Improving Livestock Water Productivity**

Iain A. Wright, Ph.D.
Program Leader, Animal Science for Sustainable Productivity,
International Livestock Research Institute, Addis Ababa, Ethiopia

Summary
Demand for livestock products is increasing rapidly in the developing world as a consequence of population growth, rising incomes, urbanization, and changes in dietary preferences. The livestock sector now accounts for about 40% of agricultural GDP in developing countries, although the investment in the sector falls far short of its economic importance. While this increasing demand presents opportunities, especially for small-hold farmers, to supply livestock products, it also puts pressure on the natural resource base, including pressure on water resources. Livestock water productivity (LWP) — a measure of the efficiency with which water is used to produce economic benefit from livestock — varies widely among systems, but data on different systems, particularly in developing countries, is scarce. Since water for growing feed is the major water requirement in livestock systems, any measures to improve efficiency of water use for producing feed will have a major effect on LWP. Improving animal productivity also increases LWP, as a lower proportion of the total feed intake (and hence water requirement) is used for maintaining the animal. National governments and international agencies should increase the proportion of agricultural research and development budgets spent on livestock to 20%. This should include providing better estimates of the use of water and LWP for different livestock systems. Major improvement in LWP could be achieved if investments were made in improving livestock productivity through research, development, and extension. Design of irrigation systems needs to include the water demand for production of feed for livestock as well as crops.

Current realities

In the developing world, demand for livestock products is increasing because of population growth, rising incomes (people consume more animal products as incomes rise), urbanization, and changes in dietary preferences. Globally, four of the five highest value agricultural commodities are livestock (milk, beef, and pig and chicken meat) — only rice is higher. Over 1 billion people in developing countries depend on livestock for their livelihoods and livestock account for 40% of agricultural GDP, although investment in the sector from public and private sources at all levels, global, regional and national, is not commensurate with this proportion. For example, in Ethiopia only 10% of recurrent expenditure in agriculture is on livestock. Of the water used for agriculture globally (which accounts for 70% of water used to support human activity) approximately 11% is used for livestock production. Water consumed directly by livestock is less than 2% of this figure, with most water being used for feed production. However, little attention has been paid to policies that could reduce the demand for water to produce livestock products. There are also huge differences in the water requirements of livestock in different livestock production systems — the amount of water used to produce a kilogram of beef from a steer in a feedlot in North America is vastly different from that needed to produce a kilogram of beef from in a mixed crop livestock small-hold farm in the Ethiopian Highlands. Therefore, applying data from one part of the world to another can lead to erroneous conclusions about water-use efficiency.

Scientific opportunities and challenges

Livestock water productivity (LWP) is defined as the ratio of net beneficial livestock-related products and services to the water depleted in producing these products and services. It

acknowledges the importance of competing uses of water, but focuses on livestock-water interactions. While LWP is a useful concept, there is a lack of good estimates of LWP for different livestock and mixed-crop livestock systems. It is also known that the range in LWP among systems is huge, mainly due to the 70-fold variation in the amount of water needed to produce forage. Also, most existing estimates of water productivity focus on meat and milk as the main outputs and ignore other uses of animals such as draught power, transport, and the role of the asset value of livestock acting as savings and insurance, resulting in underestimation of true LWP.

Two key strategies for increasing LWP include improving feed sourcing and increasing animal productivity.

Improving feed sourcing
Data suggests that the amount of feed produced from evapotranspired water (i.e. water that is taken up by plants) varies from 0.5 to 8 kg per m^3, which in turn has a major impact on LWP. Livestock systems that utilize crop residues as a major feed source have high levels of LWP as much of the water used in crop growth is used to support grain production for human consumption and the straw or stover is almost a by-product, albeit a very valuable one. One study in Ethiopia shows that as the proportion of crop residues in livestock diets increases from 35% to 70%, LWP increases from about 0.1 to 0.6 USD per m^3. Crop residues are usually of low to moderate nutritive value. Crop improvement programs have focused on increasing grain yield and traits such as disease resistance, but research over the past 10 years has shown considerable potential for increasing the nutritive value of crop residues through plant breeding without compromising grain yield. A one percentage point increase in digestibility can increase livestock output by 6%-8% and increase LWP.

Increasing animal productivity
Animals need feed regardless of whether they produce any product — animal scientists term this the maintenance requirement. Water transpired to produce maintenance feed is a fixed input required for animal keeping whether animals are gaining weight, producing milk, or working. Additional water is needed for production, but since the maintenance requirement is fixed, water productivity increases with increasing animal productivity (i.e., the higher the milk or meat output per animal the higher the LWP). Thus, any measure that increases productivity through better feeding, breeding, or animal health will improve LWP.

Policy issues

- Despite the importance of livestock for food security and poverty reduction, and its significant role in the agricultural economy, the investment in livestock development has been inadequate. National governments and international agencies should increase the proportion of the agricultural development budget for livestock to at least 20%.

- Livestock-water interactions have been mainly ignored in water research and planning. As a consequence, there is limited information on the water requirements of different livestock systems, which vary widely. Data from one system are not applicable to another — just because 15,000 liters of water are need to produce 1kg of beef from a feedlot in North America does not mean that the same amount of water is needed to produce 1kg of beef in from a small-holder mixed-crop livestock system in Africa. Researchers need to assess the true water requirements and water productivity in different livestock systems, especially in developing countries. In addition, livestock

water productivity estimates must take account of all the outputs from livestock, not just meat and milk.

- There is considerable scope for increasing water productivity by making better use of crop residues for feeding livestock. Crop improvement programs need to be designed to include traits for increasing the nutritive value of crop residues. Investment in technologies, such as second-generation biofuel technology. could lead to large increases in the amount of animal feed available by breaking down lignin to digestible compounds.

- There is a large "yield gap," the difference between potential and actual level of productivity, in most livestock systems in developing countries. Better animal nutrition, animal health, and breeding would have a large effect on productivity, increase food security, and help reduce poverty as well as improve LWP. National governments and international development agencies need to increase investment in the livestock sector, including in research and development and in effective extension services

- Few development programs consider the integration of crops and livestock. Development agencies such as the development banks, other international organizations, and national governments need to incorporate water requirements for feed production in the design of irrigation systems. Forage production can consume a considerable proportion of the water but is not factored in to design

Reference

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