SUSTAINABLE FOREST MANAGEMENT
Research Institute
University of Valladolid-INIA

"Heritability and correlations among biomechanical parameters involved in stem straightening in *Pinus pinaster* progenies"

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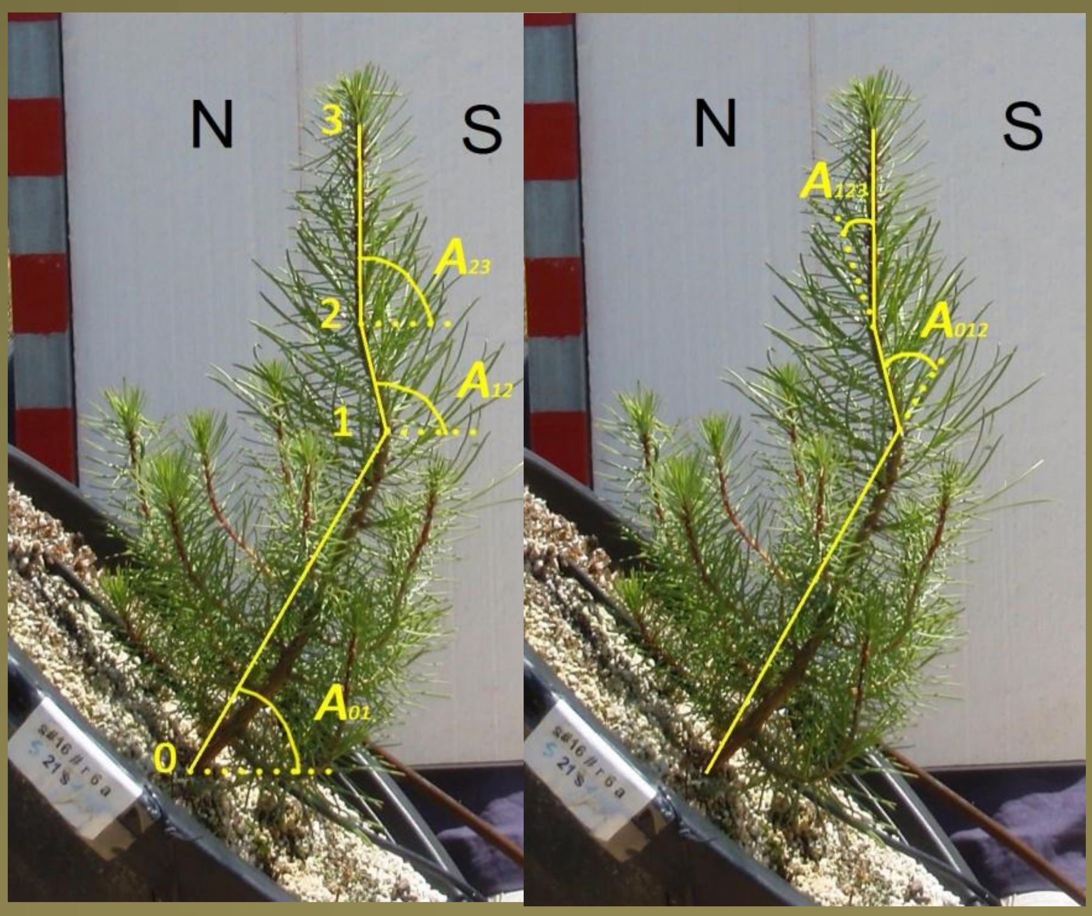
INTRODUCTION:

Maritime pine *(Pinus pinaster* Ait.) is the conifer which major volume of wood is obtained in Spain. In this species the wood quality is usually low due to the lack of stem straightness. In addition, stem flexuosity produces an increase in the costs of transport and manufacturing of the row material. Recently, an alternative method for early selection of the stem straightness has been proposed, based on the biomechanical processes underlying the stem straightening reactions instead of the evaluation of stem form.



OBJECTIVES:

We studied the variability among progenies in the gravitropic and autotropic reactions, and the efficiency of compression wood in the stem straightening process, following the same method.

MATERIAL AND METHODS:

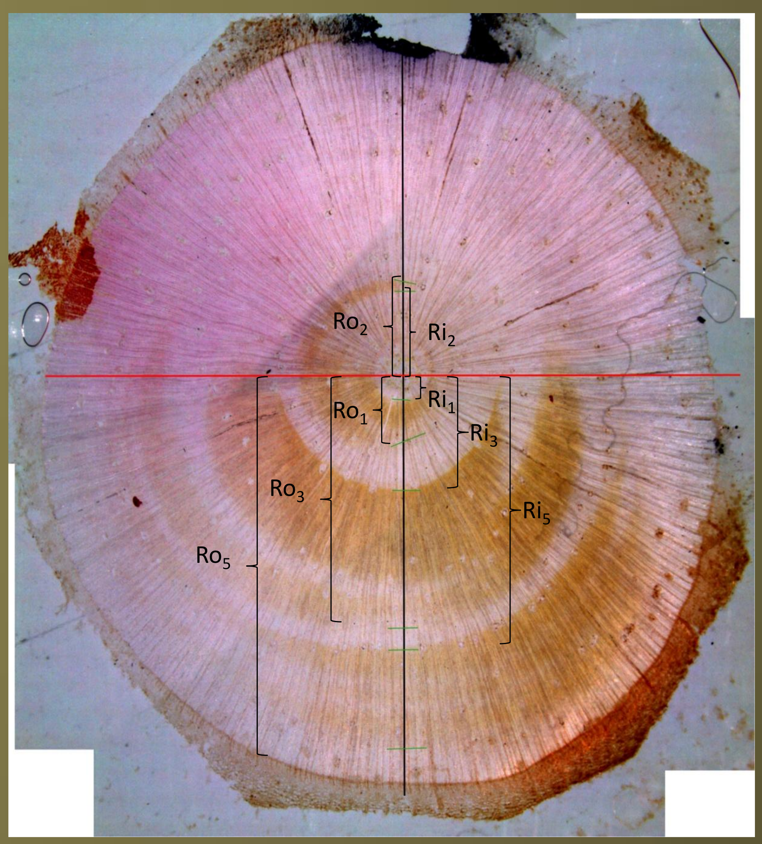
Plants from 38 *Pinus pinaster* half-sib families from the Norwest Interior provenance and 6 different provenance commercial seeds controls were used. When the plants were one year old, they were artificially tilted at 45°.

VARIABLES ANALYZED:

The kinetic study of the stem form changes (angles of deviation from the horizontal) were measured based on photographs taken during a 4 month period after tilting. Subsequently, compression wood (CW) was analyzed in four stem cross sections per plant. We estimate heritabilities and genetic correlations among variables related with stem straightening process. The CW efficiency in the straightening process (estimated by maturation strains) was calculated with Fournier's biomechanical model (1994).

$$\partial C = -4 \cdot \alpha_j \cdot \frac{dR}{R^2}$$

$$\Delta A_{01}(t) \cdot = \beta * \varphi_{01}(t) + \varepsilon$$



The changes in local curvature was integrated along the stem to estimate the final angle of A_{01} predicted by the model (Φ). α is half the difference in maturation strain between the upper and lower sides of the stem and β is the estimator of α.

β	A_{01}	A_{012}	Φ
19	36	30	38
22	14	2	13
5	8	TIET	15
1	GRE	11	29
21	20	7	35
6	5	14	TIET
GRE	21	15	37
3	10	35	27
36	18	4	OÑA
NO L	1	25	26
11	26	13	24
23	9	NO L	TEL
16	6	33	20
8	27	5	21
14	3	16	2
4	17	TEL	17
33	19	21	GRE
18	38	MC	30
9	37	8	12
17	24	9	31
25	4	32	18
12	31	GRE	32
28	34	38	9
26	NO L	OÑA	5
20	11	28	28
34	12	12	1
27	13	6	10
37	15	20	34
10	22	10	44 - MC
31	7	23	4
35	33	27	3
7	29	37	23
29	28	31	8
38	35	18	6
15	16	22	16
13	23	29	NO L
24	25	34	25
TIET	32	1	7
2	TEL	36	14
TEL	TIET	19	33
32	2	24	11
MC	OÑA	26	19
30	MC	17	22
OÑA	30	3	36

RESULTS:

We found high significant correlations among gravitropic movements driven by secondary growth and maturation strains, and high heritabilities of these movements. It suggests that a high genetic control of gravitropic movements driven by secondary growth exists, so these parameters might be interesting for early selection in breeding programs.

We expected that the most straight families are those which values of β, ΔA_{01} and A_{01} parameters are the highest. This together with the good heritability values of these variables and the high correlation between ΔA_{01} and A_{01} with β, indicate them as the most interesting variables for the early selection in a breeding program of *Pinus pinaster* Ait. the Northwest Interior provenance

	r_A_{01}	r_A_{12}	r_A_{23}	r_ΔA_{01}	r_A_{012}	r_A_{123}	r_ΔA_{012}	r_Φ
r_β	0.5961	0.3445	0.3899	0.7216	-0.2678	0.1143	0.5285	-0.6173
	<.0001	0.022	0.0089	<.0001	0.0788	0.46	0.0002	<.0001

Heritabilities (h^2)									
	ΔA_{01}	β	A_{01}	A_{12fin}	A_{23}	A_{012}	A_{123}	ΔA_{012}	Φ
h^2	0.5483	0.5210	0.4916	0.4222	0.4780	0.4121	0.2895	0.6205	0.2500

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Acknowledgements: We thanks Felicidad López, Evelio Alonso, Ana Olivera, Pablo Martínez-Zurimendi and María Menéndez, for their help in field work. This work was supported by nº PGIDIT07MRU005E de la Xunta de Galicia Project.

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