Supplementary Materials

Table S1. Level of analysis of climate impact studies

Level of analysis	**N of studies**	**References**
Individual crop/plot	9	Ahmed et al, 2022; Alayon-Gamboa, 2020; Gulino et al, 2023; Ruiz et al, 2019; Vanongeval et al, 2023; Alidoost et al, 2019; Bencze et al, 2010; Klatt et al, 2021; Schlenker et al, 2009
Individual farm	17	Chatzopoulos et al, 2015; Ahmed et al, 2022; Blanco-Penedo et al, 2020; Bozzola et al, 2018; Durant et al, 2018; Mukherjee et al, 2013; Papadopoulou et al, 2021; Pourzand et al, 2020; Schauberger et al, 2021; Wang et al, 2021; Dalhaus et al, 2020; Eakin et al, 2012; Hill et al, 2014; Huitu et al, 2020; Perez-Uribe et al, 2024; Skoufias et al, 2013; Vroege et al, 2023
Region/county level	42	Akbar et al, 2020; Beillouin et al, 2020; Burke & Emerick, 2016; Demirdogen et al, 2024; Dono et al, 2013; Espe et al, 2017; Gonzalez et al, 2008; Harkness et al, 2023; Himanen et al, 2013; Huszvai et al, 2020; Jiang et al, 2020; Kaufmann et al, 1997; Lee et al, 2018; Li et al, 2018; Linnenleucke et al, 2020; Maqsood et al, 2020; Mendelsohn et al, 1996; Meng et al, 2017, Mourtzinis et al, 2016; Nguyen et al, 2023; Ortiz-Bobea et al, 2019; Polsky et al, 2001; Ray et al, 2018; Wang et al, 2016; Zalud et al, 2017; Albers et al, 2017; Changnon et al, 2000; Di Poala et al, 2023; Feng et al, 2018; Galushko et al, 2022; Hamed et al, 2021; Heil et al, 2023; Lobell et al, 2011; Murray-Tortarolo et al, 2019; Plastina et al, 2021; Quiroga et al, 2009; Schaub et al, 2020; Sharma et al, 2019; Thomasz et al, 2020; Van Oort et al, 2012; Zipper et al, 2016; Finger et al, 2018
National level	15	Benito-Verdugo et al, 2023; Vaakan et al, 2024; Chandio et al, 2020; Dogan et al, 2010; Himanen et al, 2013; Karahasan et al, 2023; Mayer et al, 1999; Nasrullah et al, 2021; Chavas et al, 2017; Kalbarczyk et al, 2015; Powell et al, 2015; Reinermann et al, 2019; Sheng et al, 2019; Villa-Falfan et al, 2023; Deschenes et al, 2007
Other (e.g. European level)	7	Massetti et al, 2018; Quiédeville et al, 2022; Reidsma et al, 2007; Reidsma et al, 2009; Van Passel et al, 2017; Wu et al, 2017; Fabri et al, 2022

Table S2. Level of analysis of the adaptation studies

Level of analysis	**N of studies**	**References**
Individual crop/plot	8	Fernandez-Ortega et al, 2023; Petonen-Sainio et al, 2014; Quiroga et al, 2014; Ruiz et al, 2019; Wittwer et al, 2023; Bowles et al, 2020; Alayon-Gamboa et al, 2011; Domingos et al, 2021
Individual farm	12	Auci et al, 2023; Bouttes et al, 2019; Di Falco et al, 2014; Gafsi et al, 1997; Jordan et al, 2021; Láng et al, 2023; Mukherjee et al, 2013; Pexas et al, 2021; Vanschoenwinkel et al, 2018; Perez-Uribe et al, 2024; Skidmore et al, 2022; Zhang et al, 2018
Region/county level	20	Akbar et al, 2020; Burke & Emerick, 2016; Harkness et al, 2023; Kaugmann et al, 1997; Lee et al, 2016; Li et al, 2020; Lu et al, 2020; Parker et al, 2017; Patanita et al, 1029; Polsky et al, 2011; Smith et al, 2021; Wang et al, 2016; Wang et al, 2021; Jacobs et al. 2022; Kath et al, 2018; Whitbread et al, 2015; Zhang et al, 2015; Karapinar et al, 2020; Wheeler et al, 2014; Won et al, 2024
National level	3	Michalopoulos et al, 2020; Harkness et al, 2021; Matsushita et al, 2016
Other (e.g. European level)	4	Reidsma et al, 2007; Reidsma et al, 2009a; Reidsma et al, 2009b; Reidsma et al, 2010

Table S3. Examples of net benefit of adaptation by strategy

Main adaptation strategies	Studies	Country	Examples of net benefit of adaptation
Irrigation & water storage	Akbar et al, 2020; Auci et al, 2023; Foudi et al, 2011; Jordan et al, 2021; Li et al, 2020; Lu et al, 2020; Patanita et al, 2019; Pérez-Uribe et al, 2024; Polsky et al, 2001; Quiroga et al, 2014; Reidsma et al, 2009a; Reidsma et al, 2009b; Reidsma et al, 2010; Smith et al, 2021; Vanschoenwinkel et al, 2018; Wang et al, 2016; Zhang et al, 2015	USA; Italy; France; Chile; USA; USA; Portugal; Colombia; USA; Spain; Europe; Europe; Europe; USA; Europe; USA; USA	Irrigation leads to a yield increase of 12.28% per acre (Li et al, 2020). Irrigation plays an important role in boosting the crop yield, with the highest increases for spring wheat (147%), hay (139%), corn silage (132%), and corn grain (124%) (Lu et al, 2020). Arid regions with access to stored water avoided the 13% losses in crop value experienced in irrigated areas with more limited storage during droughts (Smith et al, 2021). Irrigation serves as a self-insurance. Irrigating farmers have higher means but lower variance of profits than non-irrigating farmers. However, for already irrigating farmers using more water volumes increases the variance of outcome (Foudi et al, 2011).
Crop diversification	Burke et al, 2016; Bowles et al, 2020; Di Falco et al, 2008; Matsushita et al, 2016	USA; USA; Italy; Japan	More diverse rotations increased maize yields (28.1% on average), including in favorable conditions (22.6%). Notably, more diverse rotations also showed positive effects on yield under unfavorable conditions, whereby yield losses were reduced by 14.0%, and 89.9% in drought years (Bowles et al, 2020).
Cooling systems	Li et al, 2020; Mukherjee et al, 2013; Pexas et al, 2021	USA; USA; Sweden	Cooling systems contribute to an annual increase in gross revenues of between $106,830 and $162,631(Mukherjee et al, 2013). Farm profitability improved by +6.79% with showers and +3.37% with increased air velocity (Pexas et al, 2021).
Business & government strategies	Alayón-Gamoa et al, 2011; Gafsi et al, 1997; Harkness et al, 2021; Harkness et al, 2023;	Mexico; France; UK; UK; USA; Europe; Europe; Europe; USA	Monetary surpluses have increased considerably thanks to the high level of MW subsidies given to farms (140000FF on average) and to bonuses from the European Union (CAP) and from the French State. The

	Polsky et al, 2001; Reidsma et al, 2009a; Reidsma et al, 2009b; Reidsma et al 2010; Won et al, 2024		increase in monetary surplus has enabled the farmers to increase their private expenditure by 90% on average and to make large investments (Gafsi et al, 1997). An increase in agri- environment payments per hectare decreases the variability of income for mixed farms by 6% whereas increases the variability income by 3% for cereal farms. Subsidies therefore have a smaller relative effect on the variability of income, in comparison to the farming practices examined in this study (Harkness et al, 2023). Counties with higher levels of government program participation have higher land values (Polsky et al, 2001).
Reducing or changing stock	Akbar et al, 2020; Skidmore et al, 2022	USA; Brazil	The hybrid breed is expected to be smaller, travel longer distance for water, use a wider variety of forage and would be more resilient to temperature; but it will take at least a decade to find out whether the hybrid was a success for the Southern Utah landscape and climatic conditions or not (Akbar et al, 2020).
Specialisation	Harkness et al, 2021; Harkness et al, 2023	UK; UK	For general cropping farms specialisation has a large relative effect; increasing specialisation by 1 standard deviation increases the variability of income by 13% (Harkness et al, 2023).
Leasing acreage	Zhang et al, 2018	USA	A one-inch precipitation increase reduces leased land by 44 acres. Projections estimate that by 2050, leased acreage on average will decline by 23% under RCP 4.5 and 29% under RCP 8.5 (Zhang et al, 2018).
Changing cropping patterns	Domingos et al, 2021; Fernández-Ortega et al, 2023; Jacobs et al, 2022; Karapinar et al, 2020; Làng et al, 2023; Lee et al, 2016; Michalopoulos et al, 2020; Parker et al, 2017; Peltonen–Sainio et al, 2014; Ruiz et al, 2019; Whitbread et al, 2015; Wittwer et al, 2023	England, Spain, USA; Türkiye; Hungary; South Korea; Greece; Germany; Finland; Spain; Australia; Switzerland	Date and cultivar adaptation increase yields of adapter households by 16% and 31% respectively (Karapinar et al, 2020). By combining barley and sweet corn yields during double cropping, the overall crop yield was 18.5 tonnes/ha; compared to single cropping 5.6 tonnes/ha (Làng et al, 2023). Results indicate an increase of 46 kg ha for every day earlier that the crop is planted (Parker et al, 2017).

			When early sowing occurred with late maturity, yields were at their highest for all cereals (barley 5710kgha) (oat 5930kgha) (wheat 4700kgha). For barley, the yield was enhanced by a combination of early sowing and late maturity by 0.15, in oat by 0.19 and in wheat by up to 0.24. In oat and wheat, such combinations were also associated with high single grain weight (Peltonen-Sainio et al, 2014).
Insurance participation	Di Falco et al, 2014; Kath et al, 2018; Wang et al, 2021	Italy; Australia; USA	Index insurance could make farmers better off by $269.85 AUD/ha on average in years with excessive rainfall (Kath et al, 2018).
Fertilisation & other inputs	Fernàndez-Ortega et al, 2023; Harkness et al, 2021; Harkness et al, 2023; Kaufmann et al, 1997; Michalopoulos et al, 2020; Patanita et al, 2019; Pèrez-Uribe et al, 2024; Reidsma et al, 2007; Reidsma et al, 2009a; Reidsma et al, 2009b; Reidsma et al, 2010; Wang et al, 2016	Spain; UK; UK; USA; Greece; Portugal; Colombia; Europe; Europe; Europe; Europe; USA	Using fertilizer has the most consistent association with yields as it increases yields by 0.8, 0.02, and 0.24 t/h for plantains, coffee, and cassava, respectively (Pèrez-Uribe et al, 2024). Fertilizer intensive farmers can largely reduce the negative effects of higher temperatures in the UK, France and Italy, while in other regions, the effect is small or even negative (Reidsma et al, 2010). On average, a $10/acre increase in fertilizer use can lead to a yield increase around 9 kg/acre for cotton, and about 0.12 ton/acre for hay (Wang et al, 2016).
Conversion to organic farming	Bouttes et al, 2019; Di Falco et al, 2008; Wittwer et al, 2023	France; Italy; Switzerland	Following conversion to organic farming, farm self-sufficient milk productivity in 2012 ranged from 2558 to 4932 kg milk/ha/year, economic efficiency in 2012 ranged from 1.5 to 6.5, and profitability per worker in 2012 ranged from 12 to 84 EUR/year (Bouttes et al, 2019).

Source: Own elaboration