SUMMARY AND CONCLUSION
SUMMARY AND CONCLUSION

The present studies were directed towards assessing, in an objective manner, the source and level of non protein nitrogen compounds with optimum proportion of other ingredients as supplements to the poor quality straws commonly available in India. Ultimate aim was to enrich the poor quality roughages by NPN compounds and to formulate a balanced and maintenance compounded feed for the cattle and the buffaloes, the species of prime importance to the dairy industry of India.

Indices of improvement adopted were as usual (i) palatability of the feed as reflected by the voluntary consumption of dry matter (ii) the digestibility coefficients of feed nutrients (iii) the balances for nitrogen and major minerals like calcium and phosphorus (iv) general condition and health of the animals and (v) level of nitrogen fractions in the blood.

To embrace all these aspects, an endeavour was made to critically compare the results obtained in the present investigation with the information provided by the earlier workers.

Keeping this background in view, and with an integrated approach, the project was divided into following parts:
1. Effect of urea supplementation on the nutritive value of paddy straw;
2. Effect of urea supplementation on the nutritive value of wheat straw.
3. Effect of biuret supplementation on the nutritive value of wheat straw.
4. Effect of grinding wheat straw and supplementing with urea on its nutritive value.
5. Blood studies of animals given the feeds as stated above.

For all these experiments the comparative utilization of two levels of NPN was studied in mature dry cows and buffaloes. To facilitate better and prompt understanding of the entire project, the results observed and conclusions drawn have been summarised in the following page.

1.1 In urea and paddy straw experiments, one group was fed two times a day while the other once a day. Urea replaced 45% nitrogen of the concentrate mixture in the first experiment and 65% in the second experiment. Simultaneously the control groups were fed with maintenance ration but containing neither urea nor molasses. Paddy straw formed the sole fodder moiety and molasses was added as the readily available source of energy. Urea used in the experimental ration contained 45.34% nitrogen. The mineral mixture and Vitamin A (Rovimix) were supplemented in all rations to provide at least 5000 IU per day.

1.2 Voluntary consumption of dry matter was found to be
higher (37% to 48%) in urea fed cows and buffaloes than non urea fed groups. However, in buffalo groups the increase was 24% to 36%. The digestibility coefficients for dry matter were found to be higher for urea fed group as compared to control and at higher level of urea fed (65%) than lower level (45% urea replacement).

In most of the observations the buffaloes consumed and digested more dry matter as compared to the cows.

Frequency of feeding, i.e., one time versus two times a day, had no significant effect on intake or digestibility of dry matter.

1.3 Water intake was found to be more in the non urea fed groups of cows and buffaloes than those receiving urea in their diet, although trend for water to dry matter intake ratio was contrary to this.

1.4 Buffaloes digested more crude protein than the cows (P < 0.01). Apparently 65% replacement level resulted in higher digestibility of crude protein than 45% urea nitrogen level in both the species.

Two times a day feeding evoked favourable response to the crude protein digestibility as compared to once a day feeding, though the differences were not significant.

1.5 Digestion coefficient for organic matter was higher in urea fed animals than those not fed with urea in their ration. Values were higher in 65% level than 45% urea nitrogen replacement and the differences were found to be significant (P < 0.01).
1.6 Urea fed groups of both the species digested more ether extract than the control. Buffaloes had higher values for ether extract digestibility coefficients than cows (P \( \leq 0.01 \)). Replacement at 45% by urea nitrogen showed higher values than 65% urea nitrogen level (P \( \leq 0.01 \)).

1.7 Values for digestibility coefficient of crude fibre were significantly higher in urea fed groups than the non urea fed groups and 65% level was found to be superior than 45% urea nitrogen level. Buffaloes digested more crude fibre than cows and one time feeding was better than two times feeding. There was significant difference (P \( \leq 0.05 \)) between species and treatment.

1.8 The nitrogen free extract digestibility was higher in non urea groups than urea fed groups. Sixty five per cent level gave better results than 45% (P \( \leq 0.01 \)). One time feeding produced higher values than two times feeding practice.

1.9 Digestion of total carbohydrate was better in urea fed animals than those not receiving urea in their diet. Sixty five per cent urea replacement provided better results than 45% replacement (P \( \leq 0.01 \)).

1.10 Intake of nitrogen was more in urea fed cows and buffaloes as compared to control groups. Animals consumed more nitrogen at 65% urea nitrogen level than at 45% level.

Like nitrogen intake, excretion was also higher in both the species getting urea in their ration than the control. In control groups of cows, loss was mostly
through dung (about 60% of the total loss). While in urea fed groups it was 46% to 52% through urine. Thus in cows, loss of nitrogen through urine was more in all the urea fed groups than the control and in two times fed groups and 45% level than one time fed and 65% urea nitrogen replaced group. Similar trend was followed by the buffaloes in which loss through urine was 51% to 52% in urea fed groups.

All the animals were found to be in positive nitrogen balance. Statistically significantly higher nitrogen retention was found in urea fed groups than the non urea groups which was found to be correlated with the level of urea supplementation. Balances were higher ($P \leq 0.01$) in one time fed groups of cows than two times fed groups. Whereas in buffaloes, reverse was the trend. Buffaloes produced substantially higher balances ($P \leq 0.01$) than cows under all treatments. Interaction between species and the time (feeding frequency) was also found to be significant ($P \leq 0.05$).

1.11 All the groups were found to be on positive calcium and phosphorus balance. And no significant difference in balances between species, times and treatments or interaction between them was observed.

1.2 Intake of DCP and TDN was more in case of urea fed groups as compared to non urea fed groups of cows and buffaloes. Sixty five per cent urea nitrogen fed groups of both the species got more DCP than on 45% level. But in case of TDN, 65% urea nitrogen level showed superiority
only in two times feeding regime in both the species. Buffaloes received higher amount of DCP and TDN than cows. Control groups of cows and buffaloes got lesser DCP but more TDN than the recommended values of Sen and Ray (1964). However, all groups of cows and buffaloes on experimental ration consumed more DCP and TDN than the recommended scales. Thus showing that 45% as well as 65% urea nitrogen supplemented groups in both the species under both the regimes consumed sufficient DCP and TDN from their rations during the course of present investigation.

2.1 Because of the difference in chemical composition in the paddy and wheat straw as also in the response to urea incorporation towards improvement in their nutritive values as reported by several workers, paddy straw was replaced by wheat straw in the subsequent urea supplementation studies.

    Further, since cows and buffaloes fed with 45% and 65% level of urea supplemented ration maintained satisfactory condition and health all along the experimental period, the level of supplements were increased further to replace 50% and 75% nitrogen from the ration of cattle and buffalo.

    During these investigations, the two times feeding practice was maintained to reduce the risks of toxicity generally associated with urea feeding, by dividing the intake of urea through diet.

2.2 These experiments were also conducted on adult animals in dry state (eight cows of Tharparkar breed and eight mature Murrah buffaloes). The wheat straw formed
the sole roughage and no green fodder was offered to the animals. In the control ration, G.N. cake contributed the major source of crude protein. Whereas, in the experimental ration in which 50% and 75% of crude protein was replaced by urea nitrogen, the G.N. cake was reduced accordingly. However, crude protein content of all the concentrate mixtures were 24.18, 23.49 and 24.48% respectively for control, 50% and 75% supplemented groups.

2.3 Consumption of dry matter was found to be more in urea fed cows and buffaloes than control animals. Intake of dry matter was greater in 75% urea fed groups of either species than 50% level. Buffaloes consumed more dry matter than the cows.

Digestibility of dry matter was significantly higher in urea fed groups than the control in both the species (significant at $P \leq 0.01$ in 75% nitrogen replacement group). However, no statistical significant difference existed between species, periods (1st and 2nd) or between levels of urea supplemented.

2.4 Urea was found to increase the water intake as compared to the control groups in both the species. Water consumption was more in period I than in period II, in 50% urea level in cows and 75% urea nitrogen level in buffaloes. Similarly water to dry matter intake ratios were also invariably higher in urea fed groups than the non urea ration fed groups.
2.5 Urea groups of cows and buffaloes utilized crude protein in a better way than their control (P < 0.01). Buffaloes recorded better utilization than cows, but differences was non significant. No significant difference was observed due to extending the time from first period to second period.

2.6 Both species getting urea in their ration digested more organic matter than their corresponding control groups. Although buffaloes showed greater digestibility than its counterpart at both the level of urea supplementation, but the difference was not significant statistically. There was no significant difference between period I and II or in levels of urea feeding.

2.7 No species or treatment difference in digestibility coefficient values for ether extract was noticed. However, highly significant difference (P < 0.01) was observed in interaction between species and treatments. Cows had higher values in period II than in period I on 50% urea replaced diet (P < 0.05). There was no statistical difference between urea fed groups and the control.

2.8 Addition of urea in the ration, significantly increased the digestibility of crude fibre in both the species. Values for period I were higher than period II, though the differences in respect to species, treatment or their interaction were not significant.

2.9 Apparently buffaloes showed greater power of digestion for nitrogen free extract as compared to cows.
There was a decline in the digestibility as the animals entered from period I to period II. The values for digestibility of nitrogen free extract were highly significant ($P \leq 0.01$) in case of buffaloes, in 75% replacement groups as compared to control while it was significant ($P \leq 0.05$) in 50% I replacement versus control. There were no significant differences on account of species, treatment or their interaction.

2.10 Intakes of nitrogen were higher in urea fed groups than non urea groups of cows and buffaloes. Buffaloes ingested more nitrogen than cows. In cows 75% urea nitrogen supplementation resulted in greater intake of nitrogen than 50% supplementation.

Total nitrogen excretion was found to be less in 50% urea fed groups of cows than the control, more in 75% urea nitrogen level than control cows and less at both levels in buffaloes, than their respective controls. Buffaloes excreted more nitrogen at 50% level of urea nitrogen, but almost same as cows at 75% urea nitrogen replacement. Loss of nitrogen through urine was about 40% in control groups of cows and also buffaloes.

In 50% urea nitrogen groups of cows, loss through urine varied from 43% to 47%. While in 75% urea nitrogen groups, loss through urine constituted 48% to 51%. In buffaloes (50% urea nitrogen group) nitrogen loss through urine was 45% and 47% in case of 75% urea nitrogen level. Thus loss of nitrogen through urine was more in urea fed
animals than the control.

All the animals exhibited positive nitrogen balances. Nitrogen retention was more in urea fed groups of both the species and at both the levels of replacement. More retention in buffaloes was noted than cows. Buffaloes at 75% urea nitrogen level produced higher storage of nitrogen than at 50% urea supplementation but cows registered same nitrogen balance at either of the two level.

The values for balances in 50% I and 75% I replacement groups were significantly higher (P < 0.01) as compared to control group in cows. However, no statistically significant difference among species, treatments and interaction thereof was observed in the retention of nitrogen.

2.11 No significant difference was observed in calcium balance, either between control and experimental ration fed groups of both species or between periods at either level of urea supplementation in both the species tested. Analysis of variance also failed to show any difference due to species, treatment or their interaction.

All the groups were in positive calcium balance. Intake of calcium by different groups of cows and buffaloes was higher than the recommended values by Sen and Ray (1964).

2.12 There was no statistical difference in phosphorus balances between 50% I and control groups of cows and buffaloes, nor between period I and II, in either species or the level of nitrogen replacement. However, difference
in 75% I versus control in both the species were found to be highly significant (P ≤ 0.01).

Total intake as also outgo of phosphorus was higher in urea fed groups than those on unsupplemented ration and higher in buffaloes than cows. In cows intake was slightly lower in 75% urea nitrogen groups than 50% urea nitrogen groups while reverse was the position for excretion. However, intake as well as excretion values were lower in 75% urea nitrogen group of buffaloes, compared to 50% urea nitrogen groups.

All groups were on positive phosphorus balance with the sole exception of 75% I group of cows, which showed a negative phosphorus balance.

2.13 Intake of DCP and TDN was found to be more in urea fed groups than the control groups. Intake was more in buffaloes than cows and more at 75% urea nitrogen level than at 50% level of supplementation.

Control groups of cows received less DCP than the recommended values though the TDN values were almost same. Cows on 50% urea nitrogen also got less DCP than the recommended values though consumption of TDN was more than the recommended values. Animals on control (for 75% urea nitrogen level) also got less DCP and TDN than the recommended values, while cows on 75% level of urea nitrogen consumed more DCP and TDN than the values suggested by Sen and Ray (1964). Thus wheat straw with 50% and 75% urea nitrogen level and 15% and 20% molasses has proved to be a maintenance ration for cows.
Control groups of buffaloes got less DCP but more TDN than the recommended values while buffaloes at 50% urea nitrogen got equal or slightly less DCP but more TDN than the recommended values of Sen and Ray (1964). While buffaloes on 75% urea nitrogen derived more DCP and TDN from the ration as compared to the suggested values of Sen and Ray (loc. cit), thereby suggesting that wheat straw with 15% to 20% molasses in which urea nitrogen substituted 50% or 75% of the total nitrogen can form a maintenance ration for the buffaloes.

3.1 Biuret which is considered to be a safe NPN compound because of its low toxicity was also tested and the results obtained were compared with those obtained by feeding urea to cows and buffaloes. Biuret supplemented 50% of the dietary nitrogen in one group and 75% to other group of cows and buffaloes. The wheat straw formed the sole roughage. The feeding practices were kept similar to the urea feeding experiments.

3.2 Biuret feeding induced greater consumption of dry matter. Buffaloes fed with biuret containing wheat straw showed more intake than the cows and 75% nitrogen replacement by biuret caused greater voluntary intake than at 50% replacement. Fifty percent biuret nitrogen caused 23% to 29% improvement, while 75% biuret nitrogen supplementation resulted in 24% to 27% improvement in the dry matter consumption over the corresponding control in cows. Improvement in buffaloes was 25% to 41% at 50%
biuret nitrogen and 28% to 50% at 75% biuret nitrogen supplementation than the respective groups of control.

Digestibility of dry matter was significantly (P < 0.01) increased due to feeding of biuret containing diet than those without biuret (control).

Fifty per cent nitrogen biuret replacement induced the cows to consume more dry matter than those received 50% urea nitrogen. While at 75% level reverse was the trend. In case of buffaloes, biuret caused increase in voluntary intake of dry matter than urea feeding at both the levels.

Apparently dry matter digestion was higher for biuret fed cows and buffaloes than those receiving urea in their diet.

Highly significant differences were found between species and levels, i.e., 50% and 75% nitrogen replacement (P < 0.01) while differences were significant (P < 0.05) between replications, i.e., period I and II and interaction between species and levels.

3.3 Buffaloes on 50% biuret nitrogen consumed less water than the control but 75% biuret nitrogen grouped had little higher values than the control. Seventy five per cent nitrogen groups of buffaloes drank more water than 50% biuret supplemented group, but there was erratic trend in case of cows. Buffaloes in general consumed more water than their counterpart species.

Ratio of water to dry matter intake were higher in cows than buffaloes and higher in biuret fed groups than their respective controls.
When compared to urea fed cows, biuret fed cows consumed less water, but no definite trend was observed by buffaloes fed with these two NPN compounds. Ratios were found to be higher for biuret fed cows and buffaloes than urea fed animals.

3.4 Digestibility coefficient values for crude protein were significantly higher (P < 0.01) in all groups of cows and buffaloes receiving biuret than control groups.

Animals of both the species fed with biuret showed lower digestible coefficient than those getting urea. Differences were highly significant (P < 0.01) between species, treatments (urea and biuret), interaction between species and levels and interaction between levels and treatments.

3.5 Cows and buffaloes digested significantly more organic matter from the ration in which biuret was incorporated than the control. No statistically significant difference was observed in species or the periods I and II.

Biuret fed cows and buffaloes digested slightly more organic matter than urea fed groups. There was a significant difference (P < 0.05) between species, periods and levels on comparing the effect of urea and biuret incorporation into the wheat straw.

3.6 Digestibility coefficient for ether extract values were higher in biuret fed animals than the control groups of cows and buffaloes. Buffaloes showed greater ability to digest ether extract from the ration than the cows.
However, difference due to species and treatment or their interaction were statistically non significant.

Digestible coefficient values for ether extract were significantly higher (P $\leq 0.01$) in biuret fed groups of cows and buffaloes than urea fed groups at both the levels and in both the periods. The interaction between species and treatment also revealed significant differences (P $\leq 0.05$).

3.7 There was similarity in the trend regarding digestibility of crude fibre and ether extract so far the comparison between experimental and control groups, and among species was concerned. But crude fibre digestibility was greater at 75% level than at 50% biuret supplementation. Period II at both the levels and in both the species manifested significantly higher values than period I (significant at P $\leq 0.05$ in 50% supplemented groups). Augmented digestion in the said groups bear direct and positive relationships with the intake of crude fibre which in turn was influenced by the rate of dry matter consumption.

Invariably all groups digested more crude fibre from the ration when urea was included in the ration than when biuret formed part of the ration. Analysis of variance showed highly significant difference (P $\leq 0.01$) between species and treatments (urea versus biuret) and interaction between species and level, and level and treatments.

3.8 Significantly higher (P $\leq 0.01$) digestibility for nitrogen free extract was shown by the experimental
animals getting biuret than the control groups. Buffaloes provided higher values than the cows at 50% level of biuret nitrogen replacement. Whereas, reverse was true at 75% replacement.

No significant differences because of species, treatment or their interaction were detected when 50% and 75% levels of biuret were compared with control and both these levels within period (I and II).

Values were significantly higher (P < 0.05) in biuret fed groups of animals than those in which nitrogen was replaced by urea with the exception of 75% II group of buffaloes where urea fed groups had little higher digestibility than the counterparts. Significant difference (P < 0.01) was noted between periods.

3.9 Intake of nitrogen was more in experimental groups of cows and buffaloes than the control animals. Fifty per cent biuret nitrogen groups of cows ingested more nitrogen than those on 75% supplemented groups, while reverse was the picture in case of buffaloes. However, these differences in both the species were only marginal. Buffaloes consumed more nitrogen than the cows in all groups and at both the replacement levels.

Excretion was more in experimental cows getting biuret than the control with the exception of 50% I cows. But in buffaloes only 75% I group excreted more nitrogen than the control. Buffaloes excreted more than cows in period I, but not in period II. Loss was more at 75% level than at 50% level. Loss through urine was more in experimental
animals than their respective controls, although losses were almost at par with the control and 50% biuret nitrogen replacement groups (I and II) of buffaloes. Loss through urine was more at 75% replacement level than at 50%.

Greater loss through urine occurred in cows than buffaloes.

All the animals fed biuret containing diet exhibited positive nitrogen balances. Balances for nitrogen were significantly higher in experimental groups of cows and buffaloes than their control (P < 0.01 in 50% versus control of cows and 75% versus control groups of buffaloes and P < 0.05 in 75% versus control group of cows). Balances were significantly higher in period I than in period II (P < 0.01 in 50% groups of cows and at P < 0.05 in 75% supplemented groups of buffaloes).

Highly significant differences (P < 0.01) between species, at P < 0.05 and between levels were found in utilizing these two NPN compounds.

There was more intake of calcium in all experimental groups than the corresponding control groups. Total intake was higher in buffaloes than the cows.

All the groups showed positive calcium balance. Significant difference (P < 0.05) between control and 50% I cows were present, but not at other levels when compared to control as also among periods. Analysis of variances showed no significant difference between species, treatment or their interaction, on comparing experimental groups with controls and period I and with period II at both the replacement levels.
Cows and buffaloes at both nitrogen replacement levels by urea had higher calcium balance than in which biuret supplemented the dietary nitrogen. However, significant difference on account of species, replicates, levels or treatments as also due to their various interactions were not present.

3.11 Like calcium intake, important source for phosphorus supply was also wheat straw. Contribution of wheat straw towards supply of phosphorus was more in buffaloes than cows, more in experimental groups than the control and more at 75% level than at 50% level.

All groups were on positive phosphorus balance. No significant difference could be detected between experimental groups and the controls or between periods.

No persistent trend could be traced out when the effect of these two NPN compounds on the phosphorus utilization was compared. However, analysis of variance established significant difference (P < 0.05) between species.

Like urea, biuret was also incapable of altering the phosphorus utilization to any measureable magnitude.

3.13 Control group of cows and buffaloes consumed lesser DCP than the recommended values of Sen and Ray (1964). However, TDN values were almost identical in cows and little higher in buffaloes. Biuret fed cows also consumed less DCP than the recommended, though the differences were small. Nonetheless TDN intake was comparatively more than the
suggested levels. While buffaloes fed with biuret consumed more DCP as well as TDN than the recommendations made by Sen and Ray (Loc.cit). Thus buffaloes established their superiority in overall utilization of biuret than cows.

Cows were found to utilize urea in a better way than biuret though the differences were minor. But buffaloes utilized urea and biuret equally well.

4.1 With a view to study the effect of grinding, a compounded feed was formulated to contain 5.6 kg DCP and 40.9 kg TDN per 100 kg feed. The feed had 9 parts of wheat straw ground to 3-4 mm sieve size; two parts of urea and 10 parts of molasses. Adequate quantities of salt, mineral mixture and Vitamin A were also incorporated to make the ration palatable and balanced. The ration was tested on four dry adult Tharparkar cows.

4.2 Voluntary intake of dry matter was more in compounded feed containing urea with ground wheat straw as the base than the control with no urea and chopped wheat straw diet by about 20%. Digestibility coefficient of dry matter was also significantly (P ≤ 0.01) higher in experimental group than the control.

4.3 Water consumption as also the ratio between water to dry matter intake was higher in the urea fed compounded feed than the control ration.

4.4 Consumption of crude protein as also its digestibility was significantly higher (P ≤ 0.01) in cows getting ground wheat straw plus urea than the straw in chopped form with no urea.
4.5 Similar trend was observed in organic matter and the difference was significant \((P \leq 0.01)\) among the two groups. 

4.6 However, intake as well as digestibility coefficient of ether extract was higher in control group or chopped wheat straw than the ground wheat straw containing urea, though the difference was not significant statistically. 

4.7 No statistically significant difference was observed in the digestibility of crude fibre in experimental and control groups. 

4.8 It was interesting to note that while intake of nitrogen free extract was slightly more in case of control group than the experimental group, reverse was the trend so far as the digestibility coefficient was concerned. This difference was found to be significant \((P \leq 0.05)\). 

4.9 Intake of nitrogen in the experiment cows was much more than the control, which appeared to be due to higher ingestion of dry matter in the experimental group, enabling the cows to draw more nitrogen. Both the groups of cows exhibited positive nitrogen balance \((1.61 \pm 0.73\) and \(6.37 \pm 1.37\) g/day respectively for the control and the experimental group). Nitrogen balance was more than three times higher \((P \leq 0.01)\) in the experimental group than the control. 

4.10 Intake of calcium was more than double in case of experimental cows than the controls. Both the groups recorded positive calcium balance. But no significant difference was observed in control and experimental groups.
4.11 Experimental cows consumed more phosphorus and also excreted more phosphorus than the control cows. Loss in both the groups was mainly through faeces. Control as well as experimental groups registered positive balance for phosphorus. And no significant difference was observed in the balances among two groups.

4.12 Consumption of DCP and TDN and comparison of these values with those of Sen and Ray (1964) suggested that compounded feed based on ground wheat straw plus urea and molasses formed a balanced and complete maintenance ration for the cows.

4.13 Overall utilization of compounded feed enriched with urea and molasses, when compared to chopped wheat straw supplemented with 50% urea nitrogen and molasses was not very much different except in case of digestibility of dry matter, which was higher in cows on compounded feed than those getting urea along with chopped wheat straw. This was attributed to the higher digestibility of nitrogen free extract in compounded feed ration. Thus the enrichment of poor quality straws by urea and molasses itself was a contributing factor in the efficient utilization of nutrients. Grinding process, although slightly increased the utilization of nutrients, but will enhance the cost, which may not be worthwhile economically at the present juncture in this country.

5.1 Blood study was also undertaken during each trial to correlate the feeding of urea and biuret at different levels, with the health and general condition of the cattle
and buffalo. In urea-paddy straw experiments, different levels of urea increased the values of total protein, NPN and urea nitrogen, but haemoglobin was not affected. Buffaloes had higher values for all the blood constituents studied except haemoglobin in which opposite trend was exhibited.

5.2 Urea and biuret feeding along with wheat straw increased the values of blood nitrogen fractions, i.e., NPN and urea nitrogen. The higher NPN fed groups recorded higher NPN and urea nitrogen level in the blood. Values for buffaloes were found to be higher than the corresponding groups of cows.

5.3 Highly significant difference ($P \leq 0.01$) between control group and those fed with compounded feed containing urea were found in all the periods, i.e., higher values in compounded ration fed cows than those getting no urea in the ration.

5.4 From these studies it can be concluded that even high urea or biuret replacement (upto 75% of the total nitrogen requirement for maintenance) did not raise blood urea level, resulting in the production of toxic symptoms; that buffaloes had a better urea recycling mechanism than cows as a result of which buffaloes used urea more efficiently than cows; values of blood urea decreased with passage of time, showing that urea was quickly eliminated from circulation; two times feeding resulted in better utilization of nitrogen than one time feeding.