

Supplementary Materials

Table S1: Statistical assessments of the differences between the regions concerning the importance attributed to early measures for stand establishment in i) the future and ii) the future in contrast to the past. The table contains the results for the the measures as well as the post-hoc verification. For further details refer to the text.

Tabelle S1: Statistische Analyse der Unterschiede zwischen den Regionen betreffend die den Bestandesbegründungsmaßnahmen zugemessene Bedeutung, und zwar i) in Zukunft ii) in Zukunft im Unterschied zur Vergangenheit. Die Tabelle enthält die Ergebnisse zu den aufgelisteten Maßnahmen als auch zu den post-hoc Untersuchungen (paarweise Gegenüberstellung der einzelnen Regionen innerhalb einer jeweiligen Maßnahme). Weitere Details finden sich im Text.

	Urgency in the future	Difference between urgency in the future and the past	
	<i>p-value</i>	<i>p-value</i>	<i>p-value</i>
<i>Kruskal Wallis-test</i>			
Measure			
Against drought	0.065	0.003 *	
Fertilization nutrients	0.178	0.054	
Fertilization growth	0.054	0.016 *	
Against soil compaction	0.015 *	0.618	
<i>Dunn test</i>			
Pairs of regions	Against soil compaction	Against drought	Fertilization growth
Atl – Atl Cont	0.569	0.274	0.440
Atl - Boreal	0.024 *	0.266	0.039 *
Atl Cont - Boreal	0.035 *	0.001 *	0.048 *
Atl - Cont	0.481	0.918	0.369
Atl Cont - Cont	0.807	0.101	0.624
Boreal - Cont	0.034 *	0.222	0.149
Atl – Atl Med	0.485	0.796	0.605
Atl Cont – Atl Med	0.780	0.031 *	0.642
Boreal – Atl Med	0.038 *	0.296	0.020 *
Cont – Atl Med	0.915	0.883	0.440
<i>Significance level $\alpha < 0.05$ *</i>			

Tabe S2: Silhouette coefficients as measures for the goodness of clustering.

Tabelle S2: Silhouette Koeffizienten als Maßzahlen für die statistische Genauigkeit der Clusteranalyse.

<i>Goodness of clustering</i>	
Cluster	Silhouette coeff
1	0.15
2	0.27
Model total	0.36
<i>0 - 0.25 no structure 0.26 - 0.5 weak structure 0.51 - 0.75 middle structure 0.76 - 1 strong structure</i>	

Questionnaire

Early operations at stand establishment

The questionnaire contains two sections (to be filled):

1. General information on practices at stand establishment applied by your company

2. Description of the measures practiced by your company as to
 - a) Irrigation/Water supply + example for illustration
 - b) Mechanical site preparation + example for illustration
 - c) Fertilization + example for illustration

If you are not able to give information to a particular question, please feel free to skip.

However, we are grateful for any information. Please note, it is not required to give scientifically substantiated answers, it's essential to communicate your personal experience and opinion!

Thank you!

Company:

Email adress:

Intensity levels 1 very low 2 low 3 medium 4 high 5 very high					
General information on practices applied by your company					
According to your opinion, what are nowadays the key aspects for successful stand establishment? What matters the most?					
In your company, what is the priority of the here listed measures at present? <i>From 1 to 5</i>	<i>Against drought</i>	<i>Fertilization against lack of nutrients</i>	<i>Fertilization for enhancing growth</i>	<i>Against soil compaction</i>	<i>Other measures (if available)</i>
	<i>Please name other measures (if available)</i>				
In your company, what was the priority of the here listed measures in the last 10 years? <i>From 1 to 5</i>	<i>Against drought</i>	<i>Fertilization against lack of nutrients</i>	<i>Fertilization for enhancing growth</i>	<i>Against soil compaction</i>	<i>Other measures (if available)</i>
In your opinion, what will be the priority of the here listed measures within the next 10 years? <i>From 1 to 5</i>	<i>Against drought</i>	<i>Fertilization against lack of nutrients</i>	<i>Fertilization for enhancing growth</i>	<i>Against soil compaction</i>	<i>Other measures (if available)</i>
During the last 10 years, could you observe an increase of the failure rate at stand establishment? Yes / No If so, to what percentage (see right hand)	< 10	10-30	30-50	50-70	>70
At present, what is the most essential problem at stand establishment (water scarcity, lack of nutrients, soil compaction, or other problem(s)?)					
Has this problem intensified during the last 10 years? <i>1 very low 2 low 3 medium 4 high 5 very high</i>	1	2	3	4	5
If so (see previous question) to what percentage have the costs increased (approx.) – compared to the situation 10 years ago?	< 10	10-30	30-50	50-70	>70

Description of the measures applied by your company

The measures include three aspects: Irrigation/water supply, mechanical site preparation, fertilization.

In the following, in a first section please give a general explanation of the measure you want to describe, and in a second section please describe a concrete example for illustration, respectively.

How to classify a measure, is defined by the purpose. For example, if you practice soil scarification with the purpose of enhancing the water infiltration, please put it in the section *irrigation/water supply*, otherwise in the section *mechanical site preparation*.

Please note: It is not required to give scientifically substantiated answers, it's essential to communicate your personal experience and opinion!

Irrigation/Water supply

In this context, the term irrigation comprises systems where the water is being transported to the stand, e.g. sprinklers, drip irrigation, irrigation with tanker...

In contrast, we define (alternative sustainable forms of) water supply as given when methods are applied for retaining, storing and re-distributing the available (rain)water on a particular site, e.g. by mulching...

What is the name of the measure?

Which work steps are included, how do you proceed?

Under which conditions do you use this method?

What does one have to pay attention when using this method? What is your personal recommendation?

What do you expect from this method? If omitting this method, what would probably happen?

Did this method fulfil your expectation?
From 1 to 5
1 very low 2 low 3 medium 4 high 5 very high

1

2

3

4

5

Has the use of this method intensified during the last 10 years?
From 1 to 5
1 very low 2 low 3 medium 4 high 5 very high

1

2

3

4

5

What are the approx. costs per ha?

According to your personal opinion, is this method reasonable? Why?

Other remarks as to this method.

Concrete example for the above-described method for irrigation / water supply	
Please designate the stand unambiguously, in case you report this stand also in another category, like mechanical site preparation or fertilization.	
What is the name of the measure illustrated by the following example (and described above)?	
Name of the stand (if available)	
Location (eventually coordinates)	
Sea level	
Slope exposition	
Slope inclination (approx.)	
Geomorphological characteristics (e.g. remarkable soil elevations and depressions...)	
Soil depth (organic layer, mineral soil layer, approx.)	
Included tree species and share of tree species (in tenths, referring to stem number)	
Spacing pattern/distances? Stem number/ha?	
If mixture: tree by tree or in mono-species patches?	
In what year occurred the stand establishment? In what season? What was the age of the trees at planting?	
What was the planting technique?	
What was the age of the plants when the here-described measure was applied?	
Why was the measure performed (reaction to problem, out of routine, preventively?)	
Costs/ha?	
Did the measure fulfil the expectation?	
Were there any further specific details at stand establishment and early operations on this stand?	

Mechanical site preparation					
What is the name of the measure?					
Which work steps are included, how do you proceed?					
Under which conditions do you use this method?					
What does one have to pay attention when using this method? What is your personal recommendation?					
What do you expect from this method? If omitting this method, what would probably happen?					
Did this method fulfil your expectation? <i>From 1 to 5</i> 1 very low 2 low 3 medium 4 high 5 very high	1	2	3	4	5
Has the use of this method intensified during the last 10 years? <i>From 1 to 5</i> 1 very low 2 low 3 medium 4 high 5 very high	1	2	3	4	5
What are the approx. costs per ha?					
According to your personal opinion, is this method reasonable? Why?					
Other remarks as to this method.					

Concrete example for the above-described method for mechanical site preparation	
Please designate the stand unambiguously, in case you report this stand also in another category, like irrigation/water supply or fertilization.	
What is the name of the measure illustrated by the following example (and described above)?	
Name of the stand (if available)	
Location (eventually coordinates)	
Sea level	
Slope exposition	
Slope inclination (approx.)	
Geomorphological characteristics (e.g. remarkable soil elevations and depressions...)	
Soil depth (organic layer, mineral soil layer, approx.)	
Included tree species and share of tree species (in tenths, referring to stem number)	
Spacing pattern/distances? Stem number/ha?	
If mixture: tree by tree or in mono-species patches?	
In what year occurred the stand establishment? In what season? What was the age of the trees at planting?	
What was the planting technique?	
What was the age of the plants when the here-described measure was applied?	
Why was the measure performed (reaction to problem, out of routine, preventively?)	
Costs/ha?	
Did the measure fulfil the expectation?	
Were there any further specific details at stand establishment and early operations on this stand?	

Fertilization					
What is the name of the measure?					
Which work steps are included, how do you proceed?					
Under which conditions do you use this method?					
What does one have to pay attention when using this method? What is your personal recommendation?					
What do you expect from this method? If omitting this method, what would probably happen?					
Did this method fulfil your expectation? <i>From 1 to 5</i> 1 very low 2 low 3 medium 4 high 5 very high	1	2	3	4	5
Has the use of this method intensified during the last 10 years? <i>From 1 to 5</i> 1 very low 2 low 3 medium 4 high 5 very high	1	2	3	4	5
What are the approx. costs per ha?					
According to your personal opinion, is this method reasonable? Why?					
Other remarks as to this method.					

Concrete example for the above-described method for fertilization	
Please designate the stand unambiguously, in case you report this stand also in another category, like mechanical site preparation or irrigation/water supply.	
What is the name of the measure illustrated by the following example (and described above)?	
Name of the stand (if available)	
Location (eventually coordinates)	
Sea level	
Slope exposition	
Slope inclination (approx.)	
Geomorphological characteristics (e.g. remarkable soil elevations and depressions...)	
Soil depth (organic layer, mineral soil layer, approx.)	
Included tree species and share of tree species (in tenths, referring to stem number)	
Spacing pattern/distances? Stem number/ha?	
If mixture: tree by tree or in mono-species patches?	
In what year occurred the stand establishment? In what season? What was the age of the trees at planting?	
What was the planting technique?	
What was the age of the plants when the here-described measure was applied?	
Why was the measure performed (reaction to problem, out of routine, preventively?)	
Costs/ha?	
Did the measure fulfil the expectation?	
Were there any further specific details at stand establishment and early operations on this stand?	

Additional:

Please just list measures for irrigation/water supply, mechanical site preparation, fertilization that are being practiced in your company and that have not been mentioned in the previous chapters: