



# **The Liquid Advantage**

## **An Introduction to Liquid Supplements For Beef Cows**





Spurred by ongoing industry advances, increased adoption of supplementation programs, and the perennial need to maximize net returns while effectively using available roughages, liquid feed use has seen dramatic growth in the beef sector.

Liquid supplements are standard components of mixed rations fed to thousands of drylot beef and dairy animals. Producers appreciate the advantages of improved palatability and diet uniformity, and reductions in ration sorting and dustiness. Liquid supplements are nutrient-dense, and serve as excellent carriers for additives.

Traditional liquid feeds, delivered in self-fed lick wheel feeders or directly applied to harvested forages, offer their own set of nutritional, practical, and economic benefits to cow/calf producers.

Quality Liquid Feeds, Inc. (QLF) has been a pioneer and leader in the liquid feed supplement area for over 30 years, offering their customers consistent, scientifically-formulated feeds for a wide range of animals, diets, and environments.

# Liquid Supplements

# ADVANTAGES of Liquid Supplements

More and more feed dealers and cow/calf producers are opting to use liquid feed supplements. Their primary reasons for moving to liquids are as diverse as their operations, but they all enjoy a wide range of benefits.

- ◆ **Increased forage intake and utilization**
- ◆ **Convenience**
- ◆ **Economics**
- ◆ **Palatability**
- ◆ **Less Feed Waste**
- ◆ **Reduced Supplement Shrink**
- ◆ **Less Ration Sorting**
- ◆ **Decreased Labor Requirements**
- ◆ **Enhanced Soluble Nitrogen Utilization**
- ◆ **Superior Phosphorus Source**
- ◆ **Greater Vitamin Stability**
- ◆ **Lower Equipment Costs**
- ◆ **Superior Additive Carrier**
- ◆ **Improved Ration Uniformity**
- ◆ **Reduced Ration Dustiness**
- ◆ **Ease of Fat Addition**
- ◆ **Increased Safety Margin**



# Applications

## LICK TANKS

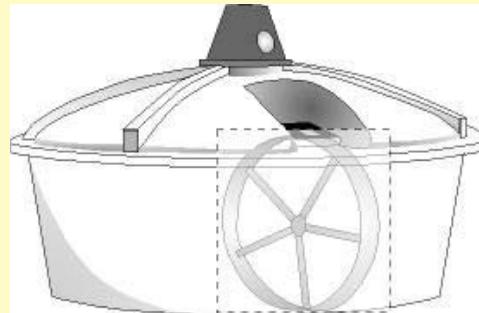
Lick-wheel tank feeders are designed specifically for self-fed liquid supplements. Typically made of polyethylene, they are covered to maintain product quality. Cattle access the supplement by licking a rotating wheel which is immersed in the liquid. The broad, slightly rough surface of the wheel is coated by the “liquid” (which actually will contain 60-70% dry matter) as it is turned by a cow’s tongue, bringing feed up to the animal.

A lick tank will typically have 2 or 4 lick wheels. Producers should allow 1 wheel per 20-25 head of cattle. It is critical that cattle “eat” (lick) rather than drink liquid feeds. Cattle are able to direct most of the fluids they drink directly to their true stomach, by-passing the rumen. To be used effectively, liquid supplements need to flow with the rest of the diet, and be subject to ruminal fermentation. This occurs when lick tanks are used.

A dealer should work with new customers to determine optimal lick tank placement. Dealers and QLF representatives can help monitor actual intake, and take steps to encourage increased or decreased consumption if necessary. Additional product will be delivered directly to the lick tank, freeing the producer from supplemental feeding chores and related expenses.

### THE LICK TANK ADVANTAGE

- Several small meals over the course of the day**
- Opportunity for less dominant animals to come to the feed unchallenged**
- Virtually no waste**
- Intake can change as conditions dictate**
- Diverse animals in a herd can match intake to individual needs.**
- No bags...No trash...No tubs to clean or dispose of**

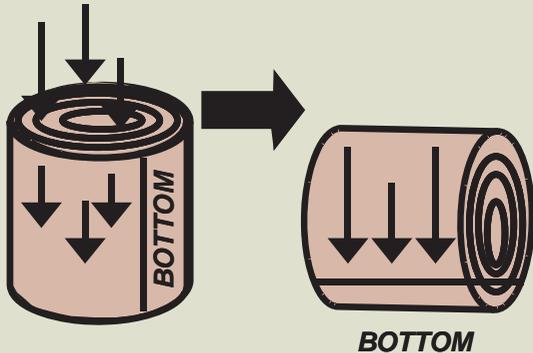


# HAY TREAT

Large round bale treatment offers an alternative delivery method for liquid supplements. Product is poured or pumped on, or probed into, the top of an upturned bale, and allowed to soak through the bale. Nutritional value of the hay is significantly enhanced, and cattle can be expected to consume and digest more of the treated forage. Some producers develop a process for pouring bales just prior to feeding; the more common approach is to treat a large number of bales at once.



- 1) Tilt the bale on end, using a bale fork, front-end loader, etc.
- 2) Evenly pour or pump QLF supplement on the top surface
  - Suggested application rate is 7 to 10% by weight (7 to 10 gallons per 1000 lb bale)
  - Leave an untreated strip about 12" wide along the 'bottom' edge
- 3) Allow to sit until liquid has penetrated through
  - Consider placing 1 or 2 bales on plastic or paper, to time seepage for these particular bales
  - Time will vary with bale density
- 4) Tilt bales back into original position



Before		After
1,000	Weight of Bale, as-is	1,100
5%	Crude protein % DM	8%

**Plus:**

- improved digestibility
- 24 pounds added sugar
- phosphorus
- vitamins
- trace minerals

Treating with QLF liquid supplements allows animals to more effectively utilize available low-quality forages, much like the application of anhydrous ammonia does. But, in contrast to the ammoniation process, bale pouring involves no hazardous materials, no bale stacking, no plastic, and no nutrient (nitrogen) vaporization loss.

# MIXED RATIONS

For producers in a position to offer at least some of their cows' diet as a bunk-fed mix, liquid supplements offer special advantages. Adding liquid supplements to a bunk-fed mix allows incorporating a broad range of supplemental nutrients and additives in liquid form while improving palatability, reducing dust and fines, improving stability and uniformity of the mix, and reducing ration sorting.

# Focus on Lick Tanks

Lick tanks are the most common method of delivering liquid supplements to beef cows. They can be effective, convenient, and economical. Records show that cows adjust their intake to compensate for changing forage quality and availability.

## Average Lick Tank Consumption

*Actual Multi-year Records (lb/head/day)*

<u>Location</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug</u>	<u>Sept</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
Tennessee	1.63	1.58	1.47	1.14	.41	.40	.41	.50	.87	1.11	1.39	1.57
Wisc./Minn.	1.93	1.54	1.41	2.03	.22	.36	.49	.62	.77	2.26	2.33	1.51

## NUTRITION

QLF beef cow supplements are formulated to complement available forages. When managed properly, offering these feeds in free-choice lick tanks optimizes forage use, and helps cattle maintain condition and level of performance.

### FORMULATING A LICK TANK SUPPLEMENT

#### Base Ingredients

Unlike some dry feeds, QLF liquid products don't contain any "fill" or low-value carriers. Every ingredient is a significant contributor to the supplement's nutrient profile.

Most liquid feeds are molasses-based. QLF is the largest user of domestic cane molasses, ensuring quality, consistency, and high sugar content in our primary ingredient. Other liquid co-products, such as whey and corn processing byproducts, may be substituted for a portion of the molasses. These ingredients may be used to fine tune physical characteristics, specific nutrient levels, and/or handling properties of the final product.

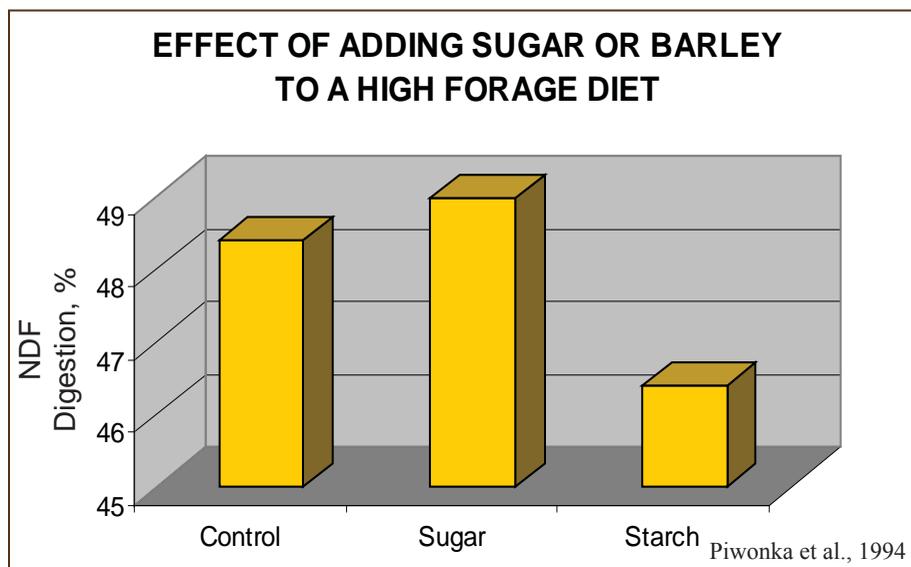
These high-inclusion ingredients provide readily-available energy (sugar) to stimulate ruminal fermentation, ensure a base level of natural protein, contain significant levels of some essential minerals, are responsible for the palatability of the feed, and largely determine the physical and handling characteristics of the finished product.



Molasses enhances fiber digestion. Research done at Louisiana State University clearly showed the positive impact of molasses on rumen function, where cattle on a low quality forage diet received increasing levels of supplemental molasses.

BEEF STEERS, RICE STRAW-BASED DIET		
Percent <u>Molasses</u>	Dry Matter <u>Digestion</u>	Crude Fiber <u>Digestion</u>
0	38.6	41.6
5	43.1	47.5
10	45.3	49.8
20	48.7	49.6

White et al., 1973



On the other hand, moderate amounts ( $\geq 4$ lb) of grain can inhibit forage utilization. Starch, unlike sugar, cannot effectively meet the energy needs of the fiber-digesting microbes.

### Crude Protein

Supplemental protein is often the key to improving forage utilization and overall cowherd nutrition. In particular, cows receiving forage-based diets have a dietary need for DIP (Degradable Intake Protein); that is, crude protein (ammonia-yielding compounds) that can be readily broken down in the rumen. As liquid supplements provide this source of ruminal ammonia, microbial fermentation is enhanced. The net results include greater flow of microbial protein to the small intestine, increased forage intake, and increased supply of energy and other nutrients from the roughage portion of the diet.

Many liquid supplements include urea as a highly-concentrated, economical source of DIP. Because urea is 46% nitrogen, it is the equivalent of being 281% crude protein (CP). Using such a concentrated protein source at minimal inclusion rates maximizes the use of nutrient-dense base ingredients.

Natural protein in liquid feeds usually comes from the base ingredients, and possibly inclusion of protein sources such as fish meal. Corn steepers may be as high as 20% CP, but the low dry matter and sugar content of this co-product limits inclusion rates. Much of the protein in fish meal is "by-pass" rather than DIP, so is not as effective in stimulating intake and utilization of low-quality forages as more soluble nitrogen sources.

Liquid feeds are ideal carriers for urea, enhancing utilization more effectively than traditional dry supplements.

- Base ingredients (primarily molasses) supply the readily available sugar energy and other nutrients the microbes need.
- Urea bound to phosphoric acid, as that found in QLF “Timed Release”™ products, is broken down to ammonia over a longer period of time than straight urea.
- As fermentation (digestion) is enhanced, rumen pH is optimized, encouraging efficient fiber digestion and keeping free ammonia in a form that will remain in the rumen.
- Cows receive daily lick tank supplementation from several periodic “meals,” or trips to the tank, avoiding large “doses.”
- Molasses overcomes potential urea palatability problems, so animals are willing to consume the intended amount.
- Proper ruminal N:S ratio is readily maintained, providing microbes with the sulfur building-blocks they need to effectively convert urea into protein.

## ROLE OF NPN

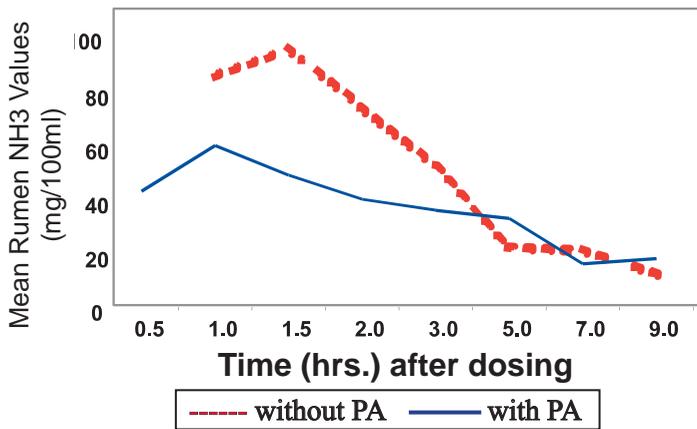
In the rumen, NPN (non-protein nitrogen) is broken down, yielding ammonia. Dietary sources of NPN include urea, biuret, APP, and glutamic acid fermentation product. The ruminal microbes can -- and in most fiber-digesting species, prefer to -- use ammonia as their source of nitrogen (N). This ammonia-N requirement is actually met more efficiently through the simple breakdown of NPN versus degradation of more complex proteins. As the microbes take in nutrients, grow, and reproduce, the N is incorporated into their cell structures as microbial cell protein. The net benefit to the animal comes when millions of these bacterial and protozoal cells flow with the digesta to the small intestine, where the high-quality microbial protein is digested, and its amino acids and peptides absorbed.

If microbial utilization lags behind supply, rumen ammonia concentrations will naturally rise. Eventually, conditions may lead to the movement of excess ammonia into the bloodstream, and then to the liver for conversion to urea. This urea may recycle back to the rumen, via blood and saliva, or be excreted in the urine. This cycle is costly to the animal from an energy standpoint. Efficient utilization of urea occurs when there is enough microbial growth to utilize all of the available ammonia.

This efficiency can also be aided by providing all other microbial nutrients (in particular, energy) in adequate amounts, so a shortage of something other than N doesn't slow growth; and, slowing the release of ammonia from urea in the first place. QLF liquid feeds do both. As needed sugar energy is provided, fermentation is enhanced, and microbial demands for ammonia increased. And urea breakdown is slowed when it is bound to phosphoric acid prior to feeding (*see the charts on the next page*). Lower ruminal pH, which accompanies improvements in fiber digestion, also slows the movement of ammonia out of the rumen.

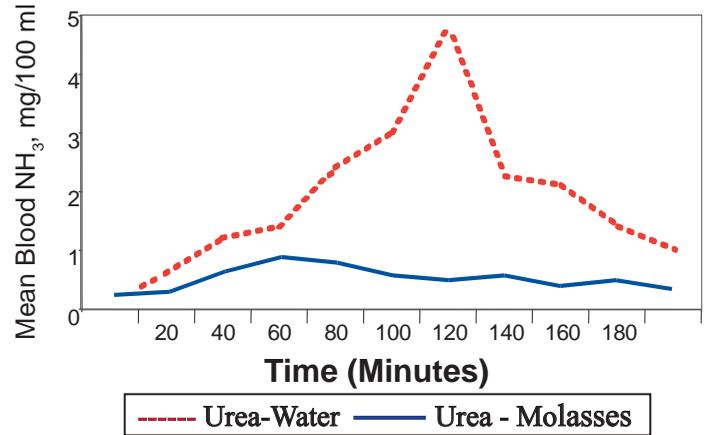


**Mean Rumen Ammonia Values after Dosing With Urea (15 g per 100 lbs. BW), With and Without Phosphoric Acid (PA)**



*Perez et al., 1967*

**Mean Blood Ammonia Values after Dosing With Urea (27 g per 100 lbs. BW), Using a Water or Molasses Carrier**



*Lichtenwalner and McCain, 1978*

### **Minerals and Vitamins**

While the liquid “protein” supplement should NOT be considered a substitute for providing a good mineral mix, cattle do receive significant levels of many essential minerals and vitamins at the lick tank. Incorporating dietary minerals in the liquid protein supplement can help ensure consumption by cattle that might not take, or get, a turn at the mineral feeder.

Many forage-based diets are particularly lacking in phosphorus. The phosphoric acid used in liquid feeds is a highly available source of supplemental P. Phosphoric acid also helps regulate intake, and lower the viscosity of high-molasses formulas. And by lowering pH, it aids in product preservation.

A critical concern in mineral nutrition is bioavailability, or how much of the dietary supply will actually be absorbed by the animal. In the case of phosphorus, environmental concerns about minimizing the levels in manure may be nearly as pressing as meeting the needs of the cow. Only about 75% of the P in dicalcium phosphate is absorbed by the animal, compared to 90% of the P in phosphoric acid. If the P requirement is met with phosphoric acid, rather than DiCal or MonoCal, the amount of supplemental phosphorus excreted by the animal **is decreased 67%**.

All molasses products will naturally contain relatively high levels of potassium. Other trace minerals critical to health and reproductive performance are added to the feed, as are stable forms of vitamins A, D, and E.

Sources of trace minerals can vary significantly in availability; in general, organic forms are more available than inorganic, and sulfates more available than oxides. Feed tags will list which ingredients are used to provide various minerals. Most standard QLF supplements contain sulfate forms of copper, manganese, zinc, and cobalt, with optional organics available for stressed or high-demand cattle. Iodine is supplied in organic (EDDI) form, and selenium as sodium selenite.



## **Fat**

Liquid supplements offer a simple, convenient way to add effective levels of dietary fat, which may have a positive impact on beef cattle performance. Fats are highly concentrated energy sources, but the small total amount of fat provided by typical intakes of liquid supplement would not have a significant impact on a cow's total energy supply. However, some research has suggested that dietary fat may provide the gestating and lactating beef cow with precursors that stimulate cold tolerance in newborn calves, increase milk production, and/or hasten the return to estrus.

## **Additives**

Liquid supplements offer unique opportunities for supplying various feed additives to beef cows. In grazing situations, lick tanks are a realistic, free-choice delivery option, especially in situations where daily hand feeding is impractical or cost-prohibitive. And compared to other free-choice supplement options (tubs, blocks, mineral), research shows we can expect less between-animal and between-day intake variations with liquids. In measured (bunk) feeding situations, the addition of a precise amount of an additive-containing liquid offers simplicity, ease and accuracy.

Development and evaluation of new additives, nutraceuticals, and trace ingredients is proceeding at a rapid pace. Designed to address a specific need, improve efficiency, or enhance performance, many of these products are well-suited to liquid feed delivery. However, challenges do exist in adding live organisms (i.e., probiotics) to the aqueous, acidic environment of a lick tank.

<b>CURRENT ADDITIVE OPPORTUNITIES</b>	
<b>IN FREE-CHOICE SUPPLEMENTS</b>	<b>FORCE-FED (In TMR)</b>
<ul style="list-style-type: none"><li>▪ Altosid®</li><li>▪ Yeast</li><li>▪ Yeast Extracts, MOS products</li><li>▪ Yucca Extract</li><li>▪ Specific mineral sources</li><li>▪ Increased vitamin levels</li><li>▪ Enzymes</li><li>▪ Bovatec®</li><li>▪ Safe-Guard®</li></ul>	<ul style="list-style-type: none"><li>▪ all free-choice options, PLUS:</li><li>▪ Rumensin®</li><li>▪ Cattlyst®</li><li>▪ Gain Pro®</li><li>▪ Tylan®</li><li>▪ melengestrol acetate</li><li>▪ Deccox®</li><li>▪ Rabon®</li></ul>

Cow-calf producers wanting a self-fed option for delivering ionophore to their replacement heifers or creep-fed calves have the option of including lasalocid (Bovatec®) in their liquid supplement. Benefits include improved rate of gain and control of coccidiosis. Other ionophores and medicated additives can be added to liquid supplements when they are force-fed to approved cattle in bunk or TMR rations. Liquid supplements can be an efficient, practical delivery vehicle for a range of GRAS (Generally Recognized As Safe) additives as well.

# Lick Tank Management

While lick tanks can free the producer from daily supplement delivery tasks, they **DO NOT** eliminate the need for feeding management. Successful lick tank use hinges on proper placement, maintenance, and monitoring.

All feed tags for lick tank products include the following statements.

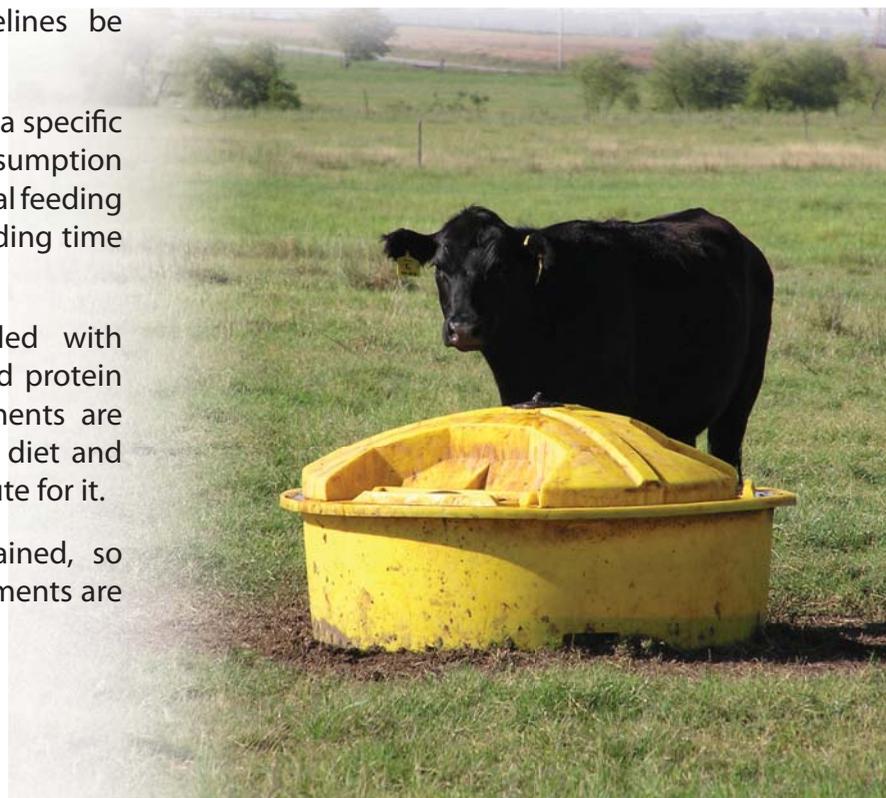
When **THIS QLF PRODUCT** is fed free choice the following **MUST BE OBSERVED**:

1. Provide unlimited fresh, clean water. Place lick feeders at least 50 feet away from water supply and away from where animals congregate.
2. Provide adequate available roughage and energy at all times. **DO NOT FEED** free choice to empty, energy-starved cattle or other hungry livestock.
3. Allow access to loose salt and the appropriate calcium - phosphorus mineral free choice.
4. Never allow lick tank to become empty between fillings. Use Keepfill System to maintain adequate supply. Keep tanks half full during the winter months.
5. Keep lick feeders in good repair and working condition. Replace or repair damaged parts. Clean lick feeders as needed.
6. Avoid placing lick feeder where excessive heat can build up and moisture contamination can occur inside the tank, causing damage to product and the lick feeder.

Consult with your **QLF REPRESENTATIVE** or **DEALER** for specific recommendations.

It is extremely important that these guidelines be followed, for these key reasons:

- Feeding at the lick tank should require a specific 'decision' on the cow's part; over - consumption will occur if the tank is available for casual feeding in a spot where the cows will be spending time for other purposes.
- Cattle need a healthy rumen fueled with adequate forage to benefit from liquid protein supplements. QLF beef cow supplements are designed to complement a roughage diet and enhance forage utilization, not substitute for it.
- Product quality needs to be maintained, so cattle receive the nutrition the supplements are designed to supply.



# SAFETY

When QLF liquid supplements are properly managed, safety is not a concern. However, urea is a feed ingredient that has, under certain conditions, led to ammonia toxicity in cattle. Dealers and users of NPN feed supplements simply need to understand the whole picture.

“Urea poisoning” is actually ammonia toxicity. High ruminal ammonia concentrations can result in movement of ammonia to the bloodstream, and then to the liver for conversion to “non-toxic” urea. The problem occurs if blood ammonia levels exceed the liver’s ability to detoxify it.

## Urea By The Numbers

Crude protein is, by definition, 16% N (nitrogen).

Crude protein is then calculated as  $\%N \div .16$

Urea, which is 45% N, is  $45 \div .16 = 281\% \text{ CP}$

So the amount of urea in a feed is calculated:  $\text{NPN equivalents} \div 281\% \text{ (or 2.8)}$

## How much urea does a cow get at the lick tank?

Example: Liquid supplement with 28% CP equivalent from NPN

$$28 \div 2.81 = 10\% \text{ urea}$$

Assume 2 lb consumption

$$2 \times .10 = .2 \text{ lb urea}$$

$$.2 \text{ lb} \times 454 = 91 \text{ g}$$

## What does it take to cause a problem?

In research that mimicked a worst-case scenario - - fasted animals receiving a pulse dose of urea straight to the rumen - - toxicity symptoms were triggered by 27.5 g urea/100lb. of body weight. But when urea was given as urea phosphate (the form used in QLF), it took 40g/cwt. *So...*

$$\text{Toxic level for an 1100 lb cow} = 11 \times 40 = 440 \text{ g}$$

Example: Liquid Supplement with 30% NPN equivalents

$$30 \div 2.81 = 10.7\% \text{ urea}$$

$$1 \times 10.7\% = .107 \text{ lb urea per lb supplement}$$

$$.107 \times 454 = 48.5 \text{ g urea/lb}$$

$$440 \div 48.5 = \text{OVER 9 lb. OF LIQUID}$$

Which would have to be consumed in a short time period.

When cattle receive liquid supplements in lick wheel feeders, and have access to adequate forage and water, safety should not be an issue.

# CONSUMPTION



Voluntary consumption of liquid supplement is *expected* to vary as supplemental needs change. The gap between nutritional requirements and forage nutrient supply fluctuates significantly as cows move through the stages of production, environmental conditions change, and forage quantity and quality cycles. Also, when introduced to lick tanks, cattle go through an initial “adjustment” and may consume relatively large amounts of liquid for a limited time (usually 2-3 weeks). If a lick tank is empty for as little as 2 days, cattle may repeat this adjustment (temporary

high intake) behavior when re-supplied with supplement. Depending on animal needs, “normal” consumption may range from less than 1/4 lb per day to several pounds. Allow for the fact calves will use lick tanks, too.

When “over-consumption” or “under-consumption” are reported, first determine whether this judgement is made from the cow’s perspective (nutritional) or the producer’s (economic).

- The diet should be evaluated, based on actual forage analysis.
- Calculated requirements need to account for cow size, age and breed type, stage and level of production, and environmental factors.
- Be sure the animals aren’t being forced to meet their mineral or water needs from the lick tank.
- Double-check the actual consumption figures. Could there have been any miscalculations, physical spills, or significant wildlife consumption?
- Go back to the basics of lick tank management. Evaluate tank placement, the physical condition of the tank, and check for product contamination.
- Now, if necessary, adjust forage or water supply, mineral program, tank placement or maintenance, or liquid supplement product.



# EFFECTIVENESS

University research supports the effectiveness of lick tank programs.



## UNIVERSITY OF KENTUCKY (Ely et al. 1996)

- ☞ Beef cows and heifers
- ☞ Fescue pasture May-October
- ☞ With or without 32% lick tank supplement
- ★ Supplemented cows had higher BCS throughout
- ★ Calves from the supplemented treatment weighed 15 lbs more

## AUBURN UNIVERSITY (Dawkins, 1987)

- ☞ Crossbred steers
- ☞ Coastal Bermuda grass late July - December
- ☞ With or without 35% lick tank supplement
- ★ When forage quality dropped to  $\leq 7\%$  CP, supplemented animals consumed 25% more grass
- ★ Supplemented steers gained an additional 114 pounds



## UNIVERSITY OF FLORIDA (Arthington et al., 2004)

- ☞ Yearling heifers
- ☞ Winter Pasture
- ☞ Supplement treatments:
  - A. Wheat midds-based cubes, 3x/week
  - B. Molasses/Protein supplement
- ★ No difference in growth
- ★ Pregnancy rates improved 50% with the molasses treatment

## MONTANA STATE UNIVERSITY (Earley et al., 1999)

- ☞ Angus cow/calf pairs
- ☞ Improved pasture, late July-October
- ☞ With or without 41% CP, 3% fat lick tank supplement
- ★ Calf ADG was doubled in supplemented pastures
- ★ Cow daily gains increased 32% in supplemented pastures



# Lick Wheel Feeders:

## Do's and Don'ts

Free-choice feeding of liquid supplement is a convenient and economical method of supplying nutrients to livestock. It is NOT, however, a cure-all for all programs. The management practices outlined below MUST be followed for safe, efficient utilization of the liquid supplement.

### **Feeding Program**

Cattle need a healthy rumen fueled with adequate forage to benefit from liquid protein supplements. QLF beef cow supplements are designed to complement a roughage diet and enhance forage utilization – not substitute for it. BE SURE:

- ◆ Cattle are in good healthy condition;
- ◆ Cattle have, and have had, access to adequate forage; cattle are NOT fasted or underfed;
- ◆ Proper minerals and salt have been fed free-choice for a sufficient period prior to lick tank availability (intake leveled out at expected intake rate);
- ◆ Adequate fresh water is available;
- ◆ Other NPN sources (e.g., ammoniated hay) will be accounted for to avoid exceeding recommended levels of total dietary intake.

### **Lick Tank Placement**

QLF protein supplements are designed for delivery via lick-wheel feeders, or incorporation into the ration – not open tanks or troughs. Feeding at the lick tank should require a specific 'decision' on the cow's part; overconsumption will occur if the tank is available for casual feeding near where the cows will be spending time for other purposes. BE SURE:

- ◆ Tank is clean, top and lick wheels are secure, lick wheels rotate freely, tank is set level;
- ◆ Tank is placed where cattle do not congregate; minimum of 50 feet from water;
- ◆ Tank is not placed on path to water, or under shade trees or behind windbreaks where cattle congregate;
- ◆ Tank is located away from possible sources of contamination, e.g. roof run-off;
- ◆ Tank is placed to avoid excessive heating and restricted air circulation.

### **Management**

Your supplementation program should be based on defined goals and expected intake. Management should include monitoring performance and consumption, and taking basic precautions to ensure maintenance of product quality. BE SURE:

- ◆ Any new cattle being placed with lick tank access will be well-fed before moving;
- ◆ Lick tank consumption will be checked on a regular schedule and adjustments made in the ration if needed;
- ◆ Additional forage or grain to be fed in case of storm conditions, snow or ice cover, or other restrictions on pastures, stalk fields or range;
- ◆ If cattle cannot access product for 2 or more days (tank completely empty or physically inaccessible, cattle moved before tank, etc.), the animals will need to readjust to the liquid supplement; handle the refill as a new placement (be sure cattle are well-fed, recognize potential for temporarily increased intakes, etc.);
- ◆ Lick tanks will be cleaned as needed, or once a year.



*- Where Quality Comes First -*

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