Supplementary Material for Review

Effect of *Rhizobium* seed inoculation on grain legume yield and protein content – a systematic review and meta-analysis

Enas Khalid Sufar 1\*, Gultekin Hasanaliyeva 1,2, Juan Wang 2,3, Paul Bilsborrow 4, Leonidas Rempelos 5, Nikolaos Volakakis 1,6, Marcin Barański7\* and Carlo Leifert 8,9\*

1 Nafferton Ecological Farming Group, Newcastle University, Newcastle upon Tyne, Tyne and Wear, NE1 7RU, UK. [Enas-KH.Sufar@newcastle.ac.uk](mailto:Enas-KH.Sufar@newcastle.ac.uk)

2 School of Animal, Rural and Environmental Sciences, Nottingham Trent University, Brackenhurst Campus, Nottinghamshire, NG25 0QF, UK. [gultekin.hasanaliyeva@ntu.ac.uk](mailto:gultekin.hasanaliyeva@ntu.ac.uk)

3 Department of Clinical Nutrition, School of Medicine, Shanghai Jiao Tong University, Shanghai 200025, China. [j.wang28@outlook.com](mailto:j.wang28@outlook.com)

4 School of Natural and Environmental Sciences, Newcastle University, Newcastle upon Tyne, NE1 7RU, UK. [paul.bilsborrow@newcastle.ac.uk](mailto:paul.bilsborrow@newcastle.ac.uk)

5 Lincoln Institute for Agri-Food Technology, University of Lincoln, Lincoln, Lincolnshire. LN2 2LG, UK. [lrempelos@lincoln.ac.uk](mailto:lrempelos@lincoln.ac.uk)

6 Geokomi plc, P.O. Box 21, Sivas Festos, GR70200, Crete, Greece. [nvolakakis@gmail.com](mailto:nvolakakis@gmail.com)

7 Laboratory of Neurobiology, Nencki Institute, 3 Pasteur Street, 02-093 Warsaw, Poland; [m.baranski@nencki.edu.pl](mailto:m.baranski@nencki.edu.pl)

8 Department of Nutrition, IMB, University of Oslo, 0317 Oslo, Norway.

9 SCU Plant Science, Southern Cross University, Military Rd., Lismore, NSW 2480, Australia; [carlo.leifert@gmail.com](mailto:carlo.leifert@gmail.com)

**\*** Correspondence: [Enas-KH.Sufar@newcastle.ac.uk](mailto:Enas-KH.Sufar@newcastle.ac.uk) (EKS); [m.baranski@nencki.edu.pl](mailto:m.baranski@nencki.edu.pl) (MB); [carlo.leifert@gmail.com](mailto:carlo.leifert@gmail.com) (CL)

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| **Supplementary Fig. S1.** Number of articles included in the meta-analysis by year of publication |

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| **Supplementary Fig. S2.** Number of articles from which data were extracted for meta-analysis by country (field experiments only). |

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| **Supplementary Fig. S3.** Forest Plot showing standardized mean differences (SMD) and 95% confidence intervals of comparisons of grain/seed yields in rhizobium-inoculated and non-inoculated legume crops in studies/experiments included in the standard random effect model-based weighted meta-analysis. The average SMDs for studies/experiments that used different types of fertilizer are presented at the bottom of the figure. A positive SMD indicates higher and a negative SMD lower grain yield in rhizobium inoculated crops. Fert., fertilizer type(s) used; Exp., Experiment type; Crop, Grain legume species used; year, year(s) in which experiment(s) were carried out. |

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| **Supplementary Fig. S4.** Forest Plot showing standardized mean differences (SMD) and 95% confidence intervals of comparisons of grain protein content in rhizobium inoculated and non-inoculated legume crops in studies/experiments included in the standard random effect model-based weighted meta-analysis. The average SMDs for studies/experiments that used different types of fertilizer are presented at the bottom of the figure. A positive SMD indicates higher and a negative SMD lower grain yield in rhizobium inoculated crops. Fert., fertilizer type(s) used; Exp., Experiment type; Crop, Grain legume species used; year, year(s) in which experiment(s) were carried out. |

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| **Supplementary Table S1.**  Article quality assessment results of publications that provided data for the weighted meta-analyses | | | | |
| **Article**  **Assessment criteria** | Awan (1994) | Bahadur & Tiwari (2014) | Bajracharya et al. (2007) | Bambara &  Ndakidemi (2010) |
| **Study overview** |  |  |  |  |
| The study addresses agronomic question/hypothesis | yes | no | yes | yes |
| The type of study is clearly explained (field experiment, pot trial, farm survey) | yes | yes | yes | yes |
| **Internal validity** |  |  |  |  |
| Comparison is made between appropriate agronomic systems in terms of question/hypothesis | yes | yes | yes | yes |
| The number of replicates (sample size) is described | yes | yes | yes | yes |
| The number of replicates (sample size) is sufficient for statistical evaluation | yes | yes | yes | yes |
| The number of replicates (sample size) is the same or similar for all agronomic systems | yes | yes | yes | yes |
| Each agronomic system is sufficiently described | yes | yes | no | yes |
| The geographic location of the experiment is the same for all agronomic systems | yes | yes | yes | yes |
| The season and cultivation conditions (e.g. climate, soil properties) are the same or  similar for all agronomic systems, except factors used to test question/hypothesis | yes | yes | yes | yes |
| The variety of plants used in the study is the same for all agronomic systems | yes | yes | yes | yes |
| **Analytical methods** |  |  |  |  |
| Samples selection is described | yes | no | yes | yes |
| Samples selection is the same for all agronomic systems | yes | no | no | no |
| The post-sampling storage time and conditions are described | yes | yes | no | no |
| The post-sampling storage time and conditions are the same for all agronomic systems | yes | yes | yes | no |
| Choice of statistical methods is appropriate | yes | yes | yes | yes |
| **Results** |  |  |  |  |
| Outcome measures are reliable and adequate to test question/hypothesis | yes | yes | yes | yes |
| Effect sizes are given as mean or median values for each agronomic system | yes | yes | yes | yes |
| The measurement of variance is provided for each mean (as confidence intervals, standard error, etc.) | yes | yes | yes | yes |
| All outcome measures described in the methods section are reported (in tables, figures or text) | yes | yes | yes | yes |
| **Overall assessment** |  |  |  |  |
| The limitation of the study design is discussed | no | no | no | no |
| Authors discuss whether an effect found in study can be seen in the real life | no | no | no | no |
| Study successfully minimizes the risk of bias or confounding | yes | yes | yes | yes |
| There is clear evidence of an association between agronomic systems and outcome | yes | yes | yes | yes |
| The sponsorship/conflict of interest is reported | no | no | no | no |
| Final Rating | high | high | high | acceptable |
| **Supplementary Table S1 cont.**  Article quality assessment results of publications that provided data for the weighted meta-analyses | | | | |
| **Article**  **Assessment criteria** | Buttery et al. (1987) | Elsheikh & Osman (1995) | Elsheikh et al. (2009) | Fatnassi et al. (2013) |
| **Study overview** |  |  |  |  |
| The study addresses agronomic question/hypothesis | yes | yes | yes | unclear |
| The type of study is clearly explained (field experiment, pot trial, farm survey) | yes | yes | yes | yes |
| **Internal validity** |  |  |  |  |
| Comparison is made between appropriate agronomic systems in terms of question/hypothesis | yes | yes | yes | yes |
| The number of replicates (sample size) is described | yes | yes | yes | yes |
| The number of replicates (sample size) is sufficient for statistical evaluation | yes | yes | yes | yes |
| The number of replicates (sample size) is the same or similar for all agronomic systems | yes | yes | yes | yes |
| Each agronomic system is sufficiently described | yes | yes | yes | yes |
| The geographic location of the experiment is the same for all agronomic systems | yes | yes | yes | yes |
| The season and cultivation conditions (e.g. climate, soil properties) are the same or  similar for all agronomic systems, except factors used to test question/hypothesis | yes | yes | yes | yes |
| The variety of plants used in the study is the same for all agronomic systems | yes | yes | yes | yes |
| **Analytical methods** |  |  |  |  |
| Samples selection is described | yes | yes | no | yes |
| Samples selection is the same for all agronomic systems | yes | no | no | no |
| The post-sampling storage time and conditions are described | no | no | no | yes |
| The post-sampling storage time and conditions are the same for all agronomic systems | yes | yes | no | no |
| Choice of statistical methods is appropriate | yes | unclear | yes | yes |
| **Results** |  |  |  |  |
| Outcome measures are reliable and adequate to test question/hypothesis | yes | yes | yes | yes |
| Effect sizes are given as mean or median values for each agronomic system | yes | yes | yes | yes |
| The measurement of variance is provided for each mean (as confidence intervals, standard error, etc.) | yes | no | yes | yes |
| All outcome measures described in the methods section are reported (in tables, figures or text) | yes | yes | yes | yes |
| **Overall assessment** |  |  |  |  |
| The limitation of the study design is discussed | no | no | no | no |
| Authors discuss whether an effect found in study can be seen in the real life | no | yes | no | no |
| Study successfully minimizes the risk of bias or confounding | yes | yes | yes | yes |
| There is clear evidence of an association between agronomic systems and outcome | yes | yes | yes | yes |
| The sponsorship/conflict of interest is reported | no | no | no | no |
| Final Rating | high | acceptable | acceptable | acceptable |

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| **Supplementary Table S1 cont.**  Article quality assessment results of publications that provided data for the weighted meta-analyses | | | | |
| **Article**  **Assessment criteria** | FengXian et al. (2009) | Goudar et al. (2008) | Hoque (1993) | Jagdish & Ram  (1988) |
| **Study overview** |  |  |  |  |
| The study addresses agronomic question/hypothesis | yes | yes | yes | yes |
| The type of study is clearly explained (field experiment, pot trial, farm survey) | yes | yes | yes | yes |
| **Internal validity** |  |  |  |  |
| Comparison is made between appropriate agronomic systems in terms of question/hypothesis | yes | yes | yes | yes |
| The number of replicates (sample size) is described | no | yes | yes | yes |
| The number of replicates (sample size) is sufficient for statistical evaluation | yes | yes | yes | yes |
| The number of replicates (sample size) is the same or similar for all agronomic systems | yes | yes | yes | yes |
| Each agronomic system is sufficiently described | no | yes | yes | yes |
| The geographic location of the experiment is the same for all agronomic systems | yes | yes | yes | yes |
| The season and cultivation conditions (e.g. climate, soil properties) are the same or  similar for all agronomic systems, except factors used to test question/hypothesis | yes | yes | yes | yes |
| The variety of plants used in the study is the same for all agronomic systems | yes | yes | yes | yes |
| **Analytical methods** |  |  |  |  |
| Samples selection is described | yes | no | yes | yes |
| Samples selection is the same for all agronomic systems | no | no | yes | yes |
| The post-sampling storage time and conditions are described | no | no | yes | no |
| The post-sampling storage time and conditions are the same for all agronomic systems | yes | unclear | yes | yes |
| Choice of statistical methods is appropriate | yes | unclear | no | yes |
| **Results** |  |  |  |  |
| Outcome measures are reliable and adequate to test question/hypothesis | yes | yes | yes | yes |
| Effect sizes are given as mean or median values for each agronomic system | yes | yes | yes | yes |
| The measurement of variance is provided for each mean (as confidence intervals, standard error, etc.) | yes | yes | yes | yes |
| All outcome measures described in the methods section are reported (in tables, figures or text) | yes | yes | yes | yes |
| **Overall assessment** |  |  |  |  |
| The limitation of the study design is discussed | no | no | no | no |
| Authors discuss whether an effect found in study can be seen in the real life | yes | no | yes | no |
| Study successfully minimizes the risk of bias or confounding | yes | yes | yes | yes |
| There is clear evidence of an association between agronomic systems and outcome | yes | yes | yes | yes |
| The sponsorship/conflict of interest is reported | no | no | no | no |
| Final Rating | acceptable | acceptable | high | high |

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| **Supplementary Table S1 cont.**  Article quality assessment results of publications that provided data for the weighted meta-analyses | | | | |
| **Article**  **Assessment criteria** | Kellman et al. (2006) | Krishnareddy & Ahlawat (1996) | Mahadkar & Saraf (1988) | Mandimba & Mondibaye (1996) |
| **Study overview** |  |  |  |  |
| The study addresses agronomic question/hypothesis | yes | yes | yes | yes |
| The type of study is clearly explained (field experiment, pot trial, farm survey) | yes | yes | yes | yes |
| **Internal validity** |  |  |  |  |
| Comparison is made between appropriate agronomic systems in terms of question/hypothesis | yes | yes | yes | yes |
| The number of replicates (sample size) is described | yes | yes | yes | yes |
| The number of replicates (sample size) is sufficient for statistical evaluation | yes | yes | yes | yes |
| The number of replicates (sample size) is the same or similar for all agronomic systems | yes | yes | yes | yes |
| Each agronomic system is sufficiently described | no | no | no | yes |
| The geographic location of the experiment is the same for all agronomic systems | yes | yes | yes | yes |
| The season and cultivation conditions (e.g. climate, soil properties) are the same or  similar for all agronomic systems, except factors used to test question/hypothesis | yes | yes | yes | yes |
| The variety of plants used in the study is the same for all agronomic systems | yes | yes | yes | yes |
| **Analytical methods** |  |  |  |  |
| Samples selection is described | yes | no | no | no |
| Samples selection is the same for all agronomic systems | no | no | unclear | no |
| The post-sampling storage time and conditions are described | yes | no | no | no |
| The post-sampling storage time and conditions are the same for all agronomic systems | yes | no | unclear | no |
| Choice of statistical methods is appropriate | yes | no | unclear | unclear |
| **Results** |  |  |  |  |
| Outcome measures are reliable and adequate to test question/hypothesis | yes | yes | yes | yes |
| Effect sizes are given as mean or median values for each agronomic system | yes | yes | yes | yes |
| The measurement of variance is provided for each mean (as confidence intervals, standard error, etc.) | yes | no | yes | no |
| All outcome measures described in the methods section are reported (in tables, figures or text) | yes | yes | yes | yes |
| **Overall assessment** |  |  |  |  |
| The limitation of the study design is discussed | no | no | no | no |
| Authors discuss whether an effect found in study can be seen in the real life | no | no | no | no |
| Study successfully minimizes the risk of bias or confounding | yes | yes | yes | yes |
| There is clear evidence of an association between agronomic systems and outcome | yes | yes | yes | yes |
| The sponsorship/conflict of interest is reported | no | no | no | no |
| Final Rating | high | acceptable | acceptable | acceptable |

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| **Supplementary Table S1 cont.**  Article quality assessment results of publications that provided data for the weighted meta-analyses | | | | |
| **Article**  **Assessment criteria** | McKenzie & Hill (1995) | Ndakidemi et al. (2006) | Nleya et al. (2009) | Olivares et al. (1982) |
| **Study overview** |  |  |  |  |
| The study addresses agronomic question/hypothesis | yes | yes | yes | yes |
| The type of study is clearly explained (field experiment, pot trial, farm survey) | yes | yes | yes | yes |
| **Internal validity** |  |  |  |  |
| Comparison is made between appropriate agronomic systems in terms of question/hypothesis | yes | yes | yes | yes |
| The number of replicates (sample size) is described | yes | yes | yes | yes |
| The number of replicates (sample size) is sufficient for statistical evaluation | yes | yes | yes | yes |
| The number of replicates (sample size) is the same or similar for all agronomic systems | yes | yes | yes | yes |
| Each agronomic system is sufficiently described | no | no | no | no |
| The geographic location of the experiment is the same for all agronomic systems | yes | yes | yes | yes |
| The season and cultivation conditions (e.g. climate, soil properties) are the same or  similar for all agronomic systems, except factors used to test question/hypothesis | yes | yes | yes | yes |
| The variety of plants used in the study is the same for all agronomic systems | yes | yes | yes | yes |
| **Analytical methods** |  |  |  |  |
| Samples selection is described | yes | yes | no | no |
| Samples selection is the same for all agronomic systems | no | no | no | no |
| The post-sampling storage time and conditions are described | no | no | no | no |
| The post-sampling storage time and conditions are the same for all agronomic systems | no | yes | no | no |
| Choice of statistical methods is appropriate | yes | yes | unclear | unclear |
| **Results** |  |  |  |  |
| Outcome measures are reliable and adequate to test question/hypothesis | yes | yes | yes | yes |
| Effect sizes are given as mean or median values for each agronomic system | yes | yes | yes | yes |
| The measurement of variance is provided for each mean (as confidence intervals, standard error, etc.) | yes | yes | yes | yes |
| All outcome measures described in the methods section are reported (in tables, figures or text) | yes | yes | yes | unclear |
| **Overall assessment** |  |  |  |  |
| The limitation of the study design is discussed | no | no | no | no |
| Authors discuss whether an effect found in study can be seen in the real life | no | no | no | no |
| Study successfully minimizes the risk of bias or confounding | yes | yes | yes | yes |
| There is clear evidence of an association between agronomic systems and outcome | yes | yes | yes | yes |
| The sponsorship/conflict of interest is reported | no | no | no | no |
| Final Rating | acceptable | high | acceptable | acceptable |

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| **Supplementary Table S1 cont.**  Article quality assessment results of publications that provided data for the weighted meta-analyses | | | | |
| **Article**  **Assessment criteria** | Pineda et al. (1994) | Provorov et al. (1998) | Rao & Patil (1976) | Ray & Valsalakumar (2010) |
| **Study overview** |  |  |  |  |
| The study addresses agronomic question/hypothesis | yes | yes | yes | yes |
| The type of study is clearly explained (field experiment, pot trial, farm survey) | yes | yes | yes | yes |
| **Internal validity** |  |  |  |  |
| Comparison is made between appropriate agronomic systems in terms of question/hypothesis | yes | yes | yes | yes |
| The number of replicates (sample size) is described | no | yes | yes | yes |
| The number of replicates (sample size) is sufficient for statistical evaluation | no | yes | yes | yes |
| The number of replicates (sample size) is the same or similar for all agronomic systems | yes | yes | yes | yes |
| Each agronomic system is sufficiently described | no | no | no | yes |
| The geographic location of the experiment is the same for all agronomic systems | yes | yes | yes | yes |
| The season and cultivation conditions (e.g. climate, soil properties) are the same or  similar for all agronomic systems, except factors used to test question/hypothesis | yes | yes | yes | yes |
| The variety of plants used in the study is the same for all agronomic systems | yes | yes | yes | yes |
| **Analytical methods** |  |  |  |  |
| Samples selection is described | no | no | no | yes |
| Samples selection is the same for all agronomic systems | no | no | no | yes |
| The post-sampling storage time and conditions are described | no | no | yes | no |
| The post-sampling storage time and conditions are the same for all agronomic systems | yes | no | no | unclear |
| Choice of statistical methods is appropriate | yes | yes | unclear | yes |
| **Results** |  |  |  |  |
| Outcome measures are reliable and adequate to test question/hypothesis | yes | yes | yes | yes |
| Effect sizes are given as mean or median values for each agronomic system | yes | yes | yes | yes |
| The measurement of variance is provided for each mean (as confidence intervals, standard error, etc.) | no | yes | yes | yes |
| All outcome measures described in the methods section are reported (in tables, figures or text) | yes | yes | yes | yes |
| **Overall assessment** |  |  |  |  |
| The limitation of the study design is discussed | no | no | no | no |
| Authors discuss whether an effect found in study can be seen in the real life | no | no | no | no |
| Study successfully minimizes the risk of bias or confounding | yes | yes | yes | yes |
| There is clear evidence of an association between agronomic systems and outcome | yes | yes | yes | yes |
| The sponsorship/conflict of interest is reported | no | no | no | no |
| Final Rating | acceptable | acceptable | high | high |

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| **Supplementary Table S1 cont.**  Article quality assessment results of publications that provided data for the weighted meta-analyses | | | | |
| **Article**  **Assessment criteria** | Sanoria & Mallik (1981) | Shahzad et al. (2014) | Singh et al. (2008) | Sogut (2006) |
| **Study overview** |  |  |  |  |
| The study addresses agronomic question/hypothesis | yes | yes | yes | yes |
| The type of study is clearly explained (field experiment, pot trial, farm survey) | yes | yes | yes | yes |
| **Internal validity** |  |  |  |  |
| Comparison is made between appropriate agronomic systems in terms of question/hypothesis | yes | yes | yes | yes |
| The number of replicates (sample size) is described | yes | yes | yes | yes |
| The number of replicates (sample size) is sufficient for statistical evaluation | yes | yes | yes | yes |
| The number of replicates (sample size) is the same or similar for all agronomic systems | yes | yes | yes | yes |
| Each agronomic system is sufficiently described | unclear | yes | yes | yes |
| The geographic location of the experiment is the same for all agronomic systems | yes | yes | yes | yes |
| The season and cultivation conditions (e.g. climate, soil properties) are the same or  similar for all agronomic systems, except factors used to test question/hypothesis | yes | yes | yes | yes |
| The variety of plants used in the study is the same for all agronomic systems | yes | yes | yes | yes |
| **Analytical methods** |  |  |  |  |
| Samples selection is described | yes | yes | yes | yes |
| Samples selection is the same for all agronomic systems | no | no | no | no |
| The post-sampling storage time and conditions are described | no | no | no | yes |
| The post-sampling storage time and conditions are the same for all agronomic systems | no | no | no | no |
| Choice of statistical methods is appropriate | yes | yes | yes | yes |
| **Results** |  |  |  |  |
| Outcome measures are reliable and adequate to test question/hypothesis | yes | yes | yes | yes |
| Effect sizes are given as mean or median values for each agronomic system | yes | yes | yes | yes |
| The measurement of variance is provided for each mean (as confidence intervals, standard error, etc.) | no | no | yes | no |
| All outcome measures described in the methods section are reported (in tables, figures or text) | yes | yes | yes | yes |
| **Overall assessment** |  |  |  |  |
| The limitation of the study design is discussed | no | no | no | no |
| Authors discuss whether an effect found in study can be seen in the real life | no | no | yes | no |
| Study successfully minimizes the risk of bias or confounding | yes | yes | yes | yes |
| There is clear evidence of an association between agronomic systems and outcome | yes | yes | yes | yes |
| The sponsorship/conflict of interest is reported | no | no | no | no |
| Final Rating | acceptable | acceptable | acceptable | high |

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| **Supplementary Table S1 cont.**  Article quality assessment results of publications that provided data for the weighted meta-analyses | | | | |
| **Article**  **Assessment criteria** | Verma et al. (2012) | Verma et al. (2013) | Yadav & Verma (2014) | Yadegari et al. (2008) |
| **Study overview** |  |  |  |  |
| The study addresses agronomic question/hypothesis | yes | yes | yes | yes |
| The type of study is clearly explained (field experiment, pot trial, farm survey) | yes | yes | yes | yes |
| **Internal validity** |  |  |  |  |
| Comparison is made between appropriate agronomic systems in terms of question/hypothesis | yes | yes | yes | yes |
| The number of replicates (sample size) is described | yes | yes | yes | yes |
| The number of replicates (sample size) is sufficient for statistical evaluation | yes | yes | yes | yes |
| The number of replicates (sample size) is the same or similar for all agronomic systems | yes | yes | yes | yes |
| Each agronomic system is sufficiently described | yes | yes | yes | no |
| The geographic location of the experiment is the same for all agronomic systems | yes | yes | yes | yes |
| The season and cultivation conditions (e.g. climate, soil properties) are the same or  similar for all agronomic systems, except factors used to test question/hypothesis | yes | yes | yes | yes |
| The variety of plants used in the study is the same for all agronomic systems |  | yes | yes | yes |
| **Analytical methods** |  |  |  |  |
| Samples selection is described | yes | yes | yes | yes |
| Samples selection is the same for all agronomic systems | no | no | no | no |
| The post-sampling storage time and conditions are described | yes | yes | yes | yes |
| The post-sampling storage time and conditions are the same for all agronomic systems | no | no | no | no |
| Choice of statistical methods is appropriate | yes | yes | yes | yes |
| **Results** |  |  |  |  |
| Outcome measures are reliable and adequate to test question/hypothesis | yes | yes | yes | yes |
| Effect sizes are given as mean or median values for each agronomic system | yes | yes | yes | yes |
| The measurement of variance is provided for each mean (as confidence intervals, standard error, etc.) | no | no | no | yes |
| All outcome measures described in the methods section are reported (in tables, figures or text) | yes | yes | yes | yes |
| **Overall assessment** |  |  |  |  |
| The limitation of the study design is discussed | no | no | no | no |
| Authors discuss whether an effect found in study can be seen in the real life | no | no | no | no |
| Study successfully minimizes the risk of bias or confounding | yes | yes | yes | yes |
| There is clear evidence of an association between agronomic systems and outcome | yes | yes | yes | yes |
| The sponsorship/conflict of interest is reported | no | no | no | no |
| Final Rating | high | high | high | high |

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| **Supplementary Table S1 cont.**  Article quality assessment results of publications that provided data for the weighted meta-analyses | | | | |
| **Article**  **Assessment criteria** | Yasmeen & Bano (2014) | Yasmeen et al. (2012) | Young et al. (1988) | Zaman-Allah et al. (2007) |
| **Study overview** |  |  |  |  |
| The study addresses agronomic question/hypothesis | yes | yes | yes | yes |
| The type of study is clearly explained (field experiment, pot trial, farm survey) | yes | yes | yes | yes |
| **Internal validity** |  |  |  |  |
| Comparison is made between appropriate agronomic systems in terms of question/hypothesis | yes | yes | yes | yes |
| The number of replicates (sample size) is described | yes | yes | yes | yes |
| The number of replicates (sample size) is sufficient for statistical evaluation | yes | no | yes | yes |
| The number of replicates (sample size) is the same or similar for all agronomic systems | yes | unclear | yes | yes |
| Each agronomic system is sufficiently described | yes | no | no | no |
| The geographic location of the experiment is the same for all agronomic systems | yes | yes | yes | yes |
| The season and cultivation conditions (e.g. climate, soil properties) are the same or  similar for all agronomic systems, except factors used to test question/hypothesis | yes | yes | yes | yes |
| The variety of plants used in the study is the same for all agronomic systems | yes | yes | yes | yes |
| **Analytical methods** |  |  |  |  |
| Samples selection is described | yes | no | yes | no |
| Samples selection is the same for all agronomic systems | no | no | no | no |
| The post-sampling storage time and conditions are described | no | no | no | no |
| The post-sampling storage time and conditions are the same for all agronomic systems | no | no | no | no |
| Choice of statistical methods is appropriate | yes | yes | yes | yes |
| **Results** |  |  |  |  |
| Outcome measures are reliable and adequate to test question/hypothesis | yes | yes | yes | yes |
| Effect sizes are given as mean or median values for each agronomic system | yes | yes | yes | yes |
| The measurement of variance is provided for each mean (as confidence intervals, standard error, etc.) | no | no | yes | no |
| All outcome measures described in the methods section are reported (in tables, figures or text) | yes | yes | yes | yes |
| **Overall assessment** |  |  |  |  |
| The limitation of the study design is discussed | no | no | no | no |
| Authors discuss whether an effect found in study can be seen in the real life | no | no | yes | no |
| Study successfully minimizes the risk of bias or confounding | yes | yes | yes | yes |
| There is clear evidence of an association between agronomic systems and outcome | yes | yes | yes | yes |
| The sponsorship/conflict of interest is reported | no | no | no | no |
| Final Rating | acceptable | acceptable | acceptable | acceptable |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Supplementary Table S1 cont.**  Article quality assessment results of publications that provided data for the weighted meta-analyses | | | | |
| **Article**  **Assessment criteria** | Zhang et al. (2010) |  |  |  |
| **Study overview** |  |  |  |  |
| The study addresses agronomic question/hypothesis | yes |  |  |  |
| The type of study is clearly explained (field experiment, pot trial, farm survey) | yes |  |  |  |
| **Internal validity** |  |  |  |  |
| Comparison is made between appropriate agronomic systems in terms of question/hypothesis | yes |  |  |  |
| The number of replicates (sample size) is described | yes |  |  |  |
| The number of replicates (sample size) is sufficient for statistical evaluation | yes |  |  |  |
| The number of replicates (sample size) is the same or similar for all agronomic systems | yes |  |  |  |
| Each agronomic system is sufficiently described | no |  |  |  |
| The geographic location of the experiment is the same for all agronomic systems | yes |  |  |  |
| The season and cultivation conditions (e.g. climate, soil properties) are the same or  similar for all agronomic systems, except factors used to test question/hypothesis | yes |  |  |  |
| The variety of plants used in the study is the same for all agronomic systems | yes |  |  |  |
| **Analytical methods** |  |  |  |  |
| Samples selection is described | yes |  |  |  |
| Samples selection is the same for all agronomic systems | no |  |  |  |
| The post-sampling storage time and conditions are described | yes |  |  |  |
| The post-sampling storage time and conditions are the same for all agronomic systems | no |  |  |  |
| Choice of statistical methods is appropriate | yes |  |  |  |
| **Results** |  |  |  |  |
| Outcome measures are reliable and adequate to test question/hypothesis | yes |  |  |  |
| Effect sizes are given as mean or median values for each agronomic system | yes |  |  |  |
| The measurement of variance is provided for each mean (as confidence intervals, standard error, etc.) | yes |  |  |  |
| All outcome measures described in the methods section are reported (in tables, figures or text) | yes |  |  |  |
| **Overall assessment** |  |  |  |  |
| The limitation of the study design is discussed | yes |  |  |  |
| Authors discuss whether an effect found in study can be seen in the real life | no |  |  |  |
| Study successfully minimizes the risk of bias or confounding | yes |  |  |  |
| There is clear evidence of an association between agronomic systems and outcome | yes |  |  |  |
| The sponsorship/conflict of interest is reported | no |  |  |  |
| Final Rating | high |  |  |  |

**Reference List 1.**

Articles that provided data for the weighted meta-analyses that compared grain yields and protein content in rhizobium-inoculated and non-inoculated legume crops

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