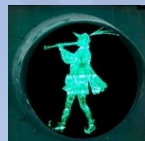


# Moisture Committee

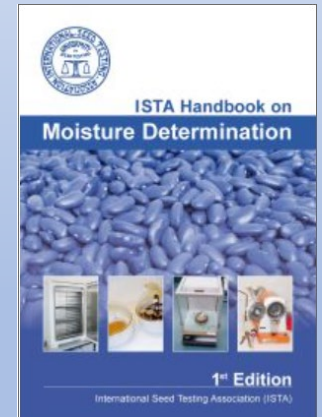


**eRH**

Presenter: Axel Goeritz  
Location: Hamelin  
Date: 30.5.2023



**Moringa oleifera**



**Handbook**

# Moisture Committee



USA



Denmark



Germany  
Chair



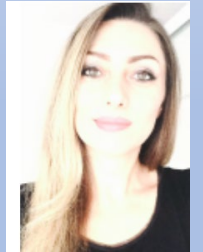
Serbia  
Vicechair



India



Turkey



# MOI

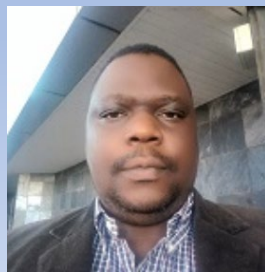


Netherlands

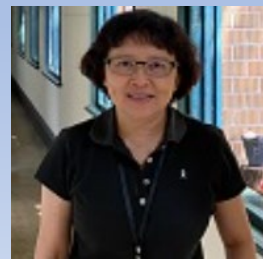
Italy



Zambia



TW



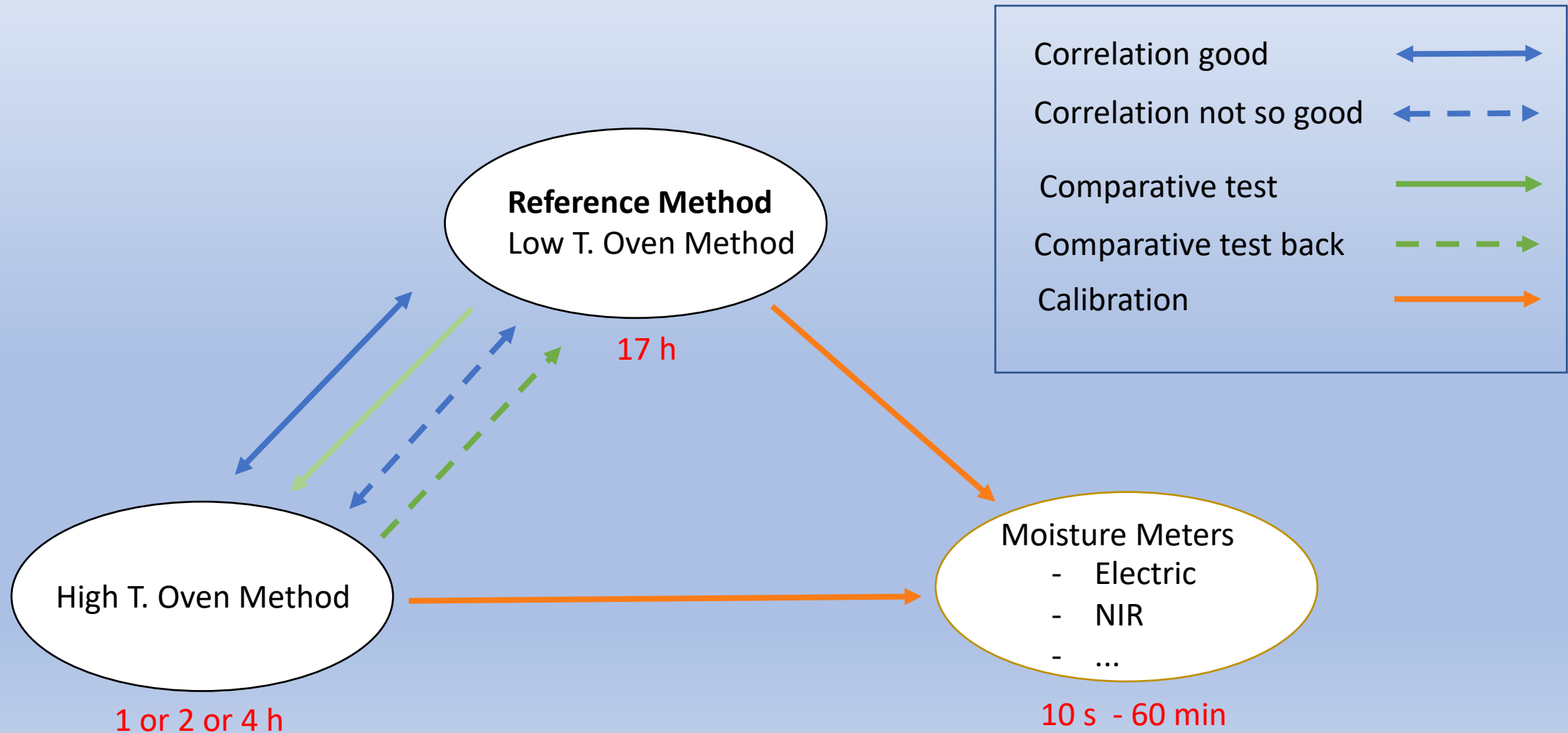
France



USA



# Methods to test seed moisture



# eRH

## A. RULES DEVELOPMENT

### A1. Introduction of New Methods

Method name	proposed	collaboration	remarks
subject	finalisation		update
1 Use of equilibrium Relative Humidity (eRH) as an alternative method for the determination of seed moisture status	2022	FTS, STA	progress

Questionnaires sent out to ISTA laboratories to gather information on how much use of this method is already made and on current methods used (53 responses). The majority of respondents were in favour of adding eRH to the rules.

Comparative testing with various species was planned for 2020 but didn't take place. The use of eRH for testing of coated seeds to be investigated.

The funding of a special eRH-project will be applied in 2021.

Equilibrium Relative Humidity (eRH) will be updated

Use of equilibrium relative humidity measurements for determining the moisture status of stored seeds



Monitor the seed drying

- Water activity meters measure the relative humidity of the air around a sample of seeds at the operating temperature;
- Usually relatively fast (15-60 minutes depending on seed moisture content and equipment);
- Can be related to seed moisture content through seed moisture isotherms (with caution);
- Non-destructive, so seed sample can be used for further testing or returned to the bulk;
- Widely used by seed-/genebanks – particularly useful for following the progress of seed drying.



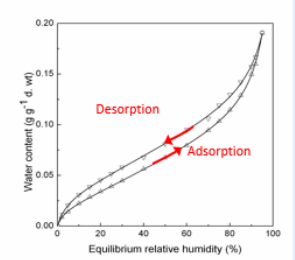
### Special Project – MOI and STO collaboration

will be updated

- Objectives
  - Gain an understanding of current use of eRH measurements for assessing seed moisture status in seed-(gene)banks and in seed testing laboratories in proposed species (vegetable seeds, flower seeds, tree and shrub seeds) and the level of interest in developing eRH measurement as an ISTA method.
  - Develop and implement research to understand reproducibility of seed eRH measurements across different laboratories and any limitations to achieving reproducibility.
  - Develop a proposal for further work based on outcomes of objectives above.

Other research at Aarhus University related to:

- Use of eRH for treated seeds.
- How the isotherm varies depending on moisture history (cycles of drying / water uptake).





# Helianthus annuus

Is currently pending

## A2. Introduction of New Species

Species and test	proposed finalisation	collaboration	remarks update progress
2 <i>Helianthus annuus</i>	2022		Elena Nicolae from the Central Laboratory for Quality of Seeds and Planting Material in Romania will

### Helianthus annuus



2 samples (A+B) in 2 labs with different oven methods

Sample	17 h 103°C		1 h 130°C A		diff. 1 h to 17h		4 h 130°C A		diff. 4 h to 17h	
	A	B	A	B	A	B	A	B	A	B
1BU	4,1	5,0	4,2	5,1	0,1	0,1	4,6	5,3	0,5	0,3
2BU	4,2	4,9	4,3	4,9	0,1	-	4,5	5,2	0,3	0,3
1HM	4,0	5,0	4,1	5,0	0,1	-	4,4	5,3	0,4	0,3
2HM	4,0	5,0	4,1	5,0	0,1	-	4,3	5,3	0,3	0,3
3HM	4,1	4,9	4,1	4,9	-	-	4,5	5,2	0,4	0,3
mean	4,1	5,0	4,2	5,0	0,1	0,0	4,5	5,3	0,4	0,3

Which factors can be detected in advance to reduce

### Helianthus annuus

Different oven methods, TSW and Germination

U-Nr	TSW	Germ.	17h 103°C	1h 130°C	4h 130°C	1h - 17h	4h - 17h
4075	46	92	6,1	6,3	6,7	0,2	0,6
3500	47	94	6	6,3	6,5	0,3	0,5
6403	47	74	7,8	7,9	8,2	0,1	0,4
7480	69	76	6,5	6,5	6,5	0	0
3315	70	95	7,6	7,5	7,7	-0,1	0,1
1673	77	91	8,2	8,2	8,5	0	0,3
7207	77	41	7,2	7,1	7,7	-0,1	0,5
7494	79	84	7,8	8	8,3	0,2	0,5
3569	80	95	7,8	7,9	8,2	0,1	0,4
7478	107	92	6,8	6,7	7	-0,1	0,2
7260	107	83	7,8	7,6	8,3	-0,2	0,5
mean						0,0	0,4

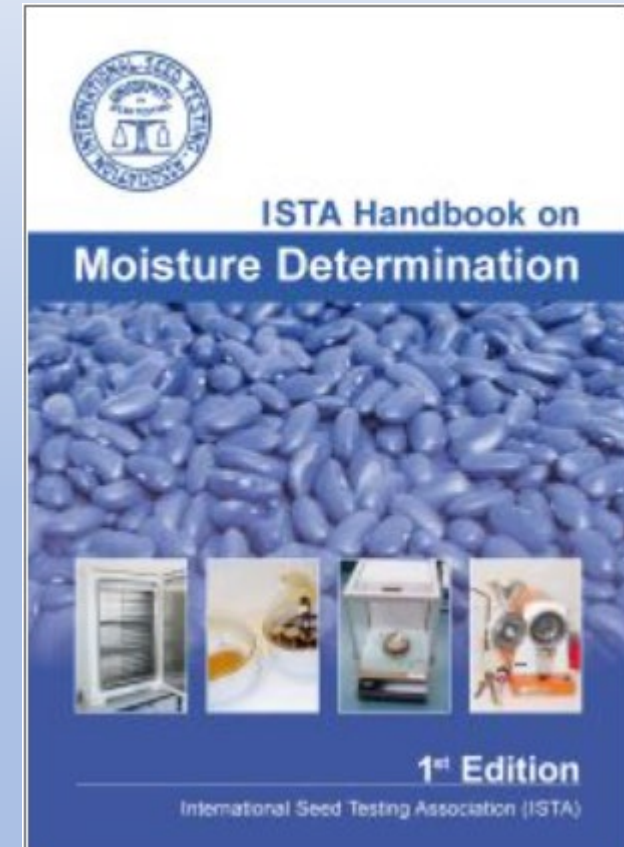
proposal for a currently being

# MOI-Handbook



- Current handbook from the year 2007
- Lead is Sue Alvarez
- Project Group is installed
- Work is in progress

**but: Changes in the rules have to be made, and this must be reflected in the handbook, especially regarding the calibration of moisture meters**



# Excel-Tool Moisture Calculator



- Extension is planned regarding
  - routine tests
  - QM
- → Excel-file

# Rules changes



## C.9.1 Specifying oven temperatures and tolerances

Current version of the paragraph "9.2.5.7" provides only tolerated ranges for drying temperatures. In this proposal, prescribed temperatures are explicitly given, as in paragraphs 9.1.2 and 9.1.3 (103°C resp. 130°C). The proposed tolerated range for the high temperature method (127-133°C) deviates from the current one (130-133°C), but it is the same range prescribed by AOSA (127-133°C). A comparison was conducted in 2 labs. The Statistics TCOM analysed the data and supports the proposed change, the report of the peer method validation is added.

This proposal originates from and is supported by the Moisture Committee.

CURRENT VERSION	PROPOSED VERSION
<b>9.2.5.7 Prescribed methods</b>	<b>9.2.5.7 Prescribed methods</b>
...	...
e. <del>Tolerances for the temperatures and durations are:</del>	e. <b>Methods and their Tolerances for temperatures and durations:</b>
<del>101–105 °C</del> (low temperature): 17 ±1 h;	Low temperature <b>103°C (± 2°C)</b> ; 17 h ± 1 h;
<del>130–133 °C</del> (high temperature): 1 h ±3 min, 2 h ±6 min or 4 h ±12 min. ...	High temperature <b>130°C (± 3°C)</b> ; 1 h ±3 min, 2 h ±6 min or 4 h ±12 min....



# Rules changes



current Rules	Setting point °C	Proposal
126		126
127		127
128		128
129		129
130		130
131	← ???	131
132		132
133		133
134		134

# Rules changes



## Statistical analysis of high oven temperature tolerance for seed moisture – peer method validation

Kirk Remund & Jean-Louis Laffont – ISTA Statistics Committee

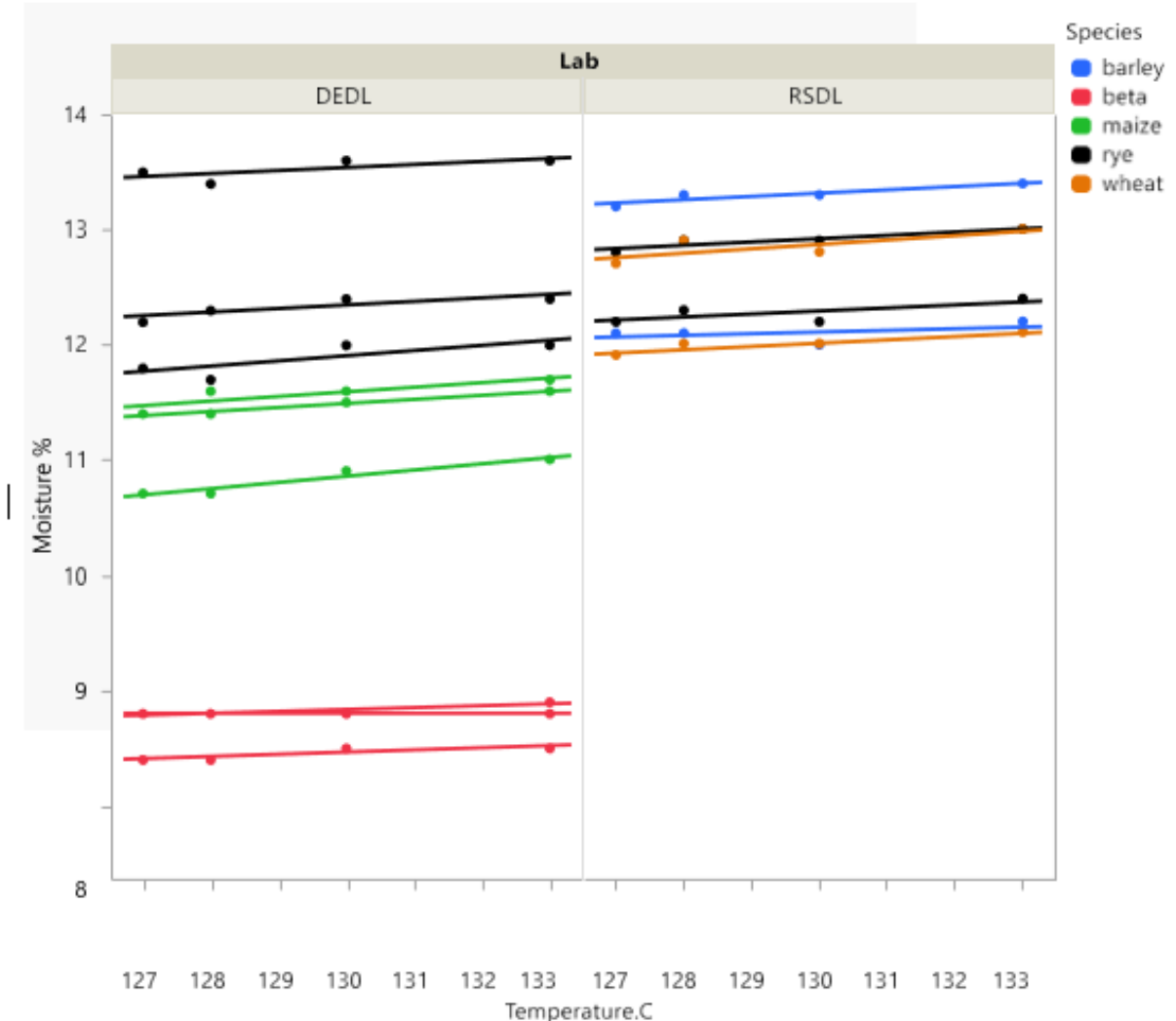
### Stated requirements:

- At least 2 labs
- 3 species (must not be the same between the 2 labs)
- 2 samples per species → 6 samples per lab
- Range from 127 – 133 °C
- Each sample at 3 different temp.

### Result

„This moisture difference is below the 0.2% tolerance from the ISTA Rules (paragraph 9.2.6.2) and therefore the high oven temperature tolerance can be expanded to 130°C ± 2°C for seed moisture in the ISTA Rules. Note that even for the high oven temperature range of 127°C to 133°C the seed moisture prediction range is only 0.17% moisture.“

## 2. Data exploration with scatter plots



# Rules changes



## C.9.2 Reporting moisture content in seed mixtures

In special cases it should be possible, to report the moisture content of seed mixtures.

This proposal originates from and is supported by the Moisture Committee. Note: If this proposal is accepted, the remaining sections in Chapter 18 will be renumbered (18.8 **Reporting Results** will be renumbered 18.9, etc.).

CURRENT VERSION	PROPOSED VERSION
<p><b>18.8 Reporting Result</b></p> <p>.....</p>	<p><b>18.8 Moisture content</b></p> <p>Moisture content can be determined on seed mixtures containing only species with the same moisture method prescribed (Table 9A). The result for moisture content must be entered in the appropriate field in the BIC. For all other mixtures, there is no ISTA moisture method and moisture content cannot be reported.</p> <p><b>18.9 Reporting Result</b></p> <p>.....</p>

# Rules changes



## C.9.3 Moisture test for coated seeds

The moisture test on seeds is usually done with naked, treated or pelleted seeds. Per definition given in chapter 11 also seed mats and seed tapes are coated seeds. This proposal describes clearly now how to handle seed mats and seed tapes regarding the moisture test.

This proposal originates from and is supported by the Moisture Committee.

CURRENT VERSION	PROPOSED VERSION
<p><b>9.2.7 Reporting of results</b></p> <p>...</p> <ul style="list-style-type: none"><li>In the case of pelleted seeds (see Chapter 11), the following statement must be entered: 'The seeds of the submitted moisture sample were pelleted, and the moisture content reported is the average of seed and pelleting materials'.</li></ul>	<p><b>9.2.7 Reporting of results</b></p> <p>...</p> <ul style="list-style-type: none"><li>In the case of pelleted seeds (see Chapter 11), the following statement must be entered: 'The seeds of the submitted moisture sample were pelleted and the moisture content reported is <b>that of the combined unit comprising seed and pelleting material</b>'.</li></ul>
	<ul style="list-style-type: none"><li>The moisture content of seed tapes and seed mats cannot be reported on an OIC or BIC since there is no ISTA method for this kind of sample.</li></ul>



- Same changes as well in 1.5.2.12 Moisture content

# Rules changes



## C.9.4 Merging Parts 1 and 2 of Table 9A

Part 1 and Part 2 of Table 9A are merged due to changes in the crop groups (e.g. Malva transferred from tree and shrub to flower crop group). This change would allow easier inclusions and modifications in future. Some species are renamed according to table 2C. Additional Information of species that are included according to new Taxonomy are given in the last column, this column won't be in the Rules.

As well the method, which has to be applied, can be found better and faster.

This proposal originates from and is supported by the Moisture Committee.

**Table 9A Part 1.** Details of methods for moisture determination: agricultural and vegetable seeds

The low-temperature method (low) or high temperature (high) method must be used as specified for the species in this Table.

Species	Grinding/cutting (9.2.5.4, 9.2.5.5)	Method to be used	Drying at high temperature (h)	Predrying requirement (9.2.5.6)
1	2	3	4	5
<i>Agrostis</i> spp.	No	High	1	–
<i>Allium</i> spp.	No	Low	–	–
<i>Alopecurus pratensis</i>	No	High	1	–
<i>Anethum graveolens</i>	No	High	1	–
<i>Anthoxanthum odoratum</i>	No	High	1	–
<i>Anthriscus</i> spp.	No	High	1	–
<i>Apium graveolens</i>	No	High	1	–
<i>Arachis hypogaea</i>	Cut	Low	–	To 17 % moisture content or less
<i>Arrhenatherum</i> spp.	No	High	1	–
<i>Asparagus officinalis</i>	No	High	1	–
<i>Avena</i> spp.	Coarse	High	2	To 17 % moisture content or less
<i>Beta vulgaris</i>	No	High	1	–
<i>Brassica</i> spp.	No	Low	–	–
<i>Bromus</i> spp.	No	High	1	–
<i>Camelina sativa</i>	No	Low	–	–
<i>Cannabis sativa</i>	No	High	1	–

**Table 9A Part 2.** Details of methods for moisture determination: tree and shrub seeds

The low-temperature method must be used for all species in Table 9A Part 2.

Species	Grinding/cutting (9.2.5.4, 9.2.5.5)	Remarks
<i>Abies</i> spp. (TSW ≤200 g)	No	–
<i>Abies</i> spp. (TSW >200 g)	Cut	High oil content
<i>Acacia</i> spp.	Coarse	–
<i>Acer</i> spp.	Coarse	Because of heterogeneity
<i>Aesculus hippocastanum</i>	Cut	–
<i>Ailanthus altissima</i>	Coarse	–
<i>Alnus</i> spp.	No	–
<i>Amorpha fruticosa</i>	Coarse	Moved from Table 9A Part 1
<i>Berberis aquifolium</i>	No	–
<i>Betula</i> spp.	No	–
<i>Calocedrus decurrens</i>	Coarse	–
<i>Caragana arborescens</i>	Coarse	–
<i>Carica papaya</i>	No	High oil content
<i>Carpinus betulus</i>	Coarse	–

# Rules changes

## C.9.4 Merging Parts 1 and 2 of Table 9A

The oven method must be used as specified for the species in this Table.

Species	Grinding/cutting (9.2.5.4, 9.2.5.5)	Drying Temp. High: 130°C Low: 103°C	Drying time (h)	Tolerances of replicates (9.2.6.2)	Predrying requirement (9.2.5.6) / remarks
1	2	3	4	5	6
<i>Abies</i> spp. (TSW >200 g)	Cut	Low	17	Table 9B	– / High oil content
<i>Abies</i> spp. (TSW ≤200 g)	No	Low	17	Table 9B	–
<i>Acacia</i> spp.	Coarse	Low	17	Table 9B	–
<i>Acer</i> spp.	Coarse	Low	17	Table 9B	– / Because of heterogeneity
<i>Aegilops</i> spp.	Fine	High	2	0.2%	To 17 % moisture content or less
<i>Aesculus hippocastanum</i>	Cut	Low	17	Table 9B	–

one species from genus *Triticum* has been placed into genus *Aegilops*

→ Every Rules chapter has its on special cases

# Rules changes



## C.9.5 Clarifying the wording "initial moisture content"

The wording 'initial moisture content' is used in '9.2.6.2 Tolerances' in the sense of the moisture content measured by the lab, but it is not defined. To make it clear, the word 'initial' is deleted 2 times in the text and as well in the header of column 2-4 of table 9B.

This proposal originates from and is supported by the Moisture Committee.

CURRENT VERSION	PROPOSED VERSION
<p><b>9.2.6.2 Tolerances</b></p> <p>...</p> <p>These are related to seed size and <del>initial</del> moisture content (Table 9B).</p> <p>To use Table 9B, in column 1, select the relevant row depending on seed size. Then select the</p>	<p><b>9.2.6.2 Tolerances</b></p> <p>...</p> <p>These are related to seed size and moisture content (Table 9B).</p> <p>To use Table 9B, in column 1, select the relevant row depending on seed size. Then select the</p>

correct column (2, 3 or 4) depending on the ~~initial~~ moisture content of the sample.

...

**Table 9B.** Tolerance levels for differences between the two duplicate determinations of moisture content of tree and shrub seeds (significance level not defined)

Seed size	Average <del>initial</del> moisture content		
	<12 %	12–25 %	>25 %
	2	3	4
Small: TSW <200 g	0.3 %	0.5 %	0.5 %
Large: TSW ≥200 g	0.4 %	0.8 %	2.5 %

correct column (2, 3 or 4) depending on the moisture content of the sample.

...

**Table 9B.** Tolerance levels for differences between the two duplicate determinations of moisture content of tree and shrub seeds (significance level not defined)

Seed size	Average moisture content		
	<12 %	12–25 %	>25 %
	2	3	4
Small: TSW <200 g	0.3 %	0.5 %	0.5 %
Large: TSW ≥200 g	0.4 %	0.8 %	2.5 %

# Questions and Answers



No	date of input	from	question	answer	by	date of answer	remarks
#1-23	6.1.2023	Ainara Fernández ; Irene	<p>I am writing to you to request clarification regarding an issue we have with our new moisture ovens. When we test samples at low constant temperature settings every time we open the door and the temperature drops, in order to regain 103°C the temperature spikes up to between 107°C and 118°C and it takes another 10/20 minutes to return to 103°C.</p> <p>The only guidance we could find in the ISTA rules was:</p> <ul style="list-style-type: none"> <li>- The oven must be able to regain this temperature in less than 30 minutes after insertion of the maximum number of test samples that can be dried simultaneously.</li> <li>- Tolerances for the temperatures and durations are: 101–105 °C (low temperature): 17 ±1 h</li> </ul> <p>Is the performance of our ovens in line with the ISTA recommendations? I am attaching the Check for capacity temperature profiles for our two ovens at low constant temperature.</p>	<p>From the point of time your closing the oven the allowed range of temp. (101 – 105) must be regained. From your charts I can't see exactly, if this fits, but for sure you got as well the single datapoints of the measurements. The oven used in our lab has not such a big amplitude (117°C), but I would see this as acceptable (even if I had to discuss this finding with the ISTA-Auditors in our last audit).</p> <p>So again: If the time from closing the oven (after filling the oven with samples) till reaching the allowed range is less than 30 min, I would regard the test result as ok.</p> <p>But in your charts after ca. an hour there is again a fast loss of temp., I assume, you opened the door again?</p> <p>And just another remark: To test, if the oven is fit for purpose, you have also to check the oven capacity, therefore we use a big sample of wheat after fine grinding to fill all the containers. This works well in our lab.</p>	Axel	12.1.2023	
#2-23	7.5.2023	Florina ISTA	For Pinus cembra in the ISZA Rules table 9A it	Table 9A for tree and shrubs was added by	Sergio	7.5.2023	

They will be answered – sometime it takes time ...



# Workshop in Peri



# Friendship – ISTA-family



# Moisture Committee



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Denmark



Germany  
Chair



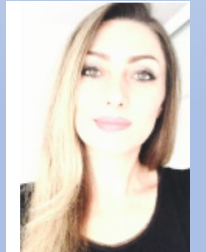
Serbia  
Vicechair



India



Turkey



# Thank you



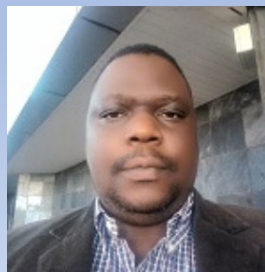
Netherlands



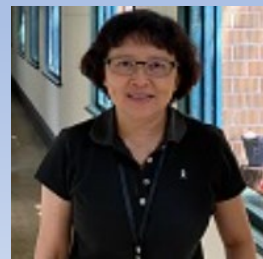
Italy



Zambia



TW



France



USA

