*Egyptian J. Anim. Prod. (1994) 31(2):179-187.*

# GROWTH PERFORMANCE OF BUFFALO MALE CALVES AS AFFECTED BY USING COWPEAS AND SOYBEAN SEEDS AS A SOURCE OF UREASE DURING UREA-TREATED WHEAT STRAW ENSILING PROCESS

M. Sarwar[1], M.A Iqbal[2], C.S. Ali[3] and Tanweer Khaliq[3]

1- Department of Animal Nutrition, University of Agriculture, Faisalabad, 2- Livestock and Dairy Development Department, Punjab, Lahore, 3- Department of Physiology and Pharmacology, University of Agriculture, Faisalabad

SUMMARY

A study was conducted to examine the effect of cowpeas and soybean seeds as sources of urease on the nutritive value of urea treated ensiled wheat straw. Twenty four buffalo calves divided into 4 groups, 6 animals in each group. Four isonitrogenous and isoenergetic rations, containing untreated wheat straw or treated with 4% urea with or without the source of urease enzyme, were prepared. The animals were fed ad libitum for 90 days. The average daily dry matter intake of ration containing untreated wheat straw, 4% urea treated wheat straw, 4% urea treated wheat straw with 1% cowpeas seed and 4% urea treated wheat straw with 1% soybean seed as a urease source were 6.234, 7.045, 6.656 and 6.503 kg, respectively. The average daily weight gain of calves fed respective rations were 0.107, 0.363, 0.442 and 0.383 kg and feed efficiency for weight gain were 58.04, 19.41, 15.04 and 16.96 respectively. The animals fed urea treated straw rations had better ($P<0.01$) weight gain and feed efficiency as compared to those fed untreated straw containing rations.

**Keywords:** Growth performance, buffalo male calves, urea treated wheat straw, cowpea, soybeans

## INTRODUCTION

Availability of quality forages in sufficient quantity is an important dietary acquirement for any ruminant production system. One of the main bottlenecks for profitable livestock keeping in Pakistan is the scarcity of forage because of increasing allocation of acreage for the production of grains to meet the dietary needs of ever increasing human population. Hence under present conditions the livestock in Pakistan is receiving about 50% of their required energy, resulting in low productivity (Sarwar et al., 1992).

The shortage of good quality forage can be overcome by improving the feeding value of abundantly available poorly digestible crop residues in the country. Improvement in the feeding values of straws and other crop residues through chemical treatments is being investigated vigorously. Ali et al. (1977) reported imported digestibility of organic matter of diets containing NaOH treated wheat straw. Similar findings were reported by Sarwar et al. (1985 and 1992) when they fed diets containing wheat straw treated with NaOH to buffalo heifers. Ammonia has also been used to improve the nutritive value of low quality roughages (Sundstol et al., 1978). Sadullah et al. (1982) and Ali et al. (1993) used urea for straw ammoniation because urea is rapidly decomposed into ammonia by the action of urease in aqueous medium. This enzyme is abundantly present in soybeans (Katsitodze et al., 1974) but not enough in wheat straw to affect the decomposition of urea (Coxworth and Kullman, 1978). The present study was conducted to investigate the effectiveness of urease enzyme from cowpeas and soybean seeds for the improvement of nutritive value of urea treated wheat straw fed to growing buffalo calves.

## MATERIALS AND METHODS

### Treatment of wheat straw

Wheat straw was treated with 4% (w/w) urea solution and ensiled in four different stacks for a period of 30 days. In the control stack the wheat straw was treated with equal weight of water only. In the second stack wheat straw was sprayed with 4% urea solution (w/w). In the third and fourth stacks addition of 1% crushed

cowpeas or soybeans were added as a source of urease, respectively. Each stack was covered with 4 inches thick layer of rice straw, followed by polyethyline sheet covering which was plastered with a blend of wheat straw and mud to avoid any cracking on drying. The stacks were allowed to react for 30 days and it was assumed that polyethyline and mud plastering provided anaerobic conditions for proper silage making. On 31st day the stacks were opened and straw silage samples were obtained for further use in production trial.

**Feeding and digestion trials**

Four isonitrogenous and isoenergetic rations (Table 1) were prepared by using NRC values (1988). Twenty four buffalo calves of about one year (10-12 mo.) age and same weight were divided into 4 groups, 6animals each. The experiment was planned as randomized complete block design. The experimental rations were randomly allotted to these groups. The animals were allowed 15 days adjustment period, followed by 90 days experimental period. Prior to the start of the experiment, the animals were treated against the ecto- and endo-parasites. The rations were mixed daily and fed twice (a.m. & p.m.) ad. libitum. The animals were offered clean water three times a day. Animals were weighed forthinghtly for three consecutive days before the morning feeding.

The total feces collection procedure was used to determine the digestibility during last 10 days of the trial. All the 24 experimental animals were involved in the digestion trial. The feces of each animal were transferred to respective metal tubs several times daily. The total feces were thoroughly mixed with a wooden spatula and weighed, and a 1% sample was taken with a special coring tube at the end of each 24 hours period. The dry matter contents of the feces were determined. The dry matter contents of the rations were determined every day by obtaining a representative sample before feeding. The data for feed intake and weight gain were maintained accordingly. Analyses of feeds and feces were determined by the official A.O.A.C (1984) methods. The data thus collected were subjected to analysis of variance (Steel and Torrie, 1984).

## RESULTS AND DISCUSSION

### Growth performance

The means for weight gain, feed consumption and feed efficiency are shown in Table 2. The buffalo calves fed rations containing untreated wheat straw, urea treated wheat straw and urea treated wheat straw + cowpeas or soybean gained, on an average, 0.107, 0.363, 0.442 and 0.383 Kg body weight daily, respectively. The calves fed rations containing straw treated with urea as well as cowpeas and soybean gained significantly ($P<0.05$) more weight than those fed the ration containing untreated wheat straw. However, the weight gained by the calves fed the three experimental rations containing treated straw were significantly different from each other. A significant increase in weight gain in animals fed rations containing urea treated wheat straw have also been reported by Al-Rabbat and Heaney (1978), Sundstol et al. (1978) and Haque et al. (1984). The improvement in body weight gain due to rations containing urea treated wheat straw as compared to control ration which had 1.2% urea (Table 1) could be due to slow release of ammonia in the rumen, traped in the fibre matrics during ensiling process. The slow release of ammonia in the rumen not only minimizes its ruminal losses but also increases the activity of ureolytic bacteria (Slyter et al., 1971) and possibility synchrony of $NH_3$ and energy availability for maximal microbial protein synthesis.

### Feed consumption and digestibility

The average daily dry matter intake by calves fed rations containing untreated wheat straw, urea treated wheat straw and urea treated wheat straw plus cowpeas or soybeans were 6.234, 7.045, 6.656 and 6.503 kg (Table 2), respectively. The analysis of variance of the data revealed non significant differences among the groups. In contrast to our results, Sadullah et al. (1982) and Al-Rabbat et al. (1978) have reported significantly ($P<0.05$) higher dry matter intake by cattle fed roughage based rations containing urea or ammonia treated straw. In this study, the non significant variation in feed intake due to ammoniation of the wheat straw might be due to (1) non-significant changes in the digestibility of the rations and/ or (2) the straw contributed only 35% of the ration which is

not expected to make much changes in the gut fill.

Table 1: Composition of experimental rations

| Ingredients as fed, % | Rations A | B | C | D |
|---|---|---|---|---|
| Cotton seed cake (undecoricated) | 20 | 20 | 20 | 20 |
| Rape seed cake | 10 | 10 | 14 | 14 |
| Wheat bran | 14 | 14 | 14 | 14 |
| Wheat straw | 33.8 | 35 | 35 | 35 |
| Molasses | 20 | 20 | 20 | 20 |
| Mineral mixture | 1 | 1 | 1 | 1 |
| Urea 46% (fertilizer grade) | 1.2 | 0 | 0 | 0 |
| Chemical composition DM basis, % | | | | |
| Dry Matter | 70.08 | 71.86 | 69.72 | 68.83 |
| Crude protein | 16.87 | 16.61 | 16.81 | 16.31 |
| Crude fibre | 26.46 | 24.85 | 28.37 | 29.13 |
| Crude lipid | 4.35 | 3.75 | 4.08 | 4.05 |
| Nitrogen free extract | 41.04 | 41.13 | 38.65 | 38.92 |
| Ash | 11.28 | 13.66 | 12.09 | 11.59 |

A=Wheat straw treated with water(100 litter water/100 Kg wheat straw, B=Wheat straw treated with 4% urea solution (w/w), C=Wheat straw treated with 4% urea solution plus 1% crushed cowpeas seeds and d=Wheat straw treated with 4% urea solution plus 1% crushed soybean seeds.

Table 2. Average weight gain, dry matter intake, dry matter digestibility and feed efficiency in growing buffalo calves fed experimental rations

| Parameters | Rations A | B | C | D |
|---|---|---|---|---|
| No. of animals | 6 | 6 | 6 | 6 |
| Days on experiment | 90 | 90 | 90 | 90 |
| Average initial body weight (kg) | 173.17 | 173.17 | 173.17 | 173.17 |
| Average final body weight (kg) | 182.83 | 205.83 | 213.00 | 207.67 |
| Average total weight gain (kg) | 9.66 | 32.66 | 39.83 | 34.50 |
| | a | b | c | c |
| Average daily weight gain(kg) | 0.107 | 0.363 | 0.442 | 0.383 |
| Average daily dry matter intake (kg) | 6.234 | 7.045 | 6.656 | 6.503 |
| DM digestibility (%) | 65.74 | 69.30 | 68.13 | 67.40 |
| Feed efficiency (dry matter intake/weight gain) | a 58.26 | b 19.41 | c 15.06 | c 16.98 |

a, b, c Means in the same row having different superscript differ significantly ($P<0.05$)

The apparent dry matter digestibility values (Table 2) were 65.74, 69.30, 68.13 and 67.40% in animals fed rations containing untreated wheat straw, urea treated wheat straw, wheat straw treated with urea plus cowpeas or soybean, respectively. The rations containing urea treated wheat straw showed an increasing trend of digestibility. However, the differences were non significant when results were subjected to analysis of variance. These results agreed with the earlier reports of Ali et al. (1993), Dolbery et al. (1981), Shea et al. (1980) and Altaf-ur-Rehman (1985). Ali et al. (1993) pointed out that small improvement in the dry matter digestibility of the ration containing ammoniated wheat straw due to the fact that the digestibility of the total mixed ration was not true measurement of the improvement for the digestibility of the wheat straw alone.

**Feed efficiency**

The average amount of dry matter consumed by calves to gain one Kg body weight was 58.26, 19.41, 15.06 and 16.98 Kg for rations containing untreated wheat straw, urea treated wheat straw, urea treated wheat straw with cowpeas or soybeans, respectively. Similar results were reported by Huber and Kung (1981). They mentioned that growing heifers showed reduced growth when fed rations supplying 45% of the total CP from NPN. In our study, more than 40% of the total nitrogen came from NPN and thus the reduced growth may be due to negative reaction of growing calves to dietary NPN.

## CONCLUSION

Replacement of wheat straw with urea ensiled straw did not significantly improve the dry matter intake by buffalo calves. However, feed efficiency of buffalo calves fed ration containing 35% urea ensiled straw was significantly greater when compared to those fed control ration. Addition of urease sources in rations containing urea ensiled straw further improved the efficiency of the buffalo calves as compared to the control as well as urea ensiled straw rations. The ration containing urease sources showed significantly greater weight gain and feed efficiency as compared to those without urease sources. However, no difference was observed between the

two sources of urease i.e. cowpeas and soybean seeds. The results of average daily gain and feed efficiency indicated that addition of urease can be practised in urea ensiling straw, however, the cost factor, which varies from place to place, must be considered.

**REFERENCES**

Ali, C.S. and Andersen, 1979. Sodium hydroxide-treated barley straw in pelleted diets for beef cattle. Acta Agric. Scaned. 29:24-28.

Ali, C.S., V.C. Mason and J. Waageptersen, 1977. The voluntary intake of pelleted diets containing sodium hydroxide treated wheat straw by sheep. 1. The effect of alkali concentration in the straw. Z. Tierphysiol., Tierernhary. U. Futtermittelkde. 39:173-182.

Ali, C.S., M. Sarwar, R.H. Siddiqi, R.F. Hussain, T. Khaliq, S.U.R. Chaudhry and A.R. Barque, 1993. Effect of Urea treatment of wheat straw on disappearance and rate of passage through reticulo-rumen of buffalo. Pak. Vet. J. 13:74-78.

Altaf-ur-Rehman, 1985. Improvement in the nutritive value of sugarcane pith with ammoniation using cattle manure as an additive. Thesis Faculty of Animal Husbandry, N.W.F.P., University of Agriculture, Peshawar.

Al- Rabbat, M.F. and D.P. Heaney, 1978. The effect of enhydrous ammonia treatment wheat straw and steam cooking of aspen wood on their feeding value and on ruminal microbial activity Can. J. Ani. Sci 58:443-451.

AOAC, 1984. Official Methods of Analysis. Association of Official Analytical Chemist. Washington D.C., USA.

Coxworth, E. and P. Kullman, 1978. Improving the feeding value of straw and other forages by the use of ammonia released from urea by the action of urease enzymes. Sekchewen Res. Council. 14:6-10.

Dolbery, F., M. Sadullah, M. Haque and R. Ahmad, 1981. Storage of urea treated straw using indigenous material. World Ani. Rev. 38:37-39.

Haque , M., C. M. Davis, M. Sadullah and F. Dolbery, 1984. A note on the performance of cattle fed treated paddy straw with animal urine as source of ammonia. Nutri. Abst. and Review 54:3486.

Huber, J. T. and J.R. Limin Kung, 1981. Protein and non protein nitrogen utilization in dairy cattle. J. Dairy Sci. 64:1170-1175.

Katsitodze. B., A. Kozmanishyili and E. Kandashyili, 1974. Rapid method to determine urea content in mixed feeds. Chem. Abst. 82:2799.

National Research Council, 1988. Nutrient requirements of dairy cattle. 6th Rev. ed. Nat. Acad. Sci., Washington D.C.

Sadullah, M., H. Haque and F. Dolbery, 1982.. Treated and untreated rice straw for growing cattle. Tropical Anim. Prod. 7:20-23.

Sarwar, M., C.S. Ali and M.Z. Alam, 1992. Ruminal degradation of sodium hydroxide treated cellulosic materials. Pak. Vet. J. 12:75-77.

Sarwar, M., C.S. Ali, M.A. Sial and MZ. Alam, 1985. Growth performance of buffalo heifers as affected by sodium hydroxide treated wheat straw. Pak. Vet. J. 5:127-129.

Shea, O., J. Laular and M.J. Drennan, 1980. Chemical treatment improves the feeding value of straw. Nutri. Abst. and Review 51. 4064.

Slyter, L.L., R.R. Oltjen, E.E. Williams and R.L. Wilson, 1971.Influence of urea, biuret and starch on amino acid patterns in ruminal bacteria and blood plasma and on nitrogen balance of steers fed high fiber prified diets. J. Nutr. 101:839-846.

Steel. R. G. D. and J. H. Torrie, 1984. Principles and Procedures of Statistics. Mcgraw-Hill Book Co., Inc. New York.

Sundstol, F., E. Coxworth and D.N. Mowat, 1978. Improving the nutritive value of straw and other low quality roughages by treatment with ammonia. World Ani. Review 26:13-17.

# إستخدام لوبيا العلف وفول الصويا كمصدر لإنزيم اليوريز خلال سيلجة تبن القمح المعامل باليورياو تأثيره على نمو عجول الجاموس.

م. سارور[1] ، م.أ . إقبال[2] ، س . على[2] وتنوير خالق[3]
١- قسم تغذية الحيوان بكلية الزراعة فيصل أباد ٢- قسم تنمية الحيوان - البنجاب - لاهور ٣- قسم الفسيولوجى والفارماكولوجى - كلية الزراعة - فيصل أباد .

درس تأثير إضافة لوبيا العلف وفول الصويا كمصدر لإنزيم اليوريز على القيمة الغذائية لتبن القمح المعامل باليوريا بإستخدام أربعة وعشرون عجل جاموس فى أربع مجموعات كل تحتوى ستة عجول غذيت على علائق متساوية الطاقة والنيتروجين لمدة ٩٠ يوما. وتكونت العلائق من تبن قمح غير معامل ، أو معامل بيوريا بنسبة ٤٪ بدون أو مع مصدر لإنزيم اليوريز .

أوضحت النتائج أن متوسط المأكول من المادة الجافة بلغ ٦,٢٣٦ ، ٧,٠٥٤، ٦,٦٥٦ ، و٦,٥٠٣ كجم يوميا للرأس أما الزيادة اليومية فى وزن العجول فكانت ٠,١٠٧ ، ٣٦٣ ، ٠,٤٤٢ و٠,٣٨٣ كجم . و القيم المقابلة للكفاءة الغذائية ٥٨,٢٦ ، ١٩,١٤ ، ١٥,٠٤ و١٦,٩٦ وذلك للعلائق الأربع على الترتيب .

وقد أثبتت النتائج أن الحيوانات المغذاة على العلائق المحتوية على تبن القمح المعامل باليوريا أظهرت زيادة يومية فى الوزن أعلى منها للحيوانات المغذاة على تبن القمح الغير معامل .