Supplementary Material

Climate smart agricultural practices improve soil quality through organic carbon enrichment and lower greenhouse gas emissions in farms of bread bowl of India

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Supplementary Table S1. Mean maximum and minimum annual temperature, relative humidity and annual evaporation and rainfall

Parameter	June, 2009 to May, 2010	June, 2010 to May, 2011	June, 2011 to May, 2012	June, 2012 to May, 2013	June, 2013 to May, 2014	June, 2014 to May, 2015	June, 2015 to May, 2016	June, 2016 to May, 2017	June, 2017 to May, 2018
Mean maximum (^{0}C)	30.77	29.32	29.46	29.85	29.19	29.70	30.25	30.50	29.94
Mean minimum (^{0}C)	17.50	17.16	16.87	16.71	16.92	17.22	17.08	17.40	17.09
Average relative humidity	81.31	85.46	84.79	84.25	86.36	85.45	84.05	83.22	83.35
Total Rain (mm)	470.20	1179.40	622.90	639.70	902.20	709.00	521.60	634.50	815.00
Average Evaporation (mm)	63.40	48.90	52.38	55.88	44.79	47.76	47.37	43.75	48.50

Supplementary Table S2. Amount of rice residues (t/ha) kept in the field before wheat sowing under farmers following CA based wheat

Name of the farmer	Village	Amount of rice residue (t/ha)
Rambir	Gheer	8.12
Dharampal	Gheer	7.44
Kanwar Lal	Gheer	6.56
Meghnad	Gheer	8.15
Bittu	Chandsamand	8.45
Rajesh	Badarpur	7.45
Manoj Kumar	Tarawari	9.45
Dharampal s/o Badhwaram	Gheer	8.23
Avinash	Tarawari	6.76
Sham Singh	Sagga	7.56
Mukesh	Tarawari	8.12
Subhash Chand	Nadana	9.23
Kapil	Tarawari	8.12
Vipin	Chorpura	7.98
Rajesh	Chorpura	8.56
Sohan	Chorpura	9.00
Ravinder Singh	Dabkoli	7.65
Ravinder	Kutail	6.78
Prem Singh	Nadana	9.25
Sahib Singh	Nadana	8.45
Paramjeet Singh	Nadana	7.20
Jitender Singh Rana	Nadana	9.00

Supplementary Table S3. Principal components (PC) and component loadings extracted from soil physicochemical parameters under CA were used to interpret the PC

PCs	PC1	PC2	PC3
Eigen value	4.077	2.928	1.299
% Variance	40.768	29.282	12.993
Cumulative %	40.768	70.051	83.043
Factor loading/eigen vector			
EC	-0.224	0.216	0.661
pH	-0.217	0.815	0.001
WB-C	**0.986**	-0.144	0.039
TOC concentration	**0.987**	-0.141	0.039
TOC Stock	**0.930**	-0.128	-0.220
BD	-0.079	0.049	**-0.772**
IC	0.087	**0.852**	-0.255
TC	**0.955**	0.241	-0.072
GWC	-0.071	**0.807**	0.467
VWC	0.025	**0.840**	0.422

Where EC: electrical conductivity, WB-C: Walkley and Black carbon concentration, TOC: total organic carbon concentration, TOC stock: total organic carbon stock, BD: bulk density, IC: inorganic carbon, TC: total carbon concentration, GWC: gravimetric water content, VWC: volumetric water content
Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Supplementary Table S4. Principal components (PC) and component loadings extracted from soil physicochemical parameters under CT were used to interpret the PC

PCs	PC1	PC2	PC3	PC4
Eigen value	4.635	2.389	1.166	0.933
% Variance	46.349	23.894	11.655	9.331
Cumulative %	46.349	70.243	81.899	91.230
Factor loading/eigen vector				
EC	-0.001	-0.185	0.085	**0.918**
pH	0.035	-0.425	0.737	-0.378
OC	**0.986**	0.158	-0.005	-0.024
TOC concentration	**0.985**	0.164	-0.003	-0.020
TOC Stock	**0.938**	0.313	-0.030	-0.093
BD	0.178	0.690	-0.139	-0.305
IC	0.126	-0.027	**0.867**	0.384
TC	**0.926**	0.142	0.315	0.122
GWC	0.226	**0.928**	-0.063	-0.015
VWC	0.222	**0.941**	-0.102	-0.029

Where EC: electrical conductivity, WB-C: Walkley and Black carbon concentration, TOC: total organic carbon concentration, TOC stock: total organic carbon stock, BD: bulk density, IC: inorganic carbon, TC: total carbon concentration, GWC: gravimetric water content, VWC: volumetric water content

Extraction Method: Principal Component Analysis.

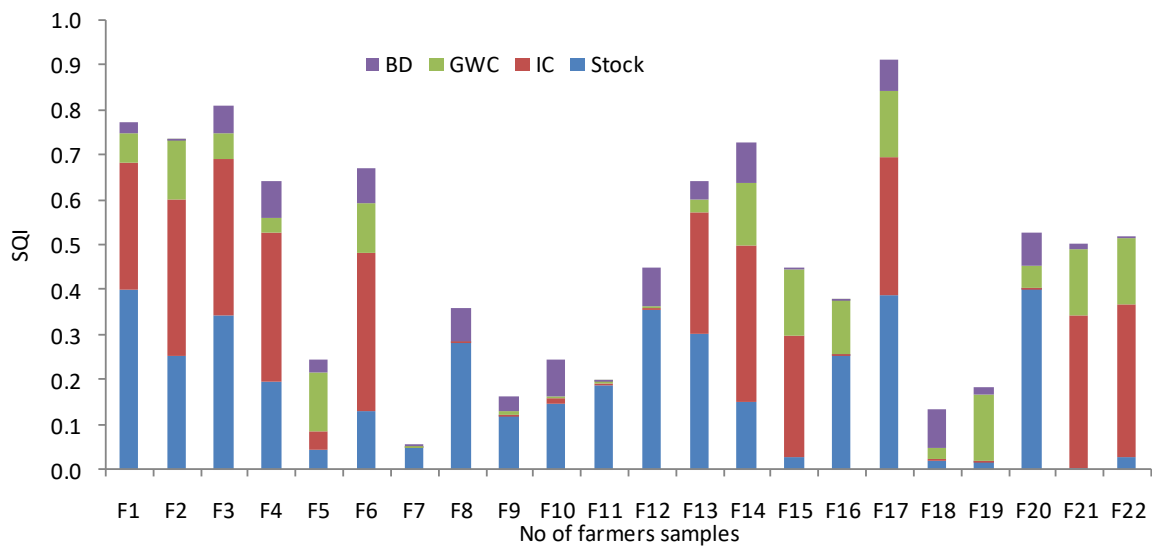Rotation Method: Varimax with Kaiser Normalization.

Supplementary Table S5. Wheat grain yield and SQI of the farmers fields following CA

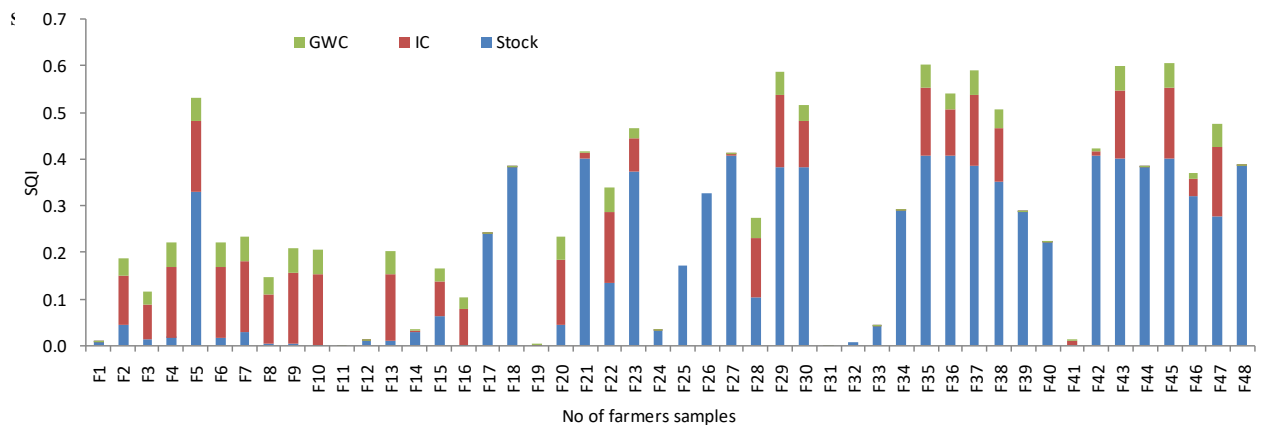| Name of the farmer	Village	Wheat grain yield (t/ha)	SQI
Rambir	Gheer	6.0	0.82
Dharampal	Gheer	5.5	0.83
Kanwar Lal	Gheer	6.0	0.81
Meghnad	Gheer	6.3	0.62
Bittu	Chandsamand	6.0	0.64
Rajesh	Badarpur	6.3	0.72
Manoj Kumar	Tarawari	5.5	0.56
Dharampal s/o Badhwaram	Gheer	6.2	0.72
Avinash	Tarawari	6.0	0.67
Sham Singh	Sagga	5.9	0.51
Mukesh	Tarawari	6.0	0.55
Subhash Chand	Nadana	6.0	0.55
Kapil	Tarawari	6.0	0.64
Vipin	Chorpura	6.1	0.82
Rajesh	Chorpura	6.0	0.57
Sohan	Chorpura	6.0	0.52
Ravinder Singh	Dabkoli	6.0	1.00
Ravinder	Kutail	5.5	0.59
Prem Singh	Nadana	6.0	0.68
Sahib Singh	Nadana	6.1	0.58
Paramjeet Singh	Nadana	6.5	0.61
Jitender Singh Rana	Nadana	6.0	0.63

Supplementary Table S6. Wheat grain yield and SQI of the farmers field following CT

Name of the farmer	Village	Wheat grain yield (t/ha)	SQI
Jabbar Singh	Chandsamand	5.20	0.31
Ranbir Singh	Chandsamand	5.50	0.18
Ramesh	Chandsamand	5.50	0.09
Naresh	Chandsamand	5.50	0.21
Udham Singh	Badarpur	5.79	0.60
Satyapal	Badarpur	5.90	0.16
Basant	Badarpur	5.00	0.18
Jay Singh	Badarpur	5.00	0.11
Jay Singh S/o Lal Singh	Badarpur	5.20	0.15
Darambir	Chorpura	5.45	0.14
Amit	Chorpura	5.70	0.00
Naresh	Chorpura	5.45	0.02
Ajmer Singh	Chorpura	5.50	0.15
Balinder	Dabkoli	5.60	0.04
Govind	Kartarpur	5.40	0.16
Rishipal	Kartarpur	5.31	0.07
Dharampal	Kartarpur	5.80	0.34
Tilakraj	Kartarpur	5.30	0.54
Rameshwar	Kartarpur	5.10	0.21
Sushil Kumar	Kartarpur	5.30	0.20
Shiv Kumar	Kartarpur	5.50	0.85
Pramod	Kartarpur	5.10	0.63
Sanju	Sambhli	5.50	0.88
Hardip	Sambhli	5.60	0.34
Inderpal	Sambhli	5.50	0.51
Samer Singh	Sambhli	5.40	0.72
Ravinder Kumar	Sambhli	5.50	0.85
Amardeep	Sagga	5.80	0.34
Jasbir	Sagga	5.50	0.98
Subash	Sagga	5.50	0.92
Jagmal	Sagga	5.50	0.26
Krishan Lal	Taraori	5.70	0.30
Vikash	Taraori	5.80	0.32
Kashmir Singh	Nadana	5.60	0.69
Balbinder	Nadana	5.43	0.56
Multan Singh	Nadana	5.65	0.96
Jay Singh Rana	Nadana	5.40	0.91
Jogga Singh	Nadana	5.25	0.55
Amar Sigh	Kutail	5.73	0.70
Omprakash	Kutail	5.52	0.56
Krishan Kumar	Kutail	5.65	0.01
Anil Kumar	Kutail	5.75	0.87

Amar Singh Muktiar Singh	Kutail	5.50	0.55
Balbir Singh	Kutail	5.65	0.83
Samar Singh Dalel Singh	Kutail	5.85	0.64
Vedpal	Kutail	5.35	0.74
Balkar Ram Singh	Kutail	4.90	0.81
Karambir	Kutail	5.65	0.82

Supplementary Fig. S1. Contribution of selected key indicators to SQI under CA based

system. Where BD: bulk density, GWC: gravimetric water content, IC: inorganic carbon, Stock: TOC

Supplementary Fig. S2. Contribution of selected key indicators to SQI under CT based

system Where GWC: gravimetric water content, IC: inorganic carbon, Stock: TOC stock