CONE AND SEED CHARACTERISTICS IN THE SECOND GENERATION SEED ORCHARD OF *PINUS THUNBERGII*: SEEDS ARE SIGNIFICANT CARBON SINK

*Kyu-Suk KANG[1], **Ki-Won KIM[1]**, Ji-Min PARK[1], Da-Bin YEOM[1], Sung-Joon Na[2] and Hae-In KANG[1]*

[1]Department of Forest Sciences, Seoul National University, Seoul, Republic of Korea

[2]National Institute of Forest Science, Suwon, Republic of Korea

Seed orchards are established from selected trees (plus trees) by sexual or asexual propagation, and functioned as the bridge between breeding program and plantation establishment. They are designed and managed to produce genetically improved seeds as many as possible. *Pinus thunbergii* is a two needle pine and native along the coastal areas in Korean peninsula. Based on the genetic information of progeny tests, the second generation seed orchard of *P. thunbergii* was established to achieve further genetic gain by grafts propagated from the selected combinations. The main purposes of present study were to survey the variation of seed-cone production among combinations, to investigate the characteristic of cone and seed by cone analysis, and to estimate genetic parameters (variance component, heritability and correlation) of seed characters in the second generation seed orchard.

We collected three to five mature cones from all individuals for three consecutive years and selected five healthy cones from 26 parental combinations, which had been not suffered from insects or diseases. And then we measured the length (mm), width (mm) and fresh weight (g) of cones each year. After the measurement, the cones were placed at room temperature for cone analysis. The cones were completely open after four week drying and seeds were extracted. The scales were classified into fertile and infertile scales depending on their shape and the seeds were grouped into developed seeds and aborted ovules. Mature seeds were classified into filled seeds, empty seeds and damaged seeds. Aborted ovule was classified into first-year aborted ovule and second-year aborted ovule. One-way ANOVA was carried out for the characteristics of cone and seed, and variance component and brood-sense heritability were estimated. Pearson's and Spearman's correlation coefficients were calculated for the characteristics during the survey years (2014∼2016).

There was a large variation of cone characteristics among combinations. The morphological characters of cone were superior in 2016 but the difference among combinations was relatively larger than other years. The mean weight of cone was ranged from 18.1g in 2014 and 28.4g in 2016, which was 56.9% heavier for three years. The means of cone length and width were also increased as the seed orchard is matured. The cone analysis revealed that there was a large difference of seed characteristics among combinations and years. The numbers of developed seeds were 60.4 (2014), 65.0 (2015) and 71.0 (2016), and the percentage of filled seed per cone was increased from 77.6 (2014) to 90.1 (2016). The aborted ovule was highest in 2014 (24.9%) and the seed efficiency was improved from 2014 to 2016. The broad-sense heritabilities (H2) of seed characters were ranged from 0.25 (filled seed) to 0.54 (seed efficiency), and the H2 of cone characters were also high. These results imply that seed and cone traits are under strong genetic control. The correlation among cone characters was positive and highly significant for all studied years. As expected, there was a strong positive correlation between cone weight and yield.

Developing seed is a strong carbon sink. Under the increased ambient CO2 concentration, trees may mature reproductively fast and produce more seeds. The carbon sink by seed production is a natural reservoir that stores carbon-containing chemical compound for an almost indefinite period of tree life.

Contact Information: Ki-Won KIM, Seoul National University, Gwanak-ro 1, Gwanak-gu, Seoul 08826, Republic of Korea, Phone: + 82-10-7380-2434, Email: origin7k@snu.ac.kr