MULTIDISCIPLINARY AND INTERNATIONAL LEADERSHIP KEYNOTE (MILK) SYMPOSIUM: WATER: CONSIDERATION FOR THE FUTURE OF ANIMAL AND FOOD PRODUCTION AND PROCESSING

0430 Drought: Lessons to learn in agriculture.
K. Matthews*, *ERS-USDA, Washington, DC.*

Drought impacts vary by commodity and region. Drought in 2012 was the most widespread since 1934. Drought has been pervasive in the West and Southern Plains since 2000, while the Midwest has experienced only 3 years of widespread drought in the same period. Most market participants are adversely affected by drought. Drought-reduced yields for commodities often result in higher prices, but higher prices may not offset lower yields and higher costs, so producer profit margins can be adversely affected. Consumers face higher prices for affected commodities and likely higher prices for substitutes for those commodities. Producers unaffected by drought are the only group who benefit from drought-reduced commodity supplies because they likely produce at least near-normal quantities of products and have access to higher prices for their products, which can boost their profit margins.

Key Words: drought, water, agriculture

0431 Water sources and chemical quality considerations for animal production and food processing.
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This presentation will focus on the varying qualities of water required for livestock consumption and food processing operations; also to be discussed are implications for changes to water quality due to natural situations (e.g., drought), engineered water treatment, and industrial activity. Quantity and quality of water are the most critical dietary elements for livestock as water directly or indirectly affects physiologic processes. Chemical water quality parameters that are important for livestock and food processing include presence of macrominerals (e.g., total dissolved solids, hardness, sodium, calcium, magnesium, chloride, nitrate, and sulfate), microminerals (iron, copper, manganese, chromium, arsenic), presence of toxic chemicals (e.g., pesticides or cyanotoxins), and whether the water is required to meet standards established by the USEPA for Primary and/or Secondary Maximum Contaminant Levels. How drinking water can enhance or exceed nutritional needs will be presented through comparison of nutritional requirements for livestock and the corresponding data and variability for specific chemical parameters in ground and surface waters. For example, the macronutrient sulfate and micronutrient iron can either negatively affect either livestock health or the taste of meat and milk. Sulfate and iron concentrations vary widely in drinking water due to local geology, as this controls which minerals are available to be dissolved into water. Another issue for livestock nutrition is its interplay with changing chemical water quality, as can be illustrated by total dissolved solids (TDS). Total dissolved solids is the composite measure of all dissolved minerals and organics in water; it is an indicator of overall water quality that is readily measured. Guidance for livestock is that TDS should be at or below 1000 mg/L, with an upper limit of 2500 mg/L, and although higher levels can be tolerated for drinking, about 3000 mg/L can cause diarrhea. Drought conditions increase TDS, both because there is insufficient water to dilute natural TDS and due to water evaporation. Total dissolved solids levels in the range of 3000 mg/L have occurred in the last few years and can negatively impact livestock health. Maintaining healthy livestock can be achieved through knowledge of which chemical parameters affect nutritional status, the natural occurrence of chemicals, plus regional and seasonal variability of water quality.

Key Words: water quality, nutrition, drinking water standards, minerals, livestock

0432 U.S. dairy water footprint in context. Y. Wang*[1], A. D. Henderson[2], and O. Jolliet[3], [1]*Innovation Center for U.S. Dairy, Rosemont, IL,* [2]*University of Texas, Houston,* [3]*University of Michigan, Ann Arbor.*

Dairy production in the United States at the national scale is a distributed production system that entails great geographic diversity with respect to inputs and outputs. Milk therefore represents an interesting case study to develop and test spatialized life cycle approaches for both inventory and impact assessment. The study is to be used by the U.S. dairy industry to create a baseline of water footprint, helping that industry and its constituent milk producers to identify areas to target for improvement, explore the changes in impact associated with new management scenarios, and document those improvements. The result showed that water stress is 146 L in competition per 1 kg milk consumed, and 121 L in competition per 1 kg milk at farm gate (water consumption is 225 L per 1 kg milk consumed and 181 L of water consumed per 1 kg milk at farm gate).

Key Words: water footprint, spatialization, milk

0433 Rethinking the dairy supply chain: Innovative opportunities for creating value, efficiency, and sustainability. R. T. Sirolli*, *Cargill Dairy Enterprise Group, Windsor, CO.*

In recent years, Consumer Packaged Goods (CPG) firms utilizing large volumes of dairy ingredients have ventured into new partnership models directly with dairy farms to address unmet needs relating to environmental sustainability, reducing market volatility, security of milk supply, improving the connectivity of consumers to dairy farms, and to create opportunities to enhance the value of the overall dairy supply chain. In the spring of 2012, the first model of this kind was implemented between a large dairy farm in Northwestern Kansas and a leading dairy CPG firm. To supply the desired products to the partnering CPG firm, the milk produced is initially processed directly on the farm. Three products are produced from the process, including heavy cream, condensed skim milk, and water. By creating a direct-supply model between the dairy farm and CPG firm, multiple opportunities are created to reduce environmental impact and improve water conservation. By removing water through a condensing process of whole milk, transportation required to move cream and condensed skim milk is reduced by > 75%. Approximately sixty thousand gallons of milk are produced per day, and of that, approximately forty thousand gallons of water are reclaimed for use on the farm. Western Kansas is an arid environment where water conservation is a critical component of the long-term sustainability of dairy production in the region. Water that is reclaimed is reused initially for watering cows or cleaning before eventually being irrigated on crops grown for feed. Water availability is one of the leading factors limiting dairy growth in the Western United States. Direct-supply models with on-farm milk condensing are growing in interest as a means of improving long-term sustainability of dairy production in arid environments, improving efficiency of the dairy supply chain, and creating opportunities for enhancing value for dairy farmers, CPG firms, and consumers.

Key Words: sustainability, water, dairy, milk

0434 Water usage at cattle feedlots and the potential for water conservation. K. D. Casey*[1], J. M. Sweeten[1], and R. Hagevoort[2], [1]*Texas A&M AgriLife Research, Amarillo,* [2]*New Mexico State University, Clovis.*

Water is increasingly valuable due to limited supply with declining aquifers and prolonged droughts, and higher water costs through infrastructure and energy costs. Environmental sustainability is an increasingly important issue for the general public, and the water use efficiency of industries is particularly topical during the current drought conditions. Water is an essential part of any beef feedlot or dairy operation. At beef cattle feedyards, fresh water is needed for cattle drinking, feed preparation, dust control, trough cleaning, system spillage, and staff amenities. While little potential exists to reduce genuine cattle water consumption, potential exists to reduce fresh water used to prevent troughs from freezing in winter and to control dust under dry conditions. Under summer conditions in the Texas High Plains, water use for dust control at feedyards has been measured at 8% of total fresh water use. Capture, treatment, and reuse of water from overflow waterers has been shown to be cost effective when compared with pumping extra fresh water. At dairies, fresh water is needed to water cows, cool cows and milk, flush alleyways, wash udders in wash pens, clean milking equipment, and increase feed moisture content. Similar to water intake requirements for cows, dairy operation water use can vary greatly depending on management practices, location, and the recycling of water on the dairy. Close attention to minimizing water wastage and a focus on reusing process water where possible can yield significant reductions in overall water use. On an open corral dairy and a freestall dairy on the Texas High Plains, monitoring on the overall facility water balance over 2 to 3 yr has shown that 30 to 40% of total fresh water usage is beneficially reused for irrigation.

Key Words: beef, water intake, reuse