

Ministry of Forests



Seedling Delivery Inspections



BCTS
BC Timber Sales
Seedling Services

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TABLE OF CONTENTS

1	INTRODUCTION.....	3
2	PRE-LIFT INSPECTIONS.....	3
2.1	Approval to Lift.....	3
3	LIFT OR POST-LIFT INSPECTIONS	4
3.1	Sampling Frequency.....	5
3.2	Sample Size.....	5
3.3	Inspection Details	5
3.3.1	Packaging Inspection	5
3.3.2	Seedling Inspection	5
3.3.3	Comments.....	8
3.4	Sample Retention	8
4	INSPECTION DESCRIPTION	8
4.1	Inspection Comparisons	8
4.2	Combination Protocol	8
4.3	Penalties.....	8
5	SUMMARY OF NURSERY RESPONSIBILITIES	9
6	CONTACT INFORMATION	9
	APPENDICES	11

LIST OF TABLES

Table 1: Hot-lift planting stock hardiness classification for select species	4
Table 2: Summary of how Nursery Inspections (NI) are accepted and combined with Random Inspection (RI) and Check Inspection (CI) data	8
Table 3: Contact Information for Seedling Services staff	11

LIST OF APPENDICES

Appendix 1 Seedlots Excluded from Nursery Performance Rating.....	Error! Bookmark not defined.
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1 INTRODUCTION

Seedling delivery inspections are used by Seedling Services and commercial nurseries to assess the quality of seedlings delivered under contract to BC Timber Sales (BCTS). These inspections provide a record of seedling morphology, apparent physiology, and packaging, and are performed during or after the lift with results recorded using the provided digital platform. Lift quality will determine whether a price adjustment is applied to the payment for seedlings delivered and provide data for the Nursery Performance Rating system that is used when evaluating future nursery contract tenders.

For administrative purposes, stock is ordered and tracked by individual request keys¹, which refer to a particular number of seedlings. Seedlings are grouped and inspected by stock ID², which refers to a nursery/seedlot³/stock type⁴/age/planting season combination, and may include more than one request key. Request keys are used to identify a specific number of seedlings within any one stock ID. Seedling delivery inspections are part of the BCTS seedling quality assurance program and are usually preceded by pre-lift inspections of nursery crops.

2 PRE-LIFT INSPECTIONS

Requests for deviation from contract specifications, such as “spec” reductions, are to be considered at the time of a pre-lift inspection. It is the responsibility of the nursery to gather the necessary information in order for Seedling Services to consider the request.

2.1 Approval to Lift

Approval to lift BCTS stock is given by Seedling Services after the stock achieves a certain level of hardiness. The hardiness of stock to be stored in freezers for spring planting is determined by storability testing following the onset of dormancy. This testing typically commences during the first week of October, but varies with nursery location. Seedling Services will provide the nursery with the details for shipping their samples prior to the onset of storability testing. Seedling Services will request specific request keys to be sent from the nursery for the testing.

Hardiness of hot-lift⁵ stock for summer or fall planting is determined by visible characteristics. A majority of the crop must exhibit a hardened condition before lifting can commence. A hardened condition is determined by species according to the characteristics in Table 1.

¹ A request key is a registration number for tracking a specific volume of a stock ID

² A stock ID is a unique combination of nursery/seedlot/stock type/age/planting season. A stock ID may encompass more than one request key.

³ A seedlot is a registration number given to seeds by the Surrey Seed Centre, which have been collected and registered as per section 5 of the “Chief Forester’s Standards for Seed Use”. A seedlot is a unique assemblage of seeds destined for a specific area of use.

⁴ Stocktype includes container type and size. For example, PSI410 and PSB412A are stocktypes.

⁵ Hot-lift stock refers to stock that is not destined for cold storage. Summer/fall stock is greenhouse sown in January or February, where it usually remains until the last month prior to lifting, at which time the greenhouse covers may be removed, exposing the crop to full sunlight. Hot-lift stock does not break bud the year of planting, instead it concentrates its resources on stem diameter and root growth.

Seedling Delivery Inspections

Table 1: Hot-lift planting stock hardiness classification for select species.

Species/ Hardiness	Foliage	Stems	Buds	Lift?
Pli				
Soft	Top 5-10 cm light green, soft; flexible	Top 2-5 cm lime green, soft; breaking easily	Terminal buds not visible	No
Marginal	Top 2-5 cm light green, soft; flexible	Top 2 cm green; soft	Terminal buds barely visible and green	Maybe
Hardened	Top 2 cm dark green and stiff	Top 2 cm mottled green-brown; firm	Terminal buds straw-coloured; firm	Yes
Reflush			Stem stretching under bud (candling)	Maybe
Elongation of the stem units under the terminal bud is acceptable in most cases. The elongated stem must be reasonably strong to avoid packaging and handling damage. The Nursery Services Manager or designate will advise if unacceptable.				
Ss/Sx				
Soft	Top 5-10 cm light green soft, and flexible	Top >2.5 cm green; soft	Terminal buds not visible	No
Marginal	Top 2-5 cm light green, soft, and flexible	Top 2 cm green; soft	Terminal buds barely visible; green. Lateral buds small; straw-coloured	Maybe
Hardened	Top 2 cm blue-green and stiff	Top 2 cm straw-coloured; firm	Terminal buds straw-coloured; firm.	Yes
Reflush			Terminal bud scales separating	No
Fdc/Fdi				
Soft	Top 5-10 cm light green, soft; flexible	Top 2-5 cm light green, soft; flexible	Terminal buds not visible	No
Marginal	Top 2-5 cm light green, soft; flexible	Top 2 cm reddish green; soft	Terminal buds barely visible; reddish green. Lateral buds small; straw-coloured	Maybe
Hardened	Less than 2 cm not dark green; stiff	Top 2 cm brown; firm	Terminal buds obvious, red-brown; firm	Yes
Reflush			Terminal bud scales straw-coloured, papery; separating	No
Lw				
Note: Crops must have hardened foliage, stems and buds. That is, foliage generally dark green and stiff, must be brown or straw coloured to within 2 cm of the terminal bud firm, terminal buds straw colour to brown and firm.				
BI				
Note: Lighter green tops are acceptable provided that top foliage has lost its succulence and terminal bud is well developed.				
Hw				
Note: Up to 3 cm of a marginally soft top may be accepted provided that buds below the soft top are healthy.				
Note:				
Stock will not be accepted if more than 5% of the trees are flushing.				

3 LIFT OR POST-LIFT INSPECTIONS

Seedling delivery inspections are performed by both Seedling Services (random inspections (RIs)) and nursery staff (nursery inspections (NIs)). These inspections may be done on the lift line or on packaged stock.

When crops are problematic, it is beneficial to do nursery and random inspections throughout the lift to ensure pre-lift examination decisions were realistic and understood. Inspection results (RI & NI) are

combined as described in Section 4, Inspection Results. All inspections must include information regarding packaging quality.

3.1 Sampling Frequency

Random inspections are intended to verify the quality of seedlings packaged over the lift period as reflected by the NI. The seedlots inspected are usually selected at random but may be identified during pre-lift inspections or from nursery scattergrams. Nurseries are required to perform inspections on 100% of their stock IDs. For stock lifted to cold storage, NIs must be done for request amounts over 3000. **One nursery inspection is required for every 100,000 seedlings of a stock ID.** If a hot-lift request key is lifted in multiple shipments a minimum of one NI is required for each shipment. These inspections should target any apparent differences within a request key due to growing environment or stock quality differences.

3.2 Sample Size

Seedling bundles are selected randomly during the lift or from cartons in storage. The number of seedlings and bundles per inspection depends on stock type but **the sample must comprise a minimum of either 120 seedlings or 10 bundles, whichever comprises the greater number of seedlings.** All seedlings in a sampled bundle must be individually inspected.

When samples are drawn from cartons in storage the following sample selection is to be used:

- Select only two bundles per box, and
- One box per pallet

If the seedlot is small, still select two bundles per box but draw from more boxes per pallet.

3.3 Inspection Details

Inspections include a physical examination of seedlings, packaging, and type of packaging. Inspections may also include a check of stock handling and packaging during the lift. Inspection data is entered on a mobile device. Detailed instructions for completing the inspection documentation are provided in the current guide ‘Nursery Instructions for Using SNAP on a Mobile Device’.

3.3.1 Seedling Inspection

Each seedling in a sample is assessed for several characteristics. Seedlings not meeting the contract standards for any given characteristic are culled.

a) Root collar diameter measurement (RCD⁶)

Root collar diameter is measured within 1 cm below the cotyledon node⁷, but immediately below any obvious swelling. To ensure accuracy, the seedling should be measured, rotated 90 degrees and re-measured; the average of the two measurements will become the RCD.

Ensure that the callipers are properly "zeroed" and that the seedling is positioned in the centre of the calliper jaw.

b) Height measurement

⁶ RCD is initialism for **root collar diameter**, however it is the stem diameter measured within 1cm below the cotyledon node.

⁷ The cotyledon node is the point on the stem where the first leaves developed by the embryo were attached.

Seedling Delivery Inspections

Height is measured from the tip of the terminal bud to the top of the root plug or to the change in stem colour if the top of the plug is not cohesive (for example Douglas-fir).

c) Shoot form

- i. Double trees: Two or more seedlings per plug are not acceptable. The second seedling can be pruned to the soil line leaving a single acceptable seedling.
- ii. Basal forks: Defined as a branch that occurs within 20% of the target height at an angle $<45^\circ$ to the main stem. Basal forks are not acceptable nor can they be clipped to result in a single stem.
- iii. Multiple tops: Single tops are preferred but multiple tops are acceptable for Ba, Bl, Bg, Bn, Cw, Yc, Hw. For other species the following procedures apply:
 - Where 2 or 3 tops are present, one must be 3 cm taller and substantially greater in diameter than the others. If agreed to by BCTS, the unwanted tops may be clipped.
 - Clipping of the excess tops must be done at a distance approximately 1 cm from the main stem to reduce the likelihood of disease entry.
 - Where there are 4 or more tops, the tree is a cull. No clipping is permitted
- iv. Pine with long laterals: Pine seedlings shall have no competing lower lateral branches.
 - If the terminal stem and lateral branches are similar in diameter, such that the diameter of any lateral is greater than 75% of the diameter of the terminal stem:
 - i. the height of the terminal shoot including the bud must extend at least 1 cm above the height of any lateral shoot bud, OR
 - ii. the terminal stem bud must be at least two times (2x) the size of the lateral stem bud.
 - The height of competing lateral branches can be reduced by clipping at a height on a horizontal plane at least 1cm below the terminal bud, and not closer than 2.5cm to the main stem.
 - If there are three or more lateral branches competing for dominance with the main stem, the seedling cannot be clipped and must be culled.
- v. Foliage: Conifer seedlings (except Lw) must have at least 2/3 of the stem length exhibiting live, healthy foliage free of disease. Extremely chlorotic foliage is not acceptable.
- vi. Bud form/hardiness must be considered with respect to the two lifting seasons:
 - Lift to cold storage: Buds should be straw-coloured to red brown and firm. Abnormal, damaged, deformed or diseased buds are not accepted. Very small diameter buds (< 2 mm.) may be considered culls depending on pre-harvest inspection determinations. Rosette buds are not accepted (> 5 buds at the terminal). If a visibly larger, healthy and central bud is present, the seedling is acceptable.
 - Hot lift: see Section 2.1 Approval to Lift.

d) Root Assessment

- i. Container Seedlings: There must be adequate root mass to form a cohesive plug. Plugs where the soil easily falls away from the root are unacceptable. Plugs from copper treated blocks (PCT) can be softer and pliable, but must retain the soil mass intact to be acceptable. PCT plugs may

have a few fractures along the plug mass provided minimal soil loss occurs. Plug moisture must be adequate but not excessive or too dry.

- Species such as Bl, Fdi, Py and Lw, sometimes do not have roots near the top of the plug. Seedling Services may accept seedlings with up to 1/3 of the top of the plug missing due to handling.
- Dead or diseased roots are sometimes identified by colour and root stripping. The occurrence of dead roots should be immediately communicated to Seedling Services staff. Further consultation with Seedling Services may be required together with an independent disease assay.

ii. Rooted cuttings: Rooted cuttings exhibiting plagiotropism⁸ and branch like form are culled. Stecklings may exhibit a form known as “hinging” where the stem is not properly supported by the root mass and consequently falls over, rather than standing upright. To evaluate acceptability, hold the plug reasonably firmly at the approximate planting depth. If the seedling leans more than 45 degrees from the vertical, the seedling is culled.

e) Damage – Not an exclusive list

- i. Handling: The goal is to avoid mechanical damage such as broken tops, or terminal buds, stripped foliage, or severely bent plugs due to poor wrapping etc.
- ii. Disease: Any disease infecting the main stem is unacceptable.
 - Moulds such as *Botrytis* and *Septonema* are acceptable when restricted to the foliage but 2/3 of the foliage must be disease free.
 - *Keithia* can be acceptable if restricted to minor portions of the foliage.
 - Larch Meria Needle Cast and *Sirococcus* are acceptable if restricted to minor portions of the foliage.
- iii. Insect damage:
 - Lygus damage permanently deforming the terminal bud is unacceptable.
 - Insect damage can be present, but stock with significant damage to the cambium is culled.
- iv. Environmental damage: Generally, frost or drought damage that kills buds, foliage or roots is unacceptable. Minor amounts of damage may be permitted in consultation with Seedling Services.

3.3.2 **Comments**

- The comment section of the inspection report should highlight any aspect of performance and stock quality that deserves attention or can be improved. All NI's and RI's must have appropriate comments. Significant amounts of dead foliage often require monitoring inspections during transportation, cold storage, thawing and planting to monitor stock for moulds such as *Botrytis*.
- Wrapping and packaging observations.
- Poor stock handling such as rough handling of cartons, throwing seedling bundles or styroblocks with seedlings.
- Presence of any root disease.

⁸ Plagiotropism is the tendency of rooted cuttings to grow at an oblique or horizontal angle, without an upright leader or main stem.

- List any modifications to stock specifications with an additional note at top of the inspection report.

3.4 Sample Retention

The nursery must retain their inspection samples on site with the rest of the request key. Samples should be placed in boxes clearly marked to identify them as inspection samples. These may be needed for subsequent inspections and should be easily accessible. Once the samples are released by Seedling Services (usually within one week), these boxes can be shipped with the request key. If a Check Inspection (CI) is required and the NI is not retained on site, the RI will be applied.⁹

If an RI results in a cull % >6, the culled seedlings should be made available to nursery staff for inspection and comment.

4 INSPECTION DESCRIPTION

4.1 Inspection Comparisons

If the number of culls in the RI and NI differ by $\leq 3\%$ the NI is combined with the RI and their weighted average becomes the applied rate. If the difference is $>3\%$, a check inspection (CI), or re-inspection of the original NI bundles is done. If the CI culls differ by $>3\%$ from the NI, the NI is rejected and the RI becomes the applied rate. The NI methodology will be reviewed with nursery staff and differences resolved. If the CI culls are $\leq 3\%$ of the NI, the NI is accepted and averaged with the RI to calculate the applied rate. The CI data are never used to calculate the accepted rate.

4.2 Combination Protocol

All acceptable NI's are combined with the RI's and their average is the applied cull rate. If the rate is $\leq 6\%$, the population is accepted without deduction. If the rate is $>6\%$ and $\leq 10\%$, it is acceptable with deduction. Table 2 provides a summary of how the various inspections are accepted or rejected.

Table 2: Summary of how Nursery Inspections (NI) are accepted and combined with Random Inspection (RI) and Check Inspection (CI) data

Scenario	Outcome
If there is no RI	NI is accepted
If there is no NI	RI is accepted
If there is more than one NI or RI	average NI compared to average RI
If cull difference between all NI and RI is $\leq 3\%$	average of all NI and RI is accepted
If cull difference between all NI and RI is $>3\%$	auditor may do a CI on the NI
If cull difference between all NI and RI is $>3\%$ but the cull rate is less than 6%	Average of all RI and NI is accepted and no CI on the NI.
If cull difference $>3\%$ and if there is no CI	NI rejected and the RI is accepted
If cull difference between CI and NI $\leq 3\%$	average of all NI and RI is accepted
If cull difference between CI and NI $>3\%$	NI is rejected and the RI is accepted

4.3 Penalties

If the final assessed cull percentage is $\leq 6\%$, nursery payment is not affected. If the final assessed cull percentage is $>6\%$ and $\leq 10\%$, the crop is acceptable, however, a financial deduction is applied at a rate of

⁹ See section 4 for explanation

cull percentage minus 6.0%. If the cull rate is >10.0%, a re-sort may be required, at the Ministry's discretion. If there is a re-sort, new inspections are required; if there is no re-sort, payment is reduced by the full cull percentage.

5 SUMMARY OF NURSERY RESPONSIBILITIES

- Nurseries will perform NIs on all request amounts 3000 seedlings or greater. One NI is required per every 100,000 seedlings of all Stock IDs.
- Inspection data will be submitted by syncing the data collected on a mobile device via the digital platform provided by Seedling Services.
- For each inspection, the sample bundles will be numbered from 1 to 10/12/20 or 40, depending on the stocktype and placed in one or more boxes that are clearly identified as inspection samples. With this identification, Seedling Services can locate the nursery samples and carry out CIs as required.
- Nurseries must provide Seedling Services staff with NIs so comparisons can be immediately made with RIs.
- Nurseries must notify Seedling Services staff when any NI is greater than 10% cull.

6 PACKAGING

Incorrect packaging procedures must be immediately brought to the attention of the nursery supervisor and Seedling Services then followed up on the inspection report. Carton size and type must be confirmed by Seedling Services prior to lifting.

- The following information must be printed on the carton label: **nursery name, species, stocktype, age class, seedlot, request key, number of seedlings in the carton, date lifted (yy/mm/dd), requesting agency name**. Labelling must also include stock orientation - **horizontal or vertical**, and if stock has been **individually wrapped**. Request key and seedlings per carton font must be at least 13 mm tall, and on the last line of the label. All other required elements must be at least 9 mm tall. Any variation must be approved by Seedling Services.
- Seedling cartons must have a white reflective outer coating and able to withstand anticipated seedling packing weights, along with the demands of regular handling from packaging, transporting, storing, thawing and planting.
- All cartons for frozen storage must have a liner and be closed correctly to prevent moisture from escaping. Carton liners are not required for hot lift stock. All frozen-stored stock must have a poly liner. **All spring plant frozen-stored stock must be packaged in a manner most suitable to the stock's morphological condition.** Horizontal packing is preferred whenever possible but must not collapse or tip into the centre of the box. Short stock must be packaged vertically or appropriate supporting material provided to prevent collapse. Any variation to packaging must be approved in advance by Seedling Services.
- When packaged vertically, all bundles must be placed on the bottom of the carton and not on top of other bundles, which can occur when attempting to "squeeze" the last of the bundles into the box.
- All Lw, summer and fall hot-lift seedlings should be packaged standing upright, unless permission is granted by Seedling Services to package stock horizontally. If using partitions, they must stand up to moisture inside the carton and be sufficient to avoid tumbling during transport and handling.

Seedling Delivery Inspections

- Wrapped bundles of seedlings should have root collars evenly aligned. The wrap should cover the root mass only, not the foliage, and should not be folded under the bottom of the root mass. Root plugs should be sufficiently moist, or dipping bundles in water after lifting will be required. Excessive moisture is not acceptable.
- For seedling requests that are required to be individually wrapped, suppliers will ensure root mass is completely covered, and seedlings are wrapped in a way that facilitates easy separation when frozen.
- Partial Boxes will not be accepted.

7 CONTACT INFORMATION

Seedling Services is responsible for managing and monitoring the production of seedlings used to reforest crown land. Seedling Services is part of BC Timber Sales, BC Ministry of Forests.

Table 3: Contact Information for Seedling Services staff

Seedling Services	Contact/Title	Phone	Email
Seedling Services Southern Interior 2501 14 th Ave Vernon, BC V1T 8Z1	Mark Hay, RPF Senior Manager, Seedling Services	250-838-2854 C: 250-643-0711	Mark.Hay@gov.bc.ca
	Alan Rasmussen, RPF Seedling and Reforestation Specialist-South	250-838-2856 C: 250-864-8697	Alan.Rasmussen@gov.bc.ca
	Art Moeller Technician - South	250-838-2855 C: 250-540-4092	Art.Moeller@gov.bc.ca
	Leanne Hildebrand Seedling Analyst	778-943-0110 C: 250-308-6818	Leanne.Hildebrand@gov.bc.ca
Seedling Services Northern Interior 2000 South Ospika Blvd. Prince George, BC V2N 4W5	Scott Ruzyllo, RFT Seedling and Reforestation Specialist-North	250 649-2815 C: 250-614-9690	Scott.Ruzyllo@gov.bc.ca
	John Van Geloven, FT Technician – North	(250) 614-6847	John.VanGeloven@gov.bc.ca
Seedling Services - Coast	Kona Van Diest, RPF Seedling and Reforestation Specialist - Coast	250-850-1686 C: 250-202-4368	Kona.VanDiest@gov.bc.ca

APPENDIX 1. INSTRUCTIONS FOR COMPLETING DIGITAL INSPECTIONS



SNAP- Desktop



SNAP - Mobile

Instructions for Nur:Device Instructions 1