Multiple Seed and Cone Insects

Fogal, W. H.; Larocque, G. 1992. Development of flowers, cones, and seeds in relation to insect damage in two white spruce communities. Forest Ecology and Management 47: 335-348.

Objective: To determine the optimal time to sample seed and cone pests of white spruce, *Picea glauca*, based on the temporal relationship between seed and cone development and the occurrence of pest damage.

Abstract: Seed- and cone-feeding insects of white spruce, *Picea glauca* (Moench) Voss, can cause substantial seed loss in seed orchards. Trees are frequently sprayed for seed and cone pests after the upright cones turn to a pendant position to avoid interfering with pollination while cones are upright (Fogal and Plowman 1988). However, research on the temporal relationship between seed and cone development of white spruce and the occurrence of damage by seed and cone insect pests indicated that spruce budworm, *Choristoneura fumiferana* (Clem.), spruce coneworm, *Dioryctria reniculelloides* Mutuura and Munroe, and spruce seedmoth, *Cydia strobilella* (L.), damaged some cones before they assumed the pendant position. Waiting until cones have turned to a pendant position before applying insecticides may be too late to prevent some losses by these pests.

Depending on the life cycle of the species of pest to be controlled, insecticides should be applied before or soon after pollination to limit seed loss. Insecticides should be applied before pollination against *C. fumiferana* and most likely *D. reniculelloides* as these larvae feed on microstrobili and megastrobili before fertilization occurs. Systemic insecticides against *C. strobilella* and other insects that oviposit directly into seed cones after pollination should be applied before or soon after pollination to allow the translocation of the material into the cones. However, avoid any canopy sprays that interfere with pollination.

The efficacy of insecticide applications can be assessed by sampling insect damage. Sample developing cones no earlier than mid-July to maximize sampling effort. Waiting until mid-July helps avoid underestimating seed losses due to late-season insect pests or overestimating seed yield due to seed abortion or cones dropping prematurely later in the season. Managers may consider canceling the harvest if heavy damage to cones and seeds is found (Dobbs et al. 1976). Damage detected at this sampling date cannot be abated by the use of insecticide applications this late in the season, but large populations of seed and cone insects in the samples may signal the need for insecticide application the following season to protect the next crop.

Sampling Procedure: Sample developing cones no earlier than mid-July for the following insects that damage seeds and cones:

Insect	Type of feeding damage
Spruce budworm, *Choristoneura fumiferana* (Clem.)	Curled, distorted cones
Spruce cone-axis midge, *Dasineura rachiphaga* Tripp	One or more larvae in silken cocoons in cone-axis gallery
Spruce cone maggot, *Strobilomyia neanthracina* Michelsen	Reddish-brown tunnels filled with resin around cone axis
Spruce coneworm, *Dioryctria reniculelloides* Mutuura and Munroe	Cone-axis gallery filled with frass, silk
Spruce seed chalcid, *Megastigmus piceae* Rohwer	Larvae in seed
Spruce seed midge, *Mayetiola carpophaga* (Tripp)	Larvae in seed
Spruce seedmoth, *Cydia strobilella* (L.)	Seeds filled with frass; one or more larvae in cone-axis gallery

Cones infested by *C. fumiferana* and *D. reniculelloides* can be distinguished by the characteristic damage patterns made by the larvae. Examine longitudinal sections of cones and seeds under a dissecting microscope to identify the other insect species present. Larvae in seed were recorded as seed-inhabiting insects in the study and were not identified to species.

Sampling after mid-July will ensure that insects damaging cones and seeds late in the season are included in the assessments and that a more accurate assessment of seed loss is noted. For example, trees may abscise cones attacked by *C. fumiferana*, *S. neanthracina*, or *C. strobilella* in mid-season so that late season assessments may underestimate damage by these pests. However, damage by *D. rachiphaga* and seed pests such as *M. carpophaga* and *Megastigmus piceae* is less evident early in the season and may be overlooked if assessments are made too early. Sampling seed and cone pests after mid-July offers a good compromise in terms of maximizing sampling efforts, but multiple samples made over the season are preferable to a single sample.

References:

Dobbs, R. C.; Edwards, D. G. W.; Konishi, J.; Wallinger, D. 1976. Guidelines to collecting cones of B.C. conifers. Joint Rep. No. 3. Victoria, B.C.: Canadian Forest Service, British Columbia Forest Service; 98 p.

Fogal, W. H.; Plowman, V. C. 1989. Systemic insecticides for protecting northern spruce and pine seed trees. Inf. Rep. PI-X-92. Chalk River, Ont.: Natural Resources Canada, Canadian Forest Service, Petawawa National Forestry Institute; 17 pp.