International
Journal
Of Advanced Research in Engineering& Management (IJAREM)
ISSN: 2456-2033 || PP. 89-104

Evaluating the Efficiency of Continuous and Single Batch Curing on Palatability, Production and Nutrients Availability on Wheat Straws

Siele Joseah[1]* Dr. William Ncene[2] & Dr. Mworia Mugambi
[1]*Department of Agriculture and Natural Resources, Kenya Methodist University, Meru-Kenya*
[2]*Department of Agriculture and Natural Resources, Kenya Methodist University, Meru-Kenya*
[3]*Department of Agriculture and Natural Resources, Kenya Methodist University, Meru-Kenya*

Abstract: In Kenya, many farmers are engaging in wheat production throughout the year, this makes the availability of straws huge. However, the presence of lignocellulosic complex makes their palatability and general intake limited. Intake also has been reduced by the rigid procedures available to the farmers. The nutritional value for wheat crop residue to ruminants is constrained by low nitrogen and high fibre contents. Livestock farmers accept that fibrous straws from wheat are a poor feed resource because of their low crude protein content and high fibre levels. However, these residues are often the only livestock feed available in smallholder mixed farming systems. Introducing the continuous procedure of urea – ammonization and liming intends to take advantage of the excess ammonia on the already cured feed and the peak volumes of urease enzymes to quickly break urea to ammonia which is known to cure feeds in synergy with lime. Urea-Ammonization and liming of straws seem to be a feasible option for improving nutritive value, hence reducing the limiting effects of livestock production through feeds in the country. Treated wheat straws samples were ground in the laboratory hammer mill and the sample sieved through a 1mm screen and then analyzed in a laboratory to study the associative effect of ammonia and lime on the chemical composition of straws. The study analyzed for dry matter, total ash and crude protein of feed types. The results were tabulated to shows the efficiency and benefit of using either continuous or single batch method. Data collection covered result from the three dairy cows in the two replicates. The dairy cows selected were those on zero-grazing setup and feeding will be uniform. The six dairy cows, in two replicates were put on trials for a period of ninety days. Specific data is on palatability and production of milk from benefits from treated straws on procedures of continuous and single batch methods of applying treatment.
Keywords: Wheat straw nutrients; fibre straws palatability & intake; cell- wall and cellulose;Rumen-microbial; crop residue; lignocellulosic ; urea treatment; Supplementation; Lime treatment; Urea-Ammonization and liming; palatability and production of milk.

Introduction

The agricultural sector employs most of the rural populace and contributes to over 24 % of Kenya's Gross Domestic Product (GDP). More than 80 % of Kenyan citizens also live in rural areas where agriculture is their main occupation (GOK, 2007). An intervention to improved livestock production goes a long way in reducing poverty and fundamental step in food security. Risk of livestock loss during dry seasons most of which emanate from lack of quality and enough feed to mitigate the dry spell has been felt in livestock farming communities and as a continuous or cyclic phenomenon. Achieving secure household incomes is generally assumed to be a fundamental step out of poverty and food insecurity especially from livestock as a farming option. In practice, most smallholder ranchers feed crop residues with no type of handling, supplementation, or treatment, and subsequently affecting unfavorably on performance of animal production. Wheat straws and crop residue, in general, represent a large feed resource base for ruminants, especially during the dry season but remain underutilized for a number of reasons including being bulk to store and expensive transport. They have low nutritive value caused by high levels of lignification and high cell wall content (Mahesh &Mohini, 2013).
On a world scale, the total production of straws and other related materials has been calculated to be sufficient to meet the maintenance needs of all ruminant livestock.in many tropical and subtropical countries that cannot

afford to use the land for forage production, straws is an is an essential basal food for ruminant livestock. A dairy cow in a single lactation produces five times as much dry matter in form of milk as is present in her own body. The raw materials and the energy for the synthesis of constituents is the mammary gland, which is supplied by food. These high potential animals are exceptionally hard to keep up high levels of nourishing in early lactation when dry issue intake is low. Treating the wheat straw will go far in improving dry issue intake (Genc, Oldark& McDonald, 2010).

Cost of production has additionally made animals producers diminish feed costs at whatever point conceivable. A harvest buildup due to accessibility are potential for diminishing feed costs for domesticated animals makers, but since of low edibility allow by domesticated animals is lessened astoundingly. Treatment of low-quality wheat with smelling salts and lime enhances edibility or aggregate edible supplements (TDN) and increment utilization of forages. The great impacts of ammonia and lime treatment on edibility and admission of low-quality scrounges are that it makes them a reasonable alternative in nourishing administrations of domesticated animals.

Urea- Ammonization and liming procedure in this study was mainly on wheat. In areas endowed with suitable conditions for agriculture and where most of the farmers are engaged with either dairy or wheat for farming or both. The Urea- ammonization and the liming procedure are intended to relatively be a simple procedure and easy to accomplish (Genc, Oldark& McDonald, 2010).

Feed is an important limiting factor to the performance of livestock in Kenya, making an intervention on this factor is paramount. Plenty of wheat and other crop residue are left to rot in fields or fed unimproved leading to wastefulness. Efficiency in the procedure of curing straws and feeding to animals went a long way in increasing intake per animal and by extension increasing overall livestock production. Some studies have been documented in crop residue improvement but the procedure in undertaking the same is not efficient with farmers still losing their livestock during droughts. This study intends to fill this knowledge gap of straw treatment manipulation.

Fodder availability is increasingly becoming a problem with climate change. Mitigation to reduce wastage on the available straws and enhancing utilization through nutrients – boosting and efficient utilization is of great importance. It has been recognized that ruminants have a positive relationship between the digestibility of food and their intake.

Although the rate of digestion and intake are related to the concentration of cell wall in ruminant foods, the physical form of the cell wall also affects intake. Treating the straws with lime and urea-ammonia changed the physical form of the cell wall and enhance intake. Urea-Ammonization and liming can be manipulated to convert the straw into useful ruminant feed efficiently.

Specific Objectives of the Study

I. To determine the effects of a single batch and continuous curing of wheat straw on nutrients available in the feeds of lactating dairy cows.
II. To determine the effects of a single batch and continuous curing of wheat straw on dry matter intake by lactating dairy cows
III. To determine the effects of a single batch and continuous curing of wheat straw on milk production in lactating dairy cows.

Literature Review

2.1 Chemical and Physical Form and curing of Wheat Straws

The young plants have a thin divider that thickens as the plant develops. This outcomeis a physical obstruction to the cell content concoction, enzymatic or microbial assimilation. Cell content is typically effectively processed and its supplements are promptly accessible. Nonetheless, the cell divider segments are accessible and processed to a specific degree, and this is a restricting variable as far as creature nourishment. Consequently, cell divider thickness, which changes with age, time and climate, is the principal factor influencing search absorbability. Cross area of the straw, perception demonstrates the presence of 3 layers; sclerenchyma parenchyma and essence (Mahesh &Mohini, 2013).

2.2 Components of cell- wall and cellulose

The fundamental mixes present in the cell-divider are; cellulose, pectines, a few proteins, lignin, silica, cutin, phenolic corrosive, tannins and the Maillard response items. Cellulose is the richest particle in nature.

2.2.1 Hemicelluloses

Hemicelluloses have been characterized as antacid dissolvable cell divider polysaccharides nearly connected with cellulose, made primarily out of D-Galactose-Galactose, D-mannose, D-xylose and L-Arabinose units consolidated in various blends. Hemicellulose is normally conformed to the cellulose fibrils (Fazaeli, Aziz and Amile, 2006).

2.2.2 Gelatin substances

They are a gathering of related polysaccharides bottomless in delicate tissues. Gelatin is a straight chain of D-Galacturonic corrosive units with some methyl esters (Grabber, 2005).

2.2.3 Lignin

It's anything but a solitary compound yet a group of polymers of phenylpropane units composed in an intricate cross-connected three-dimensional structure. It begins from three fundamental mixes subsidiaries from phenyl propane. Amid the lignification procedure, the relative measures of guaiacyl or **pyrid**yl increment quickly. This absence of information has various commonsense ramifications, restricting our capacity to foresee the nutritive estimation of a feedstuff just from compound information; or the reaction liable to guarantee from medicines intended to upgrade the nutritive esteem (Wanapat, Polyorach, Boonnop, Mapato, **&**Cherdthong, 2009).

Furthermore, low sub-atomic weight phenolic mixes. Likewise seem to tie glucans and xylans in an unpalatable complex. Particularly negative to scrounge absorbability is p-coumaric corrosive; this corrosive is additionally dangerous to ruminal microorganisms at bring down fixations than different acids. Ruminal growths seem to have a more prominent potential to corrupt lignocellulose than microorganisms do (Gado, Salem, Odongo, and Borhami, 2011).

2.3 Rumen microbial requirement

It isn't conceivable to measure the nutritive estimation of a deposit or a side-effect for a ruminant when the necessities of its rumen organisms were not thought about. The meaning of miniaturized scale life form insignificant prerequisites for the diverse supplements isn't anything but difficult to decide. The sulfur (S) focus must be around 1.8 g of Sulfur for each kg of the stomach related natural issue (Babcock, Hayes and Lawrence, 2008).

In any case, the ideal level of S will rely upon its quality and accessibility in covering the smaller scale living beings prerequisites in the rumen. For customary feedstuffs, the S portion related to the protein, itself, which changes a considerable measure starting with one feedstuff then onto the next. As a rule, one can state that the pH will not diminish beneath 6.0 and that all supplements ought to be given on a persistent way, particularly when the sustaining source is gradually debased, which frequently happens with the scrounges (Grabber, 2005).

2.4 Standardization of in Vivo Digestibility Measurements

With respect to the institutionalization of in vivo edibility estimations and from what has been said previously, it is conceivable to assess straw, particularly untreated straw, sustained alone as a result of the unbalance caused in the rumen microflora.. The use of treated straw in down to earth conditions needs more a nourishing an incentive than a nutritive esteem, which implies a proportion of the intentional feed admission of the straw (Borba and Ramalho Ribeiro, 1994).

2.5 Urea as a chemical

Urea is a white crystalline strong natural compound, broadly utilized as a nitrogen compost. Unadulterated urea has a nitrogen centralization of 46.6 %, comparable to an unrefined protein substance of 290 g for every 100 g of urea since protein itself has just 16 % nitrogen. In mild atmospheres, anhydrous (vaporous) smelling salts or fluid (alkali disintegrated in water) is utilized for the ammoniation of straws. In hotter atmospheres, the urea treatment is more possible in light of the simple accessibility of urea and its snappy separate into smelling salts mixes under higher surrounding temperatures (Mapato et al., 2010).

2.5.1 Techniques for splashing

For showering of the urea arrangement over a layer of 100 kg straw or whatever quality that is picked, a planter's sprinkler can be to accomplish consistency in urea arrangement interacting with straw. Utilization of a sweeper and a basin has additionally been observed to be powerful to spread the water. For cleaved wheat straw, some hand blending after the shower of urea arrangement is alluring (Singh and Chander, 2011).

2.5.2 Conservativeness of the stack

Once a layer of 100 kg has been dealt with, an extra layer of 100 kg is set to finish everything and showered with urea. This procedure is rehashed to make a stack. A smaller stack has two preferences; right off the bat the viability of the ammoniation procedure is better. Besides, there are less odds of shape development which prompts decay of the straw. Cleaved wheat straw compacts exceptionally well amid stack making. Such smallness can't be accomplished so effortlessly in free straw, however packages are superior to lose unchopped straw (Zijistra and Beltranena, 2013).

2.5.3 Span of treatment

Since the temperature of the stack influences the rate of hydrolysis of urea to alkali, the term of treatment can be variable, contingent upon the district or season where the treatment is finished. The term of the treatment can likewise be settled on, by thinking about the neighborhood conditions and the size of the treatment. Littler amounts can be dealt with on week by week premise, requiring less work on the double, winding up business as usual creature nourishing practices. In certain cultivating frameworks straw is put away in vast stacks for a long time. In such circumstances, a few agriculturists wish to treat straw with urea at the season of stacking directly after reap however it includes more work around then. In this manner, likewise the span of the treatment turns out to be longer. A time of no less than a little while has been proposed to be vital for the treatment of straw in the winter months when the encompassing temperature is lower. As an alert the more drawn out the times of capacity the higher the danger of waste by molds particularly when the straw is excessively wet (FAO, 2011).

2.6 Types of crop residue used

The sort of harvest buildup utilized and its underlying nourishment quality influences the viability of treatment. The poorer the underlying nature of the straw or Stover, the higher the impacts of treatment, perhaps on the grounds that better quality straws have more cell solubles and bring down fiber content, the last really getting the advantage of ammoniation.

2.6.1 Storage technique

A key factor which decides financial aspects and practicability of the urea treatment of straw is the utilization of capacity structures for the treatment. Agriculturists for the most part favor stockpiling techniques in view of existing custom, yet new ways are discovered adequate relying upon their expense. Covering of the stack is critical, however especially the bigger, and all the more thickly pressed stacks could be open, i.e. secured with just a layer of untreated straw.

The pit framework, i.e. an opening in the ground, conveys the danger of defilement with soil or leakage of water through the sides. Stacking and emptying of the pit are likewise troublesome, and the burrowing of pits can be an issue in rough soil. The distinctive strategies for stacking or putting away urea showered straw have their relative merits and merits, yet the primary concern about every one of these techniques is that the better the compaction and airtightness of the stack, the better will be the nature of the treated straw. At last, the agriculturist needs to choose as indicated by claim inclination (Ray et al., 1996).

2.7 The relation between outside temperatures with required treatment time

Usually, the temperature inside the stack is higher than the outside temperature, due to microbial action and /or chemical reactions between urea, water, ammonia and straw. And since it is ultimately the stack temperature that determines the reaction process, it appears critical that the initial temperature is high enough to get the process started. Bigger stacks or heaps can control the temperature better than smaller heaps.

Ammoniation period of seven days or less is shown to be sufficient under tropical conditions. The duration of the treatment can also be decided upon by considering the local condition as well as the scale treatment. Smaller quantities can be treated on weekly basis requiring less labour at once, becoming part of the routine animal feeding practices (Mahesh &Mohini., 2013).

2.8 Ureolysis and ureolytic medium

The urea treatment is the consequence of two procedures which happen at the same time inside the mass of scavenge to be dealt with; ureolysis which transform urea into alkali, and the along these lines created impact of the smelling salts on the cell dividers of the scrounge. Ureolysis is an enzymatic response that requires the nearness of the urease catalyst in the treatment medium. As per research and much field encounter procured amid the most recent decade, adequate urease is created by the earthly ureolytic microorganisms amid the treatment of buildups, for example, straw or maize stalk, at any rate under conditions where dampness forces no restrictions (Gado et al., 2009).

2.8.1 Moisture content

Aftereffects of both trial and useful work completed as of recently demonstrate that this rate ought to never be under 30 %, and not more prominent than 60 %. Beneath 30 %, ureolysis can be extremely lessened or even not happen

Thus, an absence of smelling salts and an abundance of oxygen in a medium with adequate dampness will prompt an awful soluble base treatment and to form advancement.

2.8.2 Temperature and span

The ideal temperature of ureolysis should lie between 30 degrees and 60 degrees, as indicated by the sort of urease. One must, along these lines, be extremely cautious in tropical good countries where night ice can amid the dry season when the time has come to treat the straw (Sawar and Muhammad, 2006).

2.9 Alkali effect of the generated ammonia

The elements guaranteeing a decent soluble base impact are obviously the same as on account of alkali treatment and they have been completely assessed by Sundstøl and Owen (1984). The criteria of stickiness, temperature and their cooperation, essential for successful ureolysis, will marginally support the soluble base treatment. Be that as it may, length, kind of rummage or more all alkali (and in this way urea) dose and their cooperation should be taken into close thought.

2.9.1 Urea Measurement/Kind of Scrounge/Length

The amount of salt to be utilized is the principal factor in charge of the effectiveness of soluble base treatment.

The lion's share of both exploratory and field work has reasoned that the prescribed dosage is 5 kg urea for every 100 kg of straw. This dosage gave great outcomes in many field venture (Mesfin&Ktaw, 2010).

2.9.2 Term/Surrounding Temperature

The term of the salt treatment is longer than the ureolysis procedure. The suggested treatment time ranges from over about two months for temperatures around 5 degrees to less multi week for temperatures over 30 degrees. In traditional tropical atmospheres, the salt treatment would thus be able to be accomplished following multi week. In any case, in perspective of what has been said before, the span to be suggested by and by ought to never be underneath multi week. As treatment proficiency enhances with time it is fitting to hold up about fourteen days before opening the stack except if limitations make this inconceivable (Garg &Bhanderi, 2011).

2.9.3 Air and Water Snugness

Smelling salts is discharged considerably more gradually from the ureolysis procedure than from an anhydrous alkali tank infusion. The dangers of misfortunes of alkali into the climate is diminished since smelling salts can tie on the scrounge cell dividers and on the water medium at the same time to its discharge. There is certifiably not a solitary settled model strategy however contemplated methods which should each adjust to the predominant agro-monetary which are, the straw or rummage molding: free shape, either long or slashed, bunches, either physically or mechanically squeezed, the amount of scavenge or straw to be dealt with required, contingent upon the quantity of creatures and the time amid which they must be sustained (Blümmel, Samad, Singh &Amede, 2009). Different sorts of medications are conceivable relying upon the methodology picked which will meet the ideal trade off among recurrence and size (Da Silva, 2015).

Frequently now it is said that the urea treatment does not require any covering: such exhortation is hazardous and questionable. At the point when the treated roughages must be put away for quite a while, it is important to cover it keeping in mind the end goal to maintain a strategic distance from shape improvement and poor smelling salts obsession (Plata &Bárcena-Gama, 1994).

2.10 Assessment of Treatment Efficiency

The best evaluation of the treatment impact is, obviously, the creature's reaction as far as admission and exhibitions. On account of urea treatment one essential point, which is by and large misconstrued, is that, when the examine is done on the dry example as over, a more noteworthy addition isn't really synonymous with an effective treatment (Fazaeli-Aziz &Amile, 2006).

Despite what might be expected, it ought to caution that leftover urea has not been. As CF (unrefined fiber), NDF (impartial cleanser fiber), ADF (corrosive cleanser fiber), and ADL (corrosive cleanser lignin) are of no utilization, they are not suggested (Qingxiang, 2002).

2.10.1 Reaction to treatment

At the point when legitimately accomplished and used, urea medications can expand the CP content by a normal of 6 % to 7 %. In any case, a state of intrigue, said by a few creators, however frequently overlooked is the generally terrible use by the creature of the nitrogen given by treatment, which is reflected by the high nitrogen fecal discharge. Subsequently, agriculturists in reality watch a superior agronomical estimation of the fertilizer gathered from the creatures bolstered with treated roughages (Huhtanen, Rinne&Nousiainen, 2007).

There are extensive variety in straws as indicated by their species, assortment, developing conditions and climate at reap. For useful use by agriculturists, urea is more secure than utilizing anhydrous or fluid smelling salts and furthermore gives a wellspring of nitrogen (unrefined protein) in which straws is inadequate.

As per look into work and the various field encounter gained amid the most recent decade, urease delivered the earthly ureolytic microscopic organisms amid the treatment of deposits, for example, straw or maize stalks, is adequate, at any rate under conditions where stickiness forces no restrictions. Just in the particular instance of deliberate decrease of water (20 l to 25 I added to 100 kg straw) for motorization reason will the option of urease be essential. The physicochemical states of treatment, specifically moistness and temperature, and their collaborations, must, in this way, support the movement of these microbes and that of their protein (Kashongwe and Osoo, 2014).

2.10.2 Mugginess

The perfect mugginess of ureolysis is 100 % (water arrangement), obviously, difficult to reach in a complex (heterogeneous) medium made out of plant material and water. This is the reason; by and by, the water substance of the medium is one key factor in the accomplishment of the (urea treatment). This additionally why there are such huge numbers of opposing statement.

2.10.4 Alkali treatment of the generated ammonia

Factor guaranteeing a decent soluble base treatment is, obviously, the same likewise with smelling salts treatment. A trail in Vietnam shows that treating with 2.5 % urea in addition to 0.5 % lime and 0.5 % salt gives a similar increment of the straws sustaining esteem contrasted with 5 % urea treatment (Zijistra & Beltranena, 2013).

2.10.5 Span/encompassing temperature

The span of the soluble base treatment is longer than the ureolysis procedure. The suggested treatment time ranges from over about two months for temperatures around 5 % to under multi week for temperature over 30 degrees (Sundstol & Owen, 1984). As treatment productivity enhances with time it is in any case better to hold up about fourteen days before opening the treatment give the search and rancher's opportunity availabilities permit such a timetable (Sundstol & Owen, 1984).

2.10.6 Air and water-tight

Alkali is discharged considerably more gradually from the ureolysis procedure than from an anhydrous smelling salts tank infusion. The dangers of misfortunes of smelling salts in the air are decreased since alkali can tie on the search cell dividers and on the water medium at the same time to its discharge. Anyway just around 1/3 of the smelling salts discharged can tie the plant material, the rest of the 2/3 being in a labile frame and lost, in any case. This point will be as vital as the capacity is long and the volume of treated material little, so as to keep up the more anaerobic and ammoniacal environment as conceivable inside the mass of search so as to accomplish the best treatment as well as the advancement of molds as could reasonably be expected (Chenost, 1995).

2.8 The practice of urea treatment

The purpose of this chapter is once the factors controlling the urea treatment have been described, to consider the various practical problems that arise when implementing the urea treatment technique at a practical level. Indeed there is no fixed model technique but rather one which is adapted for the local environmental condition in question. Various types of treatments have been described here and more recently they range from the small pit dug in the soil (only in firm clay and not draining soils) to the classical pressed bales stack covered with plastic sheets as in the anhydrous ammonia treatment, with all the intermediary solutions such as basket or any other containers, various types of clamps, existing construction e.g. storehouse or unused pen (Huhtanen*et al*., 2007).

2.8.1 Assessment of the treatment efficacy

The best assessment of the treatment efficacy is, of course, the animal response in terms of intake and performances. A lot of practical field experience has been acquired now in an extremely wide range of agro-ecological and sociological condition with success (Kashongwe*et al*., 2014).
Hermeticty is less of a concern than with anhydrous ammonia treatment and is not necessarily important when large quantities of plant material are treated the strategic supplements are urea and minerals.

2.8.2 Supplementation of treated and untreated poor quality roughages

An appropriate supplementation to poor quality roughages should first favor the rumen cellulolysis, then enhance rumen microbial synthesis and supply the animal with the required nutrients for maintenance and, when necessary, for production, bearing in mind that these nutrients cannot be compared with those expected with good forges (Selim*et al*, 2004).

2.8.3 The Catalytic Supplementation for Subsistence or Modest Production

The first step in supplementation is the catalytic step which ensures a good cellulolytic rumen ecosystem by supplying non-protein nitrogen (NPN) and minerals. Such supplementation hardly covers the maintenance requirements of the animals. Amore convenient practice, developed by the FAO, that is becoming popular throughout developing countries, is the multi-nutritional block the carrying medium is solid and therefore easier to transport (Del Coco & Bilbao, 2014).

2.9 Supplementation for a higher production level (untreated and treated poor quality roughage)

The second step in supplementation concerns the host animal, where the catalytic supplementation becomes inadequate to sustain some more production than the maintenance. For socio-economic reasons supplementation should be ensured by as much local feed resources as possible and avoid the use of classical concentrates (or their components, earmarked for human and non-ruminant nutrition, i.e. cereals and high-quality oil cakes. Contrary to conventional supplements, the main strategic supplements, consist of farm residues such as haulms and leaves of pulse crops and vegetables, these provide green or digestible matter of plant origin and of course vitamins and their nitrogen concentration is high (Wanapat*et al*, 1991).

2.10 Simplification of urea treatment

Endeavors were made in the past to enhance the edibility and protein through compound treatment. In this association, sodium hydroxide was utilized which brought about enhancing the absorbability, however its utilization stayed constrained because of a staggering expense of substance and natural contamination. The other compound utilized was anhydrous smelling salts which enhanced the edibility and expanded the nitrogen substance of the treated straw yet non-accessibility of alkali gas in the basic market and its transportation through specific holders restricted its utilization. Of late, manure review urea has been utilized for this reason (Cromwell, Kellems and Church, 1998). Urea treatment enhances edibility, admission and unrefined protein substance of the straw. The degree of reaction to urea treatment regarding straw quality is variable, because of variety in beginning straw quality, species distinction among straw and stovers, and the kind of creatures utilized for tests (Grag&Bhanderi, 2011).

2.10.1 Lime treatment

Lime Cao/Ca (Goodness) 2 is a feeble antacid operator with low solvency in water. It has been accounted for that lime can be utilized to enhance the use of straw and furthermore be utilized to supplement the proportion with calcium, which has been observed to be in negative equalization in cows sustained on unchanged just straws. Dousing and ensiling are two techniques for treating straw with lime. This blend has the upside of an expanded degradability and an expanded substance of both calcium and Nitrogen (Chenost, 1995).

2.10.2 Estimation of Straw Admission

In the three preliminaries, the straw was weighed at each bolstering. Buildups were gathered and weighed before the morning feed each day for the entire nourishing trail time frame. Natural issue consumption (OMI) of straws was resolved in light of the everyday measure of straw encouraged, buildups and their dry issue and slag substance decided. The consequences of a few investigations displayed show the degree to which admission of harvest deposit can be controlled by the sum offered and by physical preparing and measure of supplement. This is valid with most little ruminants yet with cows, admission was not changed by the quantity of straws offered (Highstreet, 2010).

2.10.3 Impact of measure of Focus Supplement

Admission of straw at the low-off-rate of straw in addition to low-supplement was the same as the admission of straw at the high-offer-rate of straw in addition to high-supplement. Real changes ought to be made in little additions over at least a little while to permit rumen microbial populaces to adjust to evolving nourishes (Robison et al, 1994).

2.10.4 Compound Investigation

Crisp examples of the diverse kinds of straws are dissected for nitrogen substance and measures of urea included before bolstering. Agent tests of treated straws at various levels of urea and untreated straws are broke down for dry issue (DM) and aggregate fiery debris (Smith and Williams, 2016).

3.0 Results

			Feeding Periods		
	Feeding Group	Cow No.	P1	P2	P3
Lactating Friesian Dairy Cows	A	1	CC	SB	UN
		6	CC	SB	UN
		8	CC	SB	UN
	B	2	SB	UN	CC
		4	SB	UN	CC
		9	SB	UN	CC
	C	3	UN	CC	SB
		5	UN	CC	SB
		7	UN	CC	SB

Figure 3.1: Experimental design layout

Key: A – Feeding Group A;B – Feeding Group B; C– Feeding Group C; CC – Continuously Cured Wheat Straw; SB – Single Batch Cured Wheat Straw; UN – Uncured Wheat Straw; P1 – Period One; P2 – Period Two; P3 – Period Three.

3.4 Experimental Procedure

Wheat straws were chopped using a bulvarizer chaff cutter so as to achieve required sizes of between 0.5-1.5 cm. Chemical treatment of the wheat straws involved adding 5 kg of urea and 6 kg of lime ($CaCO_3$)in 100litres of water to 100 kg air-dry wheat straw. Using a watering can, the treatment solution (Urea+ $CaCO_3$) was then sprayed onto a stack of 100 kg chopped wheat straw placed on a polythene sheath spread on the floor. The treated straws were manually mixed thoroughly then packed by compressing in silage tubes and covered making them air-tight and ensiled for 21 days (single batch curing). For continuous curing process, half of the treated and ensiled wheat straws were removed after 21 days and an equal amount of freshly treated wheat straws added and mixed thoroughly to achieve a homogeneous form. The half ensiled half fresh wheat straws were then ensiled for one week (7 days).

After 3 weeks of ensiling (for a single batch) and 1 week for continuously cured wheat straws, treated straws were taken out from the silage tubes as per the daily feed ratios of 10 kg per cow. The cows were fed with treated wheat straw after exposing the ensiled material to air for 2 hours to avoid inhalation of ammonia by the animals. Untreated wheat straw was fed immediately after taking out from the barn. The experiment was run in three periods, each lasting for 28 days of which first 7 days at the start of the experiment and in between the periods were the cows' adaptation to the changed feed, and milk yield and feed intake was monitored for successive 21 days. Introduction of treated wheat straw was gradual. The cows were given clean fresh water and mineral salts adlibitum. The cows were housed in individual pens and kept completely under stall feeding conditions. All other management practices were similar as far as possible.

3.5 Measurement, Sampling and Data Recording

Experimental cows were monitored and closely observed throughout the experimental period. Morning and afternoon milk produced by the experimental cows were measured and total milk yield per cow was recorded daily for 21 days in each experimental period (63 days in 3 periods). Data were also recorded for the feeds offered and left, daily intakes of continuously cured, single batch cured and untreated wheat straw. Samples from each feed treatment were taken every day, pooled to a weekly basis and ultimately composited by period for nutrient content analysis.

3.6 Data Analysis

To determine the effect of wheat straw treatment on daily dry matter intake and milk production from the 28 days data in each period, data of the 21 days excluding the first 7 days data were used for analysis. Dry matter intake and daily milk yield were subjected to Analysis of Variance using General Linear Model (GLM) procedures of Statistical Package for Social Sciences (SPSS 24). The statistical model used was:

$$Y_{ijk} = \mu + r_i + c_j + t_{k(ij)} + e_{ijk}$$

Where:

Y_{ijk} - Dependent variable (feed intake, milk yield)
μ = Overall mean
= Effect r_i of lactation stage (Period effect)
c_j = Effect of cows (column effect)
$t_{k(ij)}$ = Effect of feed treatment
e_{ijk} = Error term

The treated samples for single and continuous batch processes will be grounded using a hammer mill and passed through a 1mm screen. These samples are to be analyzed for dry matter, total ash and crude protein according to AOAC (2004) standard procedure.

4.0 Results and Discussion

Introduction

The experiments were conducted to study the effects of single and continuous curing of wheat straws on feed intake, dry matter (DM) digestibility and milk yield of lactating dairy cows under a single farmer's management conditions in the Bomet County of Kenya. In this chapter, the results of analysis of data collected from the experiments are presented and discussed as per the objectives of the study.

4.1 Effects of single and continuous curing of wheat straw on nutrients' availability

Table 4.1: Effect of urea treatment on wheat straw nutrients

	Nutrient Composition (%)	
Parameters	**Untreated wheat straw**	**Urea-treated wheat straw**
Dry matter	61.7	91.3
Crude protein	2.9	13.7
True protein	1.2	8.1
Neutral detergent fibre	82.8	70.3
Acid detergent fiber	44.6	59.9
Gross energy	1.51	1.03

Samples of diet were chemically analyzed for dry matter (DM), crude protein (CP), fat, neutral detergent fibre (NDF), acid detergent fibre (ADF) and ash following the methods of AOAC (2004). The effect of urea treatment on wheat straw nutrients availability is presented in Table 4.1. As the results in the table show, wheat straw contained 2.9 % crude protein which was increased to 13.7 % by treatment with 5% urea and ensiling, which were about 10 units higher. Similar findings were reported by Meyer *et al.*, (2010) and Rauch *et al.*, (2014). The neutral detergent fibre content decreased from 82.8 % to 70.3 % possibly due to solubilization of hemicellulose content during treatment. On the other hand, the ADF content increased from 44.6 to 59.9 units. The increase of ADF may be due to consequences of a reduction in hemicellulose.

4.2 Effects of single and continuous curing of wheat straw on dry matter intake

The mean daily dry matter intake of single and continuously cured as well as uncured wheat straw was determined and the results presented in Table 4.2.

Table 4.2: Daily DMI of Cured and Uncured Wheat Straw by Lactating Cows

	Dry Matter Intake			**95% Confidence Interval**	
Treatment	**Mean**	**Std. Deviation**	**Std. Error**	**Lower**	**Upper**
Continuously Cured	6.040	.7085	.053	5.933	6.149
Single Batch Cured	5.998	.5439	.039	5.919	6.075
Uncured	4.201	.2449	.018	4.166	4.234

The highest mean daily dry matter intake (DMI) was noted when lactating dairy cows were fed on continuously cured wheat straw (6.04 kg), which numerically differed marginally with the mean DMI of the cows when they were fed on single batch cured wheat straw (5.998 kg). The mean daily dry matter intake when the cows were fed on uncured wheat straw was lowest at 4.20 kg. The difference between daily DMI of continuously cured and single batch cured wheat straw was 0.42 %. On the other hand, the difference in daily DMI intake between continuously cured and untreated/uncured wheat straw was 18.39 % while the difference between single batch cured and untreated/uncured wheat straw was 17.97 %. Results of Analysis of variance (ANOVA) were as shown in Table 4.3.

Table 4.3: ANOVA Tests of Between-Subjects Effects for Dry Matter Intake

Dependent Variable Dry Matter Intake

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	429.292[a]	6	71.549	282.544	.000
Intercept	16359.178	1	16359.178	64601.947	.000
Period	15.638	2	7.819	30.877	.000
Treatment	411.175	2	205.588	811.860	.000
Feeding Group	3.485	2	1.743	6.882	.001
Error	139.530	551	.253		
Total	16920.120	558			
Corrected Total	568.822	557			

a. R Squared = .755 (Adjusted R Squared = .752)

Analysis of variance (ANOVA) revealed that wheat straw DMI was significantly different between the treatments ($P < 0.05$). There was a consistent increase in DMI whenever the lactating cows were fed on continuously cured and single batch cured wheat straws. Conversely, the DMI consistently declined whenever the cows were fed on uncured wheat straw.

Following post-hoc analysis utilizing LSD test (Table 4.4), it was established that there was no difference in DMI of continuously cured and single batch cured wheat straw. However, DMI of both continuously cured and single batch cured wheat straw were found to be significantly higher that DMI of untreated wheat straw ($P < 0.05$). These results implied that curing increased dry matter intake of wheat straw by the lactating cows and that continuously and single batch cured wheat straw produced similar effects on the lactating dairy cows.

Table 4.4: LSD test results for wheat straw treatment and DMI

Treatment	CC	SB	UN
CC		**0.042**	**1.839***
SB			**1.797***
UN			

*. The mean difference is significant at the 0.05 level; CC: Continuously Cured: SB: Single Batch Cured: UN: Uncured

Dry matter intake of wheat straw was not significantly affected by the different feeding groups and wheat straw treatment as shown in Figure 4.1.

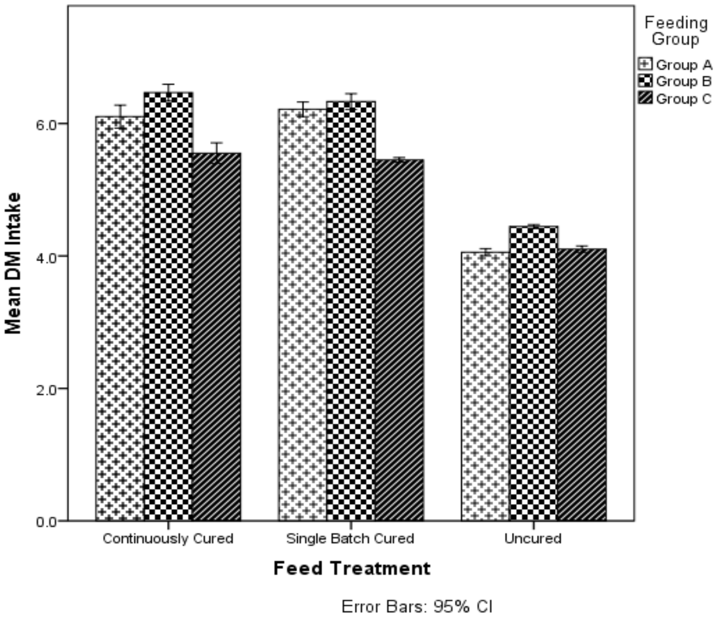

Figure 4.1: Effects of Feeding Group and Feed Treatment on Dry DMI

The findings in this study are consistent with the findings of Meyer et al.,(2010) and Huhtanen et al., (2007) whose investigation revealed that there was the exceedingly noteworthy distinction in change on DMI when dairy animals were nourished with urea-calcium hydroxide and urea-treated rice straw contrasted with the untreated treatment. Qingxiang (2002) additionally found that the treatment of urea and calcium hydroxide could somewhat expand DMI in dairy bovines when contrasted and untreated rice straw (Mesfin and Ktaw, 2010) likewise revealed that dairy cows nourished on urea treated wheat straw devoured altogether higher aggregate dry issue than those encouraged on untreated warmth straw.

The generally higher DMI of treated wheat straw contrasted with untreated implies that treating the wheat straw with urea and calcium hydroxide upgraded the viability of admission of the wheat straw. The expansion in treated wheat straw admission under the present investigation might be credited to its expanded degradability in the rumen as clarified by Smith (2001). Urea discharges smelling salts in the wake of dissolving in water. Then again, calcium hydroxide is a feeble soluble base operator with a low solvency in water and is utilized to enhance the use of straw and furthermore to supplement the apportion with calcium, which has been observed to be in a negative equalization in dairy cattle sustained just on straw. The mix of lime and urea builds degradability of wheat straw, clarifies the high DMI of treated wheat straw in the present examination (Wanapat et al., 2009).

4.3 Effects of single and continuous curing of wheat straw on milk production

The initial milk production of the 9 lactating dairy cows, in their mid-lactation, was such that their milk yield was very close to each other within ±0.05 kg/day which was not significantly different. The initial mean yield for each group of three cows that were randomly allotted to the different feeding groups was determined as A = 8.394 kg/day; B = 8.429 kg/day and; C = 8.387 kg/day. At the end of the experiment, the mean daily milk production by lactating dairy cows fed on differently treated wheat straw was determined and the results presented in Table 4.5.

Table 4.5: Mean daily milk (kg) of cows fed on cured and uncured wheat Straw

Treatment	Mean	Std. Deviation	Std. Error	95% Confidence Interval	
				Lower	Upper
Continuously Cured	10.255	1.4871	.1090	10.056	10.443
Single Batch Cured	9.958	1.247	.0914	9.780	10.124
Uncured	8.414	1.7881	.1311	8.175	8.667

The results at the end of the experiment revealed that average daily milk production increased by 22.14 % when the lactating cows were fed on continuously cured wheat straw, 18.57 % when fed on single batch cured wheat straw and an insignificant 0.12% when fed on uncured wheat straw. Analysis of variance results showed that milk yield significantly different with different feed treatments fed to the lactating dairy cows at $P < 0.05$ as shown in Table 4.6.

Table 4.6: ANOVA tests of between-subjects effects for milk yield

Dependent Variable: Milk Production

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	904.104[a]	6	150.684	111.034	.000
Intercept	50832.232	1	50832.232	37456.665	.000
Period	392.603	2	196.301	144.648	.000
Treatment	365.126	2	182.563	134.525	.000
Feeding Group	149.005	2	74.502	54.898	.000
Error	747.759	551	1.357		
Total	52462.670	558			
Corrected Total	1651.863	557			

a. R Squared = .547 (Adjusted R Squared = .542)

Milk yield of lactating cows also differed significantly by feeding period and feeding groups, confirming that changes in feed treatment induced significant effects on milk production due to the transition. The results of post-hoc analysis utilizing LSD test to determine where the significant differences in mean daily milk yield based on differences in wheat straw treatment were as presented in Table 4.7.

Table 4.7: LSD test results for wheat straw treatment and daily milk yield

Treatment	CC	SB	UN
CC		0.297*	1.841*
SB			1.544*
UN			

*. The mean difference is significant at the 0.05 level.

LSD post-hoc results revealed that there was a significant increase ($p<0.05$) in the milk yield of lactating dairy cows in their mid-lactation when the cows were fed on differently cured wheat straw. Most significant differences were realized when the lactating cows were fed on both continuously cured (1.84 kg) and single batch cured (1.54 kg) wheat straw compared to the period when the cows were fed on untreated wheat straw. The mean difference in daily milk yield between the periods when the lactating cows were fed on continuously cured and single batch cured wheat straw were significant with a marginal numerical mean difference of slightly over a quarter a kilogram of milk in favour of continuously cured wheat straw.
Mean daily milk production was not significantly affected by the feeding group and wheat straw treatment as shown in Figure 4.2.

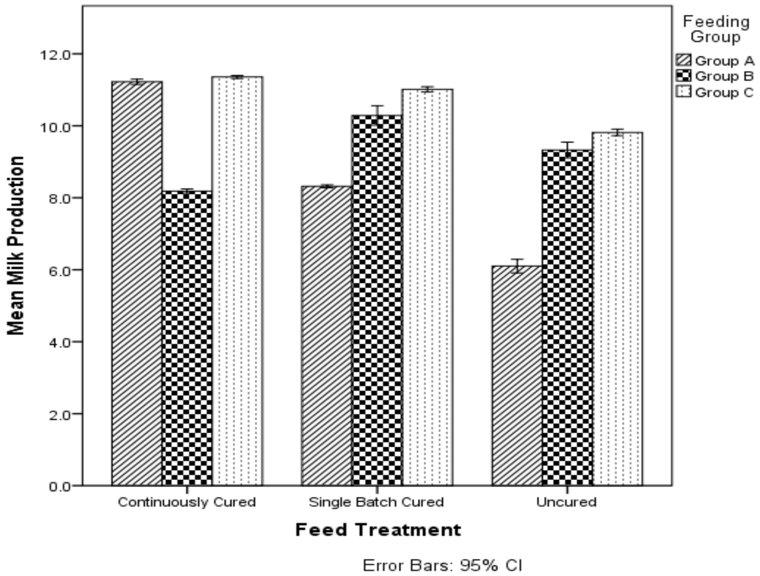

Figure 4.2: Effects of feeding group and Feed Treatment on milk Production

The foregoing results were consistent with the finding of Wanapat et al., (2009) who reported that treated straw with urea improve feed intake and digestibility, leading to an increase in milk yield (Mapato*et al.*, 2010) found an increase in milk yield when dairy cows were fed on urea treated straw. Mesfin and Ktaw, (2010) also reported similar results, that cows fed on the urea treated wheat straw based diet had higher mean daily milk yield than cows fed untreated wheat straw based diet.

The increase in milk yield when the lactating dairy cows were fed on cured wheat straw may be attributed to increased nutrient content in the treated wheat straw and higher intake and digestibility of the treated straws. This is because urea treatment increases crude protein through added non-protein nitrogen (NPN) and enhances digestibility through delignification. Increased milk yield may also be due to increased total DMI when urea treated straw was fed to the experimental lactating cows. Besides, urea treatment might have changed the intrinsic properties of wheat straw for higher energy yields might have been utilized for increased milk production.

5.0 Conclusion and Recommendations

5.1 Conclusion

The objectives of this study were to determine the effects of urea treatment of wheat straw on nutrients available in the feeds and determine the effects of a single batch and continuous curing of wheat straw on dry matter intake and daily milk production of lactating dairy cows. First, with regard to nutrients availability, the study concludes that urea treatment of wheat straw resulted in increased crude protein by 10 % units, an increase in acid detergent fibre content by 15 % units and a reduction in neutral detergent fibre content by 13 % units.
Secondly, with respect to the effect of effect of a single batch and continuous curing of wheat straw on dry matter intake by lactating dairy cows, the study concludes that there is no statistically significant difference in dry matter intake of wheat straw between single batch and continuous curing of wheat straw. However, urea

treatment of wheat improves dry matter of wheat straw since there were significant differences in the amount of dry matter intake between treated and untreated wheat straw.

Finally, in terms of the effect of a single batch and continuous curing of wheat straw on daily milk production of lactating dairy cows, it is concluded that urea treatment increases average daily milk production increased by approximately 20 %. However, the average differences are not statistically significant whenever the lactating cows are fed on continuously cured and single batch cured wheat straws.

5.2 Recommendations

Urea treatment of wheat straw improves the nutritive value, digestibility and milk production of lactating dairy cows. It is therefore recommended that dairy farmers should endeavour to utilize this technology to improve not only feed utilization efficiency of their dairy stock but also milk production which will ultimately lead to economic efficiency and higher profit margins.

The non-significant differences between dry matter intake and average daily milk production of lactating cows when fed on either single batch of continuously cured wheat straw serves to advise dairy farmers that they should judiciously adopt continuously curing model which reduces the time taken to have the cured feeds available for consumption by dairy cattle.

References

[1]. Babcock, B. A., Hayes, D. J., & Lawrence, J. D. (2008). *Using distillers grains in the US and international livestock and poultry industries*. Midwest Agribusiness Trade Research and Information Center. Retrieved from lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1000&context=card_books

[2]. Bhatta, R., &Jakhmola, R. C. (2005). Effect of feeding complete feed block containing Prosopis cineraria leaves and polyethylene glycol (PEG)-6000 on nutrient intake, its utilization, rumen fermentation pattern and rumen enzyme profile in kids. *Journal of the Science of Food and Agriculture*, *85*(11), 1788-1794. Retrieved from onlinelibrary.wiley.com/doi/10.1002/jsfa.5703/pdf

[3]. Blümmel, M., Samad, M., Singh, O. P., &Amede, T. (2009).Opportunities and limitations of food–feed crops for livestock feeding and implications for livestock–water productivity. *The Rangeland Journal*, *31*(2), 207-212. Retrieved from https://cgspace.cgiar.org/handle/10568/146

[4]. Borba, A. E. S., &Ramalho Ribeiro, J. M. C. (1994).Valornutritivo do azevémverde e ensilado, emtrêsfases de desenvolvimento, Rev. *Portuguesa Zoot*, *1*, 63-75. Retrieved from https://pdfs.semanticscholar.org/40d3/8d9cf025572826d933f3e023c5304e4245a3.pdf

[5]. Cromwell, G. L., Kellems, R. O., & Church, D. C. (1998).Feeding swine. *Livestock Feeds and Feeding. 4th ed. RO Kellems and DC Church, ed. Prentice-Hall, Upper Saddle River, NJ*, 354. Retrieved from nutrition.ansci.illinois.edu/sites/default/files/SwineFocus002.pdf

[6]. da Silva, M. J. (2015). Manihotappanii (Euphorbiaceaess), a new species from Brazil, and a key to the species with unlobed or very shortly lobed leaves. *Systematic Botany*, *40*(1), 168-173. Retrieved from www.bioone.org › All Titles › Systematic Botany › Feb 2015

[7]. Del Coco, V. F., Córdoba, M. A., Bilbao, G., de Almeida Castro, P., Basualdo, J. A., &Santín, M. (2014).First report of Enterocytozoonbieneusi from dairy cattle in Argentina. *Veterinary parasitology*, *199*(1-2), 112-115. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/24126086

[8]. Fazaeli, H., Azizi, A., &Amile, M. (2006). Nutritive value index of treated wheat straw with Pleurotus fungi fed to sheep. *Pak. J. Biol. Sci*, *9*(13), 2444-2449. Retrieved from https://scialert.net/fulltext/?doi=pjbs.2006.2444.2449

[9]. Firkins, J. L., & Yu, Z. (2015). RUMINANT NUTRITION SYMPOSIUM: How to use data on the rumen microbiome to improve our understanding of ruminant nutrition 1 2. *Journal of animal science*, *93*(4), 1450-1470. Retrieved from https://academic.oup.com/jas/article-abstract/93/4/1450/4703352

[10]. Frost, S. (1994). Broinowski versus Passmore: a dialogue of our times. *Continuum*, *8*(2), 20-48. Retrieved from wwwmcc.murdoch.edu.au/readingroom/vol1to8.html

[11]. Gado, H. M., Salem, A. Z. M., Odongo, N. E., &Borhami, B. E. (2011). Influence of exogenous enzymes ensiled with orange pulp on digestion and growth performance in lambs. *Animal Feed Science and Technology*, *165*(1-2), 131-136.

[12]. Genc, Y., Oldach, K., & McDonald, G. K. (2010). Sodium exclusion QTL associated with improved seedling growth in bread wheat under salinity stress. *Theoretical and Applied Genetics*, *121*(5), 877-894. Retrieved from agris.fao.org/agris-search/search.do?recordID=US201301881045

[13]. Garg, R., &Bhanderi, M. (2011).Enhancing livestock productivity through balanced feeding. In *14th biennial Conference of the Animal Nutritional Society of India, Pantnagar University of Agriculture and Technology, Pantnagar, UttraKhand, India*. Retrieved from https://www.researchgate.net/profile/Rita_Raghuvanshi

[14]. Grabber, J. H. (2005). How do lignin composition, structure, and cross-linking affect degradability? A review of cell wall model studies. *Crop Science*, *45*(3), 820-831. Retrieved from https://naldc.nal.usda.gov/download/3267/PDF

[15]. Hadjipanayiotou, M., & Economides, S. (1997). Assessment of various treatment conditions affecting the ammoniation of long straw by urea. *Livestock Research for Rural Development*, *9*(5). Retrieved from www.fao.org/ag/aga/agap/frg/lrrd/lrrd9/5/milt952.htm

[16]. Highstreet, A., Robinson, P. H.(2010). Response of Holstein cows to replacing urea with with a slowly rumen released urea in a diet high in soluble crude protein. *Livestock Science*, *129*(1-3), 179-185. Retrieved from www.livestockscience.com/article/S1871-1413(10)00039-9/abstract

[17]. Huhtanen, P., Rinne, M., &Nousiainen, J. (2007). Evaluation of the factors affecting silage intake of dairy cows: a revision of the relative silage dry-matter intake index. *Animal*, *1*(5), 758-770. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/22444476

[18]. Jabbar, M. A., (2009). Simplification of urea treatment method of wheat straw for its better adoption by the farmers. *South African Journal of Animal Science*, *39*(1), 58-60. Retrieved from ww.scielo.org.za/scielo.php?script=sci_arttext&pid...15892009000500014

[19]. Kashongwe, O. B., &Osoo, J. O. (2014).Improving the nutritive value of wheat straw with urea and yeast culture for dry season feeding of dairy cows. *Tropical animal health and production*, *46*(6), 1009-1014. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/24817370

[20]. Lara-Flores, M. (2017). The use of lactic acid bacteria isolated from intestinal tract of Nile tilapia (Oreochromisniloticus) as growth promoters in fish fed low protein diets. *Submission article platform-Latin American Journal of Aquatic Research*, *41*(3). Retrieved from www.lajar.cl/pdf/imar/v41n3/Articulo_41_3_12.pdf

[21]. Lohan, M. C. (2005). Iron and zinc enrichments in the northeastern subarctic Pacific: Ligand production and zinc availability in response to phytoplankton growth. *Limnology and Oceanography*, *50*(5), 1427-1437. Retreived from https://onlinelibrary.wiley.com/doi/pdf/10.4319/lo.2005.50.5.1427

[22]. Mahesh, M. S., &Mohini, M. (2013). Biological treatment of crop residues for ruminant feeding: A review. *African Journal of Biotechnology*, *12*(27). Retrieved from www.academicjournals.org/article/article1380733375_Mahesh%20and%20Mohini.pdf

[23]. Mapato, C., Wanapat, M., &Cherdthong, A. (2010).Effects of urea treatment of straw and dietary level of vegetable oil on lactating dairy cows. *Tropical animal health and production*, *42*(8), 1635-1642. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/20524063

[24]. Mesfin, R., &Kitaw, G. (2010). Effect of feeding urea treated wheat straw based diet on biological performances and economic benefits of lactating Boran-Friesian crossbred dairy cows. *Livestock Research for Rural Development*, *22*, 12. Retrieved from www.lrrd.org/lrrd22/12/mesf22231.htm

[25]. Pedersen, M., & Meyer, A. S. (2010).Lignocellulose pretreatment severity–relating pH to biomatrix opening. *New biotechnology*, *27*(6), 739-750.Retrieved from ating pH to biomatrix opening.

[26]. Plata, F. P., &Bárcena-Gama, J. R. (1994). Effect of a yeast culture (Saccharomyces cerevisiae) on neutral detergent fiber digestion in steers fed oat straw based diets. *Animal Feed Science and Technology*, *49*(3-4), 203-210.

[27]. Qingxiang, M. (2002).Composition, nutritive value and upgrading of crop residues. *FAO Animal Production and Health Paper (FAO)*. Retrieved from www.fao.org/3/a-i7779e.pdf

[28]. Ray, S., Golden, T., & Ray, A. (1996). Maternal Effects of the short integument Mutation on Embryo Development in Arabidopsis. *Developmental biology*, *180*(1), 365-369. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/8948599

[29]. Sawar, M., & Muhammad, A. (2006).Application of H2O2, UV & UV/H2O2 systems for the post treatment of biotreated industrial wastewater. *Environ Agric Food Chem*, *5*(6), 1575-82. Retirved from www.bioline.org.br/pdf?st11035

[30]. Singh, S., Chander, S., & Saini, J. S. (2011). Heat transfer and friction factor correlations of solar air heater ducts artificially roughened with discrete V-down ribs. *Energy*, *36*(8), 5053-5064. Retrieved from https://ideas.repec.org/a/eee/energy/v36y2011i8p5053-5064.html

[31]. Smith, K. A., & Williams, A. G. (2016). Production and management of cattle manure in the UK and implications for land application practice. *Soil Use and Management*, *32*, 73-82. Retrieved from https://onlinelibrary.wiley.com/doi/abs/10.1111/sum.12247

[32]. Sundstøl, F., & Owen, E. (Eds.).(1984). *Straw and other fibrous by-products as feed*. Amsterdam: Elsevier. Retrieved from https://lib.ugent.be/en/catalog/rug01:000222786

[33]. Trach, N. X. (1998). The need for improved utilisation of rice straw as feed for ruminants in Vietnam: An overview. *Livestock Research for Rural Development*, *10*(2), 1-14.

[34]. Wanapat, M., Polyorach, S., Boonnop, K., Mapato, C., &Cherdthong, A. (2009). Effects of treating rice straw with urea or urea and calcium hydroxide upon intake, digestibility, rumen fermentation and milk yield of dairy cows. *Livestock Science*, *125*(2-3), 238-243. Retirved from www.academicjournals.org/article/article1380886066_Wanapat%20et%20al.pdf

[35]. Youssef, M. K., &Barbut, S. (2011). Fat reduction in comminuted meat products-effects of beef fat, regular and pre-emulsified canola oil. *Meat Science*, *87*(4), 356-360.Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/21146328

[36]. Zijlstra, R. T., &Beltranena, E. (2013).Swine Nutrition.USA:John Wiley & Sons, İnc.