
Determination of seed lot quality

Seed testing laboratory

checks the quality of the seed lots

Seed lot

seeds (seed material) of one species, collected at the same time within one certified unit (i.e. stand or seed orchard), separately treated and stored in the same way

Quality

a set of biological and technical properties of the seed lots

Quality of seed material

- purity
- weight of seeds in cones or fruits

Quality of seeds

- water content
- purity
- weight of 1000 seeds
- germination capacity and germination energy
- viability
- health

Determination of quality of seed material

- **When?**

  - before collection
  - before storage
  - during storage
  - before sowing
  - during sale

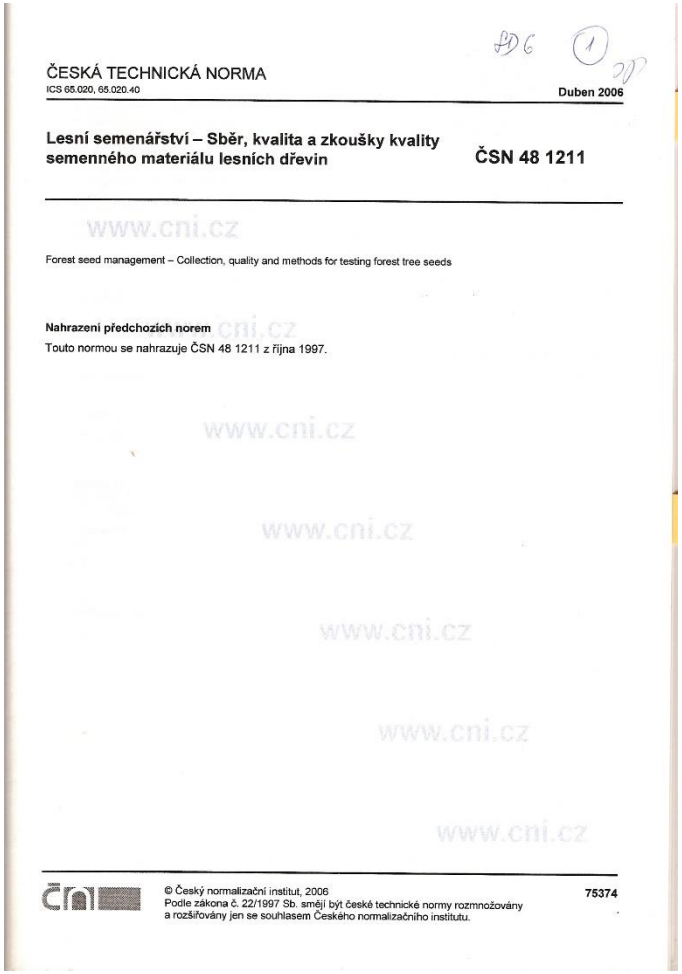
- **Who?**

- Accredited Seed Testing Laboratory (Forestry and Game Management Research Institut - **Forest Research Station Kunovice** in Czech Republic)
- seed lot owner

How?

ISTA (International seed testing asociation)

ČSN 48 1211
Forest seed management - Collection, quality and methods for testing forest tree seeds



ČESKÁ TECHNICKÁ NORMA
ICS 65.020, 65.020.40
Duben 2006

Lesní semenářství – Sběr, kvalita a zkoušky kvality semenného materiálu lesních dřevin **ČSN 48 1211**

Forest seed management – Collection, quality and methods for testing forest tree seeds

Nahrazení předchozích norem
Touto normou se nahrazuje ČSN 48 1211 z října 1997.

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Submitted sample

the amount of seeds determined by the norm, taken from one seed lot in the prescribed manner so that it represents its average quality

Samples taken by:

- **authorised sampling person** ⇒ the report is valid for the entire seed lot
- **owner** ⇒ the report is valid for the sample submitted, not for the whole seed lot!

Correct sampling of submitted sample is of utmost importance for quality testing!

Procedure of taking an submitted sample

taking primary samples

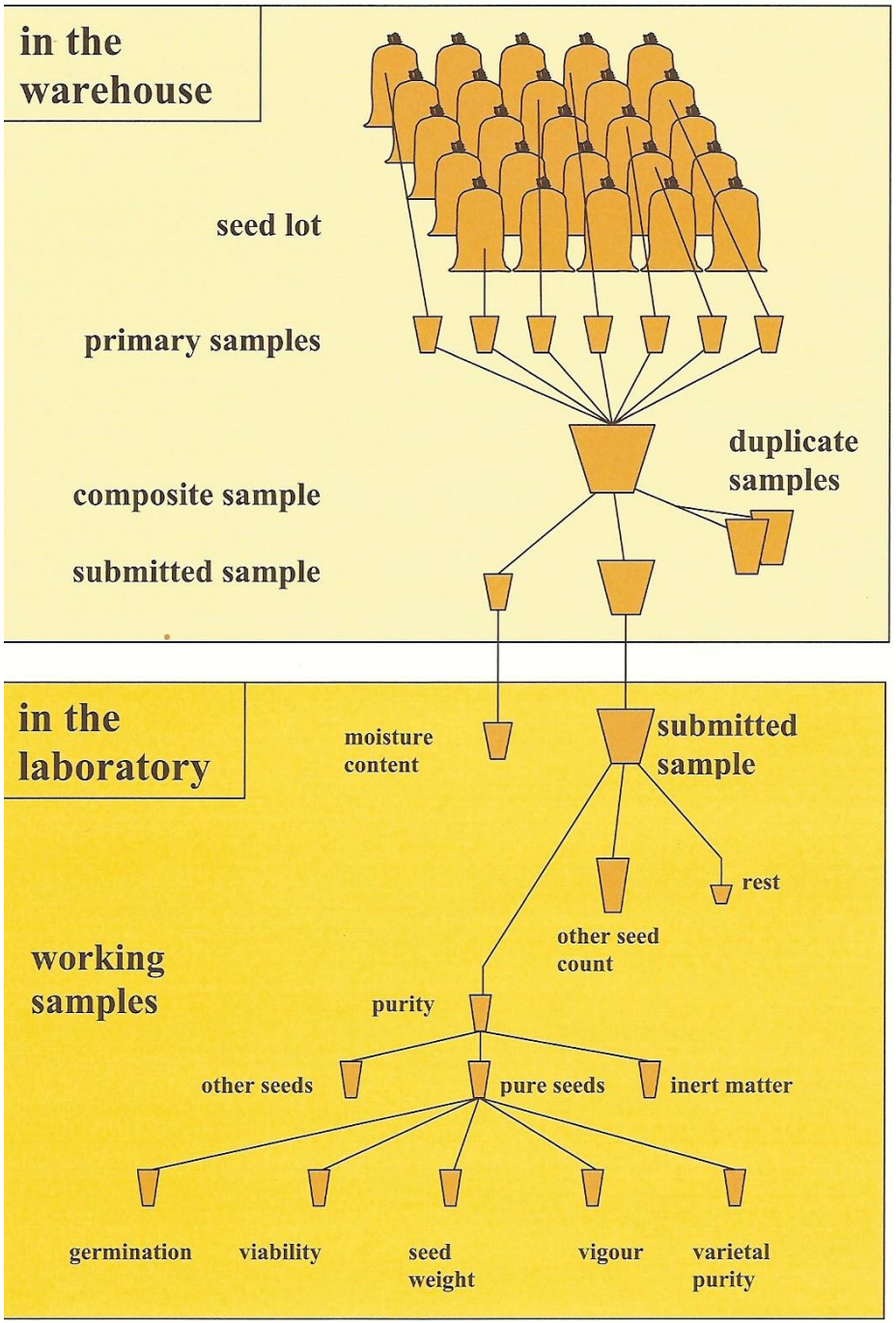
mixing

creating a composite sample

reduction

separation of the submitted sample

Taking samples (basic principle)



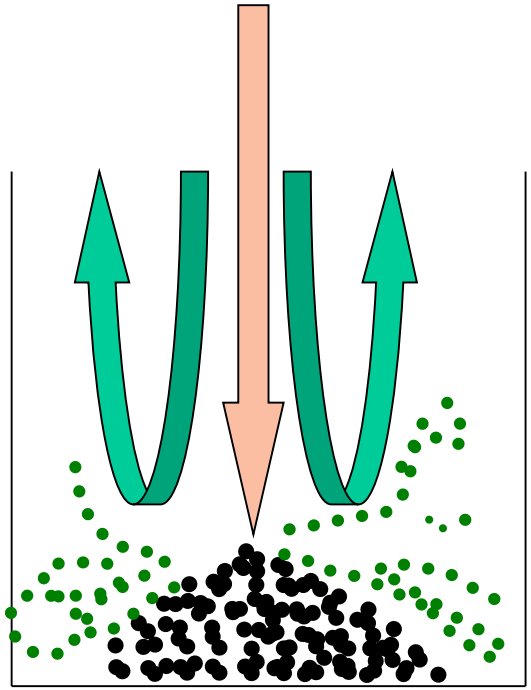
Taking primary samples

- acclimatization of the seed lot before taking samples (water condensate)

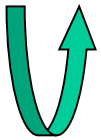
- do not open closed package immediately after taking it out of the freezer!

- before taking primary samples, stir thoroughly

Packaging procedure



Seeds



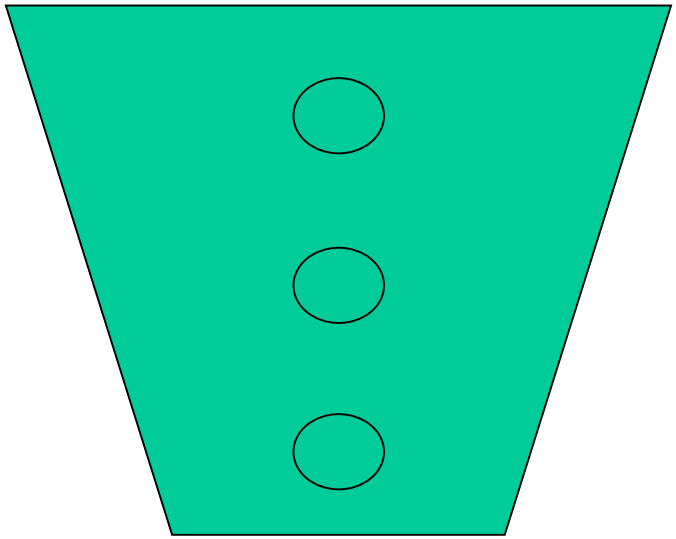
Air flow

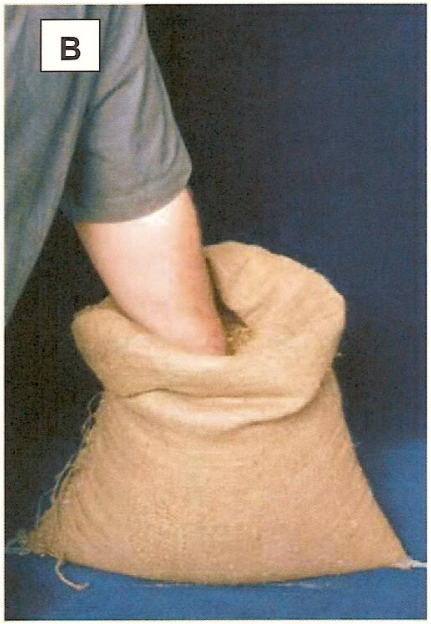
Heavy seeds

Light seeds and inert matter

Dr. Leena Pietilä

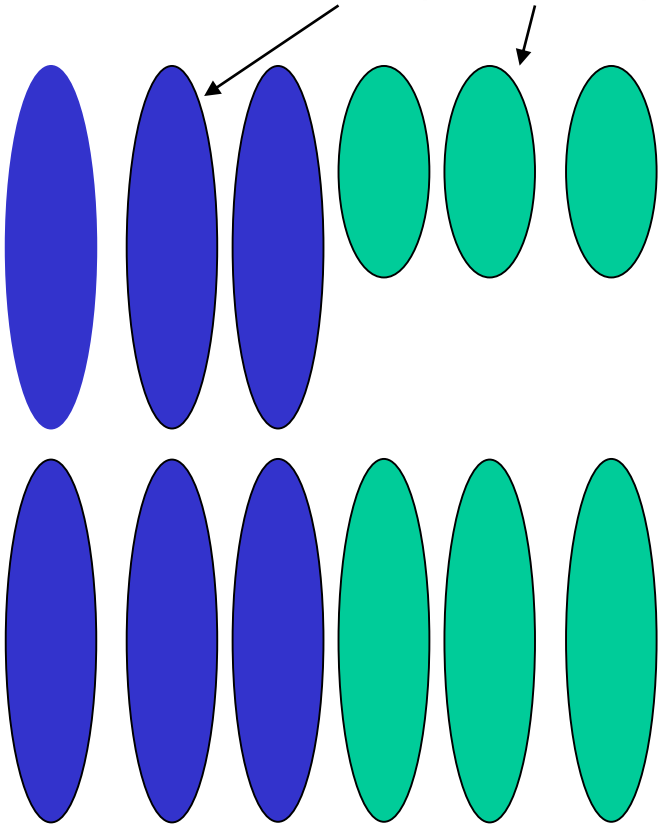
Manual sample of primary samples

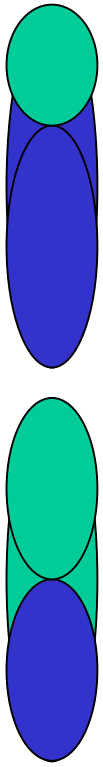




- primary samples must be the same size

Seeds with high/low germination capacity





Proportion of the seeds with high and low germination capacity

Procedure of taking an submitted sample

taking primary samples

mixing

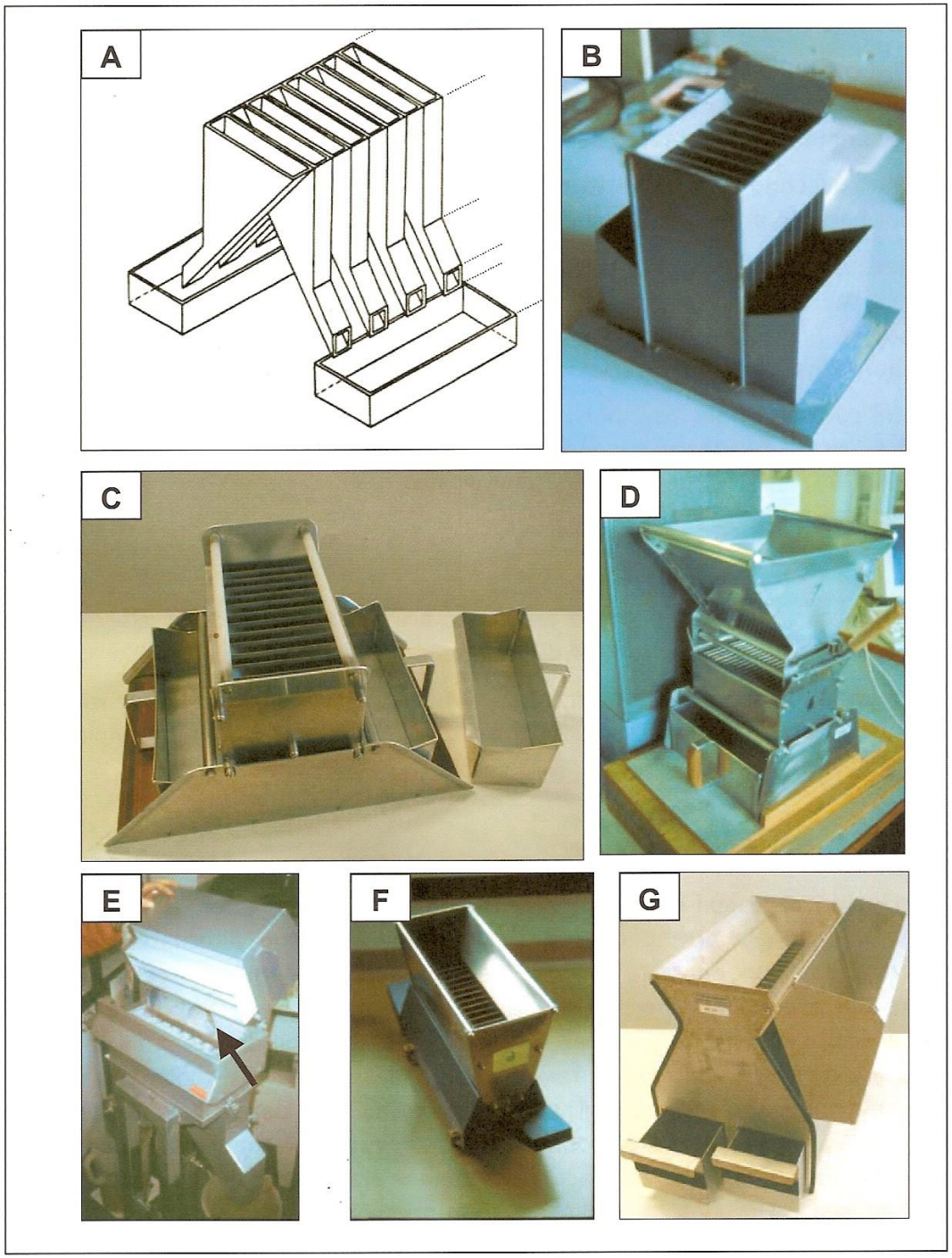
creating a composite sample

reduction

separation of the submitted sample

Preparation of the submitted sample from the composite sample

- reduction by the separator

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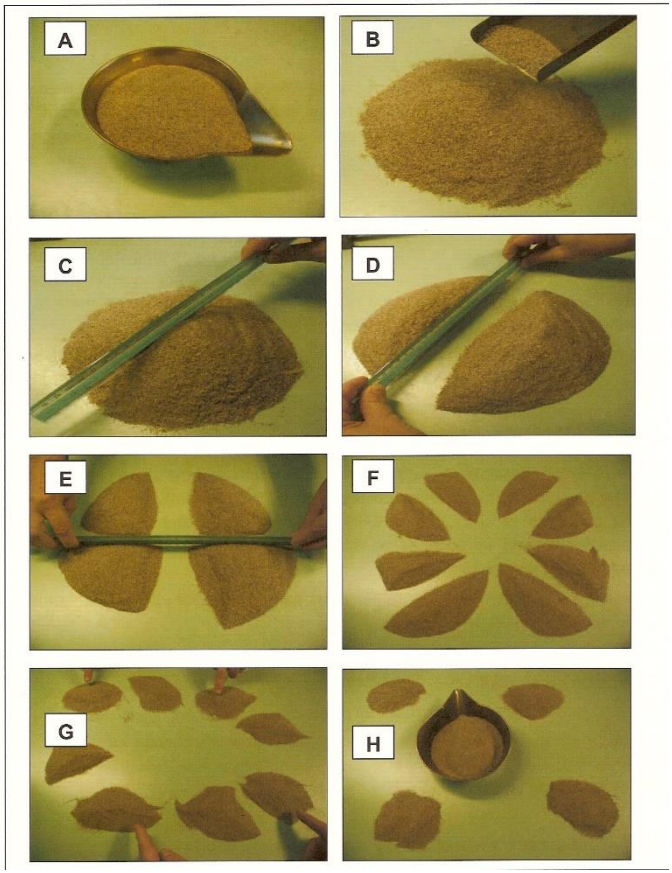
Reduction of the composite sample by manual separation

1. spread the sample onto the pad

2. divide into quarters, each quarter into halves → 8 portions

3. combine every 2nd portion, remove the remaining portions

4. if the weight is too high, repeat the procedure



WEIGHT OF SUBMITTED SAMPLE (ČSN 48 1211)

SPECIES	SUBMITTED SAMPLE (g)
Abies alba	240
Larix decidua	35
Picea abies, Pinus sylvestris	40
Pseudotsuga menziesii	60
Pinus nigra	100
Acer pseudoplatanus	600
Acer platanoides	700
Alnus glutinosa	8
Alnus incana, Alnus viridis	4
Betula sp.	10
Carpinus betulus	500
Fagus sylvatica	1000
Tillia sp.	180
Ulmus sp.	50
Quercus sp.	500 ks

Transport of samples

- in a wrapper or container impossible to open unless you damage the wrapper or its closure.

Water content (humidity)

the proportion of the weight of the water in the **working sample** of the seeds, expressed in % of the original weight of the **working sample**

Has influence on:

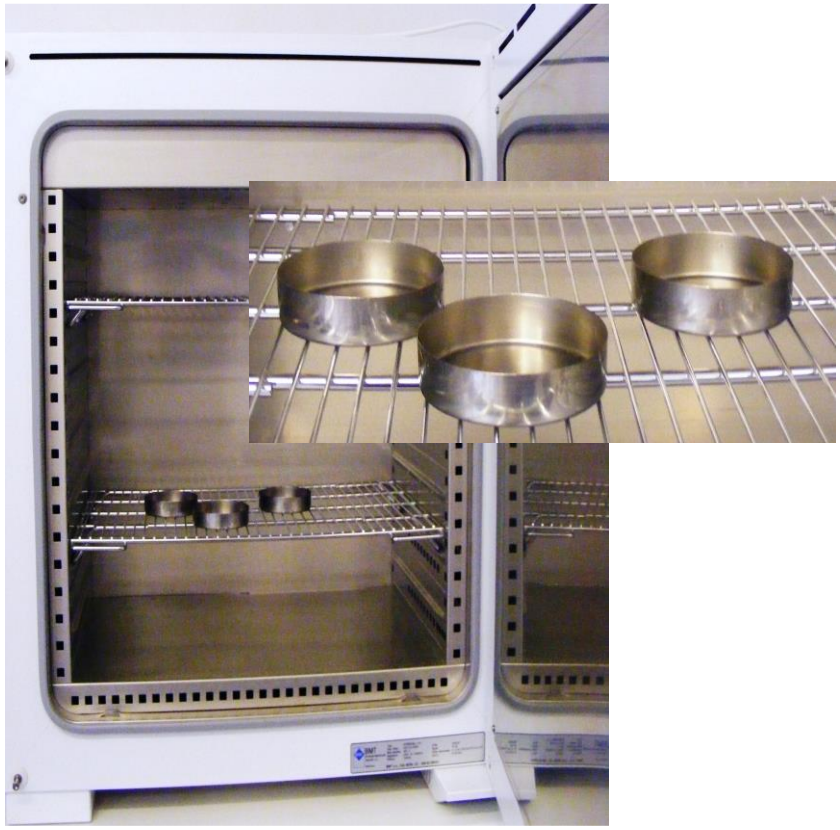
- viability of the seeds (mainly the recalcitrant ones)
- successful storage and stratification

Samples for determination of the water content must be hermetically closed

Procedure:

- Weight 2 working samples directly from the submitted sample (big seeds need to be cut or ground)

- dry at 103±2^{o}C in a dryer (17 hours) or special devices



- measure the weight
- calculate the water content (%)
- the deviation between the samples must not exceed 0.3–2.5 % (see the table); if the difference is bigger ⇒repeat the procedure

Permissible difference in water content of two working samples

Seed size	Number of seeds in kg (pieces)	Content of water (%)	Permissible difference between 2 working samples (%)
Small	More than 5 000	Less than 12	0.3
Small	More than 5 000	More than 12	0.5
Big	Less than 5 000	Less than 12	0.4
Big	Less than 5 000	12 to 25	0.8
Big	Less than 5 000	More than 25	2.5

Purity

- the weight of pure seeds expressed in % of the weight working sample of the seeds

Has influence on:

- number of seeds in 1 kg
- sowing dose
- price of the seeds

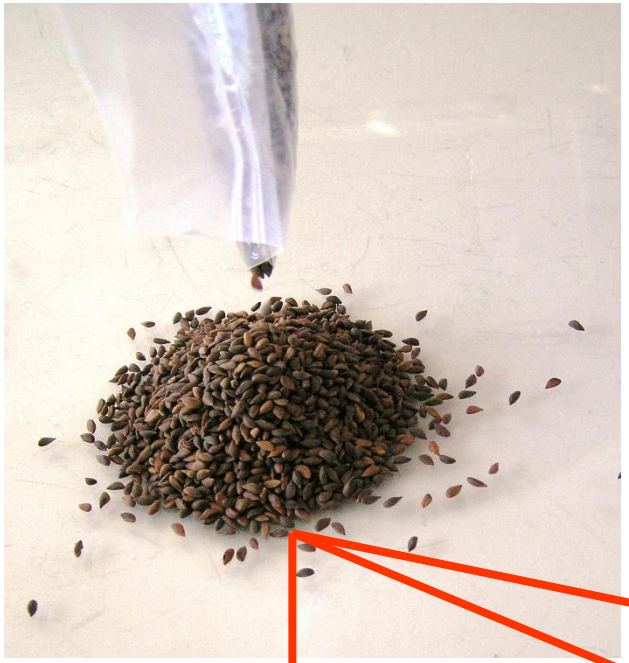
Procedure

- separate the working sample (manual reduction) and measure its weight

Weight of working samples for purity determination (ČSN 48 1211)

SPECIES	WORKING SAMPLE (g)
Abies alba	120
Larix decidua	17
Picea abies, Pinus sylvestris	20
Pseudotsuga menziesii	30
Pinus nigra	50
Acer pseudoplatanus	300
Acer platanoides	350
Alnus glutinosa	4
Alnus incana, Alnus viridis	2
Betula sp.	1
Carpinus betulus	250
Fagus sylvatica	600
Tillia sp.	90
Ulmus sp.	24
Quercus sp.	500 pcs

- divide into fractions:



Pure seeds

Inert matter

Seeds of other species

- weight the fractions

- check: the sum of the weights of the fractions must not differ from the weight of the working sample by more than 5 %

- express the purity in %

- calculate the % proportion of the fractions
(based on the summarised weight)

Weight of 1000 seeds

Weight of 1000 seeds shown in grams

Has influence on:

- number of seeds in 1 kg

- sowing dose

- **Procedure**

- 8 x 100 seeds from the fraction “pure seeds” (random selection)

- measure the weight

- **calculate the average value and the variation coefficient Vk**
- **check: Vk < 4 %,**
- **Ø x 10 = weight of 1000 seeds in grams**

Germination capacity

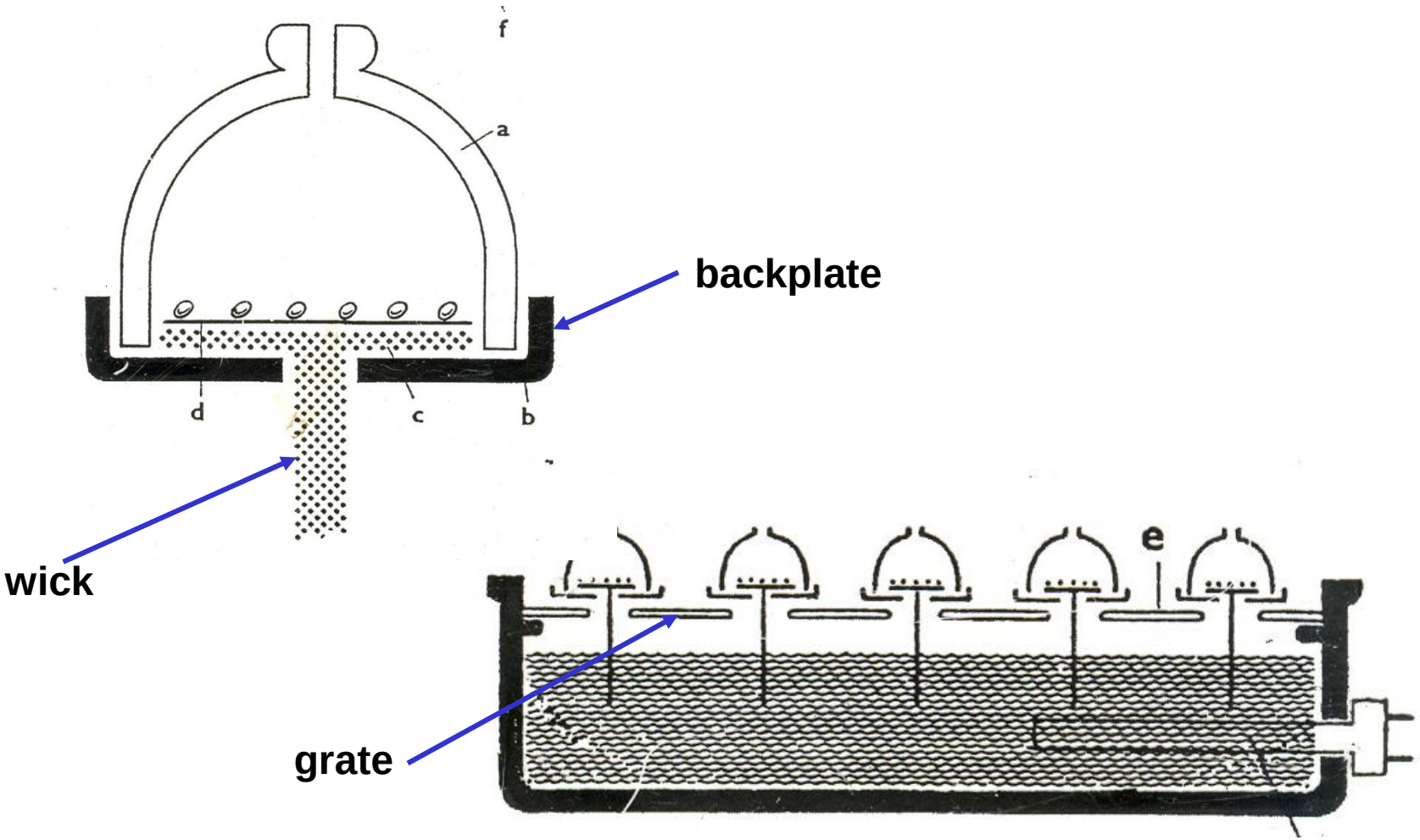
Provides information how many seeds will probably germinate and develop in a normal seedling

- **Has influence on:**

  - sowing dose
  - price of the seed lot

- **test on germinators**
  (spruce, pine, larch, birch, alder..)

  - conditions: “sterility”
  16-hour dark (20^{o}C) and 8-hour light (30^{o}C)



Jacobsen´s germination apparatus

germinators

Germination room

Germination box

Germination test in vegetation vessels (*Quercus*, *Juglans*..)

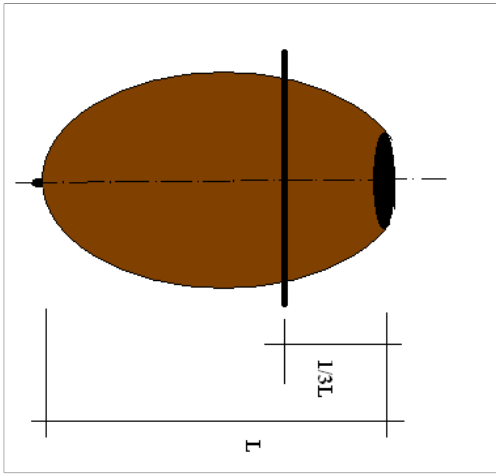
- vessels from plastic, wood, metal etc.

- sand layer of min. 8 cm

- peel the seeds and cut 1/3 of them, from the end with the scar

- **put them in the vessel and cover them with sand** (arrange for ventilation)

- conditions: chemically inert sand
temperature 20°C
a dark place
humidity

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VYFOCENO
23.5.2002
LOUPANÉ!

Germination test of beechnuts with substrate

- temperature 3-5°C

Substrate: mixture of peat and sand (1 : 1)

1 portion of beechnuts and 3 portions of substrate

Procedure, germination test

- spread 4x100 seeds onto germinators
(4x50 to veg. vessels)

- test duration according to ČSN 48 1211

The duration and the setting of the germination test (ČSN 48 1211)

Species	First count (germination energy) (days)	Last count (germination capacity) (days)	Setting	Note
Abies alba	7	28	Germinator	after 21-day stratification (3-5°C)
Larix decidua	7	21	Germinator	-
Picea abies	7	21	Germinator	-
Pinus sylvestris	7	21	Germinator	-
Pinus mugo	7	21	Germinator	-
Pinus nigra	7	21	Germinator	-
Pseudotsuga menziesii	7	21	Germinator	simultaneously with and without stratification at 3-5 °C

The duration and the setting of the germination test (ČSN 48 1211)

Species	First count (germination energy) (days)	Last count (germination capacity) (days)	Setting	Note
Alnus	7	21	Germinator	-
Betula	7	21	Germinator	-
Platanus	7	21	Germinator	-
Salix	7	14	Germinator	-
Ulmus	7	14	Germinator	-
Populus	3	10	Germinator	-
Robinia pseudoacacia	7	14	Germinator	disturb the seed coat, soak for 48 h.
Quercus	7	28	Vegetation vessels	soak for 48 h.
Castanea sativa	7	21	Vegetation vessels	soak for 48 h.

- remove and make records on germinated seeds

first count (usually on Day 7)

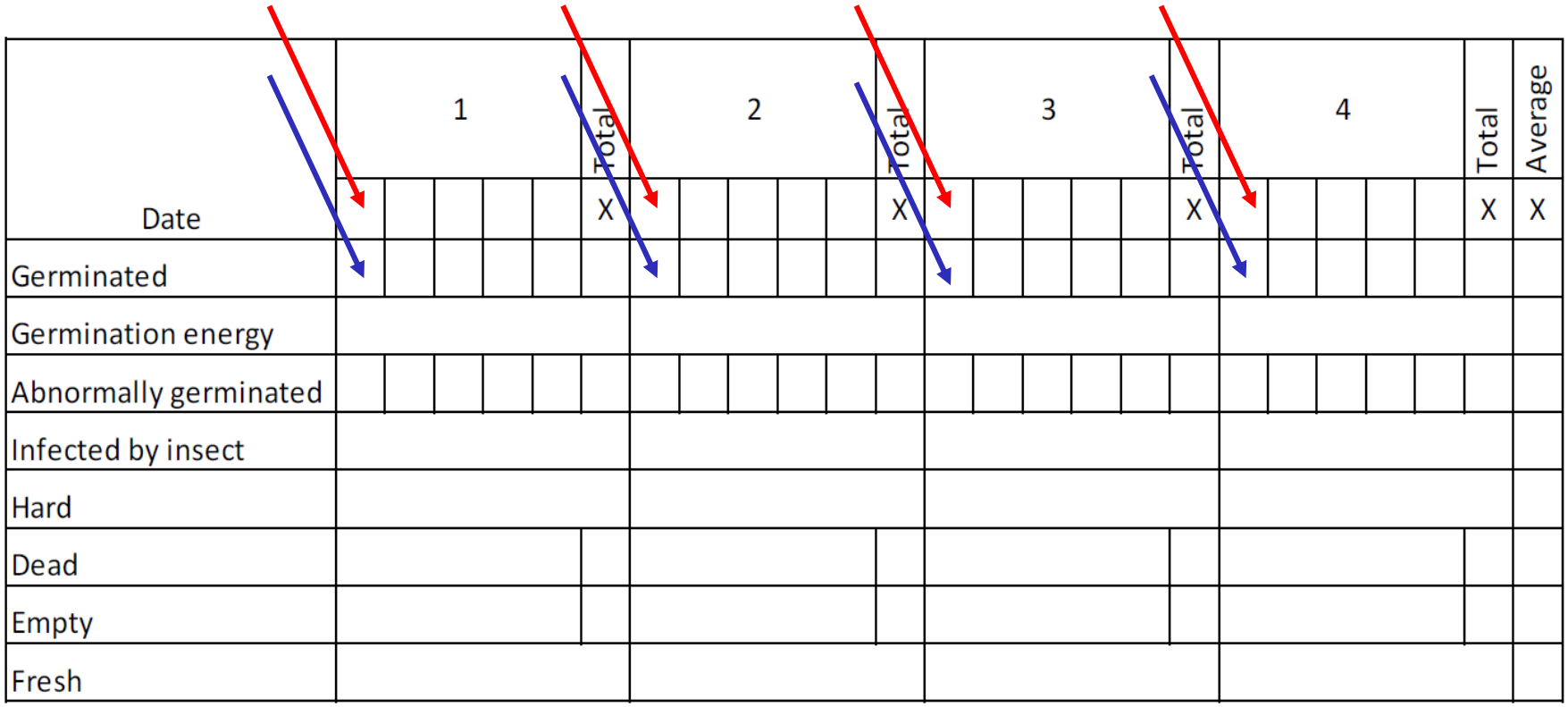
last count (usually on Day 21)

sort the germinated seeds into:

a) normal

- sprout = 4x length of seed

Date	1					Total	2					Total	3					Total	4					Total	Average
						X						X						X						X	X
Germinated																									
Germination energy																									
Abnormally germinated																									
Infected by insect																									
Hard																									
Dead																									
Empty																									
Fresh																									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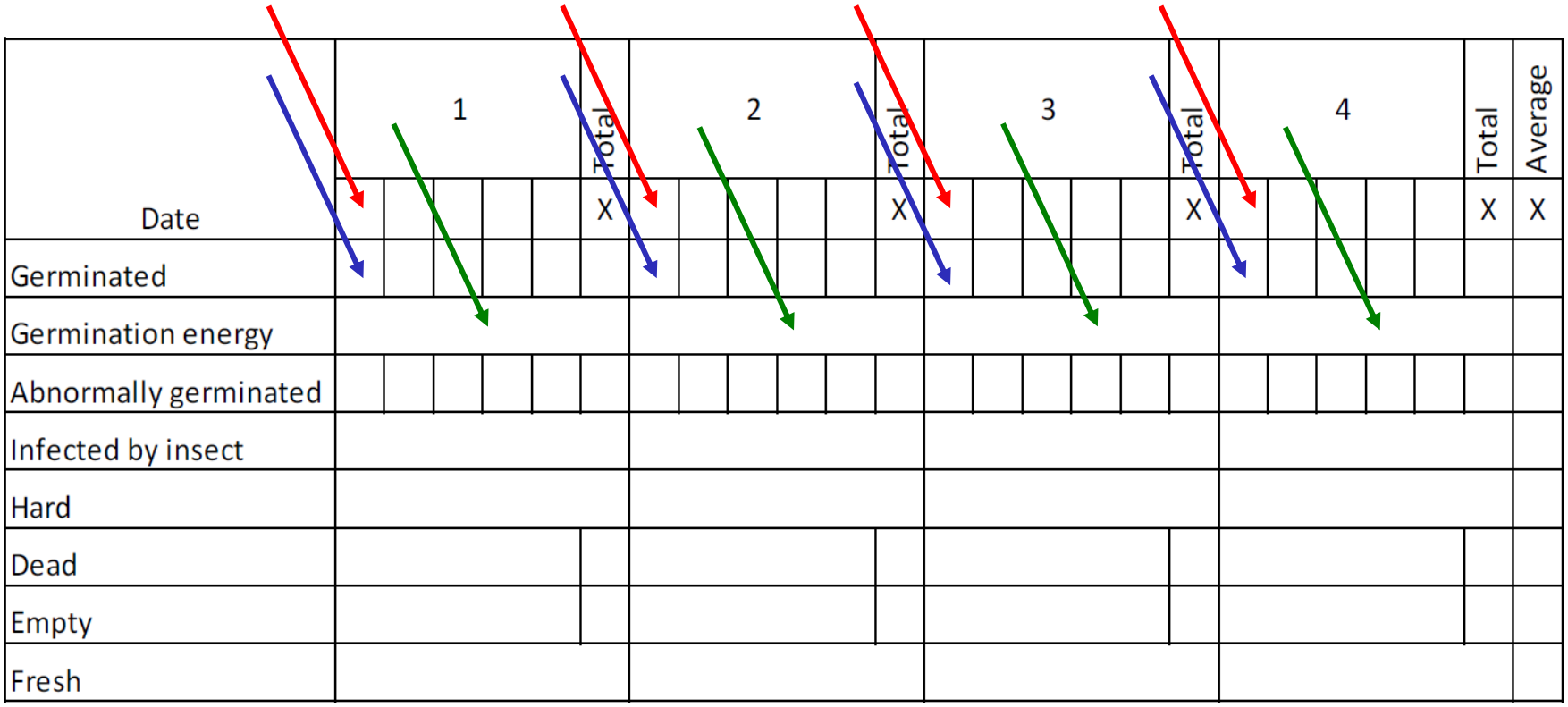
Germination energy
Abnormally germinated
Infected by insect
Hard
Dead
Empty
Fresh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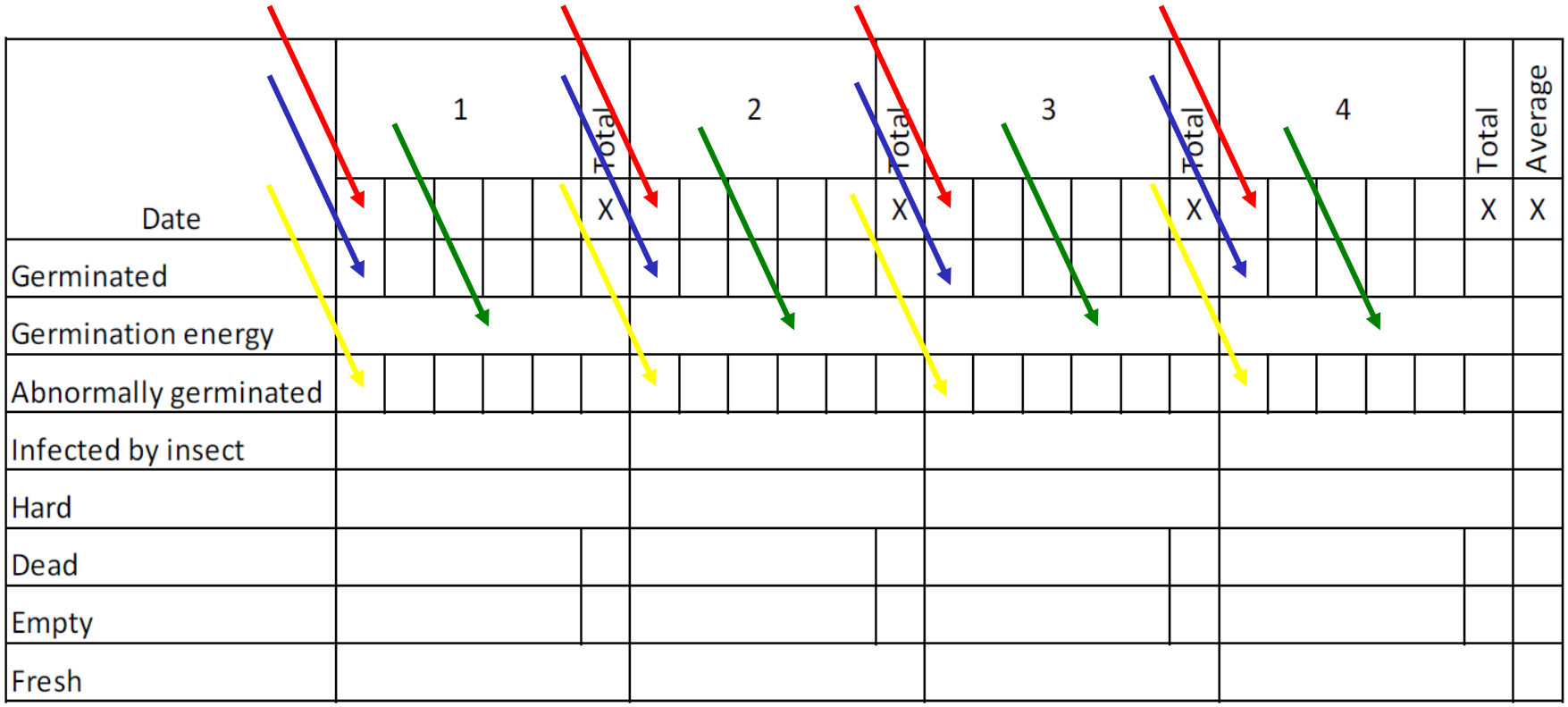
Germinated
Germination energy
Abnormally germinated
Infected by insect
Hard
Dead
Empty
Fresh

b) abnormal

- damaged root, hypocotyl
- the sprout does not penetrate the micropyle
- the seed germinates by cotyledon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Germinated
Germination energy
Abnormally germinated
Infected by insect
Hard
Dead
Empty
Fresh

- during the germination test, the following is determined:

Germination energy (GE) – the number of normally germinated seeds identified during the first count, expressed in % of the number of the germinated seeds

Germination capacity (GC) – the same during the last count

- at the end of the test, cut away the seeds not germinated (fresh, dead, empty)

- GE and GC calculated as average from 4 repetitions

- check: see the table showing permissible deviations

Date	1					Total	2					Total	3					Total	4					Total	Average
						X						X						X						X	X
Germinated																									
Germination energy																									
Abnormally germinated																									
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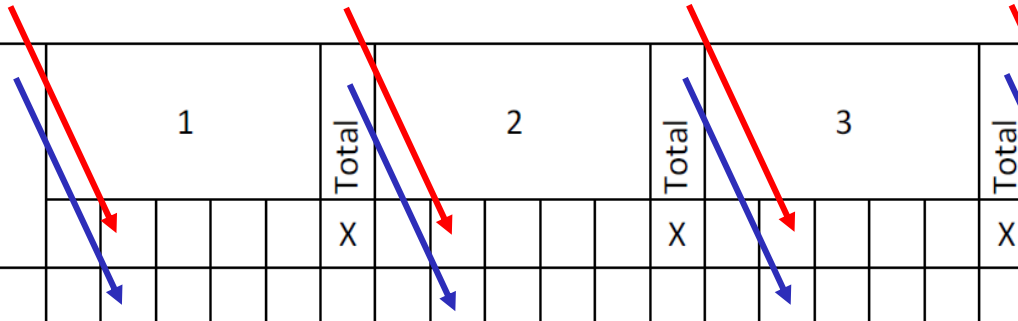

Date	1				Total	2				Total	3				Total	4				Total	Average
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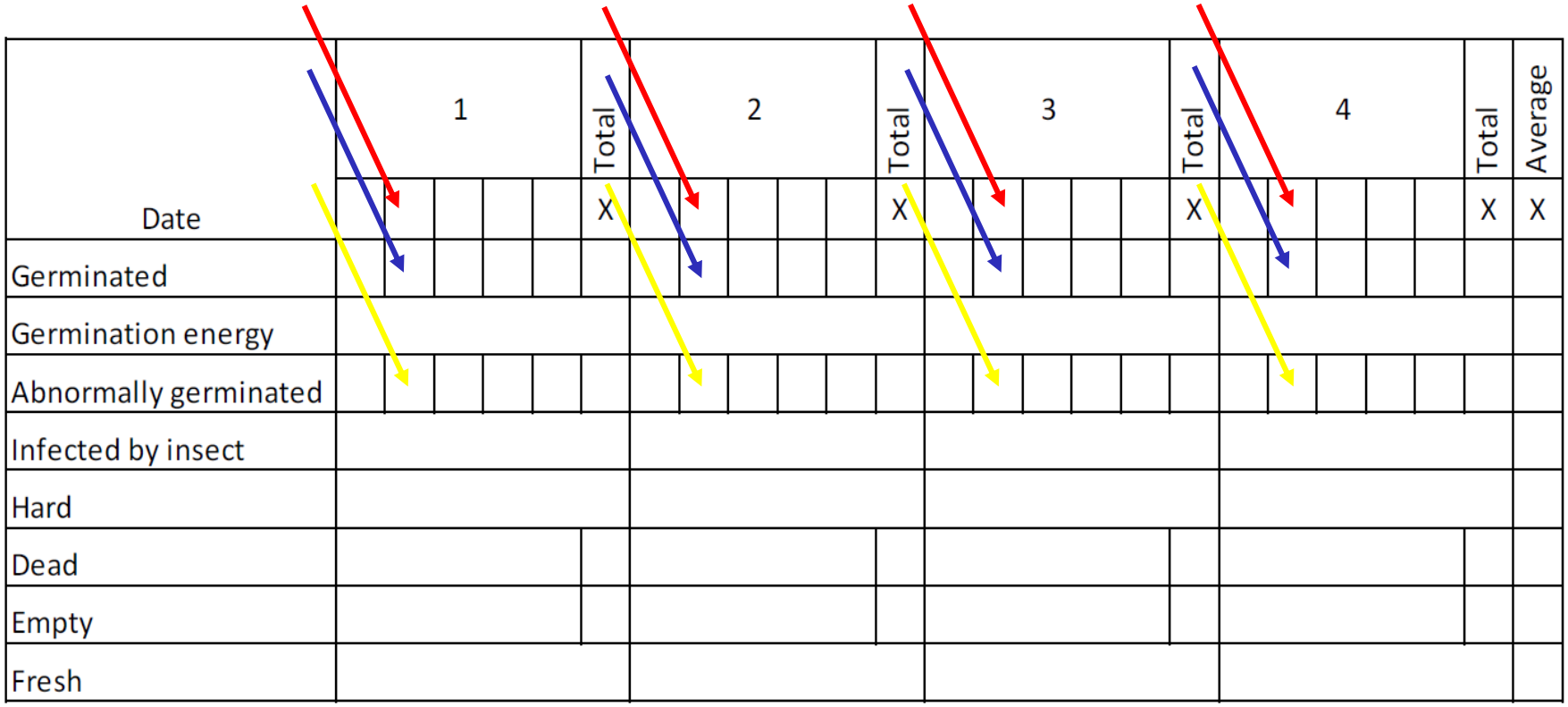

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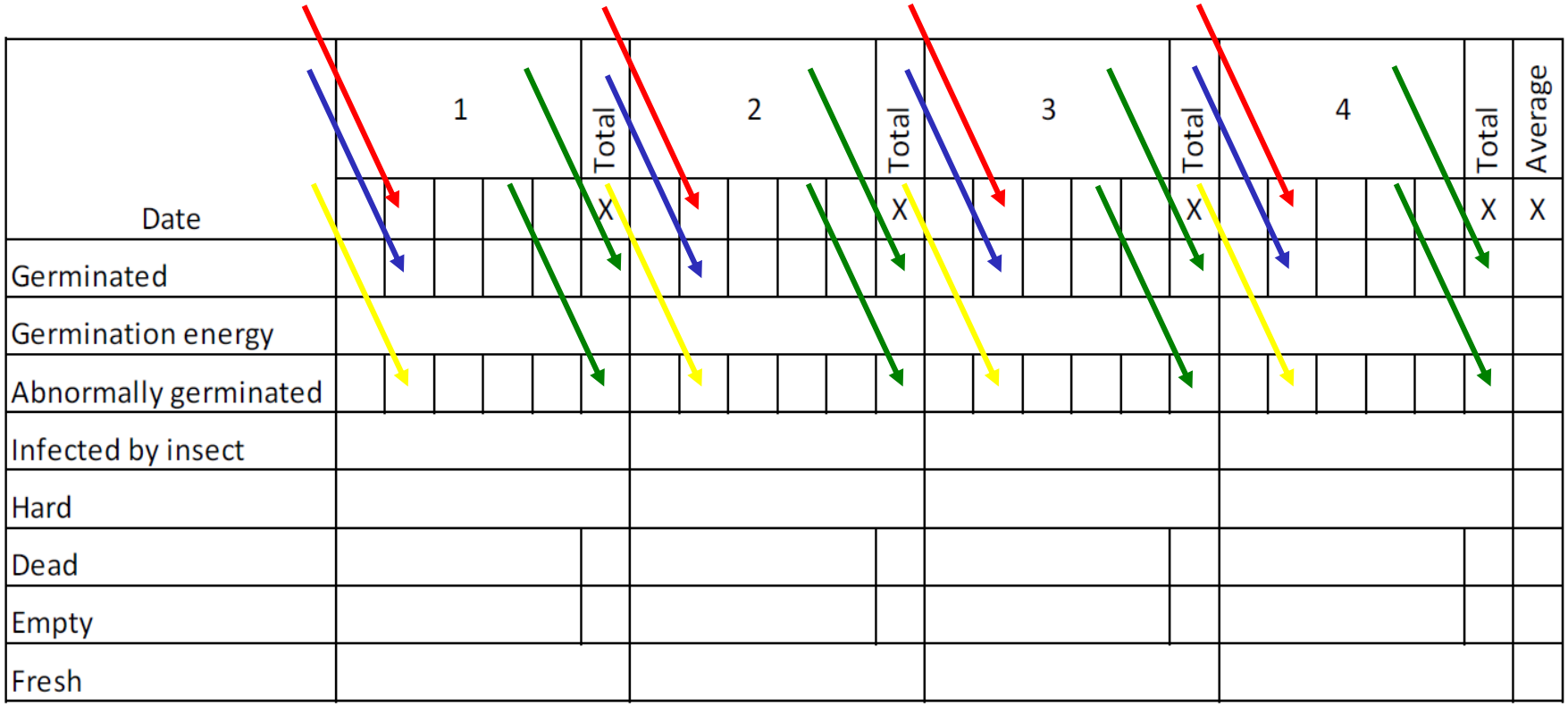

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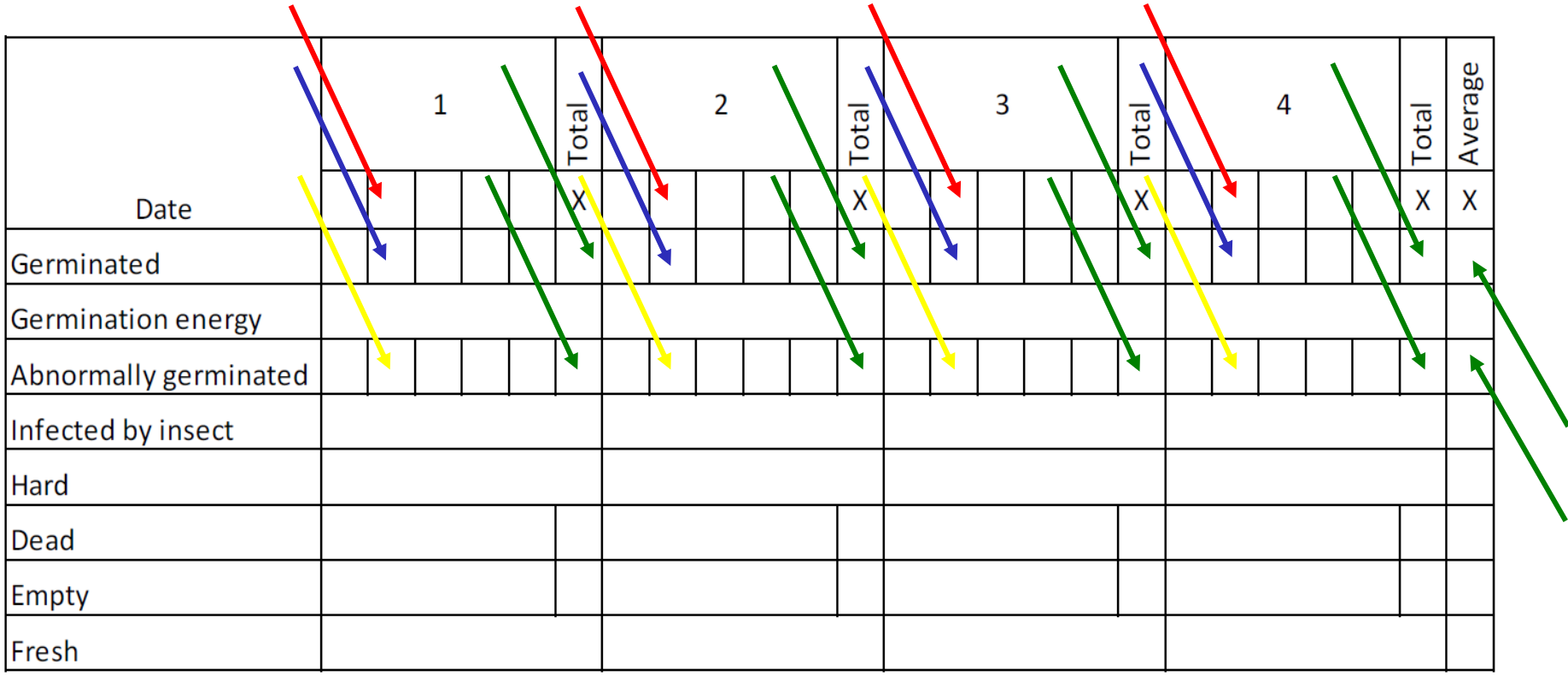
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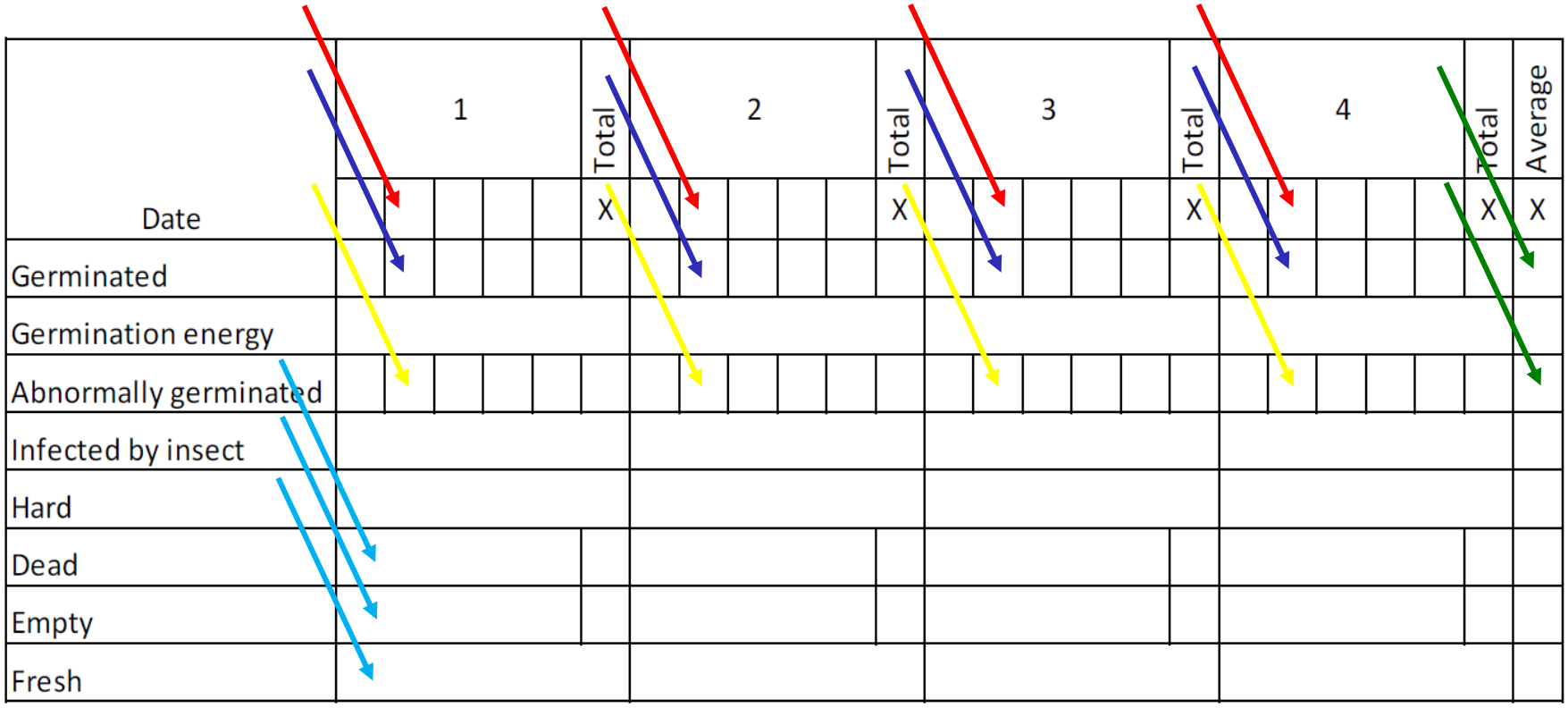
AVERAGE GERMINATION CAPACITY OR VIABILITY OF 4 HUNDRED SEEDS (%)			MAXIMUM PERMISSIBLE RANGE BETWEEN HUNDREDS (%)
99	or	2	5
98		3	6
97		4 – 5	7
96		5	8
95		6	9
93 to 94		7 to 8	10
91 to 92		9 to 10	11
89 to 90		11 to 12	12
87 to 88		13 to 14	13
84 to 86		15 to 17	14
81 to 83		18 to 20	15
78 to 80		21 to 23	16
73 to 77		24 to 28	17
67 to 72		29 to 34	18
56 to 66		35 to 45	19
51 to 55		46 to 50	20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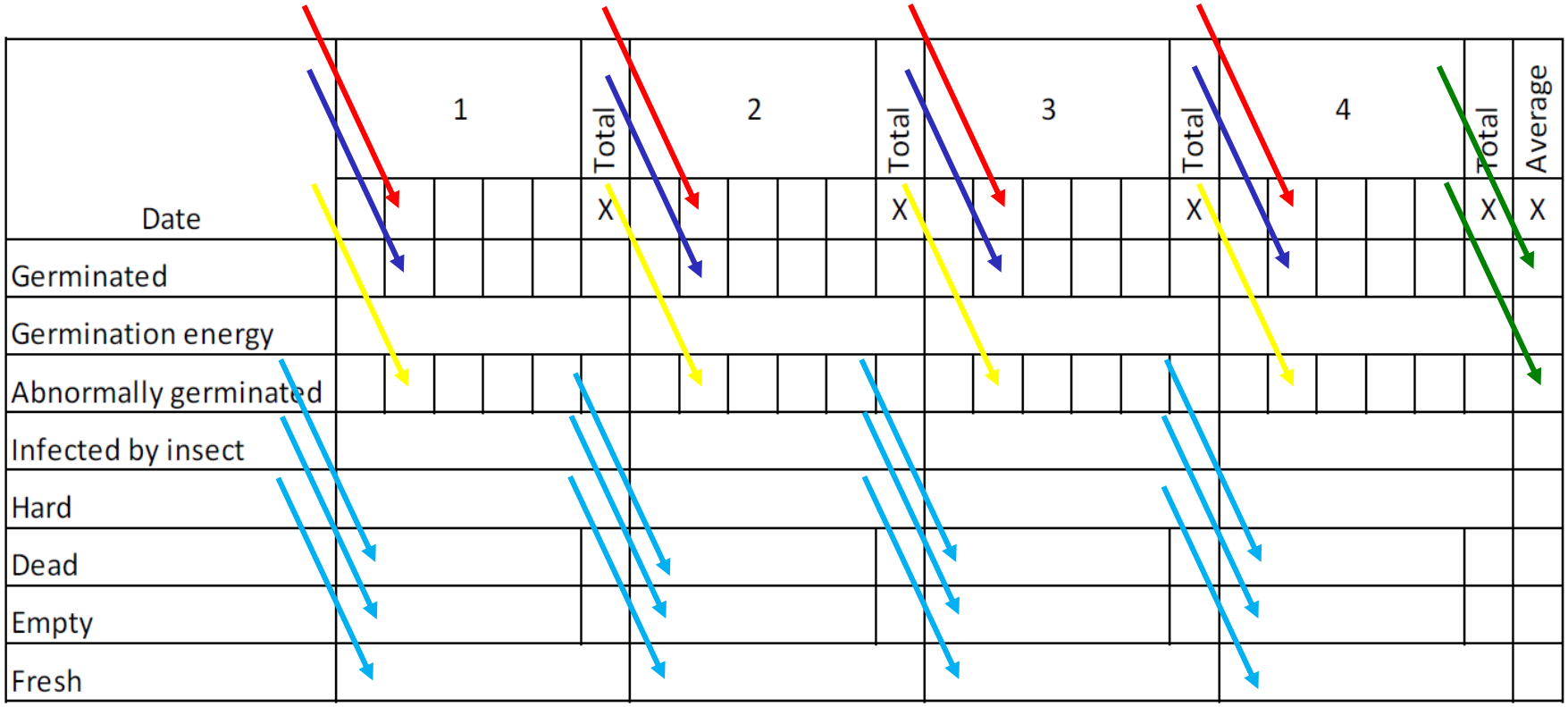
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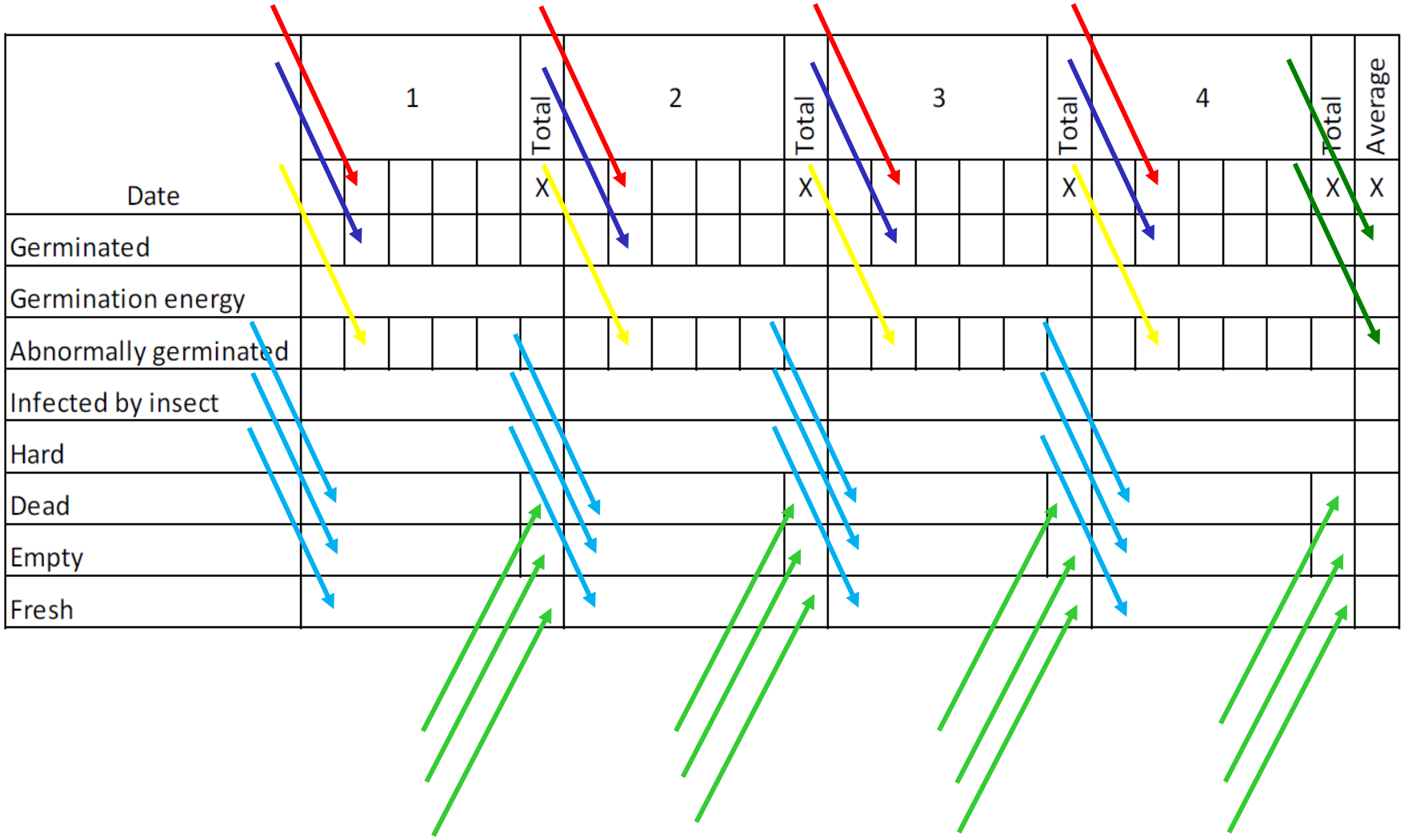
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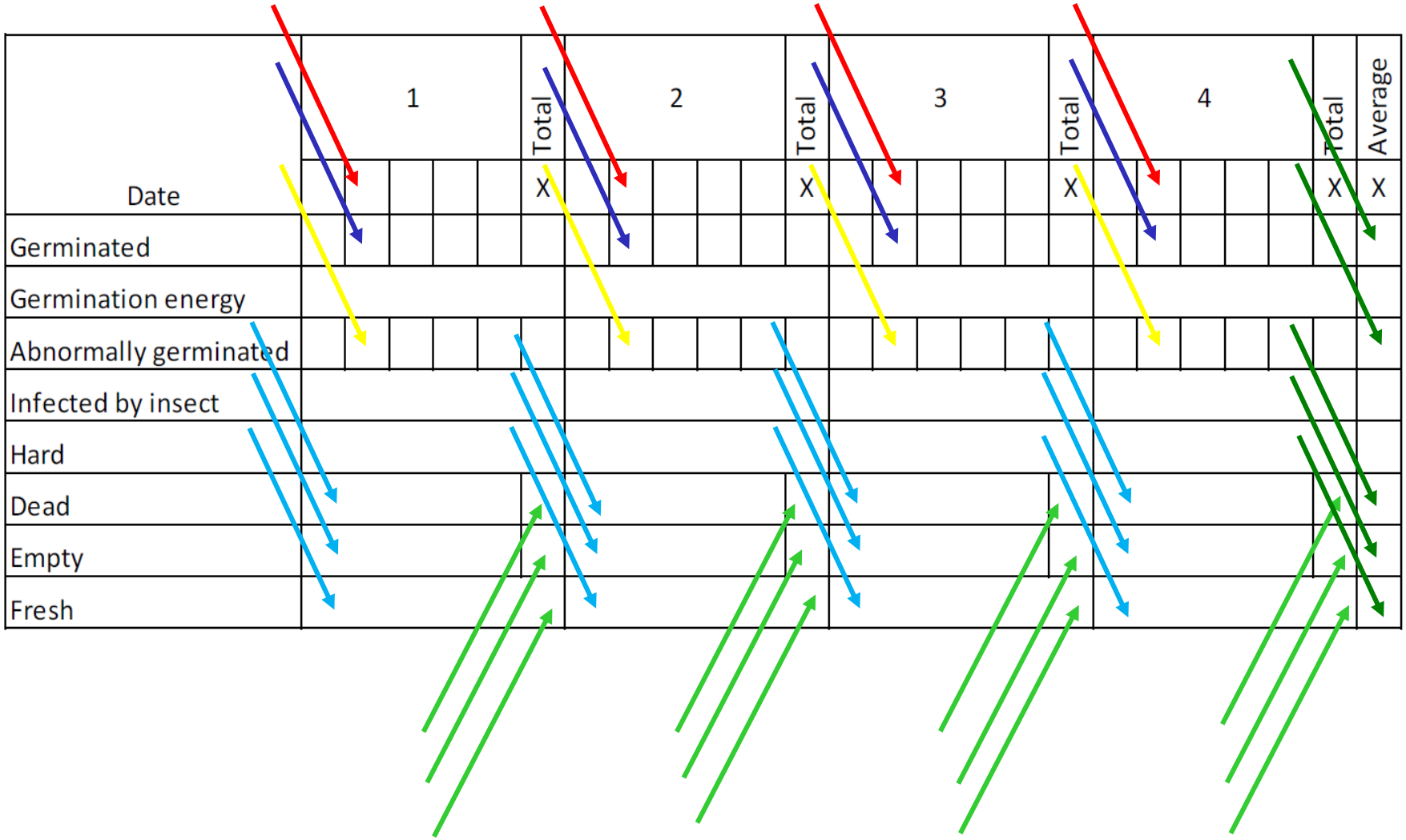
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Germination energy
Abnormally germinated
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Forestry and Game Management Research Institute
Accredited Seed Testing Laboratory
686 04 Kunovice
Tel. 572 420 920, Fax 572 549 119
semkon@vulhmuh.cz

Protocol No.

Customer information

Wood species		**Seed fraction**
Customer	**Receipt From and/or number of the Certificate of Origin**	**Year of the seed material maturing**
	Certificate of origin and/or number of unit	**Type of seed material**
Owner of seed material	**Order number**	**Weight of seed unit** **kg**
Registration number of a certified unit		

Quality test report

Date of sampling	Date of sample delivery	Date of start of the germination test	Date of end of the germination test

SOP 4 (Standard ČSN 48 1211 - 4.4.3)		SOP 6 (Standard ČSN 48 1211 - 4.4.5)	
Species (genus) of pure seeds determined in the purity test		**Germination capacity**	**%**
		Germination energy	**%**
Purity (pure seeds)	**%**	**Abnormally germinated seeds**	**%**
Seed of other species	**%**	**Dead seeds**	**%**
Admixture	**%**	**Fresh seeds**	**%**
		Hard seeds	**%**
SOP 5 (Standard ČSN 48 1211 - 4.4.4)		**Seeds infected by insect**	**%**
Weight of 1000 seeds	**g**	**Empty seeds**	**%**
SOP 3 (Standard ČSN48 1211 - 4.4.2)			
Water contend	**%**	**Percentage of full seeds**	**%**
		Germination energy of full seeds	**%**
Notes		**Germination capacity of full seeds**	**%**
		Number of pure germinated seeds in 1 kg	**pcs**

Samples were taken in accordance with the standard ČSN 48 1211 and the test results are valid for the whole seed unit.

Price **CZK**

In Kunovice

Author: **Lena Bezděčková**
Responsible manager of Accredited Seed Testing Laboratory

Date of sampling	Date of sample delivery	Date of start of the germination test	Date of end of the germination test

SOP 4 (Standard ČSN 48 1211 - 4.4.3)		SOP 6 (Standard ČSN 48 1211 - 4.4.5)	
Species (genus) of pure seeds determined in the purity test		**Germination capacity**	**%**
		Germination energy	**%**
Purity (pure seeds)	**%**	**Abnormally germinated seeds**	**%**
Seed of other species	**%**	**Dead seeds**	**%**
Admixture	**%**	**Fresh seeds**	**%**
		Hard seeds	**%**
SOP 5 (Standard ČSN 48 1211 - 4.4.4)		**Seeds infected by insect**	**%**
Weight of 1000 seeds	**g**	**Empty seeds**	**%**
SOP 3 (Standard ČSN48 1211 - 4.4.2)			
Water contend	**%**	**Percentage of full seeds**	**%**
		Germination energy of full seeds	**%**
Notes		**Germination capacity of full seeds**	**%**
		Number of pure germinated seeds in 1 kg	**pcs**

Samples were taken in accordance with the standard ČSN 48 1211 and the test results are valid for the whole seed unit.

Percentage of full seeds

$$P_{PL} = \frac{\check{C} \cdot (100 - p)}{100}$$

P_{PL} .. percentage of full seeds
$\check{C}$ …. purity (%)
p ….. number of empty seeds (%)

Date of sampling	Date of sample delivery	Date of start of the germination test	Date of end of the germination test

SOP 4 (Standard ČSN 48 1211 - 4.4.3)

Species (genus) of pure seeds determined in the purity test

Purity (pure seeds)	**%**
Seed of other species	**%**
Admixture	**%**

SOP 5 (Standard ČSN 48 1211 - 4.4.4)

Weight of 1000 seeds	**g**

SOP 3 (Standard ČSN48 1211 - 4.4.2)

Water contend	**%**

Notes

SOP 6 (Standard ČSN 48 1211 - 4.4.5)

Germination capacity	**%**
Germination energy	**%**
Abnormally germinated seeds	**%**
Dead seeds	**%**
Fresh seeds	**%**
Hard seeds	**%**
Seeds infected by insect	**%**
Empty seeds	**%**

Percentage of full seeds	**%**
Germination energy of full seeds	**%**
Germination capacity of full seeds	**%**
Number of pure germinated seeds in 1 kg	**pcs**

Samples were taken in accordance with the standard ČSN 48 1211 and the test results are valid for the whole seed unit.

Germination energy (GE) – the number of normally germinated seeds identified during the first count, expressed **in % of the number of the germinated seeds**

Germination energy of full seeds (*GE*$_{PL}$) – the number of normally germinated seeds identified during the first count, expressed **in % of the number of the germinated full seeds**

$$GE_{PL} = \frac{GE \cdot 100}{100 - p}$$

GE_{PL}…..germination energy of full seeds (%)
GE ……germination energy of pure seeds (%)
p ……..number of empty seeds (%)

Date of sampling	Date of sample delivery	Date of start of the germination test	Date of end of the germination test

SOP 4 (Standard ČSN 48 1211 - 4.4.3)

Species (genus) of pure seeds determined in the purity test

Purity (pure seeds)	**%**
Seed of other species	**%**
Admixture	**%**

SOP 5 (Standard ČSN 48 1211 - 4.4.4)

Weight of 1000 seeds	**g**

SOP 3 (Standard ČSN48 1211 - 4.4.2)

Water contend	**%**

Notes

SOP 6 (Standard ČSN 48 1211 - 4.4.5)

Germination capacity	**%**
Germination energy	**%**
Abnormally germinated seeds	**%**
Dead seeds	**%**
Fresh seeds	**%**
Hard seeds	**%**
Seeds infected by insect	**%**
Empty seeds	**%**

Percentage of full seeds	**%**
Germination energy of full seeds	**%**
Germination capacity of full seeds	**%**
Number of pure germinated seeds in 1 kg	**pcs**

Samples were taken in accordance with the standard ČSN 48 1211 and the test results are valid for the whole seed unit.

Germination capacity (GC) – the number of normally germinated seeds identified during the last count, expressed **in % of the number of the germinated seeds**

Germination capacity of full seeds (GC_{PL}) – the number of normally germinated seeds identified during the last count, expressed **in % of the number of the germinated full seeds**

$$GC_{PL} = \frac{GC \cdot 100}{100 - p}$$

GC_{PL}…. germination capacity of full seeds
GC…… germination capacity of pure seeds
p…… number of empty seeds (%)

Date of sampling	Date of sample delivery	Date of start of the germination test	Date of end of the germination test

SOP 4 (Standard ČSN 48 1211 - 4.4.3)

Species (genus) of pure seeds determined in the purity test

Purity (pure seeds)	**%**
Seed of other species	**%**
Admixture	**%**

SOP 5 (Standard ČSN 48 1211 - 4.4.4)

Weight of 1000 seeds	**g**

SOP 3 (Standard ČSN48 1211 - 4.4.2)

Water contend	**%**

Notes

SOP 6 (Standard ČSN 48 1211 - 4.4.5)

Germination capacity	**%**
Germination energy	**%**
Abnormally germinated seeds	**%**
Dead seeds	**%**
Fresh seeds	**%**
Hard seeds	**%**
Seeds infected by insect	**%**
Empty seeds	**%**

Percentage of full seeds	**%**
Germination energy of full seeds	**%**
Germination capacity of full seeds	**%**
Number of pure germinated seeds in 1 kg	**pcs**

Samples were taken in accordance with the standard ČSN 48 1211 and the test results are valid for the whole seed unit.

Number of pure germinated seeds in kg

$$P_{ks} = \frac{\check{C} \cdot GE}{AW} \cdot 100$$

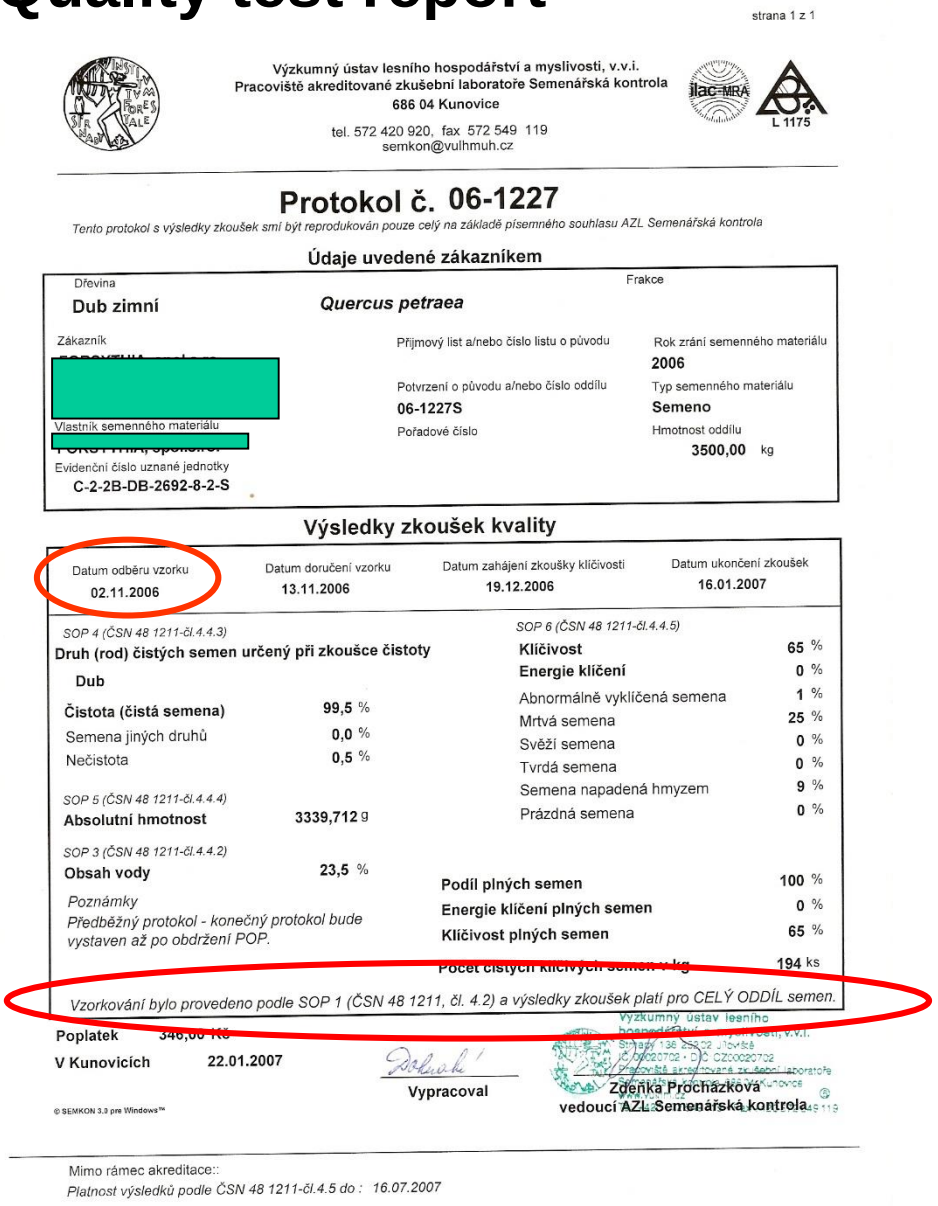
P_{ks} ….. number of germinated seeds in 1 kg (pcs)

$\check{C}$ ……. purity (%)

GC ….. germination capacity (%)

AW ….. absolut weight = weight of 1000 seeds (g)

Quality test report



strana 1 z 1

Výzkumný ústav lesního hospodářství a myslivosti, v.v.i.
Pracoviště akreditované zkušební laboratoře Semenářská kontrola
686 04 Kunovice
tel. 572 420 920, fax 572 549 119
semkon@vulhmuh.cz

ilac-MRA L 1175

Protokol č. 06-1227

Tento protokol s výsledky zkoušek smí být reprodukován pouze celý na základě písemného souhlasu AZL Semenářská kontrola

Údaje uvedené zákazníkem

Dřevina: **Dub zimní** — ***Quercus petraea***
Frakce:
Zákazník: [redacted]
Vlastník semenného materiálu: [redacted]
Evidenční číslo uznané jednotky: **C-2-2B-DB-2692-8-2-S**
Příjmový list a/nebo číslo listu o původu:
Potvrzení o původu a/nebo číslo oddílu: **06-1227S**
Pořadové číslo:
Rok zrání semenného materiálu: **2006**
Typ semenného materiálu: **Semeno**
Hmotnost oddílu: **3500,00** kg

Výsledky zkoušek kvality

Datum odběru vzorku	Datum doručení vzorku	Datum zahájení zkoušky klíčivosti	Datum ukončení zkoušek
02.11.2006	13.11.2006	19.12.2006	16.01.2007

SOP 4 (ČSN 48 1211-čl.4.4.3)
Druh (rod) čistých semen určený při zkoušce čistoty
Dub

Čistota (čistá semena)	**99,5** %
Semena jiných druhů	**0,0** %
Nečistota	**0,5** %

SOP 5 (ČSN 48 1211-čl.4.4.4)
Absolutní hmotnost **3339,712** g

SOP 3 (ČSN 48 1211-čl.4.4.2)
Obsah vody **23,5** %

Poznámky
Předběžný protokol - konečný protokol bude vystaven až po obdržení POP.

SOP 6 (ČSN 48 1211-čl.4.4.5)

Klíčivost	**65** %
Energie klíčení	**0** %
Abnormálně vyklíčená semena	**1** %
Mrtvá semena	**25** %
Svěží semena	**0** %
Tvrdá semena	**0** %
Semena napadená hmyzem	**9** %
Prázdná semena	**0** %
Podíl plných semen	**100** %
Energie klíčení plných semen	**0** %
Klíčivost plných semen	**65** %
Počet čistých klíčivých semen v kg	**194** ks

Vzorkování bylo provedeno podle SOP 1 (ČSN 48 1211, čl. 4.2) a výsledky zkoušek platí pro CELÝ ODDÍL semen.

Poplatek 340,00 Kč
V Kunovicích **22.01.2007**

Vypracoval

Výzkumný ústav lesního hospodářství a myslivosti, v.v.i. Strnady 136, 252 02 Jíloviště, IČ 00020702 • DIČ CZ00020702, Pracoviště akreditované zkušební laboratoře, 686 04 Kunovice

Zdeňka Procházková
vedoucí AZL Semenářská kontrola

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Mimo rámec akreditace::
Platnost výsledků podle ČSN 48 1211-čl.4.5 do : 16.07.2007

Sample
by authorised
person

Validity for the
<u>whole</u> seed lot

Validity of testing result

12 months	***Picea abies, Pinus nigra, Larix decidua, Pseudotsuga menziesii, Abies alba* (frozen), *Carpinus betulus, Fraxinus excelsior, Robinia pseudoaccacia, Tilia, Alnus, Betula, Sorbus, Acer* (not *pseudoplatanus*), *Crataegus, Ailanthus, Laburnum, Sophora, Caragana…***
6 months	***Abies alba* (fresh seeds), *Acer pseudoplatanus, Aesculus hippocastanum, Castanea sativa, Fagus sylvatica* (fresh seeds), *Quercus, Carylus avellana, Morus***
3 months	***Acer saccharinum***
1 month	***Ulmus, Prunus avium, Salix***

Calculation of the price of the seed lot

- **the pricelist shows basic prices**
  (i.e. purity 100 % and germination capacity 100 %)

Latin name	Price Kč/1kg without VAT
Picea abies	**4.808,-**
Picea abies	**3.700,-**
Abies alba	**2.173,-**
Abies alba	**2.479,-**
Abies grandis	**5.665,-**
Pseudotsuga menziesii	**23.745,-**
Pinus sylvestris	**11.584,-**
Pinus nigra	**3.582,-**
Pinus strobus	**5.209,-**
Pinus mugo	**5.583,-**
Larix decidua	**12.800,-**
Taxus baccata	**1.732,-**

Quercus robur	**42,-**
Quercus petraea	**47,-**
Quercus rubra	**32,-**
Fagus sylvatica	**570,-**
Fagus sylvatica	**720,-**
Carpinus betulus	**608,-**
Acer platanoides	**580,-**
Acer pseudoplatanus	**630,-**
Acer campestre	**605,-**
Fraxinus excelsior	**470,-**
Robinia pseudoacacia	**765,-**
Betula verrucosa	**5.800,-**
Sorbus aucuparia	**2.627,-**
Sorbus aria	**4.635,-**

Pyrus pyraster	**2.318,-**
Malus sylvestris	**2.318,-**
Tilia cordata	**1.350,-**
Tilia plathyphyllos	**970,-**
Tilia tomentosa	**970,-**
Alnus glutinosa	**3.154,-**
Alnus incana	**3.500,-**
Alnus viridis	**2.060,-**
Aesculus hippocastanum	**21,-**

- calculation of actual price using coefficients

purity coefficient = actual purity in % : 100
germination capacity coefficient = actual germination capacity in % : 100

- actual price = basic price x purity coefficient x germination capacity coefficient

Example: Norway spruce, purity 96 %, germination capacity 89 %, basic price per 1 kg = CZK 4808,-

0.96 x 0.89 x 4 808 = CZK 4108,-/kg