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Supplementary Information for

Impact of *Xylella fastidiosa* subspecies *pauca* in European Olives

Schneider, van der Werf, Cendoya, Mourits, Navas-Cortes, Vicent, Oude Lansink

Kevin Schneider
E-mail: kevin.schneider@wur.nl

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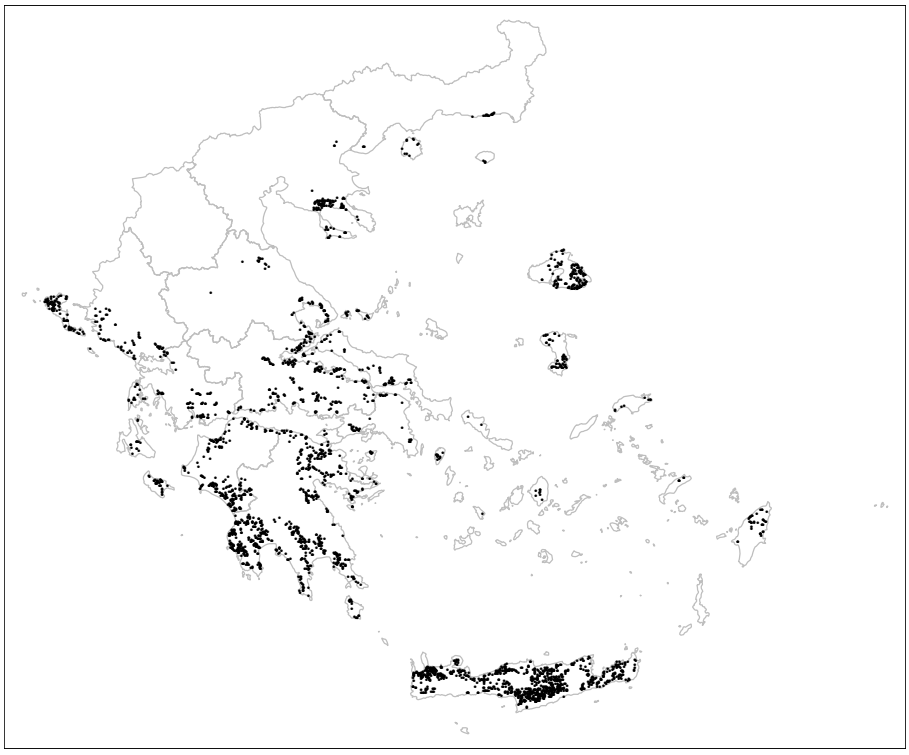
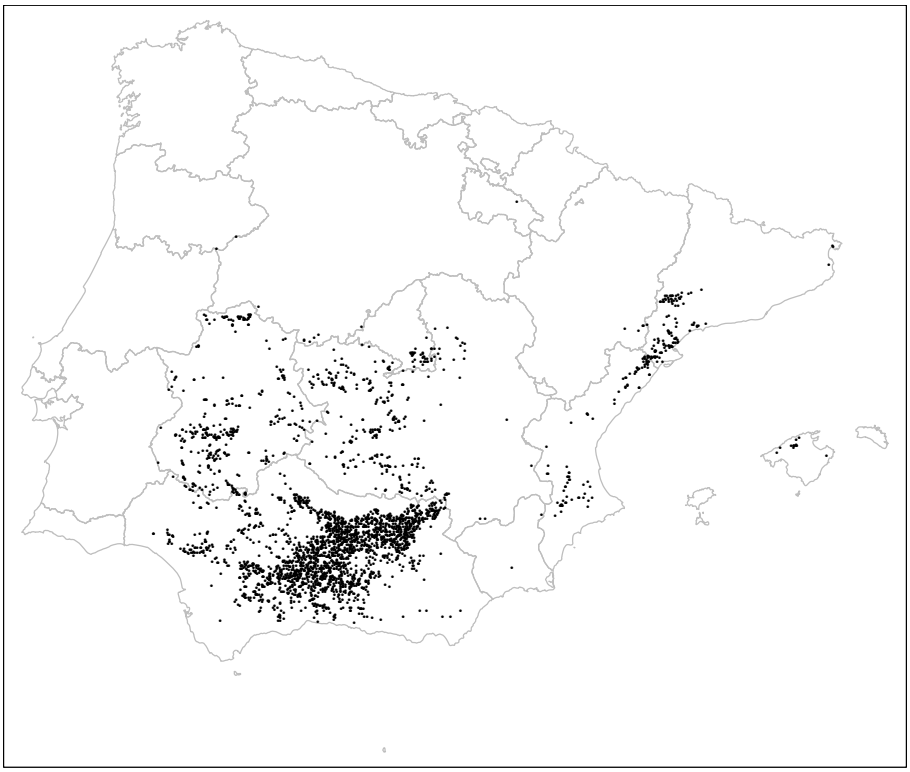


(a)



(b)

Fig. S1. All randomized points of introduction for Greece and Spain

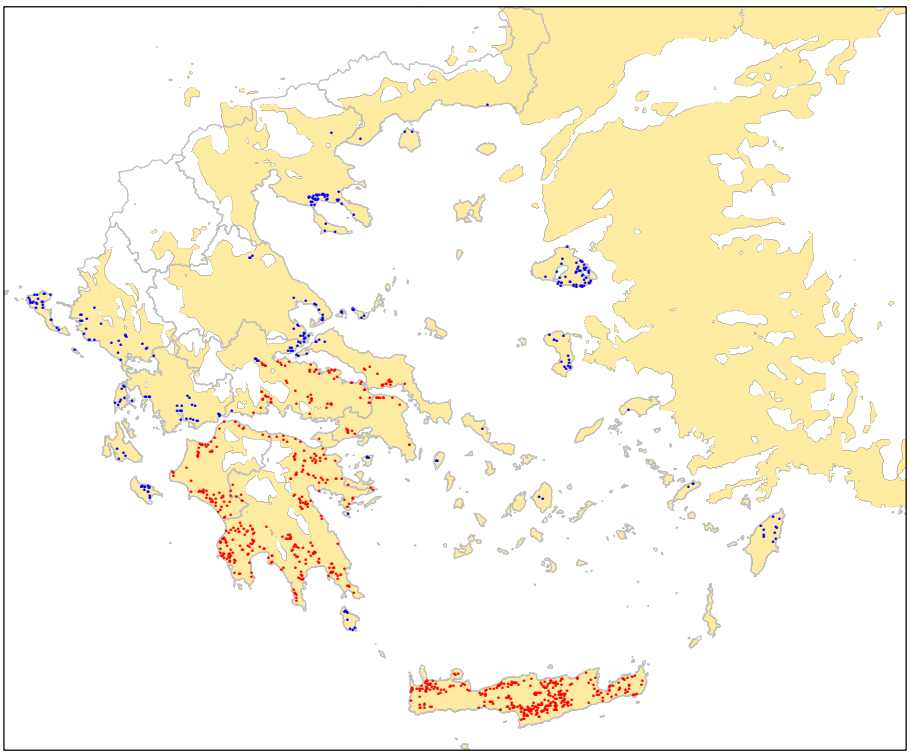


Fig. S2. Points of introduction which resulted in an infected area less than (blue) and more or equal to (red) 30 percent of the Greek area of production for the 5.18 km per year spread rate and a climatic suitability threshold of 0.132 (suitable area in yellow)

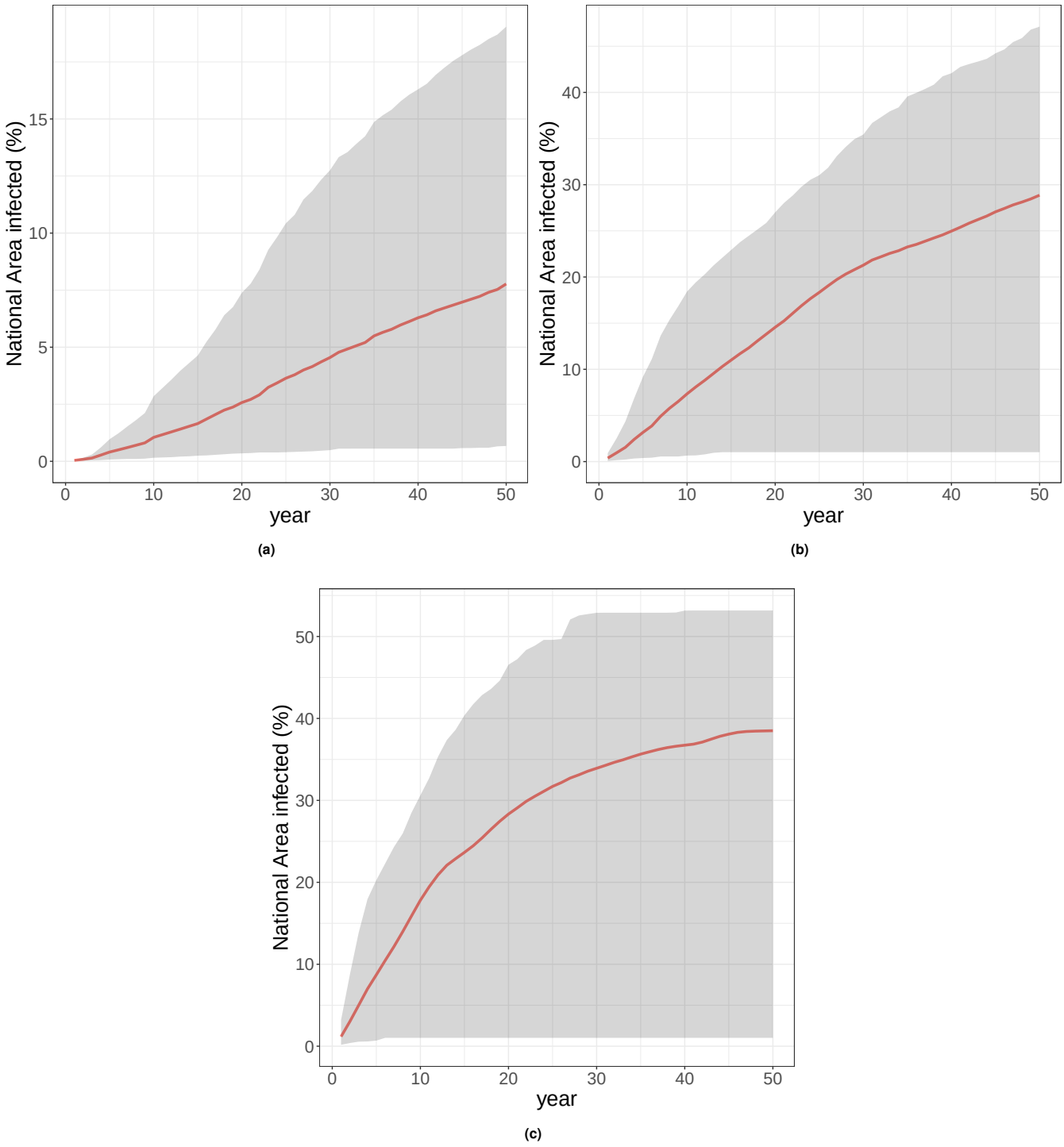


Fig. S3. Uncertainty of the Greek area of production infected over time for the 1.1 km (a), 5.18 km (b) and 12.35 km (c) per year spread rate and a climatic suitability threshold (T2) of 0.132. The mean of 1000 epidemics from 1000 random points of introduction is indicated in red. The grey area represents the 90 percent range (from the 5 to 95 percentile) of the 1000 simulated epidemics.

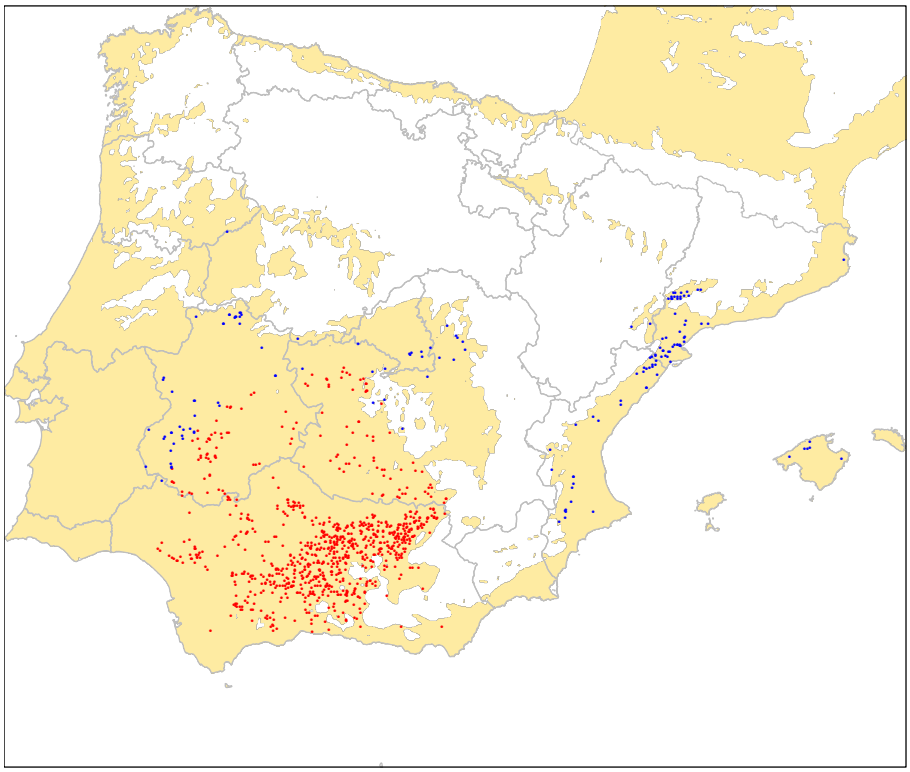


Fig. S4. Points of introduction which resulted in an infected area less than (blue) and more or equal to (red) 50 percent of the Spanish area of production for the 5.18 km per year spread rate and a climatic suitability threshold of 0.132 (suitable area in yellow)

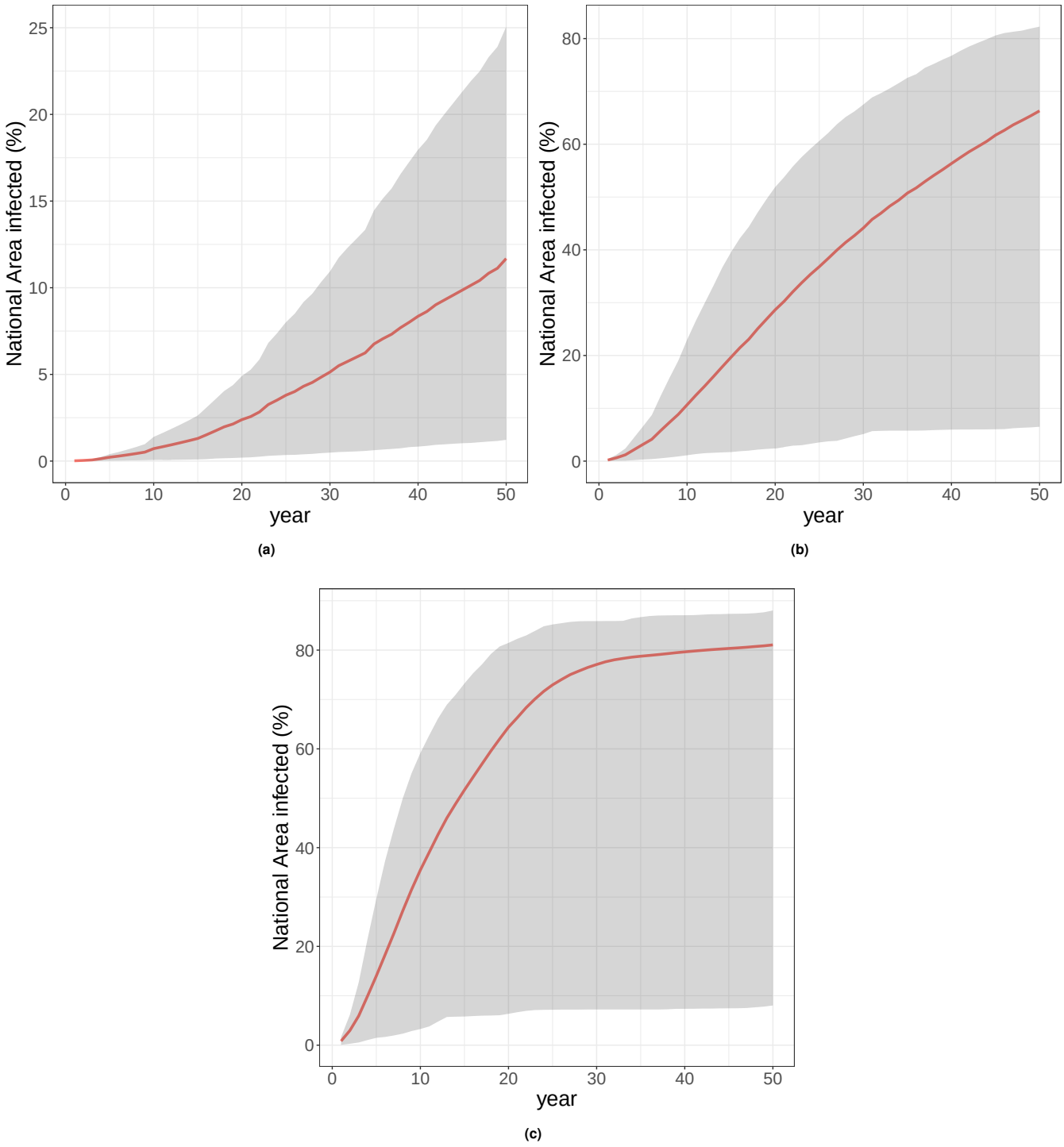


Fig. S5. Uncertainty of the Spanish area of production infected over time for the 1.1 km (a), 5.18 km (b) and 12.35 km (c) per year spread rate and a climatic suitability threshold (T2) of 0.132. The mean of 1000 epidemics from 1000 random points of introduction is indicated in red. The grey area represents the 90 percent range (from the 5 to 95 percentile) of the 1000 simulated epidemics.

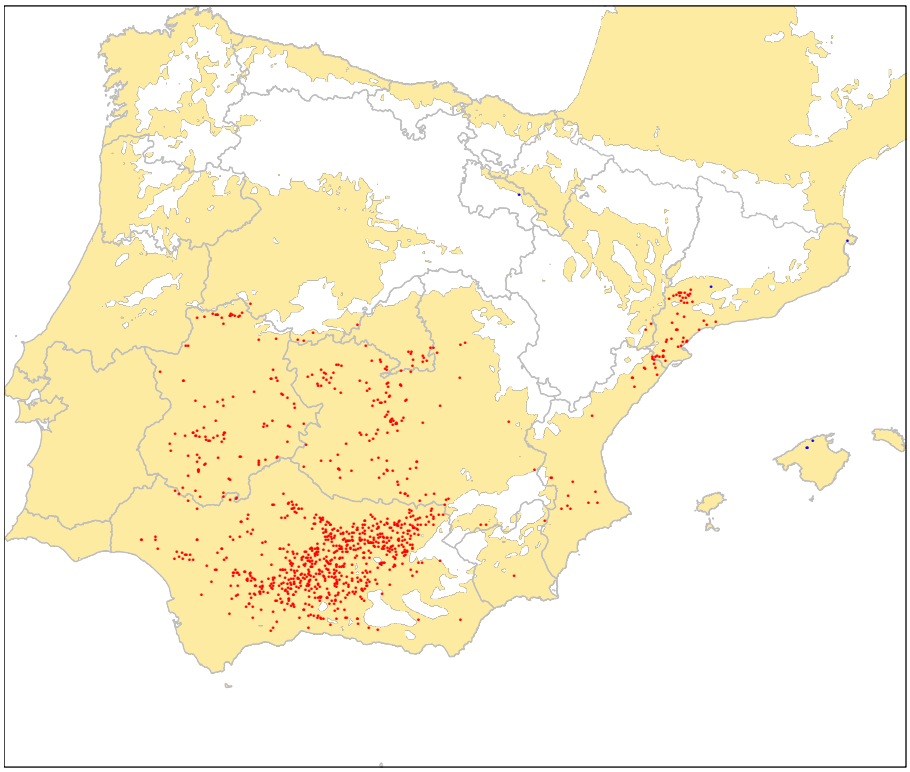


Fig. S6. Points of introduction which resulted in an infected area less than (blue) and more or equal to (red) 50 percent of the Spanish area of production for the 12.35 km per year spread rate and a climatic suitability threshold of 0.093 (suitable area in yellow)

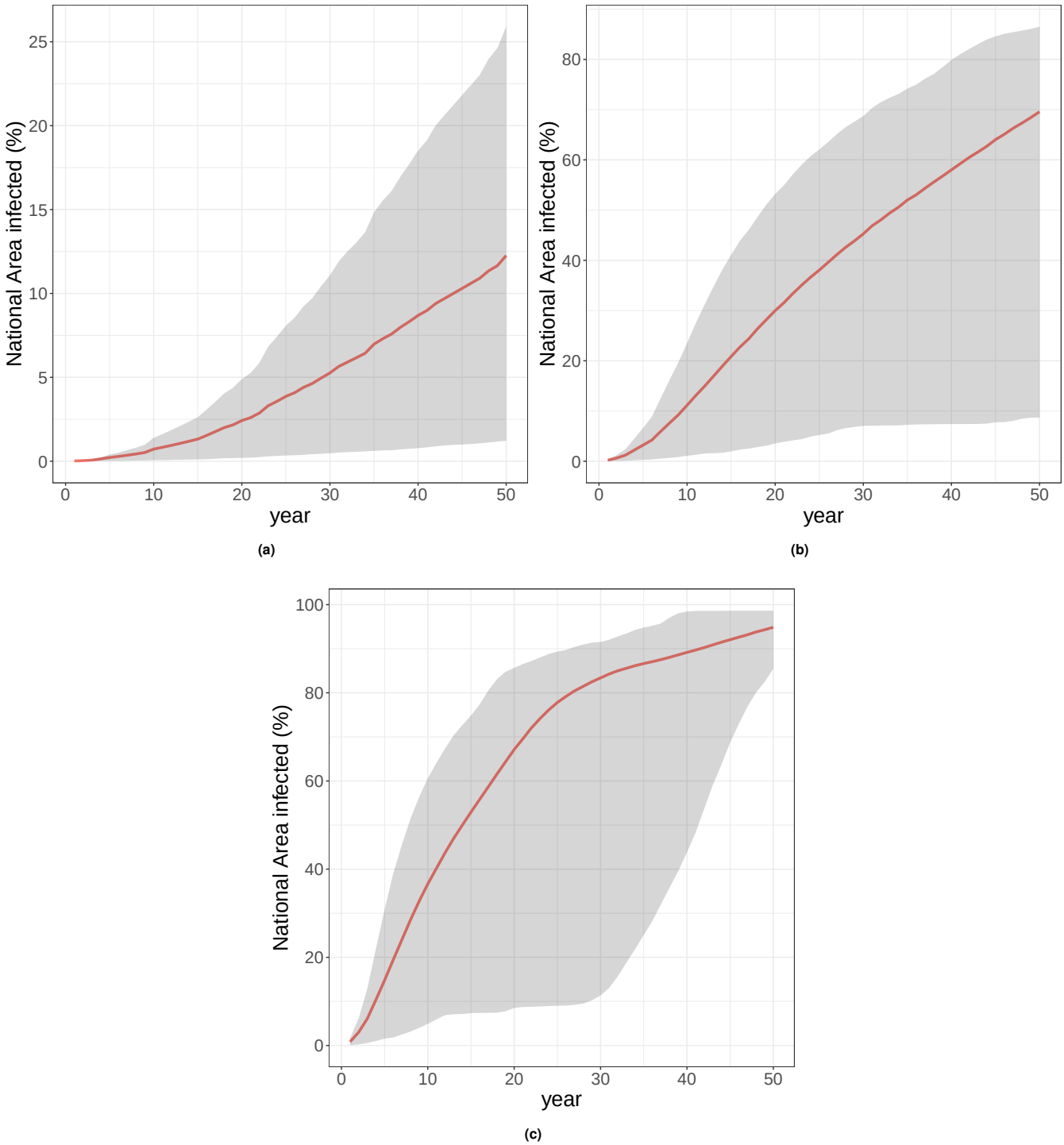
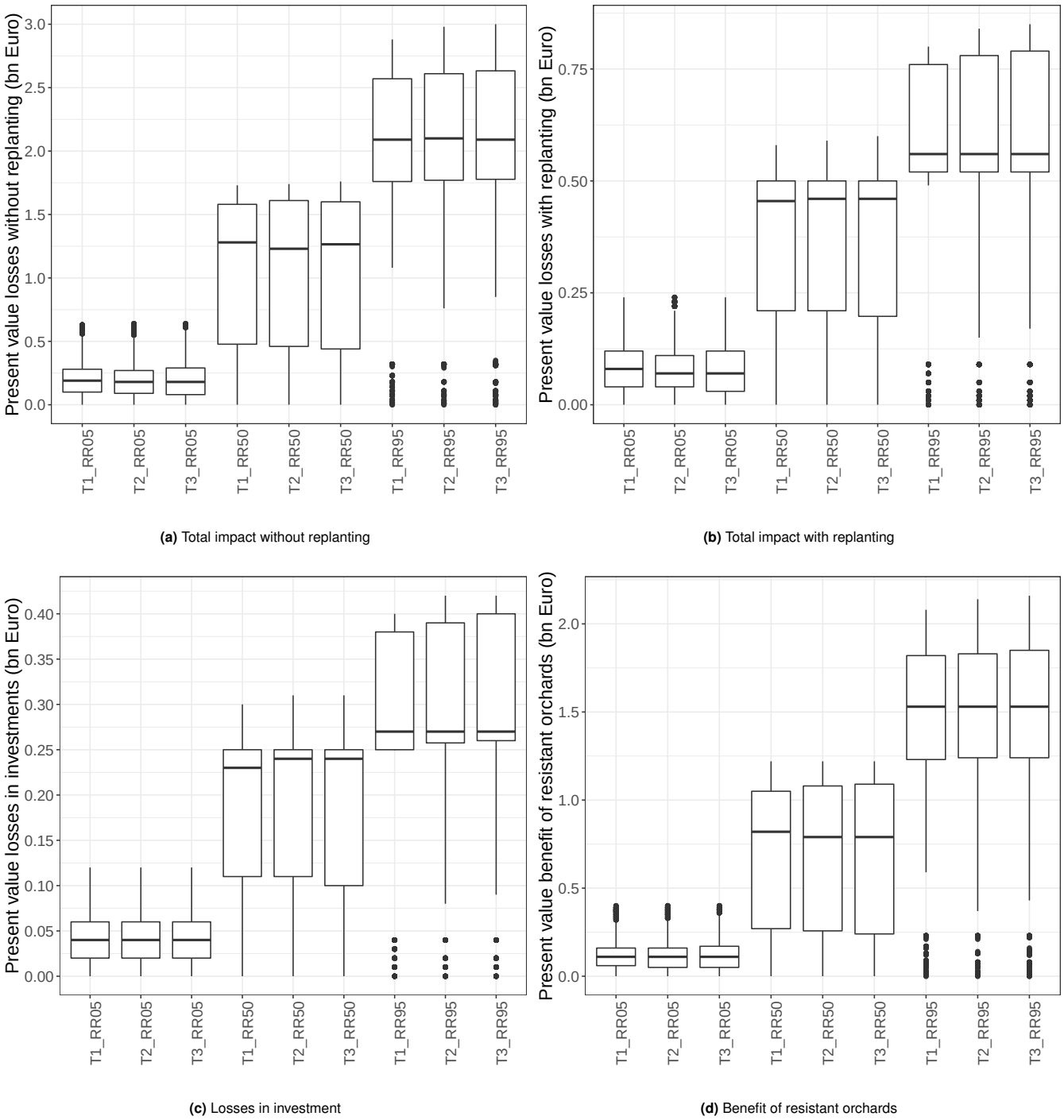


Fig. S7. Uncertainty of the Spanish area of production infected over time for the 1.1 km (a), 5.18 km (b) and 12.35 km (c) per year spread rate and a climatic suitability threshold (T3) of 0.093. The mean of 1000 epidemics from 1000 random points of introduction is indicated in red. The grey area represents the 90 percent range (from the 5 to 95 percentile) of the 1000 simulated epidemics.



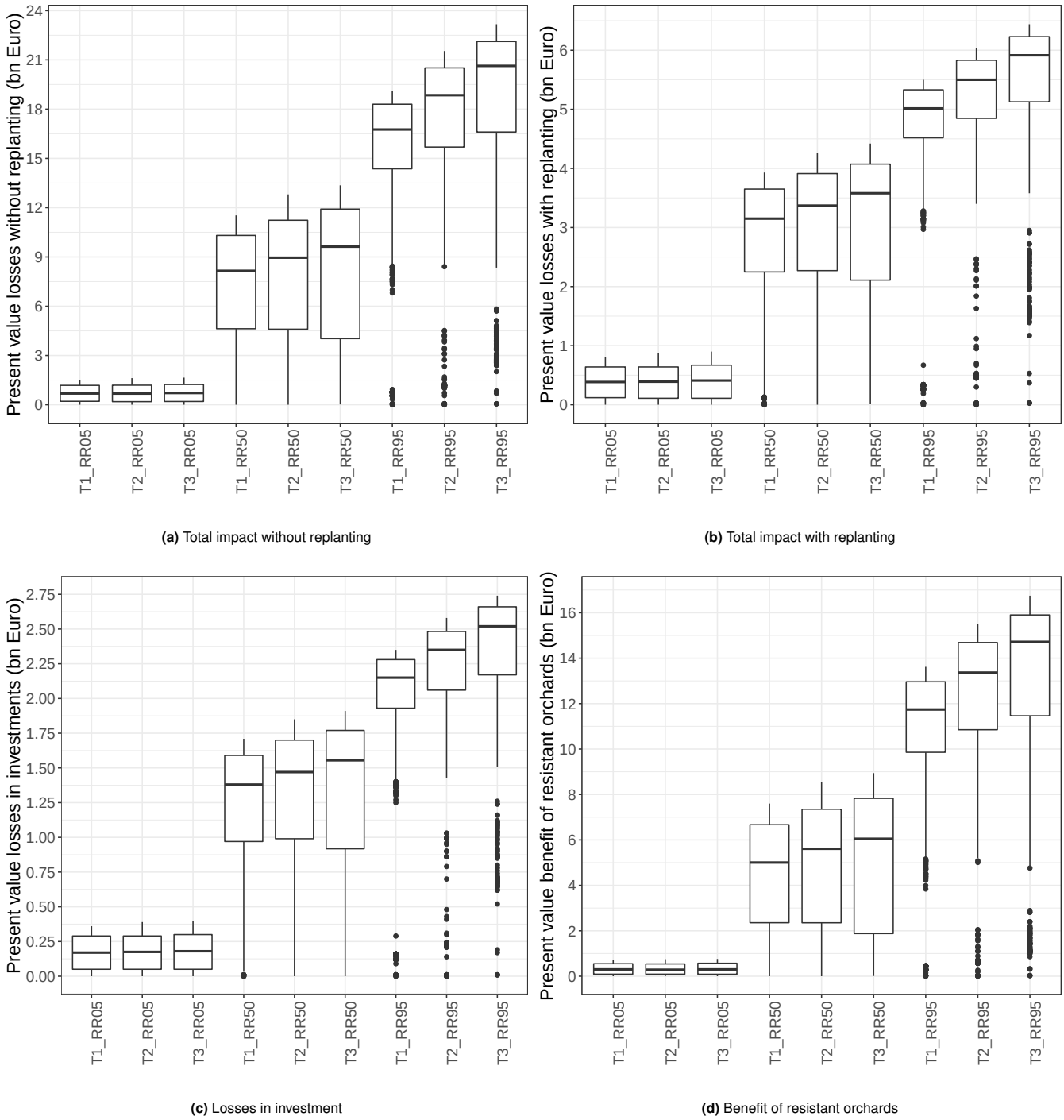
(a) Total impact without replanting

(b) Total impact with replanting

(c) Losses in investment

(d) Benefit of resistant orchards

Fig. S8. Distribution of economic results across all random points of introduction in Greece for all spread scenarios



(a) Total impact without replanting

(b) Total impact with replanting

(c) Losses in investment

(d) Benefit of resistant orchards

Fig. S9. Distribution of economic results across all random points of introduction in Spain for all spread scenarios

Table S1. Economic parameters for the deterministic analysis as well as the global sensitivity analysis

Parameter	Deterministic	Global Sensitivity Analysis		
		Distribution	Mean/Min.	SD/Max.
Planning Horizon ($years$)	50	-	-	-
Total area of production in Europe (ha)	4,600,000	-	-	-
Total production in Italy ($tons$)	3,188,712	normal	3,188,712	175,940
Total production in Greece ($tons$)	2,367,466	-	-	-
Total production in Spain ($tons$)	6,689,447	-	-	-
Price in Italy ($Euro\ ton^{-1}$)	496	normal	496	116
Price in Greece ($Euro\ ton^{-1}$)	560	-	-	-
Price in Spain ($Euro\ ton^{-1}$)	481	-	-	-
Operating Costs in Italy ($Euro\ ton^{-1}$)	316	normal	316	52
Operating Costs in Greece ($Euro\ ton^{-1}$)	387	-	-	-
Operating Costs in Spain ($Euro\ ton^{-1}$)	247	-	-	-
Price response (%)	0.52	normal	0.52	0.1
Discount rate (%)	3	uniform	3	7
Xfp yield-decline (%)	10	uniform	-50	-5
Xfp cost-change (%)	10	uniform	-25	25
Full-bearing age RT ($years$)	10	uniform	10	15
Full-bearing age IT ($years$)	8	uniform	8	10
Full-bearing age RI ($years$)	6	uniform	6	8
Full-bearing age II ($years$)	5	uniform	5	7
Full-bearing age RHD ($years$)	4	uniform	4	5
Full-bearing age IHD ($years$)	3	uniform	3	6
Yield potential RT ($ton\ ha^{-1}$)	2.5	uniform	1	5
Yield potential IT ($ton\ ha^{-1}$)	5	uniform	5	10
Yield potential RI ($ton\ ha^{-1}$)	5	uniform	4	6
Yield potential II ($ton\ ha^{-1}$)	8	uniform	8	10
Yield potential RHD ($ton\ ha^{-1}$)	5	uniform	4	6
Yield potential IHD ($ton\ ha^{-1}$)	10	uniform	10	16
Replanting cost RT ($Euro\ ha^{-1}$)	500	uniform	500	1000
Replanting cost IT ($Euro\ ha^{-1}$)	2500	uniform	2500	5000
Replanting cost RI ($Euro\ ha^{-1}$)	750	uniform	750	1500
Replanting cost II ($Euro\ ha^{-1}$)	3000	uniform	3000	6000
Replanting cost RHD ($Euro\ ha^{-1}$)	3000	uniform	3000	6000
Replanting cost IHD ($Eur\ ha^{-1}$)	6000	uniform	6000	12000
Longevity RT ($years$)	135	uniform	135	270
Longevity IT ($years$)	135	uniform	135	270
Longevity RI ($years$)	75	uniform	75	150
Longevity II ($years$)	75	uniform	75	150
Longevity RHD ($years$)	55	uniform	55	110
Longevity IHD ($years$)	55	uniform	55	110

Cropping systems are rainfed-traditional (RT), irrigated-traditional (IT), rainfed-intensive (RI), irrigated-intensive (II), rainfed-high-density (RHD) and irrigated-high-density (IHD)

Table S2. Economic impact over 50 years in billion Euro for all spread scenarios.

Spread Scenario	Without Replanting						With Replanting						Lost Investment	Benefits of Resistance		
	Total Impact			Change in Profits			Total Impact			Change in Profits						
	EL	ES	IT	EL	ES	IT	EL	ES	IT	EL	ES	IT		EL	ES	IT
Spread in Italy																
T1-RR05	0.68	1.71	−1.86	0.68	1.71	−1.65	0.10	0.26	−0.59	0.10	0.26	−0.38	−0.21	−0.58	−1.45	1.27
T2-RR05	0.68	1.71	−1.86	0.68	1.71	−1.65	0.10	0.26	−0.59	0.10	0.26	−0.38	−0.21	−0.58	−1.45	1.27
T3-RR05	0.68	1.71	−1.86	0.68	1.71	−1.65	0.10	0.26	−0.59	0.10	0.26	−0.38	−0.21	−0.58	−1.45	1.27
T1-RR50	1.03	2.59	−3.13	1.03	2.59	−2.73	0.16	0.42	−1.04	0.16	0.42	−0.64	−0.40	−0.86	−2.17	2.09
T2-RR50	1.04	2.61	−3.15	1.04	2.61	−2.75	0.17	0.42	−1.05	0.17	0.42	−0.65	−0.40	−0.87	−2.18	2.10
T3-RR50	1.05	2.64	−3.21	1.05	2.64	−2.80	0.17	0.43	−1.08	0.17	0.43	−0.66	−0.41	−0.88	−2.21	2.14
T1-RR95	1.57	3.94	−5.10	1.57	3.94	−4.50	0.24	0.61	−1.55	0.24	0.61	−0.95	−0.60	−1.33	−3.34	3.55
T2-RR95	1.59	3.99	−5.17	1.59	3.99	−4.56	0.24	0.62	−1.57	0.24	0.62	−0.96	−0.61	−1.34	−3.37	3.60
T3-RR95	1.64	4.12	−5.41	1.64	4.12	−4.77	0.25	0.64	−1.64	0.25	0.64	−1.00	−0.63	−1.39	−3.48	3.77
*Spread in Greece**																
T1-RR05	−0.22	0.18	0.09	−0.17	0.18	0.09	−0.09	0.03	0.01	−0.04	0.03	0.01	−0.05	0.13	−0.16	−0.07
T2-RR05	−0.21	0.18	0.09	−0.17	0.18	0.09	−0.09	0.03	0.01	−0.04	0.03	0.01	−0.04	0.13	−0.15	−0.07
T3-RR05	−0.22	0.18	0.09	−0.17	0.18	0.09	−0.09	0.03	0.01	−0.04	0.03	0.01	−0.05	0.13	−0.15	−0.07
T1-RR50	−1.09	0.90	0.43	−0.90	0.90	0.43	−0.37	0.12	0.06	−0.18	0.12	0.06	−0.19	0.72	−0.78	−0.37
T2-RR50	−1.08	0.89	0.42	−0.89	0.89	0.42	−0.37	0.12	0.06	−0.18	0.12	0.06	−0.19	0.71	−0.77	−0.37
T3-RR50	−1.07	0.88	0.42	−0.88	0.88	0.42	−0.36	0.12	0.06	−0.18	0.12	0.06	−0.18	0.70	−0.76	−0.37
T1-RR95	−1.87	1.56	0.75	−1.60	1.56	0.75	−0.54	0.18	0.09	−0.28	0.18	0.09	−0.27	1.33	−1.38	−0.66
T2-RR95	−1.94	1.60	0.76	−1.65	1.60	0.76	−0.58	0.19	0.09	−0.29	0.19	0.09	−0.29	1.36	−1.41	−0.67
T3-RR95	−1.91	1.58	0.75	−1.63	1.58	0.75	−0.57	0.19	0.09	−0.29	0.19	0.09	−0.28	1.34	−1.39	−0.66
*Spread in Spain**																
T1-RR05	0.21	−0.70	0.25	0.21	−0.53	0.25	0.05	−0.38	0.06	0.05	−0.21	0.06	−0.17	−0.16	0.32	−0.20
T2-RR05	0.21	−0.71	0.25	0.21	−0.53	0.25	0.05	−0.39	0.06	0.05	−0.21	0.06	−0.17	−0.16	0.32	−0.19
T3-RR05	0.22	−0.73	0.26	0.22	−0.55	0.26	0.05	−0.40	0.06	0.05	−0.22	0.06	−0.18	−0.17	0.33	−0.20
T1-RR50	1.79	−7.21	2.14	1.79	−6.01	2.14	0.35	−2.76	0.42	0.35	−1.56	0.42	−1.21	−1.44	4.45	−1.72
T2-RR50	1.90	−7.83	2.27	1.90	−6.55	2.27	0.37	−2.93	0.44	0.37	−1.65	0.44	−1.27	−1.53	4.90	−1.83
T3-RR50	1.96	−8.20	2.35	1.96	−6.88	2.35	0.38	−3.04	0.46	0.38	−1.72	0.46	−1.32	−1.58	5.16	−1.89
T1-RR95	3.54	−15.33	4.24	3.54	−13.34	4.24	0.57	−4.63	0.69	0.57	−2.65	0.69	−1.99	−2.97	10.69	−3.56
T2-RR95	3.76	−16.86	4.50	3.76	−14.74	4.50	0.61	−4.98	0.73	0.61	−2.85	0.73	−2.12	−3.15	11.88	−3.77
T3-RR95	4.01	−18.59	4.80	4.01	−16.26	4.80	0.66	−5.48	0.80	0.66	−3.15	0.80	−2.33	−3.35	13.11	−4.00

* averaged over all random points of introduction. EL=Greece, ES=Spain, IT=Italy

Table S3. First order sensitivity indices for all parameters for the economic impact without replanting

Parameter	Original	Bias	Std.Error	Min. CI	Max. CI
Price in Italy ($Euro\ ton^{-1}$)	0.6643	−0.0001	0.0069	0.6509	0.6785
Price response (%)	0.0034	−0.0003	0.0145	−0.0234	0.0348
Operating Costs in Italy ($Euro\ ton^{-1}$)	0.1649	−0.0008	0.0134	0.1388	0.1925
Total production IT (ton)	−0.0004	−0.0003	0.0147	−0.0274	0.0315
Discount rate (%)	0.0331	0.0000	0.0165	0.0024	0.0687
Xfp yield-decline (%)	0.0226	−0.0004	0.0146	−0.0044	0.0526
Xfp cost-change (%)	0.0196	−0.0005	0.0146	−0.0069	0.0504
Longevity RT ($years$)	0.0008	−0.0003	0.0146	−0.0264	0.0328
Longevity IT ($years$)	0.0007	−0.0003	0.0146	−0.0259	0.0318
Longevity RI ($years$)	0.0038	−0.0003	0.0145	−0.0228	0.0351
Longevity II ($years$)	−0.0002	−0.0003	0.0146	−0.0272	0.0318
Longevity RHD ($years$)	0.0000	−0.0003	0.0146	−0.0269	0.0315
Longevity IHD ($years$)	0.0002	−0.0003	0.0146	−0.0265	0.0319
Replanting cost RT ($Euro\ ha^{-1}$)	0.0008	−0.0003	0.0145	−0.0260	0.0319
Replanting cost IT ($Euro\ ha^{-1}$)	0.0000	−0.0003	0.0145	−0.0269	0.0316
Replanting cost RI ($Euro\ ha^{-1}$)	0.0002	−0.0003	0.0146	−0.0266	0.0311
Replanting cost II ($Euro\ ha^{-1}$)	0.0004	−0.0003	0.0145	−0.0266	0.0317
Replanting cost RHD ($Euro\ ha^{-1}$)	0.0001	−0.0003	0.0146	−0.0268	0.0316
Replanting cost IHD ($Eur\ ha^{-1}$)	0.0002	−0.0003	0.0146	−0.0266	0.0319
Full-bearing age RT ($years$)	0.0002	−0.0003	0.0145	−0.0266	0.0318
Full-bearing age IT ($years$)	0.0002	−0.0003	0.0146	−0.0266	0.0318
Full-bearing age RI ($years$)	0.0001	−0.0003	0.0145	−0.0268	0.0317
Full-bearing age II ($years$)	0.0002	−0.0003	0.0146	−0.0266	0.0318
Full-bearing age RHD ($years$)	0.0002	−0.0003	0.0146	−0.0266	0.0318
Full-bearing age IHD ($years$)	0.0002	−0.0003	0.0146	−0.0266	0.0318
Yield Potential RT ($ton\ ha^{-1}$)	0.0001	−0.0003	0.0145	−0.0268	0.0319
Yield Potential IT ($ton\ ha^{-1}$)	0.0000	−0.0003	0.0146	−0.0271	0.0316
Yield Potential RI ($ton\ ha^{-1}$)	0.0003	−0.0003	0.0145	−0.0267	0.0319
Yield Potential II ($ton\ ha^{-1}$)	0.0001	−0.0003	0.0145	−0.0269	0.0318
Yield Potential RHD ($ton\ ha^{-1}$)	−0.0001	−0.0003	0.0146	−0.0270	0.0315
Yield Potential IHD ($ton\ ha^{-1}$)	0.0001	−0.0003	0.0146	−0.0268	0.0317

Cropping systems are rainfed-traditional (RT), irrigated-traditional (IT), rainfed-intensive (RI), irrigated-intensive (II), rainfed-high-density (RHD) and irrigated-high-density (IHD)

Table S4. Total order sensitivity indices for all parameters for the economic impact without replanting

Parameter	Original	Bias	Std.Error	Min. CI	Max. CI
Price in Italy ($Euro\ ton^{-1}$)	0.7171	0.0007	0.0123	0.6922	0.7410
Price response (%)	0.0039	0.0000	0.0001	0.0037	0.0040
Operating Costs in Italy ($Euro\ ton^{-1}$)	0.1689	0.0002	0.0034	0.1620	0.1760
Total production IT (ton)	0.0044	0.0000	0.0001	0.0041	0.0046
Discount rate (%)	0.0703	0.0000	0.0018	0.0667	0.0737
Xfp yield-decline (%)	0.0727	0.0001	0.0023	0.0679	0.0770
Xfp cost-change (%)	0.0577	0.0001	0.0018	0.0542	0.0612
Longevity RT ($years$)	0.0020	0.0000	0.0000	0.0019	0.0021
Longevity IT ($years$)	0.0008	0.0000	0.0000	0.0008	0.0008
Longevity RI ($years$)	0.0030	0.0000	0.0001	0.0028	0.0031
Longevity II ($years$)	0.0007	0.0000	0.0000	0.0007	0.0007
Longevity RHD ($years$)	0.0002	0.0000	0.0000	0.0002	0.0002
Longevity IHD ($years$)	0.0000	0.0000	0.0000	0.0000	0.0000
Replanting cost RT ($Euro\ ha^{-1}$)	0.0010	0.0000	0.0000	0.0009	0.0010
Replanting cost IT ($Euro\ ha^{-1}$)	0.0005	0.0000	0.0000	0.0005	0.0005
Replanting cost RI ($Euro\ ha^{-1}$)	0.0008	0.0000	0.0000	0.0007	0.0008
Replanting cost II ($Euro\ ha^{-1}$)	0.0002	0.0000	0.0000	0.0002	0.0003
Replanting cost RHD ($Euro\ ha^{-1}$)	0.0001	0.0000	0.0000	0.0001	0.0001
Replanting cost IHD ($Eur\ ha^{-1}$)	0.0000	0.0000	0.0000	0.0000	0.0000
Full-bearing age RT ($years$)	0.0000	0.0000	0.0000	0.0000	0.0000
Full-bearing age IT ($years$)	0.0000	0.0000	0.0000	0.0000	0.0000
Full-bearing age RI ($years$)	0.0000	0.0000	0.0000	0.0000	0.0000
Full-bearing age II ($years$)	0.0000	0.0000	0.0000	0.0000	0.0000
Full-bearing age RHD ($years$)	0.0000	0.0000	0.0000	0.0000	0.0000
Full-bearing age IHD ($years$)	0.0000	0.0000	0.0000	0.0000	0.0000
Yield Potential RT ($ton\ ha^{-1}$)	0.0006	0.0000	0.0000	0.0006	0.0007
Yield Potential IT ($ton\ ha^{-1}$)	0.0003	0.0000	0.0000	0.0002	0.0003
Yield Potential RI ($ton\ ha^{-1}$)	0.0004	0.0000	0.0000	0.0003	0.0004
Yield Potential II ($ton\ ha^{-1}$)	0.0001	0.0000	0.0000	0.0001	0.0002
Yield Potential RHD ($ton\ ha^{-1}$)	0.0001	0.0000	0.0000	0.0001	0.0001
Yield Potential IHD ($ton\ ha^{-1}$)	0.0000	0.0000	0.0000	0.0000	0.0000

Cropping systems are rainfed-traditional (RT), irrigated-traditional (IT), rainfed-intensive (RI), irrigated-intensive (II), rainfed-high-density (RHD) and irrigated-high-density (IHD)

Table S5. First order sensitivity indices for all parameters for the economic impact with replanting

Parameter	Original	Bias	Std.Error	Min. CI	Max. CI
Price in Italy ($Euro\ ton^{-1}$)	0.6186	0.0001	0.0112	0.5976	0.6405
Price response (%)	−0.0117	0.0001	0.0192	−0.0481	0.0275
Operating Costs in Italy ($Euro\ ton^{-1}$)	0.1421	0.0000	0.0194	0.1050	0.1837
Total production IT (ton)	−0.0129	0.0001	0.0194	−0.0504	0.0271
Discount rate (%)	−0.0096	0.0001	0.0215	−0.0510	0.0348
Xfp yield-decline (%)	−0.0065	0.0001	0.0212	−0.0482	0.0373
Xfp cost-change (%)	−0.0260	0.0003	0.0219	−0.0687	0.0191
Longevity RT ($years$)	−0.0108	0.0001	0.0190	−0.0475	0.0286
Longevity IT ($years$)	−0.0129	0.0001	0.0190	−0.0497	0.0269
Longevity RI ($years$)	−0.0043	0.0001	0.0189	−0.0408	0.0347
Longevity II ($years$)	−0.0153	0.0001	0.0190	−0.0527	0.0241
Longevity RHD ($years$)	−0.0148	0.0001	0.0190	−0.0517	0.0248
Longevity IHD ($years$)	−0.0151	0.0001	0.0190	−0.0524	0.0244
Replanting cost RT ($Euro\ ha^{-1}$)	−0.0126	0.0001	0.0191	−0.0501	0.0268
Replanting cost IT ($Euro\ ha^{-1}$)	−0.0148	0.0001	0.0190	−0.0519	0.0249
Replanting cost RI ($Euro\ ha^{-1}$)	−0.0102	0.0002	0.0190	−0.0472	0.0296
Replanting cost II ($Euro\ ha^{-1}$)	−0.0140	0.0001	0.0190	−0.0509	0.0249
Replanting cost RHD ($Euro\ ha^{-1}$)	−0.0146	0.0001	0.0190	−0.0520	0.0255
Replanting cost IHD ($Eur\ ha^{-1}$)	−0.0152	0.0001	0.0190	−0.0525	0.0245
Full-bearing age RT ($years$)	−0.0156	0.0001	0.0190	−0.0529	0.0240
Full-bearing age IT ($years$)	−0.0152	0.0001	0.0190	−0.0526	0.0246
Full-bearing age RI ($years$)	−0.0150	0.0001	0.0190	−0.0521	0.0249
Full-bearing age II ($years$)	−0.0152	0.0001	0.0190	−0.0524	0.0246
Full-bearing age RHD ($years$)	−0.0153	0.0001	0.0190	−0.0525	0.0245
Full-bearing age IHD ($years$)	−0.0152	0.0001	0.0190	−0.0526	0.0246
Yield Potential RT ($ton\ ha^{-1}$)	−0.0133	0.0001	0.0190	−0.0504	0.0265
Yield Potential IT ($ton\ ha^{-1}$)	−0.0161	0.0001	0.0191	−0.0534	0.0239
Yield Potential RI ($ton\ ha^{-1}$)	−0.0144	0.0001	0.0190	−0.0515	0.0261
Yield Potential II ($ton\ ha^{-1}$)	−0.0151	0.0001	0.0190	−0.0524	0.0246
Yield Potential RHD ($ton\ ha^{-1}$)	−0.0152	0.0001	0.0191	−0.0528	0.0248
Yield Potential IHD ($ton\ ha^{-1}$)	−0.0153	0.0001	0.0190	−0.0526	0.0245

Cropping systems are rainfed-traditional (RT), irrigated-traditional (IT), rainfed-intensive (RI), irrigated-intensive (II), rainfed-high-density (RHD) and irrigated-high-density (IHD)

Table S6. Total order sensitivity indices for all parameters for the economic impact with replanting

Parameter	Original	Bias	Std.Error	Min. CI	Max. CI
Price in Italy ($Euro\ ton^{-1}$)	0.7565	0.0001	0.0151	0.7266	0.7853
Price response (%)	0.0029	0.0000	0.0001	0.0027	0.0031
Operating Costs in Italy ($Euro\ ton^{-1}$)	0.2231	0.0002	0.0064	0.2092	0.2352
Total production IT (ton)	0.0038	0.0000	0.0002	0.0033	0.0042
Discount rate (%)	0.0595	0.0000	0.0030	0.0534	0.0654
Xfp yield-decline (%)	0.0965	0.0002	0.0039	0.0889	0.1039
Xfp cost-change (%)	0.0907	0.0000	0.0040	0.0824	0.0984
Longevity RT ($years$)	0.0082	0.0000	0.0002	0.0077	0.0086
Longevity IT ($years$)	0.0033	0.0000	0.0001	0.0031	0.0035
Longevity RI ($years$)	0.0104	0.0000	0.0003	0.0098	0.0110
Longevity II ($years$)	0.0026	0.0000	0.0001	0.0025	0.0028
Longevity RHD ($years$)	0.0008	0.0000	0.0000	0.0008	0.0009
Longevity IHD ($years$)	0.0001	0.0000	0.0000	0.0001	0.0001
Replanting cost RT ($Euro\ ha^{-1}$)	0.0049	0.0000	0.0001	0.0046	0.0052
Replanting cost IT ($Euro\ ha^{-1}$)	0.0023	0.0000	0.0001	0.0022	0.0024
Replanting cost RI ($Euro\ ha^{-1}$)	0.0056	0.0000	0.0002	0.0051	0.0060
Replanting cost II ($Euro\ ha^{-1}$)	0.0015	0.0000	0.0000	0.0014	0.0016
Replanting cost RHD ($Euro\ ha^{-1}$)	0.0005	0.0000	0.0000	0.0004	0.0005
Replanting cost IHD ($Eur\ ha^{-1}$)	0.0000	0.0000	0.0000	0.0000	0.0000
Full-bearing age RT ($years$)	0.0002	0.0000	0.0000	0.0002	0.0002
Full-bearing age IT ($years$)	0.0000	0.0000	0.0000	0.0000	0.0000
Full-bearing age RI ($years$)	0.0002	0.0000	0.0000	0.0002	0.0002
Full-bearing age II ($years$)	0.0000	0.0000	0.0000	0.0000	0.0000
Full-bearing age RHD ($years$)	0.0000	0.0000	0.0000	0.0000	0.0000
Full-bearing age IHD ($years$)	0.0000	0.0000	0.0000	0.0000	0.0000
Yield Potential RT ($ton\ ha^{-1}$)	0.0019	0.0000	0.0002	0.0016	0.0022
Yield Potential IT ($ton\ ha^{-1}$)	0.0005	0.0000	0.0000	0.0004	0.0006
Yield Potential RI ($ton\ ha^{-1}$)	0.0008	0.0000	0.0001	0.0006	0.0009
Yield Potential II ($ton\ ha^{-1}$)	0.0002	0.0000	0.0001	0.0001	0.0003
Yield Potential RHD ($ton\ ha^{-1}$)	0.0001	0.0000	0.0000	0.0001	0.0002
Yield Potential IHD ($ton\ ha^{-1}$)	0.0000	0.0000	0.0000	0.0000	0.0000

Cropping systems are rainfed-traditional (RT), irrigated-traditional (IT), rainfed-intensive (RI), irrigated-intensive (II), rainfed-high-density (RHD) and irrigated-high-density (IHD)

Table S7. First order sensitivity indices for all parameters for the benefit of resistance breeding

Parameter	Original	Bias	Std.Error	Min. CI	Max. CI
Price in Italy ($Euro\ ton^{-1}$)	0.4805	−0.0001	0.0128	0.4560	0.5060
Price response (%)	0.0018	−0.0006	0.0164	−0.0303	0.0338
Operating Costs in Italy ($Euro\ ton^{-1}$)	0.1166	0.0000	0.0156	0.0856	0.1478
Total production IT (ton)	−0.0034	−0.0007	0.0166	−0.0357	0.0291
Discount rate (%)	0.0743	−0.0007	0.0189	0.0386	0.1138
Xfp yield-decline (%)	0.0398	−0.0005	0.0163	0.0091	0.0739
Xfp cost-change (%)	0.0388	−0.0009	0.0164	0.0083	0.0729
Longevity RT ($years$)	−0.0015	−0.0006	0.0164	−0.0336	0.0309
Longevity IT ($years$)	−0.0016	−0.0006	0.0164	−0.0338	0.0309
Longevity RI ($years$)	−0.0013	−0.0006	0.0164	−0.0336	0.0309
Longevity II ($years$)	−0.0016	−0.0006	0.0164	−0.0337	0.0308
Longevity RHD ($years$)	−0.0017	−0.0006	0.0164	−0.0340	0.0308
Longevity IHD ($years$)	−0.0015	−0.0006	0.0164	−0.0337	0.0310
Replanting cost RT ($Euro\ ha^{-1}$)	−0.0015	−0.0006	0.0164	−0.0332	0.0311
Replanting cost IT ($Euro\ ha^{-1}$)	−0.0013	−0.0006	0.0164	−0.0338	0.0308
Replanting cost RI ($Euro\ ha^{-1}$)	−0.0019	−0.0005	0.0164	−0.0337	0.0309
Replanting cost II ($Euro\ ha^{-1}$)	−0.0017	−0.0006	0.0164	−0.0336	0.0306
Replanting cost RHD ($Euro\ ha^{-1}$)	−0.0016	−0.0006	0.0164	−0.0339	0.0309
Replanting cost IHD ($Eur\ ha^{-1}$)	−0.0016	−0.0006	0.0164	−0.0337	0.0310
Full-bearing age RT ($years$)	−0.0010	−0.0006	0.0164	−0.0332	0.0316
Full-bearing age IT ($years$)	−0.0016	−0.0006	0.0164	−0.0337	0.0309
Full-bearing age RI ($years$)	−0.0019	−0.0006	0.0164	−0.0339	0.0304
Full-bearing age II ($years$)	−0.0016	−0.0006	0.0164	−0.0339	0.0310
Full-bearing age RHD ($years$)	−0.0016	−0.0006	0.0164	−0.0338	0.0309
Full-bearing age IHD ($years$)	−0.0016	−0.0006	0.0164	−0.0338	0.0309
Yield Potential RT ($ton\ ha^{-1}$)	−0.0030	−0.0006	0.0164	−0.0351	0.0296
Yield Potential IT ($ton\ ha^{-1}$)	−0.0015	−0.0006	0.0164	−0.0338	0.0308
Yield Potential RI ($ton\ ha^{-1}$)	−0.0024	−0.0006	0.0164	−0.0344	0.0302
Yield Potential II ($ton\ ha^{-1}$)	−0.0022	−0.0006	0.0164	−0.0341	0.0301
Yield Potential RHD ($ton\ ha^{-1}$)	−0.0019	−0.0006	0.0164	−0.0342	0.0307
Yield Potential IHD ($ton\ ha^{-1}$)	−0.0017	−0.0006	0.0164	−0.0339	0.0308

Cropping systems are rainfed-traditional (RT), irrigated-traditional (IT), rainfed-intensive (RI), irrigated-intensive (II), rainfed-high-density (RHD) and irrigated-high-density (IHD)

Table S8. Total order sensitivity indices for all parameters for the benefit of resistance breeding

Parameter	Original	Bias	Std.Error	Min. CI	Max. CI
Price in Italy ($Euro\ ton^{-1}$)	0.6297	−0.0002	0.0120	0.6057	0.6541
Price response (%)	0.0045	0.0000	0.0001	0.0043	0.0047
Operating Costs in Italy ($Euro\ ton^{-1}$)	0.1486	0.0000	0.0036	0.1416	0.1557
Total production IT (ton)	0.0057	0.0000	0.0002	0.0053	0.0060
Discount rate (%)	0.1603	0.0003	0.0035	0.1530	0.1673
Xfp yield-decline (%)	0.1905	−0.0004	0.0079	0.1758	0.2060
Xfp cost-change (%)	0.1630	−0.0001	0.0066	0.1495	0.1761
Longevity RT ($years$)	0.0000	0.0000	0.0000	0.0000	0.0000
Longevity IT ($years$)	0.0000	0.0000	0.0000	0.0000	0.0000
Longevity RI ($years$)	0.0002	0.0000	0.0000	0.0002	0.0002
Longevity II ($years$)	0.0000	0.0000	0.0000	0.0000	0.0000
Longevity RHD ($years$)	0.0000	0.0000	0.0000	0.0000	0.0000
Longevity IHD ($years$)	0.0000	0.0000	0.0000	0.0000	0.0000
Replanting cost RT ($Euro\ ha^{-1}$)	0.0004	0.0000	0.0000	0.0004	0.0005
Replanting cost IT ($Euro\ ha^{-1}$)	0.0002	0.0000	0.0000	0.0002	0.0002
Replanting cost RI ($Euro\ ha^{-1}$)	0.0011	0.0000	0.0001	0.0008	0.0013
Replanting cost II ($Euro\ ha^{-1}$)	0.0002	0.0000	0.0000	0.0002	0.0002
Replanting cost RHD ($Euro\ ha^{-1}$)	0.0001	0.0000	0.0000	0.0001	0.0001
Replanting cost IHD ($Eur\ ha^{-1}$)	0.0000	0.0000	0.0000	0.0000	0.0000
Full-bearing age RT ($years$)	0.0001	0.0000	0.0000	0.0001	0.0002
Full-bearing age IT ($years$)	0.0000	0.0000	0.0000	0.0000	0.0000
Full-bearing age RI ($years$)	0.0002	0.0000	0.0000	0.0002	0.0002
Full-bearing age II ($years$)	0.0000	0.0000	0.0000	0.0000	0.0000
Full-bearing age RHD ($years$)	0.0000	0.0000	0.0000	0.0000	0.0000
Full-bearing age IHD ($years$)	0.0000	0.0000	0.0000	0.0000	0.0000
Yield Potential RT ($ton\ ha^{-1}$)	0.0014	0.0000	0.0001	0.0013	0.0016
Yield Potential IT ($ton\ ha^{-1}$)	0.0005	0.0000	0.0000	0.0004	0.0005
Yield Potential RI ($ton\ ha^{-1}$)	0.0008	0.0000	0.0000	0.0007	0.0009
Yield Potential II ($ton\ ha^{-1}$)	0.0003	0.0000	0.0000	0.0002	0.0003
Yield Potential RHD ($ton\ ha^{-1}$)	0.0002	0.0000	0.0000	0.0001	0.0002
Yield Potential IHD ($ton\ ha^{-1}$)	0.0001	0.0000	0.0000	0.0000	0.0001

Cropping systems are rainfed-traditional (RT), irrigated-traditional (IT), rainfed-intensive (RI), irrigated-intensive (II), rainfed-high-density (RHD) and irrigated-high-density (IHD)