Table S1. Overview on individual trials, trial no., country, GPS coordinates, varieties, yields in untreated plots, and levels of yellow rust (YR) and brown rust (BR). .

				% severity of rust gs 75/77 untreated			
Trial no, country, locality, GPS	Varieties		Yield dt/ha untreated	YR Leaf 1	YR Leaf 2	BR Leaf 1	BR Leaf 2
20354-1 Denmark Flakkebjerg 55.324177 N / 11.400075 E	Susceptible	Benchmark	91.5	86.7	83.3	0	0
	Moderate	Sheriff	114.6	1	1.5	0	0
	Resistant:	Informer	107.4	0	0	0	0
	Mix:		108	26.7	26.7	0	0
20354-2 Sweden Staffanstorp 55.669524 N / 13.180965 E	Susceptible	Memory	104	15.7	9.3	0	0
	Moderate	Julius	93.2	12.3	11.7	0	0
	Resistant:	Informer	115.1	0	0	0	0
	Mix:		92.4	7.3	6.7	0	0
20354-3 Latvia Stintes. Bauskas "56.4097 / 24.2009"	Susceptible	Julius	59.5	0	0	0	0
	Moderate	Kalmar	64.7	0	0	0	0
	Resistant:	Informer	69.3	0	0	0	0
	Mix:		63.9	0	0	0	0
20354-4 Spain Azpa "42.806053 N / 1.522250 W"	Susceptible	Camargo	60.3	73.8	56.3	1.3	0.6
	Moderate	Filon	70.4	26.9	42.5	1.3	5.6
	Resistant:	Nudel	66.7	0	0	0	1.3
	Mix:		65.8	24.4	28.8	0.6	1.9
20354-5- YR Italy Sicily "37 N / 14 E"	Susceptible	Tirex	52.1	12	-	0	0
	Moderate	Monastir	48.2	0	-	0	0
	Resistant:	Iride	56.1	0	-	0	0
	Mix:		51.1	5	-	0	0
20354-6 SR* Italy Sicily "37 N / 14 E"	Susceptible	Monastir	46.8	0	0	0	0
	Moderate	Aureo	39	0	0	0	0
	Resistant:	Line 467175	39.7	0	0	0	0
	Mix:		43.9	0	0	0	0
20354-7 UK Cambridge "52.2 N / 0 .09EW"	Susceptible	JB Diego	65.3	3	13.3	0	0
	Moderate	KWS Zyatt	65	5.67	12.3	0	0
	Resistant:	Crusoe	67.7	0	0	0	0
	Mix:		67	0.03	2.7	0	0
20354-8 Slovakia Borovce "48.577430 N / 17.728581 E"	Susceptible	PS Sunanka	91.5	10.9	-	14.1	8.9
	Moderate	PS Puqua	97.5	1.9	-	11.2	5.3
	Resistant:	PS Jeldka	94.1	0.9	-	6.7	1.5
	Mix:		97.1	0.7	-	10.6	5.9
20354-9 Slovakia Viglas "48.5419 N / 19.3203 E"	Susceptible	PS Sunanka	88.2	0	0	10.0	10.5
	Moderate	PS Puqua	85.8	0	0	1.5	2.2
	Resistant:	PS Jeldka	87.4	0	0	1.3	1.3
	Mix:		90.8	0	0	1.9	3.7
20354-10 Germany "Dahnsdorf 52.108494 N /12.636338 E	Susceptible	Rumor	89.9	0.5	0.4	2.73	2.6
	Moderate	Sheriff	92.8	0	0	1.23	1.7
	Resistant:	Informer	98.1	0	0	0.8	0.8
	Mix:		100	0	0.1	0.8	1.1
21354-1 Denmark	Susceptible	Benchmark	90.1	46.7	-	0	0
	Moderate	Sheriff	109.1	0	-	0	0

Flakkebjerg 55.322169 N / 11.390422 E	Resistant:	Informer	105.9	0	-	0	0
	Mix:		105.0	7.3	-	0	0
21354-2 Sweden Staffanstorp 55.67169 N / 13.17778 E	Susceptible	Memory	100.3	23.3	16.7	0	0
	Moderate	Julius	99.8	10.7	5.0	0	0
	Resistant:	Informer	115.2	0	0	0	0
	Mix:		107.3	0.3	2.3	0	0
21354-3 France Banville 49.3132 N / 0.5018 W	Susceptible	Amboise	43.5	57.7	82.4	0	0
	Moderate	LG Absalon	86.5	7.4	28.6	0	0
	Resistant:	KWS Extase	93.9	1.5	19.3	0	0
	Mix:		75.8	24.6	40.6	0	0
21354-4 UK Hinxton 52.089095 N / 0.187531 E	Susceptible	Skyfall	26.2	47.1	28.3	0	0
	Moderate	KWS Zyatt	26.7	51.7	40	0	0
	Resistant:	Crusoe	45.6	0	0	0	0
	Mix:		40.2	19.0	10.0	0	0
21354-5 Germany Dahnsdorf 52.108494 N /12.636338 E	Susceptible	Rumor	68.7	1.8	6.8	0.4	0.2
	Moderate	Sheriff	76.4	2.3	1.8	0	0
	Resistant:	Informer	68.2	0	0	0.6	0.9
	Mix:		76.7	0.3	0.6	0.1	0.7
21354-6 Slovakia Borovce 48.5810 N / 17.7279 E	Susceptible	PS Sunanka	79.98	5.5	-	4.2	-
	Moderate	PS Puqua	87.5	0.3	-	4.4	-
	Resistant:	PS Jeldka	82.6	0	-	4.3	-
	Mix:		85.5	3.3	-	4.6	-
21354-7 Spain Pamplona "42.8 N / 1.6 W"	Susceptible	Camargo	78.5	88.0	74.8	0	0
	Moderate	Marco Polo	89.2	30.9	18.8	0	0
	Resistant:	Mufasa	91.7	0	0.5	0	0
	Mix:		88.95	20.9	10.6	0	0
21354-8 Italy SR* Sicily "37.5 N / 14 E"	Susceptible	Monastir	69.9	0	0	*0.7	*-
	Moderate	Aureo	59.3	0	0	*0	*-
	Resistant:	46 7178	55.6	0	0	*0	*-
	Mix:		62.4	0	0	*0	*-
21354-9 Italy YR Sicily "37.5 N / 14 E"	Susceptible	Tirex	71.3	0.2	-	0	0
	Moderate	Monastir	73.8	0	-	0	0
	Resistant:	Iride	82.2	0	-	0	0
	Mix:		75.0	0.1	-	0	0

* In Sicily the had each year focus on Stem Rust (SR) in one of the two trials they carried out.

Table S2. Information on treatments in the trials. H=High input (TF=2), L= Low input (TF=1), A= alternative solutions, D=Decision support system.

	Sowing time	Dates for treatments	Harvest date	Artificial inoculation	Treatments in DSS
Denmark Flakkebjerg 55.324177 N / 11.400075 E	20354-1 23-09-2019	H: 28/4 - 13/5 - 28/5 - 8/6	14-08-2020	Benchmark in April	28/5: 0.5 Elatus Era 8/6: 0.5 Folicur
		L: 28/4 - 13/5 - 28/5 - 8/6			
		A: 28/4 - 13/5 - 28/5 - 8/6			
		D: 28/5(ALL) - 8/6(S)			
Sweden	20354-2 09-10-2019	H: 27/4 - 12/5 - 4/6 - 15/6	17-08-2020	no	4/6: 0.25 Elastus Era
		L: 27/4 - 12/5 - 4/6			
		A: 27/4 - 12/5 - 4/6 - 15/6			

Staffanstorp 55.669524 N / 13.180965 E		D: 4/6 (S)			
Latvia Stintes. Bauskas "56.4097 / 24.2009"	20354-3 06-11-2019	H: 4/5 - 22/5 - 5/6 - 15/6 L: 4/5 - 22/5- 5/6 - 15/6 A: 4/5 - 22/5- 5/6 - 15/6 D: Not treated	14-08-2020	April	None
Spain Azpa "42.806053 N / 1.522250 W"	20354-4 30-10-2019	H: 25/3 - 15/4 - 29/4 - 18/5 L: 8/4 - 29/4 - 18/5 A: 8/4 - 15/4 - 29/4 - 18/5 D: 20/4 - 18/5 (S+M+mix)	21-07-2020	No	20/4:0.6 Comet Pto 18/5: 0.75 Revycare
Italy Sicily 37.8447 / 13.5257	20354-5 23-12 2019	H: 14/3 – 29/3 – 15/4 – 25/4 L: 14/3 – 29/3 – 15/4 – 25/4 A: 14/3 – 29/3 – 15/4 – 25/4 D: 17/03 - 26/4 (S). 18/04 (MIX)	03-07-2020	No	17/3: 0.5 Prosaro. 18/4 & 26/4: 0.5 Folicur
Italy Sicily 37.8447 / 13.5257	20354-6 23-12 2019	H: 01/04 - 11/04 23/04 02/05 L: 01/04 - 11/04 23/04 02/05 A: 01/04 - 11/04- 23/04 02/05 D: 04/05 (S)	03-07-2020	No	04/05: 0.5 Folicur
UK Cambridge "52.2 N / 0 .09EW"	20354-7 02-12-2019	H: 01/05 - 15/5 – 27/05 – 09/06 L: 01/05 - 15/5 – 27/05 – 09/06 A: 01/05 - 15/5 – 27/05 – 09/06 D: 15/5 – 27/05 – 09/06 (all)	21-08-2020	No	15/5: 0.375 Prosaro 27/05: 0.25 Elatus Era 09/06: 0.25 Folicur
Slovakia Borovce "48.577430 N / 17.728581 E"	20354-8 15-10-2019	H: 15/4 – 4/5 – 22/5 – 3/6 L: 15/4 – 4/5 – 22/5 – 3/6 A: 15/4 – 4/5 – 22/5 – 3/6 D: 3/6 (S)	31/7	April	3/6: 0.5 Horizon
Slovakia Viglas "48.5419 N / 19.3203 E"	20354-9 25-9-2020	H: 16/4 – 24/4 – 21/5 – 12/6 L: 16/4 – 24/4 – 21/5 – 12/6 A: 16/4 – 24/4 – 21/5 – 12/6 D:	24/7	April	None
Germany "Dahnsdorf 52.108494 N /12.636338 E "	20354-10 22-10-2019	H: 7/5 - 18/5 - 29/5 - 8/6 L: 7/5- 18/5 - 29/5 - 8/6 A: 27/4 - 7/5 - 18/5 - 29/5 D: No treatments	31-07-2020	2/4 + 16/4	None
Denmark Flakkebjerg 55.322169 N / 11.390422 E	21354-1 29/9-2020	H: 10/5. 19/5. 3/6. 15/6 L: 10/5. 19/5. 3/6. 15/6 A: 10/5. 19/5. 3/6. 15/6 D: 28/5(S+M+R+Mix). 16/6(S)	15/8-2021	Yes 6/4-2021	28/5: 0.5 Elatus ERA. 16/5: 0.25 Orius 200EW
Sweden Staffanstorp 55.67169 N / 13.17778 E	21354-2 21/9-2020	H: 14/5. 24/5. 8/6. 18/6 L: 14/5. 24/5. 8/6. 18/6 A: 14/5. 24/5. 8/6. 18/6 D: 8/6 (S + Mix)	23/8-2021	No	8/6 0.5 Elatus ERA
France Banville 49.3132 N / 0.5018 W	21354-3 4/11-2020	H: 14/4. 27/4. 7/5. 18/5 L: 14/4. 27/4. 7/5. 18/5 A: 14/4. 27/4. 7/5. 18/5 D: 14/4. 27/4. 7/5 (S.M.R.Mix)	17/8-2021	Yes 25/3-2021	07/05: 0.5 Elatus ERA
UK	21354-4	H: 1/5. 11/5. 27/5. 7/6	24/8-2021	No	11/5: 0.38 Prosaro

Hinxton 52.089095 N / 0.187531 E	24/10-2020	L: 1/5. 11/5. 27/5. 7/6 A: 1/5. 11/5. 27/5. 7/6 D: 11/5, 27/5, 7/6 (S, M, R, Mix)			27/5: 0.5 Elatus Era 7/6 0.25 Tebucur
Germany Dahnsdorf 52.108494 N /12.636338 E	21354-5 13/10-2020	H: 10/5. 19/5. 31/5. 10/6 L: 10/5. 19/5. 31/5. 10/6 A: 10/5. 19/5. 31/5. 10/6 D: 10/5 (M). 31/5 (S)	12/8-2021	Yes 31/3-2021 21/4-2021	10/5: 1.0 Comet + 0.6 Proline. 31/5: 0.5 Elatus ERA
Slovakia Borovce 48.5810 N / 17.7279 E	21354-6 26/10-2020	H: 7/5. 19/5. 28/5. 8/6 L: 7/5. 19/5. 28/5. 8/6 A: 7/5. 19/5. 28/5. 8/6 D: 8/6 (S +M+R+Mix)	3/8 2021	Yes 27/4-2021 12/5-2021	08/6:0.5 Horizon EW
Spain Pamplona "42.8 N / 1.6 W"	21354-7 2/11 2020	H: 24/3. 16/4. 4/5. 31/5 L: 16/4. 4/5. 31/5 A: 16/4. 28/4. 4/5. 18/5 D: 16/4 (S). 10/5 (S+M+Mix)	20/7-2021	No	16/4: 0.6 Comet Pro 10/5: 0.75 Balaya
Italy SR Sicily "37.5 N / 14 E"	21354-8 18/12 2020	H: 2/4. 17/4. 29/4. 9/5 L: 2/4. 17/4. 29/4. 9/5 A: 2/4. 17/4. 29/4. 9/5 D: 9/5 (S)	5/7 2021	No	9/5: 0.5 Folicur EC
Italy YR Sicily "37.5 N / 14 E"	21354-9 18/12 2020	H: 20/3. 2/4. 17/4. 29/4 L: 20/3. 2/4. 17/4. 29/4 A: 20/3. 2/4. 17/4. 29/4 D: 31/3; 20/4 (S)	5/7 2021	No	31/3: 0.5 Prosaro. 20/4: 0.5 Folicur EC