Alternative drought-resilient Livestock feeding systems as a Climate Change adaptation strategy in Arid and semi-arid areas of Kenya

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Research Brief

Feed the Future Innovation Lab for Collaborative Research on Adapting Livestock Systems to Climate Change

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Abstract

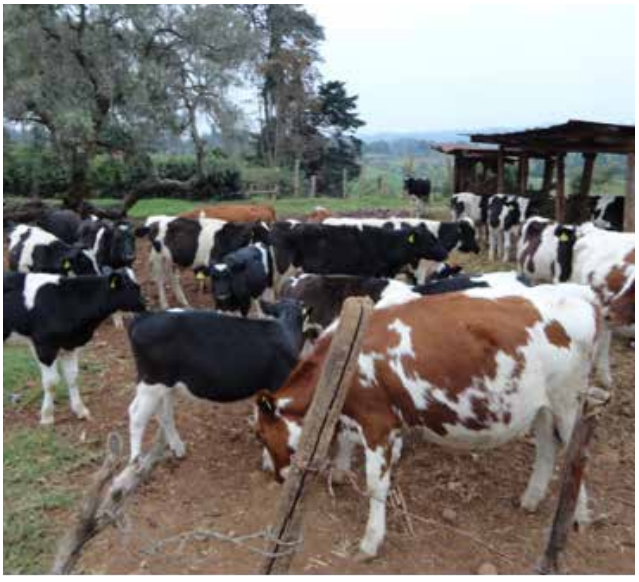
Climate change is a major challenge to agricultural development in Africa and the world at large. Agriculture, one of the most weather-dependent of all human activities, is highly vulnerable to climate change. The negative impacts of climate change are more severely felt by rural-poor people in arid regions who rely heavily on livestock keeping. Direct effects of climate change on livestock productivity include: decline in livestock productivity, low productive potential of local breeds, decline in forage quantity, quality and distribution, declining grazing areas, problem of access to water, conflicts over limited natural resources, animal diseases and fluctuations in livestock market prices. Research into new feed, resilient alternative forage species and efficiency in feed utilization by livestock has the potential to produce innovations that can reduce feed requirements and costs as well as reduce climate change impacts on livestock productivity in vulnerable rural communities, particularly in marginal areas. Although supplementary feeding would be a solution to low quality of feeds, it may not be affordable to the rural poor. Therefore, assessment of locally available drought resilient feeds, which is the focus Scholar Syomit's research, would offer a solution in dry land pastoralism.

Finding Solutions: Cactus Provides Fodder Where Other Plant Species Struggle

Cactus is an excellent example of a drought resilient feed, and may be the solution to dry land pastoralism. Cactus make use of the little moisture from the rainy season to produce large quantities of forage. It has a higher carrying capacity than any other drought tolerant fodder in arid and semi-arid areas. It remains green and succulent during drought thus supplying the much needed energy, water and vitamins to livestock in drought periods. It withstands severe defoliation and has good regeneration ability. It is easy and cheap to establish while its maintenance cost is low. Due to their anatomic and physiological makeup, cactus withstands a wide range of soil types as well as harsh climatic conditions. All of these unique features make it a perfect plant to incorporate into a productive pastoral system.

Although managing cacti seems like a promising strategy to combat changing climatic conditions, local farmers have had very little experience with the plant. In fact, cacti were introduced in some areas of Africa as ornamental plants, and in other places, by white settlers, as boundary markers. Except for a few areas, locals had no use for cactus and it was viewed as an invasive noxious weed. The local communities in Baringo believed that cacti were involved in land degradation and desertification. They have therefore appealed to the government and well-wishers to help in eradicating the plant.

To promote the use of cactus for livestock feeding, the Livestock Innovation Lab has funded an exploratory survey to characterize the nutritional fodder value of the Opuntia cactus species in selected dry regions of Kenya. A database has been created to store and synthesize



Dairy cows in Kenya. (Photo credit: Margaret Syomiti)

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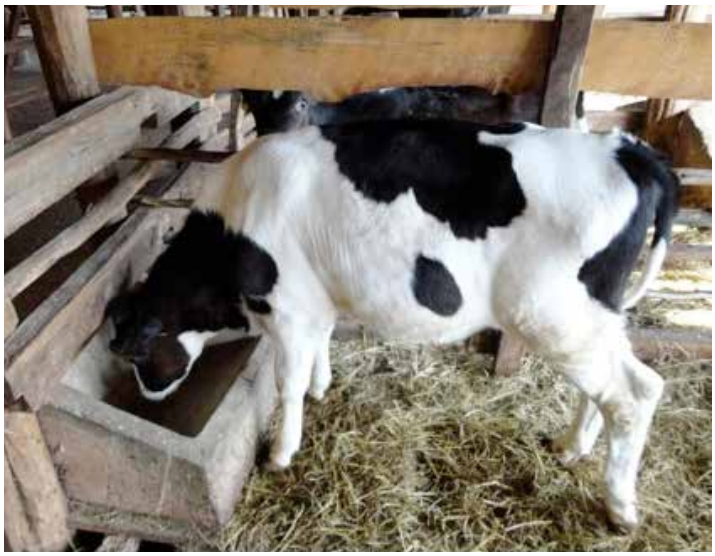


Dairy cow eating an alternate food source, multi-nutrient feed blocks. (Photo credit: Margaret Syomiti)

information from the survey. Trainings on "cactus as an asset, not liability" have been done in farmer field days and common interest farmer groups (CIGs). A poster on cactus-based multi-nutrient blocks was developed for presentation in training and demonstration forums. The effect of cactus on feed rations for sheep is under evaluation. Using this information, promotion of cactus for livestock feeding by pastoralists in marginal areas, the rangelands, arid and semi arid areas will be encouraged.

Eliminating Problems: *Prosopis juliflora* Reduces Grasslands and Kills Livestock

P. juliflora – an aggressive invader of pasture lands. (Photo credit: Margaret Syomiti)

Pastoralism is the main-stay of most rural communities in Baringo county, and the current aggressive invasion of *Prosopis* species is becoming a threat to the livelihood of these communities. *Prosopis juliflora* is an invasive weed spreading throughout the main grazing areas of Baringo county. Most pastoralists have complained that *Prosopis* is affecting the health of their animals through loss of teeth and increasing cases of death through poor digestion. This is common when the animals feed on too much *Prosopis* fodder, mainly the pods. This problem cannot be avoided, especially during droughts as there is little else the livestock can feed on. *Prosopis* is a "bad omen". It has taken all our grass for our animals, killed our goats through their poisonous thorns and even uprooted their teeth and the animal died of starvestation. If nothing is done now to control and eliminate this plant, we are likely to lose all our sources of income in the near future.

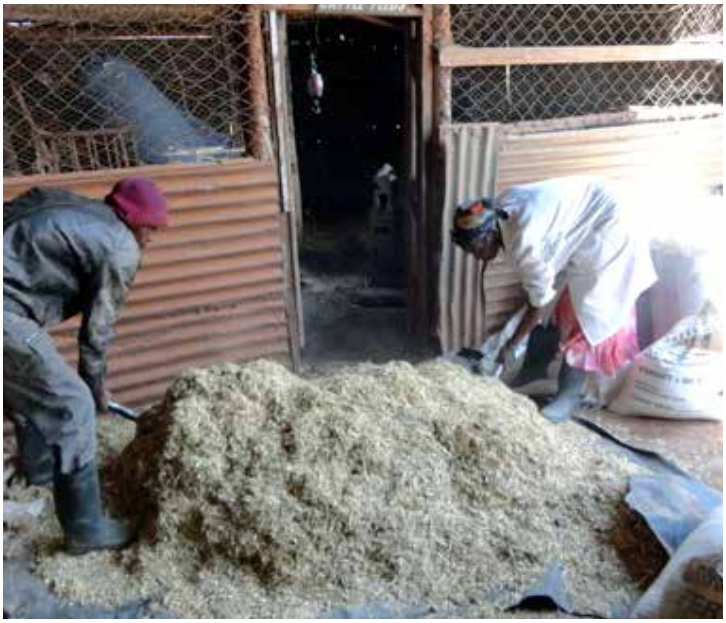
Findings from the current study funded by the Livestock Innovation Lab reveal that most pastoral communities are now worried about the future of their livestock as the sole livelihood resource, and would like the government of Kenya to eradicate *Prosopis* and replace it with a species suitable for foraging.

Mitigating and Reducing Negative Effects of Climate Change: The Use of Feed Blocks

Feeding dairy cattle over the dry period is a major challenge. If agricultural by-products are put to good use through "slash and recycle" rather than "slash and burn" policies, Crop-livestock integration can significantly contribute to the mitigation of climate change through reduced Greenhouse Gass (GHG) emissions. In this system, crop residues are used to feed the livestock, which provide manure to increase crop productivity. However, crop residues (mainly those from cereals grains) are low in crude protein and high in structural components (crude fiber). This results in low rate of digestion, rate of passage and voluntary dry matter intake. Dry matter (DM) digestibility and crude protein of fibrous crop residues can be improved by urea-treatment. However, Global climate change raises major questions about management and handling of these urea-treated residues as livestock feed. Such urea-treated crop residues contain high amounts of free ammonia and Carbon dioxide which are reduced by exposure to air.

A recently concluded study funded by the Livestock Innovation Lab revealed that fortification of urea-treated crop residue-based feed blocks with 10% bentonite and/or 5% biochar can stabilize the Ammonia gas. This reduces environmental pollution and improves the feed value and utilization of fibrous feed resources in mixed crop-livestock farming systems.

Multi-nutrient feed blocks are made with roughages, concentrates and minerals, blended together to match the nutritional needs of the animal for various production purposes including milk, beef, draft, growth etc. Feed block technology provides an opportunity to the



Mixing of maize stovers-cement/ urea mixture. (Photo credit: Margaret Syomiti)

livestock farmers who manufacture these feed-blocks. A 15 kg block is a complete daily ration for the animals. Only water is offered to the animals separately. Smaller blocks of 2 to 5 kg can also be manufactured which saves the cost of labor, handling, transportation and storage. This system provides opportunity to effectively utilize non-conventional feed resources, agro-industrial waste and crop residues to reduce the total cost of the animal feeding.

The Way Forward

Three of the biggest challenges facing livestock pastoralists in Baringo county, Kenya are (1) the limited availability of livestock feed, especially during times of drought, (2) the spread of a toxic and invasive weed throughout the main grazing area, and (3) the need to reduce environmental pollution while improving feed value. An innovative solution has been found for all of these challenges: (1) introducing and promoting cacti as a viable alternative livestock feed in especially dry regions of Africa, (2) eliminating the invasive species of trees that are harmful to the native species and livestock, and (3) the adoption of mixed crop-livestock farming in order to both reduce pollution and improve livestock feed. This project has already taken several steps in the right direction to make sure that the implementation of these solutions continue to go smoothly and prove to be effective. Moving forward, project researcher Margaret Syomiti, international graduate fellow-Livestock Innovation Lab, Colorado State University and Kenya Agricultural Research Institute, suggests the following:

- The spineless cactus should be bulked as a source of propagation materials since there are very few in the country. There is also need to conserve the cactus genetic resource for further research and use in the future.
- Commercialization of *Prosopis* products would be a valuable undertaking because *Prosopis* remains a sustainable resource in all aspects due to its invasive nature. If the seeds and branches of this tree are put into sustainable good use such as food and feed, the rapid spread of *Prosopis* will be slowed down. Total eradication of *Prosopis* species may not be an effective solution; not only is total eradication an expensive undertaking, but the plant is also reported to sustain livestock particularly during severe droughts. Therefore *Prosopis* species management by exploitation, but not by eradication is required to control weedy invasions.
- Future research should focus on evaluating storability potential of different feed block formulae.

"An innovative solution has been found for all of these challenges: introducing and promoting cacti as a viable alternative livestock feed, eliminating the invasive species of trees that are harmful to the native species and livestock, and the adoption of mixed crop-livestock farming in order to both reduce pollution and improve livestock feed."

Multi-nutrient feed blocks. (Photo credit: Margaret Syomiti)

Further Reading

Ben Salem, H, Nefzaoui, A., Abdouli, H. y Orskov, E.R. 1996. Effect of increasing level of spineless cactus (Opuntia ficus-indica var. inermis) on intake and digestion by sheep given straw- based diets. Animal Sciences, 62: 293-299.

Ben Thlija, A. 1987. Nutritional value of several Opuntia species. M.Sc. thesis. 84 p.

GISP, 2001. Global invasive Species Database. http//www.issg.org/database/welcome.

Makkar H, Sanchez M and Speedy A. 2007. Feed supplementation blocks. FAO Production and Health Paper No. 164. FAO, Rome. Pp. 251 Retrieved may 20 from http://www.fao.org/docrep/010/a0242e/a0242e00.htm.

Pasiecznik N. M., Felker P., Harris P. J., Harsh L. W., Tewari J. C., Cadoret K and Maldonado L. j. 2001. The Prosopis juliflora-Prosopis pallida complex: A Monograph. HDRA, Coventry, UK. pp 162

TIRI, Targeted Investment for Research Impact, identifies early-career researchers who are interested in tackling livestock production problems through innovative approaches and fresh perspectives. This small-grant program is open to early-career researchers (five or fewer years into research career) in any discipline, from student to professor, and from any organization that is engaged in applied research on livestock production in South Asia and East Africa — colleges and universities, government research centers or laboratories, or non-profit organizations.

Proposals are selected based on their potential to make livestock production systems more resilient to increasing climate variability and severity. At the end of one year, TIRI scholars are expected to demonstrate concrete outcomes and real potential for future impact. The 10 selected East Africa TIRI scholars and the 18 selected Nepal TIRI scholars are addressing research problems on various livestock and climate research themes.

Feed the Future Innovation Lab for Collaborative Research on Adapting Livestock Systems to Climate Change is dedicated to catalyzing and coordinating research that improves the livelihoods of livestock producers affected by climate change by reducing vulnerability and increasing adaptive capacity.

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