{b}$ | $10.51^{b}$ | 1.322 | * |
| mg/dl | 4 | $18.04^{a}$ | $16.71^{b}$ | $17.12^{ab}$ | 1.063 | * |
| **Overall means** | | $16.13^{a}$ | $13.51^{b}$ | $13.82^{b}$ | 1.260 | * |
| True protein nitrogen | 0 | $61.90^{b}$ | $83.15^{a}$ | $87.09^{a}$ | 3.021 | * |
| mg/dl | 4 | $116.40^{b}$ | $122.80^{a}$ | $121.10^{a}$ | 7.001 | * |
| **Overall means** | | $89.15^{b}$ | $102.98^{a}$ | $104.10^{a}$ | 3.021 | * |
| Microbial protein nitrogen. | 0 | $57.03^{a}$ | $51.49^{b}$ | $55.97^{ab}$ | 2.351 | * |
| mg/dl | 4 | 72.67 | 76.64 | 75.54 | 3.020 | ns |
| **Overall means** | | 64.85 | 64.07 | 65.26 | 3.006 | ns |

**a and b: Means in the same row with different superscripts are significantly different (P<0.05).**
**±SE- Standard error**

Those convert might be due to that molasses carbohydrates is characterized by quickly fermentation compared to starch fermented in the corn and sweet potato. Also, corn and sweet potato protein is characterized by low degradability and reflected on rate of $NH_3$-N release in the rumen (El-Sayed, 1991 and Zaza 1997). True protein nitrogen was significantly decreased when feeding BS-M, compared with either BS-P or BS-Y at different times and also with overall mean. Effects of feeding different types of berseem silages on microbial protein nitrogen (MPN) in the rumen liquor (Table 6) show that, MPN was decreased only before feeding when fed BS-Y. However, no significant (P<0.05) difference was found post feeding also among overall mean of the experimental diets. Hulan *et. al.* (1982) reported that potato might be considered as a substitute ingredient for a proportion of the ground corn in practical diet for livestock. The increase in TPN when feeding BS-P or BS-Y may be attributed to the decrease of nitrogen solubility in protein of corn and sweet potato (Zaza 1997).

Fig. (1) :- Effect of using different sources of energy to make berseem silages on nitrogen fraction of the rumen liquor of cows.




**Blood parameters**

Results in Table (7) show that plasma constituents were increased (P< 0.05) for total protein with added BS-Y and BS-P compared to BS-M group. Feeding BS-M, BS-Y or BS-P had no significant effects on the albumin, globulin concentration and albumin/globulin ratio. It is interest to observe that, feeding BS-P and BS-Y decreased significantly (P<0.05) urea nitrogen concentration in serum compared with feeding BS-M. The present results are in good agreement with those reported by Manda *et. al.* (1989) and Salem (2003). Animals fed BS-Y and BS-P had significantly (P<0.05) higher plasma glucose content than that of BS-M group. This observation may be due to improving the utilization of both corn and potato starch (precursor of glucose) in the small intestine with a decline in loss of energy as starch in feces (Broderick, and Mairgan 1997). The depression in serum urea in the groups which received ration containing BS-Y and BS-P, may attribute to either low nitrogen concentration in the rumen or less nitrogen was absorbed across the rumen wall as ammonia (El-Sayed 1991). Groups feed both BS-Y and BS-P rations decreased significantly (P<0.05) ALT and AST activity in serum than those fed BS-M one. The present values of serum ALT and AST are being similar to those obtained by (Salem 2003).

**Table (7): Effect of using different types of berseem silages on some blood parameters.**

| Items | BS-M | BS-Y | BS-P | ±SE | Sign. |
|---|---|---|---|---|---|
| Total protein mg/dl | 6.21[b] | 7.32[a] | 7.41[a] | 0.120 | * |
| Albumin mg/dl | 4.21 | 4.79 | 4.46 | 0.035 | ns |
| Globulin mg/dl | 2.00 | 2.53 | 2.95 | 0.011 | ns |
| A/G ratio | 1.45 | 1.89 | 1.51 | 0.023 | ns |
| Glucose (mg/dl) | 56.29[b] | 62.18[a] | 62.54[a] | 1.920 | * |
| Urea-N mg/dl | 35.5[a] | 32.00[b] | 31.61[b] | 2.031 | * |
| ALT U/ml | 15.20[a] | 12.65[b] | 13.68[b] | 1.210 | * |
| AST U/ml | 7.8[a] | 6.9[b] | 6.6[b] | 0.321 | * |

**a and b: Means in the same row with different superscripts are significantly different (P<0.05).**
**±SE- Standard error**

**Milk production and feed conversion**

Average milk yield and milk composition for the experimental groups are shown in Table (8). Milk yield and fat corrected milk (FCM) were higher (P<0.05) with BS-Y and BS-P group than those of BS-M group. Increase milk yield with feed BS-Y and BS-P might be due to protein and vitamins content in both potato and corn (Zaza 1997), and/or improvement the utilization of starch (precursor of glucose) in the small intestine lead to higher glucose in blood (Table 7) this agreement with Salem (2003). Also, these results might be due to improvement rumen fermentation and nutrient digestibility in groups fed BS-Y and BS-P (Table 4, 5 and 6). Fat and lactose percentage were increased insignificantly (P>0.05) when feeding BS-Y and BS-P than group fed BS-M, however, protein percentage, solid not fat were decreased. Fat yield, protein yield, total solid yield and solid not fat yield were increased insignificantly (P>0.05) with BS-Y and BS-P compared to BS-M group. The increase in fat, protein and lactose content with feed BS-Y and BS-P might be due to increasing digestibilities of CP, CF, NFE and increasing rumen activity and stimulating high amounts TVFA's in the rumen (Cronje *et. al.* 1991, Nagel and Broderick 1992 and Salem 2003). The obtained results might be clarified that mixing between the berseem and source of energy improves the efficiency of protein and energy utilization for milk production. The increase in TS in milk by BS-Y and BS-P could be due to the increase of lactose in milk, which makes up nearly half of the total solid in milk (Maynard *et. al.* 1983).

Data in Table (9) show that feed conversion as kg DMI, TDN, DCP and GE Mcal / kg milk or FCM were not significant difference among experimental groups with added different berseem silages, except Mcal GE intake/ kg FCM was decreased significantly (P<0.05) with fed either BS-P or BS-Y compared to fed BS-M. The present results are in good agreement with those reported by Manda *et. al.* (1989) and Salem (2003).

**Table (8): Effect of using different type of berseem silage on milk yield and composition.**

| Items | BS-M | BS-Y | BS-P | ±SE | Sign. |
|---|---|---|---|---|---|
| Milk yield (kg/h/d) | 15.20$^{b}$ | 16.44a | 16.25a | 1.601 | * |
| FCM (kg/h/d) | 14.00$^{b}$ | 16.00$^{a}$ | 15.00$^{ab}$ | 1.215 | * |
| Fat (%) | 3.62 | 3.73 | 3.69 | 0.101 | ns |
| Fat yield (kg/h/d) | 0.55 | 0.61 | 0.60 | 0.002 | ns |
| Protein (%) | 3.22 | 3.17 | 3.20 | 0.301 | ns |
| Protein yield (kg/h/d) | 0.49 | 0.52 | 0.52 | 0.002 | ns |
| Total solid (%) | 12.54 | 12.56 | 12.48 | 2.010 | ns |
| TS yield (kg/h/d) | 1.91 | 2.06 | 2.03 | 0.102 | ns |
| Solid not fat (%) | 8.92 | 8.83 | 8.79 | 2.015 | ns |
| SNF yield (kg/h/d) | 1.36 | 1.45 | 1.43 | 0.024 | ns |
| Lactose (%) | 4.82 | 4.95 | 4.91 | 0.624 | ns |
| Lactose yield (kg/h/d) | 0.73 | 0.81 | 0.80 | 0.120 | ns |
| Ash (%) | 0.88 | 0.71 | 0.68 | 0.009 | ns |

**a and b: Means in the same row with different superscripts are significantly different (P<0.05).**
**±SE- Standard error**

**Table (9): - Effect of using different types of berseem silage on feed conversion with cows.**

| Items | BS-M | BS-Y | BS-P | ±SE | Sign. |
|---|---|---|---|---|---|
| DMI kg/h/d | 14.24 | 14.60 | 14.50 | 1.021 | ns |
| DMI kg/kg milk | 0.94 | 0.89 | 0.89 | 0.012 | ns |
| DMI kg/kg FCM | 0.07 | 0.06 | 0.06 | 0.043 | ns |
| TDN kg/h/d | 9.70 | 10.41 | 10.28 | 0.710 | ns |
| TDN kg/kg milk | 0.64 | 0.63 | 0.63 | 0.016 | ns |
| TDN kg/kg FCM | 0.04 | 0.04 | 0.04 | 0.009 | ns |
| GEI Mcal/h/d | 47.334 | 48.574 | 48.242 | 4.012 | ns |
| GEI Mcal/kg milk | 3.125 | 2.961 | 2.961 | 0.301 | ns |
| GEI Mcal/kg FCM | 0.233$^{a}$ | 0.110$^{b}$ | 0.110$^{b}$ | 0.042 | * |
| DCPI kg/h/d | 1.30 | 1.41 | 1.39 | 0.062 | ns |
| DCPI kg/kg milk | 0.09 | 0.09 | 0.09 | 0.031 | ns |
| DCPI kg/kg FCM | 0.01 | 0.01 | 0.01 | 0.004 | ns |

**a and b: Means in the same row with different superscripts are significantly different (P<0.05).**
**±SE- Standard error**

**Economical evaluation**

The results in Table (10) show that the cost to produce 1kg milk decreased when feeding BS-P by 5.80 and 7.14% compared with BS-M and BS-Y, respectively. The highest return was shown when feeding BS-P (5.14 LE/h/d) compared with the lowest return (4.26 and 4.37 LE/h/d) for BS-M and BS-Y, respectively. It is therefore recommended that using BS-M, BS-Y and BS-P as balanced diets of energy and protein in early stage of lactation of lactating cows would improve the revenue and production efficiency.

In conclusion, these results are indicating that, added source of energy must be taken into account when making berseem silage and this could improve silage quality, recover gap between caloric and protein ratio and improve feed efficiency for dairy cows.

**Table (10): Economical evaluation for using different type of berseem silage.**

| Items | BS-M | BS-Y | BS-P |
|---|---|---|---|
| **Feed intake (kg/h/d as fresh).** | | | |
| CFM | 6.89 | 7.19 | 7.15 |
| Rice straw | 2.29 | 2.39 | 2.38 |
| BS-M | 20.14 | 0.00 | 0.00 |
| BS-Y | 0.00 | 19.20 | 0.00 |
| BS-P | 0.00 | 0.00 | 19.42 |
| **Total intake.** | 29.32 | 28.78 | 28.95 |
| Cost of total intake, LE | 9.42 | 10.43 | 9.48 |
| Price of kg ration, LE | 0.32 | 0.36 | 0.33 |
| Price of kg TDN, LE | 0.97 | 1.00 | 1.08 |
| Price of kg DCP, LE | 7.24 | 7.41 | 6.81 |
| Price of kg milk | 0.90 | 0.90 | 0.90 |
| **Revenue.** | | | |
| Nutrition cost / kg milk, LE | 0.69 | 0.70 | 0.65 |
| Total revenue, LE | 4.26 | 4.37 | 5.14 |

**Cost of CFM =750 LE/ ton**
**Cost of Rice straw = 100 LE/ ton**
**Cost of BS-M = 200LE/ ton**
**Cost of BS-Y = 250 LE/ ton**
**Cost of BS-P = 200 LE/ ton**
**Cost of El-Mufeed =334 LE/ ton**
**Cost of corn = 1000 LE/ ton**
**Cost of potato = 400LE/ ton**

## ACKNOWLEDGMENT

The authors are indebted to all staff members of the Lab. in By-products improvement section for the kind help. I wish to express my sincere gratitude to Prof. Dr. A. Z. Mehrez, Professor of Animal Nutrition and Prof. Dr. E. A. Gomaa, Professor of Animal Nutrition for helping to overcome all obstacles to bring this work into light.

## REFERENCES

A. O. A. C. (1995). Association of analytical chemists. Official methods of analysis. International 16th Ed. Vol.1 " Agricultural Chemicals Contaminants, Drug Washington, D. C. USA.

El-Emam, G.I. (2001) Studies of making silage in Egypt. Ph.D. Thesis, Fac. Of Agric., Zagazig Univ.

Abd El-Malik, W. H. (1972). Some nutritional studies on silage making of clover-ryegrass mixture for feeding dairy cattle. Ph.D. Thesis, Fac. Of Agric., Cairo Univ.

Abdel Rahman, H.; G. A. Baraghit, S. S. Omar and O. F. Komonna (2001). Growth performance, nutritive value, nitrogen balance, some rumen and blood parameters and testicular development of Ossimi lambs fed either berseem, ryegrass or their mixture. The 8th Scientific conference on Animal Nutrition October 2001-Sharm El-Sheik, Egypt. P: 155.

Abou-Akkada, A. R. and T.H. Blackburn (1963). Some observations on the nitrogen metabolism of rumen proteolytic bacteria. J. Gen. Microbial., 3: 461.

Agriculture Economics and Statistics, ( 2000). Institute of Agric. Economics., Ministry of agric., Egypt

Analytical Chemistry of Foods (1995). Published by Blockier Academic and Professional, an Imprint of Chapman & Hall, Western Gladdens Road, Bishop Briggs, Glasgow G64 2nz, UK.

Bendary, M. M.; S. A. Mahmoud; E. M. Abd El-Roouf; M. K. Mohsen and H. M. A Gssfar (2001). Economical and nutritional evaluation of ensilage corn crop. The 8th Scientific Conference on Animal Nutrition October 2001-Sharm El-Sheik, Egypt. P: 89.

Broderick, G.C. and S. Mairgan (1997). Alfalfa silage versus red clover silage or a mixture of alfalfa and red clover silage as the sole forage for lactating dairy cows. U.S. Dairy Forage Research Center Research Summaries (1997, MAR, 97-99.

Chen, J.; M. R. Stockes and C.R. Wallance (1994). Effect of enzyme-inoculate systems on preservation and nutritive value of hay crop and corn silage. J. Dairy Sci., 77:501.

Conway, E. J. (1978). Microdiffusion analysis and volumetric error. 4th Ed. The McMillan co., N. Y.

Cronje, P. B; J. V. Nolan and R. A.Leng (1991). Acetate clearance rate as a potential index of the availability of glycogenic precursors in ruminants fed roughage-based diets Br. J. Nutr., 66:301.

Dominguez, P . L . ( 1992). Feeding of sweet potato to monogastrics. Roots, tubers, plantains and bananas in animal feeding. FAO Anim. Prod. and Health paper 95:217.

Duncan, D. B. (1955). Multiple ranges and multiple F test. J. Biometrics. 11:1.

Eadie, J. M; P. N. Hobson and S. O. Mann (1967). A note of some comparisons between the rumen content of barley fed steers and that of young calves also fed on high concentrate rations. J. Anim. Prod. 9:247.

El-Sayed., (1991). Performance of growing ruminants on high energy density diets .PH. D. Th. Ain-Shams Univ. Fac. Of Agric.

Erwin, E. S.; G. T. Marco and E. M. Emery (1961). Volatile fatty acid analysis of blood and rumen fluid by gas chromatography. J. Dairy Sci. 44: 1768.

Goering, T. K. and P. J. Van Soest (1970). Forage fiber analysis (apparatus, reagents, procedures and some applications). USDA. ARS. Agro. Hand book, No. 379.

Hulan, H. W.; Proudfoot,F. G. and C. G. Zarkadas (1982). Potato waste meal. I . Compositional analyses. Can. J. Anim. Sci. 62:1161.

Kummar, N.; U. B. Singh and D. N. Verm (1980). Effect of different levels of dietary protein and energy on growth of male buffalo calves. Ind. J. Anim. Sci. 51: 513.

Makkar, G. S.; Kakkar,V. K.; Bhullar, M. S. and N. S. Malik (1984). Potato waste as a substitute for cereal grains in rations of buffalo-calves. Indian J. Anim. Sci. 54: 1060.

Manda, T.; M. Shinoda and T. Sugihara (1989). The effect of ad libitum feeding with roll baled grass and legume silage on the rumen fermentation and blood metabolites of high yielding dairy cows. Research Bulletin of Hokkaido National Agriculture Experiment Station, No. 151:7.

Maynard, A.; J. K. Loosli; H. F.Hintz and R. G. Warner (1983). Animal Nutrition. The carbohydrates and their metabolism. Chapter 6 pp.99. Tata Mcgraw. Hill. Pupil. Co. Ltd New Delhi. USA.

McDonald, P.; R. A. Edwards; J.F. Edward; J. F. D. Greenhalgh and C. A. Morgn (1995). Animal nutrition. 5th Ed., Text Book Copyright Licensing. LTD., London.

Murray, R. K.; D. K. Granner; P. A. Rodwell and V. Wu ( 1991 ). Harper' s Biochemistry. Libraries duliban, Appleton & Lange, California.

Nagel, S. A. and G. A. Broderick (1992). Effect of formic acid or formaldehyde treatment of alfalfa silage on nutrient utilization by dairy cows. J. Dairy Sci., 1:140.

NRC. (1988). National Research Council. Nutrient Requirements of Dairy Cattle. 6th rev. ed. Nath. Acad. Sci., Washington, DC.

Saleh, M. S.; N. M. Eweedah, M. F. Ali and M. K. Mohsen (2001). Comparison between dried sugar beet pulp and yellow corn as a source of energy with berseem in rations of growing lambs. The 8th Scientific Conference on Animal Nutrition October 2001-Sharm El-Sheik, Egypt. P : 231

Salem, F. A. (2003). Effect of dietary silage source on feed intake, nutrients digestibility, some blood constituents and milk production in lactating buffaloes. The 9th Scientific Conference on Animal Nutrition October 2003-Horgada.

SAS, (1990). SAS Statistics. Analysis System: SAS User's guid3: Inst., Inc., Cary N.C. U.S.A.

Schneider, P. L.; Stokes M. R.; Bull, L. S. and Walkker, C. K. (1985). Evaluation of potato meal as a feedstuff for lactating cows. J. Dairy Sci., 68:1738.

Sheperd, A. C. and L. Kung (1996). Effect of an enzyme additive on composition of corn silage ensiled at various stages of maturity. J. Dairy Sci., 79:1767.

Shultz, T. A. and E. Shultz. (1970). Estimation of rumen microbial nitrogen by three analytical methods. J. Dairy Sci., 52: 781.

Steven P. Hart ( 1987). Associative effects of sorghum silage and sorghum grain diets. J. Anim. Sci. 64:1779.

Van Keulen, J. and A. Young, (1977). Evaluation of acid-insoluble ash as a natural marker in ruminant digestibility studies. J. Anim. Sci., 44: 282.

Waldo, D. R. and L. H. Schultz (1956). Lactic acid production in the rumen. J. Dairy Sci., 39:1455.

Warner, A.C.I. (1964). Production of volatile fatty acids in the rumen. Methods of measurements. Nutr. Abstr. And Rev. 34:339.

Youssef, M. S. S. (1978). Nutritional status of livestock in Egypt. In symposium on the role of scientific research in sowing feedstuffs, 19-20 September, Cairo, Egypt.

Zaza, G.H. (1997). Studies on the effect of non-conventional feedstuffs on growth performance of rabbits. PH.D. Thesis. Faculty of Agriculture, Al-Azhar University.

## تأثير استخدام مصادر مختلفة من الطاقة عند عمل سيلاج البرسيم على أداء الأبقار الحلابة

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**معهد بحوث الإنتاج الحيواني- مركز البحوث الزراعية - وزارة الزراعة**

أجريت هذة الدراسة بهدف استخدام درنات البطاطا غير المستخدمة في الاستهلاك الآدمي عند عمل سيلاج برسيم متوازن في الطاقة والبروتين كبديل لمصادر الطاقة التقليدية المستخدمة من مولاس أو حبوب الذرة، حيث إنها تتوفر بكميات كبيرة واسعار رخيصة، ودراسة تأثير ذلك على اداء الأبقار الحلابة.

استخدمت في هذة الدراسة ثمانية عشر بقرة خليط فريزيان وزعت على ثلاثة مجا ميع متساوية، غذيت على ثلاث علائق متوازنة في البروتين والطاقة تحتوى على سيلاج البرسيم وعلف مركز وقش ارز. المجموعة الأولى تناولت سيلاج برسيم بالمولاس مع علف مركز وقش ارز والثانية سيلاج بحبوب الذرة مع علف مركز وقش ارز والثالثة سيلاج برسيم بدرنات البطاطا التي لا تستخدم في استهلاك الغذاء الآدمي مع علف مركز وقش ارز.

أظهرت نتائج اختبار السيلاج (pH, TVFA's, Lactic acid and $NH_3$-N) انة يمكن اعتبار السيلاج الناتج جيد. أوضحت نتائج الماكول تساوى الكميات الماكولة من العلف المركز والسيلاج وقش الأرز والمادة الجافة الكلية الماكولة. في حين أظهرت النتائج المتحصل عليها ارتفاع معاملات هضم المكونات الغذائية المختلفة عند التغذية على سيلاج البرسيم المصنع بإضافة الذرة ومخلفات درنات البطاطا مقارنة بتلك الذي تم تصنيعه بإضافة المولاس. نفس الاتجاه كان ملاحظا مع NDF, hemi-cellulose بينما لم يكن هناك أي اختلاف معنوي بين المعاملات بالنسبة لكل من ADL & ADF كذلك السليلوز.

لم يلاحظ وجود فرق معنوي للحموضة بالكرش بين المجاميع المختلفة في حين زاد إنتاج الأحماض الدهنية الطيارة عند التغذية على سيلاج البرسيم المحتوى على الذرة ودرنات البطاطا مقارنة بسيلاج البرسيم المعامل بالمولاس. أوضحت النتائج المتحصل عليها عدم وجود اختلافات معنوية بين المجاميع المختبرة في إنتاج الخلات والبروبيونات والبيوتيرات والفاليرات في حين زادت الايزوبيوتيرات عند التغذية على سيلاج البرسيم مع الذرة والبطاطا. أشارت النتائج المتحصل عليها إلى ارتفاع النتروجين الكلى والحقيقي في كرش الحيوانات التي تناولت في غذائها سيلاج البرسيم المصنع بإضافة كل من الذرة والبطاطا عن المصنع بإضافة المولاس، من ناحية أخري حدث انخفاض في تركيز كلا من $NH_3$-N & NPN ولم يحدث تغير في البروتين الميكروبي.

حدث ارتفاع في تركيز بلازما الدم لكل من البروتين الكلى والجلوكوز في حين حدث انخفاض في تركيز اليوريا ALT و AST بينما لم يكن هناك اختلافات معنوية بين المجاميع في كل من الجلوبيولين والالبيومين ونسبة الالبيومين الي الجلوبيولين . أظهرت النتائج ارتفاع إنتاج البن في المجاميع التي تناولت سيلاج البرسيم المصنع بإضافة الذر والبطاطا عن تلك المصنع بإضافة المولاس.

من نتائج هذه الدراسة يمكن التوصية بإضافة درنات البطاطا غير المستخدمة في الاستهلاك الآدمي كمصدر طاقة رخيص الثمن يؤدى الي اتزان الطاقة مع البروتين للبرسيم ويقلل من تكاليف التغذية مع المفيد أو الذرة إذا توفر ورخص سعرة .