



HOKKAIDO UNIVERSITY

Title	Studies on the year-round production and quality improvement of baby-leaf vegetables [an abstract of dissertation and a summary of dissertation review]
Author(s)	高濱, 雅幹
Degree Grantor	北海道大学
Degree Name	博士(環境科学)
Dissertation Number	甲第13747号
Issue Date	2019-09-25
Doc URL	https://hdl.handle.net/2115/76258
Rights(URL)	https://creativecommons.org/licenses/by/4.0/
Type	doctoral thesis
File Information	Masayoshi_TAKAHAMA_abstract.pdf, 論文内容の要旨



学 位 論 文 内 容 の 要 旨

博士 (環境科学)

氏 名 高 濱 雅 幹

学 位 論 文 題 名

Studies on the year-round production and quality improvement of baby-leaf vegetables
(ベビーリーフの周年生産と品質改善に関する研究)

‘Baby-leaf vegetables (BLV)’ is new category in leafy vegetables and are used as the mixture of juvenile stage of different kinds of leafy vegetables. They include *Brassicaceae*, *Asteraceae*, *Amaranthaceae*, and other vegetable leaves. These crops show wide ranges of leaf shapes, colors, textures and flavors. BLV production began in early 1980s. mainly in Europe and the USA as kinds of ready-to-eat salad mixtures, and has increased gradually also in Japan. In such a consumption trend, Hokkaido has been expected as a new production area. Ready-to-eat salad mixtures such as BLV are expected to be available in stable qualities all year-round. However, BLV contains many kinds of crops (baby leaf crops; BLC) and production and quality characteristics are different among the BLC. Furthermore, the characteristics in each crop vary among growing season. Therefore, the following studies were examined for the establishment of year-round production of BLV with higher quality.

In Chapter 2, questionnaire survey was carried out to grasp consumer needs unique to BLV. More than half of consumers had “tasty” and “healthy” image for BLV more strongly and “colorful” and “fashionable” impression next to them. Based on the result of survey, the measurement of ascorbic acid and nitrate content as most interesting internal qualities and SPAD value as external appearance was determined. Commercial BLV from each production region had 4 to 10 crops and contained green-colored crops and red one. Leaf length and leaf area in most of BLC in commercial BLV products are around 80 mm and 1,000 - 1,500 mm² except for spatulate incised leaf blade crop (Mizuna et al, leaf length is below 120 mm) and some leaf lettuce (leaf area is below 2,000 mm²). Based on the survey results, harvest criteria were established as to BLC.

In Chapter 3, the emergence periods, growing periods, total cultivation periods, from sowing to harvest, as well as the yields, SPAD values, ascorbic acid and nitrate contents, and leaf characteristics of 22 BLC were investigated in spring season. A principal component analysis, based on the total cultivation periods, the yields, the SPAD values, as well as the ascorbic acid and nitrate contents, showed 3 main groups: *Brassicaceae* crops, which had short total cultivation periods and high ascorbic acid contents; *Asteraceae* crops (except for ‘Italian Red’ chicory), which had long total cultivation periods and low ascorbic acid contents; *Amaranthaceae* crops, which had a comparatively high yields and low nitrate contents. ‘Italian Red’ chicory did not fall into any

of these 3 groups. The yield had very limited effects on the grouping. The higher-yield crops tended to have more leaves and less dry matter ratios, and the crops with higher SPAD values tended to have thicker leaves.

In Chapter 4, the total cultivation periods, yields, SPAD values, ascorbic acid and nitrate contents and leaf characteristics of 22 BLC were investigated from spring season to autumn. Most of the BLC had longer total cultivation period, higher yield, higher ascorbic acid and lower nitrate contents in May and showed shorter total cultivation period, lower yield, lower ascorbic acid and higher nitrate contents in August. The lower daily mean air temperature during total cultivation period is, the longer total cultivation period, the higher yield, and lower nitrate contents most of the BLC had. The leaf weight and leaf thicknesses increased by low temperature conditions in some BLC. The ascorbic acid contents were affected more strongly by daily minimum temperature immediately before harvest in some *Brassicaceae* and *Asteraceae* crops. There were less relations between SPAD value and air temperature condition in most of the BLC.

In Chapter 5, the total cultivation periods, yields, ascorbic acid and nitrate contents, Brix and leaf characteristics of 22 BLC were investigated in an unheated greenhouse in winter season. All the BLC could survive though the lowest air temperature during the total cultivation period was shown about -10°C within greenhouse and could be harvested from December to February, though the adjustment of intact harvest were required. The adjusted yields, ascorbic acid contents, and Brix increased and the nitrate contents decreased from December throughout February in almost all the BLC. The dry matter ratio increased in January and February, unlike any other seasons from spring to autumn. The increase of Brix and the decrease of nitrate content showed the strong relations with the increase of dry matter ratio caused by low air temperature condition. Consequently, the possibility of BLV production in severe cold condition such as winter in Hokkaido was shown.

In Chapter 6, the influences of salinity treatment to BLC in soilless culture which ranged EC 2.5 to $7.5\text{ dS}\cdot\text{m}^{-1}$ of hydroponic solutions by adding NaCl for one to two weeks before harvest were evaluated in hot season in which BLV yield and qualities depress easily. The yield was likely to increase due to rise of water content in leaves of ‘Detroit’ table beet by the salinity treatment. The ascorbic acid contents of spinach crops increased according to increase of the Na^{+} absorption. The total phenolics increased in ‘Green Romaine’ lettuce and rucola when the crops contained more Na^{+} , K^{+} , and Ca^{2+} . The nitrate contents decreased according to the increasing Na^{+} absorption, especially in *Asteraceae* crops.

Based on the studies so far, year-round BLV production system in Hokkaido was established and screened the BLC suitable for each growing season. These results on the studies will contribute to the enhancement of BLV production in Hokkaido and the improved publicity of BLV produced in Hokkaido.