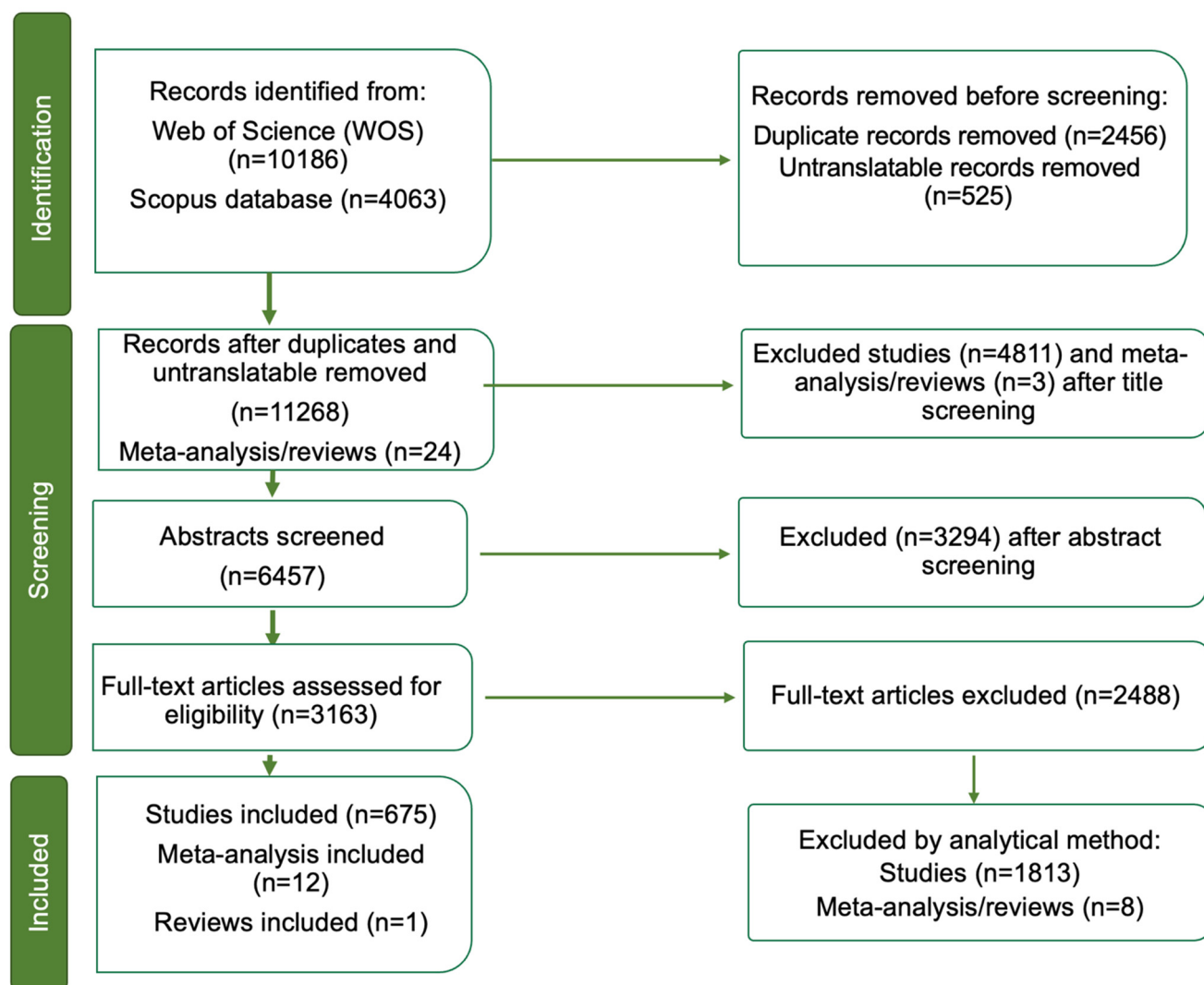


**Supplementary material – Relationship among soil biophysicochemical properties, agricultural practices and climate factors influencing soil phosphatase activity in agricultural land.**

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**Figure S1.** Article search and selection process.



**Table S1.** Comprehensive overview of meta-analyses and reviews investigating explanatory drivers for phosphatase activity (APase), including the total number of studies, enzyme analysis substrates, and ecosystem types.

Author and Year	Studies	Type	Substrates	Ecosystems
Janes-Bassett et al. (2022)	37	Fertilization	Disodium-p-nitrophenyl phosphate among others	Farmland, grassland
Miao et al. (2019)	85	Fertilization	Disodium-p-nitrophenyl phosphate, 4-MUB-phosphate	Farmland
Jian et al. (2016)	65	Fertilization	Disodium-p-nitrophenyl phosphate, 4-MUB-phosphate	Farmland, grassland, forest, peat
Marklein and Houlton, (2012)	34	Fertilization	Disodium-p-nitrophenyl phosphate among others	Grassland, shrubland, forest, tundra, wetland
Pokharel et al. (2020)	72	Fertilization esp. Biochar	Disodium-p-nitrophenyl phosphate among others	Based on textural classes
Lin et al. (2021)	73	Pollution	Disodium-p-nitrophenyl phosphate among others	Arable land, grassland
Aponte et al. (2020)	46	Pollution	Disodium-p-nitrophenyl phosphate among others	Based on soil (cultivated and uncultivated)
Riah et al. (2014)	47	Pollution	Disodium-p-nitrophenyl phosphate	Agricultural landscapes, microcosms
Margalef et al. (2017)	183	Soil properties/ Climatic	Disodium-p-nitrophenyl phosphate, disodium phenyl phosphate, 4-methyl umbelliferyl phosphate	Soil forest, shrublands, grasslands
Margalef et al. (2021)	97	Climatic	Disodium-p-nitrophenyl phosphate, disodium phenyl phosphate, 4-methyl umbelliferyl phosphate	Soil forest, shrublands, grasslands
Gao et al. (2020)	79	Climatic	Disodium-p-nitrophenyl phosphate	Cropland, grassland, forest, wetland, shrubland, wasteland, open area,
Meng et al. (2020)	78	Climatic	Disodium-p-nitrophenyl phosphate among others	Farmland, forest, grassland, peatland, shrubland, tundra
Sun et al. (2020)	139	Climatic	Disodium-p-nitrophenyl phosphate, disodium phenyl phosphate, 4-methyl umbelliferyl phosphate	Soil forest, shrublands, grasslands

**Table S2.** Comprehensive overview of meta-analyses and reviews detailing factors influencing phosphatase activity (APase), encompassing number of observations, drivers, variables and acid and alkaline phosphatase (ACP and ALP, respectively) response.

Reference	Number of observations*	Driver	Variable	APase	Response
Jian et al., 2016	16	Fertilization	N	ACP	Positive
Marklein and Houlton, 2012	112	Fertilization	N	ACP, ALP	Positive
Marklein and Houlton, 2012	112	Fertilization	P	ACP, ALP	Positive
Margalef et al., 2021	50	Fertilization	N	ACP, ALP	Positive
Margalef et al., 2021	24	Fertilization	P	ACP, ALP	Negative
Margalef et al., 2021	49	Fertilization	N, P	ACP, ALP	Negative
Janes-Bassett et al., 2022	163	Fertilization	P	Monoesterases (unspecified)	None
Miao et al., 2018	46	Fertilization	Chemical fertilizer (unbalanced application, NPK)	ACP, ALP	Positive
Miao et al., 2018	19	Fertilization	Organic fertilizer (straw residue retention, manure)	ACP, ALP	Positive
Miao et al., 2018	35	Fertilization	Chemical+Organic (NPK+straw, NPK+manure)	ACP, ALP	Positive
Pokharel et al., 2020	37	Fertilization	Biochar	ACP	Positive
	23			ALP	None
Riah et al., 2014	4	Pollution	Herbicide	ACP	None
	5			ALP	None
Riah et al., 2014	4	Pollution	Fungicide	ACP	Positive
	5			ALP	Negative
Reference	Number of	Driver	Variable	APase	Response

	observations*				
Riah et al., 2014	6 8	Pollution	Insecticide	ACP ALP	Negative Positive/ none
Aponte et al., 2020	103 67	Pollution	Pb, Zn, As	ACP ALP	Negative Negative
	103 67		Cu, Cd	ACP ALP	Positive Negative
Lin et al., 2021	27 13	Pollution	C, Cu, Ag NMs	ACP ALP	Negative
			Fe NMs	ACP ALP	Positive
Sun et al., 2020	139	Climate	MAT MAP	ACP	Positive
Meng et al., 2020	78	Climate	MAT	ACP ALP	Positive
Margalef et al., 2021	13	Climate	MAT	ACP, ALP	None
Margalef et al., 2021	11	Climate	Drought	ACP, ALP	Negative
Margalef et al., 2021	37	Climate	CO <sub>2</sub> fertilization	ACP, ALP	Positive
Gao et al., 2020	97	Climate	Drought	ACP	Negative
	15			ALP	

\* When data is accessible, the number of observations evaluating APase activity in cropland, farmland, and grassland is provided.

## Tables S3 to S20

Summary and comprehensive tables inclusive of references.

*Table S3. Single studies of APase response relationships to soil microbe and fauna factors.*

Soil microbe/fauna factor	APase	Response relationship	Vote counting	Study
Total microbe activity	ACP	Positive	9	Boccolini et al., 2019; Bolton et al., 1985; Chellappa et al., 2021; Datta et al., 2021; Nath et al., 2017; Nedunchezhiyan et al., 2018; Radhakrishnan et al., 2022; Stegarescu et al., 2021; Tu C.M., 1995;
	ALP	Positive	4	Datta et al., 2021; Delgado et al., 2012; Nedunchezhiyan et al., 2018; Singh et al., 2022;
Microbe abundance (Bacteria, Actinobacteria, Fungi)	ACP	Positive	11	Carricondo-Martínez et al., 2022; Chen et al., 2018; Chowdhury and Rasid, 2021b; Dolker et al., 2020; Idris and Yuliar, 2021; Li et al., 2002; Meher et al., 2021; Sanchez-Peinado et al., 2009; Swędrzyńska et al., 2013; Tarafdar et al., 1989; Yu et al., 2021;
	ALP	Positive	12	Al-Taweel et al., 2019; Firmano et al., 2021; Idris and Yuliar, 2021; Lemanowicz et al., 2016; Li et al., 2017a; Li et al., 2002; Meher et al., 2021; Niewiadomska et al., 2016; Tamilselvi et al., 2015; Tarafdar et al., 1989; Xu et al., 2019; Yu et al., 2021;
Microbial biomass phosphorus content	ACP	Positive	6	Basak and Gajbhiye, 2018;

				de Jesus Franco et al., 2020; Katsalirou et al., 2016; Moharana et al., 2022; Redel et al., 2011; Turner and Haygarth, 2005;
	ALP	Positive	6	Basak and Gajbhiye, 2018; Hu et al., 2009a; Katsalirou et al., 2016; Moharana et al., 2022; Touhami et al., 2021; Zhou et al., 2022;
Microbial biomass carbon content	ACP	Positive	36	Ansari et al., 2021; Antolín et al., 2005; Arora et al., 2021; Balota et al., 2011b; Banerjee et al., 1999; Bhattacharyya et al., 2003; Biswas et al., 2018; Borase et al., 2021; Choudhary et al., 2021; Chowdhury and Rasid, 2021a; Chowdhury and Rasid, 2021b; da Cunha et al., 2021; de Barros et al., 2019; de Castro Lopes et al., 2013; de Jesus Franco et al., 2020; Feng et al., 2021; Furtak et al., 2017; Gelsomino et al., 2011; Hazarika et al., 2009; He et al., 2010; Katsalirou et al., 2016; Li et al., 2012; Liu et al., 2008; Lungmuana et al., 2019; Mahajan et al., 2021; Mandal et al., 2007; Pascual et al., 2007; Rouydel et al., 2021; Roy et al., 2019; Sarkar et al., 2009; Sudhakaran et al., 2019; Tamilselvi et al., 2015; Turner and Haygarth, 2005;

		Negative	1	Tuti et al., 2020; Wei et al., 2017; Woźniak et al., 2022; Bera et al., 2016;
ALP		Positive	38	Acosta-Martínez et al., 2004; Acosta-Martínez et al., 2011a; Arora et al., 2021; Bera et al., 2016; Bissonette et al., 2001; Biswas et al., 2018; Borase et al., 2021; Chander et al., 1997; Chaudhary et al., 2015; Choudhary et al., 2021; Dar G., 1996; Dong et al., 2016; Gelsomino et al., 2011; He et al., 2010 Hojati and Nourbakhsh, 2006; Katsalirou et al., 2016; Kaur et al., 2017; Li et al., 2017a; Li et al., 2012; Liu and Zhou, 2017; Lungmuana et al., 2019; Madejón et al., 2007 Mandal et al., 2007 Mbarki et al., 2010 Melero et al., 2007a; Pascual et al., 2007 Rouydel et al., 2021; Roy et al., 2019; Sarkar et al., 2009; Sepat et al., 2014; Sudhakaran et al., 2019; Tamilselvi et al., 2015; Tripathi et al., 2007; Tuti et al., 2020; Verma et al., 2016b; Wang et al., 2014a; Wick et al., 1998; Zhao et al., 2009;
Microbial biomass nitrogen content	ACP	Positive	10	Ajwaa et al., 1999; Borase et al., 2021;

				de Jesus Franco et al., 2020; Furtak et al., 2017; Gelsomino et al., 2011; Katsalirou et al., 2016; Lungmuana et al., 2019; Sarkar et al., 2009; Sudhakaran et al., 2019; Woźniak et al., 2022;
	ALP	Positive	10	Acosta-Martínez et al., 2011a; Borase et al., 2021; Dong et al., 2016; Gelsomino et al., 2011; Katsalirou et al., 2016; Lungmuana et al., 2019; Mandal et al., 2007 Sarkar et al., 2009; Sepat et al., 2014; Sudhakaran et al., 2019;
Microbe diversity (Shannon diversity index)	ACP	Positive	3	Diallo-Diagne et al., 2016;  Sun et al., 2018;  Woźniak et al., 2022;
	ALP	Positive	2	Cao et al., 2021; Liu et al., 2021a;
phoD gene abundance and richness	ALP	Positive	3	Bi et al., 2020  Gou et al., 2020; Wang et al., 2022c;
Earthworm abundance	ACP	Positive	2	Noronha et al., 2022;  Saha et al., 2008a;
		None	1	Wu et al., 2012;
	ALP	Positive	3	Balachandar et al., 2021; Buck et al., 2000; Tao et al., 2009;
		None	1	Stoven and Schnug, 2009;



*Table S4. Single and meta-analysis studies of APase response relationships to soil physical properties.*

Soil property	APase (single <sup>1</sup> or meta- analysis <sup>2</sup> study)	Response relationships	Vote counting	Study
Depth	ACP <sup>1</sup>	Negative	26	Baligar et al., 2005; Bolton et al., 1993; Cao et al., 2021; de Barros et al., 2019; de Castro Lopes et al., 2021; Denton et al., 2006; Fialho et al., 2008; Firmano et al., 2021; Gelsomino et al., 2011; Guo et al., 2009 Kahle et al., 2010; Kumar et al., 2021a; Lemanowicz et al., 2016; Rao et al., 1995; Sigua et al., 2017; Tarafdar et al., 1989; Taylor et al., 2002; Tiecher et al., 2012; Trujillo-Narcía et al., 2019; Venkatesan et al., 2006 Wang et al., 2011c; Wang et al., 2012; Yoshioka et al., 2006; Zhang et al., 2016b; Zhong et al., 2015; Zhu et al., 2022;
	ALP <sup>1</sup>	Negative	18	Cao et al., 2021; Caudle et al., 2020; de Barros et al., 2019; Dou et al., 2016; Gelsomino et al., 2011; Guo et al., 2009 Jat et al., 2019; Kumar et al., 2021a; Lalande et al., 2009; Lemanowicz et al., 2016; Mahmood et al., 2022; Melero et al., 2008b;

				Melero et al., 2011; Rao et al., 1995; Rao et al., 1997; Stehouwer et al., 1993; Tarafdar et al., 1989; Zhang et al., 2018;
Soil moisture content	ACP <sup>1</sup>	Positive	5	Gispert et al., 2013;  Hoyle and Murphy, 2006; Lungmuana et al., 2019; Omenda et al., 2019; Stegarescu et al., 2021;
	ALP <sup>1</sup>	Positive	2	Gangwar et al., 2021; Monaci et al., 2022;
		None	1	Wang et al., 2022a;
Clay content	ACP <sup>1</sup>	Positive	10	Acosta-Martínez et al., 2003b; Bossio et al., 2005; Cycoń et al., 2013; Cycoń Piotrowska-Seget, 2015; de Castro Lopes et al., 2013; Fernández et al., 2008; Mejia Guerra et al., 2018; Nedyalkova et al., 2020; Nedyalkova et al., 2020; Sudhakaran et al., 2019;
	ALP <sup>1</sup>	Positive	21	Abdalla and Lager, 2009; Acosta-Martínez et al., 2003b; Acosta-Martínez et al., 2003a; Banerjee et al., 2008; Bergstrom and Monreal, 1998a; Calvarro et al., 2014; Cycoń et al., 2013; Dar G., 1996; Fernández et al., 2008;
				Gelsomino et al., 2011; Li et al., 2018c; Łukowski and Dec, 2018;

				Mahmood et al., 2022; Melero et al., 2007a; Senwo et al., 2007; Stehouwer et al., 1993; Stenberg et al., 1998; Sudhakaran et al., 2019; Tavali et al., 2021; Vekemans et al., 1989; Wyszkowska et al., 2005;
	ACP, ALP <sup>2</sup>	Positive	1	Aponte et al., 2020;
Sand content	ACP <sup>1</sup>	Positive	1	Acosta-Martínez et al., 2003b;
		Negative	3	Fernández-Calviño et al., 2010; Nedyalkova et al., 2020; Woźniak et al., 2022;
	ALP <sup>1</sup>	Positive	3	Acosta-Martínez et al., 2003b; Bergstrom and Monreal, 1998a; Wyszkowska et al., 2005;
		Negative	3	Garg and Bahl, 2008; Gelsomino et al., 2011; Łukowski and Dec, 2018;
Microaggregate content (<0.25 mm)	ACP <sup>1</sup>	Negative	1	Wei et al., 2014b;
	ALP <sup>1</sup>	Negative	2	Sharma et al., 2019a; Wei et al., 2014a

*Table S5. Single and meta-analysis studies of APase response relationships to soil pH and associated factors.*

Soil pH factor	APase (single <sup>1</sup> or meta-analysis <sup>2</sup> study)	Response relationship	Vote counting	Study
pH	ACP <sup>1</sup>	Negative at pH >7	50	Acosta-Martínez and Tabatai, 2000; Alvarenga et al., 2008; Bachmann et al., 2014; Balota et al., 2011b; Bera et al., 2016; Bi et al., 2020; Biswas et al., 2018; Borase et al., 2021; Caballero Vanegas et al., 2018; Chakrabarti et al., 2000; Chang et al., 2007; Chen et al., 2021a; Dick et al., 2000; Fernández-Calviño et al., 2010 Firmano et al., 2021; Futa et al., 2021; Gaiind and Nain, 2015b; Ghiloufi and Chaieb, 2021; Gispert et al., 2013; Gupta et al., 1988; Hu et al., 2019a; Juma and Tabatai, 1988; Katsalirou et al., 2016; Kunito et al., 2001; Laxminarayana K., 2017; Li et al., 2021a; Li et al., 2009; Liu et al., 2008; Martyniuk et al., 2019; Masto et al., 2013;

Meli et al., 2002;  
Mullen et al., 1998;  
Nakas et al., 1987;  
Nedunchezhiyan et al., 2018;  
Nedyalkova et al., 2020;  
Nurulitaa et al., 2016;

ACP <sup>2</sup>	Negative at pH >7	3	<p>Ortiz et al., 2020;</p> <p>Pan et al., 2018;</p> <p>Roldán et al., 2007;</p> <p>Singh et al., 2012b;</p> <p>Stege et al., 2009;</p> <p>Sun et al., 2019;</p> <p>Tripathi et al., 2007;</p> <p>Trujillo-Narcía et al., 2019;</p> <p>Turner and Haygarth, 2005;</p> <p>Vanlalveni and Lalfakzuala, 2018;</p> <p>Venkatesan et al., 2006;</p> <p>Wang et al., 2017;</p> <p>Wang et al., 2021c;</p> <p>Woźniak et al., 2022;</p> <p>Janes-Bassett et al., 2022;</p> <p>Pokharel et al., 2020;</p> <p>Sun et al., 2020;</p>
ALP <sup>1</sup>	Positive at pH >7	45	<p>Abdalla and Lager, 2009;</p> <p>Acosta-Martínez and Tabatai, 2000;</p> <p>Bachmann et al., 2014;</p> <p>Basak et al., 2017;</p> <p>Bera et al., 2016;</p> <p>Bi et al., 2020;</p> <p>Biswas et al., 2018;</p> <p>Borase et al., 2021;</p> <p>Caballero Vanegas et al., 2018;</p> <p>Carpenter-Boggs et al., 2003;</p> <p>Chang et al., 2007;</p> <p>Dick et al., 1988;</p> <p>Dick et al., 2000;</p> <p>Dinesh et al., 1998;</p> <p>Firmano et al., 2021;</p> <p>Gelsomino et al., 2011;</p> <p>Graça et al., 2021;</p>

				<p>Guo et al., 2009</p> <p>Gupta et al., 1988;</p> <p>Katsalirou et al., 2016;</p> <p>Kunito et al., 2001;</p> <p>Laxminarayana K., 2017;</p> <p>Li et al., 2017a;</p> <p>Li et al., 2009;</p> <p>Madejón et al., 2003;</p> <p>Mandal et al., 2018;</p> <p>Melero et al., 2008a</p> <p>Melero et al., 2009;</p> <p>Meli et al., 2002;</p> <p>Monkiedje et al., 2006;</p> <p>Nath et al., 2021;</p> <p>Nedunchezhiyan et al., 2018;</p> <p>Rouydel et al., 2021;</p> <p>Senwo et al., 2007</p> <p>Shi et al., 2020;</p> <p>Siebielec et al., 2018;</p> <p>Singh et al., 2012b;</p> <p>Singh et al., 2020;</p> <p>Stege et al., 2009;</p> <p>Tavali et al., 2021;</p> <p>Tripathi et al., 2007;</p> <p>Truu et al., 2008;</p> <p>Wang et al., 2022c;</p> <p>Wojewódzki et al., 2022;</p> <p>Yu et al., 2021</p>
	ALP <sup>2</sup>	Positive at pH >7	3	<p>Janes-Bassett et al., 2022;</p> <p>Pokharel et al., 2020;</p> <p>Sun et al., 2020;</p>
Cation exchange capacity	ACP <sup>1</sup>	Positive	1	Gonnety et al., 2012;
		Negative	1	Senwo et al., 2007;
	ALP <sup>1</sup>	Positive	1	Gonnety et al., 2012;

		Negative	1	Senwo et al., 2007; Valarini et al., 2003;
Electrical conductivity	ACP <sup>1</sup>	Positive	3	Arora et al., 2021;  Liu et al., 2008; Venkatesan et al., 2006;
	ALP <sup>1</sup>	Positive	7	Al-Taweel et al., 2019; Arora et al., 2021; Guo et al., 2009; Melero et al., 2008a; Melero et al., 2009; Monkiedje et al., 2006; Singh et al., 2012b;
Chlorine anion content	ACP <sup>1</sup>	Negative	1	Dinesh et al., 1995;
Carbonate content	ACP <sup>1</sup>	Negative	2	Dick et al., 2000;  Siddaramappa et al., 1994;
	ALP <sup>1</sup>	Positive	2	Dick et al., 2000; Mahmood et al., 2022;
Iron content	ACP <sup>1</sup>	Positive	1	Maini et al., 2022;
	ALP <sup>1</sup>	Positive	3	Maini et al., 2022; Senwo et al., 2007; Yu et al., 2006;
Exchangeable aluminium content	ACP <sup>1</sup>	Positive	1	Meena et al., 2021;

*Table S6. Single studies of APase response relationships to levels of soil salinity.*

APase	Response relationship	Vote counting	Study
ACP	Negative	3	Garcia and Hernández, 1996; Rouydel et al., 2021; Sadeghi and Taban, 2021;
ALP	Negative	2	Al-Taweel et al., 2019; Fitriatin et al., 2018;



*Table S7. Single and meta-analysis studies of APase response relationships to soil carbon content.*

Soil carbon variable	APase (single <sup>1</sup> or meta-analysis <sup>2</sup> study)	Response relationship	Vote counting	Study
Soil organic carbon/matter	ACP <sup>1</sup>	Positive	53	<p>Acosta-Martínez et al., 2003b;</p> <p>Acosta-Martínez et al., 2004;</p> <p>Avila-Salem et al., 2020;</p> <p>Babu et al., 2020;</p> <p>Baligar et al., 2005;</p> <p>Balota et al., 2011b;</p> <p>Bobul'ská et al., 2015;</p> <p>Borase et al., 2021;</p> <p>Butterly et al., 2011;</p> <p>Chang et al., 2007;</p> <p>Chellappa et al., 2021;</p> <p>Chen et al., 2021c;</p> <p>Choudhary et al., 2021;</p> <p>D'Ascoli et al., 2006;</p> <p>de Varennes and Torres, 2011;</p> <p>Eivazi et al., 2003;</p> <p>Evald et al., 2021;</p> <p>Fernández-Calviño et al., 2010;</p> <p>Gaind and Singh, 2016;</p> <p>Green et al., 2007;</p> <p>Hazarika et al., 2009;</p> <p>Katsalirou et al., 2016;</p> <p>Laxminarayana K., 2017;</p> <p>Li et al., 2021a;</p> <p>Lungmuana et al., 2019;</p> <p>Mahajan et al., 2021;</p> <p>Maini et al., 2022;</p> <p>McCallister et al., 2002;</p> <p>Monkiedje et al., 2006;</p>

			Mullen et al., 1998; Omenda et al., 2019; Pan et al., 2018; Ramdas et al., 2016; Rietz and Haynes, 2003; Roy et al., 2019; Sangma et al., 2016; Šarapatka et al., 2004; Sarkar et al., 2020; Sharma et al., 2013a; Sharma et al., 2019a; Singh et al., 2018b; Singh et al., 2021; Siwik-Ziomek et al., 2014; Soon et al., 2000; Sudhakaran et al., 2019; Tarafdar et al., 1989; Truu et al., 2008; Tuti et al., 2020; Venkatesan et al., 2006; Wang et al., 2011b; Wei et al., 2017; Yu et al., 2006; Zuazo et al., 2020; Sun et al., 2020;
ACP <sup>2</sup>	Positive	1	
ALP <sup>1</sup>	Positive	47	Acosta-Martínez et al., 2003b; Acosta-Martínez et al., 2004; Arora et al., 2021; Bhattachayya et al., 2008; Blaise and Rao, 2004; Bobul'ská et al., 2015; Borase et al., 2020; Borase et al., 2021; Cao et al., 2022; Cattaneo et al., 2014; Chang et al., 2007;

Chocano et al., 2016;  
Choudhary et al., 2018c;  
Choudhary et al., 2021;  
Cui et al., 2015;  
Eivazi et al., 2003;  
Gaind and Singh, 2016;  
Gangwar et al., 2021;  
Ghosh et al., 2019;  
Laxminarayana K., 2017;  
Li et al., 2017b;  
Liu et al., 2017;  
Łukowski and Dec, 2018;  
Lungmuana et al., 2019;  
Madejón et al., 2007;  
Maini et al., 2022;  
Melero et al., 2006;  
Mullen et al., 1998;  
Rietz and Haynes, 2003;  
Roy et al., 2019;  
Sepat et al., 2014;  
Sharma et al., 2015;  
Sharma et al., 2019a;  
Shi et al., 2020;  
Singh et al., 2018b;  
Singh et al., 2021;  
Siwik-Ziomek et al., 2014;  
Sudhakaran et al., 2019;  
Tarafdar et al., 1989;  
Truu et al., 2008;  
Tuti et al., 2020;  
Vekemans et al., 1989;  
Verma et al., 2016a;  
Wang et al., 2011b;  
Yu et al., 2006;  
Yu et al., 2021;  
Zhao et al., 2009;

	ALP <sup>2</sup>	Positive	1	Pokharel et al., 2020;
Total organic carbon	ACP <sup>1</sup>	Positive	10	Borase et al., 2021;  da Silva Xavier et al., 2020; Franco-Otero et al., 2012; Futa et al., 2021; Gelsomino et al., 2011; Kobierski and Lemanowicz, 2016; Kobierski et al., 2017; Liu et al., 2008; Sarkar et al., 2009; Tiecher et al., 2017;
		Negative	1	Wojewódzki et al., 2022;
	ALP <sup>1</sup>	Positive	11	Bera et al., 2016; Borase et al., 2021; Futa et al., 2021; Guo et al., 2009; Kobierski and Lemanowicz, 2016; Melero et al., 2007b; Melero et al., 2008a; Melero et al., 2009; Melero Sánchez et al., 2008; Sarkar et al., 2009; Sharma et al., 2019b;
Dissolved organic carbon	ACP <sup>1</sup>	Positive	3	Basak and Gajbhiye, 2018;  Franco-Otero et al., 2012; Hazarika et al., 2009;
	ALP <sup>1</sup>	Positive	5	Basak and Gajbhiye, 2018; Calvarro et al., 2014; Madejón et al., 2007; Sharma et al., 2019b; Wojewódzki et al., 2022;

*Table S8. Single and meta-analysis studies of APase response relationships to soil content of nitrogen forms and soil C:N ratios.*

<b>Nitrogen form/ratio</b>	<b>APase (single<sup>1</sup> or meta-analysis<sup>2</sup> study)</b>	<b>Response relationship</b>	<b>Vote counting</b>	<b>Study</b>
Nitrate nitrogen	ACP <sup>1</sup>	Positive	1	Roy et al., 2019;
		Negative	2	Schaller K., 2003; Wang et al., 2021c;
	ALP <sup>1</sup>	Positive	1	Roy et al., 2019;
		Negative	1	Verma et al., 2016a;
		None	2	Adrover et al., 2017; Wang et al., 2022b;
Ammonium nitrogen	ACP <sup>1</sup>	Positive	2	Liu et al., 2008; Roy et al., 2019;
		None	1	Wang et al., 2013a;
	ALP <sup>1</sup>	Positive	2	Roy et al., 2019; Monkiedje et al., 2006;
		None	1	Wang et al., 2022a;
Total nitrogen (Kjeldahl method)	ACP <sup>1</sup>	Positive	15	Baligar et al., 2005; Chen et al., 2021b; Chen et al., 2021a; Fernández-Calviño et al., 2010; Gelsomino et al., 2011; Green et al., 2007; Katsalirou et al., 2016; Laxminarayana K., 2017; Li et al., 2021a; Mandal et al., 2007; Qaswar et al., 2019; Sudhakaran et al., 2019; Tamilselvi et al., 2015; Turner and Haygarth, 2005; Wang et al., 2011b;
	ACP <sup>2</sup>	Positive	1	Sun et al., 2020;
	ALP <sup>1</sup>	Positive	18	Acosta-Martínez et al., 2004; Cattaneo et al., 2014;

				Dinesh et al., 1998; Gelsomino et al., 2011; Guo et al., 2009; Katsalirou et al., 2016; Laxminarayana K., 2017; Li et al., 2017a; Liu et al., 2017; Mandal et al., 2007; Melero et al., 2007b; Melero Sánchez et al., 2008; Shi et al., 2020; Tan et al., 2014; Truu et al., 2008; Vekemans et al., 1989; Wang et al., 2011b; Wojewódzki et al., 2022;
Soil C:N ratio	ACP <sup>1</sup>	Positive	1	Liu et al., 2008;
	ALP <sup>1</sup>	Positive	1	Singh and Ghoshal, 2013;

*Table S9. Single and meta-analysis studies of APase response relationships to soil content of phosphorus forms and carbon:phosphorus ratios.*

Phosphorus form/ratio	APase (single <sup>1</sup> or meta-analysis <sup>2</sup> study)	Response relationship	Vote counting	Study
Labile inorganic phosphorus (Pi)	ACP <sup>1</sup>	Negative	10	Alves et al., 2021; Arruda et al., 2018;  Castillo et al., 2017; Gao et al., 2016; Ohm et al., 2017; Romanya et al., 2017; Schoebitz et al., 2020; Simanca Fontalvo and Cuervo Andrade, 2018; Tarafdar and Claassen, 1988; Teng et al., 2013;
	ALP <sup>1</sup>	Negative	5	Fereidooni et al., 2013;

				Mahmood et al., 2022; Niewiadomska et al., 2020a; Recena et al., 2015; Simanca Fontalvo and Cuervo Andrade, 2018;
Soil solution phosphorus	ACP <sup>1</sup>	Positive	23	Arora et al., 2021;  Atoloye et al., 2021; Babu et al., 2020; Futa et al., 2021; Guo et al., 2009; Kamh et al., 1999; Kobierski and Lemanowicz, 2016; Kobierski et al., 2017; Laxminarayana K., 2017; Li et al., 2018a; Liu et al., 2008; Lungmuana et al., 2019; Mahajan et al., 2021; Maini et al., 2022; Nedunchezhiyan et al., 2018; Ortiz et al., 2020; Qaswar et al., 2019; Sharma et al., 2019a; Sharpley et al., 1995; Singh et al., 2012a; Tarafdar et al., 1989; Yuan et al., 2022; Zhong et al., 2007; Saha et al., 2008a; Koczorski et al., 2021; Waldrop et al., 2000; Wojewódzki et al., 2022;
		Negative	1	
		None	3	
	ALP <sup>1</sup>	Positive	16	Arora et al., 2021; Futa et al., 2021; Garg and Bahl, 2008;

				Guo et al., 2021; Kobierski and Lemanowicz, 2016; Laxminarayana K., 2017; Liu et al., 2017; Lungmuana et al., 2019; Maini et al., 2022; Sharma et al., 2019a; Tarafdar et al., 1989; Verma et al., 2016a; Wang et al., 2021a; Wang et al., 2021b; Wojewódzki et al., 2022; Zhao et al., 2009;
		Negative	2	Madejón et al., 2003; Saha et al., 2008a;
		None	2	Koczorski et al., 2021; Wang et al., 2022a;
Olsen phosphorus	ACP <sup>1</sup>	Positive	7	Basak et al., 2017; Basak and Gajbhiye, 2018; Moharana et al., 2022; Roy et al., 2019; Singh et al., 2018b; Yin et al., 2021; Zhang et al., 2019a;
	ACP <sup>1</sup>	Negative	1	Wang et al., 2021c;
	ACP <sup>2</sup>	Negative	1	Sun et al., 2020;
	ALP <sup>1</sup>	Positive	8	Atoloye et al., 2021; Basak and Gajbhiye, 2018; Melero et al., 2007b; Melero Sánchez et al., 2008; Moharana et al., 2022; Roy et al., 2019; Sharma et al., 2015; Singh et al., 2018b;
		Negative	4	Fraser et al., 2015; Katsalirou et al., 2016;



				Soni et al., 2021; Yu et al., 2006;
Organic phosphorus	ACP <sup>1</sup>	Positive	6	Moharana et al., 2022;  Silva et al., 2015; Tarafdar et al., 1989; Turner and Haygarth, 2005; Wang et al., 2011c; Wei et al., 2021;
	ALP <sup>1</sup>	Positive	5	Dey et al., 2019; Guo et al., 2009; Moharana et al., 2022; Recena et al., 2015; Tarafdar et al., 1989;
Labile organic phosphorus (Po)	ACP <sup>1</sup>	Negative	3	Kamh et al., 1999; Wang et al., 2022b;  Wu et al., 2012;
	ACP <sup>2</sup>	Negative	1	Sun et al., 2020;
	ALP <sup>1</sup>	Negative	1	de Santiago-Martín et al., 2013;
Soil carbon: phosphorus ratio	ACP <sup>1</sup>	Positive	1	Li et al., 2021a;

*Table S10. Single studies of APase response relationships to soil available potassium content.*

APase	Response relationship	Vote counting	Study
ACP	Positive	6	Arora et al., 2021; Koczorski et al., 2021; Laxminarayana K., 2017; Mahajan et al., 2021; Nedunchezhiyan et al., 2018; Venkatesan et al., 2006;
ALP	Positive	6	Arora et al., 2021; Koczorski et al., 2021; Laxminarayana K., 2017; Roy et al., 2019;

*Table S11. Single and meta-analysis studies of APase response relationships to land use change.*

Land use	APase (single <sup>1</sup> or meta-analysis <sup>2</sup> study)	Response relationship	Vote counting	Study
Ungrazed grassland, meadow, pasture	ACP <sup>1</sup>	Positive	25	Acosta-Martínez et al., 2008;  Avila-Salem et al., 2020; Carlos et al., 2022; Chen et al., 2004; Damian et al., 2021; Gonnety et al., 2012; Graça et al., 2021; Izquierdo et al., 2003; Katsalirou et al., 2016; Kremer and Li, 2003; Lebrun et al., 2012; Li et al., 2017b; Notaro et al., 2018; Ohm et al., 2017; Pan et al., 2018; Pankhurst et al., 1995; Paz-Ferreiro et al., 2009; Raiesi F., 2007 Reardon et al., 2016; Šarapatka et al., 2004; Serri et al., 2018; Shi et al., 2013; Silvestro et al., 2017; Tiecher et al., 2012; Vinhai-Freitas et al., 2017;
	ALP <sup>1</sup>	Positive	13	Acosta-Martínez et al., 2008; Cattaneo et al., 2014; Cui et al., 2019; Dong et al., 2016; Gonnety et al., 2012; Graça et al., 2021; Katsalirou et al., 2016; Kremer and Li, 2003;

				Lebrun et al., 2012; Notaro et al., 2018; Ohm et al., 2017; Raiesi F., 2007; Saviozzi et al., 2001;
Revegetation				
Natural vegetation	ACP <sup>1</sup>	Positive	1	Aon and Colaneri, 2001;
Non cultivated	ACP <sup>1</sup>	Positive	1	Dick et al., 1994
Recolonization trees	ACP <sup>1</sup>	Positive	1	Garcia et al., 1997;
Reconstruction prairie	ACP <sup>1</sup>	Positive	1	García-Orenes et al., 2010;
Spontaneous recovery	ACP <sup>1</sup>	Positive	3	Li et al., 2021a;  Lungmuana et al., 2019; Sciubba et al., 2021;
Plant invasion	ACP, ALP <sup>2</sup>	Positive	1	Margalef et al., 2021;
Forest clearance for cropland	ACP <sup>1</sup>	Negative	11	Barcelos Martins et al., 2019;  Caravaca et al., 2002; de Oliveira Silva et al., 2019; Dormaar and Willms, 2000; Garcia et al., 1997; Guo et al., 2009 Hernández-Vigoa et al., 2018 Katsalirou et al., 2016; Leirós et al., 1999; Raiesi F., 2007; Serri et al., 2018;
	ALP <sup>1</sup>	Negative	3	Guo et al., 2009; Katsalirou et al., 2016; Raiesi F., 2007
Afforestation	ACP <sup>1</sup>	Positive	10	Arora et al., 2021; Brackin et al., 2014; Figueira da Silva et al., 2020; Garcia et al., 1997; Kooch et al., 2019; Li et al., 2021a; Martins Sousa et al., 2020; Nurulitaa et al., 2016; Singh et al., 2012a; Ventura et al., 2021;
	ALP <sup>1</sup>	Positive	7	Arora et al., 2021; Cui et al., 2019; Dilly O., 1999; Lungmuana et al., 2019;

*Table S12. Single studies of APase response relationships to crop rotation composition and cover cropping.*

Crop rotation type/property	APase	Response relationship	Vote counting	Study
Crop rotation	ACP	Positive	14	Alvey et al., 2001; Chen et al., 2018; Eichler-Löbermann et al., 2021; Ferrerias et al., 2009; He et al., 2010; Inal et al., 2007; Jain et al., 2018; Koczorski et al., 2021; Nayyar et al., 2009 Qaswar et al., 2019; Redel et al., 2011; Siwik-Ziomek et al., 2014; Woźniak and Kawecka-Radomska, 2016; Yu et al., 2021;
	ALP	Positive	13	Acosta-Martínez et al., 2003a; Acosta-Martínez et al., 2011a; Alvey et al., 2001; Borase et al., 2020; Eichler-Löbermann et al., 2021; Gou et al., 2020; Habig and Swanepoel, 2018; He et al., 2010 Jain et al., 2018; Koczorski et al., 2021; Saad et al., 2018; Siwik-Ziomek et al., 2014; Yu et al., 2021;
	ACP	Positive	2	Eichler-Löbermann et al., 2021; Nath et al., 2021;
Cereal-legumes	ALP	Positive	2	Eichler-Löbermann et al., 2021;

Cereal-based	ACP	Positive	4	Nath et al., 2021; Acosta-Martínez et al., 2003b; Chen et al., 2021a; Datta et al., 2021; Dick et al., 1988;
	ALP	Positive	7	Acosta-Martínez et al., 2003b; Choudhary et al., 2018b; Datta et al., 2021; Dick et al., 1988; Gajda and Martyniuk, 2005; Wick et al., 1998; Zhang et al., 2018;
Cover crops	ACP	Positive	13	Adetunji et al., 2021; Boccolini et al., 2019; Chavarría et al., 2016; Cui et al., 2015; de Castro Lopes et al., 2021; Feng et al., 2021; Mullen et al., 1998; Pérez Brandan et al., 2017; Ramos et al., 2011; Ramos et al., 2010; Stegarescu et al., 2021; Takeda et al., 2009; Ventura et al., 2021;
	ALP	Positive	8	Cui et al., 2015; Feng et al., 2021; Hai-Ming et al., 2014; Melero et al., 2007a; Mullen et al., 1998; Niewiadomska et al., 2020b; Thapa et al., 2021; Wang et al., 2021b;
Intercropping	ACP	Positive	4	Balota et al., 2010; Gunes et al., 2007; Koczorski et al., 2021; Roohi et al., 2020;
	ALP	Positive	3	Koczorski et al., 2021; Roohi et al., 2020; Li et al., 2021b;
Intercropping+fertilization	ACP	Positive	1	Rezaei-Chiyaneh et al., 2021;
	ALP	Positive	3	Pittarello et al., 2021; Rezaei-Chiyaneh et al., 2021; Wang et al., 2014b;

Intercropping with legumes	ACP	Positive	2	Balota et al., 2010; Lo Presti et al., 2021;
Wheat vs maize/rice	ACP	Positive	2	Furtak et al., 2017; Masto et al., 2006;
	ALP	Positive	3	Furtak et al., 2017; Masto et al., 2006; Tao et al., 2009;
Legumes vs wheat/rice	ACP	Positive	11	Ansari et al., 2021; Aparna et al., 2016; Borase et al., 2021; Gunes et al., 2007 Kumar et al., 2017; Li et al., 2021b; Lo Presti et al., 2021; Nuruzzaman et al., 2006; Ohm et al., 2017; Raghurama et al., 2022; Singh et al., 2021;
	ALP	Positive	7	Acosta-Martínez et al., 2004; Aparna et al., 2016; Borase et al., 2021; Datta et al., 2021; Kumar et al., 2017; Singh et al., 2021; Yu et al., 2021;
Horticulture vs maize	ACP	Positive	4	Avila-Salem et al., 2020; Lago et al., 2019; Maini et al., 2022; Monkiedje et al., 2006;
	ALP	Positive	2	Maini et al., 2022; Monkiedje et al., 2006;
Barley vs horticulture	ACP	Positive	1	Moreno et al., 1998;
Monoculture maize vs others	ACP	Positive	8	Bossio et al., 2005;  Dora et al., 2006; Fialho et al., 2008; Mankolo et al., 2006; Roohi et al., 2020; Savin et al., 2009; Serafim et al., 2019; Wang et al., 2017;
	ALP	Positive	4	Bossio et al., 2005; Dora et al., 2006; Roohi et al., 2020;

Monoculture lupine vs others	ACP	Positive	4	Savin et al., 2009; Lo Presti et al., 2021; Redel et al., 2007; Schoebitz et al., 2020; Touhami et al., 2021;
	ALP	Positive	2	Touhami et al., 2021; Wyszkowska et al., 2019;
Monoculture sorghum vs others	ACP	Positive	2	Alvey et al., 2001; Neal et al., 2021;
	ALP	Positive	2	Dou et al., 2016; Neal et al., 2021;
Monoculture transgenic cotton vs cotton	ACP	Positive	2	Beura and Rakshit, 2013; Sarkar et al., 2009;
	ALP	Positive	3	Beura and Rakshit, 2013; Mandal et al., 2018; Sarkar et al., 2009;
Monoculture transgenic rice vs rice	ACP	None	2	Zhaolei et al., 2017; Wei et al., 2012

Table S13. Single studies of response relationships of APase to tillage practices.

Tillage practice	APase	Response relationship	Vote counting	Study
Conventional tillage vs others	ACP	Positive	4	Acosta-Martínez et al., 2003b; de Varennes and Torres, 2011; Niewiadomska et al., 2016; Woźniak, A., 2019;
		Negative	8	Balota et al., 2004; Balota et al., 2011a; Bini et al., 2014; Carter et al., 2007 Farhangi-Abriz et al., 2021; Jaskulska R., 2020a; Peixoto et al., 2010 Swędryńska et al., 2013;
	ALP	Positive	4	Acosta-Martínez et al., 2003a; Acosta-Martínez et al., 2003b; Niewiadomska et al., 2016; Soni et al., 2021;
		Negative	3	Balota et al., 2004; Jaskulska R., 2020a; Niewiadomska et al., 2020b;

Reduced tillage vs conventional tillage	ACP	Positive	5	Farhangi-Abriz et al., 2021; Gajda and Przewłoka, 2012; Jaskulska R., 2020a; Ventura et al., 2021; Woźniak and Kawecka-Radomska, 2016;
	ALP	Positive	2	Madejón et al., 2007 Zibilske and Bradford, 2003;
No till vs others	ACP	Positive	24	Balota et al., 2004; Balota et al., 2011a; Barcelos Martins et al., 2019; Caballero Vanegas et al., 2018; Campbell et al., 1989; Chellappa et al., 2021; Eivazi et al., 2003; Green et al., 2007; Hatti et al., 2018; Hazarika et al., 2009; Hu et al., 2019b; Kumar et al., 2017; Mina et al., 2008 Nath et al., 2017; Omid et al., 2008 Peixoto et al., 2020 Redel et al., 2011; Roldán et al., 2007; Sepat et al., 2014; Silvestro et al., 2017; Ventura et al., 2021; Wang et al., 2011a; Wang et al., 2011b; Yang et al., 2019;
	ALP	Positive	21	Acosta-Martinez et al., 2011a; Balota et al., 2004; Bergstrom et al., 1998b; Caballero Vanegas et al., 2018; Carpenter-Boggs et al., 2003; Choudhary et al., 2018a; Habig and Swanepoel, 2018; Kumar et al., 2017; Melero et al., 2011; Mina et al., 2008 Naragund et al., 2020; Omid et al., 2008



				Parihar et al., 2016; Parihar et al., 2016; Sepat et al., 2014; Shahane et al., 2020; Singh et al., 2022; Wang et al., 2011b; Wei et al., 2014b; Xomphoutheb et al., 2020; Yang et al., 2019;
No till + residue retention vs others	ACP	Positive	9	Ahmed et al., 2019; Bini et al., 2014; Chellappa et al., 2021; Malobane et al., 2020; Rabary et al., 2008 Redel et al., 2007; Redel et al., 2011; Wang et al., 2011a; Cao et al., 2021;
	ALP	Positive	1	Wei et al., 2014a;
No till with depth vs others	ACP	Positive	5	Dick W.A., 1984; Doran J.W., 1980; Green et al., 2007; Kumar et al., 2017; Wang et al., 2011a;
	ALP	Positive	6	Angers et al., 1993; Dick W.A., 1984; Kharia et al., 2017; Kumar et al., 2017; Parihar et al., 2020; Shi et al., 2012;

*Table S14. Single and meta-analysis studies of APase response relationships to types of inorganic and organic fertilization and rates.*

Fertilization type	APase (single <sup>1</sup> or meta-analysis <sup>2</sup> study)	Response relationship	Vote counting	Study
Liming	ACP <sup>1</sup>	Positive	3	Bardgett and Leemans, 1995; Meena et al., 2021; Shi et al., 2019a;
		Negative	2	Makoi et al., 2010 Siddaramappa et al., 1994;
	ALP <sup>1</sup>	Positive	3	Acosta-Martínez and Tabatai, 2000;

		Negative	1	Firmano et al., 2021; Lalande et al., 2009; Makoi et al., 2010
Inorganic fertilizer (general)	ACP <sup>1</sup>	Positive	13	Ajwaa et al., 1999; Bardgett and Leemans, 1995; Bi et al., 2018; Bi et al., 2020; Choudhary et al., 2021; de Castro Lopes et al., 2013; Futa et al., 2021; Gaind and Singh, 2016; Damian et al., 2021; Ning et al., 2017; Prasanthi et al., 2019; Rezaei-Chiyaneh et al., 2021; Verdenelli et al., 2013;
		Negative	1	Aparnad et al., 2016;
	ALP <sup>1</sup>	Positive	16	Ajwaa et al., 1999; Aparna et al., 2016; Bi et al., 2018; Bi et al., 2020 Biswas et al., 2021; Choudhary et al., 2021; Dhull et al., 2004; Futa et al., 2021; Goyal et al., 1999; Jain et al., 2018; Joshi et al., 2021; Kumar et al., 2021b; Liu et al., 2010; Manna et al., 2005; Prasanthi et al., 2019; Rezaei-Chiyaneh et al., 2021; Wang et al., 2022a;
		Negative	1	
	ACP, ALP <sup>2</sup>	Positive	1	Miao et al., 2019;
Inorganic nitrogen	ACP <sup>1</sup>	Positive	8	Bardgett and Leemans, 1995; Dick et al., 1988; Guan et al., 2011; Johnson et al., 1998; Kohler et al., 2007; Menge and Field, 2007; Sarma and Gogoi, 2017; Siwik-Ziomek et al., 2014;
		Negative	8	Arruda et al., 2018;

				Chen et al., 2021a; Koper and Lemanowicz, 2008; Mullen et al., 1998; Rakshit et al., 2016; Siwik-Ziomek et al., 2014; Sun et al., 2020; Wang et al., 2021c;
	ACP <sup>2</sup>	Positive	1	Jian et al., 2016;
	ALP <sup>1</sup>	Positive	2	Liu et al., 2017; Siwik-Ziomek et al., 2014;
		Negative	4	Manna et al., 2005; Moreno-Cornejo et al., 2017; Rakshit et al., 2016; Siwik-Ziomek et al., 2014;
	ACP, ALP <sup>2</sup>	Positive	2	Margalef et al., 2021; Marklein and Houlton, 2012;
Inorganic phosphorus	ACP <sup>1</sup>	Negative	8	de Castro Lopes et al., 2013; Gispert et al., 2013; Khandare et al., 2020; Li et al., 2021a; Liang and Elsgaard, 2021; Lo Presti et al., 2021; Silva et al., 2015; Wang et al., 2021c;
		None	3	Guan et al., 2013; Radersma and Grierson, 2004; Randall et al., 2020;
	ALP <sup>1</sup>	Negative	2	Khandare et al., 2020; Svensson et al., 2001;
		None	4	Emami et al., 2022; Shi et al., 2012; Shi et al., 2020; Trabelsi et al., 2017;
	ACP, ALP <sup>2</sup>	Negative	2	Margalef et al., 2021; Marklein and Houlton, 2012;
		None	1	Janes-Bassett et al., 2022;
Organic fertilizers	ACP <sup>1</sup>	Positive	39	Atoloye et al., 2021; Banik et al., 2006; Basak et al., 2017; Bobul'ská et al., 2015; Caballero Vanegas et al., 2018; Carricondo-Martínez et al., 2022;

Chang et al., 2007;  
 Chatterjee et al., 2021;  
 Chen et al., 2003;  
 Chen et al., 2021a;  
 Cicatelli et al., 2014;  
 Dutta et al., 2020;  
 Efthimiadou et al., 2010;  
 Eichler-Löbermann et al., 2021;  
 Gaiind and Singh, 2015a;  
 García-Ruiz et al., 2008;  
 García-Ruiz et al., 2012;  
 Guan et al., 2011;  
 Haynes and Williams, 1999;  
 Jiang et al., 2019;  
 Lalande et al., 2003;  
 Martínez et al., 2018;  
 Moharana et al., 2022;  
 Monokrousos et al., 2006;  
 Moreno et al., 1998;  
 Pajares et al., 2009;  
 Pramanik et al., 2017;  
 Prasanthi et al., 2019;  
 Radhakrishnan et al., 2022;  
 Rao et al., 1997;  
 Ros et al., 2007;  
 Sarkar et al., 2020;  
 Sharma et al., 2013b;  
 Simanca Fontalvo and Cuervo Andrade, 2018;  
 Singh et al., 2015;  
 Singh et al., 2020;  
 Sudhakaran et al., 2019;  
 Tejada et al., 2006;  
 Tuti et al., 2020;

ALP<sup>1</sup>

Positive

43

Adeleke et al., 2021;  
 Aher et al., 2019;  
 Akmal et al., 2019b;  
 Atoloye et al., 2021;  
 Basak et al., 2017;  
 Blaise and Rao, 2004;  
 Bobul'ská et al., 2015;  
 Brennan and Acosta-Martinez, 2019;  
 Caballero Vanegas et al., 2018;

				<p>Chang et al., 2007;  Chatterjee et al., 2021;  Dhull et al., 2004;  Durrer et al., 2021;  Dutta et al., 2020;  Efthimiadou et al., 2010;  Eichler-Löbermann et al., 2021;  Fereidooni et al., 2013;  Gaind and Singh, 2016;  García-Ruiz et al., 2008;  Gigliotti et al., 2001;  Krey et al., 2011;  Kumar et al., 2021a;  Meena et al., 2016;  Melero et al., 2006;  Melero et al., 2007a;  Melero Sanchez et al., 2008;  Melero et al., 2008a;  Melero et al., 2008b;  Moharana et al., 2022;  Monokrousos et al., 2006;  Okur et al., 2006;  Pandey and Pandey, 2009  Prasanthi et al., 2019;  Ram et al., 2019;  Ramanandan et al., 2020;  Rao et al., 1997;  Sharma et al., 2013b;  Singh et al., 2020;  Sudhakaran et al., 2019;  Tavali et al., 2021;  Tejada and Gonzalez, 2007;  Tejada and González, 2009;  Truu et al., 2008;</p>
	ACP, ALP <sup>2</sup>	Positive	1	Miao et al., 2019;
Manure	ACP <sup>1</sup>	Positive	22	<p>Acosta-Martinez et al., 2011b;  Ali et al., 2019;  Antonious C.F., 2009;  Balota et al., 2014;  Bhambure et al., 2018;  Chakrabarti et al., 2000;  Diallo-Diagne et al., 2016;  Dick et al., 1988;  Dinesh et al., 2012;</p>

				Dora et al., 2006; Gopinath et al., 2009; Hazarika et al., 2021; Kobierski et al., 2017; Kuziemska et al., 2020; Li et al., 2012; Mahajan et al., 2021; Mani et al., 2020; Martyniuk et al., 2019; Romanya et al., 2017; Saha et al., 2008a; Tiecher et al., 2017; Xu et al., 2019;
	ALP <sup>1</sup>	Positive	29	Antionious C.F., 2009; Böhme et al., 2005; Chaudhary et al., 2015; Delgado et al., 2012; Dick et al., 1988; Dora et al., 2006; Fereidooni et al., 2013; Fraser et al., 2015; Gaind and Nain, 2010; Garg and Bahl, 2008; Gopinath et al., 2009; Hojati and Nourbakhsh, 2006; Kobierski et al., 2017; Kumar et al., 2021b; Langer and Klimanek, 2006; Li et al., 2012; Liu and Zhou, 2017; Liu et al., 2010; Mani et al., 2020; Manna et al., 2007; Pandey et al., 2008; Qin et al., 2020; Ramesh et al., 2009; Saha et al., 2008a; Saha et al., 2008b; Shi et al., 2019b; Wang et al., 2012; Yang et al., 2018; Zhao et al., 2009;
Manure + mineral fertilizer	ACP <sup>1</sup>	Positive	26	Alguacil et al., 2003; Ali et al., 2019;

Bera et al., 2016;  
 Bhatt et al., 2016;  
 Billah et al., 2020;  
 Biswas et al., 2018;  
 Cao et al., 2022;  
 Choudhary et al., 2021;  
 Damian et al., 2021;  
 Dinesh et al., 2012;  
 Elbl et al., 2019;  
 Gagnon et al., 1999;  
 Hatti et al., 2018;  
 Jiang et al., 2019;  
 Laxminarayana K., 2017;  
 Masto et al., 2006;  
 Meshram et al., 2016;  
 Moro et al., 2021;  
 Omenda et al., 2019;  
 Qaswar et al., 2020;  
 Roohi et al., 2020;  
 Saha et al., 2019;  
 Shao et al., 2014;  
 Singh et al., 2015;  
 Singh et al., 2018b;  
 Wei et al., 2017;

ALP<sup>1</sup>

Positive

26

Akmal et al., 2019a;  
 Bera et al., 2016;  
 Bhatt et al., 2016;  
 Biswas et al., 2018;  
 Cao et al., 2022;  
 Choudhary et al., 2021;  
 Colvan et al., 2001;  
 Gagnon et al., 1999;  
 Goyal et al., 1999;  
 Guo et al., 2021;  
 Jia et al., 2018;  
 Kaur et al., 2017;  
 Laxminarayana K., 2017;  
 Mandal et al., 2007;  
 Manna et al., 2007;  
 Masto et al., 2006;  
 Meshram et al., 2016;  
 Roohi et al., 2020;  
 Saha et al., 2019;  
 Sharma et al., 2015;  
 Singh et al., 2020;

				Singh et al., 2018b; Wei et al., 2017; Wyszkowska and Wyszkowski, 2010; Xu et al., 2018; Zhao et al., 2009;
	ACP, ALP <sup>2</sup>	Positive	1	Miao et al., 2019;
Organic phosphorus	ACP <sup>1</sup>	Positive	1	Guan et al., 2013;
	ALP <sup>1</sup>	Positive	3	Durrer et al., 2021; Shi et al., 2021; Verma et al., 2021;
Vermicompost	ACP <sup>1</sup>	Positive	7	Aechra et al., 2021; Das et al., 2021; Hazarika et al., 2021; Ruiz and Salas, 2019; Saha et al., 2008a; Tejada and Benítez, 2011; Zhang et al., 2020;
	ALP <sup>1</sup>	Positive	6	Becagli et al., 2022; Das et al., 2021; Dubey et al., 2020; Nisha et al., 2019; Tejada and González, 2009; Zhang et al., 2020;
Biostimulant/bioferti lizer (±microorganisms)	ACP <sup>1</sup>	Positive	11	Aechra et al., 2021;  Bana et al., 2022a;  Bana et al., 2022b; Dubey et al., 2021; Firmano et al., 2021; Fitriatin et al., 2021; García-Martínez et al., 2010; Khandare et al., 2020; Kowalska et al., 2017; Sadeghi and Taban, 2021; Sharma et al., 2013a;
	ALP <sup>1</sup>	Positive	11	Bana et al., 2022a; Bana et al., 2022b; Chaudhary et al., 2021; Chaudhary et al., 2022; Dubey et al., 2021; Firmano et al., 2021; Guo et al., 2021; Kaur et al., 2017;



				Khandare et al., 2020; Kowalska et al., 2017; Niewiadomska et al., 2020a;
Biowaste fertilizer	ACP <sup>1</sup>	Positive	5	El-Bassi et al., 2021; Krey et al., 2011; Rajashekhara and Siddaramappa, 2008; Romero et al., 2005; Tejada et al., 2006;
	ALP <sup>1</sup>	Positive	6	Emmerling et al., 2010; Hashimoto et al., 2009 Mbarki et al., 2010; Meli et al., 2007; Piotrowska et al., 2006; Tejada et al., 2007;
Sludge	ACP <sup>1</sup>	Positive	6	Bhattacharyya et al., 2001; Gagnon et al., 1999; Gagnon et al., 2003; Moreira et al., 2017; Pascual et al., 2007 Siebielec et al., 2018;
		None	1	Alvarenga et al., 2008
	ALP <sup>1</sup>	Positive	15	Carbonell et al., 2009; Dhanker et al., 2020; Dhanker et al., 2021; Frąc M., 2011; Ghosh et al., 2019; Lakhdar et al., 2011; Liu et al., 2020; Meena et al., 2016; Meena et al., 2018; N'Dayegamiye et al., 2006; Pascual et al., 2007; Roy et al., 2019; Siebielec et al., 2018; Tavali et al., 2021; Xie et al., 2011;
Green manure	ACP <sup>1</sup>	Positive	2	Pérez Brandan et al., 2017; Zhaolei et al., 2017;
	ALP <sup>1</sup>	Positive	1	Janaki et al., 2021;
Green manure + fertilizer	ACP <sup>1</sup>	Positive	1	Bolton et al., 1985;
		None	3	Elfstrand et al., 2007a; Elfstrand et al., 2007b; Onkum and Teamkao, 2020;

	ALP <sup>1</sup>	Positive	1	Dhull et al., 2004;
Crop residue management	ACP <sup>1</sup>	Positive	8	Chatterjee et al., 2021; Nath et al., 2017; Nath et al., 2021; Qaswar et al., 2020; Sepat et al., 2014; Sharma et al., 2019a; Singh et al., 2018; Yang et al., 2019;
		Negative	1	Peruccci et al., 1985;
	ALP <sup>1</sup>	Positive	22	Chatterjee et al., 2021; Choudhary et al., 2018a; Gaiind and Nain, 2007; Galvez et al., 2012; Hai-Ming et al., 2014; Hazra et al., 2021; Jat et al., 2020; Khan et al., 2022; Melero et al., 2006; Melero et al., 2009; Moreno-Cornejo et al., 2017; Nath et al., 2021; Peruccci et al., 1985; Pooniya et al., 2022; Sepat et al., 2014; Sharma et al., 2019a; Singh et al., 2018; Tao et al., 2009; Tejada et al., 2009; Ullah et al., 2020; Wei et al., 2014a; Yang et al., 2019;
Straw residues	ACP <sup>1</sup>	Positive	3	Arun et al., 2020; Cao et al., 2022; Wei et al., 2021;
	ALP <sup>1</sup>	Positive	7	Arun et al., 2020; Cao et al., 2022; Cui et al., 2022; Singh and Sharma, 2020; Singh et al., 2022; Ullah et al., 2018a; Zhang et al., 2016a;
Mulching	ACP <sup>1</sup>	Positive	5	Arun et al., 2020; Balota et al., 2004;

	ALP <sup>1</sup>	None	1	Benítez et al., 2000; da Silva Xavier et al., 2020; Zhu et al., 2022; Jain et al., 2018;
		Positive	5	Arun et al., 2020; Balota et al., 2004; Buck et al., 2000; Rao et al., 1997; Wang et al., 2014a; Jain et al., 2018;
		None	1	
		Positive	7	Akmal et al., 2019a; Akmal et al., 2019b; Egamberdieva et al., 2019; El-Bassi et al., 2021; Noronha et al., 2022; Salam et al., 2019; Wojewódzki et al., 2022; Yuan et al., 2022;
Biochar	ACP <sup>1</sup>	Negative	1	
		Positive	14	Ali et al., 2017; Azeem et al., 2021; Becagli et al., 2022; Becagli et al., 2022; Du et al., 2014; Dubey et al., 2020; Guo et al., 2021; Jabborova et al., 2021; Khan et al., 2022; Masto et al., 2013; Saha et al., 2019; Wojewódzki et al., 2022; Yao et al., 2021; Zhu et al., 2017;
	ALP <sup>2</sup>	Positive	1	Pokharel et al., 2020;
Burning	ACP <sup>1</sup>	Negative	3	Dick et al., 1988; Hoyle and Murphy, 2006; Trujillo-Narcía et al., 2019;
	ALP <sup>1</sup>	Negative	3	Ajwaa et al., 1999; Peruccci et al., 1984; Perucci et al., 2007;
Phosphate solubilizing bacteria	ACP <sup>1</sup>	Positive	7	Aechra et al., 2021;  Chatterjee et al., 2021; Khandare et al., 2020; Khuong et al., 2018; Krey et al., 2011;

				Liu et al., 2021b; Pareek et al., 2019;
	ALP <sup>1</sup>	Positive	9	Basak et al., 2017; Biswas et al., 2021; Chatterjee et al., 2021; Chaudhary et al., 2022; Gaiind and Nain, 2007; Khandare et al., 2020; Krey et al., 2011; Naragund et al., 2020; Pareek et al., 2019;
Plant beneficial bacteria	ACP <sup>1</sup>	Positive	11	Benbrik et al., 2021;  Bhambure et al., 2018; Billah et al., 2020; de Cássia et al., 2018; Gospodarek et al., 2021; Idris and Yuliar, 2021; Rajeela et al., 2017; Madhaiyan et al., 2009 Mercl et al., 2020; Rouydel et al., 2021; Verma et al., 2016b;
		Negative	2	de Barros et al., 2019; Makoi et al., 2010
		None	1	Ruiz and Salas, 2019;
	ALP <sup>1</sup>	Positive	16	Ali et al., 2017; Benbrik et al., 2021; Chaudhary et al., 2021; Cui et al., 2015; de Cássia et al., 2018; Dubey et al., 2021; Emami et al., 2022; Idris and Yuliar, 2021; Kohler et al., 2007; Manjunath et al., 2016; Nakas et al., 1987; Omara et al., 2017; Rouydel et al., 2021; Schoebitz et al., 2019; Valarini et al., 2003; Verma et al., 2016b;
		Negative	2	Makoi et al., 2010; Mercl et al., 2020;
Arbuscular mycorrhizal fungi	ACP <sup>1</sup>	Positive	17	de Barros et al., 2019;

				Ferreira-Vilela et al., 2014; Hu et al., 2019b; Hu et al., 2019a; Kim et al., 2002; Laxminarayana K., 2017; Manjunath et al., 2016; Nakas et al., 1987; Sales et al., 2021; Sharma et al., 2013a; Tarafdar and Rao, 1996; Tarafdar and Gharu, 2006; Turan V., 2021; Wang et al., 2013c; Yadav et al., 2007; Yin et al., 2021; Zhang et al., 2019b; Wakelin et al., 2007; Izaguirre-Mayoral et al., 2000;
		None	2	
ALP <sup>1</sup>	Positive		8	Chatterjee et al., 2021; de Barros et al., 2019; Gaiind and Nain, 2007; Kohler et al., 2008; Laxminarayana K., 2017; Tarafdar and Rao, 1996; Tarafdar and Gharu, 2006; Yadav et al., 2007;
ALP <sup>1</sup>	None		1	Wakelin et al., 2007;

*Table S15. Single studies and reviews of APase response relationships to weed and pest management practices.*

Management practice	APase (single study <sup>1</sup> or review <sup>2</sup> )	Response relationship	Vote counting	Study
Manual weeding vs chemical	ACP <sup>1</sup>	Positive	3	Bhatt et al., 2016; Majumdar et al., 2010; Nedunchezhiyan et al., 2018;
	ALP <sup>1</sup>	Positive	5	Bhatt et al., 2016; Majumdar et al., 2010 Nedunchezhiyan et al., 2018; Ullah et al., 2018b; Ullah et al., 2020;
Herbicides	ACP <sup>1</sup>	Negative	4	Carter et al., 2007; Cycoń et al., 2013;

		None	6	Savin et al., 2009; Wyszkowska J., 2002; Arya et al., 2018; Majumdar et al., 2010 Meher et al., 2021; Pozo et al., 1994; Sofo et al., 2012; Tomkiel et al., 2018;
	ALP <sup>1</sup>	Negative	7	Cycoń et al., 2013; Rasool et al., 2014; Saha et al., 2016; Savin et al., 2009; Singh and Gohshal, 2013; Sofo et al., 2012; Wyszkowska J., 2002; Majumdar et al., 2010; Meher et al., 2021; Nivelle et al., 2018; Pozo et al., 1994; Tejada et al., 2017; Tomkiel et al., 2018;
		None	6	
	ACP, ALP <sup>2</sup>	None	1	Riah et al., 2014;
Fungicides	ACP <sup>1</sup>	Negative	2	Chen et al., 2001; Wang et al., 2022c;
		None	3	Ntalli et al., 2019b; Pozo et al., 1995; Singh N., 2005;
	ACP <sup>2</sup>	Positive		Riah et al., 2014;
	ALP <sup>1</sup>	Negative	1	Ntalli et al., 2019a;
		None	3	Baćmaga et al., 2019; Pozo et al., 1995; Wang et al., 2022c;
	ALP <sup>2</sup>	Negative		Riah et al., 2014;
Insecticides	ACP <sup>1</sup>	Negative	4	Dinesh et al., 1995; García-Martínez et al., 2010; Megharaj et al., 1999; Tu C.M., 1995;
		None	3	Megharaj et al., 1999; Racke et al., 1996; Tu C.M., 1995;
	ACP <sup>2</sup>	Negative	1	Riah et al., 2014;
	ALP <sup>1</sup>	Recovery with time	3	Cycoń Piotrowska-Seget, 2015; Mahapatra et al., 2017; Pandey et al., 2006;

	None	1	Racke et al., 1996;
ALP <sup>2</sup>	Recovery with time	1	Riah et al., 2014;

*Table S16. Single and meta-analysis studies of APase response relationships to irrigation practice.*

<b>Irrigation practice</b>	<b>APase (single<sup>1</sup> or meta-analysis<sup>2</sup> study)</b>	<b>Response relationship</b>	<b>Vote counting</b>	<b>Study</b>
Optimal irrigation	ACP <sup>1</sup>	Positive	10	D'Ascoli et al., 2006; George et al., 2013; He et al., 2010; Li et al., 2017a; Pascual et al., 2007; Sharma et al., 2013b; Wang et al., 2013c; Zhang et al., 2019a; Zhang et al., 2021; Zhong et al., 2007;
	ACP <sup>2</sup>	Positive	1	Sun et al., 2020;
	ALP <sup>1</sup>	Positive	10	Abdalla and Lager, 2009; George et al., 2013; He et al., 2010; Jia et al., 2018; Kumar et al., 2021b; Li et al., 2018c; Pascual et al., 2007; Romero-Trigueros et al., 2021; Sharma et al., 2013b; Tan et al., 2009;
Waste water irrigation	ACP <sup>1</sup>	Positive	1	Meli et al., 2002;
		Negative	1	Masto et al., 2008
		None	1	Santos et al., 2016;
	ALP <sup>1</sup>	Positive	4	Bhattachayya et al., 2008; García-Orenes et al., 2015; Lal et al., 2015; Meli et al., 2002;
		Negative	1	Masto et al., 2008
		None	3	Adrover et al., 2007; Adrover et al., 2017; Kayikcioglu H.H., 2018;

*Table S17. Single studies of APase response relationships to livestock, grazing and mowing management.*

Management type	APase	Response relationship	Vote counting	Study
Crop-livestock	ACP	Positive	5	de Jesus Franco et al., 2020; Izquierdo et al., 2003; Damian et al., 2021; Martins Sousa et al., 2020; Silva et al., 2015;
Grazing	ACP	Positive	4	Bardgett and Leemans, 1995; George et al., 2013; Ramos et al., 2011; Ramos et al., 2010;
	ALP	Positive	2	Galindo et al., 2020; George et al., 2013;
Mowing	ALP	Negative	1	Zibilske and Makus, 2009;

*Table S18. Single and meta-analysis studies of APase response relationships to soil pollutant content.*

Pollutant	APase (single <sup>1</sup> or meta- analysis <sup>2</sup> study)	Response relationship	Vote counting	Study
Heavy metals				
Lead	ACP <sup>1</sup>	Negative	5	Bartkowiak et al., 2021; Chowdhury and Rasid, 2021b; Lemanowicz et al., 2016; Li et al., 2009; Papa et al., 2009
	ALP <sup>1</sup>	Negative	5	Bartkowiak et al., 2021; Bhattachayya et al., 2008 Calvarro et al., 2014; de Santiago-Martín et al., 2013; Lemanowicz et al., 2016;
Chromium	ACP <sup>1</sup>	Negative	3	Bartkowiak et al., 2021; Chowdhury and Rasid, 2021a; Wyszkowska et al., 2001;
	ALP <sup>1</sup>	Negative	2	Bartkowiak et al., 2021; Wyszkowska et al., 2001;
Nickel	ACP <sup>1</sup>	Negative	2	Antonious C.F., 2009; Lemanowicz et al., 2016;
	ALP <sup>1</sup>	Negative	4	Antonious C.F., 2009; Lemanowicz et al., 2016; Pandey and Pandey, 2009;



Zinc	ACP <sup>1</sup>	Positive	1	Wyszkowska et al., 2005;
		Negative	4	Mandal et al., 2021; Chowdhury and Rasid, 2021a; Lemanowicz et al., 2016; Li et al., 2018d; Ros et al., 2008
	ALP <sup>1</sup>	Positive	1	Mandal et al., 2021;
		Negative	7	Calvarro et al., 2014; de Santiago-Martín et al., 2013; Fernández et al., 2014; Lemanowicz et al., 2016; Liu et al., 2020; Łukowski and Dec, 2018; Pandey and Pandey, 2009;
Cadmium	ACP <sup>1</sup>	Negative	2	Chowdhury and Rasid, 2021b; Li et al., 2009;
	ACP <sup>2</sup>	Positive	1	Aponte et al., 2020;
	ALP <sup>1</sup>	Positive	1	Ogunkunle et al., 2020;
		Negative	4	Calvarro et al., 2014; Dar G., 1996; de Santiago-Martín et al., 2013; Pandey and Pandey, 2009;
Copper	ACP <sup>1</sup>	Positive	1	Belyaeva et al., 2005;
		Negative	8	Bartkowiak et al., 2021; Dewey et al., 2012; Fernández-Calviño et al., 2010 Lebrun et al., 2012; Lemanowicz et al., 2016; Li et al., 2009; Papa et al., 2009 Ros et al., 2008
	ACP <sup>2</sup>	Positive	1	Aponte et al., 2020;
	ALP <sup>1</sup>	Negative	7	Bartkowiak et al., 2021; Bhattachayya et al., 2008 Calvarro et al., 2014; de Santiago-Martín et al., 2013; Kuziemska et al., 2020; Lemanowicz et al., 2016; Pandey and Pandey, 2009;
Manganese	ACP <sup>1</sup>	Negative	2	Li et al., 2009; Ros et al., 2008
Arsenic	ACP <sup>1</sup>	Negative	1	Garg and Cheema, 2021;
	ALP	Negative	1	Garg and Cheema, 2021;
Mercury	ACP <sup>2</sup>	Negative	1	Aponte et al., 2020;

	ALP <sup>1</sup>	Negative	1	Casucci et al., 2003;
	ALP <sup>2</sup>	Negative	1	Aponte et al., 2020;
Sewage sludge compost	ACP <sup>1</sup>	Negative	3	Antolín et al., 2005; Kunito et al., 2001; Moreno et al., 1998;
	ALP <sup>1</sup>	Negative	5	Dar G., 1996; Fernández et al., 2014; Kunito et al., 2001; Stoven and Schnug, 2009; Wang et al., 2021b;
Petroleum diesel	ACP <sup>1</sup>	Negative	2	Wyszkowska et al., 2002; Wyszkowska and Wyszkowski, 2010;
	ALP <sup>1</sup>	Negative	4	Gospodarek et al., 2021; Serrano et al., 2009; Wyszkowska et al., 2002; Wyszkowska and Wyszkowski, 2010;
Nanomaterials				
Carbon, copper, silver	ACP <sup>2</sup>	Negative	1	Lin et al., 2021;
Iron	ACP <sup>2</sup>	Positive	1	Lin et al., 2021;

*Table S19. Single and meta-analysis studies of APase responses to the increase of different climate change variables.*

Variable	APase (single <sup>1</sup> or meta-analysis <sup>2</sup> study)	Response relationship	Vote counting	Study
Mean annual temperature	ACP <sup>1</sup>	Positive	1	Ghiloufi and Chaieb, 2021;
		Negative	1	Chen et al., 2021b;
	ACP <sup>2</sup>	Positive	2	Sun et al., 2020; Meng et al., 2020;
	ALP <sup>1</sup>	Negative	1	Wang et al., 2021a;
	ACP, ALP <sup>2</sup>	None	1	Margalef et al., 2021;
Mean annual precipitation	ACP <sup>1</sup>	Positive	1	Ghiloufi and Chaieb, 2021;
	ACP <sup>2</sup>	Positive	1	Sun et al., 2020;
	ALP <sup>1</sup>	Positive	2	Habig and Swanepoel, 2015; Morugán-Coronado et al., 2019;
Drought	ACP <sup>1</sup>	Positive	1	Caballero Vanegas et al., 2018;
		Negative	2	Gunes et al., 2007

				Egamberdieva et al., 2019;
	ALP <sup>1</sup>	Positive	1	Caballero Vanegas et al., 2018;
		Negative	1	Egamberdieva et al., 2019;
	ACP, ALP <sup>2</sup>	Negative	2	Gou et al., 2020; Margalef et al., 2021;
Soil water scarcity	ACP <sup>1</sup>	Negative	1	Ghiloufi and Chaieb, 2021;
		None	2	Mazzuchelli et al., 2020; Zago et al., 2018;
	ACP, ALP <sup>2</sup>	Negative	1	Gou et al., 2020;
Soil water availability	ACP <sup>1</sup>	Positive	2	Figueira da Silva et al., 2020; Izquierdo et al., 2003;
	ALP <sup>1</sup>	Positive	2	Fraser et al., 2015; Jabborova et al., 2021;
Seasonal variations				
Rainy season	ACP <sup>1</sup>	Positive	14	Arora et al., 2021; Bachmann et al., 2014; Bolton et al., 1985; Carlos et al., 2022; Dormaar and Willms, 2000; Elfstrand et al., 2007b; García-Ruiz et al., 2009; Jaskulska et al., 2020b; Koper and Lemanowicz, 2008; Li et al., 2021a; Mejia Guerra et al., 2018; Mina et al., 2008 Silvestro et al., 2017; Singh et al., 2012a;
	ALP <sup>1</sup>	Positive	11	Angers et al., 1993; Arora et al., 2021; Bachmann et al., 2014; Du et al., 2014; Efthimiadou et al., 2010; Koper and Lemanowicz, 2008; Łukowski and Dec, 2018; Meli et al., 2002; Neha et al., 2020; Okur et al., 2006; Shi et al., 2020;

Dry season	ACP <sup>1</sup>	Negative	4	Bolton et al., 1985; Hoyle and Murphy, 2006; McCallister et al., 2002; Tiecher et al., 2012;
CO <sub>2</sub> fertilization	ALP <sup>1</sup>	Positive	1	Dey et al., 2019;
	ACP, ALP <sup>2</sup>	Positive	1	Margalef et al., 2021;

*Table S20. Single studies of crop yield responses to APase activity.*

Crop	APase	Response relationship	Vote counting	Study
Wheat	ACP	Positive	1	Moharana et al., 2022;
	ALP	Positive	4	Borase et al., 2020; Furtak et al., 2017; Mandal et al., 2007; Moharana et al., 2022;
Organic Wheat	ACP	Positive	1	Dick et al., 1988;
	ALP	Positive	2	Sharma et al., 2015; Tejada and Gonzalez, 2007;
Maize	ACP	Positive	1	Wei et al., 2021;
	ALP	Positive	2	Furtak et al., 2017; Zhou et al., 2022;
Organic winter barley	ACP	Positive	1	Antolín et al., 2005;
Organic beet	ACP	Positive	1	Roy et al., 2019;
	ALP	Positive	1	Roy et al., 2019;
Rice	ACP	Positive	1	Zhang et al., 2019a;
	ALP	Negative	1	Basak et al., 2017;
Organic lentil	ALP	Positive	1	Singh et al., 2018b;
Broad bean	ACP	Positive	1	Gao et al., 2016;
Organic plum	ALP	None	1	Chocano et al., 2016;
Organic orange	ALP	None	1	Madejón et al., 2003;

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