

## REVIEWERS COMMENTS AND RESPONSES OF THE AUTHORS

**(Responses of authors are marked in yellow)**

### Response file for Manuscript “Opinion paper: The relevance of feed diversity and choice for ruminant livestock”

*Dear Editors and reviewers,*

*We thank you very much for the efforts you put in our opinion paper and for your very helpful and constructive comments! We found most of the suggestions justified and tried to satisfy them as good as possible.*

*There was however one constraint, that reviewer #1 demanded a clearer scientific background, while reviewer #2 expected more application towards a practical discussion. Given the restricted space, we could try our best to follow both. Therefore we cut down our own research examples to a minimum. Also we introduced sub-headers in order to give the text a better structure.*

*Below, you will find our detailed responses.*

*In the manuscript, all changes are highlighted in yellow.*

*We very much hope that you now will find the demanded clarity and that we can convince you to publish this small paper (and agree with our arguments... ;-))*

*Many thanks again and kind regards on behalf of all authors,*

*Florian Leiber*

## COMMENTS TO THE AUTHORS

### Editor/Chief Editor Landbauforschung

We will accept your manuscript incorporating major revisions based on the comments of the reviewers. So please take into account the reviewers' recommendations to sharpen your position.

Also we got the positive suggestion that you might broaden your position: It might be worth to include ideas how diverse feed choice might be implemented in practice, what consequences it might have on nutrient utilisation in feeding, what environmental consequences might follow but also if plants can be focused at, that cannot be utilised for human nutrition. This might give additional value to your position.

*RE: we rewrote the second part of the manuscript and provided more practical views of how we think the targets should be achieved.*

Please write a short response to each of the reviewers comments. We also welcome the inclusion of a graph as recommended by reviewer #1 . Please follow strictly the instructions for authors. The revised version of your manuscript will be evaluated again by the Chief editor and, if necessary, by the reviewers.

### Reviewer # 1:

#### Summary of the aim of the paper

Authors in this manuscript argue that feed choice in livestock systems is key for animal welfare.

#### General comments

On this brief review the Authors try to make a case for the importance of forage diversity on animal welfare, which is an original and significant topic. The short presentation in this review prevents a

more comprehensive revision of the topics presented, which are diverse and emerge from different disciplines, including psychology, physiology, health, nutrition, welfare and product quality. A graph may help summarize the information presented, also contributing to give more structure and direction to the ideas presented.

*Re: we agree that we were not clear enough regarding the scientific background. We rewrote large parts of the first part aiming at a more clear story line. However, we did not see, how we could integrate a graph in this short opinion paper.*

#### General comments on strength and weaknesses of the paper and on possible improvements

A better distinction needs to be delineated regarding the presence of a diverse array of flavors, nutrients and secondary compounds on animal health and welfare. Choice of diverse flavors may entail reductions in boredom, whereas diverse nutrients help build a balanced diet and diverse secondary compounds imply improvements in health and nutrition. Again, a figure may help organize the lines of evidence presented, allowing for a more articulated presentation.

*Re: we hope that even without a graph our line of arguments is now more clear. We understand the need to go much deeper in differentiation of aspects, however, the limited space of this format does not allow for.*

#### Detailed comments referring to the line numbers, figures and tables

Line 18. A description of contrafreeloading seems appropriate here.

*Re: we did not go in details of contrafreeloading, due to the limited space.*

Line 25. Regarding “advantages in later coming precarious situations” see *Frontiers in Veterinary Science*. 2019;6:303.

*Re: thank you for this suggestion. We included this important reference in several arguments.*

Lines 28-54. Authors need to provide the classical evolutionary explanations for diverse diets in herbivores (e.g., Freeland and Janzen; *Am. Nat.* 108:269-289; Westoby, 1974; *Am. Nat.* 112:627-631). The example on linoleic acid falls within the category of Westoby’s selection of a nutritionally balanced diet with the addition that some secondary compounds (e.g., phenolics) are not directly needed to satisfy the individual’s nutritional needs but to influence the rumen microbiota such that other chemicals are provided to satisfy those individual nutritional needs.

*Re: thank you also for this suggestion. We included the Westoby 1978 reference and tried to base our arguments on diet composition on this source.*

Line 67. The *ability* is also expressed in preferences for flavors associated to nutrients.

*Re: we changed the text accordingly (now line 76).*

Line 73. The connection between calmer behavior with diversification of feed offered is not clear to me here.

*Re: we shortened this part to a minimum, so this argument is no longer part of the text.*

Lines 83-85. A better rationale for this is required within the context of the argument presented (i.e., choice, diversity and welfare). One can argue that choosing time, duration and amount of feed consumed is equally possible when animals have only access to a single ration.

Need a figure.

*Re: the argument is not only about time and duration, but about temporal change of preferences. We adapted the sentence slightly and hope it is clearer now (line 87)*

#### Conclusions

Conclusions are justified and supported by the cited references.

#### Recommendation

**Major revisions needed** (e.g., lines 93-104; 11-114).

## Reviewer # 2:

### General comments

The position paper “The relevance of feed diversity and choice for ruminant livestock” deals with the subject matter that besides further behavioural aspects the opportunity of a free choice of feed contributes to the animals’ well-being and additionally constitutes a fundamental physiological need. In the course of this, differences between animals kept in livestock systems and those living in wild life situations are contrasted. Hereby, single aspects of nutrition such as that of fatty acids are discussed in detail.

Thematically, the present manuscript relates to the main topic „Evolution in animal husbandry – Fitting animals or fitting systems?“ of the journal *Landbauforschung*’s actual issue.

The author - or perhaps the authors - present a number of results of scientific studies in a surely well prepared way. These studies describe the advantages of providing the possibility of choice from a variety of different forage crops for the feeding of ruminant livestock. For this, they partly refer to nutritional habits of animals living in wild life situations. Additionally, there are hints of how this may improve the product quality and additionally the ecological value of diverse pastures is emphasized. These insights are not fundamentally new and unfortunately the manuscript does not go ahead with those findings.

*Re: thank you for this critical assessment, because certainly, we want to go ahead with these arguments. We agree that the scientific basis of our argumentation is not that new, which however does not mean that such knowledge is translated into practical livestock husbandry solutions, yet. We therefore rewrote the last third of the paper in order to make more clear, where we see the open issues for research, development and practice in this respect.*

The reviewer considers that it is important in a manuscript under the rubric „position paper“ to present positions that give rise to a novel discussion with its readers. Concretely, this could mean the framing of positions of how a feed diversity and choice for ruminant livestock should be implemented in the author’s or authors’ opinion. Conversely, they could also name positions not at all compatible with those requirements. Exemplary considerations would be if all grazing areas could serve for obligatory pasture grazing of ruminant livestock; or if marginal areas existing in territories with low precipitations or with naturally low productivity may possibly not be appropriate to meet the animals’ fundamental physiological requirements. Another question would be if employing preserved roughage like hay enables to meet the challenges during bridging times outside the vegetation period when considering aspects of animal welfare.

*Re: the rewritten last third of our manuscript is our answer to your concerns here. We tried to find a way to satisfy your demand for better visibility and applicability of our ideas.*

In order to meet the requirements of a position paper to be published in the journal *Landbauforschung* it is recommended to reduce the detailed description of the results of academic literature so that the authors’ own concrete positions can be drafted more widely.

*Re: this recommendation is in some conflict with the view of reviewer #1. However, we omitted quite a lot of examples in the middle part of the text and increased the description of our position.*

### Some specific comments by line

L14-15 “fundamental physiological ... need of the herbivore”

What exactly does this mean? How was the fundamental physiological need derived and defined?

*RE: we consider the whole scientific part of our text to be the answer to your questions. This is the idea, which we try to develop.*

L26 Poli et al., 2018 is missing within the reference list.

*Re: added.*

L42-43 “foregut-fermenting species must by all means ensure that the microbiome in its stomach is controlled”

Are ruminants capable to control the microbiome within their forestomachs deliberately? Please state reference.

*Re: this is our hypothesis (we now stated so, line 58). But all the self-medication proofs of the Viallalba/Provenza group: what else do they say than yes, a ruminant is capable to control their metabolism deliberately, to some degree?...*

#### Recommendation

I recommend **major revisions** of the manuscript.

#### **FINAL ACCEPT**

##### **Editor/Chief-Editor Landbauforschung**

Landbauforschung: Accept (minor rev.)

We are pleased to inform you that **we've accepted your revised manuscript "Position Paper: The relevance of feed diversity and choice for ruminant livestock"**, which you submitted to Landbauforschung – *Journal of Sustainable and Organic Agricultural Systems*.

There is only one suggestion by reviewer #2 left, please see below. Please check whether you want to include this advice.

#### **Reviewer Blind Comments to Authors (Revision 1)**

##### **Reviewer #1**

I believe the Authors have taken into consideration all the suggestions I provided in my previous review and I believe the text has a broader approach that can be accepted for publication.

##### **Reviewer # 2:**

Thank you very much for the revision of the manuscript and the inserted additions.

I now regard this position paper as basically suitable for publication. Particularly endorsed is the stated recommendation for a large range of new research including systematic evaluations of animals' behavioural and metabolic responses as well as veterinary aspects concerning the relevance of feed diversity and choice for ruminant livestock.

However, I have one more remark regarding the conclusions. The fundamental rejection of total mixed rations for prospective investigations contradicts the previously postulated need for continued research. I recommend to reconsider this statement and not to exclude the use of total mixed rations from future research activities. Experience shows that despite all converse efforts to avoid selection of individual components from total mixed rations, cows are still capable to do so.