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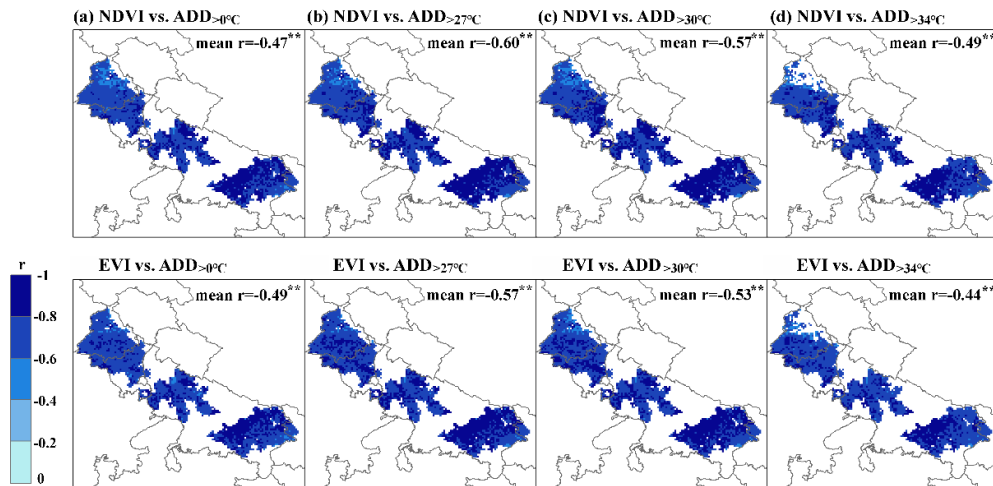


Figure S1. Pearson correlation coefficients (r) between the mean NDVI/EVI and ADD over (a) 0°C , (b) 27°C , (c) 30°C , and (d) 34°C in March–April. Colored pixels are statistically significant ($p < 0.05$). The mean r is the average of the correlation coefficients at the district scale and stars indicate statistical significance (**: $p < 0.05$).

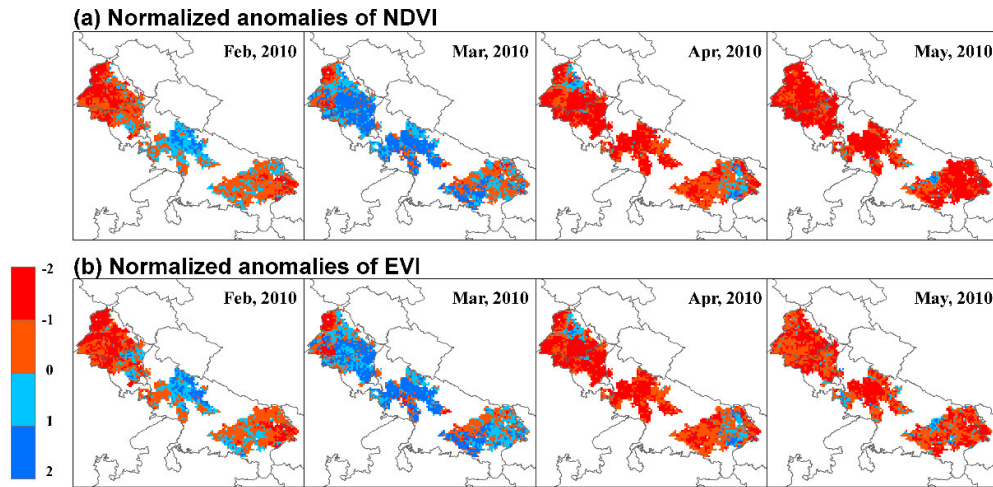


Figure S2. Spatial distribution of normalized anomalies of (a) NDVI and (b) EVI from February to May in 2010.

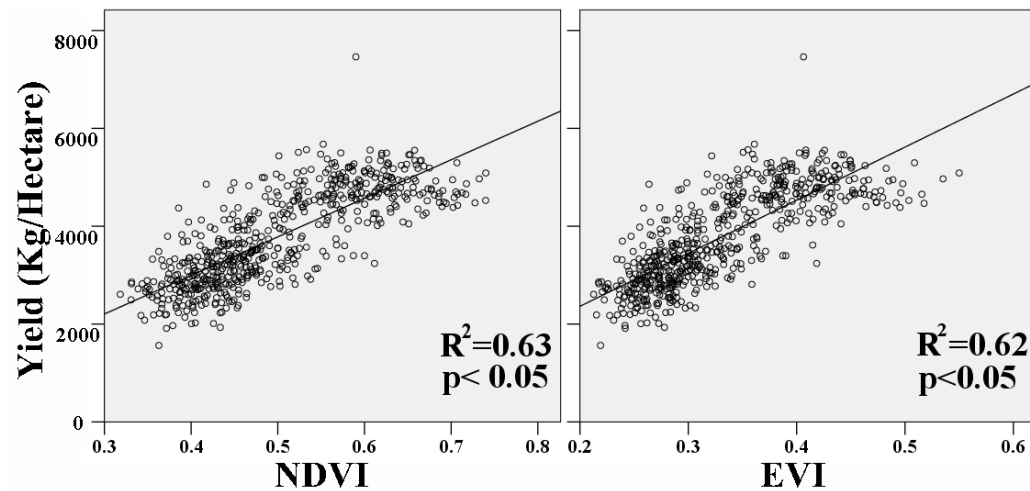


Figure S3. The relationships between the yield and NDVI/EVI at the district scale, each dot represents the statistical yield and mean NDVI or EVI in March-April from 2008–2014 and 2016–2018, for each district and one year.

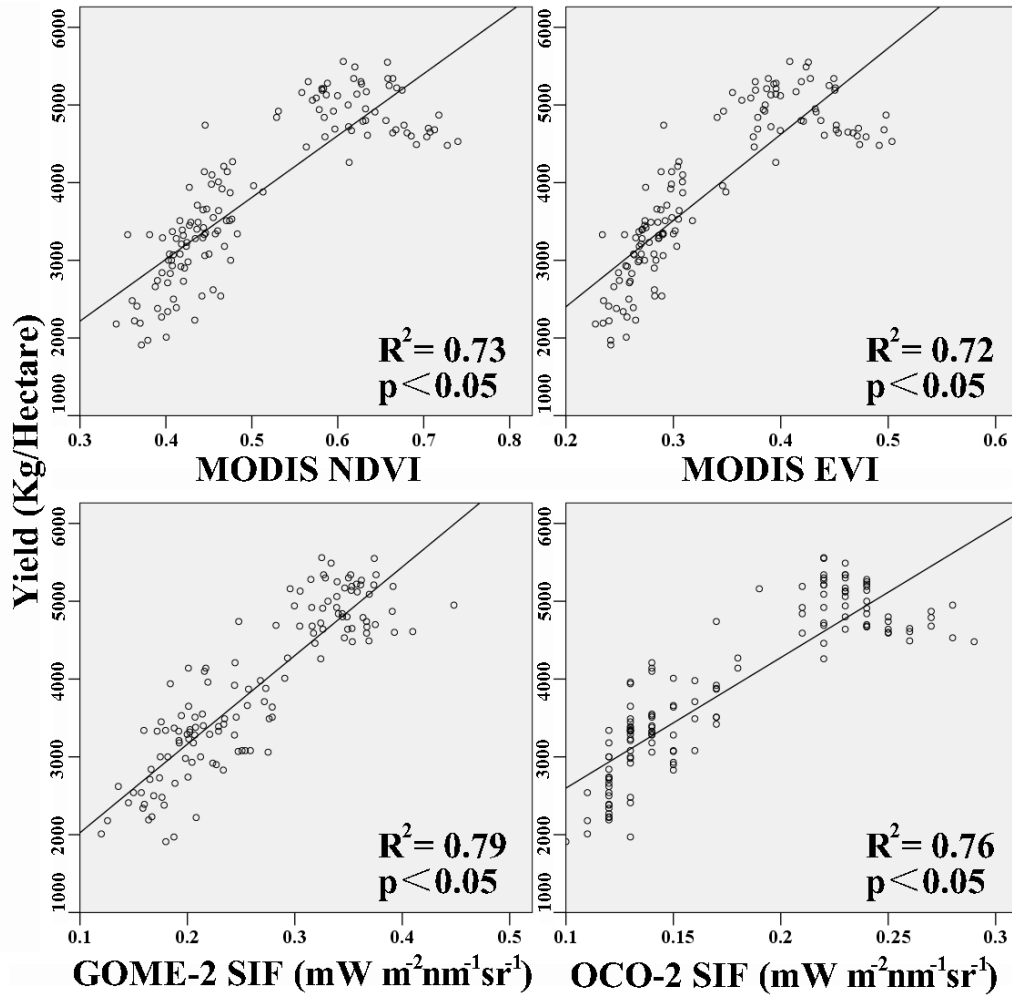


Figure S4. The relationships between the yield and NDVI/EVI/GOME-2 SIF/OCO-2 SIF at the district scale, each dot represents the statistical yield and mean NDVI or EVI in March–April from 2016 to 2018, for each district and one year.

Table S1. The district-level statistical yield (Kg/Hectare).

District	2016	2017	2018	District	2016	2017	2018	District	2016	2017	2018
Aligarh	3280	3980	-	Firozpur	4590	5210	5220	Mewat	-	-	-
Allahabad	1910	3000	-	Ghazipur	2390	3210	-	Moga	4600	5280	5190
Ambala	-	-	-	Gopalganj	2270	3400	-	Moradabad	3080	3510	-
Ambedkar Nagar	3180	3550	-	Gorakhpur	2230	3650	-	Muktsar	4640	5130	5250
Amethi	2380	3060	-	Gurdaspur	4650	4610	4740	Palwal	-	-	-
Amritsar	4480	4950	4870	Hardoi	3000	3640	-	Panipat	-	-	-
Azamgarh	2730	3350	-	Hisar	-	-	-	Patiala	4590	5160	5270
Baghpat	4140	4740	-	Jalandhar	4460	4840	5060	Pratapgarh	2190	3080	-
Ballia	2710	3940	-	Jaunpur	2660	3230	-	Rae Bareli	1970	3280	-
Bareilly	2930	3660	-	Jhajjar	-	-	-	Rampur	3420	3920	-
Barnala	4910	5490	5340	Jind	-	-	-	Rohtak	-	-	-
Basti	2620	3180	-	Kaithal	-	-	-	Sambhal	3070	3490	-
Bathinda	4680	5300	5300	Kapurthala	4260	4920	4840	Sangrur	4800	5560	5550
Budaun	2830	3510	-	Karnal	-	-	-	Sant Kabir Nagar	2540	3380	-
Bulandshahr	3870	4270	-	Kasganj	3080	3710	-	Sant Ravi Das Nagar	2220	3320	-
Deoria	2540	3340	-	Kaushambi	2180	3290	-	ShahidBhagatSinghNagar	4720	4920	5000
Etah	2900	3880	-	Kurukshetra	-	-	-	Shahjahanpur	3510	4210	-
Etawah	3330	4140	-	Kushinagar	2340	2980	-	Siddharth Nagar	3340	3960	-
Faizabad	2740	3290	-	Ludhiana	4670	5090	5140	Sirsa	-	-	-
Faridkot	4700	5210	5340	Maharajganj	3000	3530	-	Siwan	2010	2920	-
Fatehabad	-	-	-	Mainpuri	3330	4010	-	Sonipat	-	-	-
Fatehgarh Sahib	4690	5190	5340	Mansa	4640	5120	5170	Sultanpur	2840	3390	-
Fatehpur	2480	3490	-	Mathura	3450	4100	-	Tarn Taran	4530	4790	4680
Fazilka	4490	4940	4800	Mau	2500	3330	-	Varanasi	2410	3370	-

Table S2. The March–April mean value ($\text{mW m}^{-1}\text{nm}^{-1}\text{sr}^{-1}$) of OCO-2 SIF data in each district.

District	2016	2017	2018	District	2016	2017	2018	District	2016	2017	2018
Aligarh	0.15	0.16	0.16	Firozpur	0.25	0.22	0.24	Mewat	0.10	0.11	0.10
Allahabad	0.10	0.12	0.12	Ghazipur	0.12	0.13	0.13	Moga	0.25	0.24	0.24
Ambala	0.19	0.19	0.20	Gopalganj	0.12	0.14	0.14	Moradabad	0.16	0.17	0.17
Ambedkar Nagar	0.12	0.14	0.14	Gorakhpur	0.12	0.13	0.13	Muktsar	0.25	0.23	0.24
Amethi	0.12	0.14	0.14	Gurdaspur	0.26	0.26	0.25	Palwal	0.14	0.15	0.16
Amritsar	0.29	0.28	0.27	Hardoi	0.13	0.15	0.15	Panipat	0.18	0.18	0.20
Azamgarh	0.12	0.13	0.13	Hisar	0.16	0.17	0.19	Patiala	0.21	0.19	0.22
Baghpat	0.18	0.17	0.17	Jalandhar	0.22	0.21	0.23	Pratapgarh	0.12	0.13	0.13
Ballia	0.12	0.13	0.14	Jaunpur	0.12	0.13	0.13	Rae Bareli	0.13	0.14	0.14
Bareilly	0.15	0.15	0.15	Jhajjar	0.13	0.14	0.15	Rampur	0.17	0.17	0.18
Barnala	0.24	0.23	0.22	Jind	0.21	0.21	0.23	Rohtak	0.16	0.17	0.20
Basti	0.12	0.14	0.14	Kaithal	0.21	0.20	0.23	Sambhal	0.15	0.16	0.16
Bathinda	0.24	0.22	0.23	Kapurthala	0.22	0.21	0.24	Sangrur	0.23	0.22	0.22
Budaun	0.15	0.17	0.17	Karnal	0.21	0.20	0.22	Sant Kabir Nagar	0.12	0.14	0.14
Bulandshahr	0.17	0.18	0.18	Kasganj	0.15	0.16	0.16	Sant Ravi Das Nagar	0.12	0.14	0.13
Deoria	0.11	0.13	0.13	Kaushambi	0.11	0.13	0.13	ShahidBhagatSinghNagar	0.22	0.22	0.24
Etah	0.15	0.17	0.17	Kurukshetra	0.21	0.19	0.22	Shahjahanpur	0.14	0.14	0.15
Etawah	0.13	0.14	0.14	Kushinagar	0.12	0.13	0.13	Siddharth Nagar	0.12	0.13	0.14
Faizabad	0.12	0.14	0.14	Ludhiana	0.24	0.22	0.24	Sirsa	0.21	0.20	0.22
Faridkot	0.24	0.22	0.23	Maharajganj	0.12	0.14	0.13	Siwan	0.11	0.13	0.13
Fatehabad	0.22	0.22	0.22	Mainpuri	0.14	0.15	0.16	Sonipat	0.17	0.18	0.20
Fatehgarh Sahib	0.22	0.21	0.23	Mansa	0.23	0.23	0.23	Sultanpur	0.12	0.13	0.13
Fatehpur	0.13	0.13	0.13	Mathura	0.13	0.14	0.13	Tarn Taran	0.28	0.27	0.27
Fazilka	0.26	0.23	0.25	Mau	0.12	0.13	0.13	Varanasi	0.13	0.13	0.13

Table S3. The correlation of different ADDs and yield using a simple linear regression.

Year	R ²			
	ADD>0°C	ADD>27°C	ADD>30°C	ADD>34°C
2008-2018	0.37	0.36	0.33	0.25
2016-2018	0.33	0.31	0.27	0.21

Notes: From 2016 to 2018, ADDs during the grain-filling stage has also exceed the optimum ADD, but the negative impacts of ADDs on yield could be weak. All regressions are statistically significant ($p < 0.05$).