Cover crops in viticulture

Les couverts végétaux en viticulture

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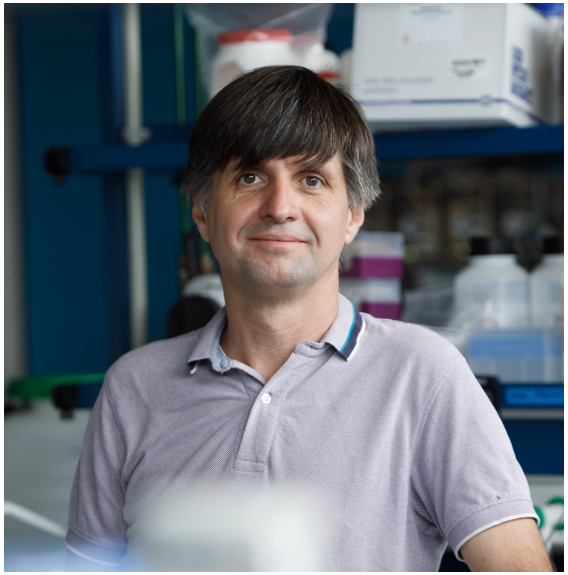

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Traubuenas (NA, Spain)

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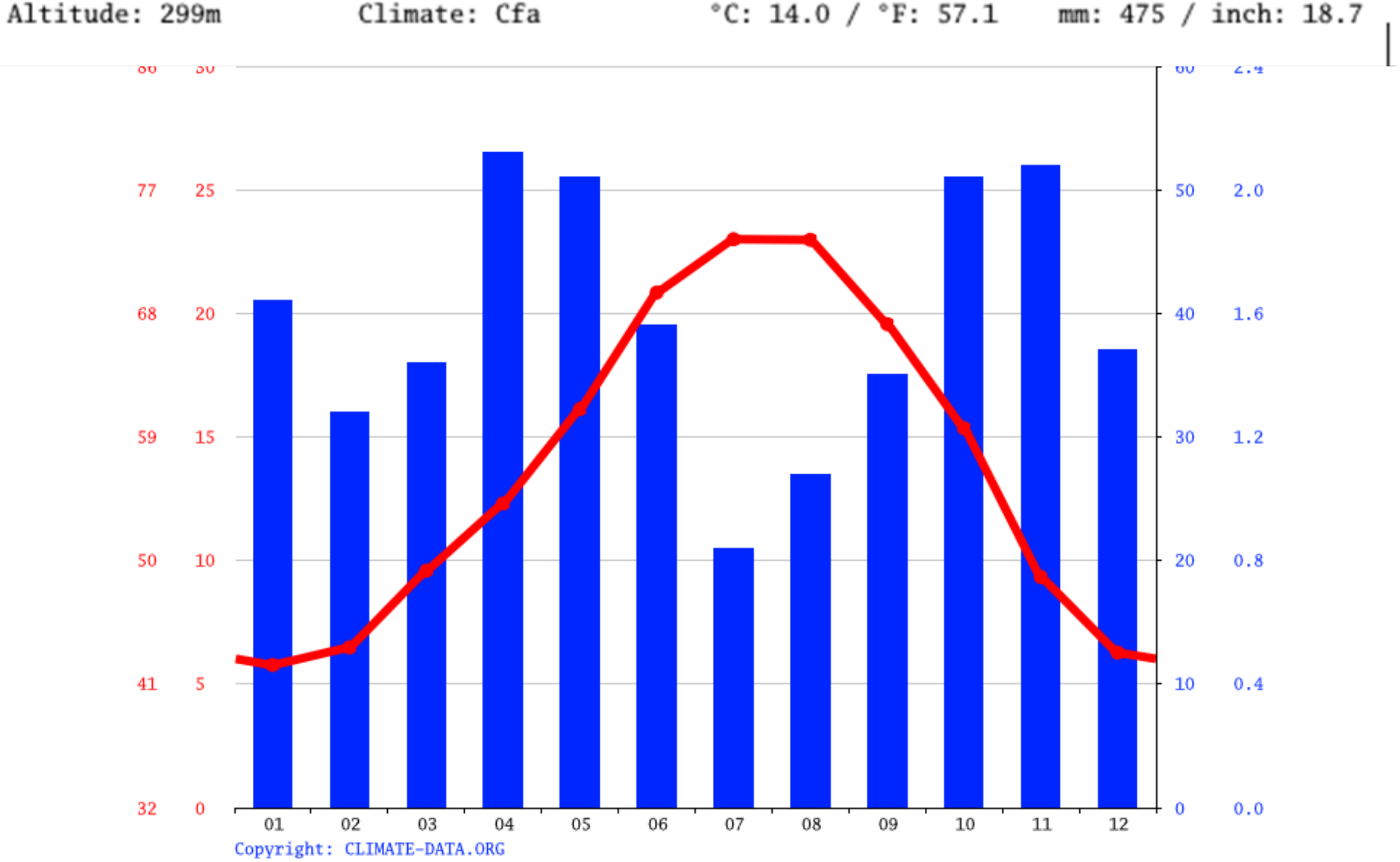
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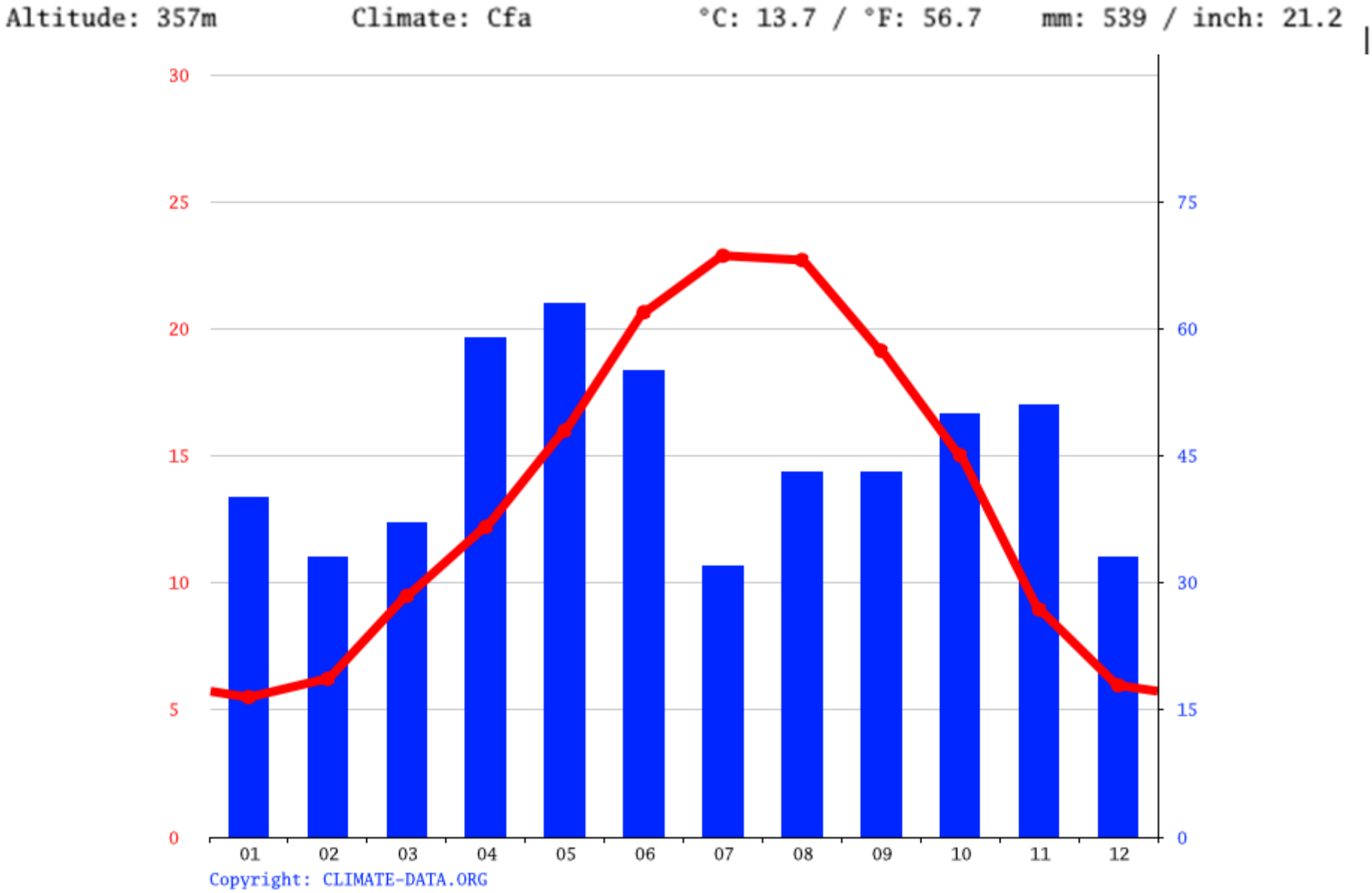
68 20
59 15
50 10
41 5
32 0
50 2.0
40 1.6
30 1.2
20 0.8
10 0.4
0 0.0
01 02 03 04 05 06 07 08 09 10 11 12
Copyright: CLIMATE-DATA.ORG

2002

Cascante (NA, Spain)



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2005

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EROSION

YIELD

PEST AND DISEASES

WEED CONTROL

SOIL STRUCTURE

VIGOUR

BIODIVERSITY

COST

COMPETITION FOR NUTRIENTS

MACHINERY TRAFFIC

COMPETITION FOR WATER

SPRING FROST RISK

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SPRING FROST RISK

yes / no

how much

where/why

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Some facts

Many urban legends

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What is a systematic review?

A review that reports or includes:

(1) a research question,

(2) a reproducible search strategy (naming of databases, naming of search platforms/engines, search date and complete search strategy)

(3) inclusion and exclusion criteria

(4) selection (screening) methods

Cover crops and viticulture systematic review

Scopus database

TITLE-ABS-KEY (“cover crop” OR “green cover” OR “ground cover” OR “tillage”)

AND

TITLE-ABS-KEY (“wine” OR “vitis” OR “vineyard” OR “grapevine” OR “grape”), between the years 1999 and 2018.).

584 published papers

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Cover crops and viticulture systematic review

Exclusion criteria

- Not based on a specific experiment.
- Crops different from vines.
- No mention (not even indirect) of cover crops
- cover crops only as examples of organic viticulture, but not the main objective of the study.
- Modelling without experimental ground-truthing.
- Table grapes.

584 published papers

272 papers selected

PERFORMED INDEPENDENTLY BY TWO PEOPLE

Cover crops and viticulture systematic review

584 published papers

272 papers selected

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Javier Abad ✉, Irantzu Hermoso de Mendoza, Diana Marín, Luis Orcaray, Luis Gonzaga Santesteban

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1) Implications on soil characteristics and biodiversity in vineyard

Soil nitrogen

N	Location	Duration	Soil management	Cover type	Final soil N Ntot (g/kg) Nmin (mg/kg)	Depth (cm)
1	Kreinbacher, Turkey	3	Tillage	CT	8.72 Nmin	0 - 30
			Spontaneous vegetation	SV	7.43 Nmin	
2	La Caple, France	4	Herbicide + tillage	CTH	0.60 Ntot	0 - 15
			Permanent cover *Festuca rubra*, *Lolium perenne*	G	0.71 Ntot	
3	Agugliano, Italy	7	Tillage (depth 5 - 8 cm)	CT	1.64 Ntot	0 - 50
			Spontaneous vegetation	SV	0.93 Ntot	
4	Tokaj, Hungary	3	Tillage (4/ seasons)	CT	6.31 Nmin	0 - 30
			Annual cover *Hordeum vulgare*	G	3.54 Nmin	
5	Montpellier, France	5	Herbicide	CH	0.78 Ntot	0 - 30
			Permanent cover *Festuca arundinacea*	G	0.82 Ntot	
			Annual cover *Hordeum vulgare*	G	0.76 Ntot	
6	Santana do Livramento, Brazil	2	Herbicide	CH	0.52 Ntot	0 - 10
			Spontaneous vegetation *Paspalum notatun*, *L. multiflorum*, *Bromus auleticu*, *Desmodium* spp., *Vicia sativa*	SV	0.50 Ntot	
7	Western Cape, South Africa	10	Herbicide	CH	7.28 Nmin	0 - 15
			Annual cover *Secale cereale*	G	6.88 Nmin	
			Annual cover *Avena sativa*	G	6.23 Nmin	
			Annual cover *A. strigosa*	G	5.25 Nmin	
			Annual cover *Medicago truncatula*	L	19.45 Nmin	
			Annual cover *Ornithopus sativus*	L	13.31 Nmin	
			Annual cover *V. dasycarpa*	L	18.53 Nmin	

1) Implications on soil characteristics and biodiversity in vineyard

Soil nitrogen

8	Mallorca, Spain	3	Tillage	T	1.8 Ntot
			Permanent cover *Medicago* sp., *A. sterilis*, *Lotus ornithopodioides*, *Trifolium scabrum*, *Chrysanthemum coronarium*	GL	1.7 Ntot
			Annual cover *T. resupinatum*, *M. truncatula*, *T. subterraneum*, *Dactylis glomerata*	GL	1.9 Ntot
9	California, U.S.A.	5	Tillage	CT	
			Annual cover Triticale x Triosecale	G	
			Annual cover *S. cereale*	G	
10	Región Maule, Chile	2	Herbicide	CH	1.90 Nmin
			Permanent cover *T. subterraneum*, *M. polymorpha*	L	21.9 Nmin
			Permanent cover *T. subterraneum*, *T. michelianum*	L	14.1 Nmin
11	California, U.S.A.	3	Herbicide	CH	1.86 Ntot
			Permanent cover *Vulpia myuros*, *B. hordeaceus*, *T. hirtum*, *T. pratenses*	GL	2.45 Ntot
			Annual cover *Vicia faba*, *Pisum sativum*, *Triticum aestivum* or *S. cereale*	GL	1.70 Ntot
12	Ligurian Apennines, Italy	3	Tillage	CT	
			Spontaneous vegetation	SV	
13	Brunello di Montalcino, Italy	5	Tillage (3/season, depth 20 cm)	CT	1.1 Ntot
			Spontaneous vegetation	SV	1.1 Ntot
			Annual cover *T. subterraneum*	L	1.5 Ntot
			Permanent cover *F. arundinacea*	G	1.2 Ntot

1) Implications on soil characteristics and biodiversity in vineyard

Soil nitrogen

14	Burgundy, France	10	Herbicide	CH	
			Permanent cover clover	L	
			Permanent cover *Festuca* sp.	G	
15	Badajoz, Spain	1	Tillage (3/ season, depth 10 - 15 cm)	CT	0.23 Ntot
			Spontaneous vegetation *Elytrichia repens*, *F. arundinacea*, *Portulaca oleracea*	SV	0.64 Ntot
16	Madrid, Spain	4	Tillage (2 - 3/ season, depth 15 cm)	CT	
			Permanent cover *Brachypodium distachyon*	G	
			Spontaneous vegetation	SV	
17	La Rioja, Spain	4	Tillage (3 - 4/ season, depth 15 cm)	CT	
			Spontaneous vegetation *B. mollis*, *H. marinum*, *Diplotaxis erucoides*, *Sonchus asper*, *Sonchus oleraceus*, *Veronica latifolia*, *Coniza canadensis*, *Papaver hibridum*	SV	
			Permanent cover *Festuca glauca*	G	
18	Madrid, Spain	2	Tillage	CT	
			Annual cover *S. cereale*	G	
			Permanent cover *Brachypodium distachyon*	G	
19	Traisen Valley, Austria	10	Annual legumes cover with tillage (5/season, depth 5 - 10 cm)	L	1.61 Ntot
			Spontaneous vegetation	SV	2.14 Ntot
20	Nueva Escocia, Canada	2	[redacted]	TH	1.27 Ntot
			Annual cover *A. sativa*, *Pisum sativum*, *V. villosa*	GL	1.42 Ntot
			Annual cover *A. sativa*, *T. pratense*	GL	1.42 Ntot
			Permanent cover *Pheum pratense* (70 %), *T. hibridum* (15 %), *T. pratense* (15 %)	GL	1.42 Ntot
21	La Rioja, Spain	10	Tillage (3 - 4/ season, depth 15 cm)	CT	
			Spontaneous cover	SV	

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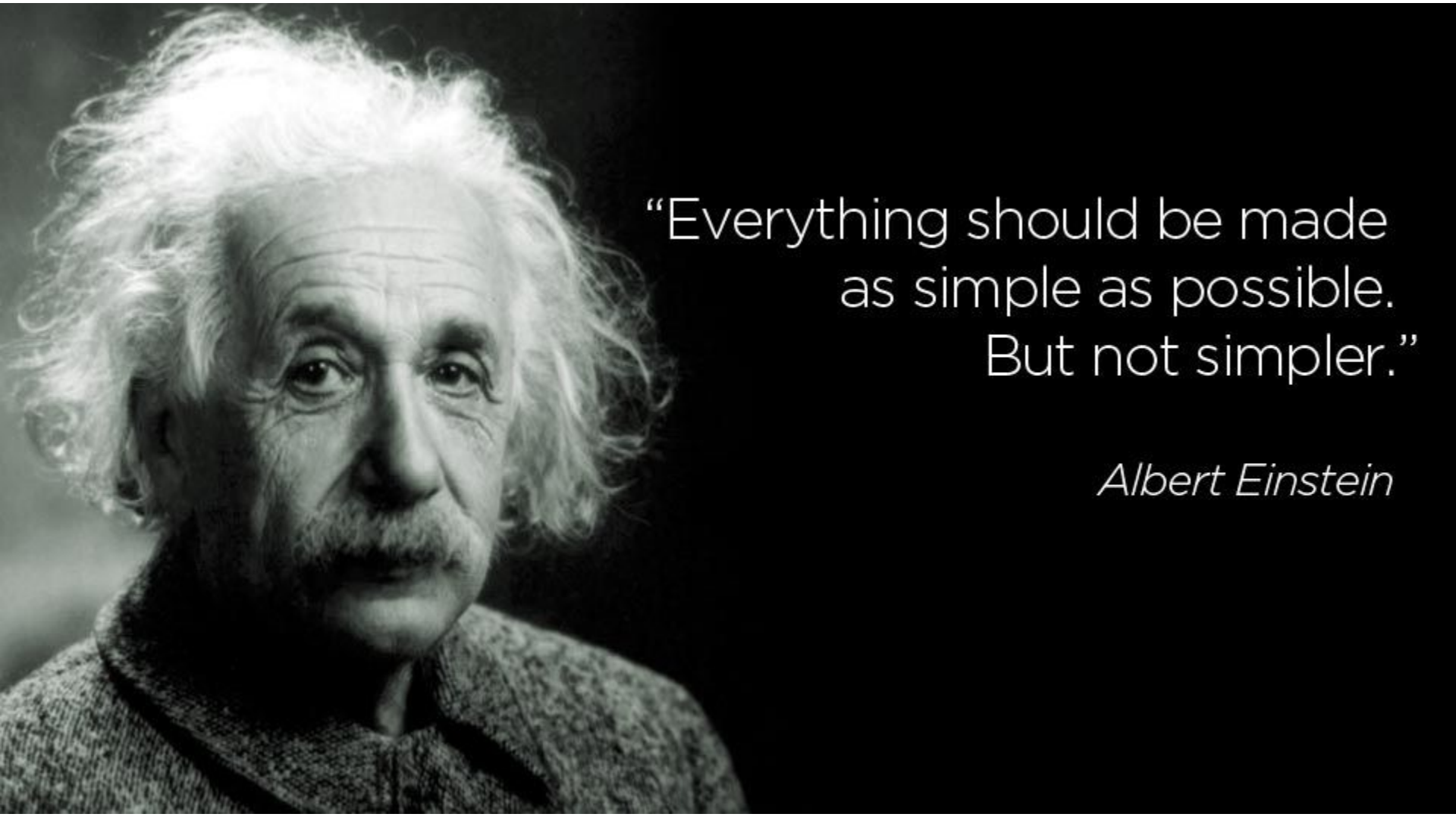

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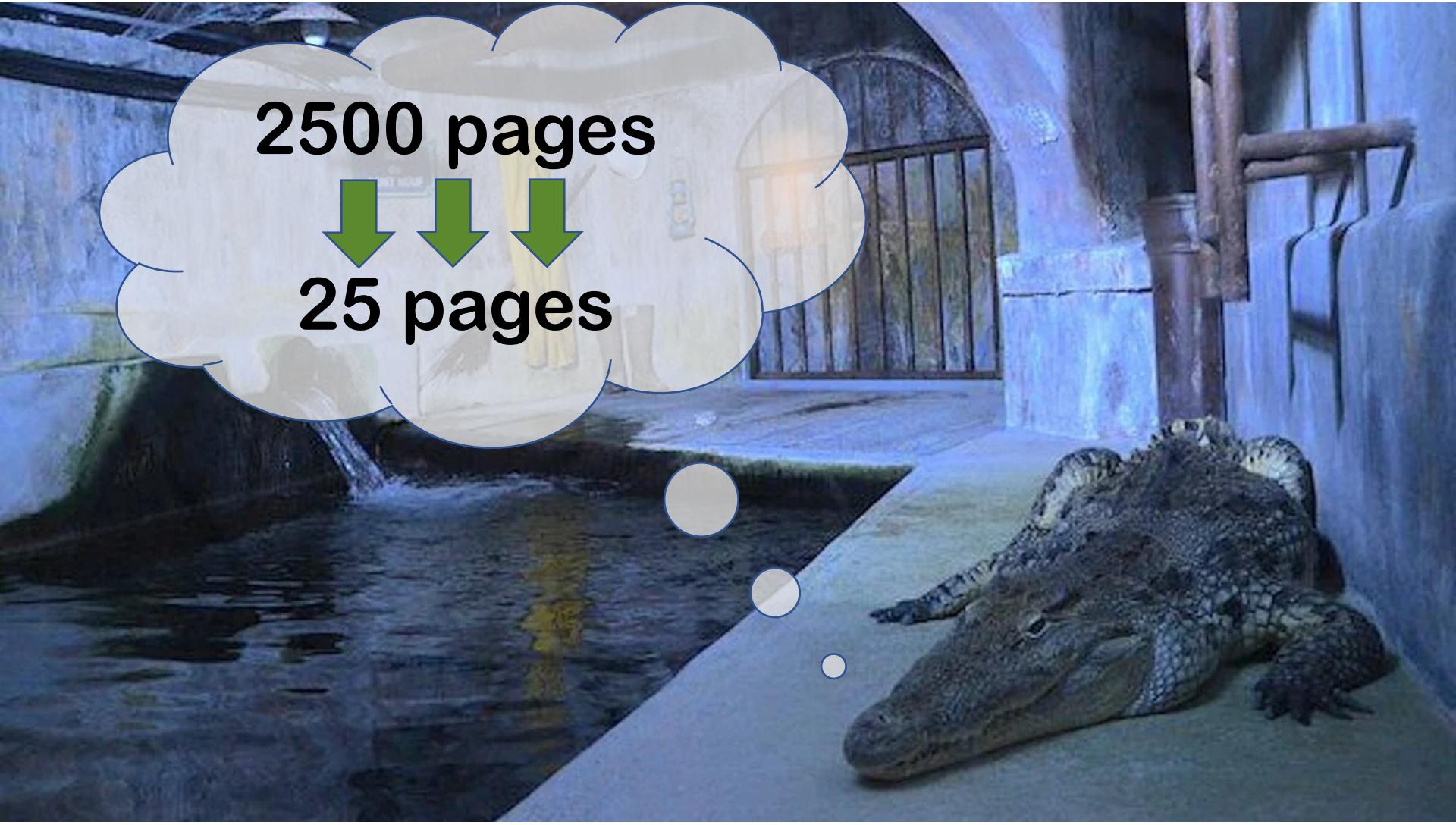

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1) Implications on soil characteristics and biodiversity in vineyard

Soil facts

Soil Nitrogen

Grasses as cover crops ↓ 25% in Ntot and Nmin

Legumes ↑ 30% in Ntot and 100 % Nmin

Soil Organic Carbon

Sulas et al. (2017) -- 10 % of the total 125 kg/ha used by vines

↑ Grasses 68.5 %

Legumes 39.2 %

Spontaneous 119.5 %

Soil Aggregates (structure)

↑ In 2-3 years

1) Implications on soil characteristics and biodiversity in vineyard

Soil facts

Soil erosion

Herbicide	12,0 T/ha yr
Tilled	11,4 T/ha yr
Grass	1,1 T/ha yr
Spontaneous	2,4 T/ha yr
Legumes	3,4 T/ha yr

1) Implications on soil characteristics and biodiversity in vineyard

Biodiversity facts

x3

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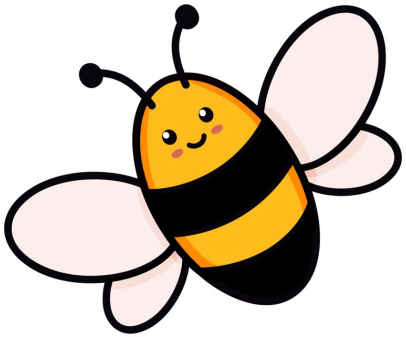
1) Implications on soil characteristics and biodiversity in vineyard

Biodiversity facts

Insectivorous birds
(Lourenço *et al.*, 2021)
(Rollan *et al.*, 2019)

Passerines
(Duarte *et al.*, 2014)

(I 9)



Larks
(Buehler *et al.*, 2017)

1) Implications on soil characteristics and biodiversity in vineyard

Pests and diseases facts

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1) Implications on soil characteristics and biodiversity in vineyard

Pests and diseases facts

DISEASES

Decreased 67% cases.
Never increased

Powdery mildew

Decreased

F. arunndinacea+L. perenne ↑ & barley
(Valdés-Gómez et al., 2011)

No change
Spontaneous
(Vogelweith and Thiéry, 2017)

1) Implications on soil characteristics and biodiversity in vineyard

Pests and diseases facts

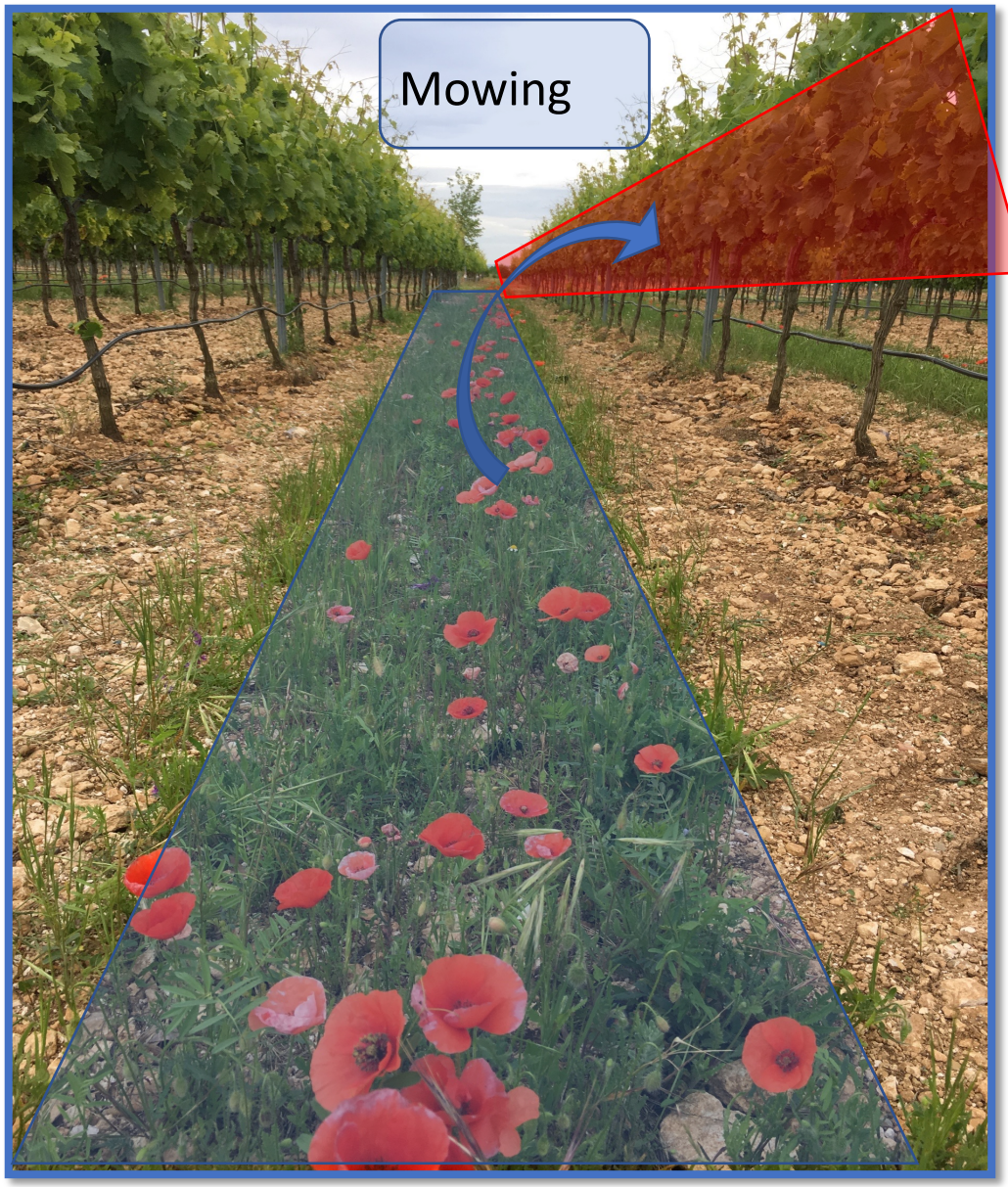
PESTS

NO INCREASE (95%)

Only one reported increase *Epiphyas postvittana* (Light Brown Apple Moth)

45% No change

50% decrease → Cycadellids → *Anagrus* (Hymenopter)



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Growth facts

herbicide applied in the row.

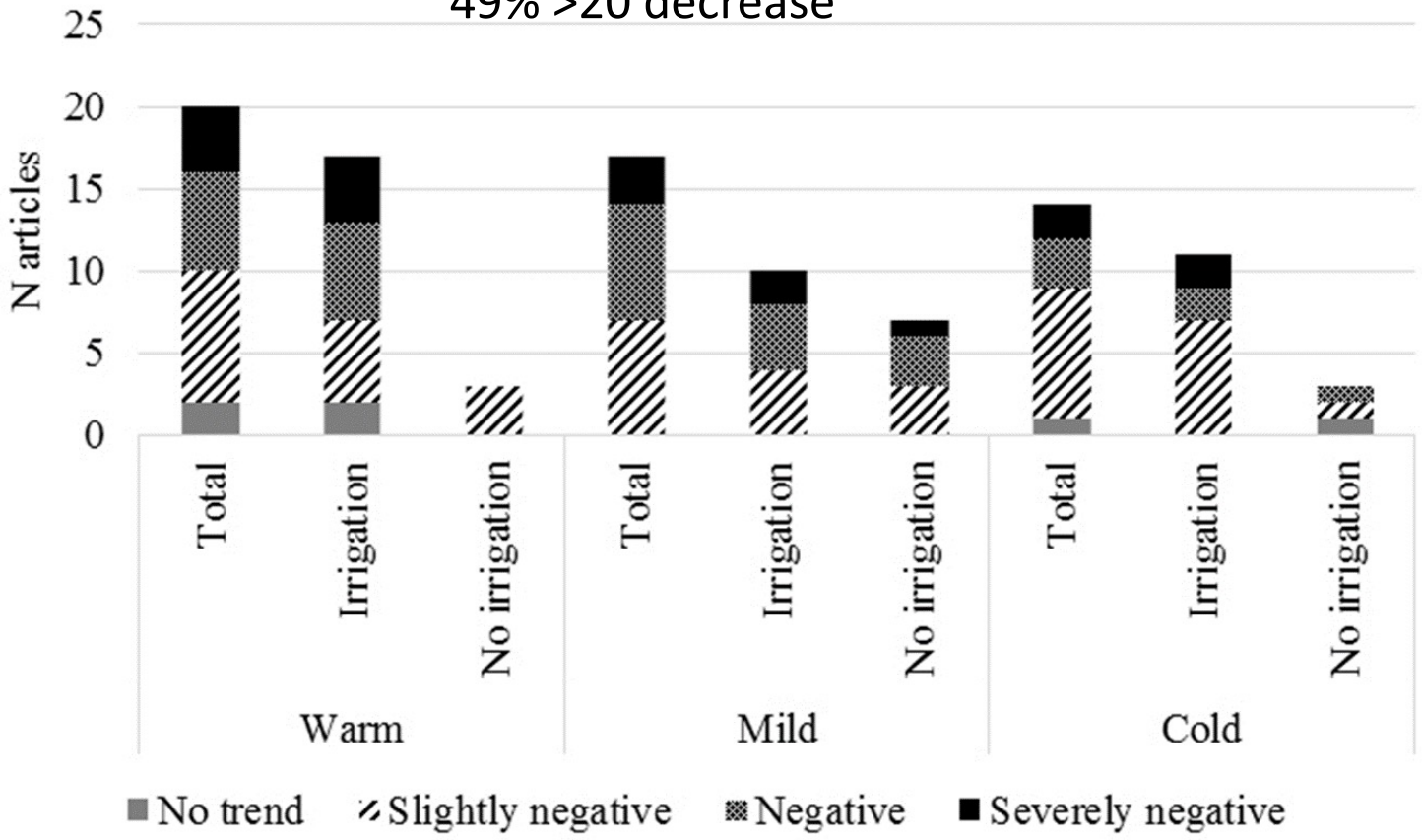
				No trend				
	Costello (2010b)	=	2	Jordan *et al.* (2016)	=	3	Wilson *et al.* (2017)	=
				Slightly negative				
4	DeVetter *et al.* (2015)	+(T)/-	12	Karl *et al.* (2016)**	=/--	20	Ingels *et al.* (2005)*	-(T)/--
5	Krohn and Ferree (2004)	+(T)/--	13	Smith *et al.* (2008)	=/-	21	Reynolds *et al.* (2006)**	-(T)/--
6	Sweet and Schreiner (2010)*	+(T)/--	14	Klodd *et al.* (2016)	- (T)	22	Ripoche *et al.* (2011)*	- (T)/--
7	Tourte *et al.* (2008)	=/-(T)	15	Steenwerth *et al.* (2016)	- (T)	23	Giese *et al.* (2016)	-
8	Lopes *et al.* (2008)	=/--	16	Coniberti *et al.* (2018a)	- (T)/-	24	Steenwerth *et al.* (2013)	-
9	Mercenaro *et al.* (2014)	=/-	17	Monteiro and Lopes (2007)	- (T)/-	25	Vrsic *et al.* (2011)	-
10	Pérez-Álvarez *et al.* (2015b)	=/-	18	Muscas *et al.* (2017)*	- (T)/-	26	Pérez *et al.* (2018)	-/--
11	Trigo-Córdoba *et al.* (2015)	=/-	19	Tomaz *et al.* (2015)	- (T)/-			
				Negative				
27	Rodriguez-Lovelle *et al.* (2000b)	+(T)/---	36	Palliotti *et al.* (2007)	--	45	Coletta *et al.* (2013)	---
28	Delpuech and Metay (2018)*	=/--	37	Pou *et al.* (2011)*	--	46	Coniberti *et al.* (2017)	---
29	Reeve *et al.* (2016)	-/---	38	Valdés-Gómez *et al.* (2011)	--	47	Gontier *et al.* (2014)	---
30	Coniberti *et al.* (2018b)	--	39	Caspari *et al.* (1997)	--/---	48	Hatch *et al.* (2011)	---
31	De Pascali *et al.* (2014)	--	40	Guilpart *et al.* (2017)	--/---	49	Olmstead *et al.* (2012)	---
32	Giese *et al.* (2015)	--	41	Mattii et al. (2005)	--/---	50	Toci *et al.* (2012)	---
33	Hickey *et al.* (2016)	--	42	Muganu *et al.* (2013)	--/---	51	Wheeler *et al.* (2005)	---
34	Linares Torres *et al.* (2018)	--	43	Rodriguez-Lovelle *et al.* (2000a)**	--/---			
35	Lopes *et al.* (2011)	--	44	Silvestre *et al.* (2012)	--/---			

= denotes does not affect, no clear trend; – (T)/+(T) denotes reduction trend/general increase; -/+ denotes difference in reduction/increase lower than 20 %; --/++ denotes difference in reduction/increase between 20 and 40 %; ---/+++ denotes difference in reduction/increase higher than 40 %; * denotes differences among treatments in one or more years; ** denotes differences among controls in one or more years.

Growth facts

Pruning weight

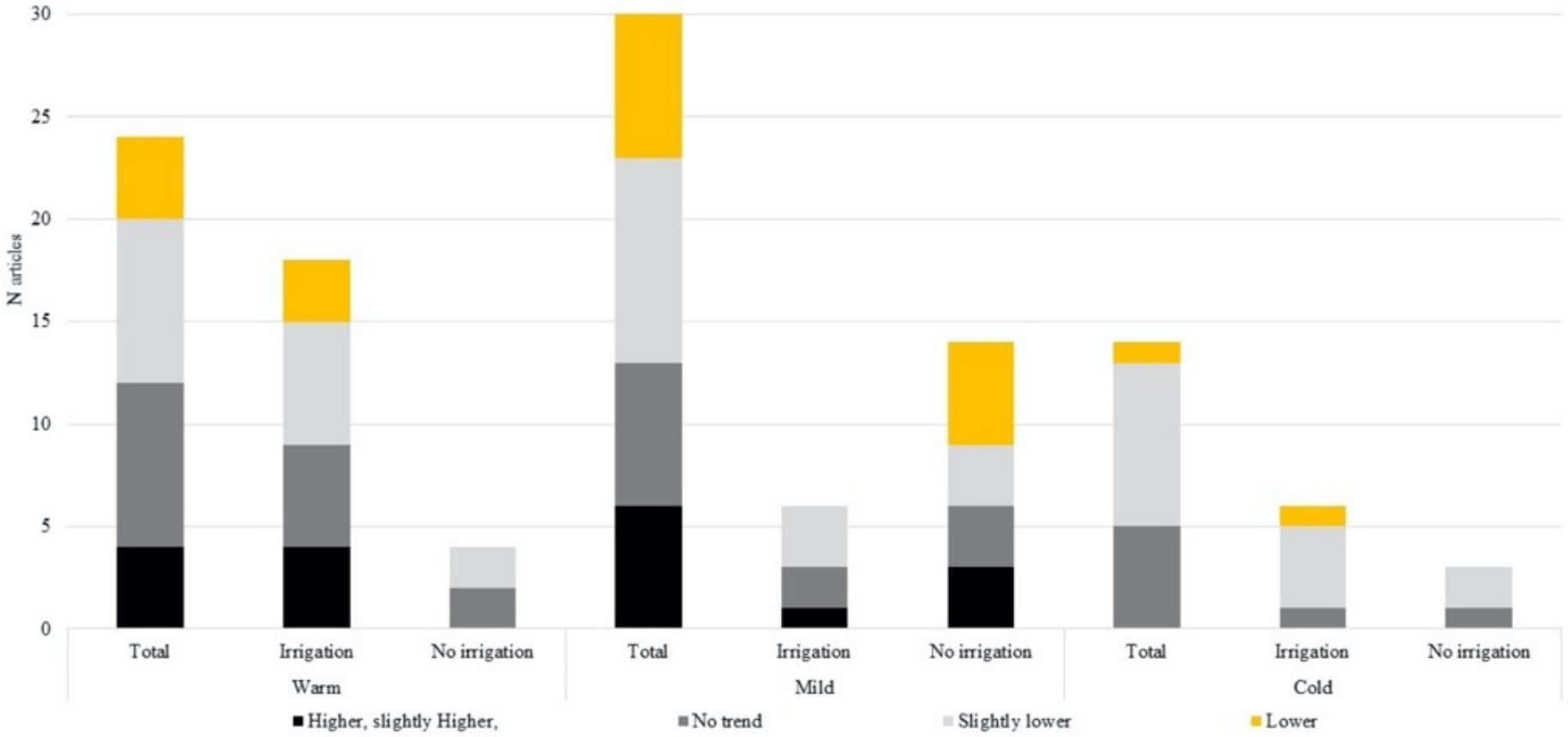
6 % no change
23% <20% decrease
49% >20 decrease



Yield facts

Yield

16 % 20-40 % increase
28 % no change
37 % <20% decrease
17 % >20% decrease



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Which cover?

Spontaneous

- Cheaper
- Locally adapted
- Less control on competition timing and depth
- Diversity

Sown

- More expensive
- A lot of options to try to adapt to competition timing and depth
- Diversity

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Our current challenge
Management under the vines

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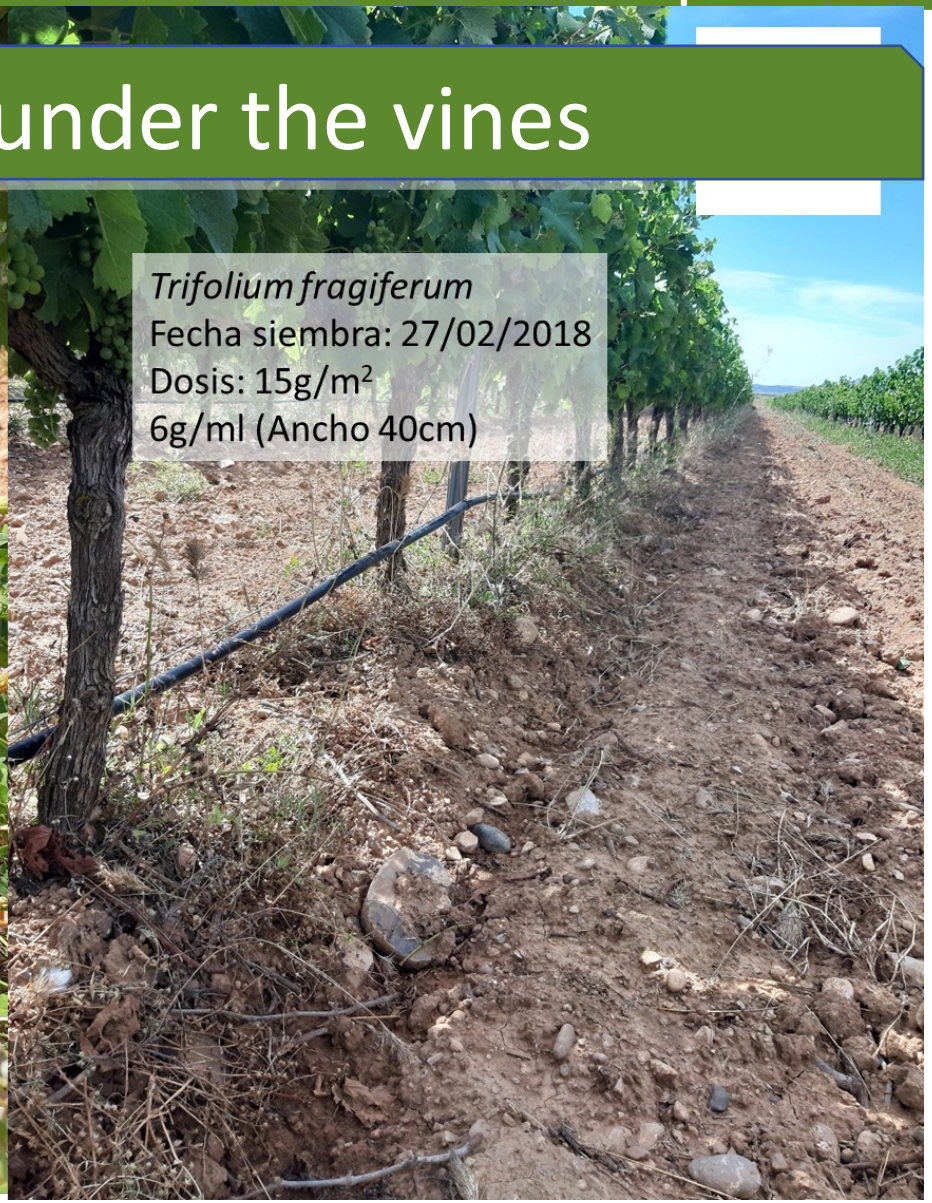
Cover crops under the vines



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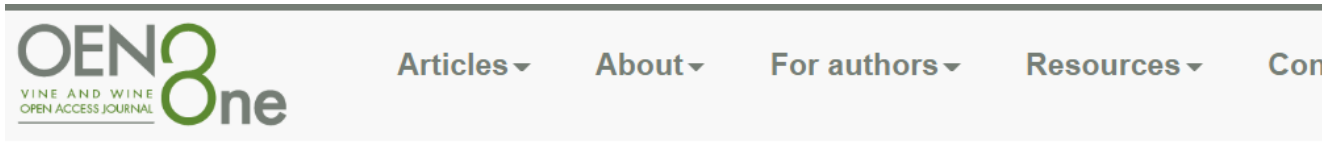
Cover crops under the vines

Cover crops under the vines



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ORIGINAL RESEARCH ARTICLES

Under-vine cover crops: impact on weed development, yield and grape composition

Javier Abad ✉, Diana Marín, L. Gonzaga Santesteban, J. F. Cibriaín, Ana Sagüés

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DOI: https://doi.org/10.20870/oeno-one.2020.54.4.4149

Légende urbaine : le crocodile des égouts de Paris

Gonzaga Santesteban, F. Javier Abad
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le dauphiné libéré

Insolite

La légende urbaine des crocodiles dans les égouts de Paris n'en est pas vraiment une

Vous avez sans doute déjà entendu cette histoire sans oser y croire. Et pourtant...

Par **La rédaction** - 17 nov. 2021 à 10:30 - Temps de lecture : 2 min

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Cover crops in viticulture

Les couverts végétaux en viticulture

Merci beaucoup

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