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On-farm appraisal of urea treated straw feeding to lactating buffaloes as means to climate resilience

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Abstract

On-farm testing and demonstration of urea treatment for improving the utilization of wheat straw was conducted in semi arid condition at village Kadesara Kalan (Lalitpur district) on eight lactating nondescript (local) buffaloes during summer season. Wheat straw was treated with 8% urea solution using standard procedure. Moisture content of treated straw increased to around 28% and caused an intensive ammonia smell at stacks opening after 21 days. Ammoniation of wheat straw improved the crude protein content from 3.16% to 8.57%. Feeding of treated straw to lactating buffaloes improved total dry matter intake by 14.78%. Overall milk yield of urea treated straw fed animals was 22.3% more than the untreated animals.

Key Words: Climate resilience, Temperature extreme, Urea treated straw

Introduction

At present the country faces a net deficit of 35.6% green fodder, 10.95% dry crop residues and 44% concentrate. Scenario at regional, seasonal and the village level do certainly differ from the national. The green fodder deficit reaches maximum in rainfed region and the availability is minimal in summer season. In Bundelkhand, green fodder availability during summer season is practically negligible. Despite many initiatives, the adoption of fodder species and improved production technologies for enhanced green forage productivity could not attract the farmer's interest. The fodder availability scenario analyses of Bundelkhand particularly Lalitpur district put forth further grim situation during summer season. Crop residues like wheat straw, barley straw, paddy straw and stovers available in the region make the major component of livestock diet. However, these crop residues for ruminant feeding is essentially constrained by its low voluntary intake (1.6 - 2.0 kg / 100 kg body weight), low crude protein, and higher masses of lignifications and poor digestibility (40-45%). Non availability of green fodder and on the other hand,extreme climatic stress during summer severely affected the animal health as well as productivity. A sudden increase in temperature during summer caused a negative impact on dry matter intake and subsequently on milk yield of buffaloes. The increase in maximum temperature (Tmax >4°C) during summer than normal was observed to negatively impact buffalo milk production. Under such a situation the only way to provide economically balanced ration is through providing urea treated straw based diet. Crude protein content of untreated straw improved from 3-4% to 8-9% with urea treatment, which is considered the minimum requirement for the adequate intake, digestive activity of the rumen microbes and maintenance of live weight (Chriyaa *et al.,* 1997). The balance animal diet helps the animal to abate the stress and maintain the health and productivity. Therefore, an effort was made to assess the effect of feeding urea treated straw as measure to reduce the adverse effect of extreme temperature and humidity on milk production in buffaloes under small holders' mixed farming system at village Kadesara kalan in Lalitpur district of Uttar Pradesh.

Materials and Methods

The on-farm trial was conducted in village Kadesara Kalan, Lalitpur, Uttar Pradesh (24^0 11' to 25^0 14'N and 78^0 10' to 79^0 00' E) during April-May, 2013. Eight lactating nondescript (local) buffaloes (average body weight 409 kg) were selected for the experiment. The buffaloes were randomly allocated to receive either the untreated or treated straw plus supplements (wheat flour -3 kg and sorghum *Chari* -4 kg). The farmers' practice is to feed the straw along with supplements in the form of *chani*. Body weights of the animals were calculated using the heart girth and body length formulae (Sastri *et al.,* 2002). A standard procedure using on-farm available wheat

straw was used for the urea treatment. Straw (100 kg) was treated with 50 liters of 8% urea solution. Treated straw was staked, compressed manually and covered with polythene sheet for adequate fermentation for a period of 21 days. The treated straw was aerated for 4 hrs to reduce the concentration of ammonia gas before feeding to animals. During adaptation period, the animals were fed a mixture of treated and untreated straw and gradually the amount of treated straw in the mixture was increased. After adaptation for a week, the straw (*ad libitum*) was offered 2 times a day to ensure refusals. The experimental animals had free access to water throughout the experimental duration. Feed intake, milk composition and general health of the animal were monitored. Animals were milked twice a day; morning at 6.30 AM and evening at 5.30 PM. Morning and evening milk yield was measured. Samples of feeds were dried in the hot air oven to determine the DM, organic matter by muffle furnace incineration, crude protein by Kjeldahl method (Nx6.25), ether extract and total ash (AOAC,1995). Fiber fractions were determined by the method Van Soest *et al*. (1991). Milk samples collected were analyzed for fat, total solids, solid not fat (SNF), CP and ash (ISI, 1961). The significance of differences between treatment mean was determined using the student "t" test (Snedecor and Cochran, 1989).

Results and Discussion

Moisture content of urea treated straw (Table 1) increased to around 27% and caused an intensive ammonia smell at the time the stacks were opened after 21 days at onset of summer. Various reports on the storage of ammoniated straws have indicated that moisture content is an important factor which determines decomposition effect. Ammoniation of wheat straw improved the crude protein content from 3.16% to 8.57% due to retention of ammonia nitrogen (Chauhan *et al.,* 2000). The reduction in cell wall contents specially the NDF fraction was observed in the treated straw. The reduction in NDF content in treated straw might be due to the dissolving effect of urea on hemicellulose fraction and subsequent removal from the cell wall constituents. Ash content also increased in treated straw from 6.12% to 9.01%. The increase in ash content might be due to the fact that some soluble nutrients like nitrogen free extract (NFE), crude protein and soluble carbohydrates are dissolved and lost in solution resulting in increased ash content.

Table 1. Chemical composition of feed ingredients (% DM basis)

Parameter	DM	OM	CP	NDF	ADF	Ash
Untreated wheat straw	96.63	93.87	3.16	84.56	57.80	6.12
Treated wheat straw	73.72	90.99	8.57	80.91	58.01	9.01
Sorghum Chari	32.53	92.42	7.86	78.46	56.88	7.58
Wheat flour	94.35	98.11	10.19	16.37	3.76	1.88

Table 2. Weather variables during April and May, 2013

Parameter	Min. Temp. (°C)	Max. Temp. (°C)	RH_{max} (%)	RH_{min} (%)	THI
April16-22 (1st week)	19.2	37.1	62	29	75
April 23-29 (2nd week)	21.1	37.9	58	24	75
April 30-6 May (3rd week)	21.1	41.1	51	19	76
May 7-13 (4th week)	23.5	42.2	46	19	78
May14-20 (5th week)	23.6	42.9	45	16	79
May 21-27 (6th week)	27.9	45.4	40	15	81

Table 3. Composition (%) of milk of buffaloes fed urea treated straw based diet

Parameter	Untreated	Treated
Average daily milk yield (kg/day)	4.47^{a}±0.10	5.47^{b}±0.06
Fat	7.92±1.05	8.22±0.72
Protein	3.60±0.06	3.58±0.11
Solid not fat	9.44±0.27	9.68±0.26
Total solids	17.34±1.21	17.90±0.96
Lactose	5.07±0.18	5.12±0.14

[a,b] figures bearing different superscript in a row differ significantly (P<0.05)

Feeding of treated straw to lactating buffaloes improved total dry matter intake by 14.78%. The intake of supplements like green berseem and wheat flour was comparable in both the groups. Although the concomitant heat stress negatively affected the feed intake in both the group of buffalo. The buffaloes of treated group consumed 22.13% more straw as compared to untreated group. The DM intake as percent of body weight was 2.98 and 2.59, respectively. Similar findings have been reported by Sharma *et al*. (2004) and Mesfina and Kebede (2011). Improvement in straw intake after urea treatment has been reported earlier by Dass (2000). The variation in intake from urea treated straw depends on straw quality and on treatment conditions. It has also been observed that forage intake drops significantly when the crude protein content of forages goes below 7% (Chriyaa *et al*., 1997) as was the case with the untreated straw diet. Daily milk yield was recorded & presented on weekly average basis (Fig. 1). The period witnessed a sharp increase in maximum as well as diurnal temperature in week 1 to 3 (Table 2) however, there was little effect of increase in temperature on milk yield in treated animal group.

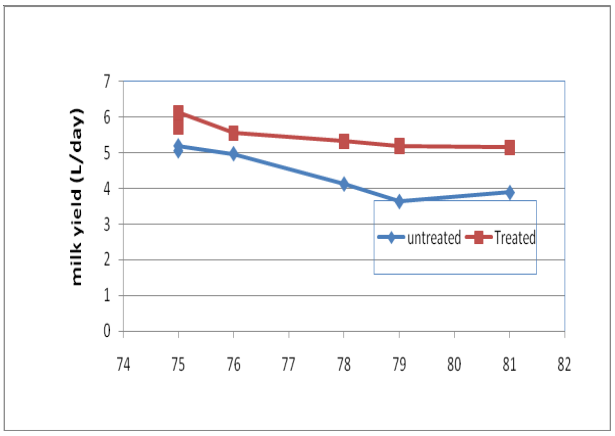

Fig.1. Effect of feeding urea treated straw on milk yield

Considering temperature humidity index (THI) as an indicator of heat stress and assuming heat stress is induced at THI $\geq$ 72, decline of milk production due to heat stress has been recorded in April as reported earlier by Bohmanova *et al*. (2007). Temperature humidity index rose from 76 in 3rd week to 81 during 6th week of the study. As a result of increased THI and consequent thermal stress, during 4th to 6th week, the milk yield of animals fed with untreated straw reduced by 29.1, 42.9 and 32.61% respectively in comparison to 2.7, 5.1 and 5.9% in urea treated straw fed animals. Similar findings *i.e*., negative correlation between milk yield of Sahiwal, crossbred cows and THI was reported by Singh and Upadhyay (2009). They were reported that milk yield was reduced by 0.43 lit/ day in crossbred cows and 0.16 lit/ day in Sahiwal cows per unit increase of THI. Ravagnalo *et al*. (2000) also reported similar finding that daily milk yield was reduced by 0.2 kg per unit increase of THI above 72 and also observed that average weekly milk yield/cow, average monthly milk yield/cow were decreased by 0.062 and 0.069 kg, respectively.

Overall milk yield of the animals fed urea treated straw was 22.3 % more than the untreated animals. The higher milk production of the cows in treated straw fed group than that of traditional group might be due to significantly higher intake of treated straw in summer by the buffaloes. The increased protein and energy supply from urea treated straw in the rumen might have enhanced microbial activity, hence increased digestibility of other feeds leading to increased milk yield (Abdulrazak *et al.,* 1996; Masama *et al.,* 1997). The finding in the present study corroborates with the earlier report of an extra yield of 0.5- 1.5 kg/d (Singh and Prasad, 2002). The animals in treated group were observed to improve their body condition. Tengyun (2000) also indicated higher live weight gains in growing animals receiving treated stovers compared to those on untreated stover. No changes in milk composition due to feeding of urea treated straw was observed (Table 3) which is in agreement with earlier report of Chauhan *et al.* (2000).

The feeding of urea treated straw resulted in additional milk yield of 1.04 kg/d/animal and net return of Rs 27.65 /d/animal. Similar results were also recorded by Sharma *et al.* (2004). It can be inferred that milk yield was increased in the animals fed with urea treated straw based diet than the animals with traditional feeding. Most of the farmers are of the opinion that straw consumption and milk production is increased in buffaloes fed with urea treated straw based diet. They also perceived the technology to bring about improvement in general health and maintain milk production during higher environmental temperature. All the farmers were influenced with the beneficial effect of feeding of urea treated straw and show their willingness to adopt the technology. However, the pungent smell of the urea treated straw was not liked by the farmers.

Thus, it can be concluded that substantial increase in the productivity as well general health condition of the buffaloes in mix farming system of small farmers during summer could be achieved through strategic feeding of urea treated wheat straw.

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