

Nitrogen cycle and dairy cows

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Comparing all the chemical elements, nitrogen (N) has the greatest total abundance in Earth's atmosphere, hydrosphere, and biosphere; it is ironic that N is the element least readily available to sustain life. More than 99% of the N is not available to more than 99% of living organism in our planet. The reason for this seeming contradiction is that while there is an abundance of N in nature, it is almost entirely in form of molecular nitrogen, a chemical form that is not usable by most organisms. Molecular nitrogen has two atoms held by a triple bond, and known as N_2 . Breaking the triple bond holding the two atoms of N together requires a significant amount of energy (high temperature) or it can be done naturally by a small number of specialized N-fixing microbes living in the soils.

Nowadays, researchers divide the N compounds in nature into two groups: non-reactive and reactive. Nonreactive N is N_2 ; and reactive N (**Nr**) includes all biologically, photochemically, and radioactively active N compounds in Earth's atmosphere and biosphere. Thus, Nr includes different forms of N as ammonia, nitrites, nitrates and oxides, also called "NO_x". During the last few decades, production of Nr by humans has been greater than production from all natural terrestrial systems. Reactive nitrogen is now accumulating in the environment on all spatial scales, local, regional, and global. The increase in Nr production has three main origins: (1) widespread cultivation of legumes, rice, and other crops that promote conversion of N_2 to Nr, (2) combustion of fossil fuel, which converts both atmospheric N_2 and fossil N to reactive NO_x, and (3) fertilizers production, which converts non-reactive N_2 to reactive ammonia, to sustain food production and some industrial activities. The accumulation of Nr in the planet has diverse negative consequences, affecting air quality, water quality, and also it is related to the global climate change.

Going to the California Central Valley Region, it is possible to find examples of almost all the causes of Nr accumulation previously mentioned. Many people in the Central Valley is working on this matter, and more research is needed to have a full understanding of this situation. Today, different research projects are carried out at farm level and under totally control conditions at UC Davis, Animal Science. This is an educational process, it is necessary to learn more on how we are affecting the environment, the interrelationships between the different actors, and the technologies to mitigate negative impacts. In the last years, the dairy industry has been working on the environmental issues, many dairy farmers in the Central Valley attended the Environmental Stewardship Short Course for California Dairy Operators, presented by the UC Cooperative Extension and supported by private industry. Last June more than 700 dairy producers were attending workshops in different meetings to fill out papers in order to comply with: (a) the new state rules on air pollution, and (b) the best management practices for dust and smell reduction. Dairy producers are doing very well and they will do the necessary work to comply the new environmental regulatory processes. But clearly, cows are not the main responsible of the Nr accumulation in the California Central Valley Region. It is expected that other responsible (cars, trucks, and heavy industries) can follow the same way. (*Note Merced Sun-Star, Agriculture, California, Monday August 9, 2004*)