Theme 2: Forage conservation

TREATMENT OF STRAW WITH UREA

(Level 1)

Topic	Training & information Content
2.1	Fodder conservation and storage
2.2	Estimating ideal time of harvesting
2.3	Guideline for silage making
2.4	Fermentation process in silage
2.5	Treatment of straw with Urea
2.6	Making of urea/molasses/mineral lick
2.7	Management of silage pit (feed out)
2.8	Estimating fodder supplies for dry season feeding & planning of feeding management

1. You will learn about (learning objectives):

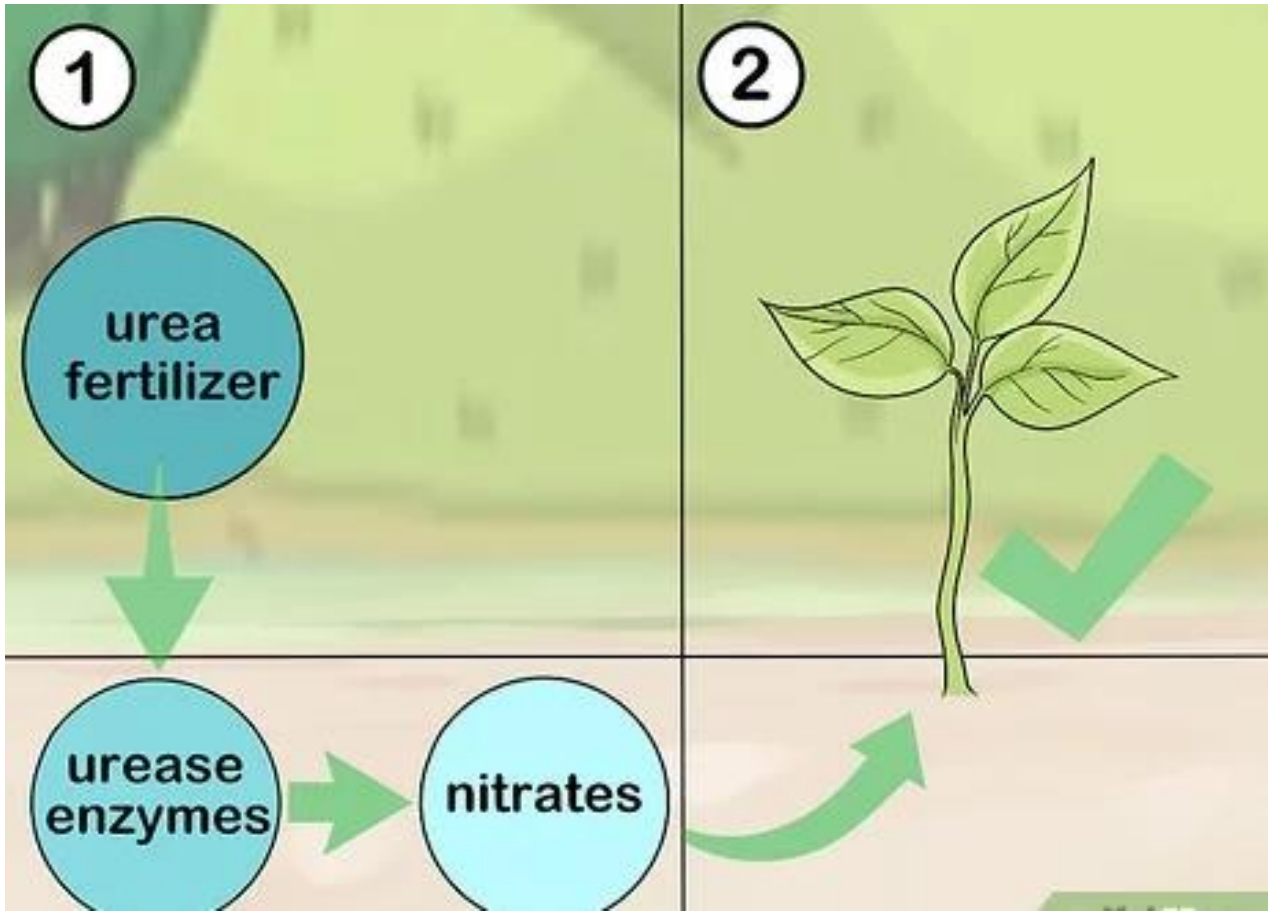
- ❑ Benefits of straw treated with urea in feeding a dairy cow.
- ❑ Factors affecting treatment of straw with urea.
- ❑ How to treat straw with urea.
- ❑ Different types of straw/stover that can be improved.

2. Introduction

- Urea as a synthetic fertilizer can be used in the treatment of straws practically in the farm.
- The procedure however has some rules on treatment of straws regarding concentration of urea, duration of treatment, amount of water to be used and way of stacking/heaping/piling.

3. What is Urea?

- Urea is a white crystalline solid organic compound, widely used as a synthetic nitrogen fertilizer.
- Urea is easily broken down to ammonia by urease enzyme that is produced by soil or rumen microorganisms.



How urea is broken down in the soil for use by plants. Same procedure applies in the rumen.

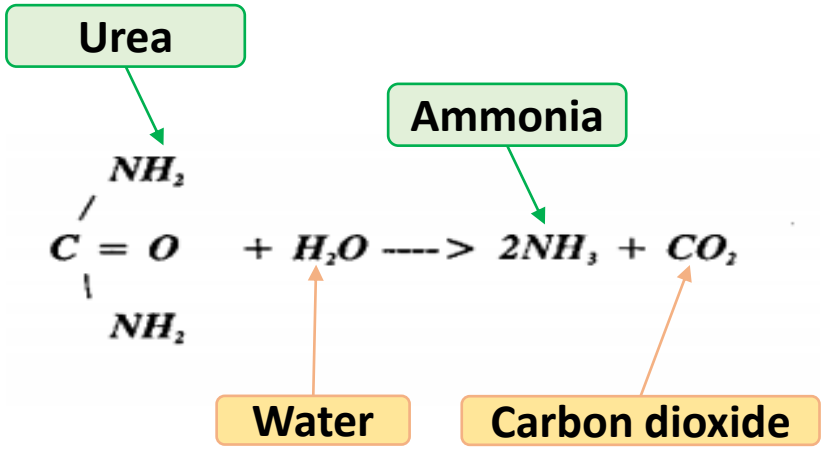
3.1 Urea Cont'd…

- Urea is a non-protein nitrogen (NPN) compound. This means the nitrogen portion of urea is used as a building block for the production of microbial protein by rumen microorganism.
- Excessive amounts of urea and/or insufficient mixing of urea with the straws can be dangerous/lethal for cows when eating the mixture.

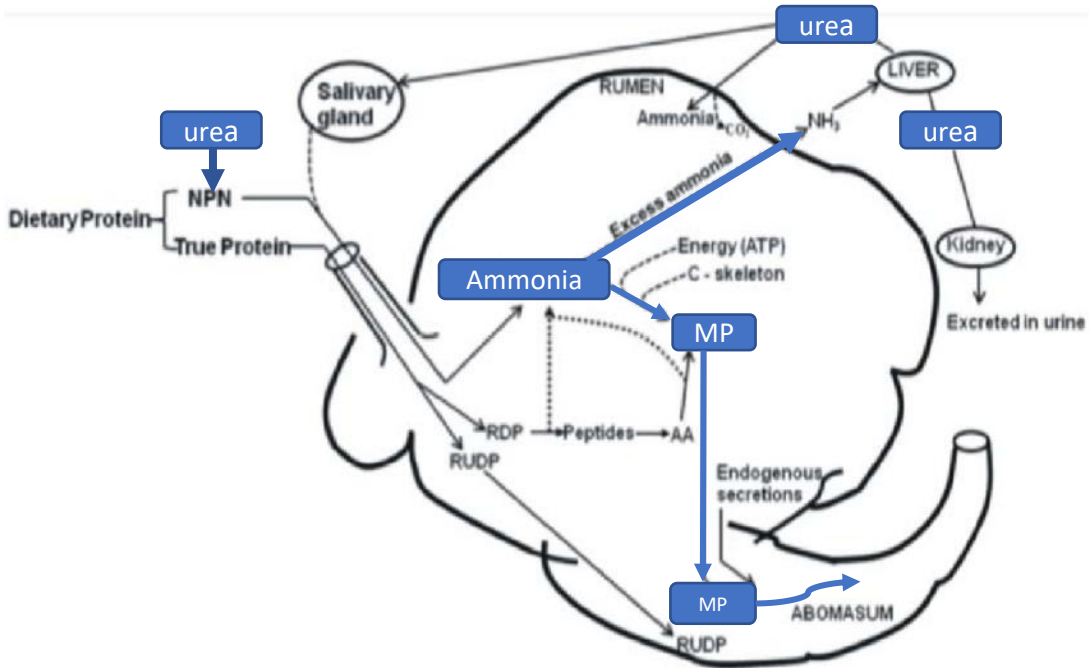
4. Why straws are treated with Urea

How Urea is broken down in the rumen

- Ruminants (rumen microbes) convert urea to protein, producing ammonia and carbon dioxide.
- The ammonia released is used in the production of microbial protein (protein source for host ruminant) and also in the liver where it is detoxified and excreted in urine.



Urea (NPN) in the rumen



MP→ Microbial protein

- When too much ammonia escapes the rumen, the capacity of liver for excretion can be overwhelmed and a toxicity can occur. Therefore the right concentration of urea is used.

5. Urea utilization in the rumen

- The level of bacterial action is determined by the urea fermentation potential (UFP) of the total digested feed.

- In summary, feedlot rations high in energy will usually have the best potential for the use of urea as a protein source. However, combining several feeds that dilute urea as a protein source can result in a good protein supplement for cattle on high energy diets.

Source: https://extension.psu.edu/urea-in-beef-cattle-rations

6. Benefits of treating straws with urea

- Increases nitrogen content, improved palatability and digestibility of straws.
- The treated straw is softer than untreated straws.
- Increased feeding intake.

7. Factors affecting treatment of straws with urea

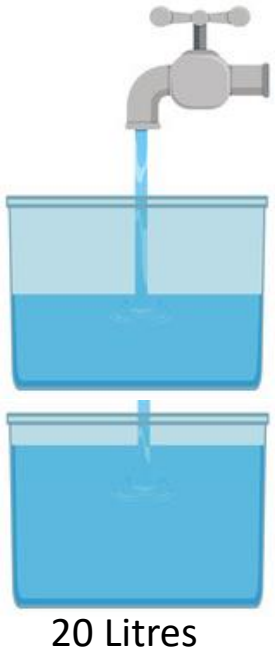
- Various factors determining the nutritional quality of straw treated with urea;
  i. Urea concentration.
  ii. Water requirement.
  iii. Methods of applying the urea/water mixture (spraying).
  iv. Compaction of the stack.
  v. Duration of anaerobic period.
  vi. Type of straw/stover used.
  vii. Storage method.

8. Urea concentration

- An amount of 4 kg of urea is effective to treat 100 kg of air dry straw/stover.
- Levels lower than 3.5 kg may not produce sufficient ammonia for effective treatment while levels above 4 kg do not further increase straw quality.

9. Water requirement

- About 50-60 litres of water can be used to dissolve 4 kg of urea and to spray it over a layer of 100 kg of air-dried straws.



10 Litres
(potentially filled to
20 litres)

20 Litres

20 Litres

+

4 Kgs Urea

10. Method of spraying

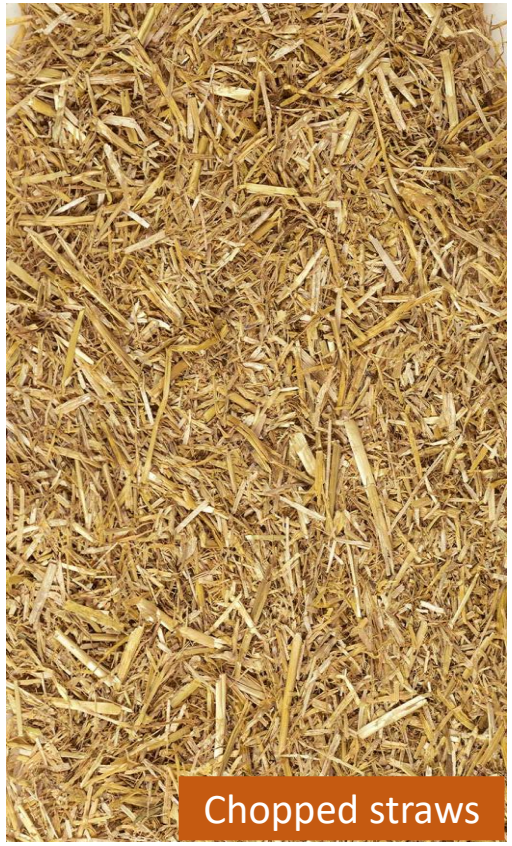
- For spraying of the urea solution over a layer of straw, a watering can or a back spray can be used to achieve uniformity.
- Use of a broom and a bucket has also been found to be effective.
- Spread about 20-25cm of straw on the ground and spray the urea solution on it and mix up the straw.
- Spread the second layer and repeat this process.

Watering can

11. Compaction of the stack

- The repeated process of adding 100kg of straw and spraying with urea-water is to make a stack/heap. A compact stack has two advantages.
  - The ammoniation process is better.
  - Less chances of mold growth that cause spoilage.
- It is easy to compact straws chopped in smaller sizes than long straws.
- After successful compaction, cover and seal the stack air tight with a plastic sheet to protect it from air and moisture entering.


Long straws


Chopped straws

12. Addition of molasses

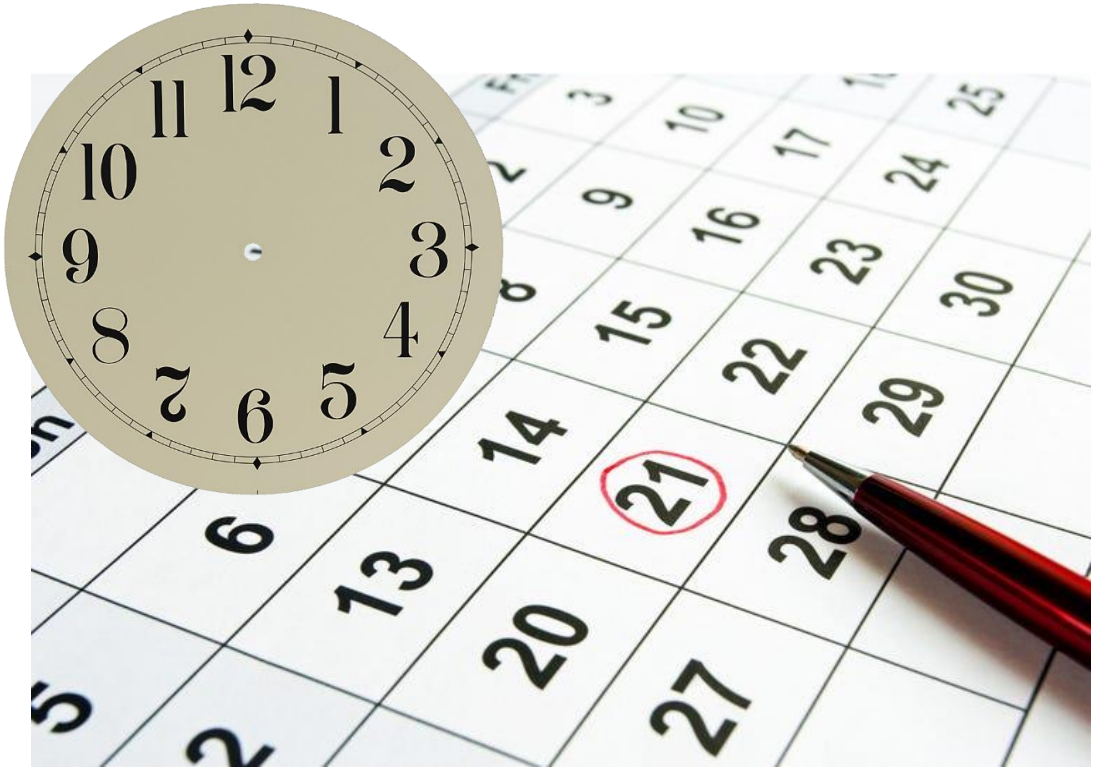
- In another processes, molasses is used with urea and water.
- For 100 kilograms of straw, 4 kilograms urea is mixed with 100 litres of water and 10-15 kilogram molasses is added to this mixture, then sprayed following the process/procedures explained earlier.

Effect of addition of molasses

- Without molasses: Protein content in the straw increases when only urea is used.
- With molasses: In addition to increase the protein content, energy content is also increased.

13. Duration of treatment

- The duration of anaerobic period can be variable, depending on the region and season.
- The anaerobic period may vary from 1-4 weeks. In a warm climate like in the tropics, e.g. East Africa region, 7-14 days is effective.
- The local conditions as well as the scale of clamp/silo also affect the duration. However more time is required with lower environmental temperatures.



Take note of calendar days

14. Type of crop residues treated

- The poorer the initial quality of the straw/stover, the higher the effect of the treatment with the water-urea mixture.
- Stover, i.e. coarse straw has a generally higher initial nutritional quality than slender stemmed straw, and they will benefit less from treatment.
- If moldy straw/stover are used, expect a reduction rather than an improvement in quality of straws.

15. Storage method

- Sealing can be done with materials like polythene.
- Farmers can also use various storage structures like earthen pits, lined and covered with polythene, clamps with cemented floor, cemented silos, and containers.

16. Effect of treatment on straw quality

- Urea treatment improves digestibility, intake and crude protein content of the straw.

Nutritious Value Increase by enrichment:

Kinds of the Straw	Proteins	
	Before enrichment	After enrichment
Wheat Straw	2.8%	6.6%
Rice Straw	6.1%	13.5%
Maize Stems	10.7%	21.2%

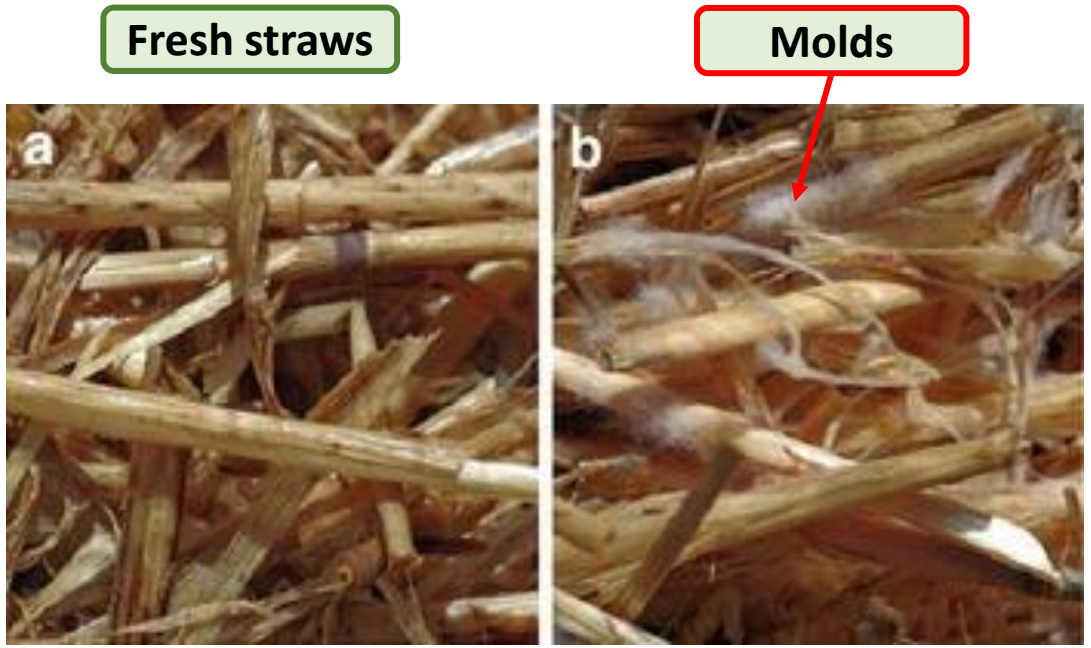
Source: http://uvas.edu.pk/doc/advisory_services/Dairy-farming/english/3-wheat-straw.pdf

17. Treated versus Untreated straws

- Dung: In some cases, the dung of animals on treated straws gets slightly stickier.
- Milk: No negative residues of treated straw rations are known to enter milk.
- Toxins: Provided the straw is not moldy, there are no reported cases of more mycotoxin.
- Urea toxicity due to feeding treated straw is unlikely or even impossible if urea and straws are well mixed.

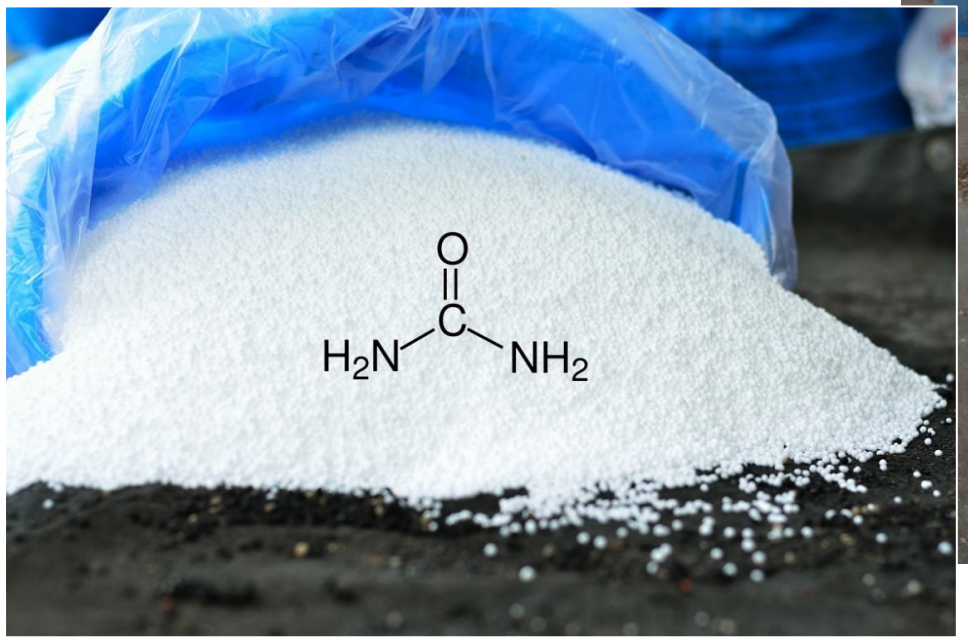
18. The major constraints of urea treatment

- Despite these beneficial effects, continued use of urea treatment face constraints like:
  - Sticky dung produced by the animals.
  - Pungent smell from ammonia.
  - Fear of fungal spoilage of straw in open stacks.
  - Toxicity if urea is not well mixed with water/straw.
  - Toxicity if fed in excess.



19. Feeding urea treated straws

- Feeding treated straws alone does not meet the nutritional requirements of a cow. Add more nutritive forage species/varieties in the cow's ration (to make a total mixed ration).



20. Take home message/Summary

1. Urea treatment improves the nutritive value of straws in terms of crude protein, palatability, intake and digestibility.
2. The effectiveness of the urea treatment depends on a number factors, some governed by local conditions.

Watch video:

How to feed cows with urea treated maize stover.

https://www.youtube.com/watch?v=rZCiooflCHQ

- END -