

**(a)**



**(b)**

Figure S1. Temporal distribution of component crops under different crop rotations in lowland (a) and upland (b) production systems. *R–W,* rice–wheat; *R–W–Mb,* rice–wheat–mungbean; *R–W–R–C,* rice–wheat–rice–chickpea (2–year rotation); *R–C,* rice–chickpea; *M–W,* maize–wheat; *M–W–Mb,* maize–wheat–mungbean; *M–W–M–C,* maize–wheat–maize–chickpea (2–year rotation); *P–W,* pigeonpea–wheat.

**(a)(b)**

Figure S2. Scatter plot of different cropping rotation treatments of lowland rice–based (a) and upland wheat based production systems (b) on PCA coordinated. *R–W,* rice–wheat; *R–W–Mb,* rice–wheat–mungbean; *R–W–R–C,* rice–wheat–rice–chickpea (2–year rotation); *R–C,* rice–chickpea; *M–W,* maize–wheat; *M–W–Mb,* maize–wheat–mungbean; *M–W–M–C,* maize–wheat–maize–chickpea (2–year rotation); *P–W,* pigeonpea–wheat; *RGY,* rice grain yield; *RSY,* rice straw yield; *WGY,* wheat grain yield; *WSY,* wheat straw yield; *SOC,* soil organic C; *Av–N,* available–N; *Av–P,* available–P; *Av–K,* available–K; *Av–S,* available–S.