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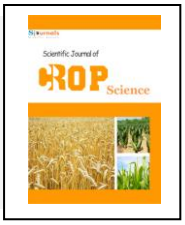

Original article

Participatory evaluation and demonstration of urea treatment of straws in Sinana districts of Bale highlands Southeastern Ethiopia

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ABSTRACT

The study was conducted from 2011 to 2013 for two years at two sites (Selka Oda and Jafa) of Sinana District of Bale highland Southeastern Ethiopia. The study aimed to enhance urea treatment technology evaluation and demonstration through participatory approach. Two farmers research group (FRGs) of 20 model farmers was established. One voluntary farmer was selected from the members at each site for conducting and demonstrating the urea treatment procedure. Theoretical and practical training was given at the beginning of the experiments for the FRGs on site selection, straw preparation, amounts of the ingredients used during the treatment practice, care to be taken while carrying out the treatment process and feeding the treated feed to animals. After the ensiled straw was opened, similar training on the procedure of urea treatment was also given for 6 development agents, 40 farmers of the member of FRGs and 59 other farmers from surrounding community. Farmers and development agents evaluated the treated straws and shared their views. The cumbersome nature of the procedure, labour-demanding, the pungent smell and fear of poisoning to human and animal were the main points raised during the evaluation and demonstration. Out of the 40 farmers considered in FRGs, 75% of them considered the cumbersome nature of the urea treatment procedure as a major fear to continue with the technology. Shortage of labour and time also indicated as the other

constraints of using urea treatment technology. Few proportions of the farmers also indicate the capability of the farmers to afford the required input and inadequate straws at the time of preparation and shortage of clean water as a challenge for continuing with the technology. On the other hand, about 80% of the farmers in the group appreciate the importance of the technology as it could increase the utilization of straws from being wasted during feeding. Farmers also noticed that the treated straw was well accepted by the animals. At the end of demonstration, farmers have shown interest on the technology and have willing to carry out at their home and to popularize the technology to nearby farmers. The technology was accepted as a beneficial practice by most farmers and it will be successful and adopted in areas where no critical water problems and excess cereal straws available. However, the technology requires strong follow up from the researchers and development agents so that the farmers continue to carry out the straw treatment.

1. Introduction

Livestock feed resources are the major constraints in most areas of the country especially during the dry seasons. In the Ethiopian highlands, where crop and livestock are well integrated, cattle are mainly fed on natural pasture, crop residue, stubble and weedy fallow grazing (Jutzi et al., 1987; Getnet and Ledin, 1999, Solomon, 2004). These feed resources are, however, inadequate in quantity and quality, and fluctuates seasonally. Moreover, grazing lands continuously shrinked and declined (Mohamed-Saleem and Abate, 1995; Zerihun, 2002). 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.

Crop residues included that of wheat, barley, emmer wheat, linseed, field pea, faba bean and maize stover are among the most widely available in cereal crops production areas of Bale highlands. These residues are often the major livestock feed available especially in mixed crop and livestock systems of Bale highland. 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). However, cereal straws and stovers fail to meet the productive functions of livestock (Michael et al., 1989). The feeding value of crop residues is limited by deficiencies of crude protein (CP), metabolizable energy (ME), minerals and vitamins. A major limiting factor to straw utilization is its bulkiness and low concentration in digestible nutrients. When offered to livestock both dry matter intake and palatability are low. Hence, these crop residues can supply only sub maintenance requirement of CP and ME of animals when they are fed alone (Owen and Aboud, 1988; Castrillo et al., 1991).

Among several methods of treatment of straws, ammoniation by urea offers greater promise because of its feasibility and it supplies non protein nitrogen (Sundstøl and Coxworth, 1984; Sundstøl, 1988). Treating, using urea as the source for generating ammonia, is a technique which can be easily mastered by farmers. 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. Urea treatment of straws is known to improve its nutritive value in terms of digestibility (Givens et al., 1988) and intake (Oosting et al., 1993). The energy value of low quality roughages can be increased to medium-quality by urea treatment (Sundstøl et al., 1978). The amount of N that was retained on the straw ranged from 39.1 to 59.5% of that applied (1.8 g/100 g DM) (Hadjipanayiotou et al., 1997) and an increase of 6 to 14.6 % unit in *in vitro* organic matter digestibility was obtained as a result of treatment. Feeding urea treated straw to animals enhance its utilization, reduces the need for concentrate supplementation, and limits animal weight loss during the dry season. The effectiveness of urea treatment depend on the type of the treated straw (residue), dosage of urea used, ambient temperature and the moisture content within the forage mass. Moreover, the types of silos and variation in

treatment procedures depending on the existing circumstances could matter the efficiency of urea treatment. Some studies (Saadullah et al., 1982*)* reported that use of earthen pits and polyethylene bags were the most efficient procedure recognized to be the lowest incidence of mould and increased digestibility and intake of the straw.

This suggests that the improvement in the nutritive value of crop residue would bring a marked reduction in dry season feeding stress in livestock especially in the highland of Bale. However, this technology has not yet well known and adopted by the farmers in Bale. To promote adoption of urea treatment by farmer's, there is a need to evaluate and demonstrate the simple and lower cost procedure of urea treatment techniques. Therefore, the objective of this study was to enhance urea treatment technology evaluation and demonstration through participatory approach.

2. Materials and methods

2.1. Study site selection and FRGs establishment

The study was conducted at two sites (Selka Oda and Jafar) of Sinana District of Bale highland Southeastern Ethiopia from 2011 to 2013 for two years. Sinana is located at about 430 km Southeast of Addis Ababa. The altitude of the area ranges from 2200 to 2600 m.a.s.l. The average annual maximum and minimum temperatures are 210c and 90c, respectively. The rainfall pattern is bimodal with annual precipitation ranging from 750-1000 mm. Two cropping seasons are known in the study area and these are locally known as Bona (from August to December) and Ganna (from March to July). Livelihood of the farming community of the area is based on mixed crop-livestock production, where cereal crop farming is dominant. The activity was carried out by using farmers research group (FRGs). Accordingly two FRG contains 20 interested and innovative farmers were established at each of the two sites. Appropriate site preferably sheltered from the sun's direct heat radiation and heavy rain was selected.

2.2. Preparation of silos and feeds to be treated

One voluntary farmer was selected where the experiment was conducted from the members at each site. Earthen pit silo of dimensions of 2 m x 2 m x 1 m (L, W and H) with polyethylene sheet coverage was prepared at each site by these voluntary farmer farmers. Straw of barley was also collected by these farmers as soon after grain harvest to reduce leaf-loss. Local materials were used to build shelter for storing straws to prevent from the effects of weathering until actual ensiling takes place. For weighing of straw a simple weighing scale was used.

2.3. Preparation of water-urea solution and straw treatment

To prepare water-urea solution, 5 kg of urea was dissolved with 100 liters of water in plastic container as recommended by (MacMillan, 1992). Watering can with sprinkler was used to sprinkling the solution over the straw. Prepared solution was applied to 100 kg of straw uniformly. The wall of the silo was covered in all directions with airtight enclosure plastic sheet and the treated straw was well trampled and compacted until the silo become full, and finally it was sealed and loaded by mass of soil on the top to make it airtight. The ensiled straw was left to stand unopened for twenty-one days as recommended by Sundstøl et al. (1978). After twenty-one days, the treated straw was allowed to aerate for two days to eliminate volatile ammonia and to disappear the pungent odor of ammonia. It was given to the animals to observe its acceptance.

2.4. Farmer's demonstration, training

Farmers were involved from site selection up to animal feeding. Treatment procedures were introduced to grouped farmers and additionally together with surrounding farmers at the beginning of the trial how to prepare the solution and treat the straw. After 21 days from ensiling, training was given for grouped farmers and surrounding farmers through practical demonstration of treated straw.

2.5. Data collection and statistical analysis

Information on residue management, time required undertaking urea treatment, sensory evaluation of treated straw quality by farmers and perception of farmers towards the technology were collected. Statistical package for social sciences (SPSS) was used for data analysis.

3. Results and discussion

The activities were conducted in the participatory approach with farmers at the two sites (Selka-jafera and Selka-oda). Theoretical and practical training was given at the beginning of the experiments for the FRGs on site selection and preparation, amounts of the ingredients used during the treatment practice; care to be taken while carrying out the treatment process and feeding the treated feed to animals. In addition, farmers were advised to properly collect and store crop residues in a well-shaded to be used for the other time.

Table 1
Participant farmers and development agents on participatory evaluation and demonstration of urea treatment of straws.

		Participants		
No	**Site**	**Development agents**	**Grouped farmers (FRG)**	**Surrounding farmers**
1	Selka Jafera	3	20	29
2	Selka Oda	3	20	30
Total		6	40	59

Similar training was also given for 6 development agents, 40 farmers of the member of FRGs and 59 other farmers from surrounding community after the ensiled straw was opened. The training was supported by a demonstration exercise. The farmers and development agents evaluated the treated straws and discussed and shared their views. Sensory evaluation (color, odor, softness) of treated straw was performed by grouped farmers and surrounding farmers. Farmers view on urea treatment technology including the procedures of urea treatment, acceptance of treated straws by the animal, advantages of the technology were collected through discussing with the farmers/participants on the demonstration. The farmers were asked to feed the treated straw in place of untreated straw to all cattle with the exception of calves, pregnant cows after 7 months and emaciated cattle. Farmers were advised to offer some roughage before feeding the treated straw.

Table 2
Farmers views on the urea treatment technology after the demonstration activity.

Views of farmers regarding to technology	% Of the farmers from the FRGs
Shortage of straw and clean water at the time preparation	12.5
Cumbersome and tedious of techniques(procedure)	75
Labour and time consuming	45
Unaffordable to farmers (purchase of urea, polyethylene sheets and other inputs)	27.5
Not liked due to pungent smell and fear of poisoning to human and animal	30
It could increase in straw consumption and reduction of feed wastage	80

The cumbersome nature of the procedure, labour-demanding, the pungent smell and fear of poisoning to human and animal were the main points raised during the evaluation and demonstration. Out of the 40 farmers considered in FRGs, 75% of them considered the cumbersome nature of the urea treatment procedure as a major fear to continue with the technology. Shortage of labour and time also indicated as the other constraints of using urea treatment technology. Few proportions of the farmers also indicate the capability of the farmers to afford the required input and inadequate straws at the time of preparation and shortage of clean water as a challenge for continuing with the technology. On the other hand, about 80% of the farmers in the group appreciate the importance of the technology as it could increase the utilization of straws from being wasted during feeding.

Generally, urea treatment preferred to be done during the dry months before the beginning of raining. Farmers also suggested that the practice of straw treatment could be one of the opportunities to solve the feed shortage at the dry period in the area. Hence, on time straw collection right after harvesting of crops is very important. Financial requirement for input purchase is not the main concern since farmers in the study area have better cash especially at the crop harvesting. Some farmers also suggested that inclusion of salt in the feed would enhance the performance of the animals of feed on urea treated straws.

According to the opinions of the farmers, feeding urea treated straw is preferable to feeding the untreated straws. Farmers also obtained good awareness from the training that feeding urea treated straw has a potential in improvement of milk yield and body condition of the animal. From on-farm training of urea treatment, the neighboring farmers who were involved on the demonstration have showed interest in straw treatment and need to know the techniques and benefits of straw treatment. Most farmers were attracted to the technology and have willing to carry out at their home and popularize to nearby farmer. Generally, the technology appeared to be a cost-effective and the farmers were satisfied with the results as long as the researchers and the extension specialists were involved in the procedure of the treatment.

4. Conclusion

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. Treating crop residues with urea practically improves the feeding values of these roughages. It is believed that feeding urea treated straw improves production performance of the animals. Accordingly, farmers whose involved on the demonstration noticed that the treated straw will improve the milk yield and body conditions of the animals. They also introduced that urea treated straw can replace hay and green feed during dry periods. At the end of demonstration, farmers have shown interest on the technology and have willing to carry out at their home and to popularize the technology to nearby farmers. The technology is accepted as a beneficial practice by most farmers and it will be successful and adopted in such areas where excess crop residues available. This practice should be further demonstrated to the others farmers with excess straw are available and no critical water problems of the highlands of Bale. However, it requires strong follow up from the researchers and development agents so that the farmers continue to apply the straw treatment technology.

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