Supplementary Material

# Supplementary Tables

**Supplementary Table 1.** Complete list of articles dataset (n=111) with description of the studied area, the adaptation (LT1: Site Selection, LT2: Plant Material, LT3: Vineyard design, LT4: Farm strategy, ST1: Irrigation, ST2: Soil management, ST3: Canopy management, ST4: Harvest and post-harvest management), scale and method.

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| N° | Reference | Studied area | Adaptation | Scale | Method | N° | Reference | Studied area | Adaptation | Scale | Method |
| 1 | (Alonso and Liu, 2013) | Spain | LT1, LT4,ST1, ST4 | Farm | Expert judgement | **56** | (Lereboullet et al., 2013) | France, Australia | LT3, ST3, ST2, ST1, LT2, LT4 | Region | Expert judgement |
| 2 | (dos Santos et al., 2007) | Portugal | ST1 | Field | Experimental | **57** | (Levy and Lubell, 2018) | USA | LT1 | Region | Expert judgement |
| 3 | (Ramos and Martínez-Casasnovas, 2010) | Spain | LT3 | Field | Experimental | **58** | (Caravia et al., 2016) | Australia | LT3 | Field | Experimental |
| 4 | (Grantham et al., 2010) | USA | ST1 | Region | Modeling | **59** | (Caravia et al., 2017) | Australia | ST1 | Field | Experimental |
| 5 | (Bardsley et al., 2018) | Australia | LT2, LT4, ST1, ST2, ST3 | Region / Farm | Expert judgement | **60** | (Carvalho et al., 2017) | Portugal | LT2 | Plant | Experimental |
| 6 | (Kapur et al., 2007) | Italy | ST1 | Field / Region | Modeling | **61** | (Mirás-Avalos et al., 2016) | Spain | ST1 | Field | Experimental |
| 7 | (Battaglini et al., 2009) | Italy | ST1, LT2 | Field / Farm | Expert judgement | **62** | (Cirigliano et al., 2017) | Italy |  | Field | Experimental |
| 8 | (Belliveau et al., 2006) | Canada | ST1, LT4, ST3, LT2 | Farm | Expert judgement | **63** | (Medrano et al., 2015) | Spain |  | Plant | Review |
| 9 | (Diffenbaugh et al., 2011) | USA | LT1, LT2 | Region | Modeling | **64** | (Georgopoulou et al., 2017) | Greece |  | Farm/Region | Modeling |
| 10 | (Carvalho et al., 2018) | Portugal | ST1, LT2 | Field | Experimental | **65** | (Santesteban et al., 2017) | Spain | ST1, ST2 | Field | Experimental |
| 11 | (Bernardo et al., 2018) | Portugal | LT3, ST3, ST2, ST1, LT1, LT2 | Field | Review | **66** | (Martínez-Lüscher et al., 2017) | Spain | LT3 | Field | Experimental |
| 12 | (Duchene et al., 2012) | France | LT2 | Plant | Experimental | **67** | (Mirás-Avalos et al., 2018) | Spain | ST1 | Plant / Field | Modeling |
| 13 | (Nicholas and Durham, 2012) | USA | LT1, LT2, ST3, LT3, ST1 | Farm | Expert judgement | **68** | (Neethling et al., 2017) | France | ST3, ST2, ST1, LT2 | Field / Farm | Expert judgement |
| 14 | (Pieri et al., 2012) | France | LT2, LT3, LT1, ST1 | Field | Modeling | **69** | (Mosedale et al., 2016) | UK | LT1, LT2, LT3, LT4, ST1, ST2, ST3 | Plant/Region | Review |
| 15 | (Hannah et al., 2013) | USA | LT1 | Plant / Region | Modeling | **70** | (Paciello et al., 2017) | Italy | ST1 | Field | Experimental |
| 16 | (Milla‐Tapia et al., 2013) | Chile | LT2 | Plant | Experimental | **71** | (Pagliarani et al., 2017) | Italy | LT2 | Plant | Experimental |
| 17 | (Palliotti et al., 2013) | Italy | ST3 | Field | Experimental | **72** | (Petrie et al., 2017) | Australia | ST3 | Field | Experimental |
| 18 | (Raymond and Spoehr, 2013) | Australia | ST2, ST1, LT2 | Farm | Expert judgement | **73** | (Ronco et al., 2017) | Italy | ST1 | Region | Expert judgement |
| 19 | (Stoll et al., 2013) | Germany | ST3 | Field | Experimental | **74** | (Sacchelli et al., 2016) | Italy | ST1, LT3, LT2, LT4 | Farm | Expert judgement |
| 20 | (Attia et al., 2014) | France | ST3 | Plant | Experimental | **75** | (Tissot et al., 2017) | France | - | Plant/Field/Region | Expert judgement |
| 21 | (Clingeleffer, 2010) | Australia | LT3, ST1, LT2, ST3 | Field | Review | **76** | (Palliotti et al., 2014) | Italy | ST3, LT3 | Plant/Region | Review |
| 22 | (Baronti et al., 2014) | Italy | ST2 | Field | Experimental | **77** | (Tomaz et al., 2017) | Portugal | ST1, ST2 | Field | Experimental |
| 23 | (Fuhrer et al., 2014) | Suisse | ST1 | Region | Modeling | **78** | (Torres et al., 2017) | Spain | ST1, LT2 | Plant | Experimental |
| 24 | (Londo and Johnson, 2014) | USA | LT2 | Plant | Experimental | **79** | (Bigard et al., 2018) | France | LT2 | Plant | Experimental |
| 25 | (Costa et al., 2016) | Portugal | ST1, ST2 | Plant/Field/Region | Review | **80** | (Bonada et al., 2018) | Australia | ST1 | Field | Experimental |
| 26 | (Meggio et al., 2014) | Italy | LT2 | Plant | Experimental | **81** | (Poni et al., 2018) | Italy | ST3 | Field | Review |
| 27 | (Pickering et al., 2014) | Canada | LT4 | Sector | Expert judgement | **82** | (Chrysargyris et al., 2018) | Cyprus | ST1, ST2 | Field | Experimental |
| 28 | (Șerdinescu et al., 2014) | Romania | ST2, ST3 | Field | Experimental | **83** | (De Micco et al., 2018) | Italy | LT2 | Plant | Experimental |
| 29 | (Dequin et al., 2017) | France | ST4 | Farm | Review | **84** | (Dinis et al., 2018b). | Portugal | ST3 | Plant | Experimental |
| 30 | (de C. Teixeira et al., 2014) | Brazil | ST3 | Plant | Modeling | **85** | (Dinis et al., 2018a) | Portugal | ST3 | Plant | Experimental |
| 31 | (Berdeja et al., 2015) | France | LT2 | Plant | Experimental | **86** | (Fraga et al., 2018a) | Portugal | ST1 | Field/Region | Modeling |
| 32 | (Corso et al., 2015) | Italy | LT2 | Plant | Modeling | **87** | (Fraga and Santos, 2018) | Portugal | ST2 | Field/Region | Modeling |
| 33 | (Delay et al., 2015) | France | LT1, LT4 | Region | Expert judgement | **88** | (Franques et al., 2018) | Spain | ST4 | Farm | Experimental |
| 34 | (Duchene, 2016) | France | LT2 | Plant | Review | **89** | (Gil et al., 2018) | Chile | ST1, LT3, ST2 | Field | Experimental |
| 35 | (Genesio et al., 2015) | Italy | ST2 | Field | Experimental | **90** | (Malacarne et al., 2018) | Italy | LT2 | Plant | Experimental |
| 36 | (Lobos et al., 2015) | Chile | ST3 | Field | Experimental | **91** | (Phogat et al., 2018) | Australia | ST1 | Region | Modeling |
| 37 | (Fleming et al., 2015) | Australia | - | Farm | Expert judgement | **92** | (Reshef et al., 2018) | Israel | LT3 | Plant | Experimental |
| 38 | (Flexas et al., 2010) | Spain | LT2, ST1 | Plant | Review | **93** | (Serra et al., 2014) | South Africa | LT2 | Plant | Review |
| 39 | (Trigo-Córdoba et al., 2015) | Spain | ST1 | Plant | Experimental | **94** | (Simonneau et al., 2017) | France | LT2 | Plant | Review |
| 40 | (Carvalho-Santos et al., 2016) | Portugal | LT1 | Region | Modeling | **95** | (Romero et al., 2018) | Spain | ST1, LT2 | Plant | Experimental |
| 41 | (Ramos, 2016) | Spain | LT3 | Region | Modeling | **96** | (Savi et al., 2018) | Italy | ST1 | Field | Experimental |
| 42 | (Dal Santo et al., 2016) | Italy | LT2 | Plant | Experimental | **97** | (Schelezki et al., 2018) | Australia | ST4 | Farm | Experimental |
| 43 | (Galbreath, 2011) | Australia | ST1 | Farm | Expert judgement | **98** | (Tomás et al., 2014) | Spain | ST3, LT2 | Plant | Review |
| 44 | (Galbreath, 2014) | Australia | ST1 | Farm | Expert judgement | **99** | (Torres et al., 2018a) | Spain | ST1, ST2 | Plant | Experimental |
| 45 | (Galbreath et al., 2016) | Australia | LT2, ST3, LT3, LT1, ST1 | Farm | Expert judgement | **100** | (Torres et al., 2018b) | Spain | ST2 | Plant | Experimental |
| 46 | (Hopper et al., 2016) | USA | LT2 | Plant | Experimental | **101** | (Wenter et al., 2018) | Italy | ST1 | Field | Experimental |
| 47 | (Hunter et al., 2016) | South Africa | LT3 | Plant / Field | Experimental | **102** | (Aparicio et al., 2019) | Malta | ST1 | Field / Farm | Modeling |
| 48 | (Montana et al., 2016) | Argentina | LT1, ST1 | Region | Experimental | **103** | (Buesa et al., 2019) | Spain | ST3 | Field | Experimental |
| 49 | (Olen et al., 2016) | USA | LT1, ST1 | Farm | Modeling | **104** | (Trouvelot et al., 2015) | France | ST2 | Field | Review |
| 50 | (Resco et al., 2016) | Spain | ST1, LT2,LT3 | Region | Modeling | **105** | (Fahey and Rogiers, 2019) | Australia | ST3 | Plant | Experimental |
| 51 | (Holland and Smit, 2014) | Canada | ST3, LT1, LT2 | Farm | Expert judgement | **106** | (van Leeuwen and Darriet, 2016) | France | LT1, LT2, LT3, ST3 | Sector | Review |
| 52 | (Vaz et al., 2016) | Portugal | LT2 | Field | Experimental | **107** | (Molitor et al., 2019) | Luxembourg | LT3 | Field | Experimental |
| 53 | (Zhu et al., 2016) | Italy | LT1, LT2 | Field/Farm/Region | Modeling | **108** | (Sabir, 2016) | Turkey | ST2 | Plant | Experimental |
| 54 | (Amendola et al., 2017) | Italy | ST2 | Field | Experimental | **109** | (Wolkovich et al., 2017) | USA | LT1, LT2 | Plant/Region | Review |
| 55 | (Keller, 2010) | USA | ST1, LT3, ST2, ST3, LT1 | Field/Region | Review | **110** | (Zhang et al., 2016) | France | LT2 | Plant | Review |
|  |  |  |  |  |  | **111** | (Valentini et al., 2019) | Italy | ST3 | Field | Experimental |

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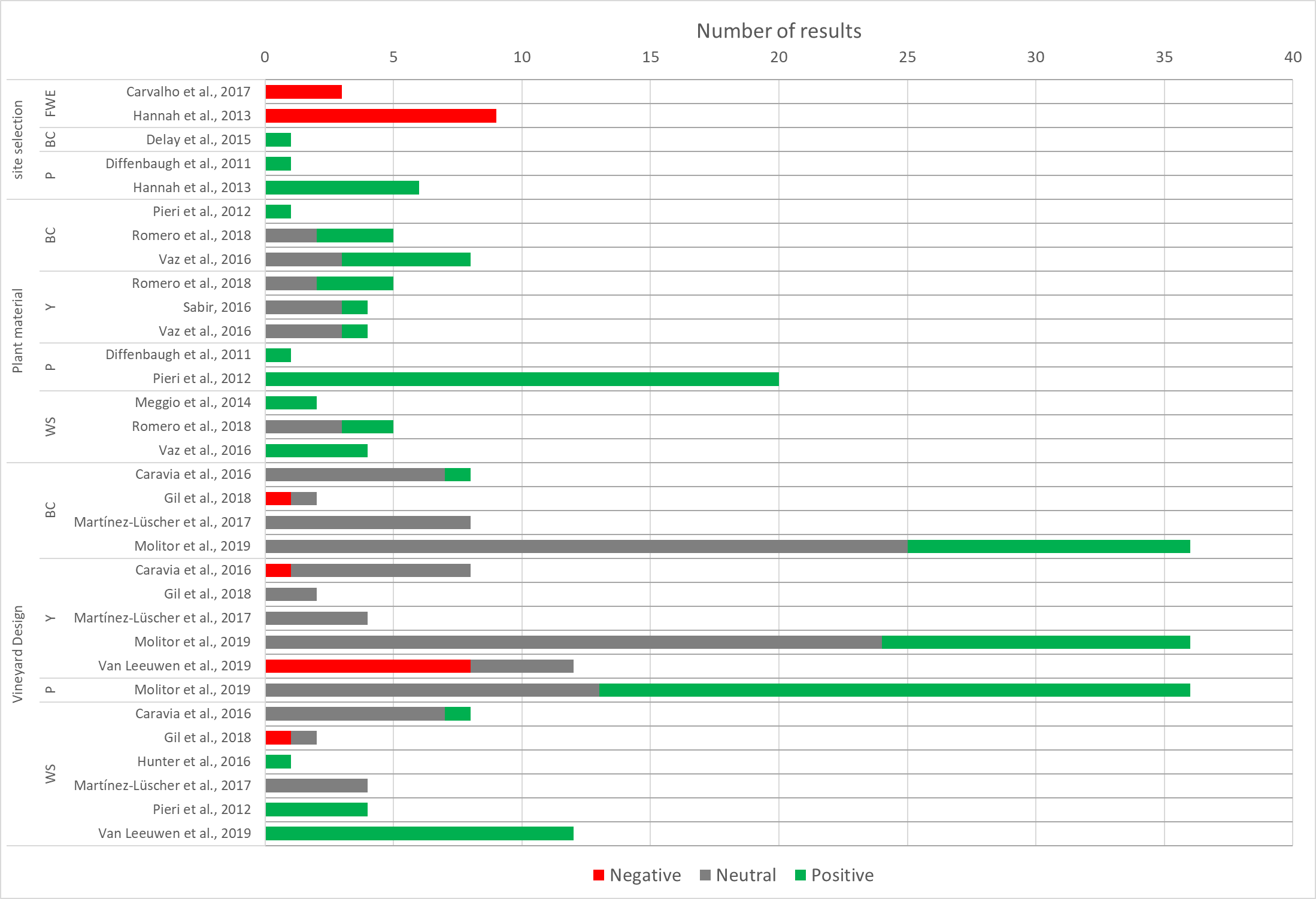
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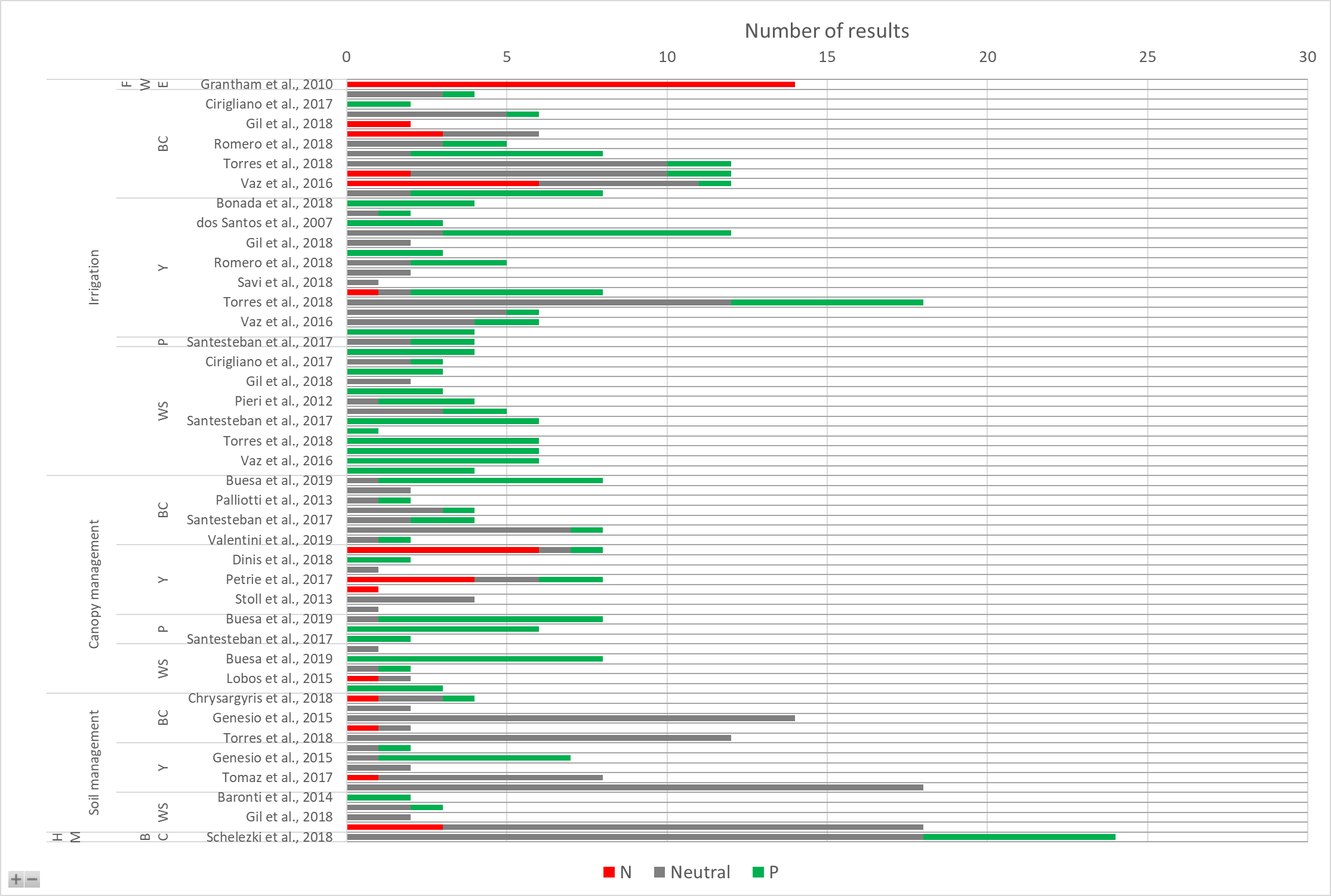
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**Supplementary Figure 1.** Number of results by study and by adaptation indicating a quantitative impact of adaptation on various outputs (FWE: freshwater ecosystem, BC: berry composition, Y: yield, P: phenology, WS: water status), summarized in Figure 5See in the material and method (Section 2) the signification of Negative (N), Neutral and Positive (P) effects.

A) Long-term adaptations



B) Short term adaptations (HM: Harvest and post-harvest management)

**Supplementary Table 2.** Complete list of indicators of evaluation with associated references (manag = management, select = selection)

|  |  |  |
| --- | --- | --- |
|  | | Adaptations |
|  | | Irrigation | Plant material | Canopy manag. | Soil manag. | Vineyard design | Farm strategy | Site select. |
| Plant scale | Gas exchanges\* | [[1]](#endnote-1), [[2]](#endnote-2), [[3]](#endnote-3), [[4]](#endnote-4), [[5]](#endnote-5), [[6]](#endnote-6) | 4 | [[7]](#endnote-7),[[8]](#endnote-8) [[9]](#endnote-9), [[10]](#endnote-10), [[11]](#endnote-11), [[12]](#endnote-12) | 8, 2 | [[13]](#endnote-13), [[14]](#endnote-14), 44 |  |  |
|  | Net photosynthesis | 3, 4, 5, [[15]](#endnote-15) | 4, [[16]](#endnote-16) | 7, [[17]](#endnote-17),9, 10, 12 | 15, 8 | 15, 13, 14, 44 |  |  |
|  | Water Status | 1, 3, 4, 5, 6, 15, [[18]](#endnote-18), [[19]](#endnote-19), [[20]](#endnote-20), [[21]](#endnote-21), [[22]](#endnote-22), 16, 32 | 4, 16, 21, [[23]](#endnote-23) | 7, 17, [[24]](#endnote-24),9, 10, 12 | 15, 8, 20, 22, [[25]](#endnote-25) | 15, 13, 14, 21 |  |  |
|  | Genetic |  | [[26]](#endnote-26), [[27]](#endnote-27), [[28]](#endnote-28), [[29]](#endnote-29) |  |  |  |  |  |
|  | Microclimate | 18 |  | 10, 11 |  | 14, 44 |  |  |
|  | Plant growth | 1, 18, 39, 4, 5, 6 | 23, 4, 39 |  | 34 |  |  |  |
|  | Root dynamics | 4 | 4 |  | [[30]](#endnote-30), 25 |  |  |  |
|  | Carbon reserve |  |  | 12 , [[31]](#endnote-31) |  |  |  |  |
| Field scale | Phenology / Suitability | 2, [[32]](#endnote-32) | [[33]](#endnote-33), 21, 36 | 17, 32, [[34]](#endnote-34) | 22 | [[35]](#endnote-35) |  | [[36]](#endnote-36), [[37]](#endnote-37) |
|  | Yield | 1, 2, 3, 4, 5, 6, 15, 16, 18, 19, 20, 22, 25, 32, [[38]](#endnote-38) [[39]](#endnote-39) | 4, 16, 39 | 10, 12, 17, 31, 32, 34, 43 | 2, 15, 25, 22, [[40]](#endnote-40) | 15, 35, [[41]](#endnote-41) |  |  |
|  | Berry / Wine composition | 2, 20, 18, 15, 16, 32, 3, 4, 22, 5, 6 | 4, 7, 21, [[42]](#endnote-42) | 17, 32, 34, 31, [[43]](#endnote-43), 12, 7 | 2, 20, 40, 15, 22 | 13, 15, 35, [[44]](#endnote-44) | [[45]](#endnote-45) | [[46]](#endnote-46) |
|  | Soil properties\*\* | 3, 4, 5 | 4 |  | 30, 25 |  |  |  |
|  | Soil biological properties | 22 |  |  | 30, 22 |  |  |  |
|  | Water use requirement | [[47]](#endnote-47), 5, 38 |  |  |  |  |  |  |
|  | Run off |  |  |  |  |  |  | [[48]](#endnote-48) |
| Farm scale | Gross income | 3, [[49]](#endnote-49), [[50]](#endnote-50), [[51]](#endnote-51) | 50, 51, [[52]](#endnote-52) | 50 |  | 50 | 50, 51, 52 | 50 |
|  | Cost | 49, 50, 51 | 50 , 51, 52 |  |  | 50 | 50, 51, 52 | 50 |
|  | Net revenue | 5, 49, 50, 51 | 50, 51, 52 | 50 |  | 50, 41 | 50, 51, 52 | 50, 41 |
|  | Labour |  |  |  |  |  |  | 46 |
|  | Vulnerability | [[53]](#endnote-53), [[54]](#endnote-54), [[55]](#endnote-55) | 53 | 53 | 53 | 53 | 53, [[56]](#endnote-56) | 53 ,54 |
| Regional scale | Freshwater ecosystem | [[57]](#endnote-57) |  |  |  |  |  | 37, [[58]](#endnote-58) |
|  | Erosion |  |  |  |  |  |  | 48, 58 |
|  | Pollution (N, salinity) | 47 |  |  |  |  |  | 58 |
|  | Economic income |  | [[59]](#endnote-59) |  |  |  |  | 59 |

\*ACO2, gs, WUEi, transpiration, \*\* soil water content, CEC, P, N, pH, particle size, Corg

1. Bonada et al., 2018 [↑](#endnote-ref-1)
2. Chrysargyris et al., 2018 [↑](#endnote-ref-2)
3. Mirás-Avalos et al., 2016 [↑](#endnote-ref-3)
4. Romero et al., 2018 [↑](#endnote-ref-4)
5. Trigo-Córdoba et al., 2015 [↑](#endnote-ref-5)
6. Wenter et al., 2018 [↑](#endnote-ref-6)
7. Lobos et al., 2015 [↑](#endnote-ref-7)
8. Baronti et al., 2014 [↑](#endnote-ref-8)
9. Attia et al., 2014 [↑](#endnote-ref-9)
10. Dinis et al., 2018 [↑](#endnote-ref-10)
11. Fahey and Rogiers, 2019 [↑](#endnote-ref-11)
12. Palliotti et al., 2013 [↑](#endnote-ref-12)
13. Caravia et al., 2016 [↑](#endnote-ref-13)
14. Hunter et al., 2016 [↑](#endnote-ref-14)
15. Gil et al., 2018 [↑](#endnote-ref-15)
16. Vaz et al., 2016 [↑](#endnote-ref-16)
17. Buesa et al., 2019 [↑](#endnote-ref-17)
18. dos Santos et al., 2007 [↑](#endnote-ref-18)
19. Savi et al., 2018 [↑](#endnote-ref-19)
20. Cirigliano et al., 2017 [↑](#endnote-ref-20)
21. Pieri et al., 2012 [↑](#endnote-ref-21)
22. Torres et al., 2018 [↑](#endnote-ref-22)
23. Meggio et al., 2014 [↑](#endnote-ref-23)
24. de C. Teixeira et al., 2014 [↑](#endnote-ref-24)
25. Tomaz et al., 2017 [↑](#endnote-ref-25)
26. Carvalho et al., 2017 [↑](#endnote-ref-26)
27. Duchene et al., 2012 [↑](#endnote-ref-27)
28. Malacarne et al., 2018 [↑](#endnote-ref-28)
29. Milla‐Tapia et al., 2013 [↑](#endnote-ref-29)
30. Amendola et al., 2017 [↑](#endnote-ref-30)
31. Valentini et al., 2019 [↑](#endnote-ref-31)
32. Santesteban et al., 2017 [↑](#endnote-ref-32)
33. Wolkovich et al., 2017 [↑](#endnote-ref-33)
34. Petrie et al., 2017 [↑](#endnote-ref-34)
35. Molitor et al., 2019 [↑](#endnote-ref-35)
36. Diffenbaugh et al., 2011 [↑](#endnote-ref-36)
37. Hannah et al., 2013 [↑](#endnote-ref-37)
38. Fraga et al., 2018 [↑](#endnote-ref-38)
39. Sabir, 2016 [↑](#endnote-ref-39)
40. Genesio et al., 2015 [↑](#endnote-ref-40)
41. Van Leeuwen et al., 2019 [↑](#endnote-ref-41)
42. Berdeja et al., 2015 [↑](#endnote-ref-42)
43. Stoll et al., 2013 [↑](#endnote-ref-43)
44. Martínez-Lüscher et al., 2017 [↑](#endnote-ref-44)
45. Schelezki et al., 2018 [↑](#endnote-ref-45)
46. Delay et al., 2015 [↑](#endnote-ref-46)
47. Phogat et al., 2018 [↑](#endnote-ref-47)
48. Concepción Ramos, 2016 [↑](#endnote-ref-48)
49. Aparicio et al., 2019 [↑](#endnote-ref-49)
50. Galbreath et al., 2016 [↑](#endnote-ref-50)
51. Sacchelli et al., 2016 [↑](#endnote-ref-51)
52. Georgopoulou et al., 2017 [↑](#endnote-ref-52)
53. Nicholas and Durham, 2012; Lereboullet et al., 2013; Neethling et al., 2017 [↑](#endnote-ref-53)
54. Montaña et al., 2016 [↑](#endnote-ref-54)
55. Ronco et al., 2017 [↑](#endnote-ref-55)
56. Pickering et al., 2014 [↑](#endnote-ref-56)
57. Grantham et al., 2010 [↑](#endnote-ref-57)
58. Carvalho-Santos et al., 2016 [↑](#endnote-ref-58)
59. Zhu et al., 2016 [↑](#endnote-ref-59)