

Table S1. List of excluded yield observations over the study period

year	Winter wheat	Spring wheat	Oats	Spring barley
1979	9	12	2	2
1980	8	13	2	2
1981	10	12	3	2
1982	10	13	2	2
1983	9	13	3	2
1984	9	13	3	2
1985	10	11	4	2
1986	11	11	4	2
1987	10	11	5	2
1988	11	11	3	2
1989	10	15	4	2
1990	10	17	4	2
1991	10	17	5	2
1992	10	14	5	2
1993	11	17	7	6
1994	11	16	7	6
1995	11	16	7	2
1996	11	16	7	2
1997	10	15	6	1
1998	8	15	5	0
1999	8	12	4	0
2000	6	10	4	0
2001	8	11	4	0
2002	8	9	2	0
2003	6	10	3	0
2004	7	9	3	0
2005	7	9	3	0
2006	6	10	3	0
2007	6	9	3	0
2008	7	7	3	0
2009	6	6	4	0
2010	6	9	4	0
2011	7	5	5	0
2012	8	4	5	0
2013	8	5	3	0
2014	5	5	4	0
2015	5	4	3	0
2016	6	6	3	0
2017	5	5	2	0
2018	6	6	4	0
2019	4	6	4	0
2020	5	7	4	0
2021	5	7	4	0

Note: A value of 0 indicates that there are no excluded observations for a given year and crop type.

Table S2. Season-specific effects of climate change on agricultural yield: Linear regression with a large dummy-variable set

	Winter wheat		Spring wheat		Oats		Spring barley	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Precipitation growing-1	70.18077*** (11.89676)	65.44990*** (11.35187)	52.19463*** (17.29547)	46.81734*** (15.54075)	51.83017*** (12.42492)	47.93872*** (12.91240)	50.49482** (18.23452)	44.31369** (18.56506)
Growing-1 squared	-0.51734*** (0.09110)	-0.47170*** (0.08698)	-0.45599*** (0.14577)	-0.38925*** (0.13246)	-0.43444*** (0.09853)	-0.38859*** (0.10624)	-0.47685*** (0.15294)	-0.41444** (0.15801)
Precipitation growing-2	13.13495** (5.23247)	12.95453** (5.68929)	-4.06998* (2.27695)	-3.42411 (2.23691)	-4.74593** (2.09223)	-5.15669*** (1.79563)	-3.58710* (2.06762)	-3.72833* (1.90216)
Growing-2 squared	-0.10268*** (0.02630)	-0.10339*** (0.03038)	-0.00487 (0.00942)	-0.00112 (0.00860)	-0.00353 (0.00663)	-0.00081 (0.00608)	-0.01077 (0.00776)	-0.00883 (0.00787)
Precipitation harvest	5.99646 (3.91126)	3.99997 (4.61399)	3.40371 (5.39094)	4.56089 (5.18126)	-2.27780 (4.50536)	-2.65909 (3.87416)	1.59690 (3.54792)	0.78607 (3.44315)
Harvest squared	-0.03095 (0.02249)	-0.02147 (0.02561)	-0.02583 (0.02796)	-0.03212 (0.02898)	0.01341 (0.02547)	0.01579 (0.02164)	-0.00441 (0.02214)	-0.00378 (0.02103)
Observations	559	559	454	454	734	734	858	858
R-squared	0.72505	0.69735	0.71421	0.66104	0.72459	0.69490	0.80256	0.78109
Other weather controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County-by-decade-fixed effects	Yes	No	Yes	No	Yes	No	Yes	No
County-specific time trends	No	Yes	No	Yes	No	Yes	No	Yes

Note: The dependent variables are agricultural yields in a specific county for the four crops indicated in the column headings. The results in columns 1–8 are derived from a linear regression with a large dummy-variable set. Other weather controls include temperatures, relative humidity, and soil moisture throughout both the growing seasons 1 and 2, as well as during the harvest period. Robust standard errors, clustered at the county level, are presented in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

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Table S3. Season-specific effects of climate change on agricultural yield: Panel fixed effect

	Winter wheat		Spring wheat		Oats		Spring barley	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Precipitation growing-1	0.01364*** (0.00268)	0.01622*** (0.00245)	0.01199*** (0.00362)	0.01244*** (0.00347)	0.01771*** (0.00458)	0.01871*** (0.00444)	0.01344** (0.00623)	0.01466** (0.00612)
Growing-1 squared	-0.00010*** (0.00002)	-0.00011*** (0.00002)	-0.00010*** (0.00003)	-0.00010*** (0.00003)	-0.00014*** (0.00004)	-0.00014*** (0.00004)	-0.00013** (0.00005)	-0.00013** (0.00005)
Precipitation growing-2	0.00248** (0.00096)	0.00317*** (0.00083)	-0.00099* (0.00055)	-0.00084 (0.00057)	-0.00142** (0.00057)	-0.00107 (0.00062)	-0.00051 (0.00064)	-0.00010 (0.00066)
Growing-2 squared	-0.00002*** (0.00001)	-0.00002*** (0.00001)	0.00000 (0.00000)	-0.00000 (0.00000)	-0.00000 (0.00000)	-0.00000 (0.00000)	-0.00001* (0.00000)	-0.00001** (0.00000)
Precipitation harvest	0.00113 (0.00083)	0.00121 (0.00102)	0.00068 (0.00114)	0.00085 (0.00110)	-0.00122 (0.00119)	-0.00088 (0.00128)	0.00069 (0.00139)	0.00120 (0.00161)
Harvest squared	-0.00001 (0.00000)	-0.00001 (0.00001)	-0.00000 (0.00001)	-0.00000 (0.00001)	0.00001 (0.00001)	0.00001 (0.00001)	-0.00000 (0.00001)	-0.00001 (0.00001)
Observations	559	559	454	454	734	734	858	858
R-squared	0.49384	0.41351	0.38241	0.36565	0.35628	0.33806	0.27812	0.24916
Other weather controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County-by-decade-fixed effects	Yes	No	Yes	No	Yes	No	Yes	No
County-specific time trends	No	Yes	No	Yes	No	Yes	No	Yes

Note: The dependent variables are the natural logarithm of agricultural yields in a specific county for the four crops indicated in the column headings. The results in columns 1–8 are derived from a panel fixed effects model. Other weather controls include temperatures, relative humidity, and soil moisture throughout both the growing seasons 1 and 2, as well as during the harvest period. Robust standard errors, clustered at the county level, are presented in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table S4. Correcting potential spatial correlation using Conley standard errors

	Winter wheat		Spring wheat		Oats		Spring barley	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Precipitation growing-1	70.18077*** (16.93523)	70.18077*** (15.74631)	52.19463** (23.60045)	52.19463** (26.59531)	51.83017*** (11.82841)	51.83017*** (11.63857)	50.49482*** (15.34604)	50.49482*** (15.86275)
Growing-1 squared	-0.51734*** (0.13843)	-0.51734*** (0.12043)	-0.45599** (0.19407)	-0.45599** (0.22813)	-0.43444*** (0.09767)	-0.43444*** (0.10752)	-0.47685*** (0.13031)	-0.47685*** (0.13890)
Precipitation growing-2	13.13495 (11.40248)	13.13495* (7.92342)	-4.06998 (4.10611)	-4.06998 (3.29824)	-4.74593* (2.88445)	-4.74593* (2.66179)	-3.58710 (2.81211)	-3.58710* (1.86919)
Growing-2 squared	-0.10268* (0.06163)	-0.10268** (0.04132)	-0.00487 (0.01831)	-0.00487 (0.01354)	-0.00353 (0.01052)	-0.00353 (0.00617)	-0.01077 (0.01219)	-0.01077 (0.00844)
Precipitation harvest	5.99646 (5.87370)	5.99646 (5.35548)	3.40371 (6.77654)	3.40371 (3.88784)	-2.27780 (2.64513)	-2.27780 (2.31679)	1.59690 (2.89115)	1.59690 (3.44766)
Harvest squared	-0.03095 (0.03360)	-0.03095 (0.02511)	-0.02583 (0.03773)	-0.02583 (0.02633)	0.01341 (0.01603)	0.01341 (0.01487)	-0.00441 (0.01704)	-0.00441 (0.01882)
Observations	559	559	454	454	734	734	858	858
R-squared	0.35010	0.35010	0.42573	0.42573	0.45258	0.45258	0.33515	0.33515
Other weather controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County-by-decade-fixed effects	Yes	No	Yes	No	Yes	No	Yes	No
County-specific time trends	No	No	No	No	No	No	No	No

Note: The dependent variables are agricultural yields in a specific county for the four crops indicated in the column headings. The estimates in all the columns exhibit a spatial autocorrelation with a lag of 1. In the odd-numbered columns, the estimates are calculated with a cutoff distance of 200 km, while in the even-numbered columns, the estimates are computed with a cutoff distance of 400 km. Other weather controls include temperatures, relative humidity, and soil moisture throughout both the growing seasons 1 and 2, as well as during the harvest period. Parentheses are used to report the Conley robust standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table S5. Effect of excluded observations

	Winter wheat (1)	Spring wheat (2)	Oats (3)
Precipitation growing-1	0.01840*** (0.00525)	0.02284*** (0.00635)	-0.00411 (0.00724)
Precipitation growing-1 squared	-0.00005 (0.00006)	-0.00019*** (0.00005)	0.00008 (0.00008)
Precipitation growing-2	0.00097 (0.00640)	-0.00132 (0.00162)	0.00662 (0.00606)
Precipitation growing-2 squared	-0.00003*** (0.00001)	-0.00001 (0.00001)	-0.00005 (0.00004)
Precipitation harvest	0.00875 (0.00723)	-0.00578*** (0.00210)	0.00189 (0.00435)
Harvest squared	-0.00004 (0.00004)	0.00002 (0.00001)	0.00000 (0.00002)
Svealand-Götaland * precip growing-1	-0.00919* (0.00534)	-0.00086 (0.00249)	0.00632* (0.00344)
Svealand-Götaland * precip growing-2	0.00086 (0.00678)	0.00127*** (0.00043)	0.00477** (0.00214)
Svealand-Götaland * precip harvest		0.00211** (0.00106)	0.00199 (0.00233)
Observations	68	115	63
Other weather controls	Yes	Yes	Yes
County fixed effects	Yes	Yes	Yes
County-by-decade-fixed effects	Yes	Yes	Yes
County-specific time trends	No	No	No

Note: The dependent variables are agricultural yields in a specific county for three crops indicated in the column headings. The results in columns 1–3 are derived from a Poisson Pseudo-Maximum Likelihood regression with a high-dimensional fixed effects model. Other weather controls include temperatures, relative humidity, and soil moisture throughout both the growing seasons 1 and 2, as well as during the harvest period. The coefficient of Svealand-Götaland × precip harvest is dropped due to multicollinearity for winter wheat. The results for spring barley are not reported because model convergence was not achieved. Robust standard errors, clustered at the county level, are presented in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$