

TAKAHASHI, HIROYUKI^{1*}, YOSHIYA SHIMAMOTO², KAZUYUKI OKAZAKI¹, KAZUNORI TAGUCHI¹, YOSUKE KURODA¹ and HIDEYUKI ABE¹, ¹National Agricultural Research Center for Hokkaido Region, Shinsei Memuro Hokkaido 082-0081 Japan and ²Tokyo University of Agriculture, Yasaka Abashiri Hokkaido 099-2493 Japan. **Flow distance and crossing ability of dispersed pollen in sugar beet.**

ABSTRACT

Introduction:

Sugar beet is one of the most important crops of upland farming in Hokkaido, and sugar manufacturing is very important industry in Hokkaido too. However, the competition between domestic sugar and import sugar or external pressure such as WTO and EPA is severe for recent years, saving labor and cost of material sugar beet production is crucial issue. Therefore, to switch the cultivation method from Transplanting method holding 95% of the cultivation area in Hokkaido to Direct-seeding method is most effective improvement. In addition, there still remains some difficult problem to achieve 'Public Acceptance', it is one of the choices to use the genetically modified sugar beet (GM sugar beet) varieties. GM sugar beet can reduce labor and cost for the weed control by machinery weeding and expensive high selectivity herbicides, and the disease and pest management with much amount of fungicides and insecticides. Fortunately because no wild beet naturally grows in Hokkaido, there is no risk that the progenies between wild beet and GM beet spread as GM weed beet which is worried in Europe and America. Therefore the only possibility of gene flow of GM sugar beet in Hokkaido is flow of dispersal pollen released from GM sugar beet into seed production field of non-GM sugar beet. In this study, we investigate two characters of pollen in sugar beet, 1st is dispersion distance, and 2nd is crossing ability in long distance.

Correlation between flow distance of sugar beet pollen and F1 seed yield and seed germination ability:

Flow distance of sugar beet pollen was investigated in NARCH (Sapporo) during July. Isolation plots with CMS donors and Durham's pollen samplers were set from pollinator to 1,555m leeward (0m, 20m, 50m 100, 460m, 840m, 1220m and 1555m). The dispersal pollen and germinative seed crossed with dispersion pollen from pollinator could be observed all isolation plots. The amount of dispersal pollen and seed yield decreased rapidly by 500m, but in further distance, the trend of decrease became moderate. In other hands, seed germination rate decrease with increasing distance from pollinator lineally.

Crossing ability of sugar beet pollen in long distance:

Crossing ability of sugar beet pollen was investigated by Tokyo University of Agriculture in Abashiri. To detect the crossing ability, 'Hypocotyl color' was used as phenotypic marker. A hypocotyl color of sugar beet was red (R) and green (r), and red color was dominant. Many isolation spots with green hypocotyl CMS plants (r) surrounded by green hypocotyl pollinator were set in all directions from the red hypocotyl pollinator (R), the furthest spot was 2.5km away in northern west. If the pollen dispersed from red hypocotyl pollinator flow into isolation plots

and cross with green hypocotyl CMS donor, the color of hypocotyl in F1 seed is sure to become red though it is usually green. The prevailing wind blew from S~ SSW (40%) during July and it was almost suited in furthest plots. Crossing with pollen from red hypocotyl pollinator was observed in every plot within 250m at high frequency (0.05%~1.04%), and within 500m, the crossing rate was 0.03%~1.45%. The crossing rate farther than 500m spot was under 0.1% and the farthest spot was 2,000m.

Conclusion:

In this study, sugar beet pollen flow was observed at 1,555m, and it expected that dispersion distance of sugar beet pollen was much longer. But crossing with dispersed pollen was not observed over 2,000m. It was still difficult to decide the isolation distance for sugar beet seed production from these results, but 2,000m would be one of the reference values. Hereafter the isolation distance for sugar beet seed production will be clarified by using the simulation model analysis etc.