

Table S1 The situation and introduction of some watermelon producing regions in China at present.

Region	Northern China (NC)	Northwest (NW)	Southwest (SW)
Climate	Temperate Continental Monsoon Climate	Temperate continental climate	Plateau mountain climate
MAP (mm)	500-1000	<300	>900
MAT (°C)	8.0-13	1.0-16	4.0-18
MAS (h)	1800-2300	2400-2800	1000-1400
Soil Type	Hapli-Udic Argosols	Loessi-Orthic Primosols	Typic Purli-Udic Cambosols
Soil Texture	Loam	Sandy	Clay
Area (10 ³ ha)	623.9 (33.5%)	244.2 (13.1%)	109.8 (5.9%)
Output (10 ⁶ tons)	34.4 (45.1%)	9.32 (12.2%)	2.80 (3.7%)
Yield (t ha ⁻¹)	55.1	38.1	25.5
Research area	Henan and Hebei	Gansu and Ningxia	Sichuan and Chongqing

These data were derived from the book entitled “Study on the Industrial Economy’s Development of Watermelon and Muskmelon”. MAS, MAT and MAP represent mean annual sunshine, temperature and mean annual precipitation, respectively. Planting area, output and yield were derived from China agricultural statistics report 2015. The percentages in brackets represented local proportions in the whole country

Table S2 Main pollutant emissions and energy use of agricultural inputs at the agricultural materials stage

Item	Unit	Global warming (kg CO ₂ -eq unit ⁻¹)	Acidification (kg SO ₂ -eq unit ⁻¹)	Eutrophication (kg PO ₄ -eq unit ⁻¹)	Energy equivalent (MJ unit ⁻¹)	Water consumption (m ³ unit ⁻¹)	References
Diesel fuel	L	3.75	0.0658	0.0119	47.8	-	[1–4]
Electricity	kWh	0.75	0.0145	0.00084	-	-	[4]
N production and transportation	kg N	8.3	0.0252	0.00303	50.5	1.1	[1,4,5]
P production and transportation	kg P ₂ O ₅	0.79	0.0006	0.00008	5.00	1.696	[1,4,5]
K production and transportation	kg K ₂ O	0.55	0.00048	0.00006	14.7	-	[1,4,5]
Manure production	kg	-	-	-	0.3	-	[6]
Pesticide	kg	19.1	0.0105	0.00194	238	3.6	[1,4,7]
PE	kg	0.1	0.00135	0.0001	32.3	-	[8]

Table S3 The quantity of pollutant emitted (expressed as a percentage of inputs) at the arable farming stage

Pollution emission	Emission factors	References
NH ₃ emissions	11% of N fertilizer input	[9]
NO ₃ ⁻ leaching	10% of N fertilizer input	[10]
N ₂ O OM Direct	1% of organic N fertilizer input	[11]
N ₂ O CE Direct	0.8% of Chemical N fertilizer input	[12]
N ₂ O Indirect	1% NH ₃ emission+ 2.5% NO ₃ emission	[13,14]
NO _x emissions	10% N ₂ O _{Total}	[13]
Phosphorus loss	0.2% of total P ₂ O ₅ fertilizer input	[15]

Table S4 Normalization values and weights for different impact categories

Impact category	Unit	Standard Value/(kg/person/a)	Weight
Water depletion	m ³ /t	2193.9	0.12
Energy depletion	MJ/a	2590457	0.15
Land occupation	m ² /t	988.17	0.13
Global warming potential	kgCO ₂ -eq	6869	0.12
Acidification potential	kgSO ₂ -eq	52.26	0.14
Eutrophication potential	kgPO ₄ -eq	1.88	0.12

Table S5 The resource burden and environmental impacts in China in different agriculture production systems.

Plant	GHG	AP	EP	LO	WD	ED	References
Unit: t⁻¹	kg CO₂-eq	kgSO₂-eq	kg PO₄-eq	m²	m³	MJ	
Fruits							
Watermelon	87-150	1.97-3.32	0.64-0.99	200-571	11-16.5	549-885	in this study
Strawberry	118	0.94	0.80			2183	[16]
Pear	120-510					2772-4503	[2,17,18]
Banana	255						[17]
Peach	347						[17]
Apple	222						[17]
Vegetables							
Tomato	261-272	2.15-5.95	0.25-3.59		50.8	1741	[8,19,20]
Pepper	368	7.93	1.52				[20]
Cereal crops							
Maize	291-2301	3.1-15.3	0.61-5.16	1348-1671	186-3555	1051-11346	[20–24]
Wheat	680-860	7.5-13.8	2.3-3.6	1086-1910		1841-10599	[17,22,25]
Rice	370-3768	11-17.8	2.4-5.5	1388-1429	947	2641-3679	[26–28]

Table S6 Field verification results in NC and SW.

Region	Number	Treatment	Total fertilizer (kg ha ⁻¹)			Yield (t ha ⁻¹)	PFP-N (kg kg ⁻¹)	Impact category (t ⁻¹)						REI
			N	P ₂ O ₅	K ₂ O			LO (m ²)	WD (m ³)	ED (MJ)	GHG (kg CO ₂ -eq)	AP (kg SO ₂ -eq)	EP (kg PO ₄ -eq)	
NC	18HB01	OPT-N	0	95	301	50.0±5.84	-	200±18.46	5.06±1.02	581±50.26	23±5.36	0.23±0.09	0.03±0.01	0.03±0.00
		OPT	263	95	301	66.5±7.43	253±11.88	150±9.84	8.16±0.98	673±49.25	68±16.25	1.27±0.11	0.37±0.05	0.05±0.01
		FP	520	395	480	62.1±4.68	119±8.74	161±10.65	10.6±1.00	680±66.33	105±11.33	2.4±0.52	0.77±0.07	0.08±0.02
	18HB02	OPT-N	0	95	301	54.0±9.32	-	185±18.88	4.69±1.68	284±55.68	21±9.20	0.21±0.08	0.02±0.01	0.03±0.01
		OPT	289	95	301	62.3±8.42	215±55.35	161±15.96	9.17±3.26	480±63.58	77±19.64	1.46±0.68	0.43±0.16	0.06±0.02
		FP	410	150	380	61.5±9.33	150±37.42	163±20.45	12.97±2.07	609±46.52	104±22.35	2.03±0.66	0.62±0.25	0.07±0.02
	18HN01	OPT-N	0	63	200	39.6±6.32	-	253±33.42	3.86±2.06	305±78.48	18±9.32	0.18±0.08	0.01±0.00	0.04±0.01
		OPT	174	63	200	46.6±5.12	268±32.15	215±28.53	7.39±3.59	448±86.95	63±35.69	1.19±1.08	0.35±0.03	0.06±0.02
		FP	377	356	359	40.6±7.33	108±11.74	246±36.52	17.15±2.68	613±84.69	122±46.88	2.66±1.02	0.85±0.07	0.10±0.02
	18HN02	OPT-N	0	63	200	45.2±5.84	-	221±18.96	3.38±0.878	267±59.68	16±6.32	0.16±0.03	0.01±0.00	0.04±0.02
		OPT	174	63	200	46.9±3.44	270±22.54	213±17.53	7.33±1.64	445±144.95	63±11.35	1.18±0.16	0.34±0.06	0.06±0.02
		FP	370	335	348	46.0±4.18	124±11.30	217±20.42	14.18±3.55	527±168.95	105±19.68	2.3±0.25	0.73±0.06	0.09±0.02
	18HN03	OPT-N	0	63	200	60.0±6.41	-	167±11.20	2.55±0.96	201±48.96	12±3.25	0.12±0.03	0.01±0.00	0.03±0.01
		OPT	174	63	200	69.6±7.33	400±15.84	144±9.40	4.95±3.58	300±57.32	42±6.85	0.79±0.08	0.23±0.01	0.04±0.01
		FP	370	333	343	63.6±6.19	172±11.39	157±12.53	10.20±2.69	380±19.68	76±10.63	1.66±0.24	0.53±0.10	0.06±0.01
SW	18CQ01	OPT-N	0	120	240	15.6±3.47	-	641±26.15	15.66±0.99	1931±84.95	48±8.69	0.42±0.06	0.05±0.01	0.10±0.01
		OPT	150	120	240	26.8±7.20	179±51.20	372±18.95	15.26±1.26	1404±76.54	99±9.63	1.79±0.16	0.53±0.12	0.10±0.01
		FP	241	190	267	26.0±6.58	108±34.12	385±16.33	19.41±2.03	1533±103.85	139±13.52	2.78a±0.27	0.86±0.18	0.12±0.01
	18CQ02	OPT-N	0	120	240	19.2±2.58	-	521±10.87	11.44±0.86	456±48.63	21±5.32	0.12±0.01	0.03±0.00	0.08±0.01
		OPT	150	120	240	27.6±3.56	184±27.35	363±13.58b	13.94±0.77	592±53.26	84±6.35	1.59±0.35	0.51±0.08	0.09±0.01
		FP	261	176	281	26.3±1.25	101±16.58	380±20.66	18.33±1.52	750±83.62	134±16.35	2.79±0.46	0.91±0.12	0.13±0.01

The cross intersection was the group mean and values were means ± SD.

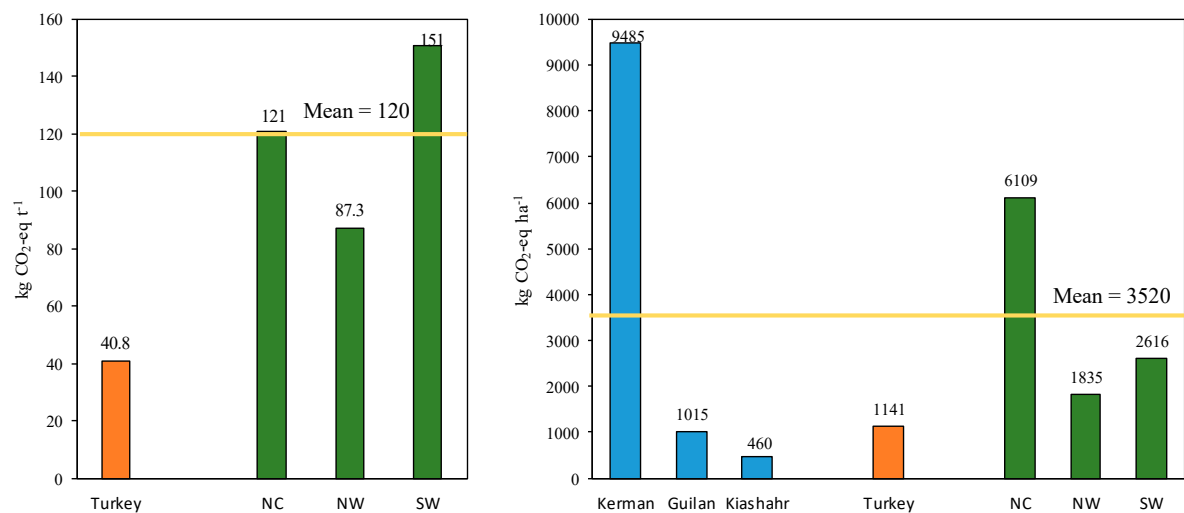


Figure S1. Greenhouse gas emissions per 1 ha and 1 ton of watermelon. GHG was the hotspot and the most influential category in current research. Hence, the GHG potentials of watermelon production in different regions of the same country were collected and shown in the form of pillars, while the yellow line represented the average potential for GHG in several areas of China.

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