

# Effect of the leaf rust *Melampsora larici-populina* on wood production of *Populus nigra* in SRC

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# Objectives

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- ▶ Evaluate resistance level of selected clones to the rust *Melampsora larici-populina*
- ▶ Assess the effect of rust *Melampsora larici-populina* on growth and yield characteristics



# Material and trial organisation

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- ▶ 10 black poplar clones with different levels of resistance to leaf rust planted in Průhonice in 2007
- ▶ spacing  $2.20 \times 0.45$  m (10,101 plants.ha<sup>-1</sup>)
- ▶ randomized block design - 4 replications and 4 or 5 plants per replication
- ▶ 2 treatments – fungicide sprayed (S) and unsprayed (U)
- ▶ early spring 2009 - first harvest
- ▶ 2009 – 2011 – II. rotation – fungicide treatment
- ▶ 2012 – 2014 – III. rotation – no fungicide treatment



# Measurements

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- ▶ Health characteristics – mortality, rust incidence
- ▶ Growth characteristics – main shoot diameter, number of shoots
- ▶ Yield characteristics – average dry matter yield of individual plant, total dry matter yields per unit area



# Results – health characteristics

clone	incidence of rust (2009-2014)		mortality [%]				
	U	S	II. rotation U	t-test	S	III. rotation U	t-test
98/7	3.58 ± 0.09	0 ±	6 ± 6		25 ± 14	38 ± 7	
97/38	3.83 ± 0.09	0 ±	42 ± 22		25 ±	50 ± 25	
98/101	3.68 ± 0.23	5 ± 5	49 ± 17	*	35 ± 17	75 ± 5	
108	2.05 ± 0.06	0 ±	0 ±		0 ±	0 ±	
98/109	3.03 ± 0.05	0 ±	0 ±		5 ± 5	30 ± 13	
98/115	3.15 ± 0.12	0 ±	0 ±		6 ± 6	6 ± 6	
98/117	3.05 ± 0.15	0 ±	0 ±		0 ±	30 ± 7	**
97/152	2.08 ± 0.06	0 ±	0 ±		5 ± 5	20 ± 8	
97/157	2.15 ± 0.13	0 ±	10 ± 10		10 ± 6	10 ± 10	
210	2.48 ± 0.05	0 ±	5 ± 5		0 ±	5 ± 5	



# Results – clone 97/38

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# Results – clone 97/152

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# Results - Main shoot diameter [mm]

clone	II. rotation		t-test	decrease [%]	III. rotation		t-test
	S	U			S	U	
98/7	39.33 ± 2.73	42.29 ± 2.52		-7.5	32.73 ± 3.07	27.00 ± 2.34	
97/38	51.20 ± 3.40	33.56 ± 3.30	**	34.5	33.45 ± 3.63	35.67 ± 2.85	
98/101	42.55 ± 2.03	32.11 ± 2.11	**	24.5	29.35 ± 2.41	22.70 ± 3.17	
108	41.75 ± 2.19	40.25 ± 1.49		3.6	37.05 ± 1.84	39.60 ± 1.68	
98/109	49.90 ± 2.68	41.90 ± 2.21	*	16.0	35.95 ± 2.01	30.40 ± 3.05	
98/115	52.47 ± 3.30	44.31 ± 2.24	*	7.0	39.27 ± 2.98	37.94 ± 2.33	
98/117	43.00 ± 2.59	40.00 ± 2.16		15.5	32.88 ± 2.03	28.12 ± 3.61	
97/152	53.89 ± 2.57	54.94 ± 3.11		-1.9	46.74 ± 2.20	47.19 ± 2.77	
97/157	46.72 ± 2.82	46.30 ± 1.89		0.9	36.83 ± 2.43	39.26 ± 2.28	
210	47.00 ± 1.55	40.20 ± 1.57	**	14.5	33.55 ± 1.46	34.47 ± 1.61	
	46.62 ± 0.86	41.84 ± 0.81	***		35.88 ± 0.80	34.83 ± 0.97	





# Results - Number of shoots

clone	II. rotation			decrease [%]	III. rotation		
	S	U	t-test		S	U	t-test
98/7	9.40 ± 1.23	6.93 ± 0.65		26.3	6.00 ± 0.88	5.15 ± 0.71	
97/38	6.45 ± 0.82	4.60 ± 1.16		28.7	7.91 ± 1.50	4.67 ± 1.20	
98/101	13.65 ± 0.97	7.37 ± 0.83	***	46	6.63 ± 0.63	3.33 ± 0.83	**
108	9.50 ± 0.72	10.30 ± 0.74		-8.4	9.25 ± 0.78	9.95 ± 0.73	
98/109	9.58 ± 0.80	7.95 ± 0.56		17	6.95 ± 0.65	5.75 ± 0.66	
98/115	12.53 ± 0.87	10.44 ± 0.85		16.7	10.13 ± 1.00	8.00 ± 0.70	
98/117	12.69 ± 0.98	8.47 ± 0.97	***	33.2	8.06 ± 0.80	5.67 ± 0.95	
97/152	9.32 ± 0.71	9.56 ± 0.70		-2.6	9.63 ± 0.78	9.13 ± 0.91	
97/157	8.61 ± 0.93	8.65 ± 0.98		-0.5	8.83 ± 1.19	9.47 ± 0.99	
210	10.00 ± 0.62	7.80 ± 0.52	***	22	8.55 ± 0.50	8.42 ± 0.81	
	10.29 ± 0.31	8.38 ± 0.27	***		8.21 ± 3.68	7.44 ± 3.85	*



# Results – Dry matter weight per plant [kg.plant<sup>-1</sup>yr<sup>-1</sup>]

	II. rotation			decrease	III. rotation		
	S	U	t-test	[%]	S	U	t-test
98/7	1.15 ±0.23	0.97 ±0.06		15.3	0.86 ±0.12	0.64 ±0.10	
97/38	1.67 ±0.38	0.88 ±0.47		47.7	1.01 ±0.20	0.87 ±0.21	
98/101	1.14 ±0.17	0.41 ±0.09	**	63.6	0.49 ±0.07	0.44 ±0.18	
108	1.44 ±0.17	1.10 ±0.11		23.7	1.31 ±0.18	1.51 ±0.15	
98/109	1.15 ±0.18	0.84 ±0.15		27.0	1.04 ±0.15	0.69 ±0.25	
98/115	1.34 ±0.15	0.95 ±0.07		29.4	1.35 ±0.24	1.01 ±0.08	
98/117	1.18 ±0.12	0.68 ±0.07	*	42.8	0.79 ±0.08	0.81 ±0.18	
97/152	2.02 ±0.22	1.92 ±0.38		4.9	1.82 ±0.17	1.95 ±0.38	
97/157	1.75 ±0.43	1.58 ±0.32		9.5	1.61 ±0.54	1.59 ±0.38	
210	1.38 ±0.15	0.87 ±0.15		36.8	1.07 ±0.10	0.96 ±0.15	
	1.42 ±0.08	1.02 ±0.09	**		1.14 ±0.09	1.05 ±0.10	



# Results - Total dry matter yield [t.ha<sup>-1</sup>yr<sup>-1</sup>]

clone	II. rotation			decrease [%]	III. rotation		
	S	U	t-test		S	U	t-test
98/7	11.12 ±2.59	8.51 ±0.48		23.5	7.91 ±0.59	5.26 ±0.81	*
97/38	14.91 ±2.05	5.88 ±2.23	*	60.6	9.06 ±1.24	3.95 ±1.57	
98/101	11.52 ±1.73	3.95 ±0.84	**	65.7	4.70 ±0.74	2.21 ±1.08	
108	14.55 ±1.69	11.10 ±1.14		23.7	13.22 ±1.83	15.26 ±1.53	
98/109	11.66 ±1.80	8.51 ±1.50		27.0	10.47 ±1.48	6.97 ±2.51	
98/115	12.45 ±0.85	9.56 ±0.70	*	23.2	12.86 ±2.63	10.20 ±0.82	
98/117	11.97 ±1.20	6.84 ±0.73	*	42.8	7.99 ±0.77	8.19 ±1.78	
97/152	19.03 ±0.98	15.13 ±3.03		20.5	17.16 ±0.69	15.32 ±2.93	
97/157	15.41 ±3.08	15.97 ±3.21		-3.6	14.04 ±4.03	15.26 ±4.45	
210	13.96 ±1.47	8.82 ±1.53		36.8	10.77 ±1.06	9.29 ±1.69	
	13.63 ±0.64	9.52 ±0.76	***		10.86 ±0.76	9.33 ±0.96	



# Results - publication

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- ▶ Results will be published soon:

Štochlová P, Novotná K, Benetka V (2015). Variation in resistance to the rust fungus *Melampsora larici-populina* Kleb in *Populus nigra* L. in the Czech Republic. *iForest* 0: 0-0. –doi: 10.3832/ifor1458-008



# Conclusions

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- ▶ Great variability in resistance to the rust in all characteristics studied
- ▶ Negative effect of the rust on the all studied characteristics that can persist to the next rotation
- ▶ Decrease in studied parameters up to 66%
- ▶ Possibility of selection *P. nigra* for resistance to the rust without a reduction in performance
- ▶ Identified resistant clones can be used as donors of resistance in resistance breeding programme

