The role of improved forages in solving the water scarcity issue of 4 billion people

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Global water footprint

- Global animal production requires about 2422 Gm^3 of water per year, composed for 87.2% by green water (effective rainfall stored in the soil), 6.2% by blue water (surface or groundwater resources), and 6.6% by grey water (required to dilute pollutants).
- One third of this volume is for the beef cattle sector; another 19% for the dairy cattle sector (Mekonnen and Hoekstra, 2010).
- The share of global water withdrawals for livestock use is projected to increase even more (Steinfeld et al., 2006).

Water productivity

- Livestock water productivity (LWP) is defined as the ratio of livestock outputs to the amount of water used.
- LWP depends on the system boundaries.
- 98% of the total volume of water used by livestock systems refers to the water footprint of the feed (Mekonnen and Hoekstra, 2010).
- Drinking water for the animals, service water and feed mixing water account only for 1.1%, 0.8% and 0.03%, respectively (Hoekstra, 2012).
- LWP can be increased by improved feed management, especially through the inclusion of improved forages, adapted to specific environments. In the tropics crop-livestock systems and pastoral systems are the most common livestock production systems, and offer several options to diversify the feed basket and increase feed water productivity.
- Other measures to increase LWP include
  - improved veterinary services
  - using system compatible breeds
  - crop-livestock integration
  - improved policies (Descheemaeker et al., 2010)

The role of forages and potential gains

Several advantages can be expected from the inclusion of improved forages:

- (i) "water saver" forages increase the amount of quality biomass available per drop of water.

Table 1. Water use strategies

Water use strategies	Water-spending	Water-saving
Benefit	Maximize growth when water is available	Reserved water in soil for later use
Trade-off	Faster desiccation of plants	Save water at expense of growth
Target enviroment based on precipitation patterns	Intermitten or short seasonal drought (1-4 months)	Long seasonal drought (>4 months)
Recommended use	Cut and carry systems and forage conservation (e.g., hay)	Grazing system

Cardoso and Rao, 2019.

- (ii) synchronization with fertilizer and manure application decreases the contamination of water bodies by a more efficient use of soil available nitrogen.
- (iii) growing forages has positive impact on soil water retention through decreased evaporation, improved texture and erosion mitigation, increasing therefore the amount of water available to plants.

Farmer in Northeast Cambodia. Photo: S. Douxchamps (CIAT)

Implications

- Although forage species adapted to different edaphic stresses and different systems have been developed, these species are not always accessible, available and/or affordable for smallholder farmers in tropical zones: few–mostly grasses–are commercialized and available, while many options remain in gene banks and seed stores due to complicated import and release processes, or lack of informal seed production systems.
- Lack of knowledge about their benefits and their management, and lack of access to planting material are major constraints for adoption.
- Findings from livestock water productivity studies are not taken forward in national water policies that used to concentrate on increasing water-use efficiency in crop production and feed conversion efficiency in the livestock sector.
- It is key aspect to improve the dialogue between professionals of the water livestock sectors. Policies should focus on facilitating the access of farmers to adapted planting materials, and on providing land use guidance to sustainably intensify livestock production in dedicated zones.

Acknowledgements

The work was undertaken as part of the CGIAR Research Program on Livestock and the CGIAR Research Program on Water, Land and Ecosystems, which are supported by the CGIAR Fund Donors and bilateral funding agreements.

Poster presented at:
Internacional Grassland & International Rangeland Kenya 2021 Virtual Congress

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