Type of the Paper (Article, Review, Communication, etc.)

Title

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**Abstract:** A single paragraph of about 200 words maximum. For research articles, abstracts should give a pertinent overview of the work. We strongly encourage authors to use the following style of structured abstracts, but without headings: (1) Background: Place the question addressed in a broad context and highlight the purpose of the study; (2) Methods: briefly describe the main methods or treatments applied; (3) Results: summarize the article's main findings; (4) Conclusions: indicate the main conclusions or interpretations. The abstract should be an objective representation of the article and it must not contain results that are not presented and substantiated in the main text and should not exaggerate the main conclusions.

**Keywords:** keyword 1; keyword 2; keyword 3 (List three to ten pertinent keywords specific to the article yet reasonably common within the subject discipline.)

0. How to Use This Template

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The template details the sections that can be used in a manuscript. Note that each section has a corresponding style, which can be found in the “Styles” menu of Word. Sections that are not mandatory are listed as such. The section titles given are for articles. Review papers and other article types have a more flexible structure.

Remove this paragraph and start section numbering with 1. For any questions, please contact the editorial office of the journal or support@mdpi.com.

1. Introduction

The introduction should briefly place the study in a broad context and highlight why it is important. It should define the purpose of the work and its significance. The current state of the research field should be carefully reviewed and key publications cited. Please highlight controversial and diverging hypotheses when necessary. Finally, briefly mention the main aim of the work and highlight the principal conclusions. As far as possible, please keep the introduction comprehensible to scientists outside your particular field of research. References should be numbered in order of appearance and indicated by a numeral or numerals in square brackets—e.g., [1] or [2,3], or [4–6]. See the end of the document for further details on references.

**2. Results**

This section may be divided by subheadings. It should provide a concise and precise description of the experimental results, their interpretation, as well as the experimental conclusions that can be drawn.

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| Chart  Description automatically generated | Chart, scatter chart  Description automatically generated |

**Figure 1.** Posterior distribution of variety x location interaction effect and of location effect for (**a**) parameter *a*; and (**b**) parameter *b*. Points represent median value and thin line represents 0.05 and 0.95 quantile range. Values displayed adjacent to distributions are for the median value with the values for the 0.05 and 0.95 quantile range displayed within the parentheses.

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| Diagram, shape  Description automatically generated |

**Figure 2.** Distribution of posterior values for parameters *a* and *b* for each location x variety interaction shown as a scatterplot with marginal density distribution given for each parameter. Pearson correlation coefficient [R] is displayed for the relationship between parameters *a* and *b* for each location x variety interaction. Data are shown at the level of individual draws (n=28,000)

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**Figure 3.** Median fitted critical N dilution curve for each location x variety interaction shown as solid black line. Biomass and nitrogen concentration data used for fitting the statistical model are displayed as points with the median fitted linear-plateau curve for each sampling date shown as grey line. The number of samples [n] and the number of sampling dates [i] used to fit the linear-plateau curves are displayed for each location x variety interaction.

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**Figure 4.** Comparison of methods to quantify uncertainty in critical nitrogen dilution curve values. Solid black line represent critical nitrogen dilution curve from median posterior values for parameters *a* and *b* **or** this represent the median critical nitrogen concentration value derived from the distribution of critical nitrogen concentration values as computed from posterior distribution of paired values for parameters *a* and *b*. Grey shaded region represents the credible region (lower bound, 5% quantile; upper bound, 95% quantile) for the critical nitrogen concentration values derived from the distribution of critical nitrogen concentration values as computed from posterior distribution of paired values for parameters *a* and *b*. Dotted lines represents non-linear regression estimate for the upper and lower bound of the credible interval based on subsequent fit of negative exponential curve using the same equation form as the critical nitrogen dilution curve. Dashed lines represent more conservative estimates of the upper and lower bounds of critical nitrogen concentration uncertainty based on the posterior distribution of parameters *a* and *b* where the estimated lower bound is defined using the 95% quantile value of parameter *a* with the 5% quantile value of parameter *b* and the estimated upper bound is defined using the 5% quantile value of parameter *a* with the 95% quantile value of parameter *b*. Percent N (%N) Difference represents the difference between the median critical nitrogen concentration value and the various boundary estimates as previously described above.

**Table 2.** Paired critical nitrogen dilution curve parameter values for each variety x location interaction defining a conservative estimate for the lower (Conserv. Low) and upper (Conserv. High), the estimate values for the credible region lower (Cred. Est. Low) and upper (Cred Est. High), and the Median value from the posterior distribution for critical nitrogen concentration.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Location** | **Variety** |  | Conserv. Low | Cred. Est. Low | **Median** | Cred. Est. High | Conserv. High |
| Argentina | Bannock Russet | *a* | 4.72 | 4.82 | **4.95** | 5.10 | 5.20 |
| *b* | 0.163 | 0.146 | **0.140** | 0.135 | 0.118 |
| Gem Russet | *a* | 4.71 | 4.79 | **4.95** | 5.07 | 5.19 |
| *b* | 0.206 | 0.190 | **0.179** | 0.153 | 0.140 |
| Innovator | *a* | 4.70 | 4.83 | **4.94** | 5.05 | 5.18 |
| *b* | 0.252 | 0.241 | **0.211** | 0.191 | 0.177 |
| Markies Russet | *a* | 4.72 | 4.82 | **4.96** | 5.08 | 5.20 |
| *b* | 0.183 | 0.168 | **0.155** | 0.135 | 0.121 |
| Umatilla Russet | *a* | 4.71 | 4.85 | **4.95** | 5.06 | 5.19 |
| *b* | 0.206 | 0.195 | **0.165** | 0.143 | 0.131 |
| Belgium | Bintje | *a* | 4.42 | 4.52 | **4.71** | 4.90 | 4.99 |
| *b* | 0.640 | 0.606 | **0.579** | 0.568 | 0.531 |
| Charlotte | *a* | 4.45 | 4.56 | **4.74** | 4.90 | 5.00 |
| *b* | 0.636 | 0.606 | **0.559** | 0.531 | 0.499 |
| Canada | Russet Burbank | *a* | 4.46 | 4.53 | **4.74** | 4.93 | 5.01 |
| *b* | 0.531 | 0.498 | **0.489** | 0.480 | 0.447 |
| Shepody | *a* | 4.48 | 4.55 | **4.76** | 4.95 | 5.03 |
| *b* | 0.447 | 0.416 | **0.412** | 0.406 | 0.376 |
| Minnesota | Clearwater | *a* | 4.45 | 4.54 | **4.75** | 4.93 | 5.01 |
| *b* | 0.646 | 0.619 | **0.584** | 0.557 | 0.53 |
| Dakota Russet | *a* | 4.45 | 4.53 | **4.74** | 4.94 | 5.01 |
| *b* | 0.646 | 0.617 | **0.598** | 0.587 | 0.557 |
| Easton | *a* | 4.45 | 4.53 | **4.74** | 4.91 | 5.01 |
| *b* | 0.636 | 0.608 | **0.591** | 0.566 | 0.541 |
| Russet Burbank | *a* | 4.45 | 4.50 | **4.74** | 4.94 | 5.00 |
| *b* | 0.595 | 0.561 | **0.564** | 0.565 | 0.532 |
| Umatilla | *a* | 4.46 | 4.55 | **4.75** | 4.91 | 5.01 |
|  | *b* | 0.655 | 0.628 | **0.586** | 0.545 | 0.521 |

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**Figure 5.** Comparison of critical nitrogen concentration values between Russet Burbank x Minnesota and all other location x variety levels fitted in the present study. Blue points indicate that the median critical nitrogen concentration is within the credible region for the critical nitrogen concentration for Russet Burbank x Minnesota; red points are those which fall outside of the credible region for critical nitrogen concentration.

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**Figure 6.** Comparison of critical nitrogen concentration from previous studies using conventional methods to derive the critical nitrogen dilution with the method used in the present study. Blue points indicate critical nitrogen concentration values calculated using the critical nitrogen dilution curve from previous studies that is within the credible region for the critical nitrogen concentration identified in the present study; red points are those which fall outside of the credible region for critical nitrogen concentration.

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**Appendix 1.**

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**Appendix 2.**

2.1. Subsection

2.1.1. Subsubsection

Bulleted lists look like this:

* First bullet;
* Second bullet;
* Third bullet.

Numbered lists can be added as follows:

1. First item;
2. Second item;
3. Third item.

The text continues here.

2.2. Figures, Tables and Schemes

All figures and tables should be cited in the main text as Figure 1, Table 1, etc.



**Figure 1.** This is a figure. Schemes follow the same formatting.

**Table 1.** This is a table. Tables should be placed in the main text near to the first time they are cited.

|  |  |  |
| --- | --- | --- |
| **Title 1** | **Title 2** | **Title 3** |
| entry 1 | data | data |
| entry 2 | data | data 1 |

1 Tables may have a footer.

The text continues here (Figure 2 and Table 2).

|  |  |
| --- | --- |
|  |  |
| (**a**) | (**b**) |

**Figure 2.** This is a figure. Schemes follow another format. If there are multiple panels, they should be listed as: (**a**) Description of what is contained in the first panel; (**b**) Description of what is contained in the second panel. Figures should be placed in the main text near to the first time they are cited. A caption on a single line should be centered.

**Table 2.** This is a table. Tables should be placed in the main text near to the first time they are cited.

|  |  |  |  |
| --- | --- | --- | --- |
| **Title 1** | **Title 2** | **Title 3** | **Title 4** |
| entry 1 | data | data | data |
| data | data | data |
| data | data | data |
| entry 2 | data | data | data |
| data | data | data |
| entry 3 | data | data | data |
| data | data | data |
| data | data | data |
| data | data | data |
| entry 4 | data | data | data |
| data | data | data |

2.3. Formatting of Mathematical Components

This is example 1 of an equation:

|  |  |
| --- | --- |
| a = 1, | (1) |

the text following an equation need not be a new paragraph. Please punctuate equations as regular text.

This is example 2 of an equation:

|  |  |
| --- | --- |
| a = b + c + d + e + f + g + h + i + j + k + l + m + n + o + p + q + r + s + t + u + v + w + x + y + z | (2) |

the text following an equation need not be a new paragraph. Please punctuate equations as regular text.

Theorem-type environments (including propositions, lemmas, corollaries etc.) can be formatted as follows:

**Theorem 1.** Example text of a theorem. Theorems, propositions, lemmas, etc. should be numbered sequentially (i.e., Proposition 2 follows Theorem 1). Examples or Remarks use the same formatting, but should be numbered separately, so a document may contain Theorem 1, Remark 1 and Example 1.

The text continues here. Proofs must be formatted as follows:

**Proof of Theorem 1.** Text of the proof. Note that the phrase “of Theorem 1” is optional if it is clear which theorem is being referred to. Always finish a proof with the following symbol. □

The text continues here.

3. Discussion

Authors should discuss the results and how they can be interpreted from the perspective of previous studies and of the working hypotheses. The findings and their implications should be discussed in the broadest context possible. Future research directions may also be highlighted.

4. Materials and Methods

The Materials and Methods should be described with sufficient details to allow others to replicate and build on the published results. Please note that the publication of your manuscript implicates that you must make all materials, data, computer code, and protocols associated with the publication available to readers. Please disclose at the submission stage any restrictions on the availability of materials or information. New methods and protocols should be described in detail while well-established methods can be briefly described and appropriately cited.

Research manuscripts reporting large datasets that are deposited in a publicly available database should specify where the data have been deposited and provide the relevant accession numbers. If the accession numbers have not yet been obtained at the time of submission, please state that they will be provided during review. They must be provided prior to publication.

Interventionary studies involving animals or humans, and other studies that require ethical approval, must list the authority that provided approval and the corresponding ethical approval code.

5. Conclusions

This section is not mandatory but can be added to the manuscript if the discussion is unusually long or complex.

6. Patents

This section is not mandatory but may be added if there are patents resulting from the work reported in this manuscript.

**Supplementary Materials:** The following are available online at www.mdpi.com/xxx/s1, Figure S1: title, Table S1: title, Video S1: title.

**Author Contributions:** For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used “Conceptualization, X.X. and Y.Y.; methodology, X.X.; software, X.X.; validation, X.X., Y.Y. and Z.Z.; formal analysis, X.X.; investigation, X.X.; resources, X.X.; data curation, X.X.; writing—original draft preparation, X.X.; writing—review and editing, X.X.; visualization, X.X.; supervision, X.X.; project administration, X.X.; funding acquisition, Y.Y. All authors have read and agreed to the published version of the manuscript.” Please turn to the CRediT taxonomy for the term explanation. Authorship must be limited to those who have contributed substantially to the work reported.

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**Data Availability Statement:** In this section, please provide details regarding where data supporting reported results can be found, including links to publicly archived datasets analyzed or generated during the study. Please refer to suggested Data Availability Statements in section “MDPI Research Data Policies” at https://www.mdpi.com/ethics. You might choose to exclude this statement if the study did not report any data.

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**Appendix A**

The appendix is an optional section that can contain details and data supplemental to the main text—for example, explanations of experimental details that would disrupt the flow of the main text but nonetheless remain crucial to understanding and reproducing the research shown; figures of replicates for experiments of which representative data is shown in the main text can be added here if brief, or as Supplementary data. Mathematical proofs of results not central to the paper can be added as an appendix.

**Appendix B**

All appendix sections must be cited in the main text. In the appendices, Figures, Tables, etc. should be labeled starting with “A”—e.g., Figure A1, Figure A2, etc.

References

References must be numbered in order of appearance in the text (including citations in tables and legends) and listed individually at the end of the manuscript. We recommend preparing the references with a bibliography software package, such as EndNote, ReferenceManager or Zotero to avoid typing mistakes and duplicated references. Include the digital object identifier (DOI) for all references where available.

Citations and references in the Supplementary Materials are permitted provided that they also appear in the reference list here.

In the text, reference numbers should be placed in square brackets [ ] and placed before the punctuation; for example [1], [1–3] or [1,3]. For embedded citations in the text with pagination, use both parentheses and brackets to indicate the reference number and page numbers; for example [5] (p. 10), or [6] (pp. 101–105).

1. Author 1, A.B.; Author 2, C.D. Title of the article. *Abbreviated Journal Name* **Year**, *Volume*, page range.
2. Author 1, A.; Author 2, B. Title of the chapter. In *Book Title*, 2nd ed.; Editor 1, A., Editor 2, B., Eds.; Publisher: Publisher Location, Country, 2007; Volume 3, pp. 154–196.
3. Author 1, A.; Author 2, B. *Book Title*, 3rd ed.; Publisher: Publisher Location, Country, 2008; pp. 154–196.
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