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Assessment of the Treatment and Use of Urea Treated Straw for Cattle Feeding in Selale, Central Ethiopia

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Abstract

A total of 60 farmers from 7 districts in Selale area of central Ethiopia, who fed urea treated straws to cattle were interviewed on the general practice of straw treatment with urea. Since the 1998/99-production year, farmers participating in the Smallholder Dairy Development Project (SDDP) have been practicing straw treatment and feeding crossbred dairy cows to improve milk production. In 2000, this practice was extended in Were-Jarso to fatten local oxen. The ratio of water:urea:molasses solution to straw used was 100L:4 kg:10L to 100 kg of straw. Farmers treated either a single type of straw or a mixture depending on what was available on their farm. Crossbred dairy cows were fed 4 – 6 kg of urea treated straw.day^{-1} and supplemented it with either concentrate feeds or cultivated forage crops depending on availability. The animals also grazed in the morning and in the afternoon. Local oxen were fed the same amount of treated straw per day and grazed without supplementation. Crossbred cows and local cattle adapt to the feed within 2-5 days and 4-6 days, respectively. As a result of feeding urea treated straw, milk production of the cows was reported to increase by 0.5 – 2.0L.day^{-1}. The body condition of both crossbred dairy cows and local oxen has improved. The feeding of urea treated straw did not result in any problem to the cattle. The majority of the farmers thought that urea treated straw could replace hay and green feed in dry and in drought periods as feed for cattle. However, about half of the interviewed farmers did not continue the practice. The reasons for this were the low level of income to purchase the inputs, the belief that straw treatment is only important during drought periods and the expectation for government support. The initial cost for purchasing plastic sheets, urea and molasses was rather expensive for the low-income farm families, and the cost would be reduced in the next treatment periods. Farmers need further training, advice and follow up to appreciate the full benefits. Since crop residues are available all the time, urea treated straw can sustainably feed dairy cattle. With increased cultivation of crops and declining grazing land, special attention should be paid to feeding animals on crop residues by improving their quality through urea treatment.

Keywords*:* Molasses, crossbred dairy cows, smallholder farmers, straw, urea treatment, fattening.

Introduction

One of the major limiting factors to animal production in Ethiopia is nutrition (Tsige-Yohannes, 1998). In the highlands, where crop and livestock are well integrated, cattle are mainly fed on natural pastures and crop residues (Jutzi et al., 1987; Getnet and Ledin, 1999). The role of crop residues as animal feed is substantial as more land is being cultivated to feed the ever-increasing human population (Jutzi, et al., 1987). Cereal straws and stovers fail to meet the productive functions of livestock (Michael et al., 1989). Farmers have some traditional practices to alleviate the poor feeding value of straws. They provide their animals with residues of both cereals and legumes in mixture. This practice, however, cannot bring considerable improvement to the nutritional status of the animals.

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Establishing simple techniques, which allow improving of the feeding value of crop residues, is important. According to Djajanegra and Doyle (1989) and O'Donovan et al. (1997), urea treatment is important for improving the nutritive value of cereal straws and stovers and it has long been used in developing countries of the tropics.

The use of urea to treat straws and stovers is not a commonly practiced technology in Ethiopia. It was introduced to the North Shewa zone of Oromia Region in the 1998/99-production year through an expert from Sri Lanka in collaboration with the SDDP, experts from the Ministry of agriculture (MOA) and the International Livestock Research Institute (ILRI). In the year 2000, the technology was tested in Were-Jarso district with the support of Canadian Physician Aid and Relief (CPAR) to fatten local oxen (Karralagama and Hassen, 1999). The technology was tested in eight districts in Selale on a total of 85 farms mainly with farmers who participated in the SDDP. However, the practice of urea treatment of straws, the feeding value of the treated straws and farmers' opinion on this practice have not been evaluated and documented. Thus this survey was carried out with the following objectives: 1) to collect information on procedure of straw treatment with urea by farmers; 2) assess the feeding value of this feed to cattle as practiced by farmers, and 3) to evaluate the acceptability of this technology to the farmers.

Materials and Methods

Study area and the situation in each district

The study was carried out in seven Districts in Selale area of central Ethiopia, namely; Sullulta, Wuchale, Yayagullelie, Girar-Jarso, Degem, Kuyyu, and Were Jarso. This area is located from 20 km (Sullulta) to 185 km (Were-Jarso) on the main northerly road from Addis Ababa to Debre Markos. In Sulluluta, most of the land is waterlogged and not suitable for cultivation of food crops. Farmers harvest pasture to make hay and good cash income for their livelihood. Cereals including barley, wheat and oats are the dominant crops. Peas and beans are the main pulse crops. Crop residues are less important compared to the other districts. A vast area of Wuchale land is kept for growing pasture, and a smaller area of Yayagullele is allocated for growing pasture crops. A mixed crop-livestock farming was practiced in Girar-Jarso. The dominant crops are teff, wheat, barley, peas, lentils and beans. A large part of the land is allocated for cultivation of crops, and crop residues are more important than pasture hay.

Degem is relatively high in its altitude, about 3000 m above sea level. Barley is the dominant crop, but oats, peas, beans and vetch are also grown. A mixed-crop livestock farming is practiced in Kuyuu, and Teff is the dominant crop. Wheat, beans and lentils are also grown. A large area of land that is waterlogged and not appropriate for the cultivation of food crops is allocated for grazing and growing of pasture crops. Were-Jarso includes both highland and lowland areas. Farmers here practice a mixed crop – livestock farming system. In the highland teff is the dominant crop, but wheat, oats, vetch are also grown. In the lowlands, sorghum is the major crop and wheat, peas and lentils are also grown. Cattle are the dominant livestock species, but sheep, goats and poultry are also common.

Target farmers

A total of 60 farmers, who had been participating in the SDDP, own crossbred milking cows and who were using urea-treated straw, were interviewed (Table 1).

Method of data collection

A semi – structured questionnaire, and PRA methods, including transect walks and discussions (IIED, 1994) were used. A pretest interview had been undertaken with a few farmers to further develop the questionnaires. The questionnaires were both quantitative and qualitative in nature. At the beginning, secondary information was gathered from representatives in each district. The interviews then were continued with a total of 60 farmers.

The interviews focused on the following major areas: 1) Traditional practices to alleviate poor feeding problems of straw; 2) Techniques of straw treatment with urea; 3) Feeding system and feeding value of urea treated straw to cattle; 4) Problems faced during the treatment of straw with urea; 5) Opinions of farmers to modify/improve the practice of straw treatment; 6) Acceptability of straw treatment by the farmer, and 7) Land and livestock holdings.

Statistical analysis

Descriptive statistics of the SPSS (1999) package was used to analyze the data.

Results

Traditional practices

All the farmers interviewed used traditional practices to alleviate problems of feeding straw. The majority of the interviewed farmers (82%) used a mixture of different straw types from legumes and cereals including peas, barley, oats, teff, beans and wheat.

Straw treatment with urea

Farmers received training from agricultural extension staff on techniques of straw treatment and its utilization. The training was supported by a demonstration exercise. Farmers were advised to use 100 L water, 4 kg urea and 10 L molasses to 100 kg of straw. They were directed to construct two pits on their farms. Each pit had dimensions of about 2m x 1m x 1m, which can hold about 100 - 150 kg of urea treated straw. Then individual farmers implemented the straw treatment on their own home, and the extension officers carried out close monitoring and follow up.

The solution of urea, molasses and water was uniformly sprayed on the straw. The soaked straw was rubbed and mixed by hand to properly incorporate the solution into the straw. A polyethylene plastic sheet lined the floor and side of the pit. The mixed straw was placed into the pit and trampled. Following similar procedures, layers of such treated straw was placed sequentially until the pit was full to its capacity. The stack was covered with the plastic sheet, and compacted with either stones or wood, according to the availability of local materials. The treated straw was kept before feeding for 7 days in Were-Jarso and 15 days in the rest of the districts.

Feeding urea-treated straw

The farmers were advised to feed treated straws to all cattle with the exception of calves, pregnant cows after 7 months and emaciated cattle. Among the cattle fed urea treated straw, 72%, 20% and 8% were crossbred milking cows, local oxen and local cows, respectively. The farmers were feeding urea treated straw to crossbred dairy cows and local oxen under fattening at the rate of 4 – 6 kg of urea treated straw per day. According to the farmers, crossbred dairy cows adapted to the urea treated straw faster than the local cattle (Table 3). Crossbred dairy cows adapted to the urea treated straw within 2- 5 days. Depending on the availability, cattle were offered some roughage before feeding the treated

straw and were supplemented with a range of roughages, forages and concentrates (Table 4). Crossbred cows were mainly stall-fed with a little grazing (4 h/day) during early morning and dusk around homestead. Local cows and oxen grazed almost the whole day and were supplemented with the treated straw in the evening. Fattening oxen were stall-fed and were allowed limited grazing around homestead.

Crossbred cows had a higher intake of urea treated straw than local cows. About 96 % of the interviewed farmers reported that milking cows fed urea treated straw had increased milk production in the range of 0.5 - 2 $L.cow^{-1}.day^{-1}$ (Table 5).

Farmers suggested that the practice of straw treatment would be better after harvesting of crops and farmers get more cash at hand. About 2% of them suggested that inclusion of salt in the feed would enhance the performance of cows. This came from the observation that cows consuming mineral licks were coming into heat earlier

Acceptability of straw treatment by the farmer

Farmers believe that feeding urea treated straw is beneficial for the following reasons. Crossbred cows fed urea treated straw increased milk production by about 0.5 – 2L $cow^{-1}day^{-1}$. Crossbred dairy cows and local oxen had also improved their body condition and their skin was shiny. The animals increased their feed intake both for the treated straw and other feeds. The consumption of water also increased. A few of the farmers also reported that cattle fed urea treated straw produced greater amounts of dung. As a result, a farmer was able to sell 2 piles of dried dung per year for Birr60 instead of the previous 1.5 piles per year. The cattle were also producing a higher amount of urine. The urine was used for fertilizing the garden, especially for potatoes. The fertilized potato grew faster and the amount of foliage increased and looked very green. According to the opinions of the farmers, feeding urea treated straw is preferable to feeding the untreated straws. Feeding untreated straw to milking cows was reported to have many drawbacks. It reduces feed intake, water consumption, milk production and body condition and the dung becomes very dry and some times mixed with blood. According to the respondents none of the neighboring farmers attempted to practice straw treatment. They were however showing interest, and asked about the techniques and benefits of straw treatment. The majority of the respondents thought that treatment of straw probably solves the feed shortage problems because the straw can replace green feed during dry and drought periods. Feeding urea treated straw resulted in fewer refusals as compared to feeding untreated straw. Although all the interviewed farmers find the practice to be beneficial, about half of them did not continue (Table 6). In total 48%, 30% and 12% of the interviewed farmers treated the straw one, two and three times, respectively. Some farmers feel that considering the benefits of feeding value of the treated straw, urea treatment is not a very expensive practice.

Problems encountered during the treatment of straw with urea

About 5% of the interviewed farmers had shortage of labour during the treatment of straw. No toxicity problems with cattle had been reported due to feeding of the urea treated straw. For the first treatment period, almost all farmers were offered for the inputs (plastic sheet, urea and molasses) from the SDDP. The majority of the interviewed farmers responded that, considering the benefits gained from feeding of urea-treated straw, the practice is not considered expensive.

Discussions

The reported reason for practicing straw treatment with only a few farmers in Sulluluta, Wuchale and Yayagullele districts was that molasses was not available in the

districts. Later, farmers participating in the SDDP were organized to purchase molasses at a price of Birr1.00 L^{-1}. More farmers (10) in Girar Jarso district treated the straw; in this district crop residues are abundant and molasses is delivered in to the district. Some farmers had treated only one type of straw while others had treated a mixture of different straws.

Since barley is the dominant crop in Degem district, most farmers used barley straw for the treatment and some also used a mixture of barley straw and other straws available at the farm. The time length for treating the straw in this district was 15 days. In Kuyuu, mainly Teff straw was used for the urea treatment. In this district, some merchants delivered molasses at a price of Birr1.00 L^{-1}. Hence, farmers were able to purchase molasses.

A higher number of farmers had performed straw treatment in Were-Jarso. Twelve of the 26 respondents were feeding urea treated straw to local oxen. The rest were feeding crossbred milking cows. More than half of the interviewed farmers used teff straw alone, while the rest used a mixture of teff and other straws available on the farm.

The majority of farmers feed mixture of crop residues from cereals and legumes either by threshing from the very beginning and making bales or simply by mixing different straws. This is a way of supplementing poor quality straws with legumes to improve digestibility of cereal straws. But they didn't mix teff straw with legume residues. Most of the farmers did not mix teff straw with other cereal straws, and this may be explained by the fact that teff straw is more palatable than the other cereal straws (Seyoum and Zinash, 1998).

The majority (83%) of farmers had used the aboveground silo and the rest used the underground pit. The aboveground silo was constructed using pieces of wood, available at the farm. The entire wall of the pit was lined with a mixture of soil and dung. A polyethylene plastic sheet was used for covering the treated straw both for the underground and aboveground silos. Farmers were provided with the plastic sheet, urea and molasses by the SDDP and the CPAR, but for the second treatment period some farmers bought urea and molasses by themselves.

The measurement of straw, water, urea and molasses was performed using local materials related to standard scales. A sack, which weighs about 10 kg while it was full of straw, was used to measure the straw. A 1L plastic cup was used to measure urea and molasses. Some of the farmers used clay pots and others had plastic buckets to measure the amount of water. A can or any other available container was used to spray the urea solution over the straw. The solution of urea, molasses and water was uniformly sprayed on the straw. The soaked straw was rubbed and mixed by hand to properly incorporate the solution into the straw. The treated straw was kept for 7 days in Were-Jarso and for 15 days in the other districts. The techniques that farmers have followed are similar to the procedure described by Chenost and Kayouli (1997).

Most farmers (88%) treated the straw during the dry season. This is because cattle in the wet season prefer green feed to the treated straw. As shown in Table 2, 38% of the farmers interviewed had used only teff straw for the treatment. Farmers in Selale normally feed mixed straw to their animals. Depending on the availability, the majority of the interviewed farmers used a range of mixtures of different straws for the treatment.

Farmers were advised to feed treated straws to all cattle with the exception of calves, pregnant cows after 7 months and emaciated cattle. Chenost and Kayouli (1997) advise not to feed urea-treated straw to calves below 3 months of age. This is because their

rumen is not developed and not equipped with adequate number and type of microorganisms that can readily utilize the ammonia released from the treated straw. The farmers were feeding urea treated straw to dairy cattle with the intention of improving milk production of crossbred cows, and later to fatten local oxen. Although crossbred cows were given priority for the feeding of urea treated straw, some farmers also fed the treated straw to local milking cows, with the objective of increasing milk yield. Since this was the first time for testing straw treatment with urea, the amount of straw that had been treated was limited and it was not possible to feed all cattle at home.

Crossbred cows had a higher intake of urea treated straw than local cows (data not presented). From the many on-station experiments on crossbred dairy cows, these cows consume larger amount of feed than local cows owing to their large body size. Almost all (96%) of the interviewed farmers reported that milking cows fed urea treated straw had higher milk production, and this is consistent with previous reported (Chenost and Kayouli, 1997; Kayouli, 1996).

The few (5%) farmers who reported to have labour problems during the treatment of straw were elders who did not have the extra human labour at home. The rest of the interviewed farmers did not consider labour as a problem. They mainly used available labour from the family and from neighbors. Some members of the families especially, teenagers had no off-farm activities, and could be made responsible for the treatment of the straw. Although straw treatment requires about 5 – 6 people, in cases where this number is not available, farmers can borrow labour from their neighbors. Followers of the Coptic Church do no farm activities during the weekend and holidays, and almost all family members are idle. Such days are suitable for the treatment of straw. All family members participated almost equally in the treatment of straw.

Farmers have accepted the practice, because they have observed that it increases feed intake, water consumption and milk yield. The increase in feed intake might be due to increased digestibility. Since urea treated straw is more alkaline and molasses is rich in sugars, these conditions stimulate thirst and increased water consumption. The best feeding value of urea treated straw was reportedly observed during the 1998/99-production year when a serious feed shortage was manifested. More urination was also observed from these cows, and this may be due to increased consumption of water. The increased manure output also relates to higher feed and water intake. Green feed is not available the whole year due to the erratic rainfall, whereas crop residues are available almost the whole year. Feeding urea treated straw resulted in fewer refusals as compared to feeding untreated straw, and hence urea treatment improves straw use efficiency. Furthermore, treated-straw can be economically fed for longer periods of time and hence it reduces feed shortage problems.

The low level of income to purchase urea and molasses, perception of some farmers that straw treatment is only important during drought periods, and the expectation for government support are the possible reasons why about half of the farmers did not continue use of urea-treated straw. Some farmers did not recognize the benefit that even in the presence of other feed resources, urea treatment could support cattle. Some farmers cannot afford to purchase the plastic sheet, urea and molasses to continually treat straw. Though farmers were provided with plastic sheets, urea and molasses at the start of straw treatment, some farmers bought molasses and urea and continued the treatment. According to the farmers, the initial cost for treating straw may be rather expensive owing to the cost of plastic sheet. Since the plastic sheet can serve for a minimum of a year, this cost will spread to subsequent treatments.

Table 1. Number of farmers interviewed by district

District	Farmers interviewed	
	No.	%
Sululuta	3	5.0
Wuchale	2	3.3
Yayagulele	2	3.3
Girar Jarso	10	16.7
Degem	10	16.7
Kuyyu	7	11.7
Were Jarso	26	43.3
Total	60	100.0

Table 2. Straw types used for urea treatment

Type of straw	Farmers interviewed	
	No	%
Teff + barley	7	11.7
Teff	23	38.3
Barley + oat	2	3.3
Barley + wheat	7	11.7
Teff + wheat + oat	1	1.7
Barley + wheat + teff	3	5.0
Barley + wheat + pea	1	1.7
Barley	3	5.0
Barley + oat + wheat	1	1.7
Barley + wheat + lentil	2	3.3
Barley + wheat + bean	2	3.3
Wheat + lentil + vetch +bean	1	1.7
Wheat + teff + vetch + lentil	1	1.7
Wheat + teff +vetch	2	3.3
Barley + teff + vetch	1	1.7
Teff + wheat	3	5.0
Total	60	100.0

Table 3. Time taken to adapt to urea treated straw (days)

Animal type	No of days	Farmers interviewed	
		Number	%
Crossbred cows	2	23	38.3
Crossbred cows	3	7	11.7
Crossbred cows	4	8	13.3
Crossbred cows	5	5	8.3
Local cows	4	3	5.0
Local cows	5	2	3.3
Local oxen	5	7	11.7
Local oxen	6	5	8.3
Total		60	100.0

Table 4. Feeds supplemented to cows fed urea-treated straw

Type of feed supplement	Farmers interviewed	
	No.	%
Hay, fodder beet	4	6.6
Elephant grass, wheat bran	1	1.7
Elephant grass	2	3.3
Fodder beet, commercial concentrate	1	1.7
Untreated straw and Atela	1	1.7
Untreated straw, hay	1	1.7
Untreated straw, Sesbania, fodder beet and elephant grass	1	1.7
Atela, noug cake, wheat bran	1	1.7
Untreated straw	1	1.7
Noug cake, hay, wheat bran	3	5.0
Untreated straw, green feed	1	1.7
Wheat bran, ground oat, noug cake, elephant grass	1	1.7
Hay	2	3.3
Ground vetch and barley	2	3.3
Untreated straw, brewery by-products	1	1.7
Hay, noug cake, salt	2	3.3
Untreated straw, hay, tree lucerne, fodderbeet and noug cake	2	3.3
Hay, noug cake, ground oat, vetch	1	1.7
Hay, noug cake, ground oat, salt	5	8.3
Hay, noug cake, ground oat and Atela	1	1.7
Hay, noug cake, green feed	2	3.3
Mineral lick, poultry litter, concentrate	1	1.7
Hay, treelucerne, fodder beet, concentrate	1	1.7
Hay and concentrate	4	6.6
Noug cake, ground oat, wheat bran, vetch	1	1.7
Hay, wheat bran, noug cake	1	1.7
Hay, atela, noug cake, mineral leak	1	1.7
Hay and noug cake	1	1.7
Commercial concentrate	5	8.3
Green oat –vetch mixture	1	1.7
Commercial concentrate, green feed	1	1.7
No supplement	9	15.0
Total	60	100.0

Conclusions

Framers believe that feeding urea treated straw improved milk production of crossbred dairy cows and the body condition of local oxen. Most farmers understood that urea treated straw can replace hay and green feed during dry and drought periods. Considering the benefit of feeding urea treated straw, farmers had accepted it as a beneficial practice. No toxicity problems were observed. However, about half of the farmers did not continue the straw treatment. The possible reasons for this were the low level of income to purchase the inputs, the opinion that straw treatment is only important during drought periods and the expectation for more government support for this activity. Farmers require training, close advice and follow up to convince them of the full benefits of straw treatment with urea and continue the practice. Since crop residues are available all the time in every farm family,

urea treated straw can be used to feed dairy cattle. This practice should be encouraged on communities with no serious water problems. With the increased cultivation of crops and declining grazing land, special attention is needed to increase the feeding of crop residues by improving its quality.

Table 5. Milk increase as a result of feeding urea treated straw

Milk increases (L)	Farmers interviewed	
	No.	%
0	2	4.2
0.5	6	12.5
1	26	54.1
1.5	7	14.6
2	7	14.6
Total	48	100

Table 6. Frequency of use of urea-treated straw by sample farmers

No. of treatments of straw with urea	Farmers interviewed	
	No.	%
One	29	48.3
Two	18	30.0
Three	7	11.7
Four	3	5.0
Five	2	3.3
Eleven	1	1.7
Total	60	100.0

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