# Supplementary Materials:



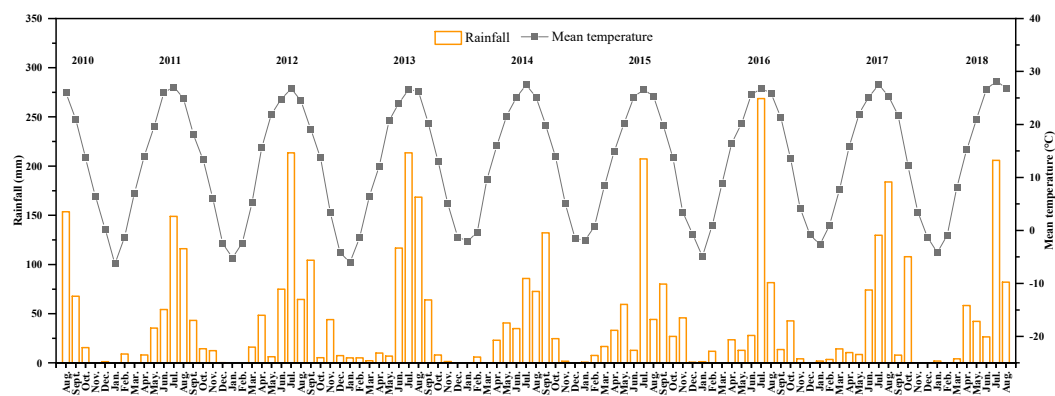**Figure S1.** Monthly rainfall (mm) and mean temperature (℃) during the maize and wheat growing seasons from 2010 to 2018.
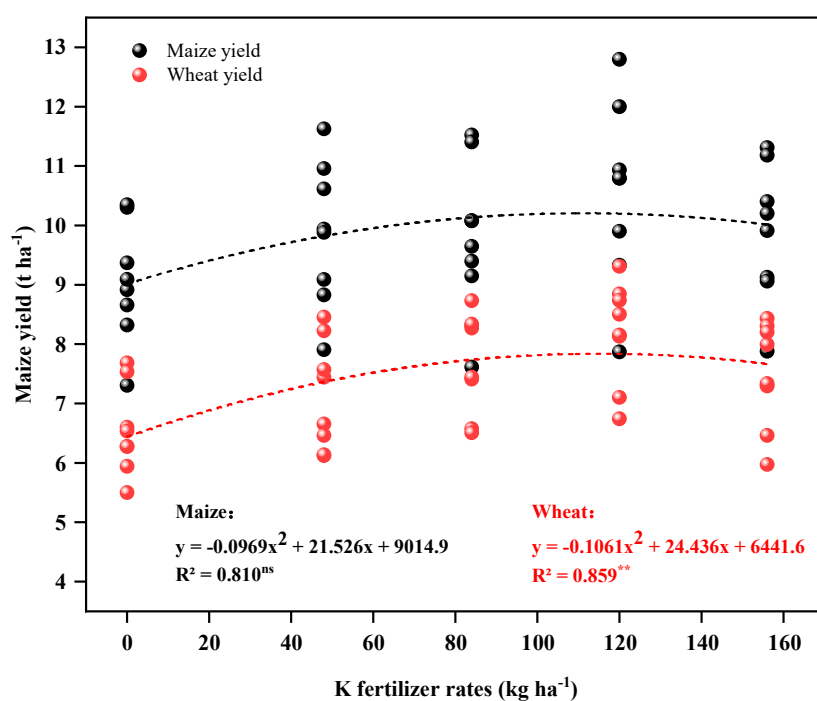


Maize：

$$y = -0.0969x^2 + 21.526x + 9014.9$$
$$R^2 = 0.810^{ns}$$

Wheat：

$$y = -0.1061x^2 + 24.436x + 6441.6$$
$$R^2 = 0.859^{**}$$

**Figure S2.** Effects of different K fertilization rates on the average yields of maize and wheat. $K_0$, no K fertilizer application; $K_{48}$, 48 kg K ha$^{-1}$; $K_{84}$, 84 kg K ha$^{-1}$; $K_{120}$, 120 kg K ha$^{-1}$; $K_{156}$, 156 kg K ha$^{-1}$. Vertical T bars in the histogram indicate SE. Different letters indicate significant differences among treatments. The dashed lines represent the relationship. ** Significant at the .01 probability level. ns, nonsignificant at the .05 probability level.

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**Table S1.** Effects of different K fertilization rates on maize yield composition between 2010-2017.

| Treatment | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|
| Effective spike number ($\times 10^4$ $ha^{-1}$) | | | | | | | | |
| $K_0$ | 7.3a | 7.4b | 7.6a | 7.6b | 7.5ab | 7.5ab | 7.4a | 7.3a |
| $K_{48}$ | 7.2a | 7.8a | 7.6a | 7.5b | 7.5a | 7.6a | 7.4a | 7.2ab |
| $K_{84}$ | 7.1a | 6.8c | 7.5ab | 7.5b | 7.3b | 7.2c | 7.3b | 7.0b |
| $K_{120}$ | 7.4a | 7.3b | 7.4ab | 7.5b | 7.4ab | 7.4b | 7.4a | 7.1ab |
| $K_{156}$ | 7.3a | 7.5b | 7.2b | 7.6a | 7.4ab | 7.6a | 7.5a | 7.2ab |
| Grain number per spike | | | | | | | | |
| $K_0$ | 486a | 480b | 454b | 490a | 488b | 588a | 517a | 573a |
| $K_{48}$ | 480a | 488ab | 456b | 495a | 517a | 540a | 544a | 590a |
| $K_{84}$ | 488a | 499a | 476ab | 508a | 519a | 579a | 468a | 616a |
| $K_{120}$ | 489a | 504a | 487a | 515a | 521a | 592a | 478a | 606a |
| $K_{156}$ | 484a | 498ab | 498a | 493a | 514a | 562a | 519a | 613a |
| 1000-grain weight (g) | | | | | | | | |
| $K_0$ | 272b | 281b | 247d | 278c | 317c | 348c | 280d | 295c |
| $K_{48}$ | 287a | 286ab | 248cd | 286bc | 322bc | 349c | 283c | 299c |
| $K_{84}$ | 283a | 292a | 251b | 305a | 323b | 353bc | 297a | 302bc |
| $K_{120}$ | 287a | 293a | 254a | 302a | 333a | 365a | 296a | 322a |
| $K_{156}$ | 285a | 289ab | 249c | 294ab· | 324b | 362ab | 289b | 319ab |

Values followed by different lower case letter(s) within a column are significant at $p < 0.05$.

**Table S2.** Effects of different K fertilization rates on wheat yield composition between 2010-2018.

| Treatments | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|
| Effective spike number ($\times 10^4$ ha$^{-1}$) | | | | | | | | |
| $K_0$ | 615a | 555c | 570a | 555a | 540b | 525b | 630a | 600b |
| $K_{48}$ | 630a | 555c | 540a | 600a | 615a | 615a | 675a | 615ab |
| $K_{84}$ | 630a | 675b | 555a | 600a | 600a | 600a | 750a | 630ab |
| $K_{120}$ | 660a | 750a | 570a | 600a | 600a | 630a | 720a | 675ab |
| $K_{156}$ | 615a | 600c | 525a | 615a | 600a | 630a | 780a | 690a |
| Grain number per spike | | | | | | | | |
| $K_0$ | 37a | 35ab | 38a | 35a | 32a | 41a | 39a | 38a |
| $K_{48}$ | 38a | 35a | 38a | 37a | 37a | 40a | 40a | 39a |
| $K_{84}$ | 39a | 32bc | 39a | 38a | 39a | 40a | 38a | 33b |
| $K_{120}$ | 39a | 34abc | 38a | 40a | 33a | 40a | 40a | 32b |
| $K_{156}$ | 38a | 31c | 39a | 38a | 32a | 41a | 39a | 37a |
| 1000-grain weight (g) | | | | | | | | |
| $K_0$ | 40.6b | 41.1b | 36.1b | 40.5b | 34.1b | 39.1c | 42.6c | 40.9b |
| $K_{48}$ | 41.6ab | 42.4ab | 36.2b | 42.5ab | 36.0b | 40.4bc | 45.6ab | 41.5ab |
| $K_{84}$ | 42.4ab | 42.9ab | 37.4ab | 43.7a | 37.3ab | 42.5a | 45.1ab | 41.9ab |
| $K_{120}$ | 43.0a | 43.1a | 38.4a | 44.0a | 39.9a | 43.3a | 46.6a | 44.1a |
| $K_{156}$ | 41.1ab | 42.0ab | 35.6b | 43.6a | 36.5ab | 41.6ab | 44.0bc | 41.2ab |

Values followed by different lower case letter(s) within a column are significant at $p < 0.05$.

**Table S3.** Correlation analysis of maize and wheat yields, yield composition.

| | Maize | | | Wheat | | |
|---|---|---|---|---|---|---|
| | Yield | Effective spike number | Grain number per spike | Yield | Effective spike number | Grain number per spike |
| Effective spike number | 0.108 | | | 0.552** | 1 | |
| Grain number per spike | 0.217 | -0.351** | | 0.324* | 0.026 | 1 |
| 1000-grain weight | 0.544** | -0.043 | 0.243 | 0.706** | 0.675** | 0.166 |

* Significant at the .05 probability level. ** Significant at the .01 probability level.
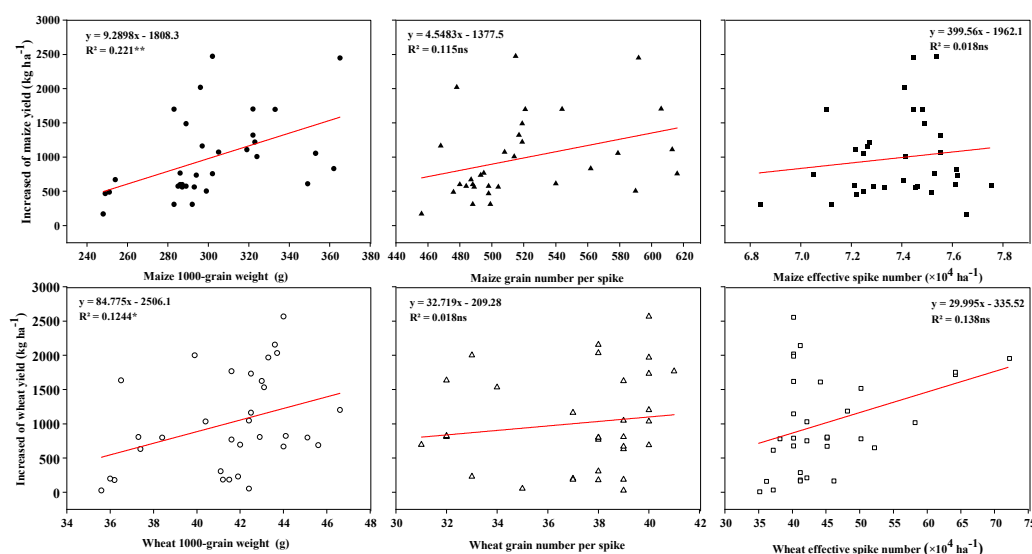
**Figure S3.** Linear regression between 1000-grain weight, grain number, effective spike number and increased of yield in maize and wheat by K application. * Significant at the .05 probability level. ** Significant at the .01 probability level. ns, nonsignificant at the .05 probability level.
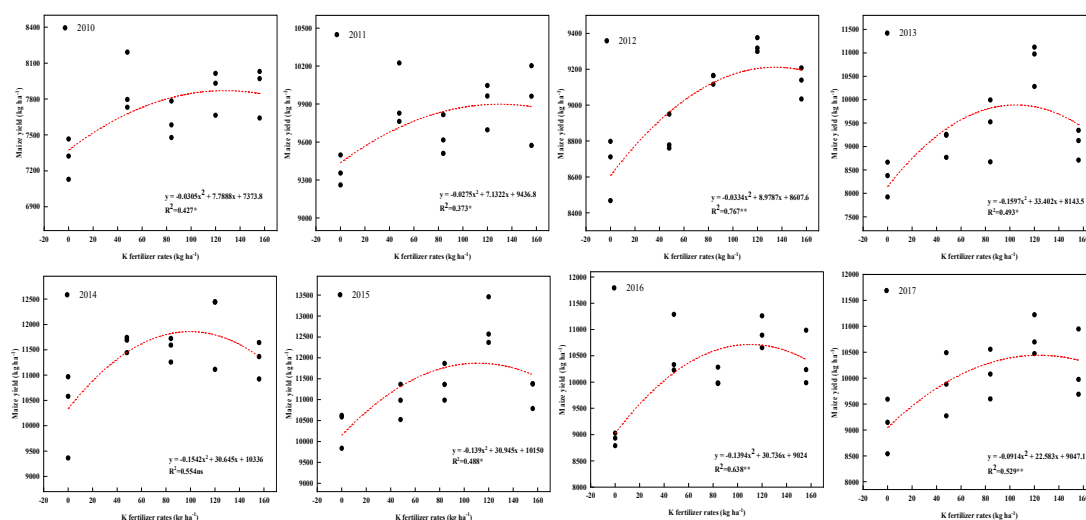


**Figure S4.** Regression analysis of maize yield with K fertilizer application in 2010-2017. The average price of maize grain was 2.02 ¥ kg$^{-1}$ (1.66-2.40 ¥ kg$^{-1}$) in 2010-2017; The average price of potassium chloride (60% K) was 3.5 ¥ kg$^{-1}$ (3.4-3.6 ¥ kg$^{-1}$) in 2010-2017. * Significant at the .05 probability level. ** Significant at the .01 probability level. ns, nonsignificant at the .05 probability level.
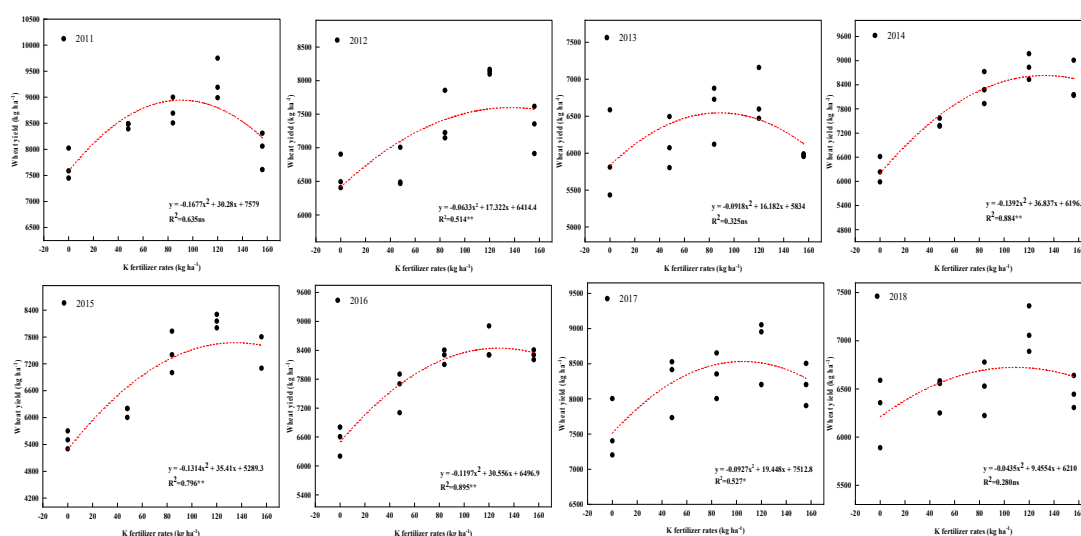
**Figure S5.** Regression analysis of wheat yield with K fertilizer application in 2011-2018. The average price of wheat grain was 2.32 ¥ kg$^{-1}$ (2.07-2.52 ¥ kg$^{-1}$) in 2011-2018; The average price of potassium chloride (60% K) was 3.5 ¥ kg$^{-1}$ (3.4-3.6 ¥ kg$^{-1}$) in 2010-2018. * Significant at the .05 probability level. ** Significant at the .01 probability level. ns, nonsignificant at the .05 probability level.