Water and Livestock Needs, Challenges, Management Issues

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Water and Livestock

Global fresh water stress



Water withdrawal as % of total available

40 to 20

> 40

20 to 10

< 10



Why are livestock important?

- livestock convert low quality biomass into high quality food
- demand for food of animal origin is constantly and sharply increasing
- animal power is still widely needed for crop production
- animal products contribute more than 50% of agricultural GDP in most countries



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Importance of water to livestock

- 90 % of all molecules in the body are water
- approximately 70 % of animal body weight is water, it varies by species and body part
- maintaining water balance is critical for survival, it is closely linked to digestion and thermoregulation



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Importance of water to livestock: Example one zebu steer at slaughter weight

(1) Drinking water

- Mean body water turnover of a zebu steer is 140 ml * I-1BWP * d-1
- Body water pool is 65 to 70 % of body weight
- Life time drinking water use at 4 years of age weighing 400 kg is 28 000 kg or 2.8 m³
- Total drinking water 70 kg per 1 kg live weight



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Importance of water to livestock: Example one zebu steer at slaughter weight

(2) Water in feed

- 250 kg water evaporated per 1 kg DM grass produced
- 11 kg of grass eaten per 1 kg body weight gain
- 2.75 m³ feed water per 1 kg of body weight
- Total feed water use at slaughter weight 1128 m³ or 2.82 m³ per kg live weight



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Importance of water to livestock: Example one zebu steer at slaughter weight

(3) Water for processing

- Dressing percentage 60 %
- Carcass weight 240 kg
- Total water use at slaughtering 0.5 m³ per carcass
- 6.18 m³ feed water per 1 kg of clean, dressed carcass



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Water cost of a continental menu [l/dish]



Source: IHE, 3rd World Water Forum, 2003



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Hierarchy of species' water turnover (ml/l^{0·82}/day) compared with the Oryx

Source: John M King and Martina Gerken, 1999

Species	Ratio	Significance of difference
African buffalo	2.6	p>0.05
Zebu cow	2.4	p<0.001
Eland	2.1	p<0.001
Small E. A. Goat	1.8	p>0.05
Sheep	1.7	p<0.001
Dromedary	1.4	p<0.001
Oryx	1.0	1.0



Comparison different grazing patterns of cattle in a tropical environment

Water intake	day	night	day & night
I* animal ⁻¹ * d ⁻¹	36.0	22.7	35.5
l∗ kg ⁻¹ forage	5.1	4.4	4.9
ml∗ kg⁻¹ BW ∗ d⁻¹	100	62	105

A.A.Ayantunde et al., 1999



Comparison of non-lactating and lactating* cows (G. Gäbel, 2000)

Water intake	non-lactating	lactating
Drinking	26	51
Water in feed	1	2
Metabolic water	2	3
Total	29	56

* 12 I milk per cow per day



Comparison of non-lactating and lactating* cows (G. Gäbel, 2000)

Water loss	non-lactating	lactating
Urine	7	11
Evaporation	10	14
Faeces	12	19
Milk	0	12
Total	29	56

* 12 I milk per cow per day



Importance of water to livestock: what do we know?





Typical urinary osmolar concentration in East African herbivores



Source: Maloiy (1972)



Estimated water loss (% of body weight per hour) for mammals on a summer day in the dry tropics



After Schmidt-Nielsen, 1954



Change in core body temperature over the course of the day for dromedaries and Greater Desert Jerboa in summer in the southern Sahel





Water cost of livestock production

Comparison of daily growth and water turnover in farmed Oryx and Eland and Zebu cattle

Species	Water turnover [ml* l ^{-0.82}]	Growth [g * kg ⁻¹ /W ^{-0.75}]*	Water cost of growth [ml ∗ g ⁻¹]
Oryx	68	3.2	21
Eland	202	3.1	65
Zebu cattle	188	3.4	55

Source: Carles, A. B. (1981)



Water Use by Livestock

Don Peden, 2003

- Drinking water intake is less than 1% of water used for production
- Water for production of feed is most important
- Feed for maintenance is about 3% of live body weight per day in most herbivores
- Feed for growth, reproduction and lactation is extra
- Other water uses
- Water degraded and devalued by livestock production
- Other impacts of livestock production on water sources



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Water for livestock feed: Some issues and questions

- Crops require 200 to 800 g of water to produce 1 g of dry matter
- Potatoes, sugar cane, elephant grass require approximately 500 g/g
- If crop residues are the only feed, is crop water NOT part of livestock water use?
- How much water used by animals is essential for enabling crop production?
 - animals needed for ploughing and other cultivation tasks
 - animals needed for transport of crops to market



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Other water uses

- How much water is needed or used to:
 - maintain hygiene, animal health and food safety
 - process animal products (slaughtering, meat packaging, dairying)
- Can waste water safely be used to produce feeds?



Impact of livestock production on water resources

Depletion, degradation, devaluation of water

- Sinking ground water levels through deep wells operation
- Evaporation/seepage from storage facilities
- Non-consumptive contamination, increasing hygienic risks, general health risks



Degradation

Evaporation and seepage

Devaluation

High faecal coliforms and streptococci
Suspended Solids
Increased biological oxygen demand (BOD)
High nitrogen concentrations

Public health implications

Impact of livestock production on water resources

Soils, hydrology and habitat

- Livestock production affects soil moisture through

 soil compaction, change of ground cover and run-off
 change of soil organic matter and water holding capacity
- Contamination of soils, ground and surface water
- Over-grazing and loss of bio-diversity
- Habitat destruction, ground water recharge potential
- Trail and sheet erosion, sedimentation



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Which Focus?

- Water cost of production (single animal)
- Water productivity (enterprise, farm, herd, production system)
- Water use efficiency (regional, basin or catchment)



What is livestock water use efficiency?



- Where P_L + S_L are quantities or values of livestock products and services and
- W_{dp} + W_{dg} + W_{dv} are quantities or values of depleted, degraded and devalued water



What is livestock water use efficiency?

- Can it be measured?
- Do we reassign water used to enable livestock to contribute to crop production?
- Can we integrate livestock with other goods and services resulting from water use in a basin?



Conclusions

- Livestock are important for food security
- Livestock production requires water
- Livestock keepers' actions lead to water depletion, degradation and devaluation
- Hypothesis: Practical technology, husbandry and policy innovations can significantly help to improve efficient use of water resources for food production



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Thank you for your attention