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Supplement of

A gridded dataset of consumptive water footprints, evaporation, transpiration, and associated benchmarks related to crop production in China during 2000–2018

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Contents

Supplementary Table

Table S1. Benchmarks for the uWFCP at different production percentiles of 21 crops under various water supply and irrigation practices (m^3 ton^{-1})

Crop	Climate zones	Furrow irrigation			Micro irrigation		
		10th	20th	25th	10th	20th	25th
Wheat	Humid	859±92	889±96	901±98	846±94	903±87	918±87
	Arid	854±56	959±62	1,002±67	731±61	770±76	789±80
Maize	Humid	747±68	804±56	826±53	664±111	716±94	746±83
	Arid	657±155	714±142	731±143	560±138	576±144	582±145
Early rice	Humid	544±36	566±35	578±34	–	–	–
	Arid	–	–	–	–	–	–
Mid rice	Humid	629±25	660±30	673±33	–	–	–
	Arid	755±50	798±63	814±66	–	–	–
Late rice	Humid	672±34	701±34	712±35	–	–	–
	Arid	–	–	–	–	–	–
Sorghum	Humid	1,061±149	1,147±176	1,181±190	1,076±200	1,144±230	1,178±250
	Arid	1,022±187	1,121±177	1,183±166	743±201	802±236	826±252
Millet	Humid	1,166±337	1,303±351	1,398±316	1,342±223	1,436±227	1,463±225
	Arid	1,446±516	1,712±502	1,767±478	1,521±523	1,635±570	1,674±580
Barley	Humid	622±94	661±96	687±87	480±55	524±61	550±67
	Arid	504±34	579±82	601±93	544±102	579±106	591±106
Soybean	Humid	1855±98	2032±74	2,098±84	1,890±197	2,000±200	2,068±170
	Arid	2,214±162	2,362±174	2,420±181	2,101±277	2,186±287	2,218±290
Potatoes	Humid	153±42	218±75	248±79	133±56	169±62	184±68
	Arid	126±17	142±24	145±24	143±41	267±275	339±335
Sweet potatoes	Humid	858±127	944±90	981±93	831±150	921±124	949±124
	Arid	1,061±161	1,211±178	1,235±185	749±203	787±217	833±245
Cotton	Humid	4,663±412	5,307±494	5,704±506	2,266±1,579	3,225±2,113	4,108±1,584
	Arid	1,704±306	1,713±309	1,728±308	1,582±283	1,588±287	1,592±287
Sugar cane	Humid	26±2	27±2	29±3	29±4	33±11	37±16
	Arid	360±172	364±173	364±173	345±165	349±165	349±165
Sugar beets	Humid	9±2	9±2	9±2	8±2	8±2	8±2
	Arid	11±2	11±2	11±2	10±2	10±2	10±2
Groundnuts	Humid	705±176	752±205	793±219	732±123	816±131	849±134
	Arid	1,025±80	1,054±83	1,061±84	957±71	1,001±80	1,061±136
Rapeseed	Humid	1,079±211	1,079±211	1,079±211	989±241	989±241	989±241
	Arid	–	–	–	–	–	–
Sunflower	Humid	1,438±289	1,698±342	1,820±348	1,134±358	1,388±501	1,532±595
	Arid	943±202	991±224	1,017±229	968±188	999±190	1,026±171
Tomatoes	Humid	56±12	60±13	62±13	52±13	57±12	58±13
	Arid	61±11	67±12	70±13	49±11	53±12	55±12
Apple	Humid	280±92	298±98	304±100	264±80	293±76	322±64
	Arid	364±166	529±198	576±183	424±127	439±134	443±135
Tea	Humid	3,485±1,387	3,900±1,520	4,225±1,533	3,298±1,432	3,645±1,597	3,852±1,670

	Arid	16,588±9,371	16,892±9,542	17,026±9,662	14,006±7,945	14,345±8,133	14,459±8,213
Tobacco	Humid	1,256±301	1,455±363	1,587±319	1,202±201	1,321±202	1,424±275
	Arid	1,218±280	1,259±296	1,287±307	1,041±185	1,101±196	1,132±209
Cabbage	Humid	747±68	804±56	826±53	664±111	716±94	746±83
	Arid	657±155	714±142	731±143	560±138	576±144	582±145
Grapes	Humid	–	–	–	–	–	–
	Arid	280±58	280±58	280±58	245±58	245±58	245±58

Continued Table S1.

Crop	Climate zones	Sprinkler irrigation			Rain–fed		
		10th	20th	25th	10th	20th	25th
Wheat	Humid	894±104	932±112	958±120	844±108	924±121	966±120
	Arid	984±59	1,107±97	1,120±100	832±140	1,010±129	1,042±126
Maize	Humid	738±93	782±92	803±91	676±68	718±61	737±58
	Arid	738±151	763±161	772±165	691±139	750±141	775±140
Early rice	Humid	558±33	581±33	589±34	–	–	–
	Arid	–	–	–	–	–	–
Mid rice	Humid	608±26	632±27	642±28	–	–	–
	Arid	728±28	758±28	781±36	–	–	–
Late rice	Humid	660±36	698±38	710±41	–	–	–
	Arid	–	–	–	–	–	–
Sorghum	Humid	1,156±248	1,218±281	1,275±301	616±117	653±129	690±153
	Arid	1,180±207	1,317±257	1,408±250	704±184	772±234	802±240
Millet	Humid	1,225±316	1,363±380	1,418±414	1,284±377	1,472±307	1,515±293
	Arid	1,501±540	1,770±593	1,847±594	1,557±371	1,650±394	1,705±396
Barley	Humid	632±110	703±105	736±92	490±66	576±80	615±78
	Arid	563±101	625±125	649±144	444±55	498±87	568±166
Soybean	Humid	1,834±255	2,008±251	2,103±220	1,868±154	2,056±172	2,105±188
	Arid	2,239±357	2,420±277	2,496±243	2,431±343	2,696±335	2,802±329
Potatoes	Humid	175±51	220±72	238±67	400±144	763±137	905±103
	Arid	141±26	145±25	147±26	786±166	994±231	1,102±258
Sweet potatoes	Humid	845±158	957±139	986±138	952±86	1,055±45	1,086±39
	Arid	879±137	980±134	1,008±127	1,156±175	1,283±234	1,331±248
Cotton	Humid	5,356±760	6,235±586	6,394±619	4,457±458	4,837±395	4,969±369
	Arid	1,758±316	1,772±316	1,788±320	1,309±238	1,415±253	1,465±257
Sugar cane	Humid	27±3	31±4	32±5	109±9	115±10	118±9
	Arid	368±177	372±177	372±177	–	–	–
Sugar beets	Humid	9±2	9±2	13±11	31±13	45±25	51±30
	Arid	11±2	11±2	11±2	22±4	29±3	31±3
Groundnuts	Humid	723±182	802±180	868±156	898±140	1,048±156	1,111±151
	Arid	1070±96	1,090±95	1097±97	2,084±623	2,400±669	2,514±679
Rapeseed	Humid	1,111±196	1,111±196	1,111±196	77±20	101±35	122±50
	Arid	–	–	–	89±21	128±35	168±43
Sunflower	Humid	1,280±454	1,676±355	1,746±376	732±219	818±291	888±322
	Arid	993±242	1,044±268	1,062±273	940±167	1,059±180	1,122±163
Tomatoes	Humid	48±12	53±13	56±14	–	–	–
	Arid	66±16	75±17	76±17	–	–	–
Apple	Humid	303±102	329±113	346±118	281±84	304±89	317±89

	Arid	369±149	527±150	563±127	394±153	426±160	444±164
Tea	Humid	3,467±1,326	3,861±1,552	4,101±1,653	4,012±1,023	4,477±1,071	4,716±1,062
	Arid	17,694±9,990	18,040±10,210	18,165±10,314			
Tobacco	Humid	1,178±275	1,316±298	1,355±313	1,836±134	1,995±94	2,044±98
	Arid	1,256±307	1,294±337	1,326±360	1,537±422	2,037±531	2,267±600
Cabbage	Humid	738±93	782±92	803±91	676±68	718±61	737±58
	Arid	738±151	763±161	772±165	691±139	750±141	775±140
Grapes	Humid	–	–	–	229±42	251±46	260±47
	Arid	294±60	294±60	294±60	232±46	243±50	248±52

Note: Data are mean ± SD for the years 2000–2018. "–" means no crops are grown.

Supplementary Figures

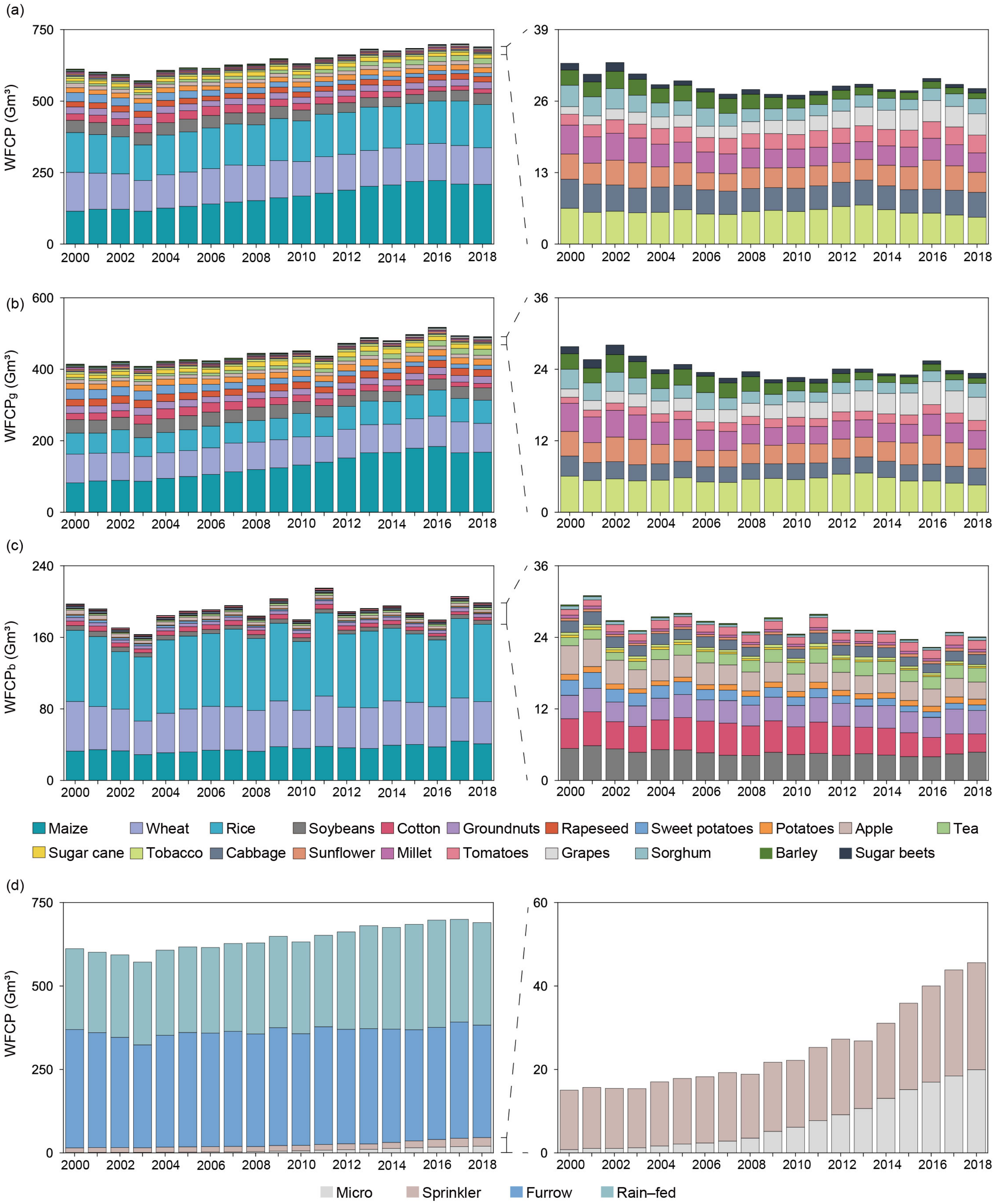


Fig. S1 The WFCP (a), WFCPg (b), WFCPb (c) of 21 crops, and total WFCP under different water supply and irrigation practices (d).

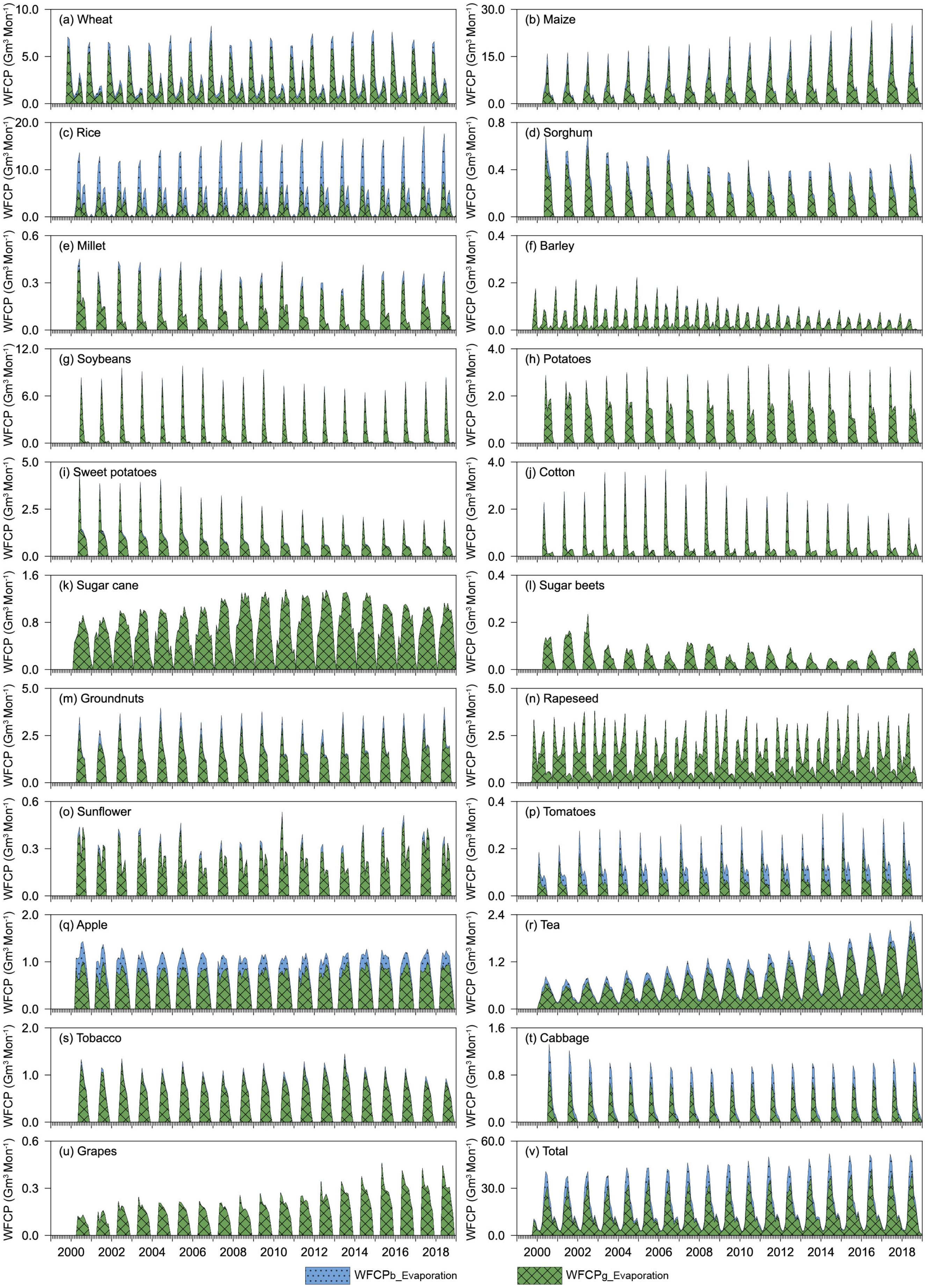


Fig. S2 Total national monthly WFCPg and WFCPb in soil evaporation (cross filling represents WFCPg, dot filling indicates WFCPb).

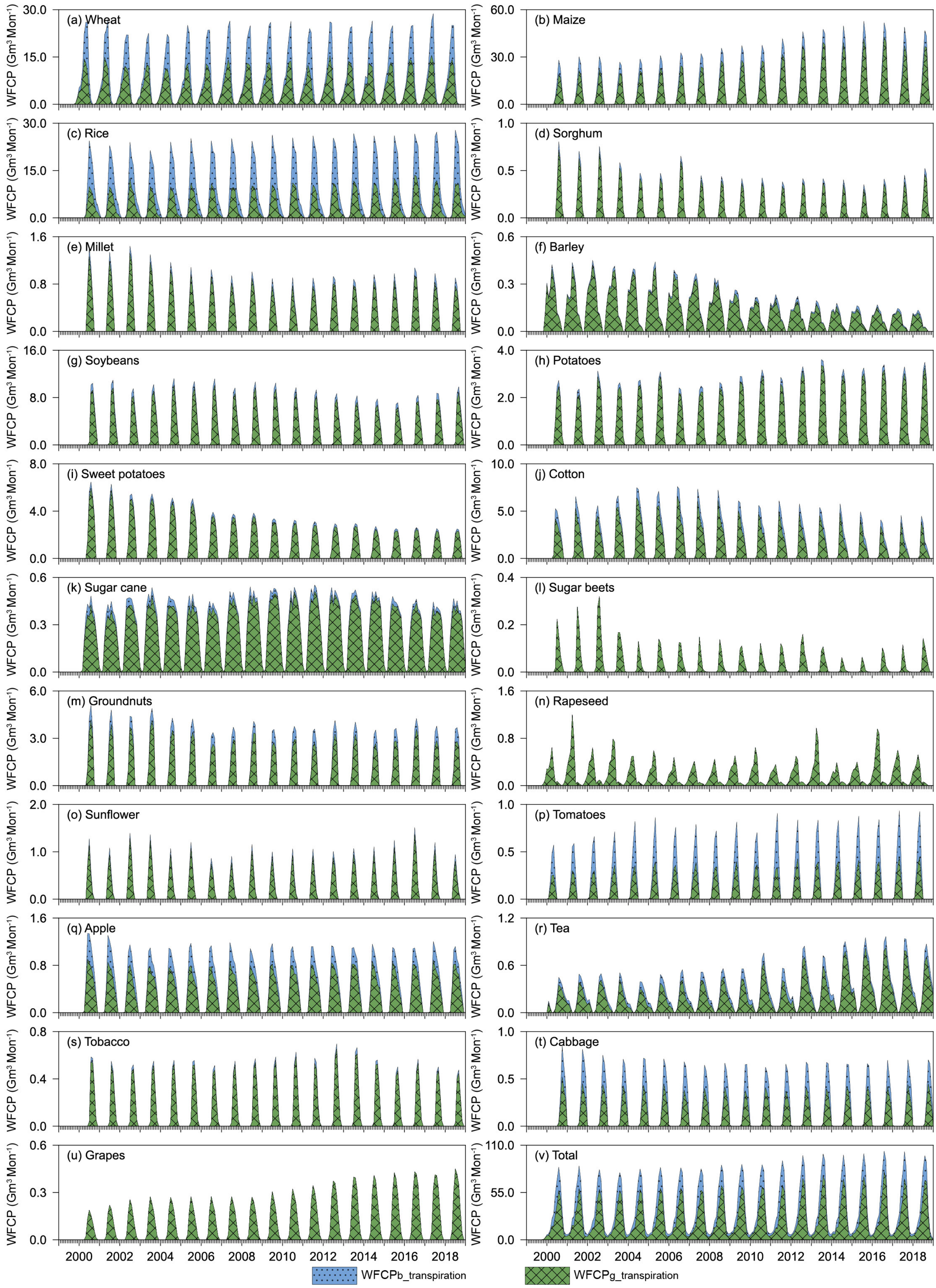


Fig. S3 Total national monthly WFCPg and WFCPb in crop transpiration (cross filling represents WFCPg, dot filling indicates WFCPb).

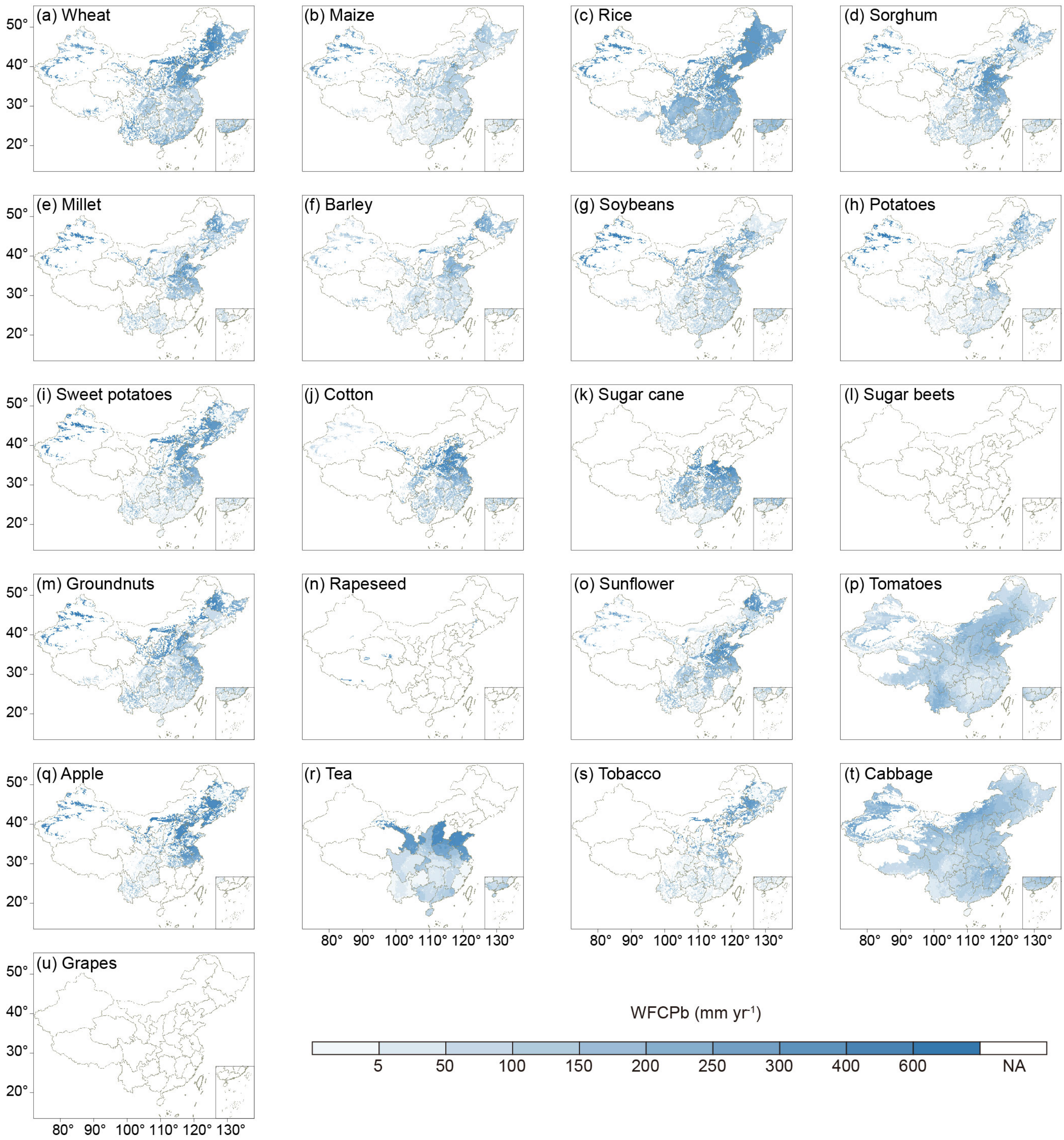


Fig. S4 Gridded WFCPb and WFCPg in 2017.

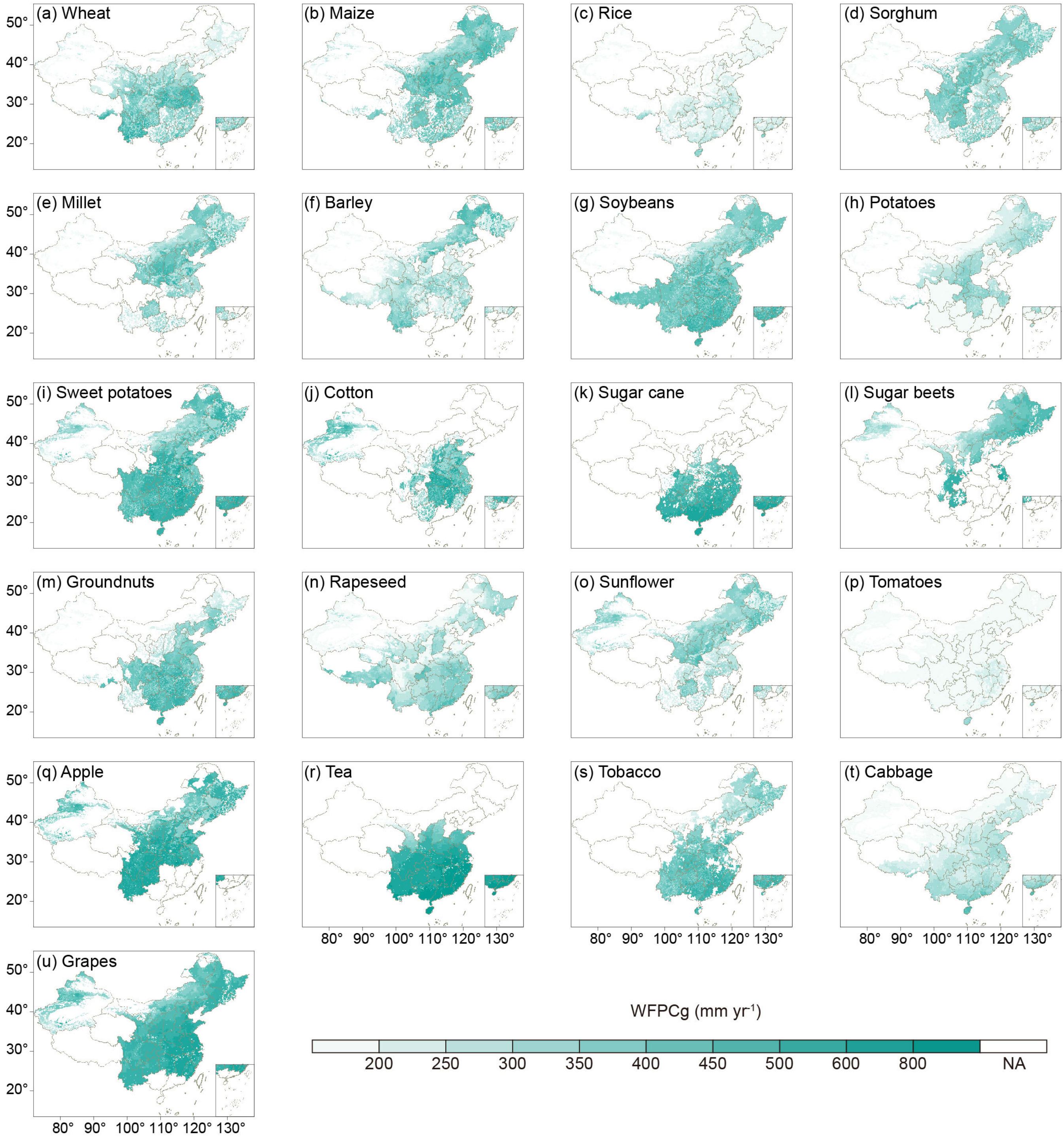


Fig. S5 Gridded WFCPg and WFCPg in 2017.

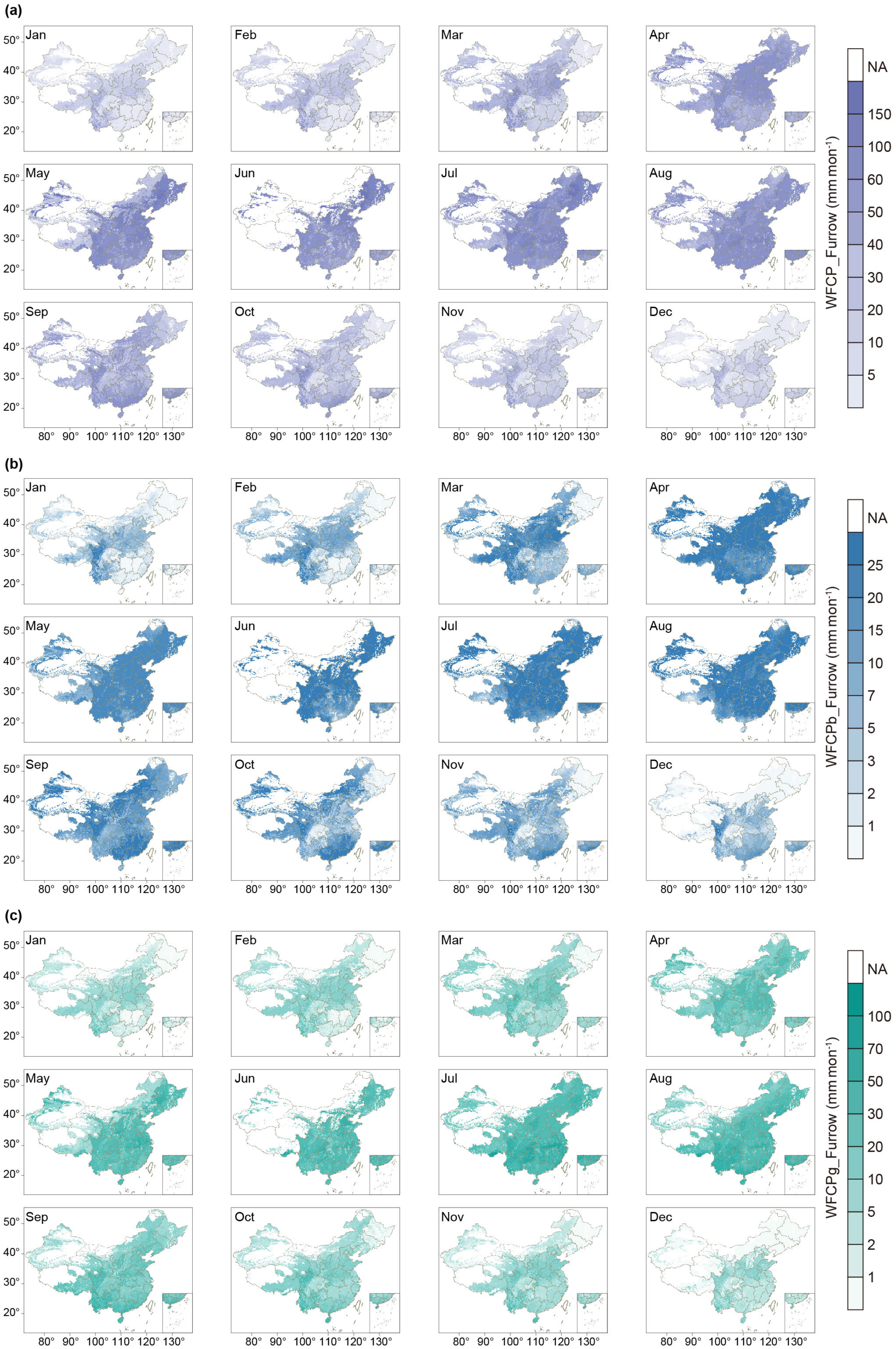


Fig. S6 Gridded monthly total WFCP (a), WFCPb (b) and WFCPg (c) of 21crops in furrow irrigation in 2017.

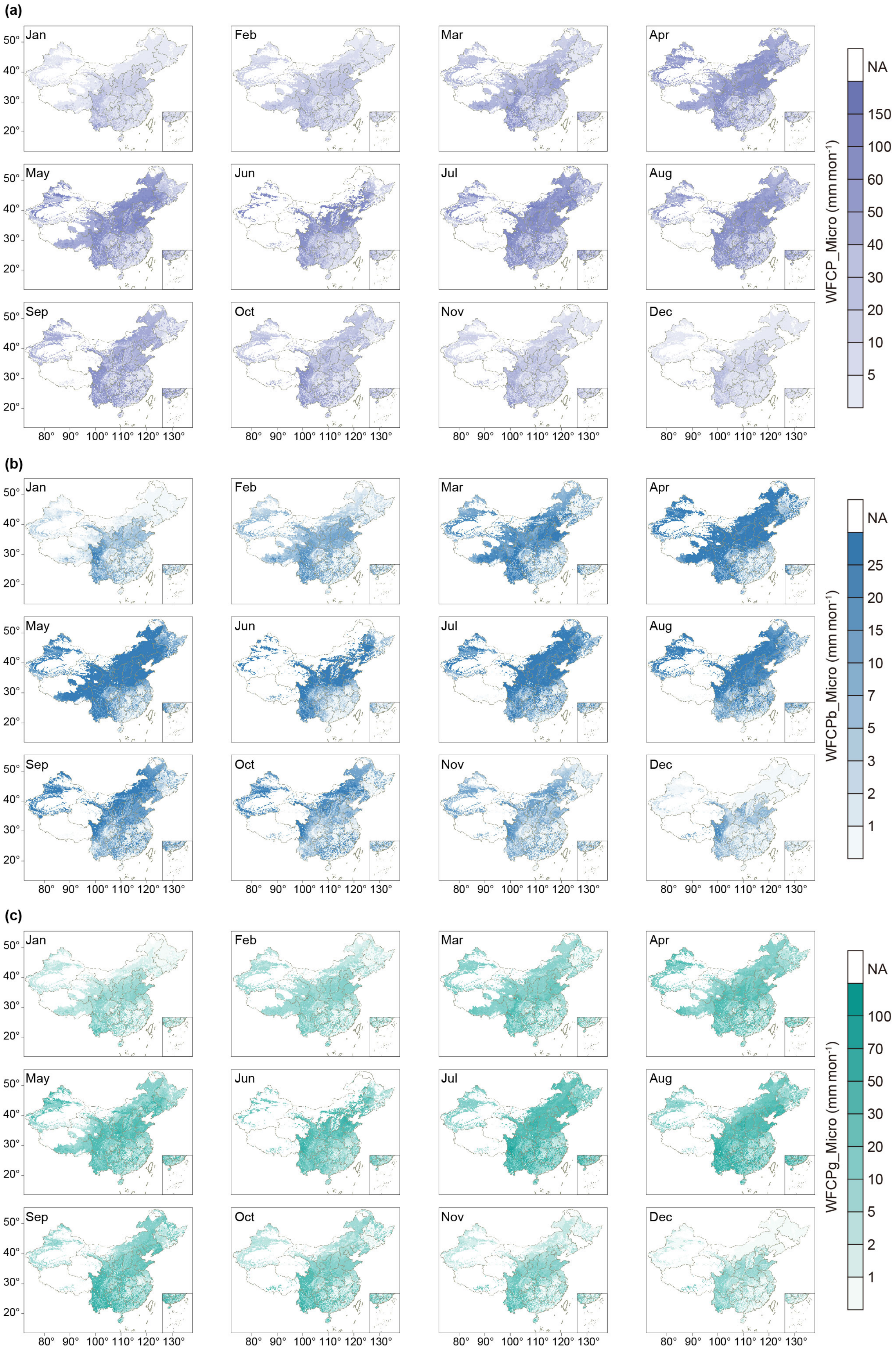


Fig. S7 Gridded monthly total WFCP (a), WFCPb (b) and WFCPg (c) of 21crops in micro irrigation in 2017.

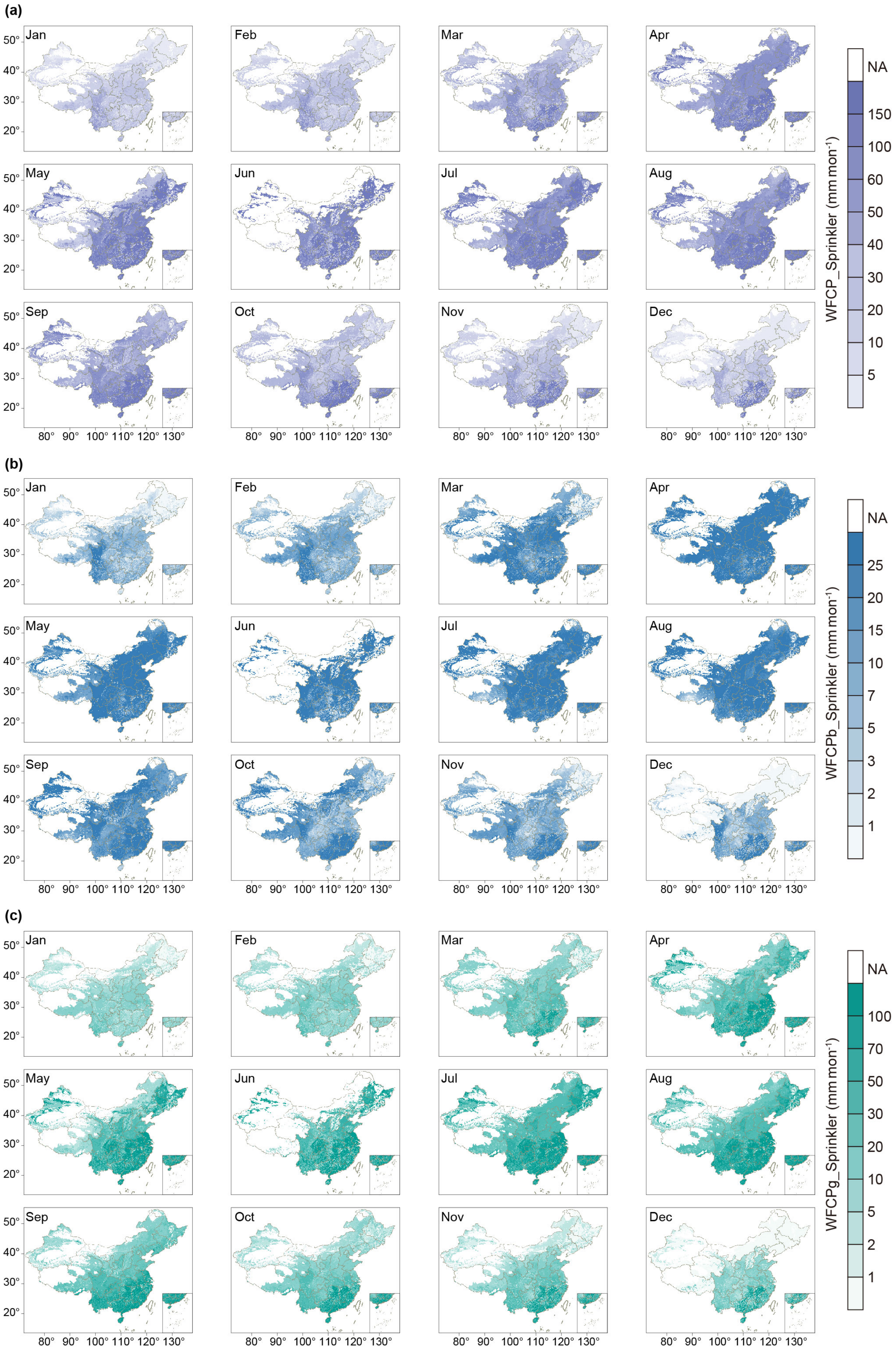


Fig. S8 Gridded monthly total WFCP (a), WFCPb (b) and WFCPg (c) of 21crops in sprinkler irrigation in 2017.

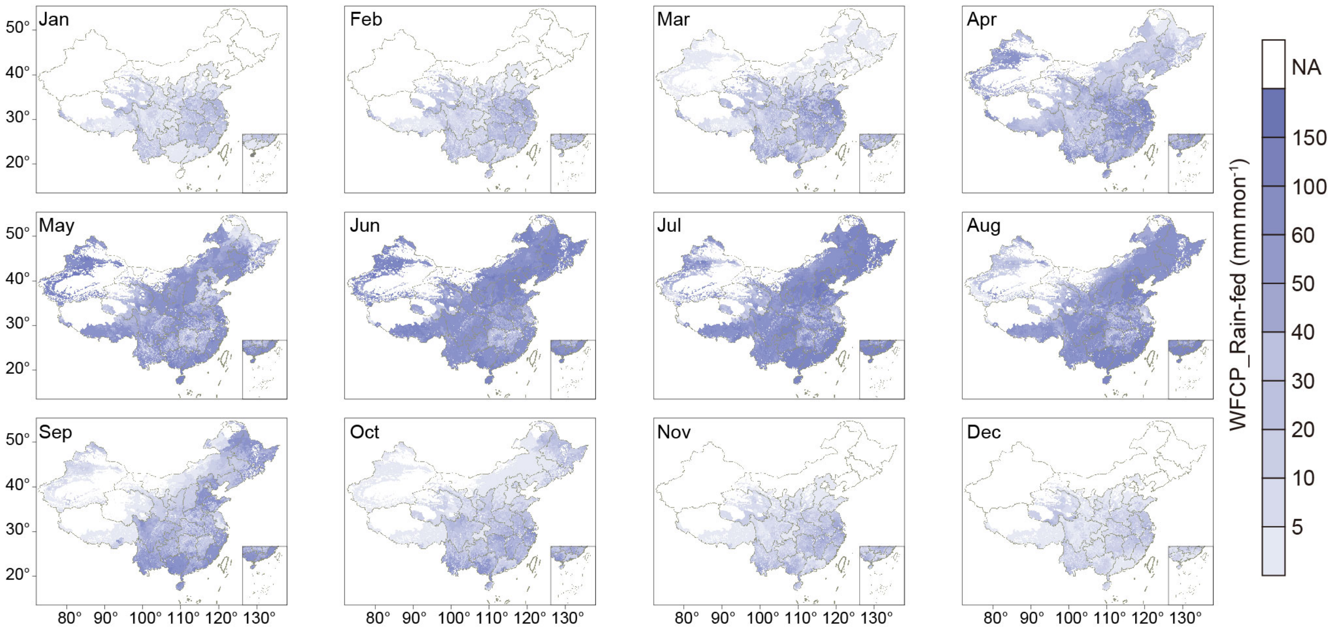


Fig. S9 Gridded monthly total WFCP in rain-fed conditions in 2017.

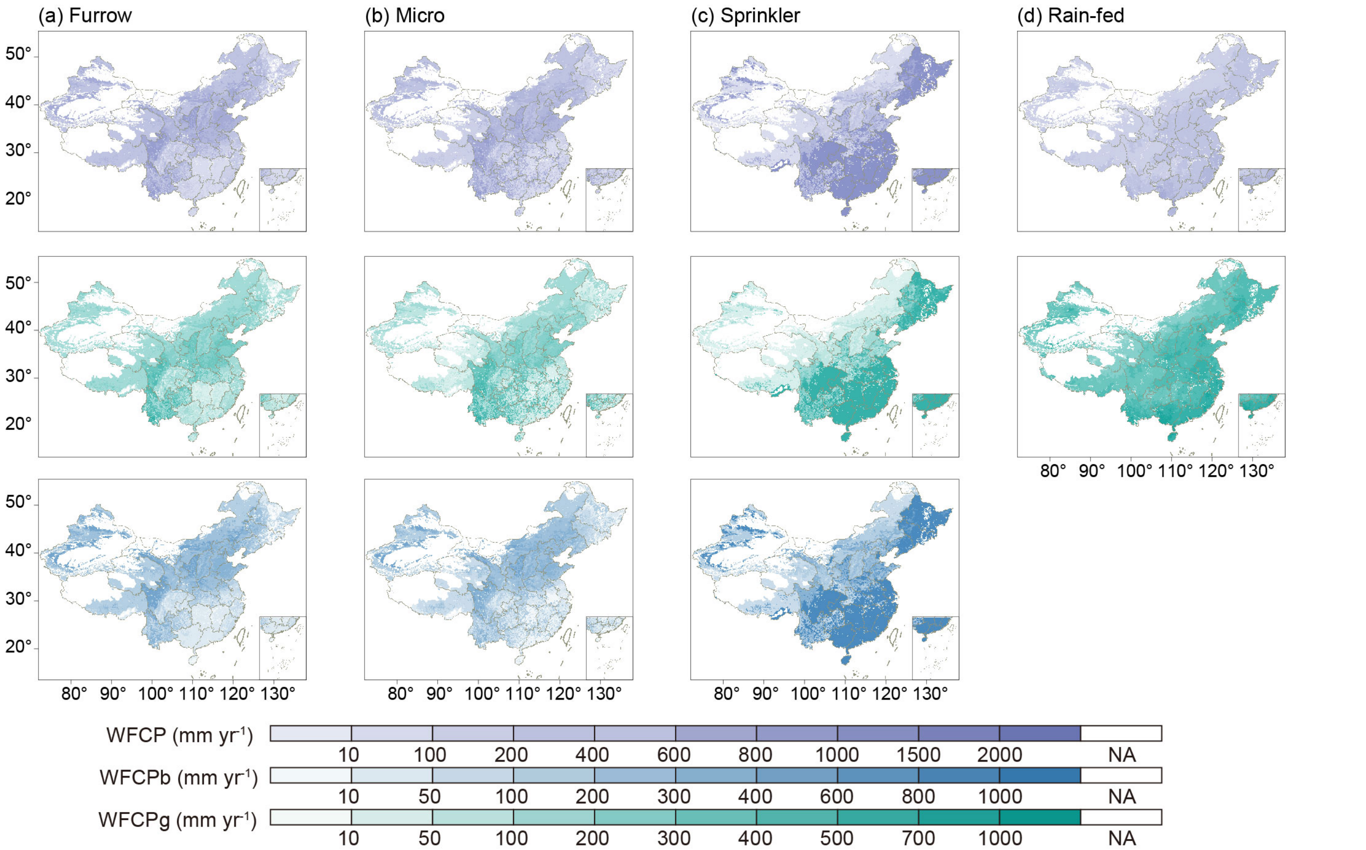


Fig. S10 Gridded monthly total WFCP, WFCPb and WFCPg in furrow irrigation (a), micro irrigation (b), sprinkler irrigation (c) and rain–fed conditions (d) in 2017.

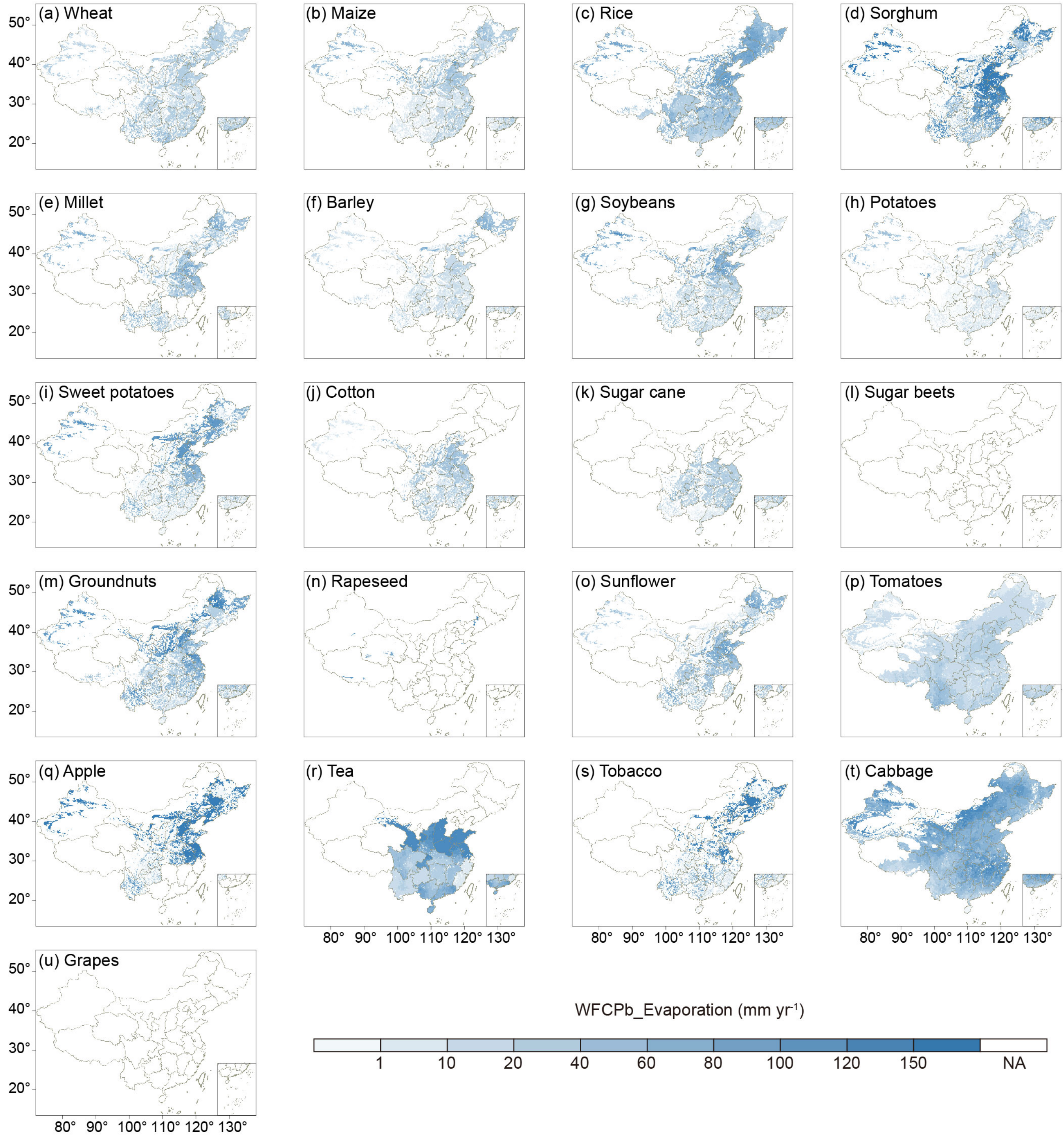


Fig. S11 Gridded WFCPb in soil evaporation in 2017.

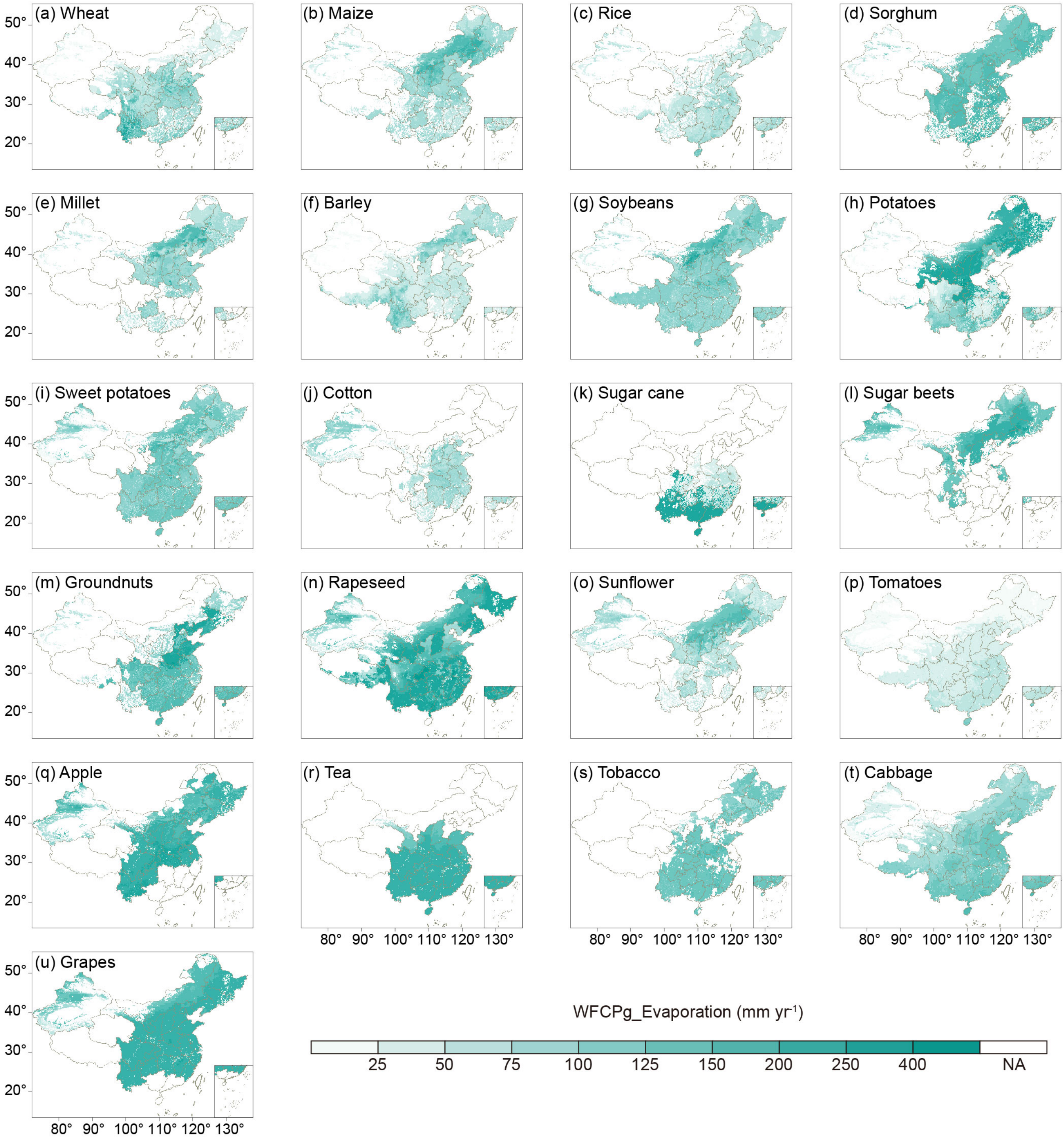


Fig. S12 Gridded WFCPg in soil evaporation in 2017.

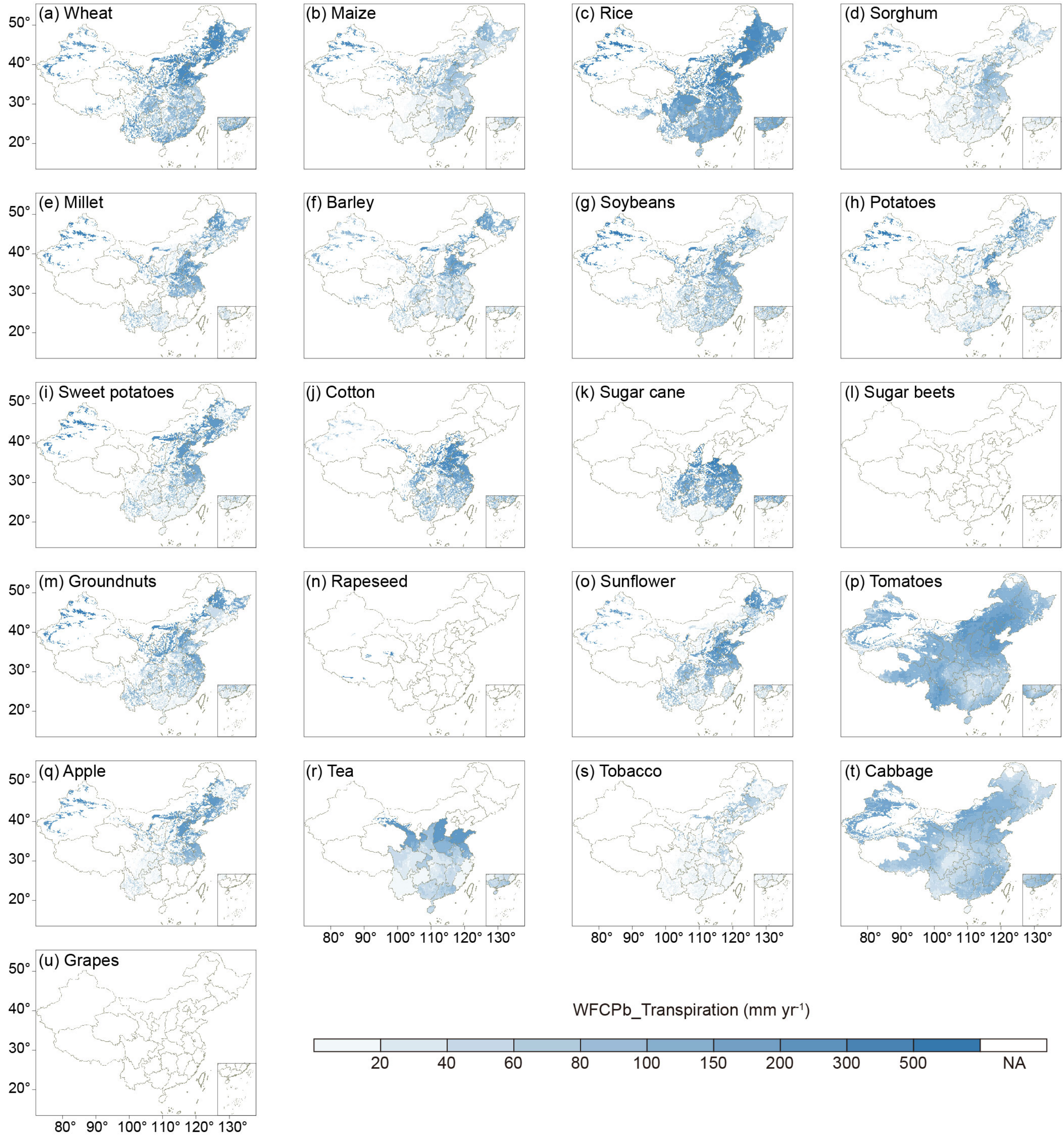


Fig. S13 Gridded WFCPb in soil crop transpiration in 2017.

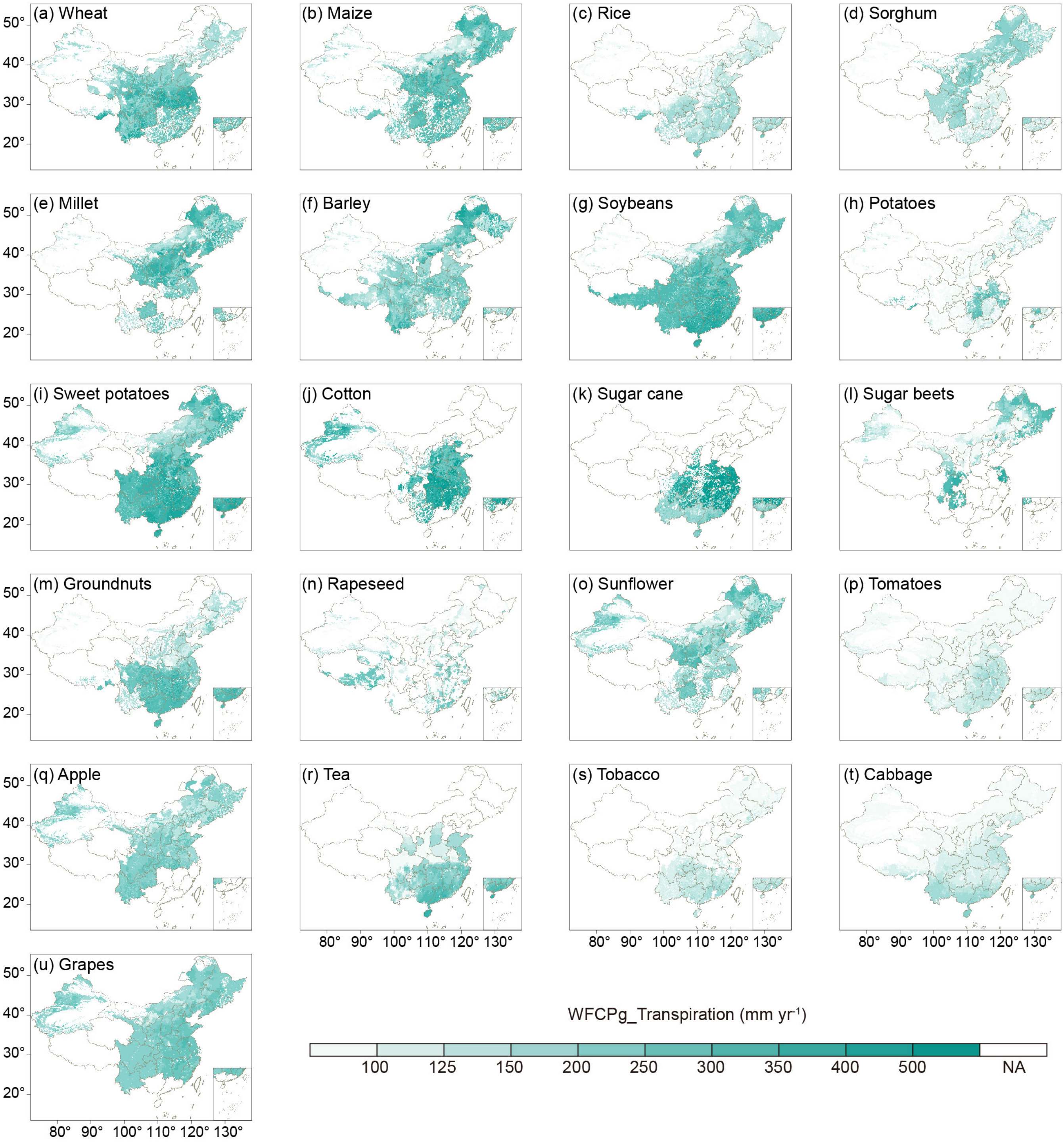
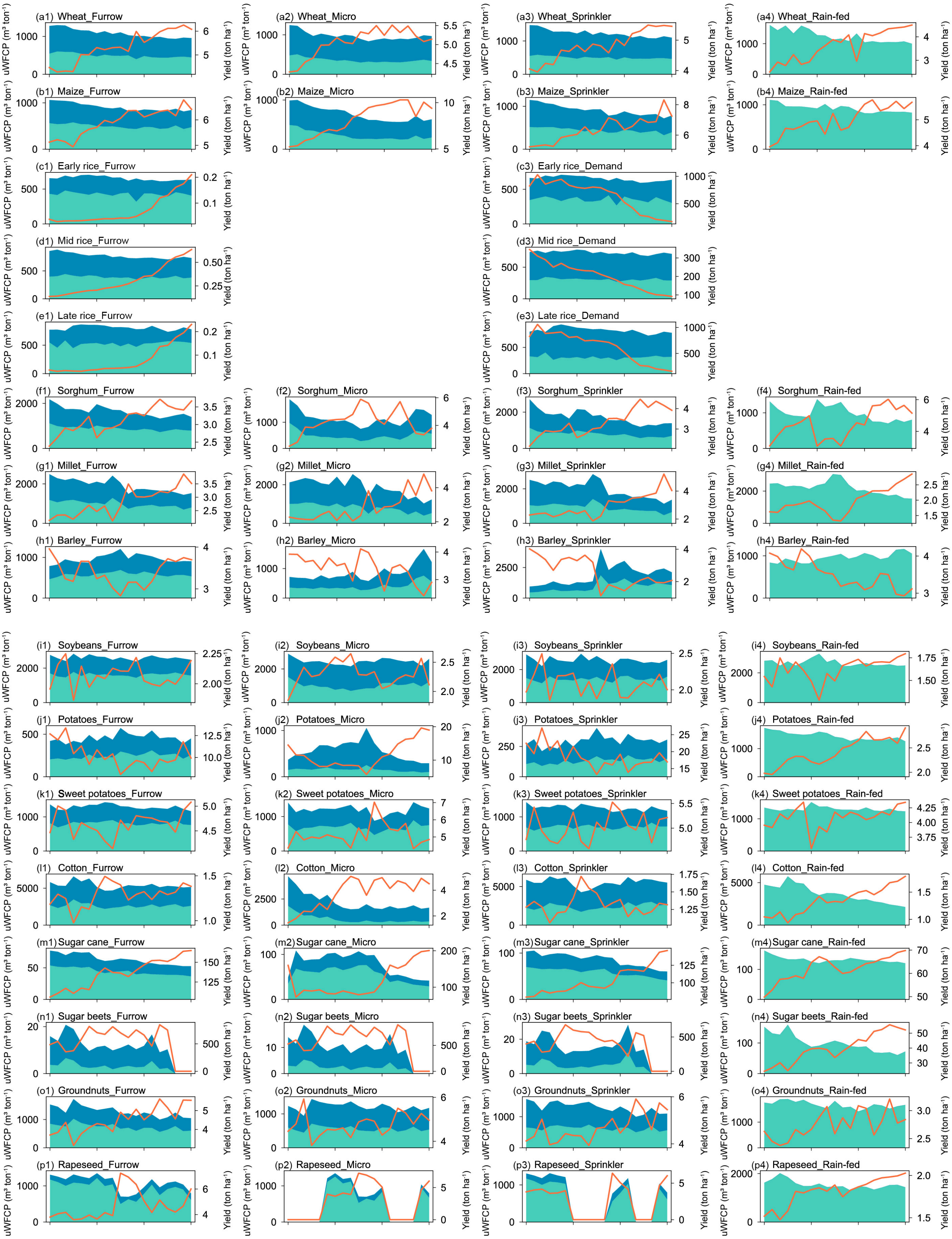


Fig. S14 Gridded WFCPg in soil crop transpiration in 2017.


(a1) Wheat_Furrow
(a2) Wheat_Micro
(a3) Wheat_Sprinkler
(a4) Wheat_Rain-fed
(b1) Maize_Furrow
(b2) Maize_Micro
(b3) Maize_Sprinkler
(b4) Maize_Rain-fed
(c1) Early rice_Furrow
(c3) Early rice_Demand
(d1) Mid rice_Furrow
(d3) Mid rice_Demand
(e1) Late rice_Furrow
(e3) Late rice_Demand
(f1) Sorghum_Furrow
(f2) Sorghum_Micro
(f3) Sorghum_Sprinkler
(f4) Sorghum_Rain-fed
(g1) Millet_Furrow
(g2) Millet_Micro
(g3) Millet_Sprinkler
(g4) Millet_Rain-fed
(h1) Barley_Furrow
(h2) Barley_Micro
(h3) Barley_Sprinkler
(h4) Barley_Rain-fed
(i1) Soybeans_Furrow
(i2) Soybeans_Micro
(i3) Soybeans_Sprinkler
(i4) Soybeans_Rain-fed
(j1) Potatoes_Furrow
(j2) Potatoes_Micro
(j3) Potatoes_Sprinkler
(j4) Potatoes_Rain-fed
(k1) Sweet potatoes_Furrow
(k2) Sweet potatoes_Micro
(k3) Sweet potatoes_Sprinkler
(k4) Sweet potatoes_Rain-fed
(l1) Cotton_Furrow
(l2) Cotton_Micro
(l3) Cotton_Sprinkler
(l4) Cotton_Rain-fed
(m1) Sugar cane_Furrow
(m2) Sugar cane_Micro
(m3) Sugar cane_Sprinkler
(m4) Sugar cane_Rain-fed
(n1) Sugar beets_Furrow
(n2) Sugar beets_Micro
(n3) Sugar beets_Sprinkler
(n4) Sugar beets_Rain-fed
(o1) Groundnuts_Furrow
(o2) Groundnuts_Micro
(o3) Groundnuts_Sprinkler
(o4) Groundnuts_Rain-fed
(p1) Rapeseed_Furrow
(p2) Rapeseed_Micro
(p3) Rapeseed_Sprinkler
(p4) Rapeseed_Rain-fed
uWFCP (m³ ton⁻¹)
Yield (ton ha⁻¹)

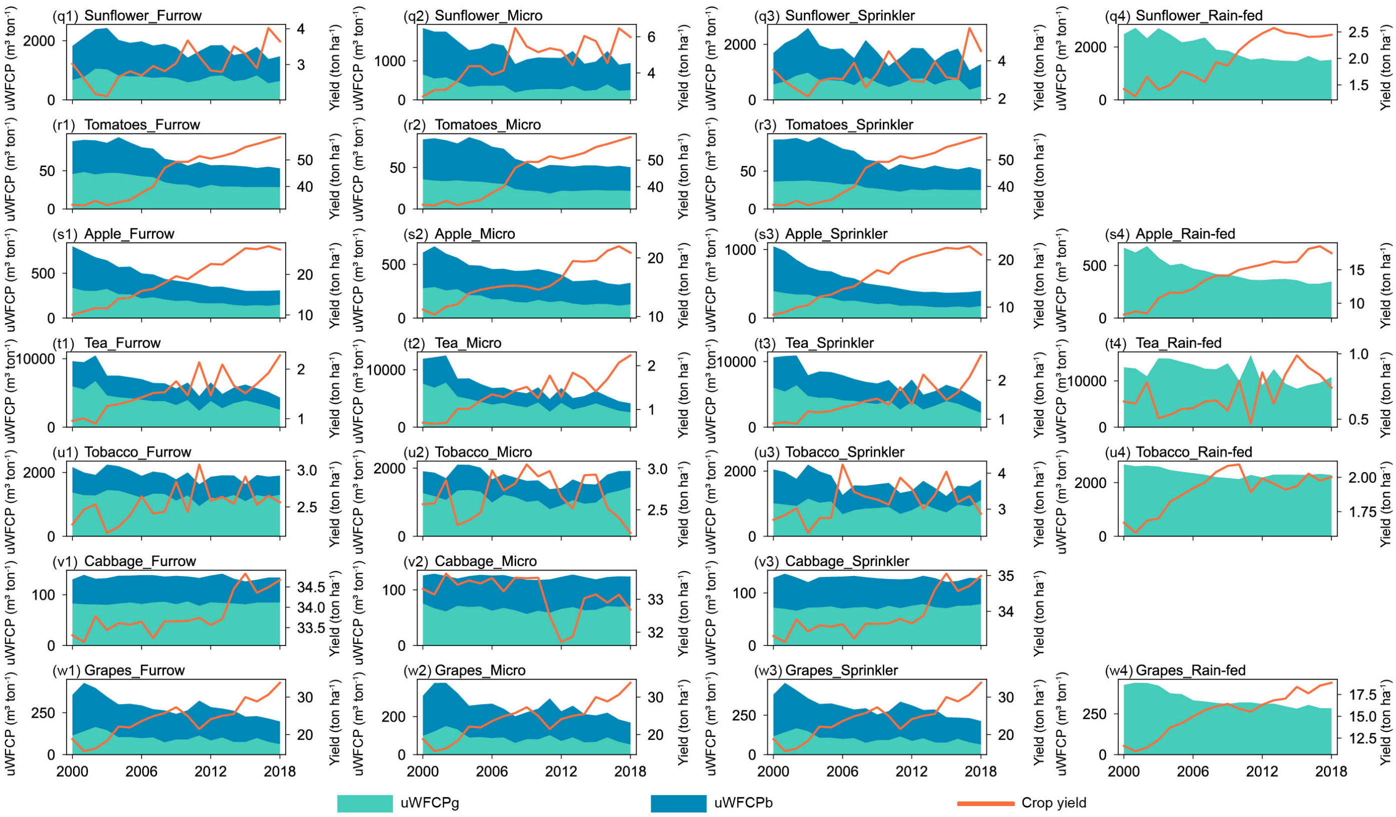


Fig. S15 Interannual variation in uWFCPb, uWFCPg and yield under different water supply and irrigation practices over 2000-2018.

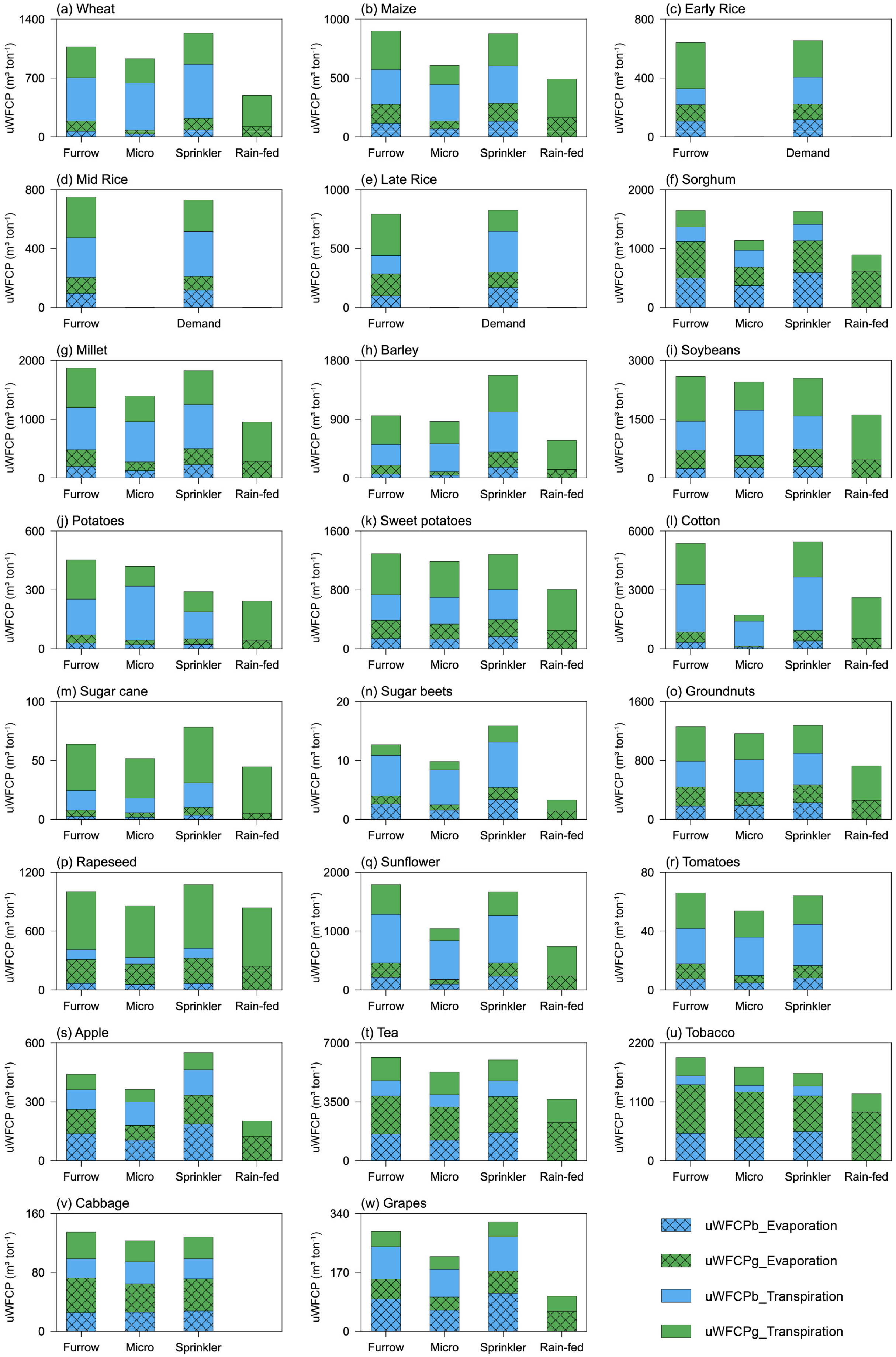


Fig. S16 Proportion of blue and green water consumption for soil evaporation and crop transpiration under different water supply and irrigation practices.

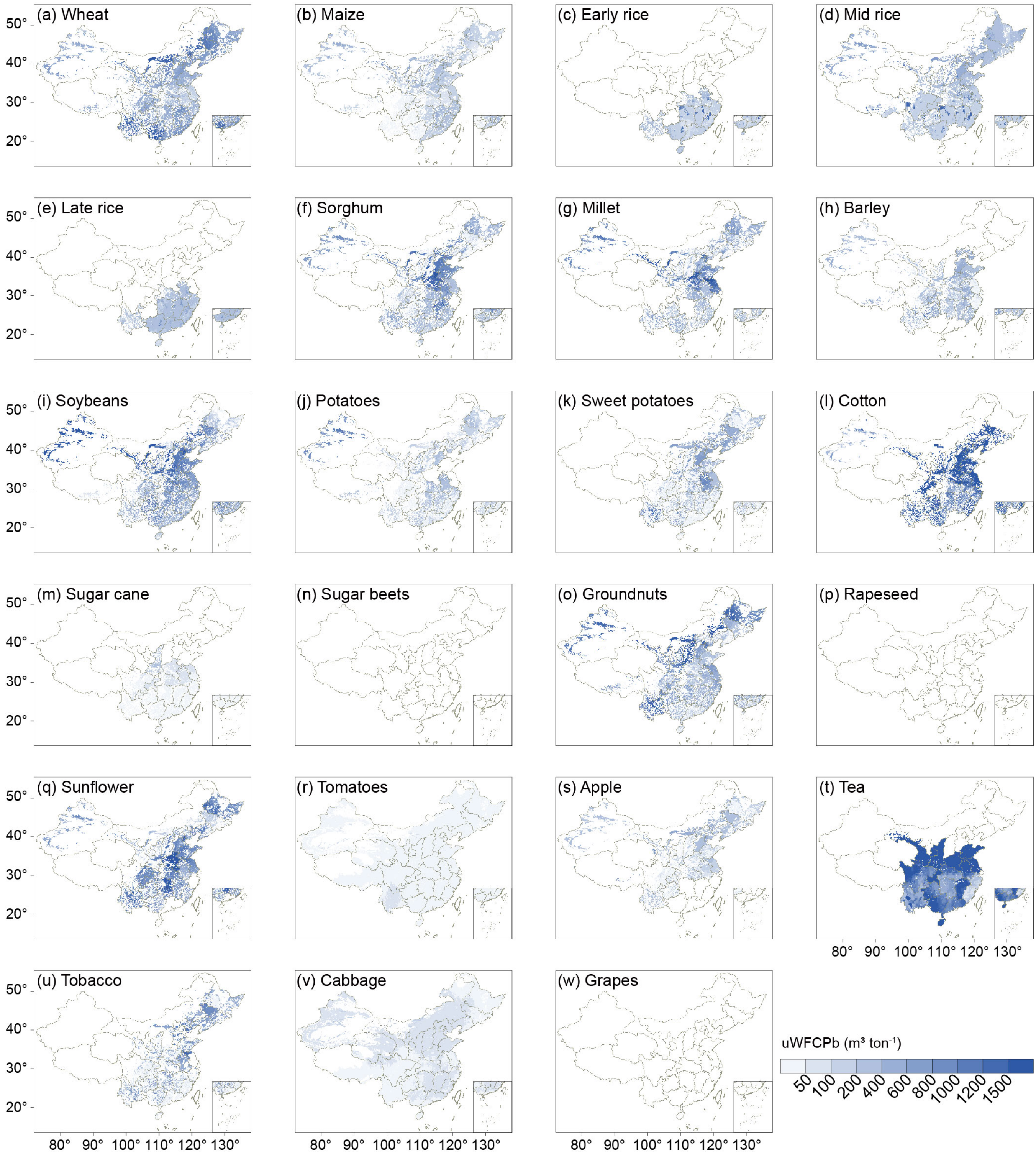


Fig. S17 Gridded uWFCPb (Annual average for 2010-2018).

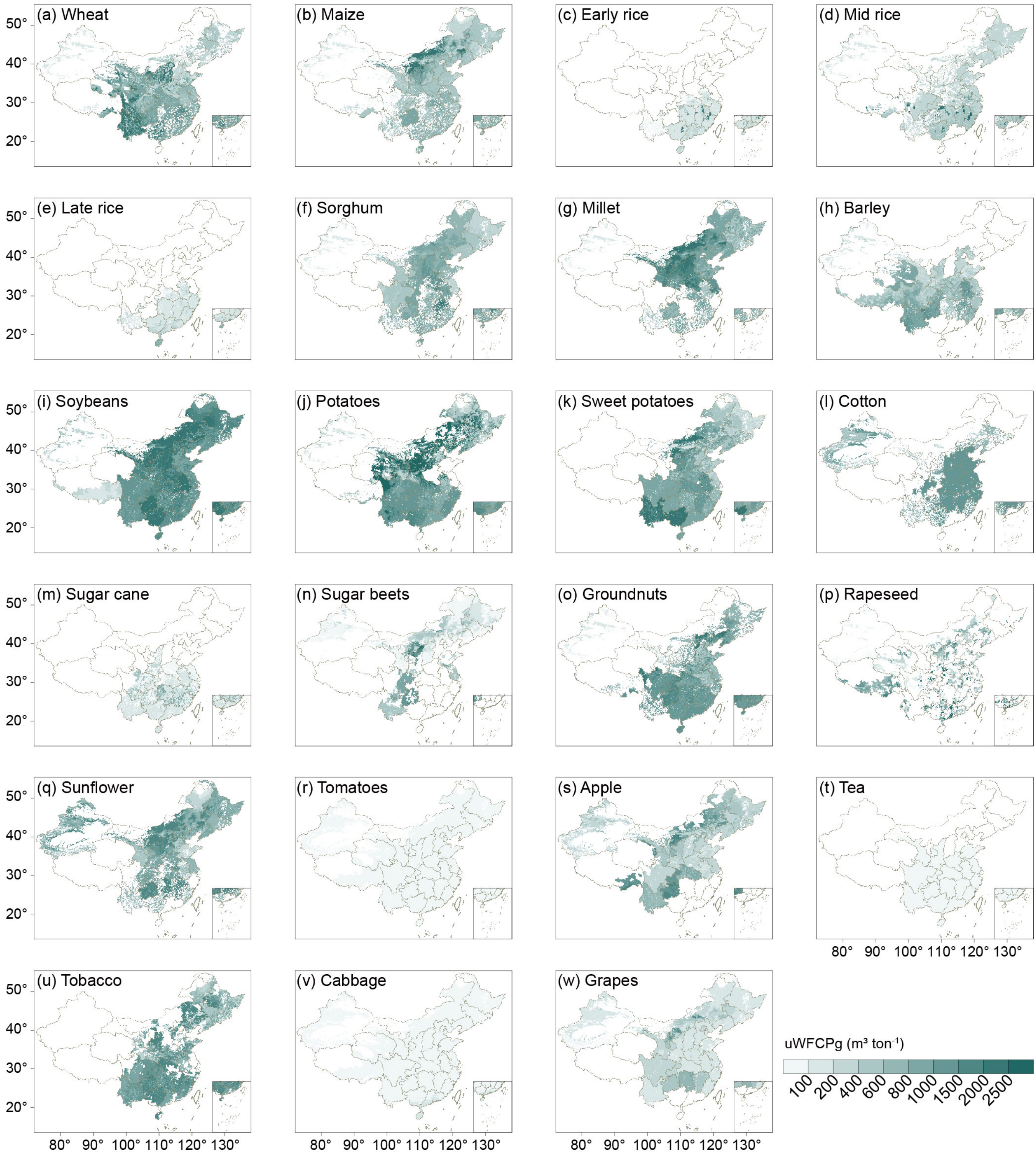


Fig. S18 Gridded uWFCPg (Annual average for 2010-2018).

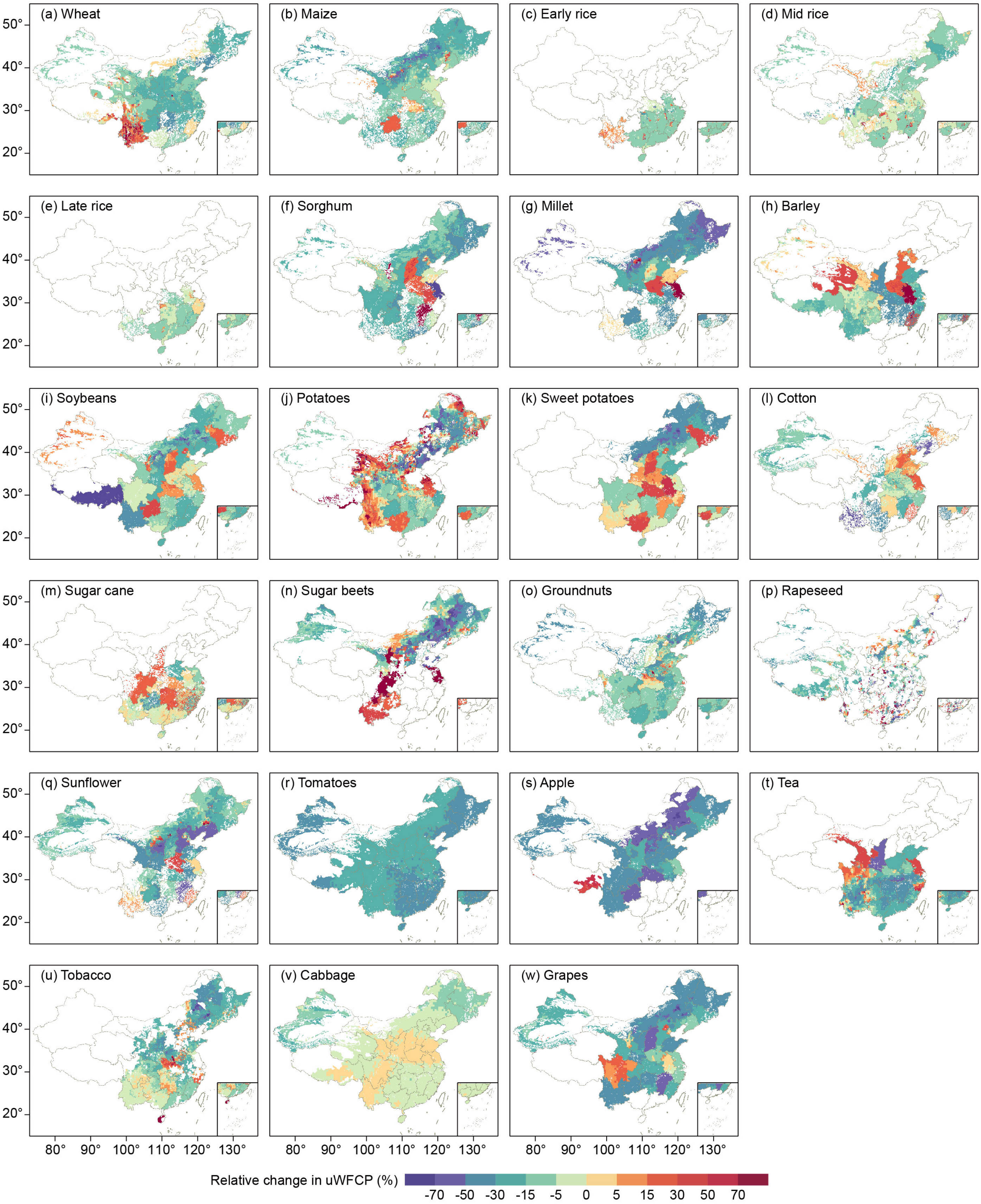


Fig. S19 Relative changes of the average gridded uWFCP for 2000-2009 to that for 2010-2018.

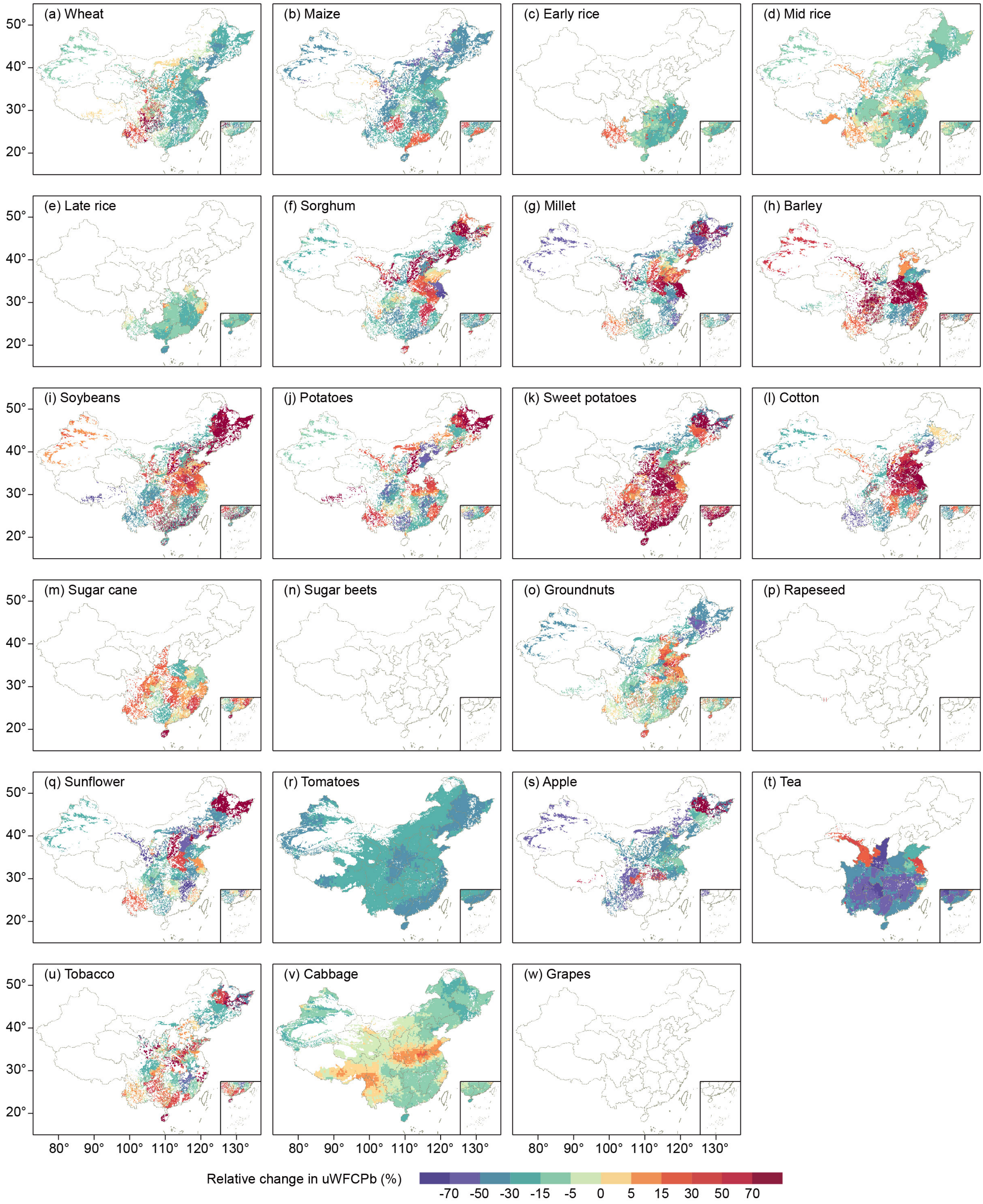


Fig. S20 Relative changes of the average gridded uWFCPb for 2000-2009 to that for 2010-2018.

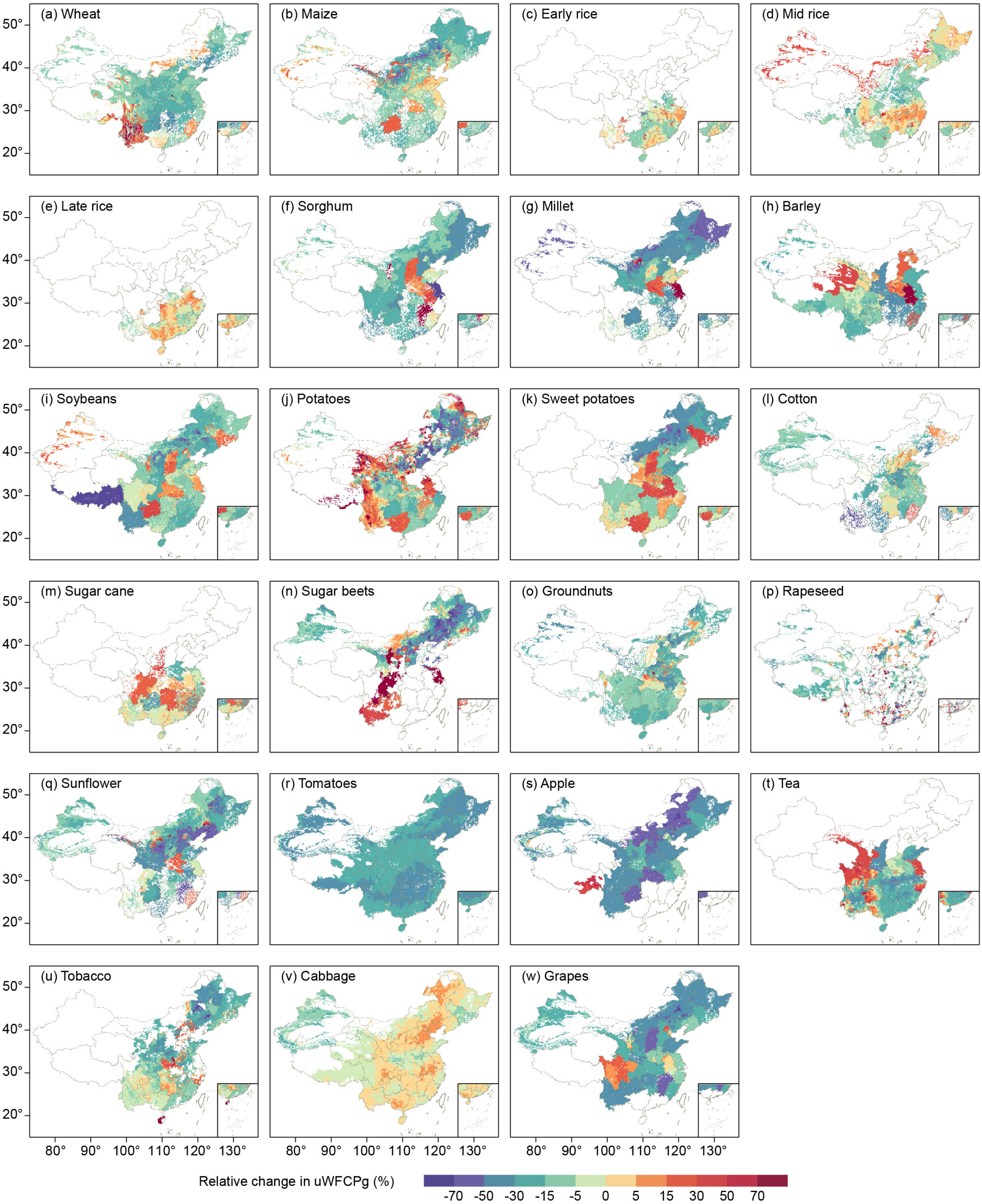
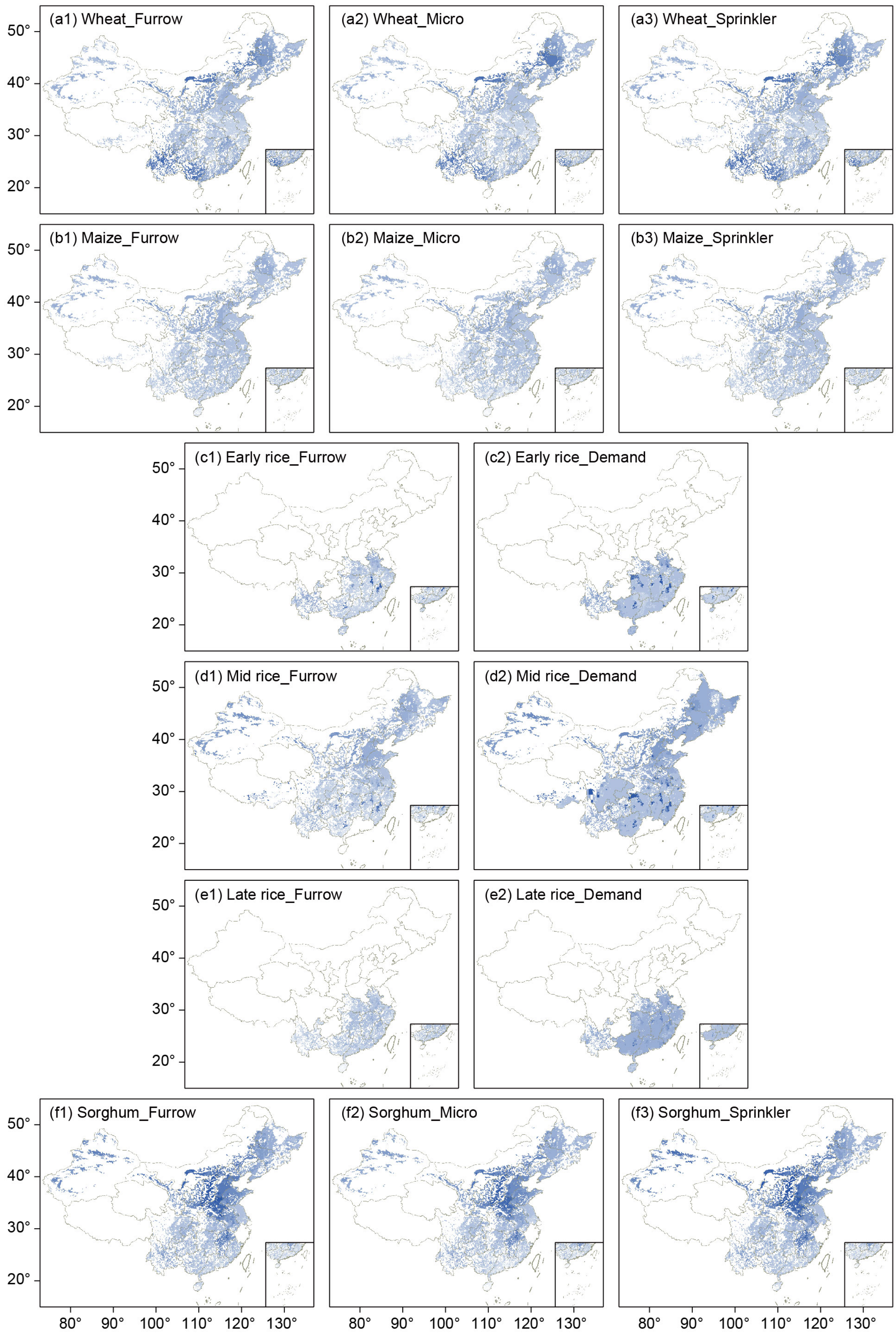


Fig. S21 Relative changes of the average gridded uWFCPg for 2000-2009 to that for 2010-2018.


(a1) Wheat_Furrow
(a2) Wheat_Micro
(a3) Wheat_Sprinkler
(b1) Maize_Furrow
(b2) Maize_Micro
(b3) Maize_Sprinkler
(c1) Early rice_Furrow
(c2) Early rice_Demand
(d1) Mid rice_Furrow
(d2) Mid rice_Demand
(e1) Late rice_Furrow
(e2) Late rice_Demand
(f1) Sorghum_Furrow
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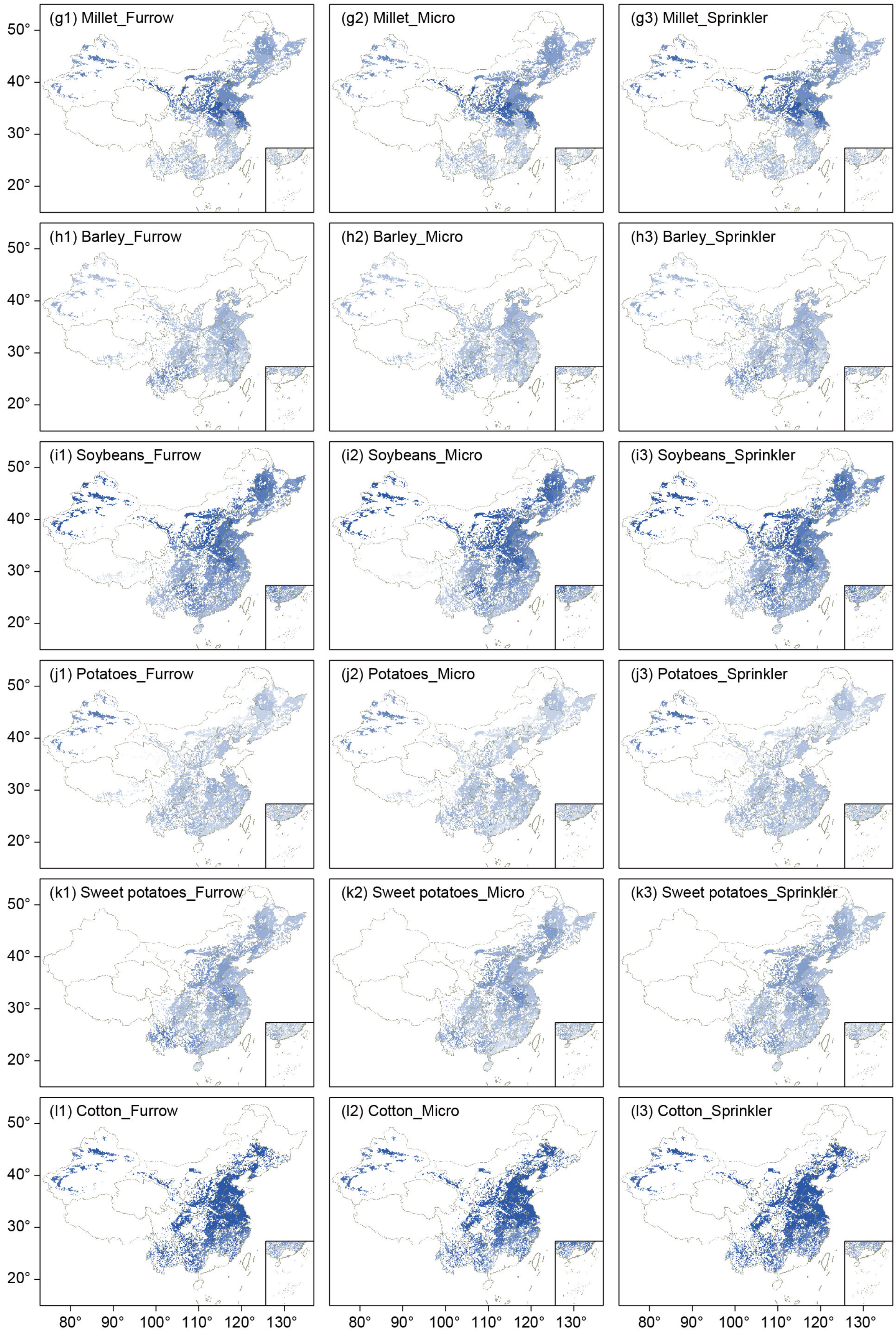
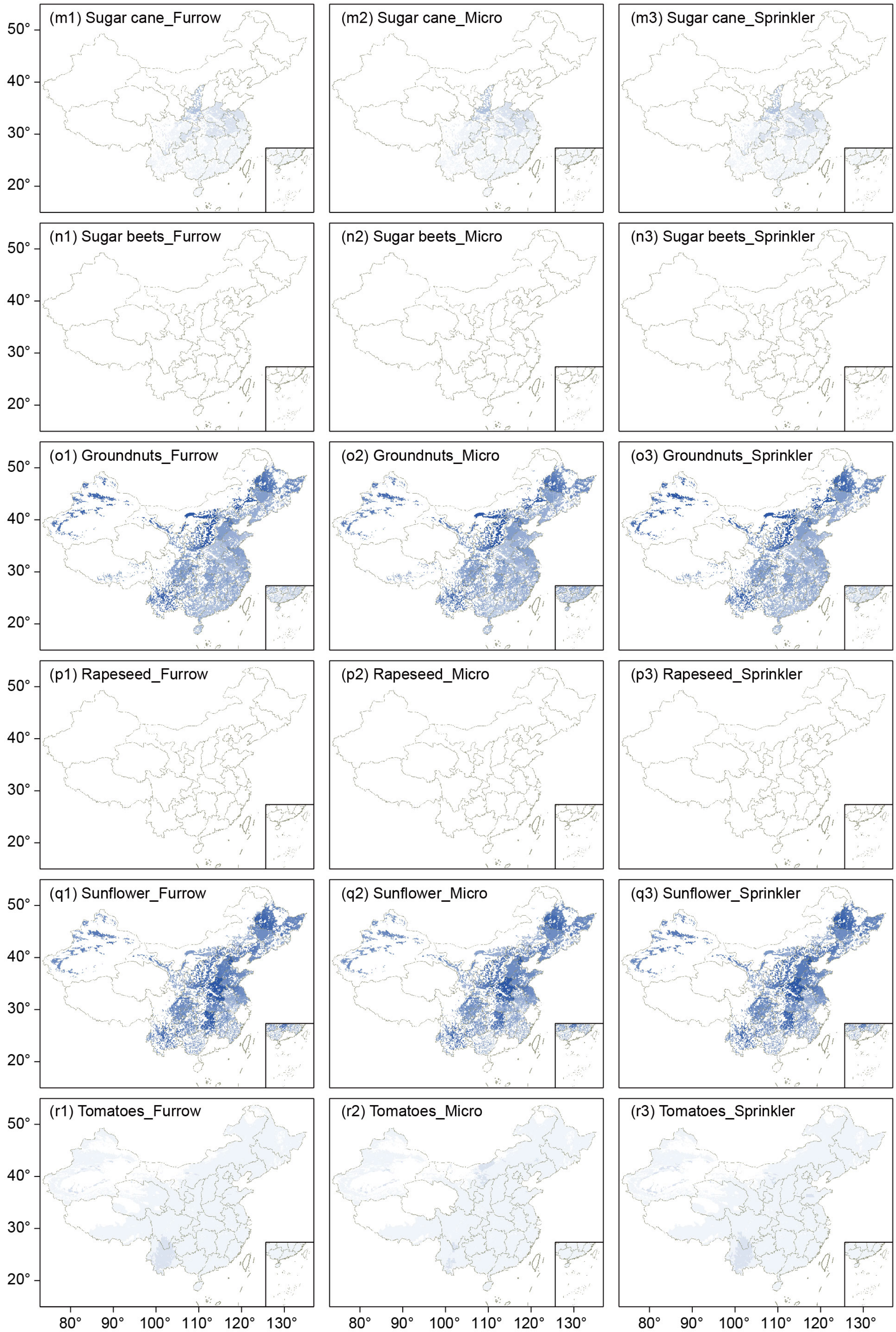
40°
30°
20°
80° 90° 100° 110° 120° 130°


(g1) Millet_Furrow
(g2) Millet_Micro
(g3) Millet_Sprinkler
(h1) Barley_Furrow
(h2) Barley_Micro
(h3) Barley_Sprinkler
(i1) Soybeans_Furrow
(i2) Soybeans_Micro
(i3) Soybeans_Sprinkler
(j1) Potatoes_Furrow
(j2) Potatoes_Micro
(j3) Potatoes_Sprinkler
(k1) Sweet potatoes_Furrow
(k2) Sweet potatoes_Micro
(k3) Sweet potatoes_Sprinkler
(l1) Cotton_Furrow
(l2) Cotton_Micro
(l3) Cotton_Sprinkler
50°
40°
30°
20°
80°
90°
100°
110°
120°
130°


(m1) Sugar cane_Furrow
(m2) Sugar cane_Micro
(m3) Sugar cane_Sprinkler
(n1) Sugar beets_Furrow
(n2) Sugar beets_Micro
(n3) Sugar beets_Sprinkler
(o1) Groundnuts_Furrow
(o2) Groundnuts_Micro
(o3) Groundnuts_Sprinkler
(p1) Rapeseed_Furrow
(p2) Rapeseed_Micro
(p3) Rapeseed_Sprinkler
(q1) Sunflower_Furrow
(q2) Sunflower_Micro
(q3) Sunflower_Sprinkler
(r1) Tomatoes_Furrow
(r2) Tomatoes_Micro
(r3) Tomatoes_Sprinkler
50°
40°
30°
20°
80°
90°
100°
110°
120°
130°

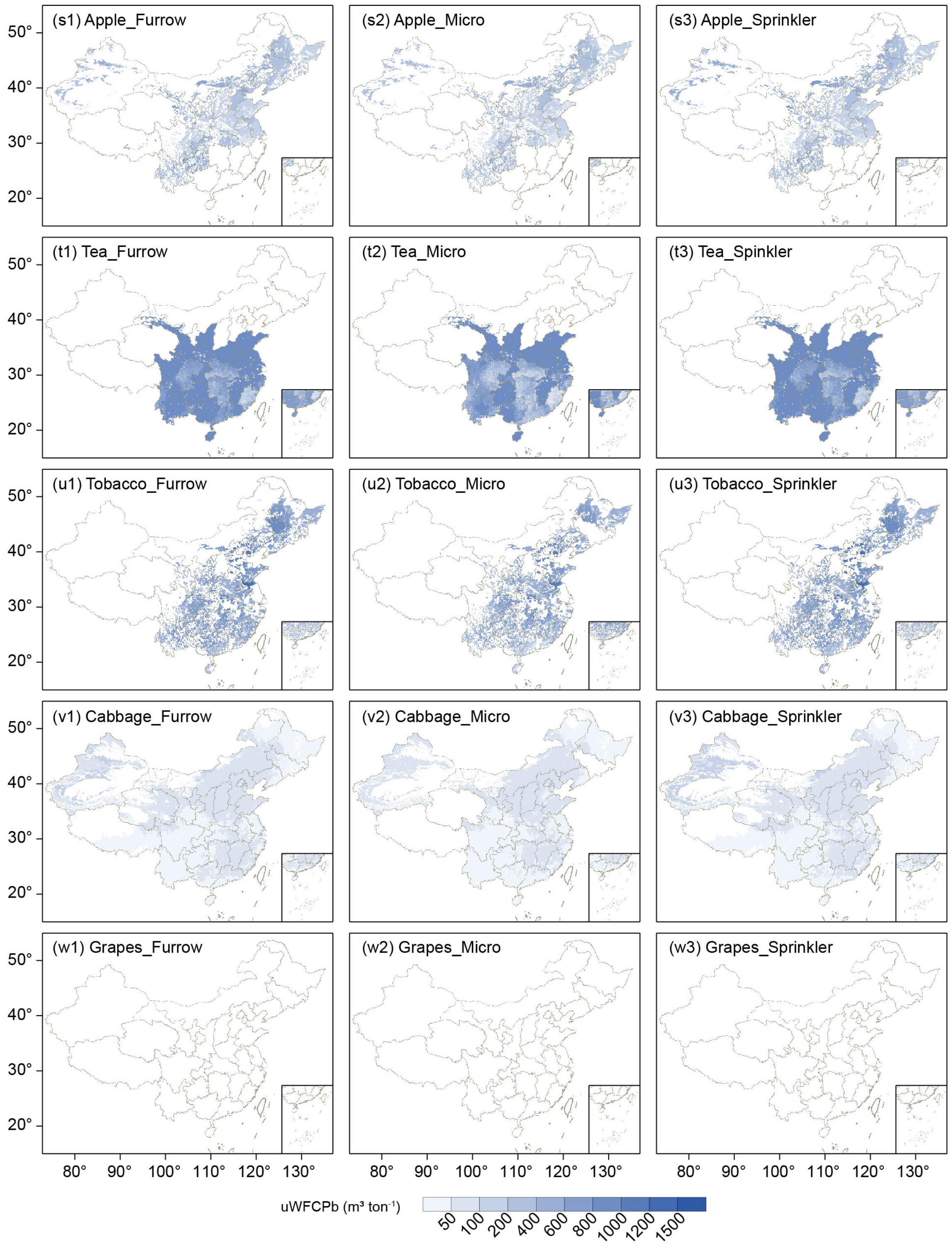
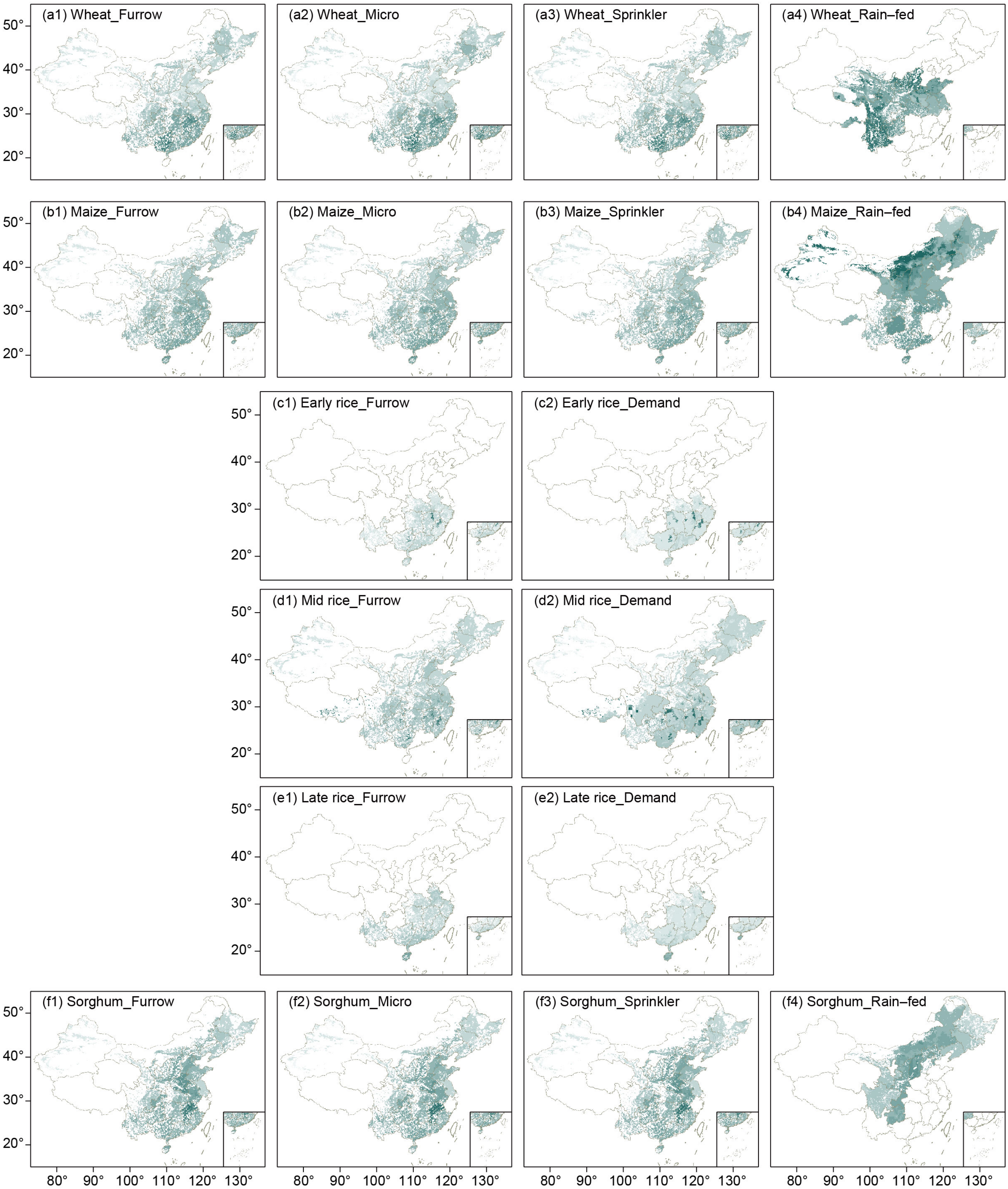


Fig. S22 Gridded uWFCPb (Annual average for 2010-2018).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(a4) Wheat_Rain–fed
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(b3) Maize_Sprinkler
(b4) Maize_Rain–fed
(c1) Early rice_Furrow
(c2) Early rice_Demand
(d1) Mid rice_Furrow
(d2) Mid rice_Demand
(e1) Late rice_Furrow
(e2) Late rice_Demand
(f1) Sorghum_Furrow
(f2) Sorghum_Micro
(f3) Sorghum_Sprinkler
(f4) Sorghum_Rain–fed
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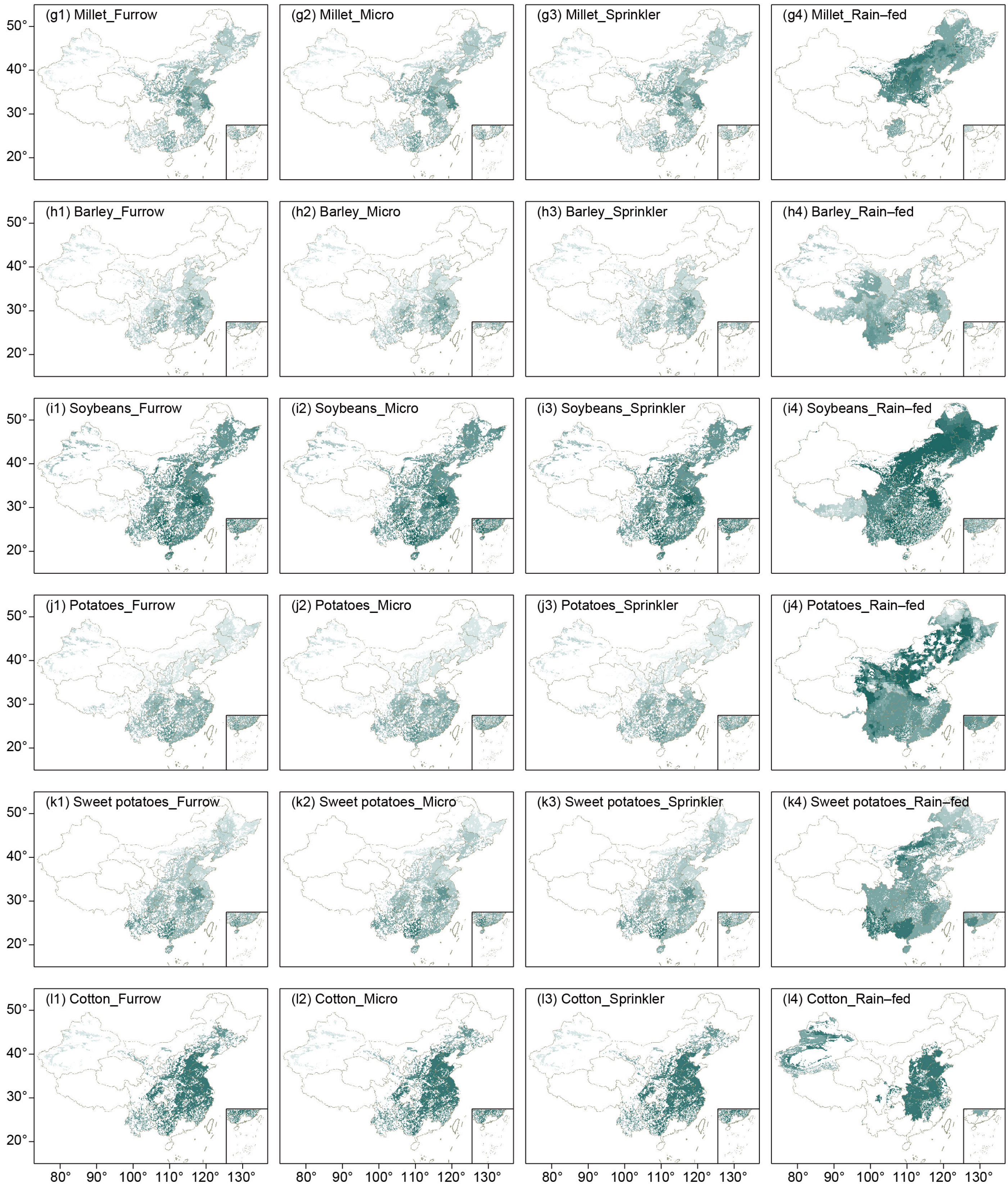
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(g2) Millet_Micro
(g3) Millet_Sprinkler
(g4) Millet_Rain–fed
(h1) Barley_Furrow
(h2) Barley_Micro
(h3) Barley_Sprinkler
(h4) Barley_Rain–fed
(i1) Soybeans_Furrow
(i2) Soybeans_Micro
(i3) Soybeans_Sprinkler
(i4) Soybeans_Rain–fed
(j1) Potatoes_Furrow
(j2) Potatoes_Micro
(j3) Potatoes_Sprinkler
(j4) Potatoes_Rain–fed
(k1) Sweet potatoes_Furrow
(k2) Sweet potatoes_Micro
(k3) Sweet potatoes_Sprinkler
(k4) Sweet potatoes_Rain–fed
(l1) Cotton_Furrow
(l2) Cotton_Micro
(l3) Cotton_Sprinkler
(l4) Cotton_Rain–fed
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(m1) Sugar cane_Furrow
(m2) Sugar cane_Micro
(m3) Sugar cane_Sprinkler
(m4) Sugar cane_Rain–fed
(n1) Sugar beets_Furrow
(n2) Sugar beets_Micro
(n3) Sugar beets_Sprinkler
(n4) Sugar beets_Rain–fed
(o1) Groundnuts_Furrow
(o2) Groundnuts_Micro
(o3) Groundnuts_Sprinkler
(o4) Groundnuts_Rain–fed
(p1) Rapeseed_Furrow
(p2) Rapeseed_Micro
(p3) Rapeseed_Sprinkler
(p4) Rapeseed_Rain–fed
(q1) Sunflower_Furrow
(q2) Sunflower_Micro
(q3) Sunflower_Sprinkler
(q4) Sunflower_Rain–fed
(r1) Tomatoes_Furrow
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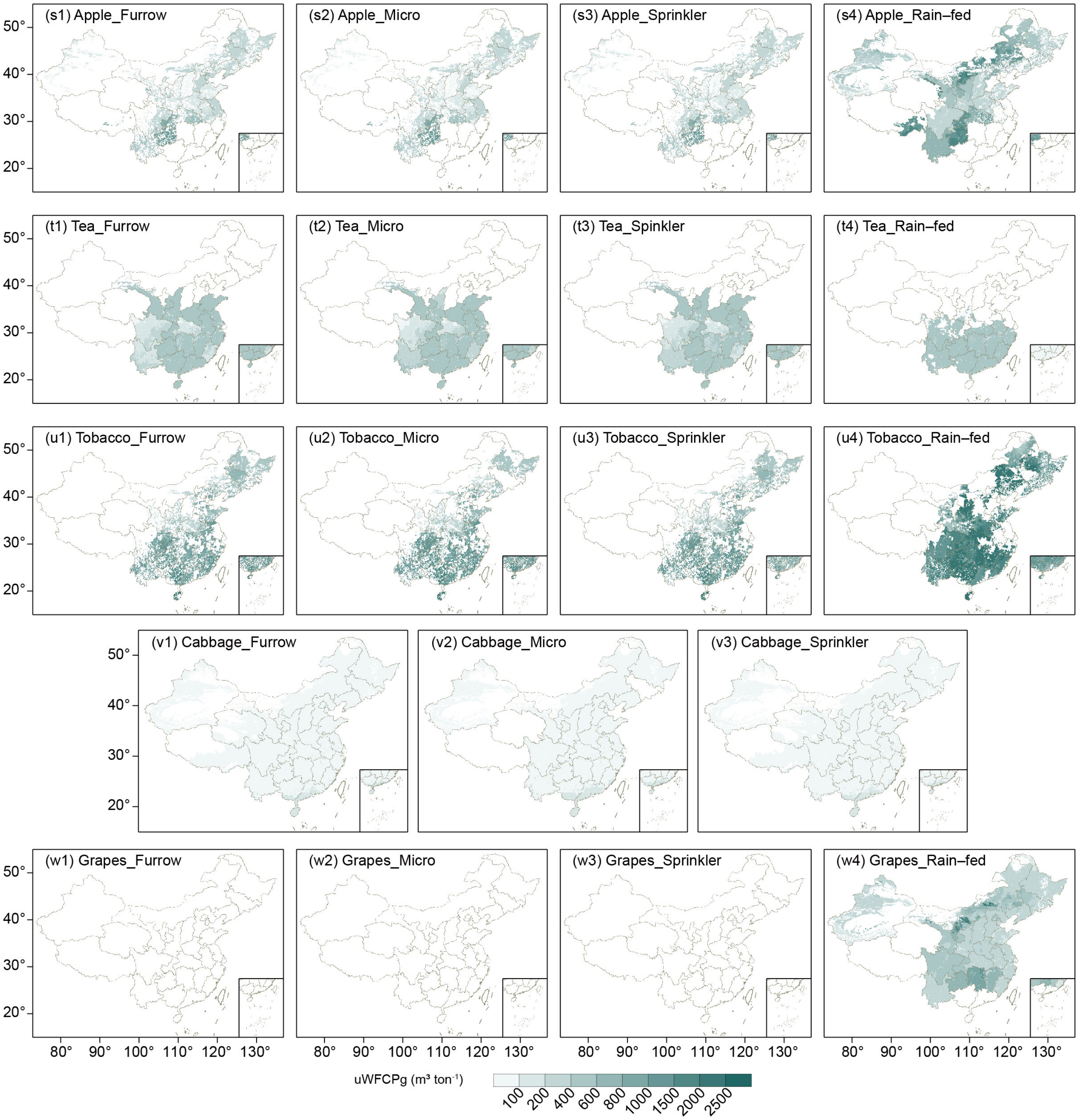
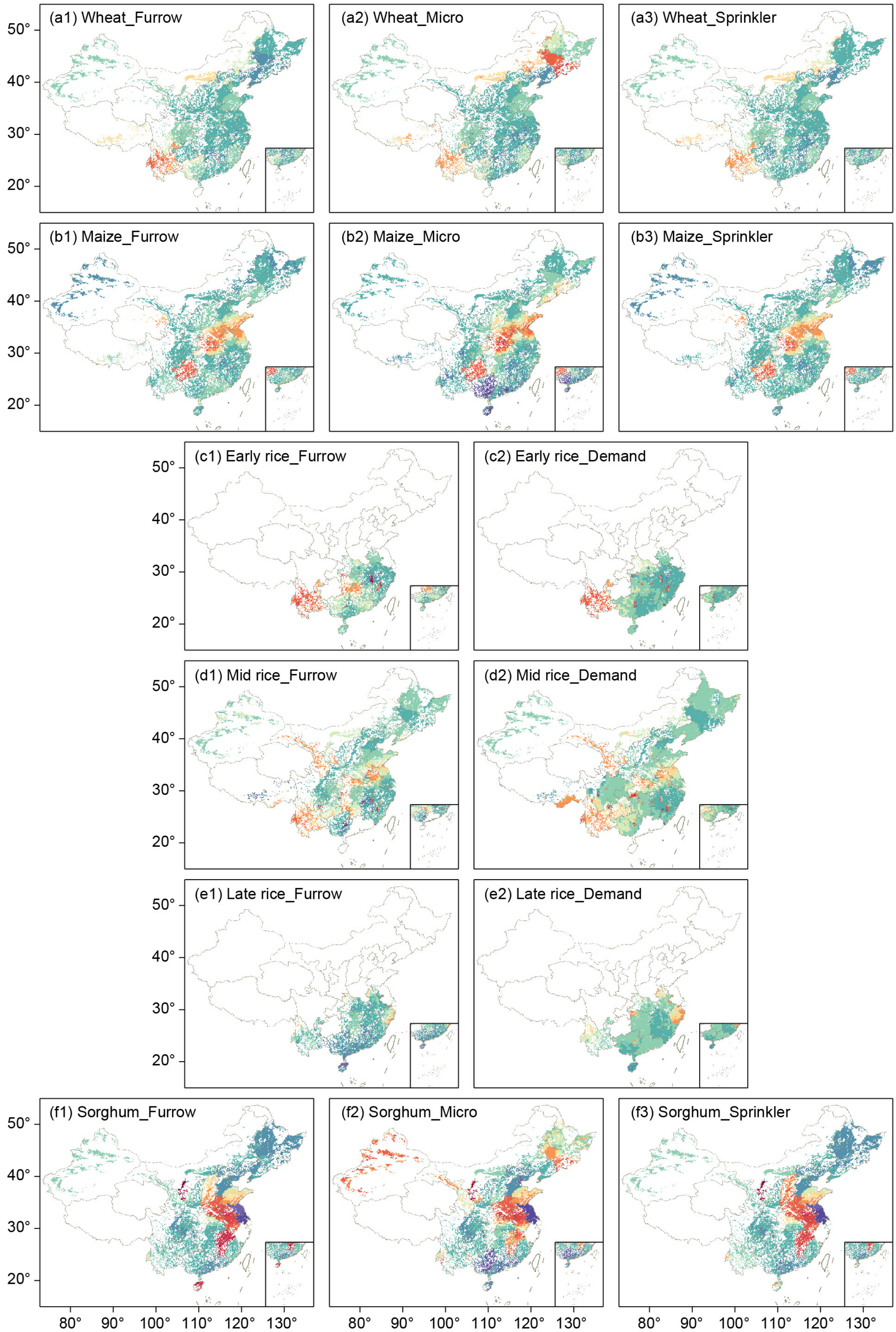


Fig. S23 Gridded uWFCPg (Annual average for 2010-2018).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(b3) Maize_Sprinkler
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(c2) Early rice_Demand
(d1) Mid rice_Furrow
(d2) Mid rice_Demand
(e1) Late rice_Furrow
(e2) Late rice_Demand
(f1) Sorghum_Furrow
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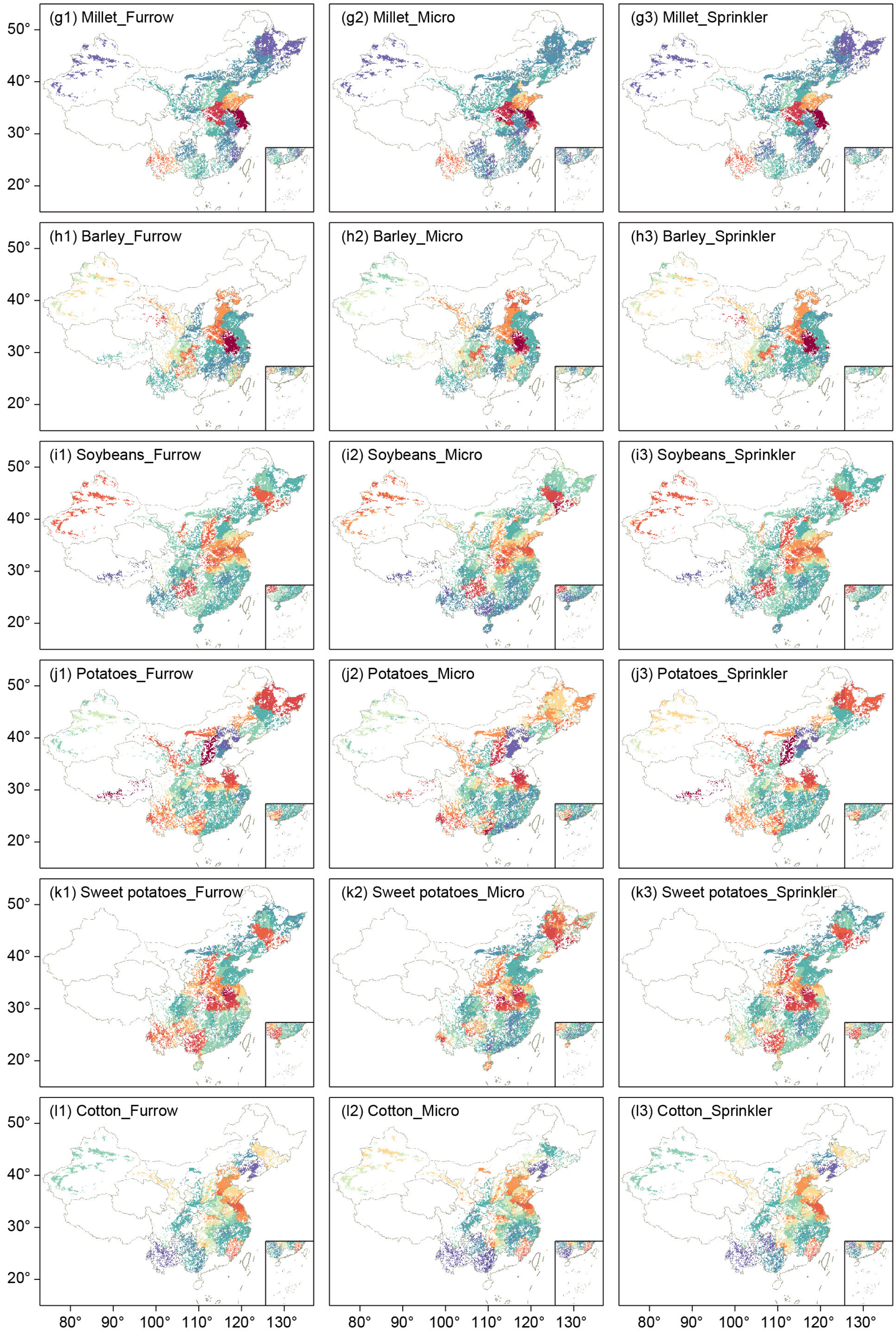

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(i2) Soybeans_Micro
(i3) Soybeans_Sprinkler
(j1) Potatoes_Furrow
(j2) Potatoes_Micro
(j3) Potatoes_Sprinkler
(k1) Sweet potatoes_Furrow
(k2) Sweet potatoes_Micro
(k3) Sweet potatoes_Sprinkler
(l1) Cotton_Furrow
(l2) Cotton_Micro
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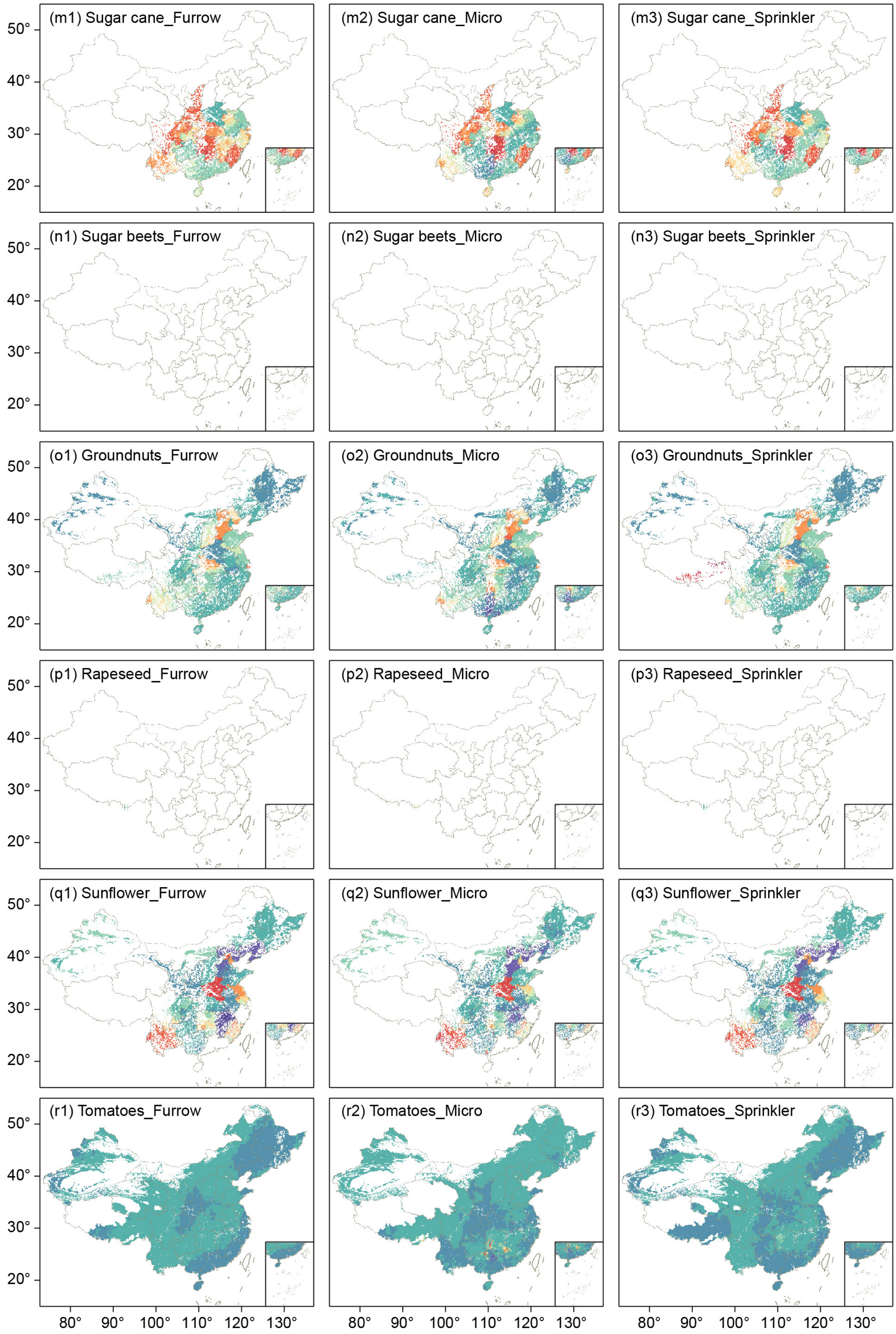
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(m2) Sugar cane_Micro
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(n3) Sugar beets_Sprinkler
(o1) Groundnuts_Furrow
(o2) Groundnuts_Micro
(o3) Groundnuts_Sprinkler
(p1) Rapeseed_Furrow
(p2) Rapeseed_Micro
(p3) Rapeseed_Sprinkler
(q1) Sunflower_Furrow
(q2) Sunflower_Micro
(q3) Sunflower_Sprinkler
(r1) Tomatoes_Furrow
(r2) Tomatoes_Micro
(r3) Tomatoes_Sprinkler
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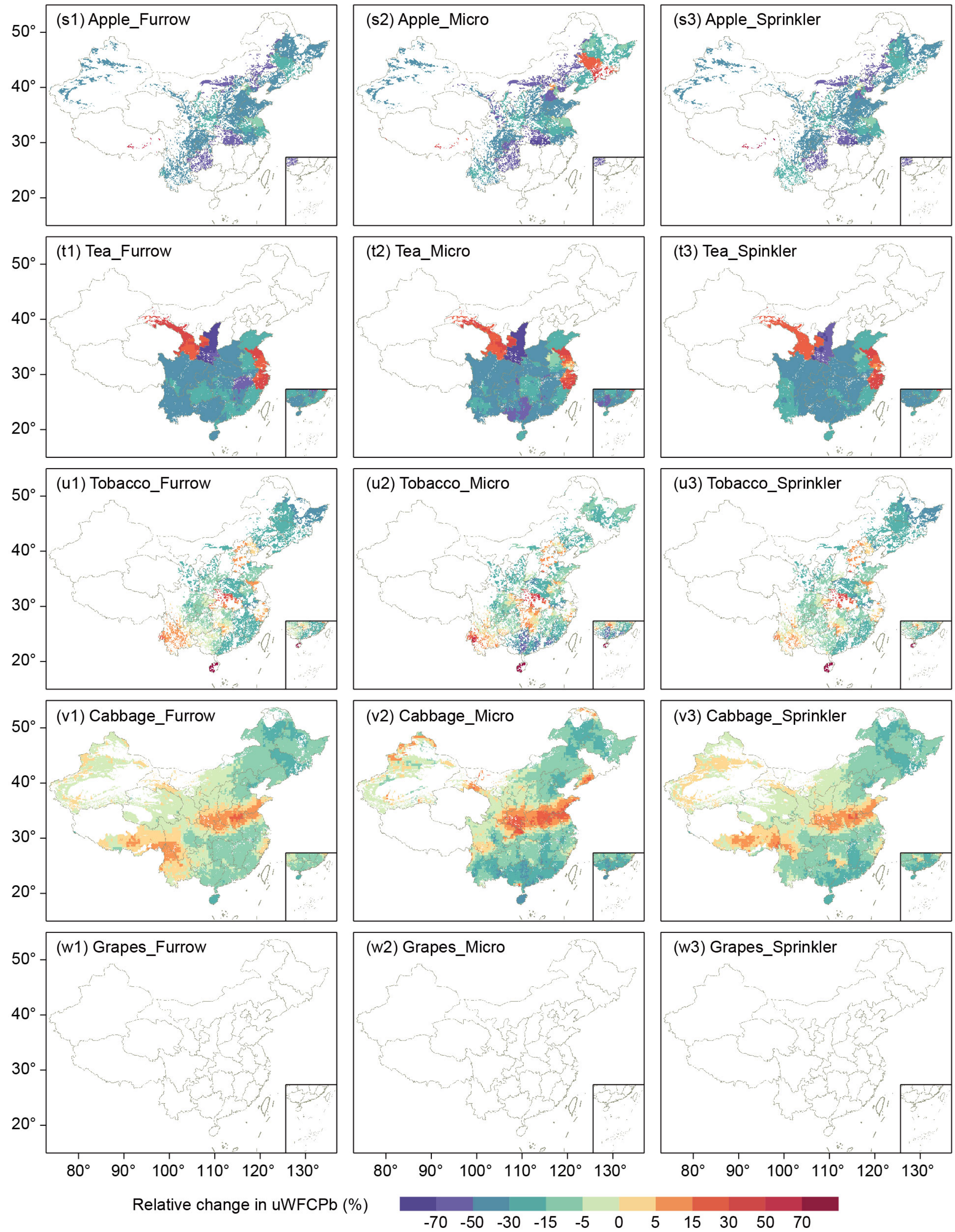
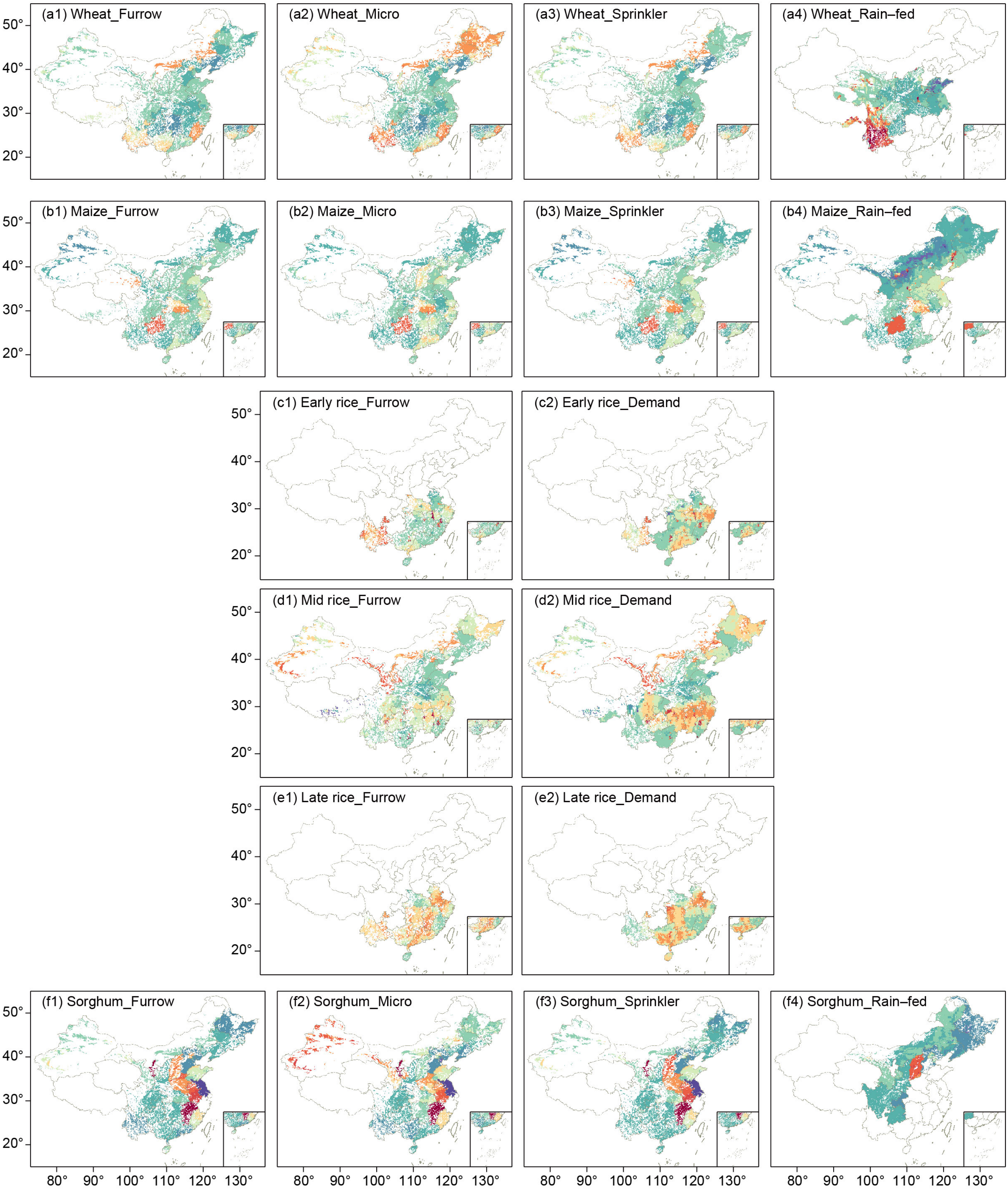


Fig. S24 Relative changes of the average gridded uWFCPb under different water supply and irrigation practices for 2000-2009 to that for 2010-2018.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(b1) Maize_Furrow
(b2) Maize_Micro
(b3) Maize_Sprinkler
(b4) Maize_Rain–fed
(c1) Early rice_Furrow
(c2) Early rice_Demand
(d1) Mid rice_Furrow
(d2) Mid rice_Demand
(e1) Late rice_Furrow
(e2) Late rice_Demand
(f1) Sorghum_Furrow
(f2) Sorghum_Micro
(f3) Sorghum_Sprinkler
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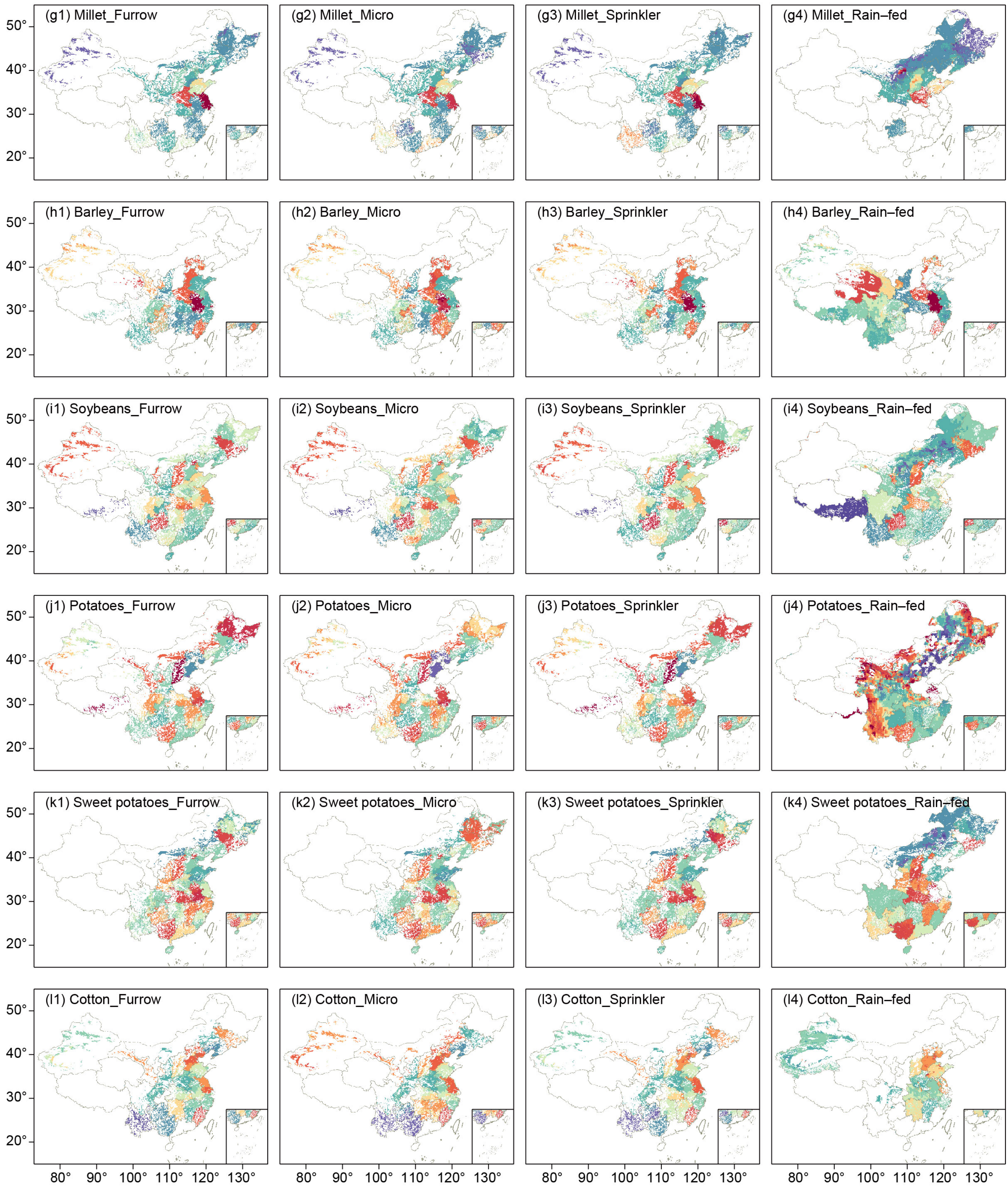

(g1) Millet_Furrow
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(g3) Millet_Sprinkler
(g4) Millet_Rain–fed
(h1) Barley_Furrow
(h2) Barley_Micro
(h3) Barley_Sprinkler
(h4) Barley_Rain–fed
(i1) Soybeans_Furrow
(i2) Soybeans_Micro
(i3) Soybeans_Sprinkler
(i4) Soybeans_Rain–fed
(j1) Potatoes_Furrow
(j2) Potatoes_Micro
(j3) Potatoes_Sprinkler
(j4) Potatoes_Rain–fed
(k1) Sweet potatoes_Furrow
(k2) Sweet potatoes_Micro
(k3) Sweet potatoes_Sprinkler
(k4) Sweet potatoes_Rain–fed
(l1) Cotton_Furrow
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(l3) Cotton_Sprinkler
(l4) Cotton_Rain–fed
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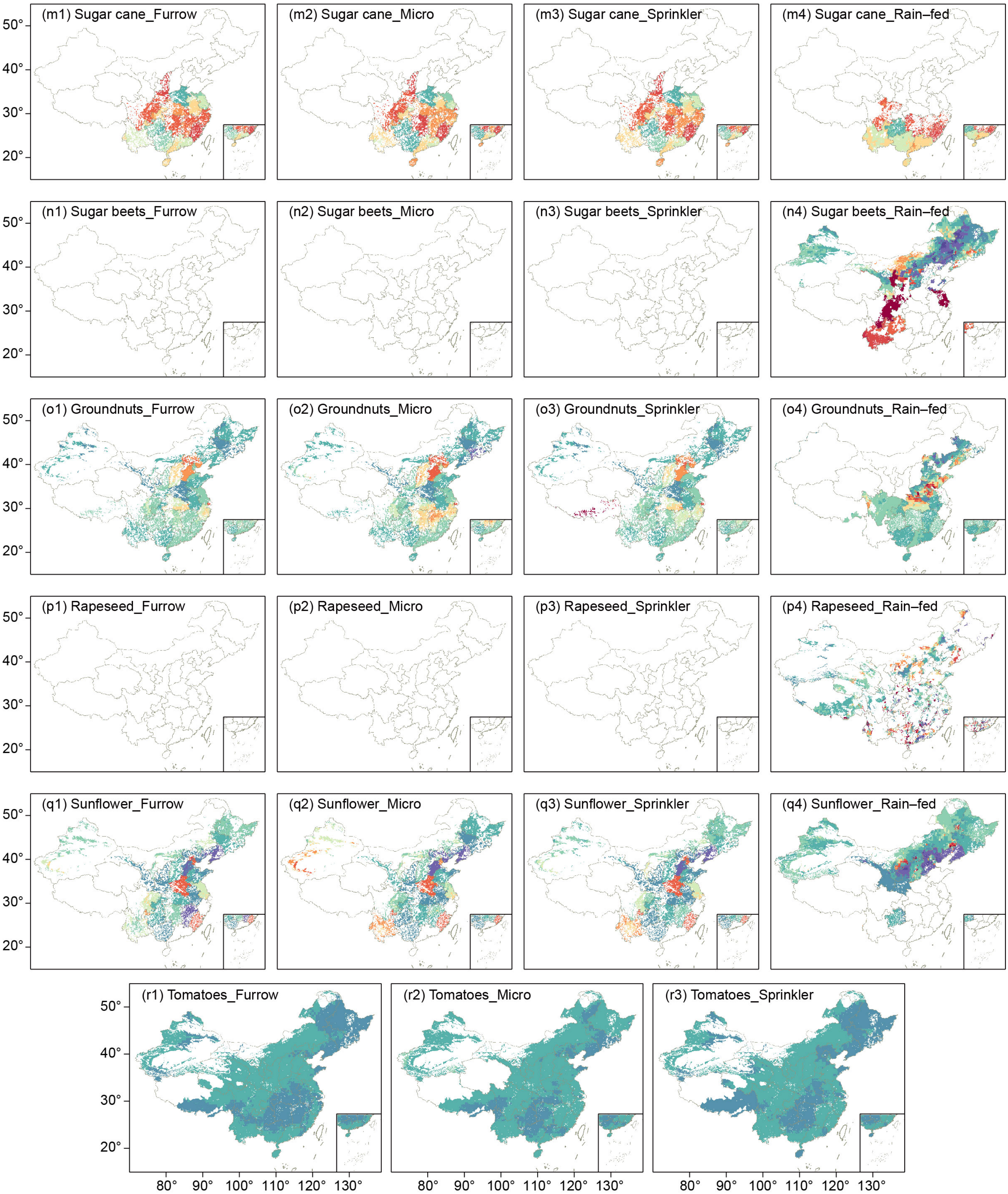
(m1) Sugar cane_Furrow
(m2) Sugar cane_Micro
(m3) Sugar cane_Sprinkler
(m4) Sugar cane_Rain–fed
(n1) Sugar beets_Furrow
(n2) Sugar beets_Micro
(n3) Sugar beets_Sprinkler
(n4) Sugar beets_Rain–fed
(o1) Groundnuts_Furrow
(o2) Groundnuts_Micro
(o3) Groundnuts_Sprinkler
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(p1) Rapeseed_Furrow
(p2) Rapeseed_Micro
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(q1) Sunflower_Furrow
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(r1) Tomatoes_Furrow
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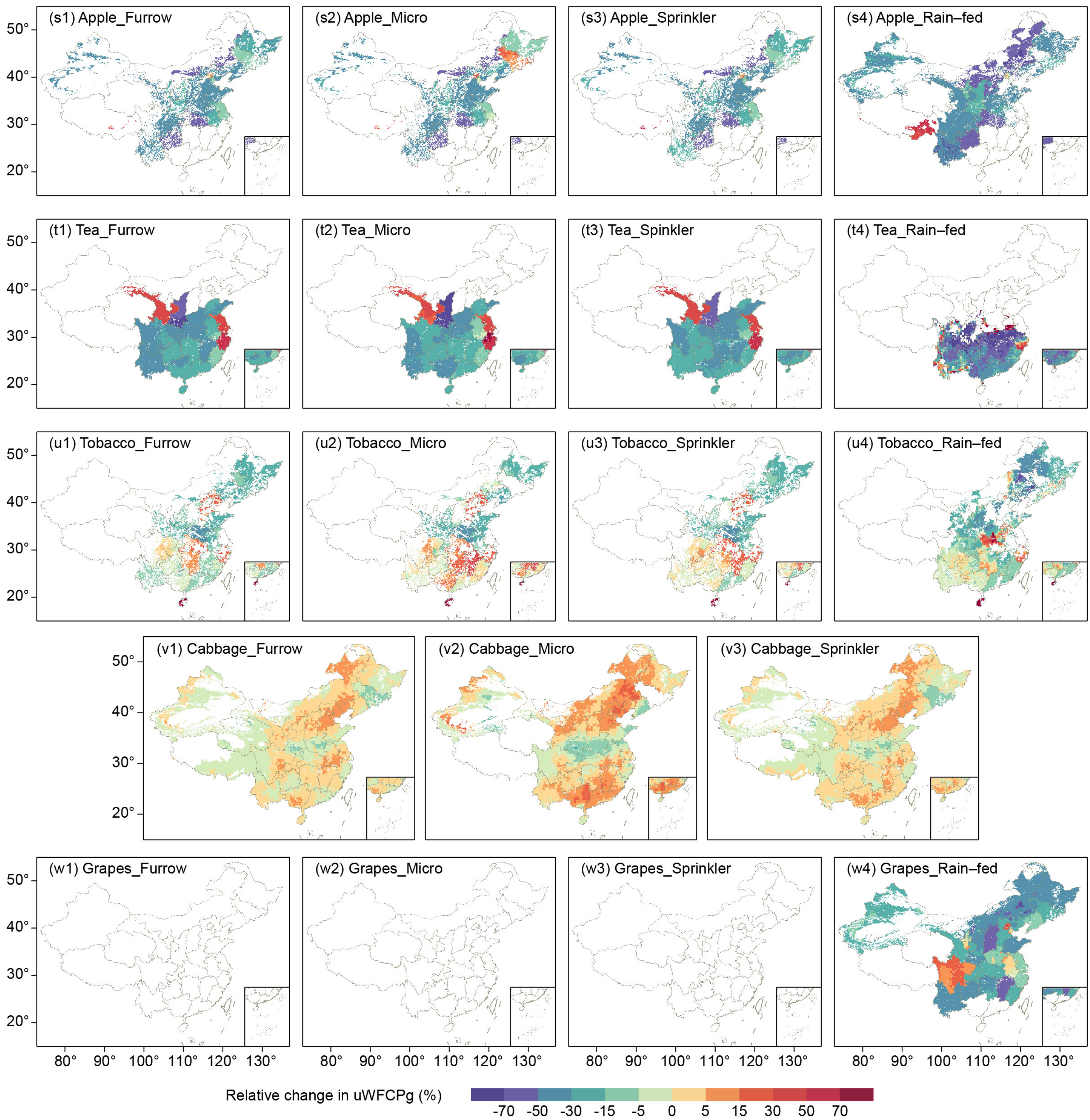

Fig. S25 Relative changes of the average gridded uWFCPg under different water supply and irrigation practices for 2000-2009 to that for 2010-2018.

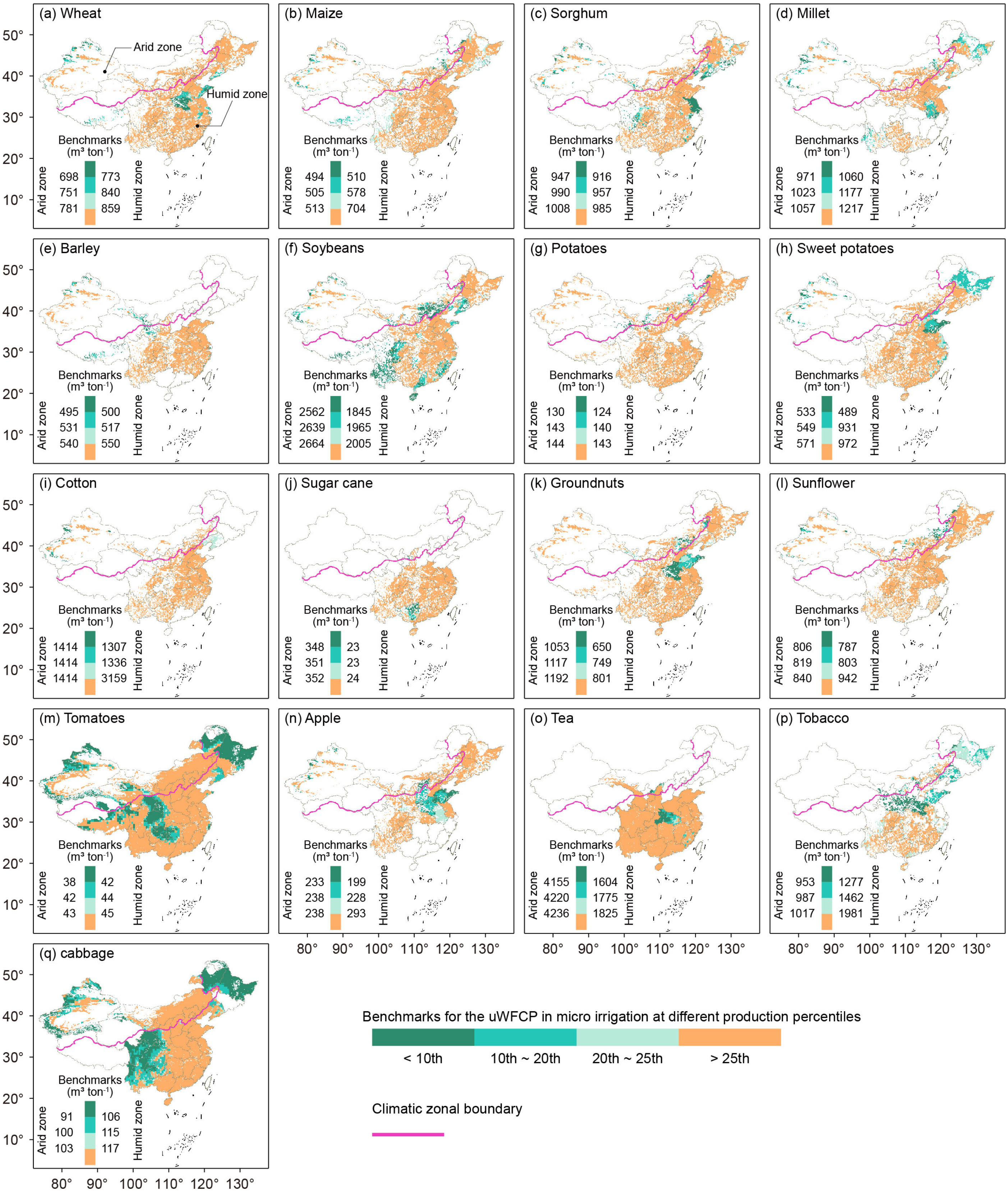

Fig. S26 Benchmarks for the uWFCP at different production percentiles under micro irrigation in China by 2018.

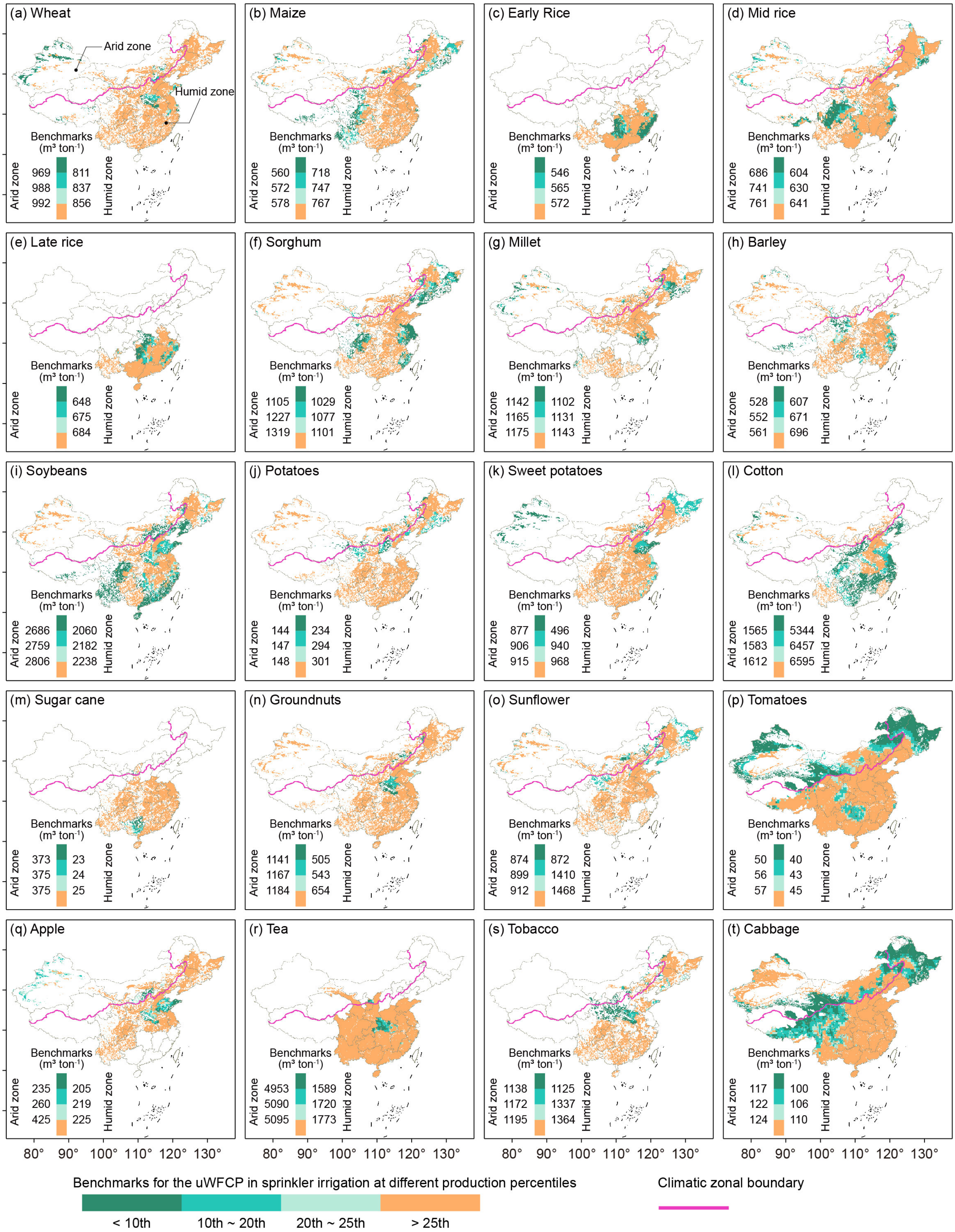

Fig. S27 Benchmarks for the uWFCP at different production percentiles under sprinkler irrigation in China by 2018.

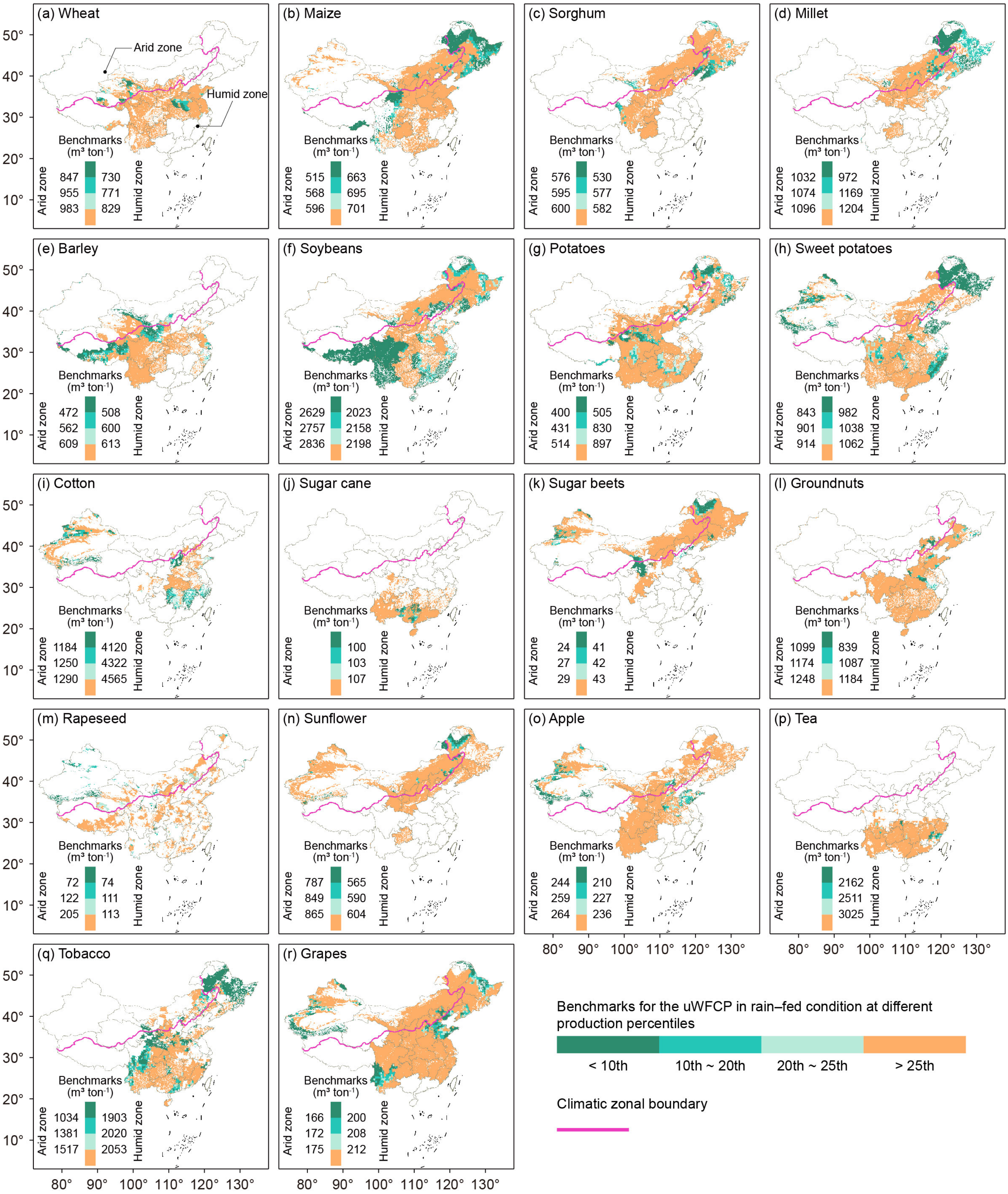

Fig. S28 Benchmarks for the uWFCP at different production percentiles under rain–fed conditions in China by 2018.

Supplementary data and methods

Planting area selection

Prior to initiating this study, we screened the required crop planting area data based on the following criteria: distinguishing crop types, separating irrigated and rainfed areas, long-term temporal resolution, and high spatial resolution. MIRCA2000 was selected because it meets the objectives of this study. This is also the reason that the MIRCA2000 dataset is still the most widely used for crop water consumption or requirement dataset making (e.g., Hoch et al., 2023; Li et al., 2023; Ruess et al., 2022; Lutz et al., 2022; Liu et al., 2022; Chiarelli et al., 2022; Chiarelli et al., 2020; Rosa et al., 2020). In order to improving the reliability of the input land use data, the proportional scaling approach based on the MIRCA2000 dataset have been applied in numerous studies in this field (Sloat et al., 2020; Yue et al., 2022; Mialyk et al., 2022; Wang et al., 2019).

Table S2 presents the crop planting area and irrigated area data products. Recent years have witnessed the emergence of numerous long-term and high-resolution irrigation area datasets for China, thanks to the combined application of remote sensing technology and machine learning approaches. However, these datasets do not differentiate between irrigated and rainfed cropping systems, and do not contain crop-specific planting information. These deficiencies fail to fulfill the original intentions of this study design.

Table S2. Inventory of irrigated cropland data.

Source	Spatial coverage	Temporal resolution	Spatial resolution	Crop type distinction	Planting pattern
Zhang et al., 2022	China	2000-2019	500 m	No	Only irrigated croplands
Zhang et al., 2022	China	2000	250 m	No	Only irrigated croplands
Zhu et al., 2014	China	2000	5 arcmin	No	Only irrigated croplands
GFSAD1KCD	Globe	2007-2012	1000 m	6 crops	Irrigated and rainfed croplands
GAEZ+ (Grogan et al., 2022)	Globe	2015	5 arcmin	26 crops	Irrigated and rainfed croplands
SPAM (IFPRI 2019)	Globe	2000, 2005, 2010	5 arcmin	42 crops	Irrigated and rainfed croplands
MIRCA2000 (Portmann et al., 2010)	Globe	2000	5 arcmin	26 crops	Irrigated and rainfed croplands

Global scale data compensates the aforementioned deficiencies to some extent. However, it is worth mentioning that existing global databases have certain limitations, including a limited range of crop types and intermittent time series. For instance, the SPAM dataset is only publicly available for a few specific years 2000, 2005 and 2010, and interpolation is still required to fill in the gaps. The GFSAD1KCD dataset encompasses a smaller variety of crop types.

We compared our 5 arcmin resolution of major crop areas, as calculated by the proportional invariant method, with the GAEZ+ and SPAM data products in the same year. The comparison results are shown in the figures below (Fig. S29–S32).

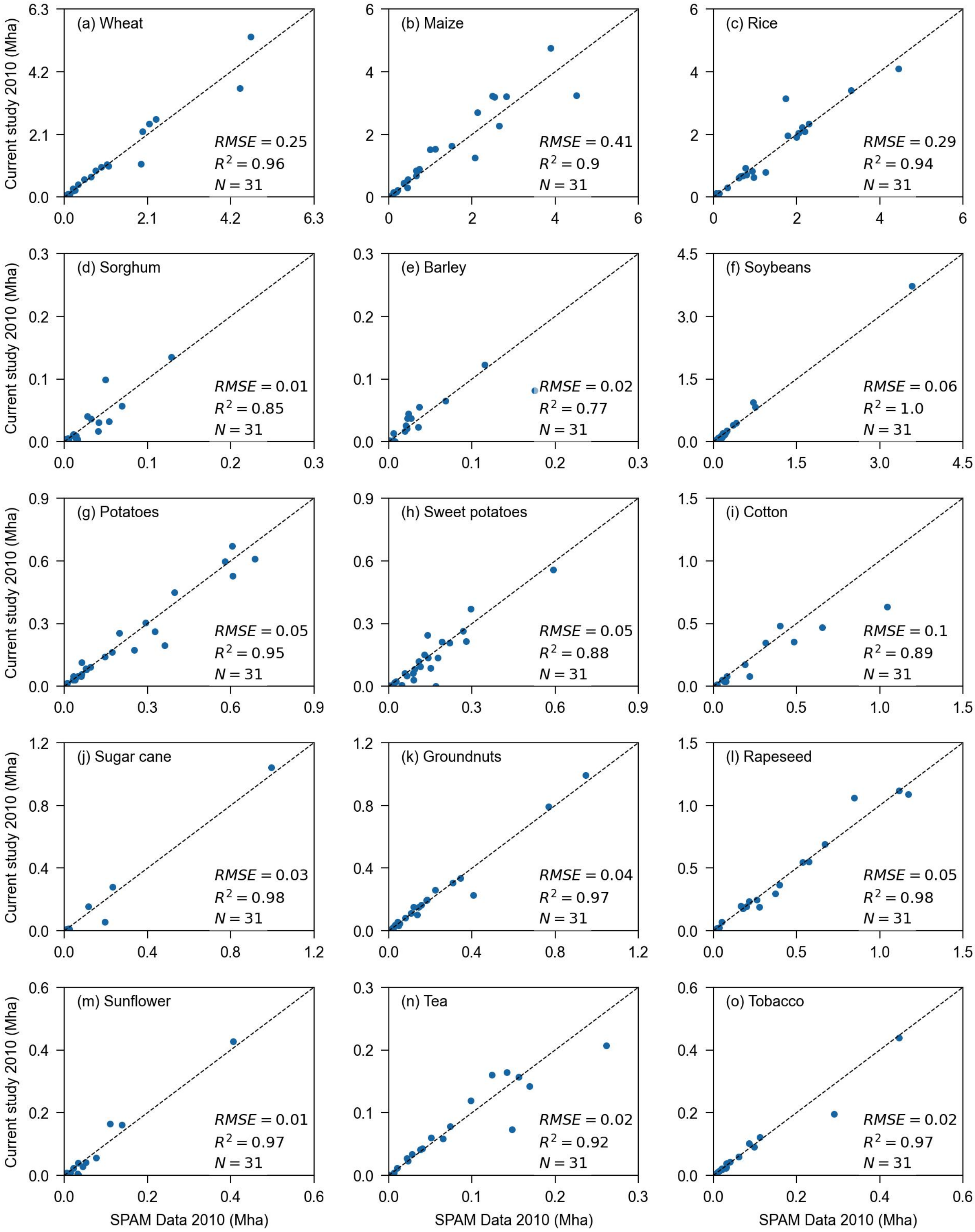

Fig. S29 Comparison of the current provincial area representing land coverage with the SPAM datasets.

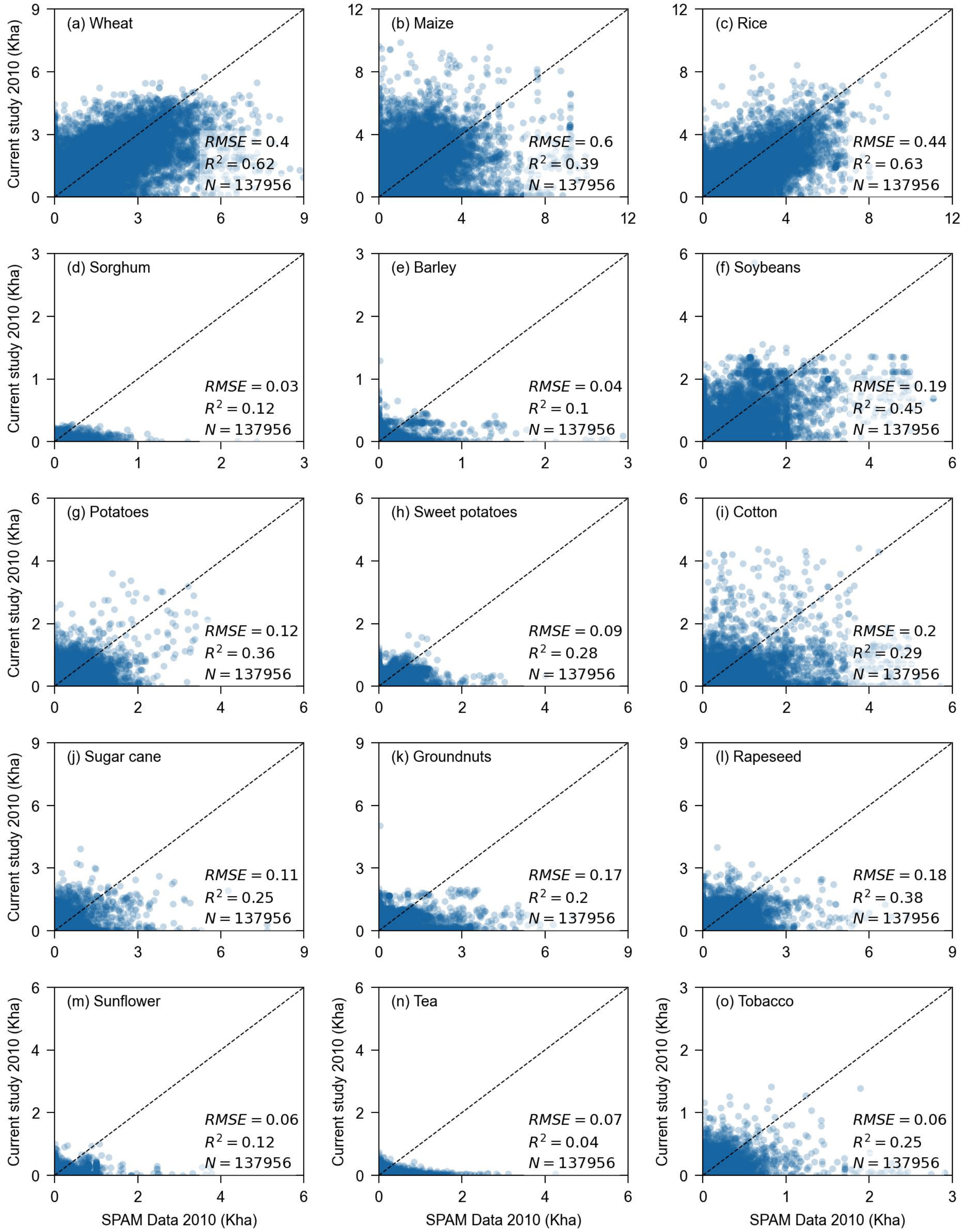

Fig. S30 Comparison of the current gridded area representing land coverage with the SPAM datasets.

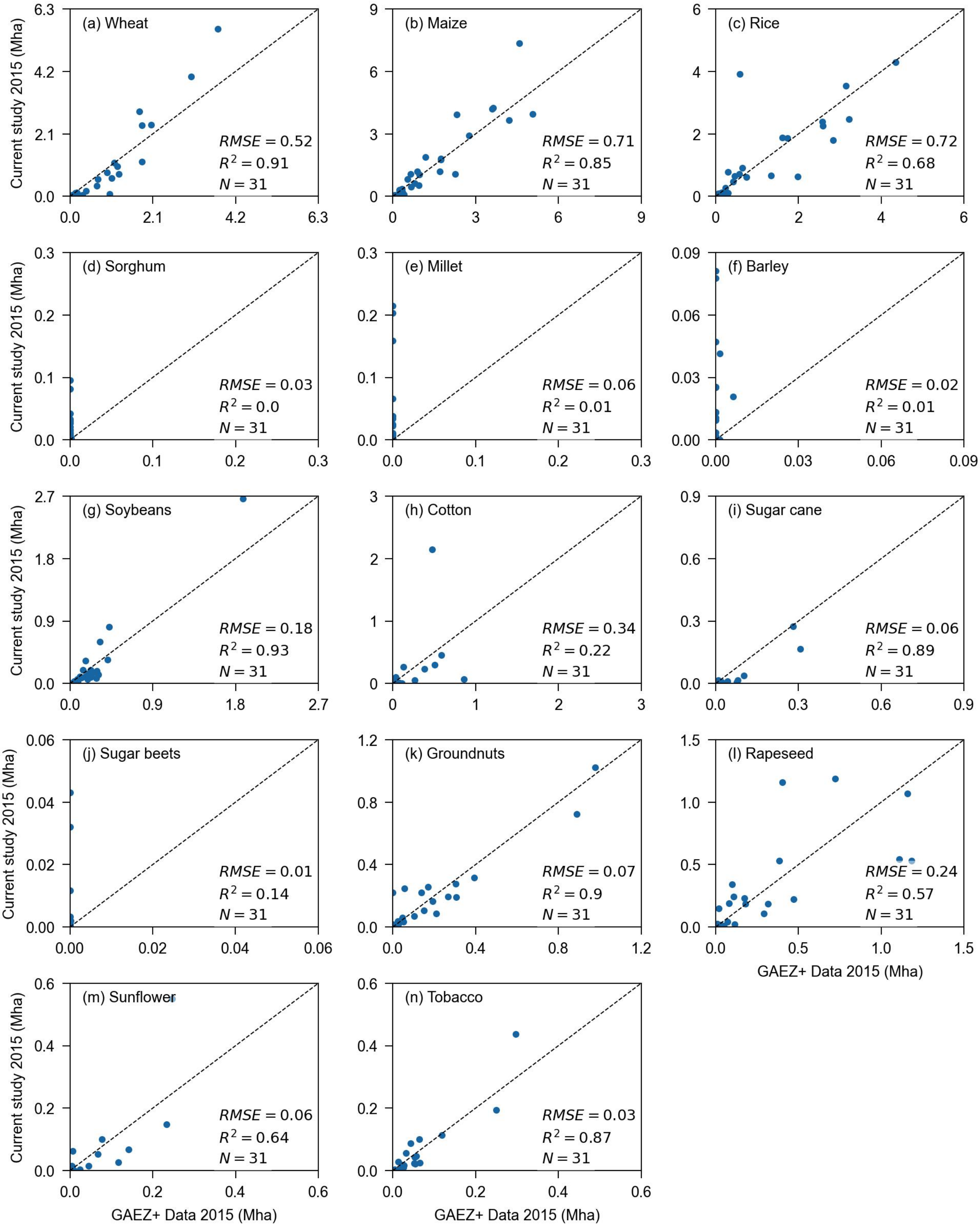

Fig. S31 Comparison of the current provincial area representing land coverage with the GAEZ+ datasets.

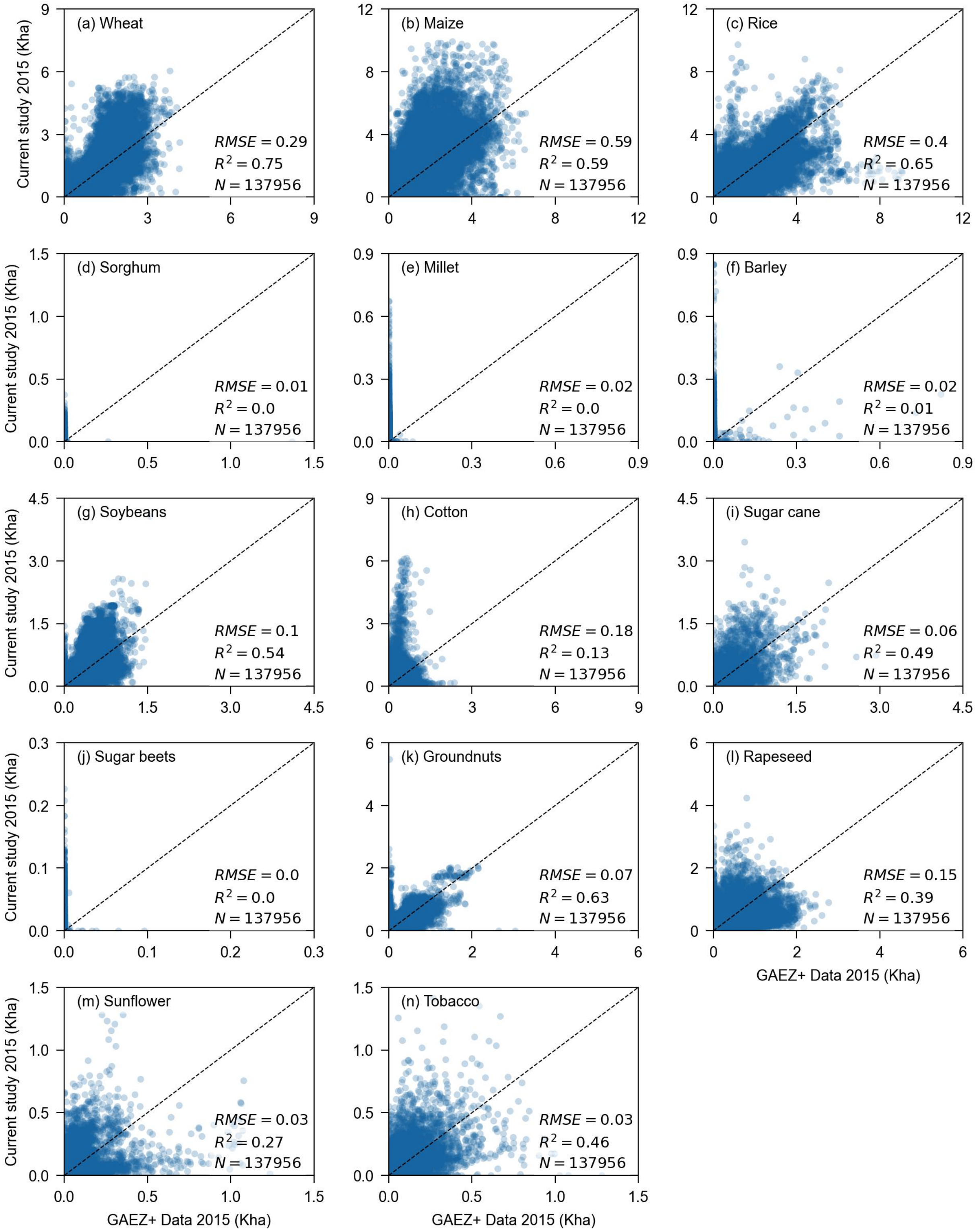

Fig. S32 Comparison of the current gridded area representing land coverage with the GAEZ+ datasets.

Validation results

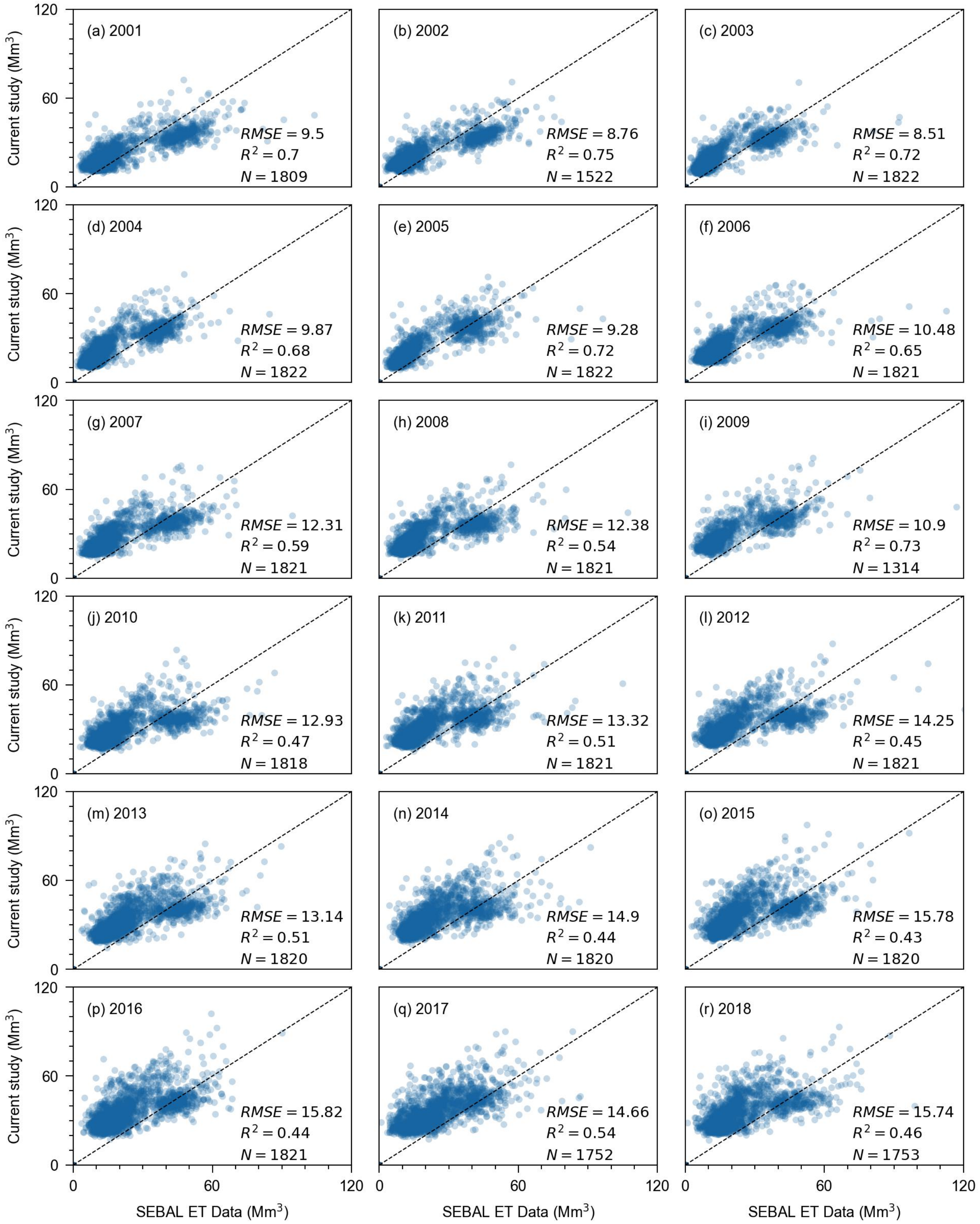

Figure S33. Validation of the evapotranspiration at croplands for the period April to August with SEBAL datasets (Cheng et al., 2021).

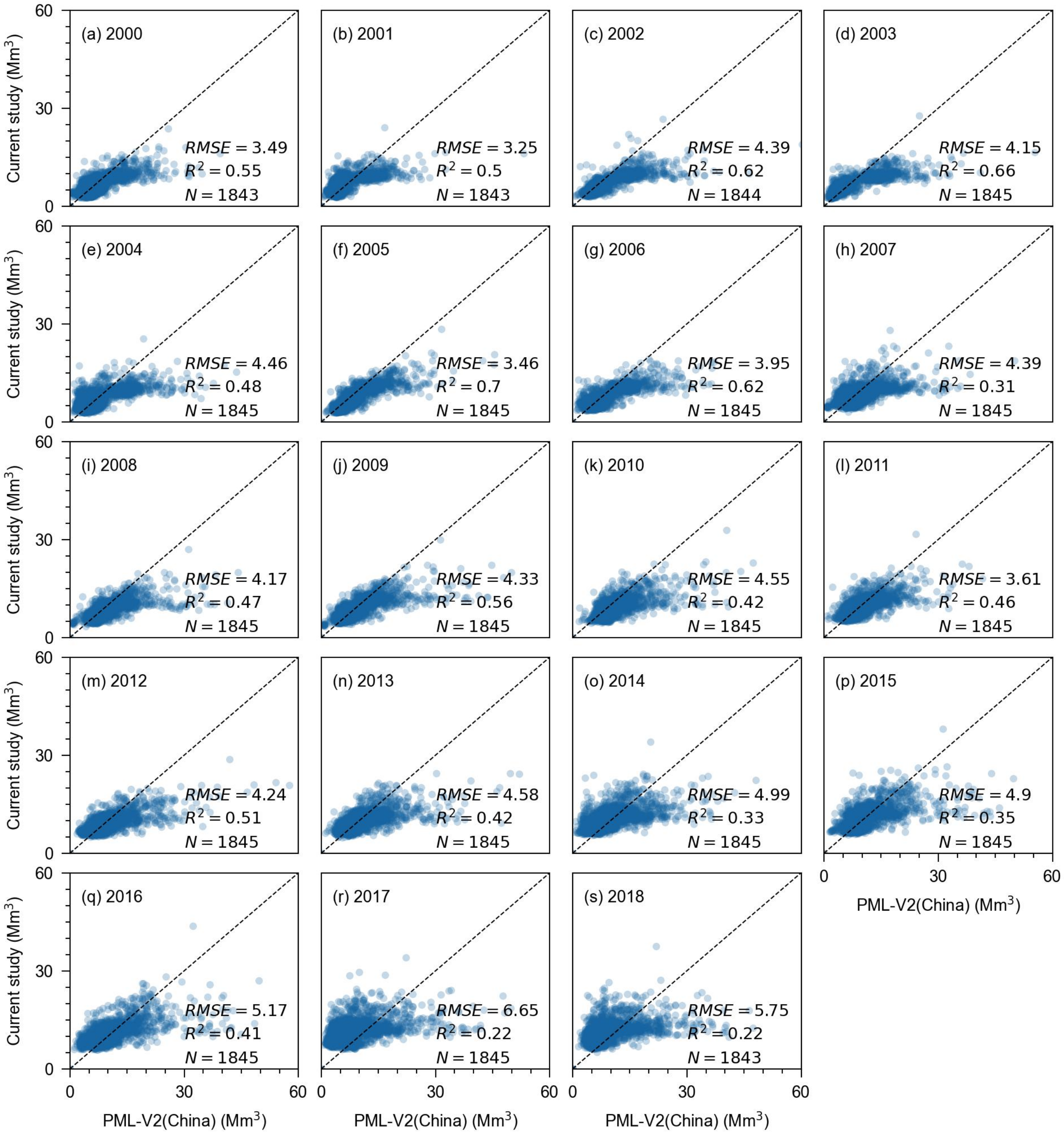

Figure S34. Validation of the evaporation at croplands for the period April to August with PML-V2(China) datasets (He et al., 2022).

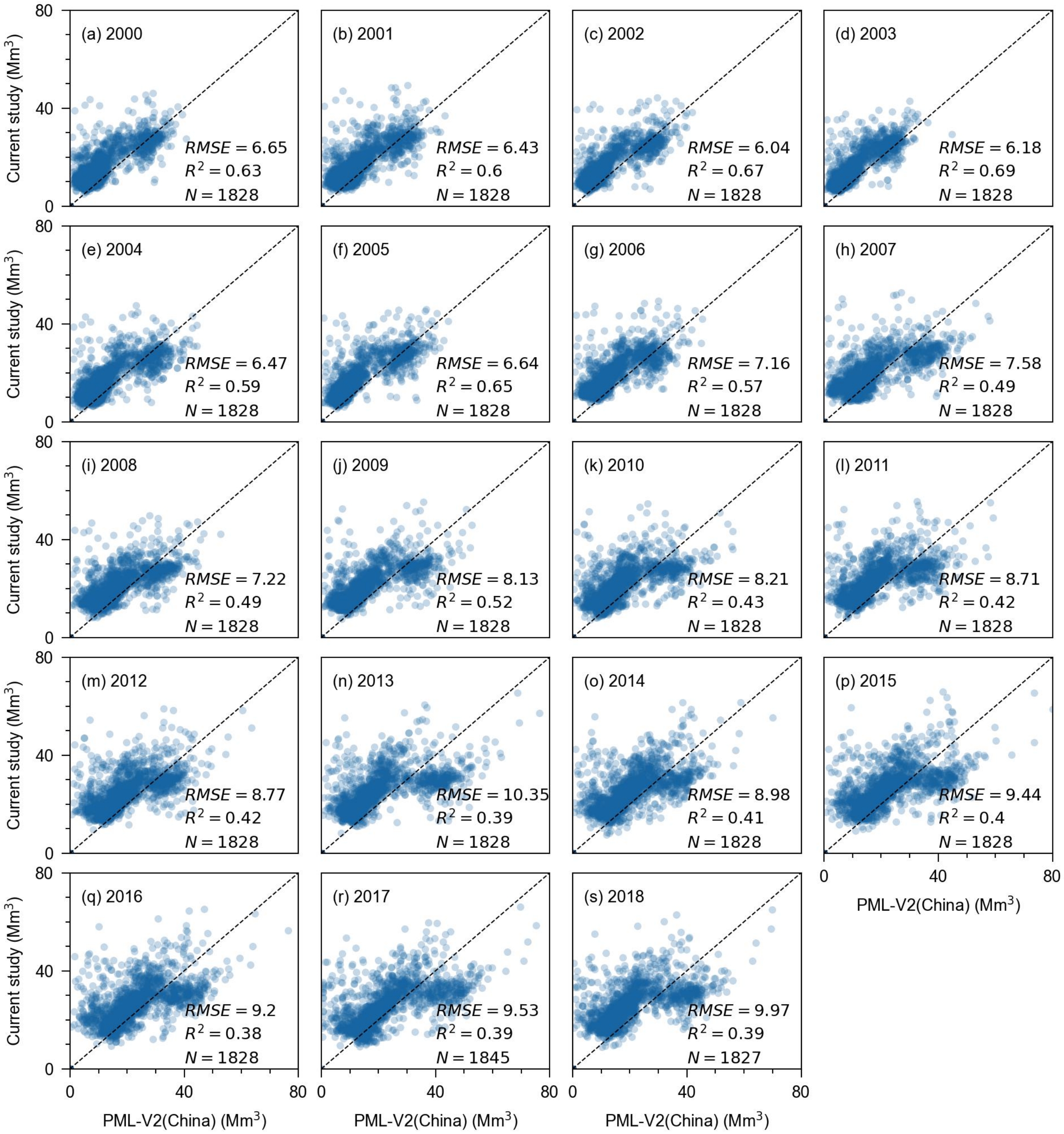

Figure S35. Validation of the transpiration at croplands for the period April to August with PML-V2(China) datasets (He et al., 2022).

Phenology selection

There are some phenology datasets for major Chinese crops. The dataset generated by Luo et al. (2020), which only encompasses three major crops wheat, rice and maize. As indicated on the website of China Meteorological Data Service Center, the "Ten-day Values Dataset of Crop Growth and Development and Soil Moisture Content" they published has not gone through quality control and is of average quality. According to the regional classification results (Table S3), we mainly used phenology data published by Chen et al. (1995) for model input since it is widely used and its reliability is validated (Long et al., 2010; Cao et al., 2014; Ding et al., 2020).

Table S3. Regional classification.

Region	Provinces	Regional classification
North	Beijing, Tianjin, Shanxi	Temperate
Northeast	Inner Mongolia, Liaoning, Jilin, Heilongjiang	Continental temperate and temperate
Huang-huai-hai	Hebei, Henan, Shandong, Anhui	Temperate
Northwest	Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang	Continental temperate and plateau and Mountain
Southeast	Shanghai, Zhejiang, Fujian	Sub-tropics
East	Jiangsu, Hubei, Hunan, Jiangxi	Sub-tropics
South	Guangdong, Guangxi, Hainan	Sub-tropics and tropics
Southwest	Chongqing, Sichuan, Guizhou, Yunan, Tibet	Sub-tropics

In discussion section, we indicated that "The effect of planting date (PD) differed for each crop, and advancing or delaying it exposed crops to completely different rain and heat conditions …. in future research, attention to the collection and organisation of basic data can play a positive role in the improvement of the model mechanism and accuracy of the output." As shown in Table S4, our previous study conducted a sensitivity analysis of WFCP to PD at the site scale. The results indicated that when PD shifts ±10 days, the change in WFCP remains within 4%. With PD shifts of ±20 days, the variation in WFCP is under 8.5%.

Table S4. Sensitivity analysis of water footprint of crop production to planting date.

Crop	-20 days	-15 days	-10 days	-5 days	+5 days	+10 days	+15 days	+20 days
Wheat (297 sites)	-5.9%	-4.5%	-3.0%	-1.4%	2.0%	3.9%	5.6%	7.5%
Maize (304 sites)	-0.4%	0.0%	0.2%	0.3%	0.2%	-0.1%	-0.6%	-1.5%
Rice (480 sites)	0.4%	0.5%	0.5%	0.4%	-0.5%	-1.1%	-2.3%	-3.6%
Soybean (299 sites)	6.3%	5.0%	3.5%	1.8%	-1.9%	-4.0%	-6.2%	-8.5%

Note: "-" means advance planting date. "+" means delay planting date. Sources: Li et al., (2022).

In short, PD's effect on WFCP estimation is acceptable since crop water consumption is primarily concentrated in crop development (L2) and mid-season (L3) stages. In this study for instance, with over 13 crops having L2 and L3 water consumption proportions exceeding 80% (Fig. S36). Therefore, minor shifts in PD forward or backward have relatively small influences on WFCP.

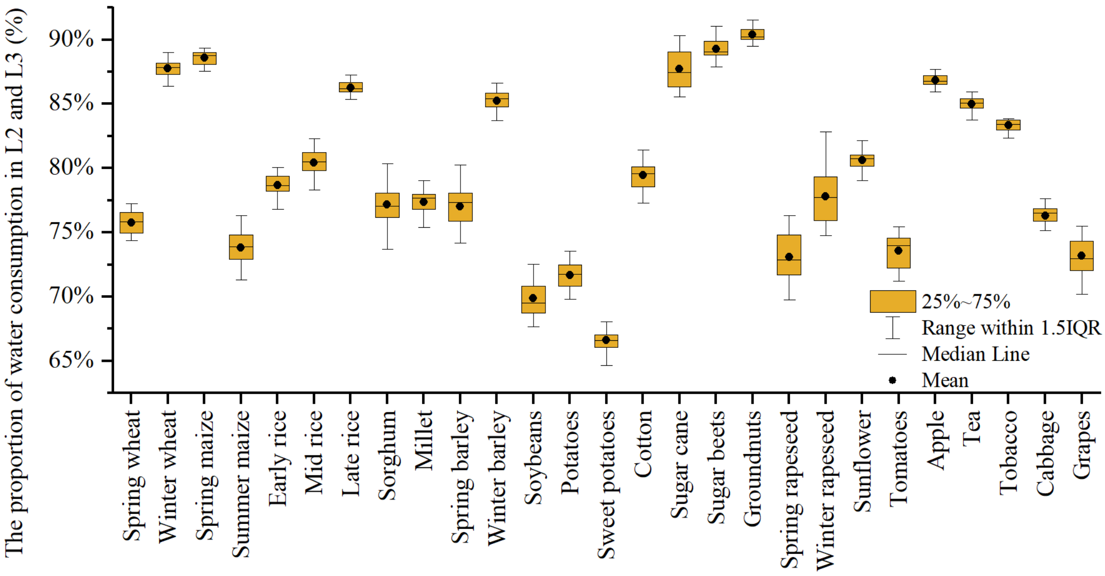

Fig. S36 The proportions of crop water consumption in stages L2 and L3 for various crops.

In addition to considering fixed planting dates and crop duration, we conducted a sensitivity analysis of the effect of growing degree days (GDD) on the quantification of WFCP (Zhuo et al., 2014). The GDD measures heat units during crop growth, greatly improves the accuracy of expressing and predicting crop phenological cycles compared to other methods like calendar year or days (McMaster and Wilhelm, 1997). The results indicated that when wheat PD was shifted 30 days earlier than the reference date, yield and WFCP decreased by 0.25% and 0.3% respectively. When rice planting was delayed by 30 days, yield and WFCP reduced by 0.2% and 9.3% respectively. Therefore, under constant GDD, yield and WFCP showed low sensitivity to changes in crop PD.

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