How-it-works brief

RESEARCH PROGRAM ON Livestock

CGIAR

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THE SUB-SAHARAN AFRICA FEEDS COMPOSITION DATABASE

KEY MESSAGES

- To boost livestock productivity in the developing world, smallholder farmers need better information about, and access to, nutritious and cost-effective feed resources.
- In that context, the sub-Saharan Africa feeds composition database (SSA Feeds) presents the nutritive values of 65,466 samples of 966 livestock feeds from 23 countries.
- SSA Feeds draws its information from a wide range of experiments, which have been analysed in the International Livestock Research Institute's (ILRI) Addis Ababa laboratories, and makes this available in the public domain in a searchable format.
- The tool aims to enable the extension, development, research and feed-manufacturing communities to design scientifically based and best-cost rations for meat, dairy and draught animals of small-scale African farmers.
- As their livestock assets are healthier and better nourished, farmers will become more food-secure and able to increase their income from animal products.

SUMMARY

Across the developing world, livestock play an important role in the livelihoods of millions of rural people. As global demand grows for meat and milk, the main constraint for productivity in these contexts – and thus for incomes and food security – is feed quality.

But most smallholder farmers don't have access to relevant information about the nutritive value of the various feed options that are available locally.

The sub-Saharan Africa feeds composition database (SSA Feeds) aims to begin addressing that problem by providing information for the extension, development, research and feed-manufacturing communities on the nutritive value of livestock feeds in sub-Saharan Africa, so that they can then design cost-effective and nutritious feed for livestock in the region.

Photo ILRI/ David Ngunga

Dairy goat feeding shrubs and beans hulls at Babati, Tanzania.

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INTRODUCTION

Livestock often represent an important source of income for smallholder farmers across the developing world. With increasing demand for animal products led by growing populations, urbanisation and dietary changes, feed has become the main constraint for farmers to improve livestock production.

However, livestock producers are often feeding their animals 'blind'. They have very limited information on the quality of material offered to their herds. This limits their ability to balance nutrients, leading to feed wastage – and productivity far below what is theoretically possible.

To address this challenge, SSA Feeds provides extensive information on livestock feed quality in tropical environments, allowing users to gain a much better understanding of the potential quality of the feed in which they are interested.

THE CHALLENGE

Livestock require a 'balanced ration' of feed that will supply the correct amount and proportions of various nutrients and fibre that are needed for an animal to grow and produce optimally, thereby maximising production efficiencies and profits for the farmer.

Without accurate knowledge of what a 'balanced ration' entails for their livestock environment, farmers can end up with either excesses or deficiencies of some feed components, which has both economic and environmental implications. It doesn't make the most of their investment, and if the nutrients cannot be utilised by the animal they are excreted, resulting in pollution for both air (increased greenhouse gas emissions) and water (nitrogen excretion).

For temperate feeds, such as those grown in North America and Europe, there is comprehensive information about quality and nutritional values. However, for their tropical feed counterparts this information has tended to be scarce and scattered.

AN OPPORTUNISTIC SOLUTION

There is a considerable amount of data on tropical feed quality that has been collected for other purposes and presented in other forms. A large amount of feed sample analysis has been carried out at the International Livestock Research Institute's (ILRI) Animal Nutrition/Analytical Services laboratories in Addis Ababa, Ethiopia.

In the early 2000s, scientists involved in the CGIAR Systemwide Livestock Program (SLP) took advantage of the wealth of research that had been carried out at the Addis Ababa facility and began collating feed sample data from a wide range of experiments and environments into SSA Feeds.

Photo ILRI/Zerihun Sewunet

Muluneh feeds a sheep Desho grass, which he grows alongside other crops on his farm in Doyogena, Ethiopia.

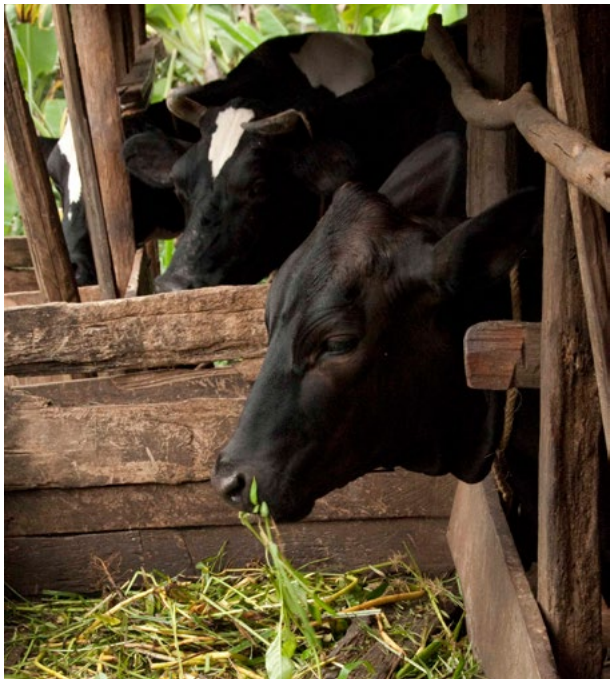


Photo ILRI/Nils Teufel

Stall-fed crossbred dairy cattle, Amani, Tanzania.

The data was first put online in 2004. In 2011, SLP released an enhanced version both that contained information on the nutritive values of 20,913 samples of 566 of the major feeds used in 15 countries in sub-Saharan Africa.

An extensive refresh of the data took place in 2020, including the addition of a substantial block of new results. As of April 2021, the database (now solely online) includes values for 65,466 samples of 966 types of feed from 23 countries.

HOW DOES THE TOOL WORK?

SSA Feeds contains a large number (up to thousands) of individual feed samples for each feed type listed. The database is targeted at the extension, development, research and feed-manufacturing communities, who can use it to design scientifically based and best-cost rations for meat, dairy and draught animals of smallholder African farmers.

People with a particular interest in a type of feed or a feed component can gather information on its quality based on estimates by an experienced professional or, at best, on a piece of literature that provides a nutritive value for that feed, which is derived from analysing a few samples during an experiment.

Users can employ a range of searches based on the feed name, the crop's scientific name, the category of feed, the country that samples were derived from or a 'free text' search. Alternatively, they can narrow down their search of the full database by first selecting from the range of feed categories available (see figure 1). If available, the database provides detail for different components of the same plant: for instance, under 'cowpea' there are separate sample collections for bran, forage, haulms, hay, hull, leaf, pod, seed, stem and straw (see figure 2).

Once the user has found what they are looking for, they can make a note of the values they require or export the whole dataset as a file and interrogate the data further.

Although nothing beats analysing one's own samples, the tool provides the average and the full range of quality variables (including dry matter, organic matter, acid detergent fibre, neutral detergent fibre, acid detergent lignin, crude protein, in vitro dry matter digestibility, metabolizable energy and a range of mineral elements (P, Ca, Na, Fe, K, Mg, Cu, Mn, and Zn)), for a large number of livestock feeds across different management systems and environments (see cowpea straw example in figure 3). In this way, the database allows users to gain a much better understanding of the potential quality of the feed in which they are interested.

Photo ILRI/Zerihun Sewunet

Sheep in Doyogena, Ethiopia, feed on the roots of the false banana plant called Enset, a plant native to Ethiopia that bears a strong resemblance to the banana plant. It is grown in the less arid highlands of the southwestern region of Ethiopia.

Figure 1: List of feed categories provided in the database (Source: Sub-Saharan Feeds database https://feedsdatabase.ilri.org/)

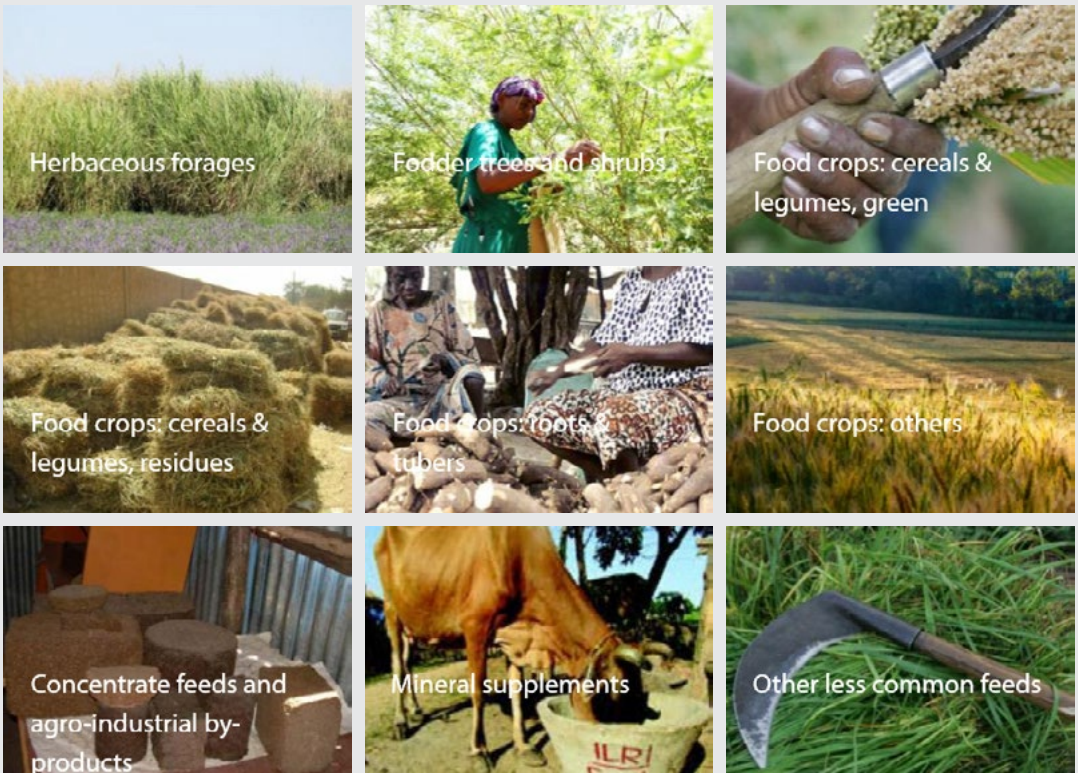
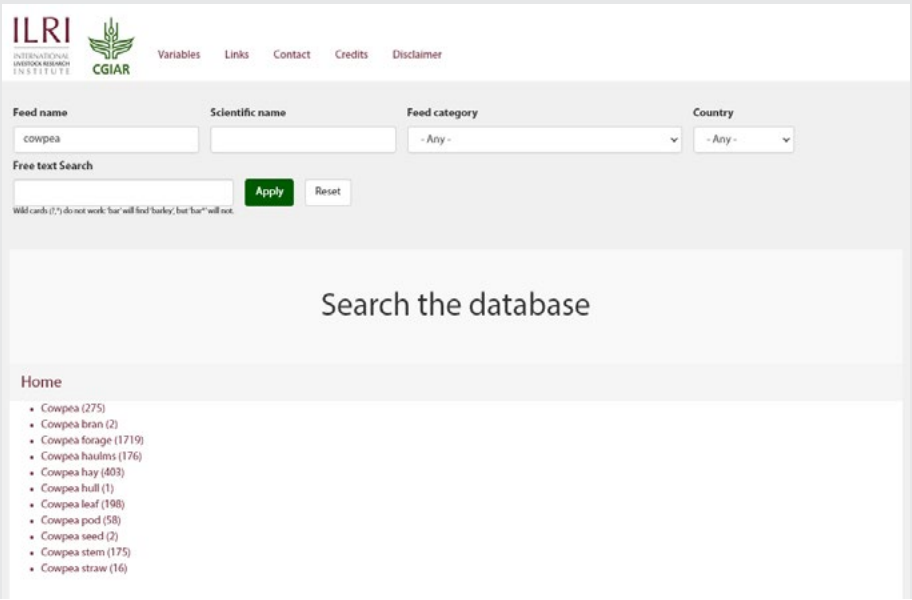


Figure 2: Screenshot showing search results for cowpea.



Source: Sub-Saharan Feed Database *https://feedsdatabase.ilri.org/search?title=cowpea&field_scientific_name_value=&field_feed_type_tid=All&field_country_tid=All&combine=*.

Figure 3: Screenshot showing nutritional values from the 176 cowpea haulm samples that have been uploaded to the feeds database.

Variables Descriptions

Click here to see the variable name, units and analysis method for each of the variables below.

Total Records: 176

Country

- Any - Apply

Scientific name: Vigna unguiculata

Feed name: Cowpea haulms

Reference	DM	ADF	NDF	ADL	CP	OM	P	Ca	Na	Fe	K	Mg	Cu	Mn	Zn	IVDMD	ME	NEm	NEg	NEl	Country
74502	90.03	52.48	64.18	8.69	10.04	92.28										59.83	9.10				
74506	89.92	56.24	69.26	8.81	6.83	92.89										58.41	8.97				
74517	91.83	60.40	80.55	10.79	5.08	94.92										47.26	7.59				
74525	91.28	60.12	77.99	11.81	3.76	97.48										45.92	7.63				
74493	90.27	54.10	64.66	8.68	8.41	90.84										58.61	8.78				
74495	92.71	61.82	81.60	11.31	4.93	93.78										47.65	7.54				
69582	91.88	36.91	53.73	8.61	10.94	88.01										40.48	5.47				
69488	91.68	44.54	58.23	10.19	10.67	90.31										56.28	8.08				
67479	90.40	31.85	45.87	9.20	9.71	84.34										88.63	13.15				
67525	90.28	37.18	48.62	7.61	13.07	89.47										55.91	7.91				
67559	90.83	45.59	55.69	12.12	8.17	86.94										80.99	12.06				
67611	89.78	34.60	44.14	5.23	6.73	86.29										68.82	10.14				
66692	91.18	24.23	45.89	6.01	17.02	90.83										64.79	9.22				
66722	90.59	72.59	45.59	39.27	10.02	80.00										55.45	7.68				Niger

Scientific name: Vigna subterranea

Feed name: Cowpea haulms

Reference	DM	ADF	NDF	ADL	CP	OM	P	Ca	Na	Fe	K	Mg	Cu	Mn	Zn	IVDMD	ME	NEm	NEg	NEl	Country
74509	90.01	53.15	63.19	10.11	6.87	89.22										54.19	8.01				
Total COUNT	**176**	**176**	**176**	**176**	**176**	**176**	**160**									**176**	**176**	**160**	**160**	**160**	
Total AVG	**91.85**	**41.43**	**54.24**	**12.46**	**13.02**	**79.05**	**2.14**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**70.03**	**9.33**	**5.75**	**3.32**	**5.80**	
Total MIN	**89.78**	**24.23**	**37.98**	**5.23**	**3.76**	**70.27**	**0.90**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**40.48**	**5.47**	**4.73**	**2.38**	**5.02**	
Total MAX	**93.02**	**72.59**	**81.60**	**39.27**	**24.03**	**97.48**	**3.60**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**88.63**	**13.15**	**7.07**	**4.48**	**6.82**	

Source: Sub-Saharan Feeds Database *https://feedsdatabase.ilri.org/food-crops-cereals-legumes-residues/Cowpea%20haulms?field_country_tid=All*.

OPPORTUNITIES AND CHALLENGES

The main opportunity that the tool provides (based on the results from over 65,000 samples) is to gain a better broad understanding of the qualities of various feed. As samples are continually being processed through the lab, the number of samples will continue to be expanded to provide more robust values.

The challenges sit in the interpretation of the results: there is not a lot of metadata associated with most samples, and the quality can be highly influenced by both environment and management. So while in some cases (such as that of cowpea) there is a good breakdown of context, in others this level of detail is lacking. What's more, if only a few samples have been submitted for a particular feed type, the values can be heavily influenced by a single experiment. Although the database lists the country that samples were derived from, it is not possible to break down most feeds further, for example for the forages and food crops breaking down by harvest season, year and soil type.

However, as the database collects more samples, there is the opportunity to break down individual feed further. Upgrading the sample submission process may be an important step because currently new data needs to be manually manipulated and uploaded to SSA Feeds, which can be time-consuming and incomplete. The scientists hope to implement an online form to capture all the metadata around a sample when it's submitted to the laboratory, meaning that when results come through, this information can be uploaded to the database 'in one click'.

Acknowledgements

Creation of this useful information tool was supported by the Sanitary and Phytosanitary Standards and Livestock and Meat Marketing Program of the Texas Agricultural Experiment Station in Ethiopia, with funding from USAID to the Ethiopian Institute of Agricultural Research and ILRI.

This work was conducted as part of the CGIAR Research Program on Livestock, which is supported by contributors to the CGIAR Trust Fund. https://www.cgiar.org/funders/

Want to learn more?

Visit the feed database https://feedsdatabase.ilri.org/.

ILRI. 2021. Nutritive values of some commonly used feeds in sub-Saharan Africa: SSA Feeds–an online database. Nairobi, Kenya: ILRI. https://hdl.handle.net/10568/111427.

ILRI. 2021. Feed Nutritional Analysis Laboratory. Addis Ababa, Ethiopia: ILRI. https://www.ilri.org/nutritional-analysis-laboratory.

Cover photo: Cattle feed on Brachiaria grass in Nairobi, Kenya.

CASE STUDY: FEEDIPEDIA

Feedipedia is a worldwide open-access information system on animal feed resources, which provides information – in the form of 'feed data sheets' – on the nature, occurrence, distribution, chemical composition, nutritional value and safe use of feed resources from around the globe. Established in 2012, it is co-managed by the Food and Agriculture Organization of the United Nations (FAO), the French National Research Institute for Agriculture, Food and Environment (INRAE), the Centre for International Cooperation in Agronomic Research for Development (CIRAD) and the French Association for Animal Production (AFZ).

Feedipedia's creators and managers have used data from the SSA Feeds database to help calculate the composition and nutritive values of many of the feed resources that it lists.

"The SSA Feeds data have been highly valued, as they allowed us to make comparisons with data that had been already collected by the Feedipedia teams through the French Feed Database and the literature," said Valérie Heuzé, a project officer at AFZ who co-manages Feedipedia. "As raw data, they could be used for reliable statistical analysis, which is not possible with the average values that are provided in most tables," she added. "Moreover, they provided values that were sometimes absent from the Feedipedia database, thus filling knowledge gaps on a number of forages."

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