**Supplementary material (Figures and Tables)**

B

A

**V**

D

C

**Fig.S1** Response of yield (A), Crude Protein-CP (B), Acid Detergent Fibre-ADF (C) and Neutral Detergent Fibre-NDF (D) of alfalfa to different Soil Olsen P (g kg-1), expressed as the mean effect size with bias-corrected 95% confidence intervals. The number of observations is indicated in parentheses.



A

B



D

C



**Fig.S2** Response of yield (A), Crude Protein-CP (B), Acid Detergent Fibre-ADF (C) and Neutral Detergent Fibre-NDF (D) of alfalfa to different NH4OAc-exchangeable K (g kg-1), expressed as the mean effect size with bias-corrected 95% confidence intervals. The number of observations is indicated in parentheses.



B

A

**Fig.S3** Responses alfalfa yield to different fertilizer combined application (A, B), expressed as the mean effect size with bias-corrected 95% confidence intervals. The fertilizer of N, P2O5 and K2O are expressed as N, P and K. The number of observations is indicated in parentheses.



B

A

**Fig.S4** Responses alfalfa Crude Protein-CP to different fertilizer combined application (A, B), expressed as the mean effect size with bias-corrected 95% confidence intervals. The fertilizer of N, P2O5 and K2O are expressed as N, P and K. The number of observations is indicated in parentheses.



**Fig.S5** Responses alfalfa Acid Detergent Fibre-ADF to different fertilizer combined application, expressed as the mean effect size with bias-corrected 95% confidence intervals. The fertilizer of N, P2O5 and K2O are expressed as N, P and K. The number of observations is indicated in parentheses.



**Fig.S6** Responses alfalfa Neutral Detergent Fibre-NDF to different fertilizer combined application, expressed as the mean effect size with bias-corrected 95% confidence intervals. The fertilizer of N, P2O5 and K2O are expressed as N, P and K. The number of observations is indicated in parentheses.



A

B

C

D

 **Fig. S7** Funnel plot of standard error of yield (A), Crude Protein-CP (B), Acid Detergent Fibre-ADF (C) and Neutral Detergent Fibre-NDF (D) against response variable Ln(R). The vertical line represents the mean log response ratio Ln(R) estimated.

**Table.S1** The sensitivity analysis on alfalfa yield, CP, ADF and NDF

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Index | Fertilizertypes | Ln(R)(%) | 95% CI(%) | n | Study |
| Yield | N | 11.8 | 8.3 | 15.4 | 12 | Hu et al., 2019 |
| P | 14.4 | 9.1 | 19.9 | 12 | Li, 2017 |
| K | 7.3 | 5.2 | 9.3 | 24 | Zhao, 2013 |
| NP | 24.9 | 19.8 | 30.3 | 12 | Chen et al., 2019 |
| PK | 21.6 | 15.3 | 28.3 | 9 | Zhao, 2013 |
| NK | 15.2 | 6.9 | 24.0 | 5 | Wu, 2020 |
| NPK | 25.0 | 19.7 | 30.6 | 20 | Yin, 2012 |
| CP | N | 6.8  | 3.1  | 10.7  | 15 | Tian, 2010 |
| P | 5.5  | 3.3  | 7.7  | 6 | Sun et al., 2022 |
| K | 1.0  | -1.4  | 3.4  | 20 | Pan, 2017 |
| NP | 19.2  | 11.5  | 27.5  | 4 | Zhang, 2017 |
| PK | 7.0  | 2.4  | 11.9  | 5 | Wu, 2020 |
| NK | 12.4  | 5.4  | 19.9  | 4 | Zhang, 2005 |
| NPK | 12.4  | 9.3  | 15.5  | 18 | Wang et al., 2019 |
| ADF | N | -6.6  | -10.0  | -3.0  | 10 | Zhang, 2014 |
| P | -4.7  | -7.1  | -2.3  | 6 | Sun et al., 2022 |
| K | 0.1  | -2.0  | 2.2  | 9 | Liu, 2016 |
| NP | -9.4  | -12.1  | -4.7  | 12 | Chen et al., 2019 |
| PK | -4.1  | -7.1  | -0.9  | 18 | Zhao et al., 2013 |
| NK | -4.8  | -9.1  | -0.3  | 3 | Zhao et al., 2013 |
| NPK | -4.4  | -7.8  | -1.0  | 9 | Xiao, 2016 |
| NDF | N | 0.9  | -6.1  | 8.5  | 8 | Zhang et al., 2020 |
| P | -3.2  | -7.1  | 0.9  | 10 | Mao, 2017 |
| K | 0.5  | -1.8  | 2.8  | 20 | Pan, 2017 |
| NP | -8.3  | -11.7  | -4.8  | 8 | Zhang, 2014 |
| PK | -1.2  | -3.0  | -0.7  | 12 | Chen et al., 2019 |
| NK | 7.2  | -10.7  | -2.5  | 3 | Zhao et al., 2013 |
| NPK | -1.0  | -2.0  | 0.0  | 7 | Meng, 2018 |

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