

## Lesson 9

# Operational Fertilization

60 minutes

## Objectives

- ▲ Explain the guidelines and statements of advice presented in the *Forest Fertilization Guidebook* section on fertilization method and application
- ▲ Review the checklist for operational fertilization projects
- ▲ Provide the necessary information to determine the elemental concentration, target application rate and total fertilizer when applying nitrogen, phosphorus, potassium, and sulphur
- ▲ Explain a method of determining both the swath length and time taken to disperse fertilizer from a spreader (hopper)
- ▲ Review an example of prescribing re-fertilization of stands
- ▲ Explain the importance of the air operations during the application phase
- ▲ Provide a model of a good contingency plan for handling accidental spills of fertilizer
- ▲ Explain the monitoring and reporting procedures that document compliance with the standards set out in the contract, stand management prescription and Silviculture Practices Regulation.

## Equipment Needs

- ▲ Overhead projector
- ▲ Lesson 11 overheads
- ▲ *Forest Fertilization in British Columbia* video
- ▲ Television and VCR

## Method

- ▲ Lecturette with overheads, exercises and class discussion
- ▲ Video presentation



**Note:** This lesson is one of the longest and has been broken down into three subsections:

- ▲ Fertilizers
- ▲ Frequency and timing of application
- ▲ Implementation plans and procedures

Key points to this lesson (by subsection) are:

## Fertilizers

- ▲ Specifications of the type of fertilizer with amount of each nutrient to apply should be included in the stand management prescription (SMP) or silviculture prescription (SP).
- ▲ Calculating the amount of fertilizer to apply and therefore how formulations of fertilizer are described are used to determine application rates.
- ▲ An optional exercise in the appendix is provided to test the participants' ability to use the conversion table, prove that the operational mix used in the interior meets the stated application rate, and work with a complex mix of three nutrients.

## Frequency and timing of application

- ▲ A calendar indicates the preferred seasons of the year for fertilizer application on the coast and in the interior.
- ▲ The re-fertilization of a stand should not occur until the initial fertilizer response has ended if the cost per unit response is important.
- ▲ A planning table is presented to assist in the long-term planning of refertilization and the escalating size of a fertilization program.

## Implementation plans and procedures

- ▲ Air operations are especially important because currently all operational fertilization in BC is conducted using helicopters or fixed-wing aircraft.
- ▲ The pilot should be supplied with good quality maps and aerial photographs that have all buffers or No Fertilizer application zones clearly marked.
- ▲ Improvements in electronic guidance methods (use of GPS instead of transponders) provide greater accuracy and monitoring of application.

- ▲ Field inspections should include measurements of the application, inspection of equipment, survey of buffer zones, and notes about the weather conditions.
- ▲ An exercise to produce a sample contingency plan to handle accidental fertilizer spills will precede a review of a model provided in the lecture notebook.
- ▲ The overall purpose of the field inspection and reports for the fertilizer project are to comply with standards established in legal binding documents such as the fertilizer contract, the SMP and the Silviculture Practices Regulation.
- ▲ There are six main points to consider during the monitoring of aerial application to confirm compliance with standards.
- ▲ An exercise to calculate the swath length and time to disperse a spreader full of fertilizer is included in the appendix.

## Air Operations

All operational forest fertilization projects in the province are currently conducted using helicopters or fixed-wing aircraft. Therefore, to ensure safe and efficient operations, the block boundaries, buffer zones, hazards and heliport locations must be discussed and agreed to with the contractor at the pre-work conference. Good quality maps and aerial photographs with clearly marked buffer and No Fertilizer application zones must be provided to the pilot. A 10 m No Fertilizer application zone is left around most lakes, streams and other important open water bodies. Within a community watershed, fertilizer must not be applied within 100 m upstream and upslope of watershed intake pipes.

Electronic guidance is very important to ensuring an accurate and even application pattern of fertilizer. Recent advancements in the area of Global Positioning Satellite (GPS) systems enables very accurate determination of the helicopter's position and flight path. While the pilot and project officer should work together to ensure even distribution of the fertilizer, the application does not need to be as accurate as aerial herbicide application, since tree roots are more dispersed than target vegetation foliage.

Field inspection of the aerial spreader or "hopper" should be made at random intervals of a fertilization project. Points to note include whether or not there is a metering system for loading the spreader and its proper use, use of a leakproof system employed to fill and dispense from the hopper, evidence of a uniform dispersal pattern during the flight and application, and proper functioning of the positive shut-off device under the control of the pilot.

The weather conditions during the time of fertilizer application can nullify the abilities of even the best pilots. Wind and visibility are two key problems that may be encountered which will necessitate the temporary suspension of operations. The only absolute for all personnel involved in fertilizer application is to put human safety as the highest priority in all aspects of the operations.

## Season of Application

The guideline for the season of application is explained by targeting the ideal weather conditions that typically occur during the same time of the year. Generally, fertilizers should not be applied from April to approximately mid-September. It is more important to apply urea compared to some other fertilizers during cool and moist conditions due to urea's propensity to volatilize (rapidly evaporate) during warm air temperatures. It is not recommended to apply any fertilizer on frozen ground, crusted snow or slopes exceeding 30%.

## Contingency Plans

A contingency plan in the case of accidental spills of fertilizer must be in place and approved by the district manager prior to the commencement of operational fertilization projects. The guidelines for a plan both within and outside of community watersheds is explained in the *Forest Fertilization Guidebook*. In addition to this contingency plan being available on site at all times, the material safety data sheet (MSDS) for the fertilizer, a copy of the fertilizer contract with maps and the silviculture prescription or stand management prescription are required.

There is no endorsed model of a contingency plan; however, a suggested model is provided in the appendices along with copies of the MSDS for urea and ammonium nitrate. The applicable legislation to accidental spills is the "Spill Reporting Regulations" of the *Waste Management Act*. A copy of this legislation is included and stipulates all the actions required in the event of a spill. The supplier of the fertilizer is also generally available for assistance in the event of a spill and their telephone contact number is found on the material safety data sheet.



# Checklist for Operational Fertilization Projects

Project Title	
File #	

STEP	TASKS / SUGGESTIONS	✓
1	Cutblock identification Collect data on strategic, biological and operational considerations, including economy of scale for a series of blocks to constitute a project (best >500 ha). Use operational plans, maps, electronic record systems, road recces, foliar analysis, screening trials to identify potential stands	
2	Tender package preparation Tender package should include: ▲ Updated maps ▲ Aerial photos showing cutblocks for fertilization, stream buffers, No Treatment zones, road access ▲ Clear, self-explanatory contract specifications ▲ Minimum standards of equipment and safety ▲ Spill Contingency Plan/Clean-up requirements ▲ Personnel skills ▲ Application techniques required ▲ Concerns if fertilizing in a community watershed	
3	Advertise, review proposals, award contract Advertising should cover British Columbia, Alberta, Saskatchewan, Washington, Oregon and Idaho	
4	Pre-work conference Review all details with the contractor on: ▲ Safety ▲ Spill Contingency Plan/Clean-up requirements ▲ Personnel ▲ Application specifics Review <b>Fertilization Pre-Work Checklist</b>	
5	Staging (equipment mobilization, road upgrading) Plans in place between contractor and district or licensee for any necessary access improvements	
6	Cutblock boundaries Mark all buffer strips around reserves, streams, edges and No Treatment zones using paper rolls, balloons or other methods	
7	Calibration of application rates Calibrate application rate of fertilizer from spreader to ensure prescribed application rate of fertilizer/ha is applied	
8	Monitoring of fertilizer application Monitor application rate, buffers, spills, waterbodies using on-site viewing of application (swath wide/overlap) and missed patches. Check for prill in buffers, streams and other No Treatment zones	
9	Monitoring of water quality As outlined in <i>Forest Fertilization Guidebook</i>	
10	Contract payment Review all phases of contract when work completed to determine appropriate payment	
11	Reporting Report all treated blocks on electronic record system	





# Refertilization

- ▲ Refertilization before the initial application response terminates reduces the potential total growth response
- ▲ Response is sustained longer with repeat treatments over one treatment

## General Rule

- ▲ Coast – Refertilize every 8–10 years
- ▲ Interior – Refertilize every 5–7 years









# Season of Application

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Treatment NOT recommended



Fertilization possible and recommended when weather permits



Fertilization in the interior





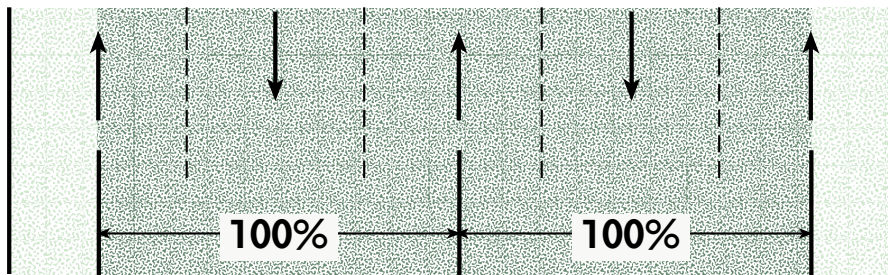
## Monitoring Plan Checklist

- ▲ Loading sites cleaned
- ▲ Flight paths, flying procedures, radio traffic, fertilizer application
- ▲ Weather and flying conditions
- ▲ Check perpendicularly to flight lines for even coverage, prescribed overlap and no gaps
- ▲ Block boundaries, buffer zones and No Treatment areas
- ▲ Monitor the cumulative weight of fertilizer spread



# Calibration

- ▲ Important to ensure prescribed application rate
- ▲ Test run when project begins
- ▲ Check periodically
- ▲ Contractor should be familiar with calibration and confident with application rate
- ▲ Proper application is in contractor's best interest!



\* 50% application on each flight line adds up to 100% application when flight lines overlap







## On-site Documents

- ▲ **Contingency plan for fertilizer spills**
- ▲ **Material Safety Data Sheet (MSDS) for fertilizer**
- ▲ **Fertilization contract with maps showing buffer areas**
- ▲ **Silviculture Prescription/  
Stand Management Prescription**





# Contingency Plan

**▲ Name and phone number for contacts in the:**

- Ministry of Health
- Ministry of Forests
- Ministry of Environment, Lands and Parks
- Ministry of Transportation and Highways
- Regional District
- RCMP

**▲ Necessary to inform that clean-up is in progress**

**▲ Contingency plan available in vehicles**

• **Overhead: Contingency Plan**

• **Key Points**

