



Feeding strategy for small and medium scale rabbit units

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Whatever the dimension of the rabbit production unit, for breeders the feeding strategy would be based on 4 main points

1. The rabbit's nutritional requirements
2. The rabbit feeding behavior
3. Raw feeds nutritional value and availability
4. Possibilities of feeds preparation in the rabbitry

These four points will be quickly developed below.

NUTRITIONAL REQUIREMENTS

For small and medium scale rabbit units it is reasonable to consider only one type of recommendation for all types of rabbit, corresponding in the nutritional tables to **a mixed or single feed** (Lebas 2004, de Blas and Mateos, 2010). The main nutritional recommendations are summarized in the following table :

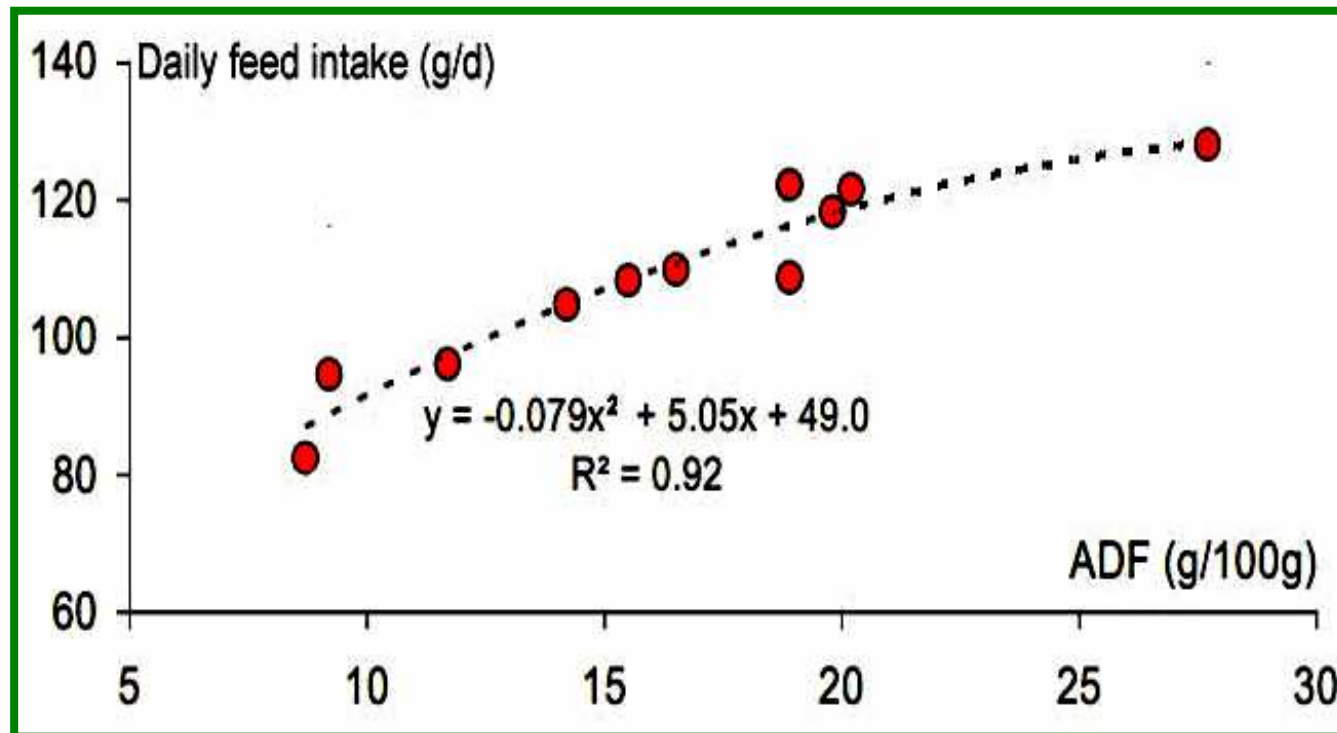
Nutrients	%	Nutrients	%
Digestible energy (MJoules/kg)	10.0	Starch	< 16.0
Crude protein	16.0	Lipids	2.50
Digestible protein	11.5	Vitamin A (IU/kg)	10 000
Lysine	0.80	Vitamin D (IU/kg)	< 1500
Methionine + Cystine	0.60	Vitamin E mg/kg	> 50
Threonine	0.65	Calcium	1.10
Crude fiber	15.0	Total Phosphorus	0.50
NDF	31.0	Sodium	0.22
ADF	17.0	Potassium mini	0.60
ADL	5.0	Potassium max	< 1.80



FEEDING BEHAVIORS



- Average **digestive transit time** is relatively short : 16-24 hours
- Contrary to ruminants, in the rabbit an **increase of diet's fiber content** increases the speed of transit, allowing the animal to **increase also it's feed intake**



Average feed intake of growing rabbits between 4 and 11 weeks of age in relation with the complete feed's ADF content (Gidenne & Lebas, 2006)

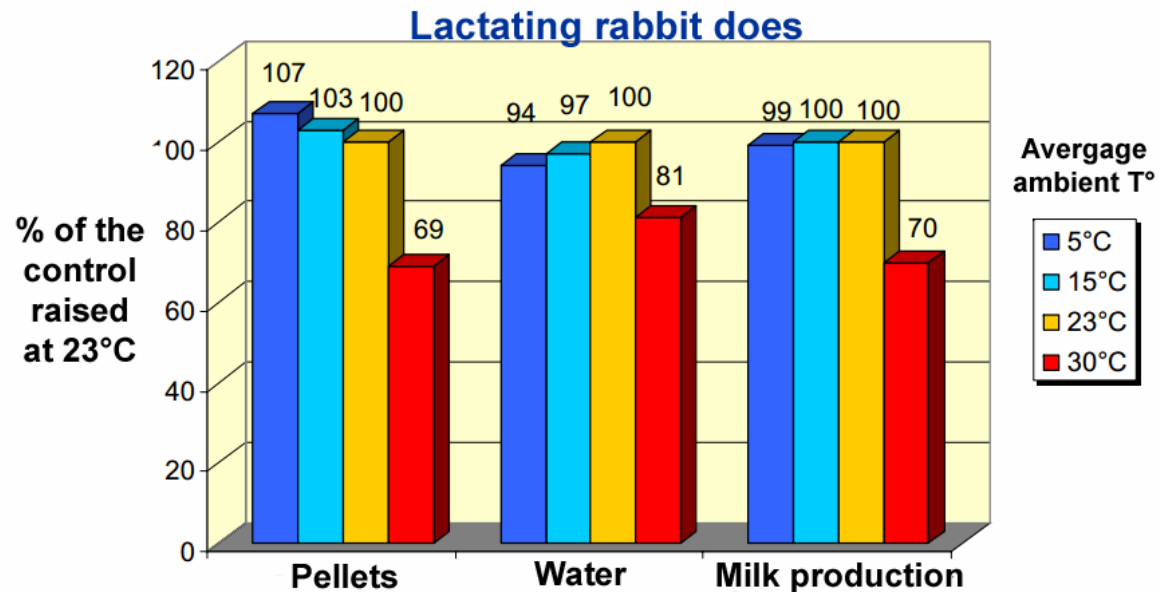


FEEDING BEHAVIORS



- The **instantaneous capacity of ingestion is limited** by the stomach small capacity : a content of about 15-18 g of dry matter for a stay of 1 to 2 hours and an average daily intake of 110-120 g (for a growing rabbit of 2kg).
- As a consequence rabbits need to make **multiples meals** during the 24h cycle.
- With pelleted feed a rabbit spends about **10% of the time to eat**. This duration increases up to 30-40% with forages.
- **2-3 rabbits are able to eat simultaneously** in a one-place feeder.
- When ambient temperature increases **above 28-30°C the intake decreases**

Effect of average ambient temperature on pellets and water intake of lactating does and on their milk production (Szendrő *et al.*, 1999)





FEEDING BEHAVIORS



- When a concentrate (low fiber compound diet) and a dry fibrous material are proposed as free choice to rabbits, **they prefer the concentrate**.
- The consequence is an immediate **increase of the sanitary risk** for rabbits with digestive disorders by lack of fiber
- If the fibrous material is presented fresh (green) the balance between concentrate and forage is more difficult to predict. The recommendation is to propose the most palatable in restricted quantity
- The **need of water** is about twice that of the dry matter intake, with an increase of the proportion when temperature is above 28-30°C.
- The **maximum intake capacity** of a rabbit per day is about 5 to 9% of its live weight expressed as dry matter. With fresh (green or humid) products the maximum intake capacity is about 20-25% of the live weight, calculated on the as feed basis.

RAW FEEDS NUTRITIONAL VALUE

The types of raw materials usable for rabbit feeding are very variable according to the country or the urban environment, but only some raw materials are effectively available for practical rabbits feeding in one place. To help in the choice of the most suitable ones, a list was established out of the free online encyclopedic data basis "Feedipedia" (www.feedipedia.org)

The screenshot shows the Feedipedia website interface. At the top, the logo "Feedipedia" is displayed in large white letters, with the tagline "Animal feed resources information system" below it. To the right of the logo are the logos for INRA, CIRAD, and FAO. Below the header is a navigation menu with links: Home, About Feedipedia, Team, Partners, Support Feedipedia, and Contact us. A search bar is located on the right side of the menu with the text "Search feedipedia.org" and a "Go!" button. On the left side, there is a sidebar with "Automatic translation" and "Feed categories". The "Feed categories" section lists various feed types such as "Forage plants", "Plant products/by-products", "Feeds of animal origin", and "Other feeds". The main content area features a large image of a person riding a water buffalo in a rural setting. Below the image, there are two main articles: "Feedipedia: An on-line encyclopedia of animal feeds" and "Sustainable Animal Diets - FAO Survey". The "Sustainable Animal Diets" article includes a call to action: "Can we move towards 'Sustainable animal diets'? Give your opinion by answering this FAO survey until 10 August 2013 in English, French or Spanish." Below the articles, there is a section titled "Explore Feedipedia" with a link to "see the list of 232 completed datasheets." On the right side, there is a "Tweets" section showing three tweets from @Feedipedia, each with a date and a link to a new feed item.

Feedipedia Animal feed resources information system

INRA CIRAD FAO

Home About Feedipedia Team Partners Support Feedipedia Contact us Search feedipedia.org Go!

Automatic translation
Sélectionner une langue

Feed categories

- All feeds
- Forage plants
 - Cereal and grass forages
 - Legume forages
 - Forage trees
 - Aquatic plants
 - Other forage plants
- Plant products/by-products
 - Cereal grains and by-products
 - Legume seeds and by-products
 - Oil plants and by-products
 - Fruits and by-products
 - Roots, tubers and by-products
 - Sugar processing by-products
 - Plant oils and fats
 - Other plant by-products
- Feeds of animal origin
 - Animal by-products
 - Dairy products/by-products
 - Animal fats and oils
- Other feeds
 - Minerals
 - Other products

Feedipedia: An on-line encyclopedia of animal feeds

Feedipedia is an open access information system on animal feed resources that provides information on nature, occurrence, chemical composition, nutritional value and safe use of nearly 1400 worldwide livestock feeds. It is managed jointly by INRA, CIRAD, AFZ and FAO.

The main objective of Feedipedia is to provide extension and development workers, planners, project formulators, livestock farmers, science managers, policy makers, students and researchers with the latest scientific information to help them identify, characterize and properly use feed resources to sustainably develop the livestock sector.

Sustainable Animal Diets - FAO Survey

Can we move towards "Sustainable animal diets"? Give your opinion by answering this FAO survey until 10 August 2013 in **English, French or Spanish**. You will receive a report of the survey analysis and a CD-ROM containing FAO publications in the area of feeding, feed and feed safety and other FAO publications. [Click here to read more about the survey.](#)

Explore Feedipedia

[Click here to see the list of 232 completed datasheets.](#)

Tweets

- 16 Aug: New: Caribbean stylo (*Stylosanthes hamata*), a tropical legume used for pasture and hay in the Caribbean, South... fb.me/1WeG7WYdt
- 15 Aug: New: Barley forage including whole crop barley, barley silage and barley straw feedipedia.org/node/432. fb.me/X5r0vqIA
- 13 Aug: New: Mung bean (*Vigna radiata*).

Automatic translation

Selectionner une langue

Feed categories

All feeds

Forage plants

- Cereal and grass forages
- Legume forages
- Forage trees
- Aquatic plants
- Other forage plants

Plant products/by-products

- Cereal grains and by-products
- Legume seeds and by-products
- Oil plants and by-products
- Fruits and by-products
- Roots, tubers and by-products
- Sugar processing by-products
- Plant oils and fats
- Other plant by-products

Feeds of animal origin

- Animal by-products
- Dairy products/by-products
- Animal fats and oils

Other feeds

- Minerals
- Other products

Latin names

Plant and animal families
Plant and animal species

Resources

Bibliography

Glossary

Images

Books

Journals

Bibliographic databases

Feeds and plants databases

Organizations and networks

Who is visiting Feedipedia?

Sweet potato, aerial part, fresh



Main analysis	Unit	Avg	SD	Min	Max	Nb
Dry matter	% as fed	13.0	2.9	8.5	17.6	21
Crude protein	% DM	16.5	4.6	8.2	24.2	23
Crude fibre	% DM	21.1	5.3	11.9	30.3	17
NDF	% DM	42.7	6.7	29.8	51.6	10
ADF	% DM	31.7	6.8	19.9	40.6	10
Lignin	% DM	8.3	2.2	4.5	11.8	10
Ether extract	% DM	4.8	2.0	2.5	10.4	14
Ash	% DM	11.2	2.2	8.0	15.3	17
Gross energy	MJ/kg DM	18.3				*

Minerals	Unit	Avg	SD	Min	Max	Nb
Calcium	g/kg DM	9.5	6.6	1.3	19.8	12
Phosphorus	g/kg DM	2.9	1.6	0.8	5.7	11
Potassium	g/kg DM	24.9	11.8	2.5	41.4	10
Sodium	g/kg DM	0.8		0.8	0.9	2
Magnesium	g/kg DM	4.0	0.9	3.1	5.7	9
Manganese	mg/kg DM	141				1
Zinc	mg/kg DM	70				1
Copper	mg/kg DM	2				1
Iron	mg/kg DM	1690				1

Amino acids	Unit	Avg	SD	Min	Max	Nb
Arginine	% protein	6.0	0.7	5.2	6.8	5
Glutamic acid	% protein	7.9	1.2	6.4	9.6	5
Glycine	% protein	5.5	1.0	4.9	7.3	5
Histidine	% protein	1.4	0.4	1.1	2.0	5
Isoleucine	% protein	5.1	0.4	4.4	5.6	5
Leucine	% protein	8.6	0.8	7.5	9.6	5
Lysine	% protein	3.6	0.7	2.3	4.0	5
Methionine	% protein	1.1	0.6	0.5	2.0	5
Phenylalanine	% protein	5.1	0.4	4.5	5.6	5
Threonine	% protein	5.0	0.4	4.4	5.4	5
Valine	% protein	5.7	0.4	5.2	6.3	5

Secondary metabolites	Unit	Avg	SD	Min	Max	Nb
Tannins (eq. tannic acid)	g/kg DM	6.2				1

The asterisk * indicates that the average value was obtained by an equation.

Example of chemical composition proposed by Feedipedia

RAW FEEDS NUTRITIONAL VALUE

Very frequently the **digestible energy** for rabbits and the **crude protein digestibility** are lacking in tables even in such a complete data basis.

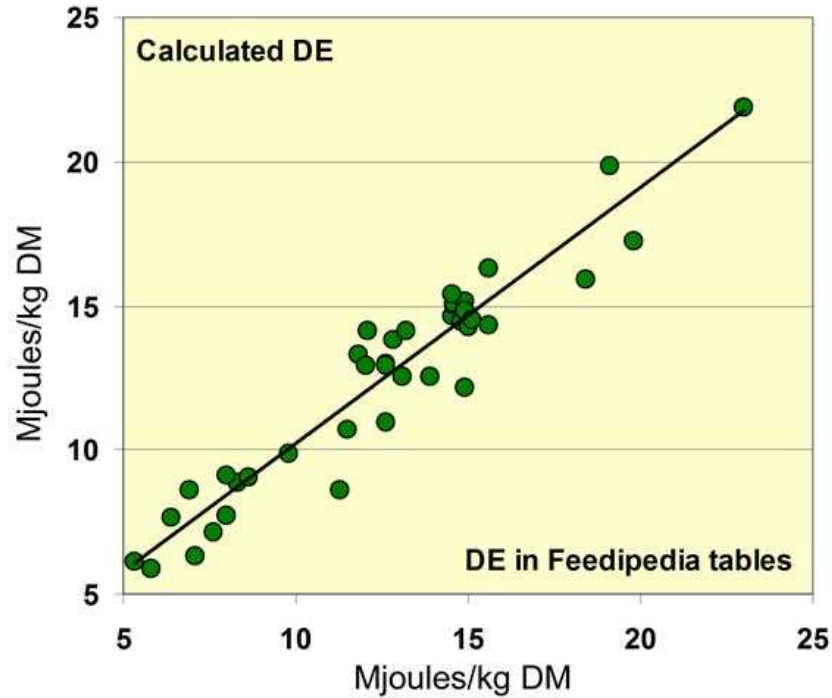
To offset this lack of information it's possible to use the equations recently proposed by Lebas (2013) for the estimation of digestible energy and protein digestibility of raw materials for rabbits, using the classical parameters of the chemical analysis.

$$\text{Digestible Energy} = 15.627 + 0.000982 \text{ CP}^2 + 0.0040 \text{ EE}^2 - 0.0114 \text{ MM}^2 - 0.169 \text{ ADF} \\ \pm 1.250 \text{ MJ/kg DM (R}^2 = 0.912 \text{)}$$

$$\text{Protein-Digestibility} = 64.734 + 0.646 \text{ CP} + 2.170 \text{ CF} + 0.414 \text{ NDF} - 2.894 \text{ ADF} \\ \pm 9.338 \% \text{ (R}^2 = 0.825 \text{)}$$

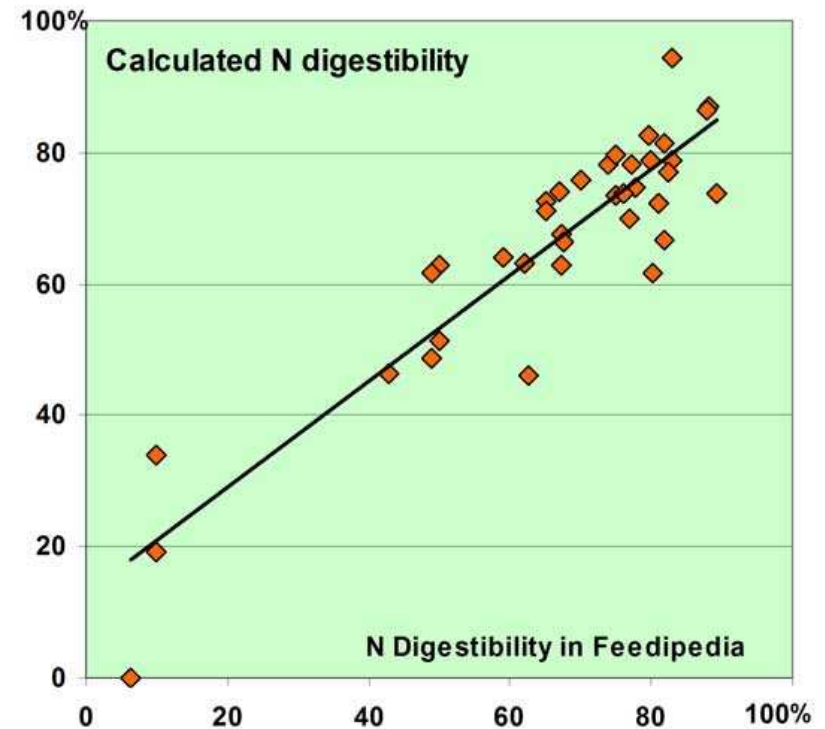
DE in MJoules /kg DM ; DM = Dry matter ; CP = % crude protein in DM; EE = % ether extract (lipids) in DM;
MM = % minerals (ash) in DM; ADF = % acid detergent fibre in DM ; CF = % crude fibre in DM;
NDF = % Neutral detergent fibre in DM.

RAW FEEDS NUTRITIONAL VALUE



Digestible ENERGY
=> ± 1.250 MJ/kg DM ($R^2 = 0.912$)

Digestibility coefficient of **PROTEINS**
=> ± 9.338 % ($R^2 = 0.825$)



RAW FEEDS NUTRITIONAL VALUE

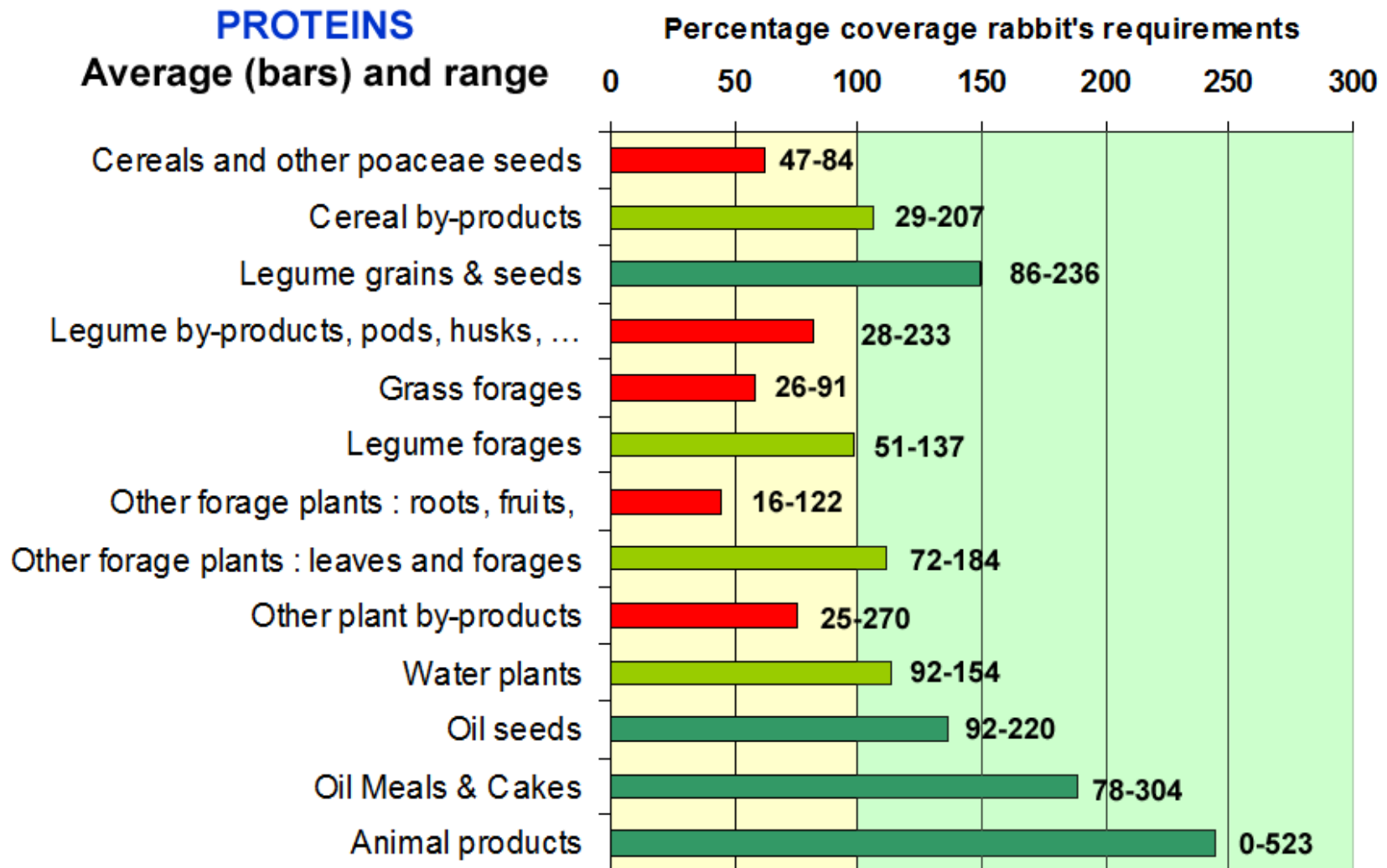
If a feeding ration respects the nutritional recommendations, even without consideration of the digestible energy, the corresponding diet is necessarily within the range of digestible energy ingestion regulation. Thus the next most important parameters to estimate the nutritive value of a feedstuff to be introduced in a balance diet are :

- the **proteins** level and these proteins **amino-acids balance**
- the ability to provide **calcium** and **phosphorus**
- the **quantity and type of fiber** (highly or poorly digestible according mainly to the lignin level)

A raw material could be **an interesting source** of protein, of amino acids, of fiber or of minerals if **the content exceed recommendations**. For this reason in the following figures, the nutrients content of groups of raw materials is presented as percentage of rabbits requirements. This type of information makes easy to determined the interest of a given raw material for such or such nutriment as well as its inadequacy for some others

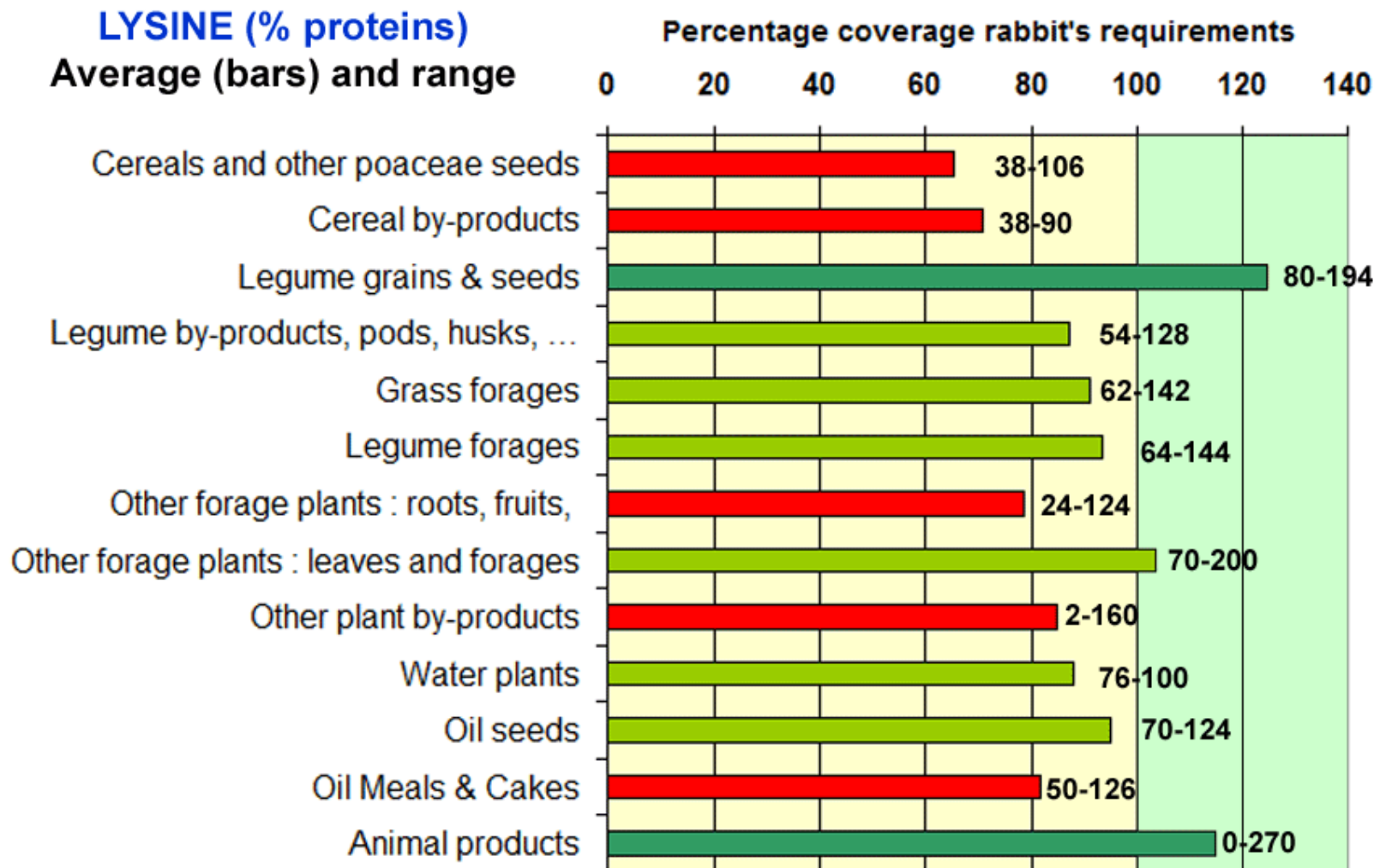
RAW FEEDS NUTRITIONAL VALUE

Ability of raw material groups to cover rabbit's requirement for **total Proteins** (18% in diets dry matter)



RAW FEEDS NUTRITIONAL VALUE

Ability of raw material groups to cover rabbit's requirement for **Lysine** (5% in diets proteins)

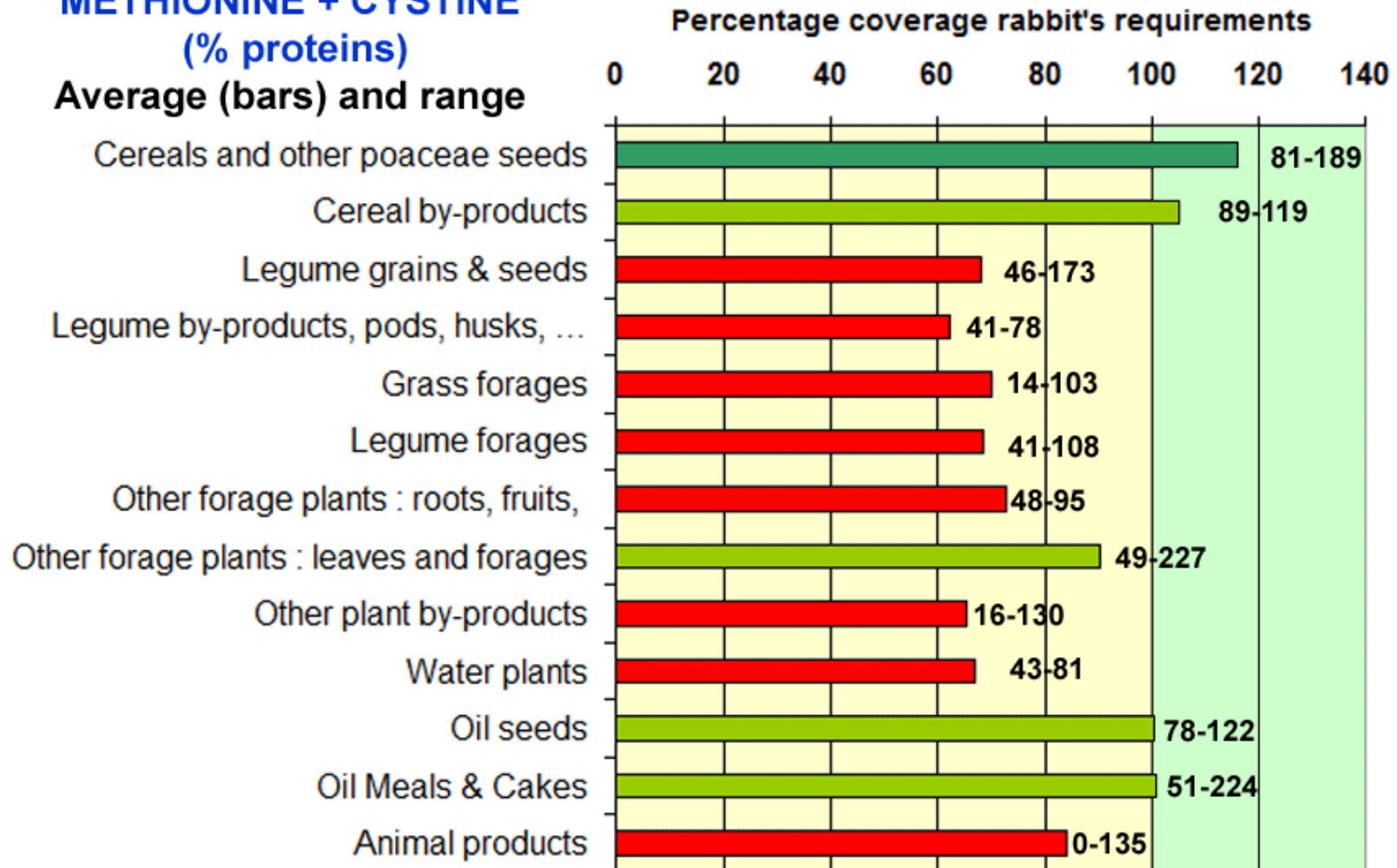


RAW FEEDS NUTRITIONAL VALUE

Ability of raw material groups to cover rabbit's requirement for **Methionine + Cystine** (3.7% in diets proteins)

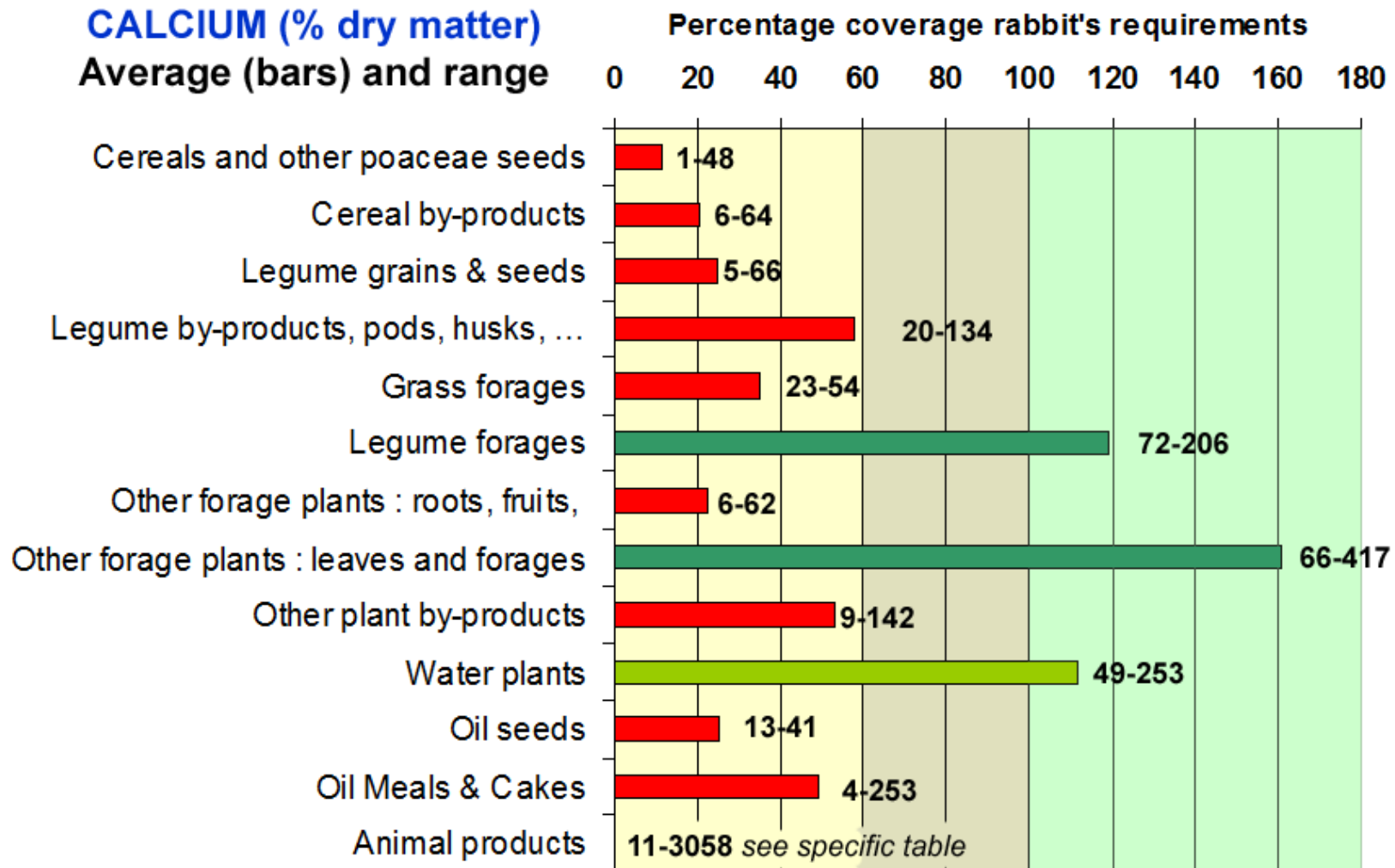
METHIONINE + CYSTINE (% proteins)

Average (bars) and range



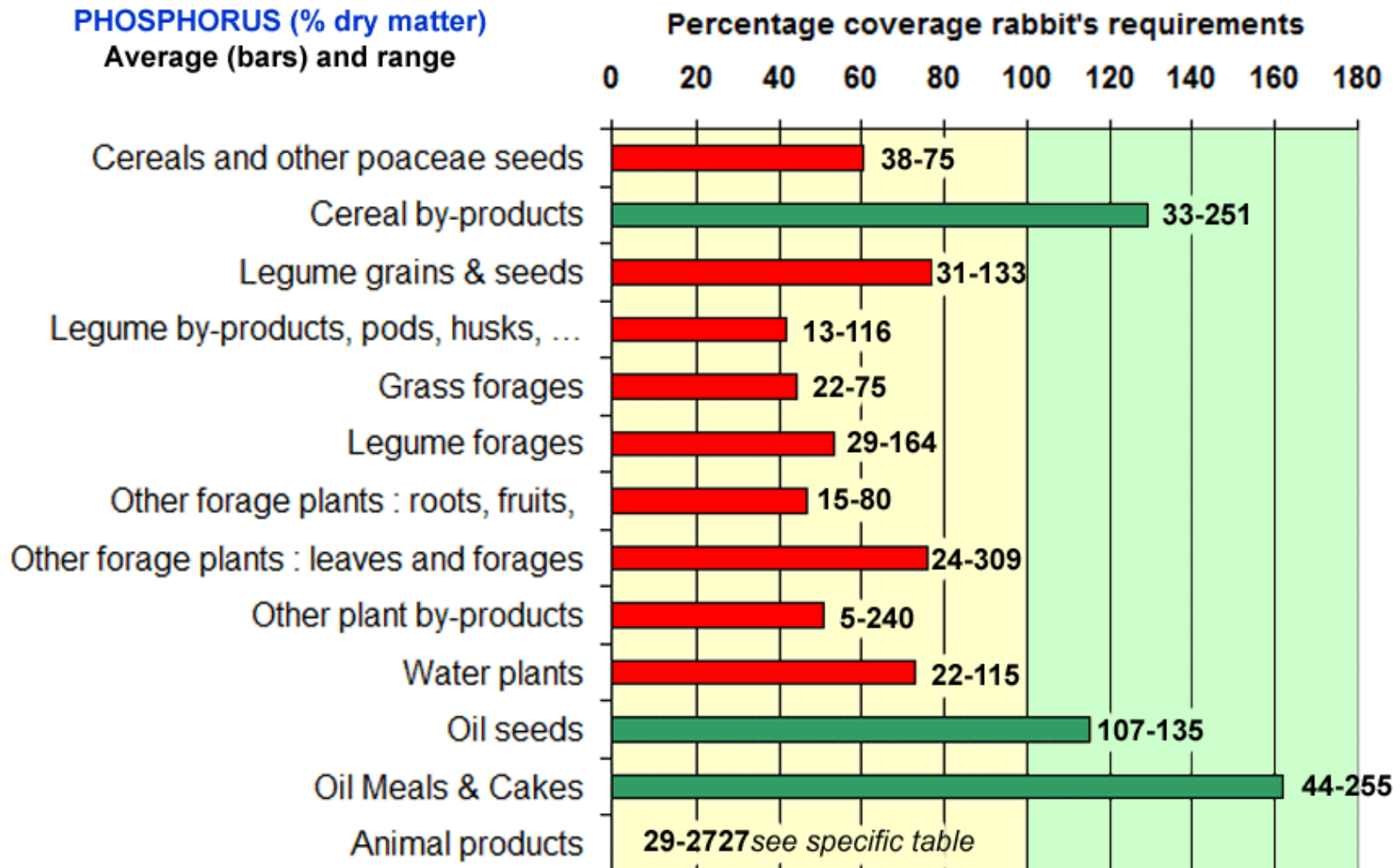
RAW FEEDS NUTRITIONAL VALUE

Ability of raw material groups to cover rabbit's requirement for **Calcium** (1.2% in diets dry matter)



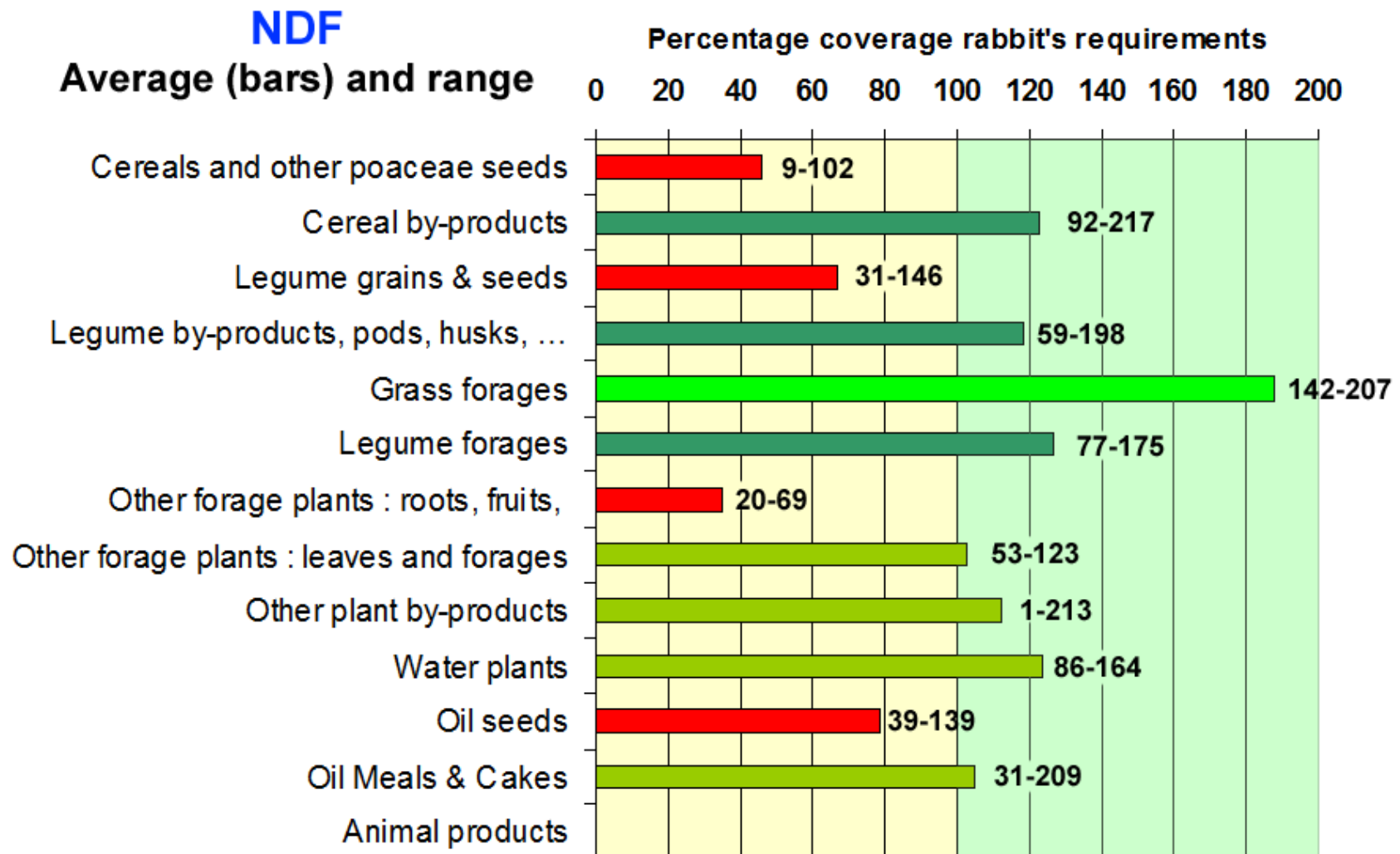
RAW FEEDS NUTRITIONAL VALUE

Ability of raw material groups to cover rabbit's requirement for **Phosphorus** (0.55% in diets dry matter)



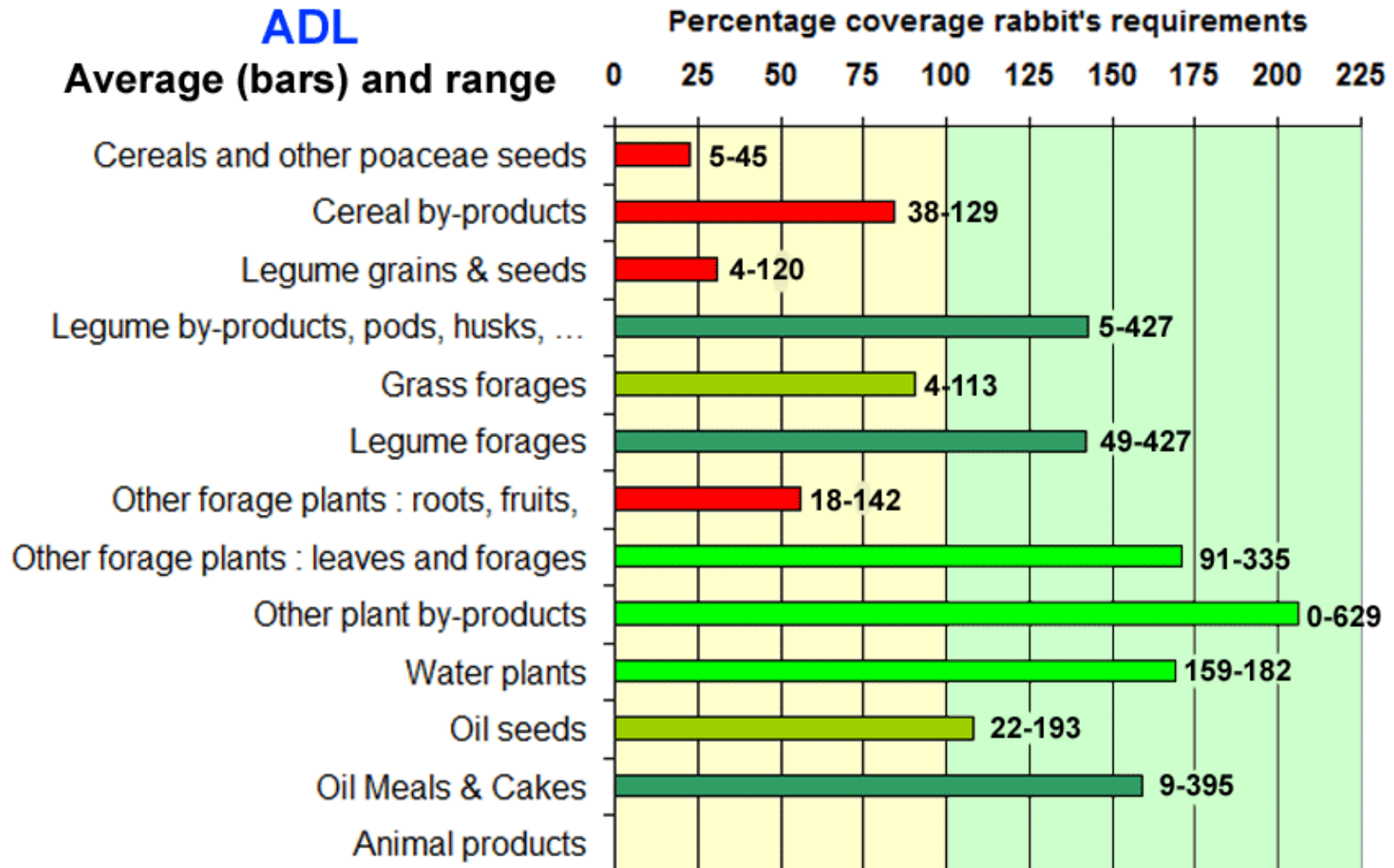
RAW FEEDS NUTRITIONAL VALUE

Ability of raw material groups to cover rabbit's requirement for **Neutral Detergent Fibre (NDF)** (35% in diets dry matter)



RAW FEEDS NUTRITIONAL VALUE

Ability of raw material groups to cover rabbit's requirement for
Lignins (ADL) (5.5% in diets dry matter)



PRACTICAL FEEDING

1 - Complete feeds are the main or exclusive source of nutrients

Whatever the dimension of the rabbit unit, the best solution is to follow recommendations proposed by the feed manufacturer and to distribute *ad libitum* clean water in addition to the pellets or complete meal

If the fiber content of the commercial feed is too low (frequent situation), it is advised to distribute in addition some fibrous forages (grass in general) : 10-20% of the total dry matter intake.

The breeder must remember that approximate feeds palatability order is :

Green forages > **Pellets** > **Dried forage** > **Meal presentation**



PRACTICAL FEEDING small units

2 - Small units and direct use of raw materials

The first work of the farmer is to determine the raw materials effectively available or possible to cultivate in the farm. The different tables included in the full paper were constructed as an help to **build a more or less balanced ration** by combination of the various raw materials produced in the farm, collected in the vicinity or purchased on the local market.



The farmer must also determine the availability of the different products during **one year cycle** according to the seasons , ...
... and the others needs of work on the farm.

The dimension of the project of rabbit unit, must be adapted to the real feed availability

PRACTICAL FEEDING small units

Don't forget that **everyday green forage** ...

cutting



transport



and distribution



are time consuming

PRACTICAL FEEDING small units

It is not advised to mix roughly non processed raw material because of the great ability of rabbits to select some parts of a mixture, to eat only the most palatable ones and then destroy the nutritional balance proposed by the breeder . When a rabbit seeks the most palatable parts, he scratches inside of the feeder and **can waste up to 40-50% of the distributed mixture.**

Morning : distribution of concentrates, separately, not mixed. The quantity distributed must be completely eaten within 6-7 hours. Commercial pellets could be considered as concentrate (maximum 40-50% of the daily DM intake)

End of the afternoon : Green forages can be distributed, in racks or feeders but never on the floor of the cage, in such quantity that, in the next morning, only very few or none of the distributed quantity remains in the rack

Dry forages (hay) could be distributed *ad libitum* but in a different part of the rack if they are used simultaneously with greens.



PRACTICAL FEEDING small units

Forage distribution must be done in specific racks, fixed inside of the cage, in a pinch on the top of the cage, but never on the floor of the cage because of the pollution of feeds by droppings.



Forage distribution directly on the cage floor could be acceptable if the forage is eaten **within 2-3 hours maximum**

PRACTICAL FEEDING small units



Rabbits should not be allowed to enter in rack



A better solution, but this rack is inside of the cage



This position, outside of the cage is one of the best, here for a pet rabbit



A rack between 2 cages is also a good solution



If the filling is not easy from the open top, a lateral access is advised



A plate under the rack is advised, to collect the wasted small parts

PRACTICAL FEEDING small units

As for forage racks, **feeders** used for concentrates should be impossible to reverse, not polluted by rabbits droppings, easy to fill without opening the cage, ...



Easy to fill from outside



Difficult to return



But too easy to pollute with droppings



<< In this feeder soybean grains *and* pellets were mixed

Consequence, rabbits have wasted one part of the pellets, lost under the cage floor >>



PRACTICAL FEEDING small units

Forages drying : In most regions, forages, the main source of the fiber for rabbits, are not necessarily available in the green form all the year round. Consequently, the **production and storage of dried forages is strongly encouraged for small breeders**. *The green forages can be harvested in small quantities, day after day, during the rainy season and/or at the beginning of the dry season, and dried in the immediate vicinity of the farmer's house.*

This sun drying can be done on large tarpaulins, on cemented or rocky areas, or on the roof terrace of the farmer's house

Sun drying of berseem on house roof terrace in Afghanistan



Such sun drying could be applied to any type of forage, including the tree leaves, as different products such as cassava root slices, fruits slices, or grains



Grain drying on a tarpaulin =>

PRACTICAL FEEDING small units

For a better conservation of the forages nutritive value (vitamins in particular), the drying may be practiced in the shadow of a shed. The shed must be well ventilated, drying duration is a little bit longer than under direct sun shine, but there is not any trouble with rain !



Drying of *Pueraria phaseolides* vines in a shed



Drying of tree foliage (*Leucaena*, *Albizia*, ...) in a shed. When the foliage is dry, it is easy to separately collect the small leaves rich in protein, by simple combing and scratching.

PRACTICAL FEEDING medium scale units

All recommendations done for small units are suitable for **medium ones**. Only the drying process of forages needs a better organization and specific means because quantities are greater.



Cutting and **drying** for example needs more people at the same time or the assistance of more sophisticated machines



PRACTICAL FEEDING medium scale units

Transport and storage of forages, if used extensively in the rabbit unit, must also be organized at a larger scale



Transport



Storage

PRACTICAL FEEDING medium scale units

Medium scale production units can **produce their own complete feed**, alone or in association with some (3-4) nearby other medium rabbit units.

The only 2 equipments strictly necessary are a forage grinder and a balance. These small equipments are available for example from different Chinese or Indian companies for a reasonable amount of money => diet presented as meal



Grain mills are **not** suitable to prepare rabbit feeds



Grinders with a large entry and hammers, are suitable to grind forages and grains also.



Different types of balances could be used, from very cheap to more expensive ones

PRACTICAL FEEDING medium scale units

The adequate quantities of the meal obtained from each raw material used in a dietary formula are weighted and then mixed together and with additives (minerals in powder, premix, pure amino acids if necessary, ...). **A correct mixture can be obtained by hand with a shovel on a cemented area**, or with a mechanical mixing device. But the later is NOT a necessary equipment if the quantity is not too large.

If some money is available, the next useful equipment is a **small pelleting machine**. Such machine were developed initially to pelletize wood by-products



Pelleting machine working
in Benin



Pelleting machine working
in China



Promotion machines during
an exhibition in China

PRACTICAL FEEDING medium scale units

If some more money is available, a mixer may be added in the small feed factory equipment. A cement mixer can be used for small quantities : 20 to 100 kg of meal according to the type of machine.

Vertical or horizontal feed meal mixers are also available for greater quantities



After this step, a more complete equipment could be purchased ... and this is without limit till industrial feed factory.



CONCLUSION

In small or medium scale rabbit production units, the **feeding strategy** must be based on different items :

- Knowledge of rabbits **nutritional requirements** : a single type of feed is sufficient
- Knowledge of rabbit's **feeding behavior**
- Determination of the **raw feeds** effectively **available** around the rabbitry
- Estimation of the **nutritive value** of these raw materials (see tables)
- Make a “simple” formulation to propose **a ration as balanced as possible**



CONCLUSION

Once these parameters determined, whatever the scale, the **practical feeding strategy** is :

- Never mix unprocessed raw materials**, rabbits select the most palatable ones and waste the others. Distribute the raw ingredients in separate feeders
- Distribute** concentrates in the morning and forages at the end of the afternoon
- Control** visually the **effective consumption** of the feeds
- Storage of dried forages** and other products is strongly recommended for periods "without fresh forages" or low availability of other raw materials

- In **medium scale rabbitry**, *if necessary in association with few neighbors*, it is possible to create a **small unit of rabbit feeds production** with a minimum of equipment : only a balance and a forage grinder.
- If some more money is available, the next equipment would be a **small pelleting machine**.
- A **meal mixer** is really necessary only if the production is important (more than 200 kg /day)

*Thanks
for your attention*

