A short history of the introduction of Rumen8 in East Africa
Memorandum for internal use

Prepared by Geert Westenbrink, Jos Creemers and Hink Perdok, April 2021

1. **Introduction**
   The dairy cow diet formulation package Rumen8 (R8) was selected in January 2018 by the former SNV-Kenyan Market-led Dairy Development Programme (KMDP) as 'software of choice'. In 2018 and 2019, KMDP undertook several activities and initiatives to make R8 'fit for use in the tropics', in the first instance for the Kenyan context. Several activities have been undertaken to further improve the relevance of R8 for the dairy farming conditions in East Africa and to train dairy professionals in the use of R8. In this memorandum, a brief account is given of the steps that were taken to contextualize R8 for East Africa in particular and for the Tropics in general. The emphasis was on how to use R8 in practice on small holder, medium and large scale farms. The 'tropicalised' R8, together with the SNV Tropical Feed Library, now provides a common reference base, which can be used as source of information for internal and external discussions. In this note first the process and considerations of selecting R8 as 'software of choice' will be dealt with. This is followed by a description of the training in and promotion of the use of R8 and suggestion for further mainstreaming of R8.

2. **Selection of R8 and development undertaken in making it fit for East Africa**
   From its inception in 2012, KMDP implemented several training trajectories for dairy advisors. During an assessment of Perfometer Advisory services in the last quarter of 2017 Jos Creemers noticed that the local consultants were hesitant to advise farmers on feeding and ration formulation of the dairy herd; mainly because of limited theoretical and practical knowledge and experience. Therefore, Anton Jansen, project leader of KMDP requested Hink Perdok, who was about to join the KMDP project as a PUM advisor, to scan several software tools that could help advisors in formulating and advising on balancing rations. In this selection process more than 10 software packages were considered and R8 was chosen as it was the most user friendly and available free of charge. At the time, there were no professional software packages available for tropical conditions and it was realised that R8 would need some adaptations to make it suitable for the Kenyan context.

See next 7 pages as well >

Box 1 Background and features of R8

At the start of this century, Rumen8 was developed by dr. Martin Staines and Richard Morris when they worked for the Department of Agriculture and Food, Western Australia. Subsequently, R8 became the most commonly used software in Australia and it was constantly improved with funding from Dairy Australia. Funding by Dairy Australia was stopped in 2018 and in 2020 Staines and Morris became the sole owners of R8. It is their ambition to keep R8 available free of charge to the user. However, that will only be feasible if some institutions pay for improvements and maintenance that will always be needed.

R8 enables the formulation of cost optimised balanced rations for dairy cows, taking into account a.o. energy, protein, NDF, starch and mineral requirements (based on a.o. live weight, milk yield, milk composition and pregnancy status). Next to recommended composition of the ration, R8 predicts 'Margin above Feed Cost' in the local currency, and Enteric Methane Emission, both per day and per kg milk.

Apart from being a tool for consultants and well trained farmers, R8 was also developed as a teaching tool and a unique feature is that it provides easy accessible background information on all terms used in the programme. This through so called 'tool tips' that appear as pop-ups when one hovers the cursor over a term.

To make R8 better 'equipped' for the Kenyan situation under KMDP numerous adjustments and improvement were made, including the following examples:

- Inclusion of low milk production levels (2,000-4,000 kg/lactation). The original version catered for lactations from 5000 to 10,000 kg in 305 days.

Inclusion of a Compact Mode which provides a more easily understandable way of formulating rations, providing the basic nutritive and economic information about advised rations. This facilitates 'first level training' and presents the information easier and clearer to understand information for farmers. VICTAM Foundation provided two grants.

After R8 was tentatively selected, discussion were held and endorsement was sought of the Kenyan Ministry of Agriculture, Livestock, Fisheries and Irrigation, KALRO, ILRI, and Nairobi and Egerton Universities. All supported the use of ME and MP as the standards and welcomed the introduction of R8. In order to make R8 fit for use in Kenya, a R8 subproject within KMDP was undertaken: 1. Develop SNV Tropical Feed Library and 2. Pilot and contextualise Rumen8 for EA. A R8-team was formed of final year MSc Students in Animal Nutrition from Nairobi and Egerton University together with Local Capacity Builders of Perfometer Consultancy and Advisory Services. The team was intensively trained by Jos Creemers and Hink Perdok in classroom settings and on farms participating in the KMDP programme. During the second phase of the pilot, the team went on to train Local Capacity Builders in Meru, Nairobi and Eldoret regions while introductory sessions were held for students in Animal Nutrition at Egerton and Nairobi Universities. By then, about 30 medium and large scale dairy farms participated in the pilot.

For information on the results of the pilot see the attached Master's Thesis of Dagmar Braamhaar of Wageningen University: 'Integration of diet formulation software in dairy farm coaching in Kenya. A pilot study'. Briefly, that study showed an average increase in milk yield of 2.6 L per cow per day in the 13 medium and large scale farms that completed a full year coaching trajectory with Rumen8 as a key component.

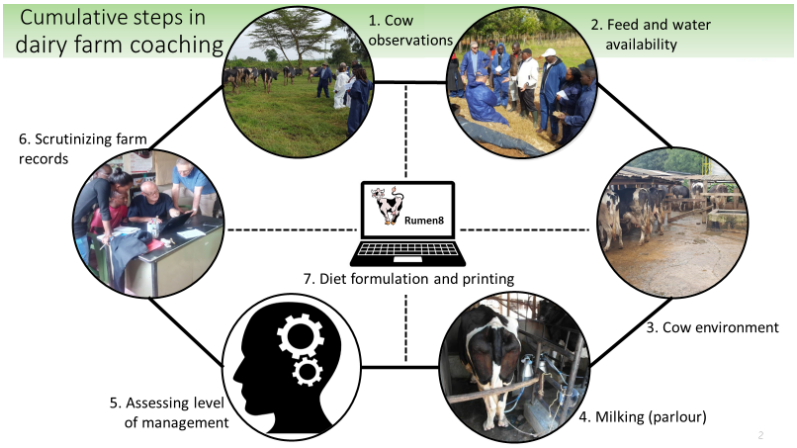
Box 2 SNV Tropical Feed Library

Under KMDP a major effort was undertaken to develop the SNV-Tropical Feed Library (https://cowsoko/rumen8). This library can only be accessed through R8 and contains the most commonly used 230 feedstuffs in Kenya. The Kenyan R8 team, guided by Jos Creemers and Hink Perdok populated the library with mean values from different, where possible tropical, feed libraries, including Feedipedia (FAO), The Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), MoAFL Feedstuff database Kenya, Sub-Saharan Africa feeds composition database (SSA table of ILRI/CGIAR), FeedPlus, NSW-DPI, AFRC, CVB, BLGG and Rumen8. It should be emphasised that the SNV Tropical Feed Library contains average values and that the actual value of the feedstuffs at a farm always deviates from the values in the Feed Library. The actual values can only be obtained by feed analyses. In the absence of those, the Feed Library values can be used, and depending on the assessment by the nutrition adviser those values can be adjusted to better mirror the actual value of the feeds used.

Parallel to the development of the Tropical Feed Library several training courses were conducted by Hink Perdok and Jos Creemers under KMDP. The aim of the training sessions was to bring local capacity builders to a professional level in dairy cattle nutrition and the use of R8 as a tool for total ration formulation. Most courses were given in the setting of dairy farms that were visited on a monthly basis over a period of a full year. Practical assignments formed a main part of the trainings. It is paramount to first assess the situation of a farm in a holistic manner before diet formulation using R8 can be done. For this the Farm Walk approach was developed.

Box 3 Farm Walk

The farm walk (know the farm and farmer and understand his management practices)



Rumen8 as a farm advisory tool should only be used after a detailed farm walk to familiarise oneself with the management practices and possibilities of the farm and farmer (see Figure above).

The tool can help users to get a better understanding of ruminant nutrition and get insight in optimum use of available forages, pasture and cut and carry grasses, forage legumes, crop residues and agro-industrial by-products as well as of purchased feedstuffs. This more in-depth knowledge will improve the quality of recommendations and discussions between advisors/extension workers and farmers. Nutritive values of all available feeds in the feed library can be changed to model the effects of anticipated or recommended management interventions. It goes without saying that feed analyses will add a lot to the predictive power of any diet formulation tool.

In total more than 100 dairy professionals were sensitised and trained under KMDP. The training and the pilot study in which 2 students from WUR participated clearly proofed that R8, preceded by a Farm Walk, is an easily accessible, high standard tool that allows well trained dairy cow advisors to advise small, medium and large scale farmers on improved feeding, thus leading to higher margins above feed costs. Also an explorative research trajectory was conducted on the effect of use of R8 by advisors in the use of R8. The results are in: https://research.wur.nl/en/publications/impact-of-fodder-management-on-dairy-farm-performance-in-kenya.

In further discussions it was decided that, Voluntary Dry Matter Intake (DMI) being a pivotal component in ruminant nutrition, a closer look in the context of tropical countries would be needed and a small project is being undertaken at this moment (see box 4). Furthermore, after a series of discussion, also with the Programme Management Team of the Netherlands East African Partnership, it was decided to develop a so called Beef Module, this to further improve the relevance for East African conditions (see box 5)

Box 4 Voluntary Feed Intake

A crucial factor in ruminant nutrition is how to estimate voluntary dry matter intake (DMI). The content of fibre in the ration (esp. in roughages) is a determining factor, especially in the tropics. At present it is advised to use 1.3% of a lactating cow's liveweight in terms of Neutral Detergent Fibre (NDF) to predict voluntary dry matter intake. A joint ILRI-SNV project has been set up for a literature review to develop an equation to better predict DMI in the tropics. The review has been done by Frida Njoki under the scientific guidance of Martin Staines (R8) and Prof. Alan Duncan (ILRI), and the data is awaiting statistical analysis by the ILRI statistician in India.

Box 5 Beef Module

While used in practical situations it was noted that use of R8 (dairy) in the tropics could be further improved if next to advising on feeding dairy cattle it would also be possible to provide advice for fattening of dairy animals that will be culled and animals kept specifically for beef purposes. The latter because many farmers in East Africa keep dual purpose cattle and/or have mixed herds. As KMDP was closed end August 2019, the development of the beef module is jointly financed by TIDE and BRIDGE (see annex). The beef module is currently being tested by Creemers and Perdok and will become available in May 2021.

With the wider use by dairy advisors and professionals in East Africa it became clear that a limited set of software issues hinder the smooth use of R8. A small project under the name "a more user friendly R8" has been set up to resolve these issues, along with developing introductory interactive tutorials for new users. VICTAM has in November 2020 agreed to finance 25% of the total cost. This project will be realized in the course of 2021.

Box 6 'A more user friendly R8'

For improving the user friendliness of R8 the following activities are in principle agreed upon:

1. **Simplification of Library files**
   At the moment R8 uses 3 'library files' for feed, milk payments and user preferences. From support questions from established consultants and user workshops it became clear that it is difficult to understand the file system.

2. **Automation of Solver set up**
   Solver is a 'automatic optimizing function' in Microsoft Excel and is used in Rumen8 (by advanced practitioners) to optimise least cost rations. At the moment R8 users have to install the Solver software. For quite some users this proved to be difficult. In this project arrangements will be made to upload Solver in R8 in a simple manner.

3. **Improve linkages to internet resources**
   The educational/training aspect of R8 will be further improved by providing easy links to relevant internet resources like Feedipedia. Next to that it will also be made easier to import results of feed analysis provided by feed laboratories.

4. **Introductory interactive tutorial for new users**
   Building on already available tutorials an update and addition to existing video tutorials will be made available.

Based on the practical experience gained in guiding dairy advisors in the use of R8 and in discussions with various stakeholders on scaling and main streaming, it became also clear that for responsible use of R8, good basic know how of forages (fodder production and conservation) and ruminant nutrition is indispensable. Therefore, the need was felt for a synopsis of the 'knowledge base' needed for advising on improving dairy nutrition and reducing cost price of raw milk through 'more and better quality on farm production roughage in combination with balanced rations'. For this purpose, Jos Creemers and Hink Perdok, together with the Australian R8 team (Martin Staines and Richard Morris), prepared a synopsis which will serve as a basis for future activities in developing teaching and training material for fodder production, conservation and feeding dairy cattle using R8 (attached).

3. Activities on training dairy advisors in R8 and promoting wider use of R8

KMDP

The training of dairy advisors and professionals under KMDP was started early 2018, parallel with the above described projects in making R8 fit for the Kenyan/East African context. In 2018 and 2019 about 100 dairy professionals have been trained. Also trainings were provided for students in Animal Nutrition in Nairobi and Egerton Universities. At the same time, a team from SNV-TIDE, Uganda received an introductory course of 6 days in Kenya. Follow up of that course was given by Jos Creemers and Julius Kosgei by remote and F2F training in Uganda.

Today more than 350 dairy advisors in East Africa are making use of R8 in advising dairy farmers. Like in Australia and elsewhere, it proved that R8 is an excellent tool in both pre-service and in-service training in dairy cattle nutrition. For responsible use in advising famers a broad know how of dairy farming is essential and so are a good basic theoretical understanding of dairy cow nutrition and versatility with R8. In practice, a limited number of dairy advisors in East Africa specialise in providing high level advice on a commercial basis on dairy cow nutrition.

PUM
PUM, where Hink was a volunteer, also designated R8 the software of choice and to remedy the shortage of trainers within PUM, Hink gave a 5-day training in R8 to 15 PUM-experts. Unfortunately, due to Covid 19 measures, so far, none of those could put this into practice. PUM experts trained include Tseard van der Kooi who is designated to advice in TIDE2. Tseard also acted as PUM-expert during the last 2 years of KMDP and gained a good understanding of dairy cattle management and nutrition in EA.

NEADAP
In the Programme Management Team meeting of June 16 2020, it was agreed that NEADAP will support the introduction and scaling of R8 with other parties. For this purpose "the Briefing Note Rumen8" was prepared (attached). The NEADAP coordinator, Geert Westenbrink, has sent this Note with an explanatory-promotion mail (and with the position paper) to the following persons: Pierre Gerber (WB), Henning Steinfeld (FAO), Eduarda ArceDiaz (Global Agenda for Sustainable Livestock/FAO), Camillo de Camillies (Livestock Assessment and Performance Partnership/FA), and Antonio Rota (IFAD), David Harvey (Land O' Lakes) and Goossen Hoenders (HeiferNL). This resulted in follow-up contacts with:

- Antonio Rota, and trough him with Joseph Nshokeyinka, Rwanda (who holds an MSc from WUR Animal Production Systems and now is in charge of Rwanda Dairy Development Project and Genetic Resources- Management), but this did not yet result in concrete action.
- David Harvey, with a follow up meeting attended by David Harvey and David Hambrook of the Royal Jersey Breeders Society with Jos Creemers on R8
- Trough Goossen Hoenders an appointment is yet to be made with Heifer-Kenya.

Between end of August and beginning of December 2020, meetings were held by Hink Perdok and Geert Westenbrink in The Netherlands with various parties on R8 with De Heus (Sander Abrahamse, Joost Janssen and Johan Verhoek), the Board of Victam Foundation (Prof. Leo den Hartog, Harm Klein, André Oosterveld en Henk van de Bunt) and with three Agricultural Universities of Applied Sciences (AERES, Van Hall Larenstein and HAS Den Bosch). Minutes of these meetings are attached. In all these meetings R8 was demonstrated and there was support for further promotion of use of R8. Besides, very useful suggestions were made. Also, the Agricultural Universities of Applied Sciences were unanimous in their desire to partner in the development, possibly together with BRIDGE and TIDE, on a teaching method on ruminant nutrition and use of R8. Separate discussions on this were held with Harm Holleman of Dairy Delta Academy (DDA). With Victam, our presentation resulted in a commitment by them to further support R8 with a 3rd grant, of this time € 12,900.

TIDE
In May 2019, a team of 8 advisors of SNV-TIDE, Uganda (incl. WUR-MSc student Marielle de Haan) received an introductory course of 6 days in Kenya. A virtual introduction of Rumen8 was given to 30 dairy extension professionals by Jos Creemers and Julius Kosgei. The first follow up Face two Face training in Uganda was done by Julius Kosgei in November 2020. Meanwhile the TIDE team had selected 15 out of the 30 dairy extension professionals who received the virtual training. The team of 15 is supported by Joan Atukunda, Tom Katsyamiira and Amon Twahiirwa, who were trained in Nairobi in May 2019. The project in Uganda will follow several farms with grazing animals that are supplemented during and after milking. The farms are divided among 6 teams of 3 people who will visit the farms every month over a period of 1 year. Jos Creemers had a chance to follow two R8 teams on two farms in February 2021 for two days. The Rumen8 project has started and on average 2-3 farm visits per team took place before March 2021.

BRIDGE
Within BRIDGE it is envisaged to train different target groups in dairy cattle nutrition and the use of R8, to start with 25-30 dairy advisors, who have recently been recruited on contract basis. The training is expected to be carried out in June-July 2021.
It is planned to conduct these trainings through a combination of one month on line blended learning, followed by face-to-face training in the field. The trainings will be carried out by Jos Creemers of ProDairy EA Ltd. The one month on line blended learning trajectory will be jointy developed by DDA (Dutch Dairy Academy) and BRIDGE (see attached memo).

4. Some suggestions for further mainstreaming of R8

The Compact Mode of R8 is suitable for training students and professionals in the basics of dairy nutrition and in simple, and in most cases adequate ration formulation. The Standard mode is more suitable for professionals who specialise in advising on feeding strategies and formulating balanced rations. For the really experienced users, R8 has an Optimise function. That facility allows real experts in dairy cow nutrition to compose nutritionally and economically optimal rations very rapidly.

At present only Jos Creemers and Hink Perdok are providing trainings in 'dairy cattle nutrition, using Rumen8'. This limits the number of professionals that can be trained in 'dairy cattle nutrition, using R8.

Based on the above our first and foremost suggestions for further promotion and scaling of R8 would be a combined approach of: 1) Refreshing the R8 specialised professionals' with 'Dairy cattle nutrition, using R8 trainers' and 2) Offer a Nutrition Advisor cum ToT-training for other organisations (governmental, NGO's, feed companies, milk processors, dairy cooperatives). The professionals under 1 can, through additional training, in a relatively short time be upgraded to 'Nutrition Advisor cum ToT' and can be 'hired' by the NEADAP (Netherlands-East Africa Dairy Partnership) partners and others for providing trainings.
For professionals of other organisations, a training and practice period of 6-12 month is needed, depending on the 'entry level'.

For the realisation of 1) and 2) we propose to develop a 'step-wise' ToT-blended learning trajectory in dairy cattle nutrition, using R8. In this step-wise learning trajectory trainees through 'on line self-study' can refresh the required basic knowledge of dairy cattle nutrition and get a first introduction on the use of R8, provided there is online coaching by an experienced coach. Through the proposed stepwise approach it is possible for trainees to easily access what they already know and what knowledge they lack. The practical training in advising on feeding regimens and balanced rations, using R8, will be mostly done on farms. It is expected that for the development of this 'Nutrition Advisor cum-ToT' we expect that it will be possible to build to a large extent on the blended learning trajectory that is planned to be developed in the coming months by DDA for BRIDGE (see above).
In addition, it would be worthwhile to explore the need and possibility to set up a Community of Practice of ToT-trainers and dairy advisors specialised in advising farmers on feeding and rations.

Next to this it is recommended to explore how NEADAP could be of help in making NIRS-technology 'practice and service ready'. We consider NIRS a 'breakthrough technology' making it possible to advise farmers on the estimated actual nutritive value of feedstuffs, instead of using general feed library data. However, NIRS technology will only be useful in the tropics if the NIRS-equations used are based on wet chemistry data generated on large numbers of samples of the tropical fodders and feed ingredients the analytical tool is used for.