GROWTH CHARACTERISTICS OF STANDING OAK INDIVIDUALS SUITABLE FOR BARREL WOOD IN A SECONDARY OAK FOREST IN JAPAN

Akira Nakaya, Hisashi Ohsaki, Satoru Murakami, Yasuyuki Ohno, and Toshiya Yoshida

PURPOSE AND SCOPE

When Japanese oak (*Quercus crispula*) is used as barrel wood, the wood must have a small grain angle and a high tyloses filling ratio to prevent liquid leakage (Alamo-Sanza and Nevares 2019). However, there are very few oak trees with these wood properties, raising concern about resource decline. So, it is necessary to grow them through silvicultural management. This study was carried out to determine whether these wood properties could be controlled. We clarify the basic characteristics of grain angle and tyloses filling ratio, and their relationship with growth properties and site conditions of each standing oak tree.

METHODS AND APPROACH

This study was conducted in a natural mixed forest in northern Japan. More than 200 standing oak individuals were identified with tags, and diameter at breast height, stem curvature, bark crack angle, and local stand density were recorded. Wood samples were collected from a height of 3 m while maintaining the individual identification and were used to measure grain angle (GA) (using the splitting method: Nakada et al. 2024) and tyloses filling ratio (TR) together with the number of annual rings and diameter growth rate.

FINDINGS AND IMPLICATIONS

The average GA was 6.3 percent (standard deviation = 3.7, range = 1.7–19.5 percent). Assuming an upper limit of 5.3 percent GA usable as barrel wood (3 cm thickness and 100 cm long board), about half of all the trees were competent. There was no directionality in the grain direction (fig. 1). There was also a weak correlation between the mean GA and the bark crack angle (r = 0.20, P <0.05), but these directions did not coincide in some trees (23 of 71 trees). Although bark crack angle can be an indicator of fiber inclination, our results suggest that there may be trees with greater bark crack angle that are suitable for barrels,

Akira Nakaya, Graduate School of Environment Science course in Forest Field Science, Hokkaido University, Nayoro, 096–0071, Japan

Hisashi Ohsaki, Hokkaido Research Organization, Forest Products Research Institute, Asahikawa, 071–0198, Japan

Satoru Murakami, Hokkaido Research Organization, Forest Products Research Institute, Asahikawa, 071–0198, Japan

Yasuyuki Ohno, Hokkaido Research Organization, Forestry Research Institute, Bibai, 079–0198, Japan

Toshiya Yoshida, Field Science Center for Northern Biosphere, Hokkaido University, Nayoro, 096–0071, Japan

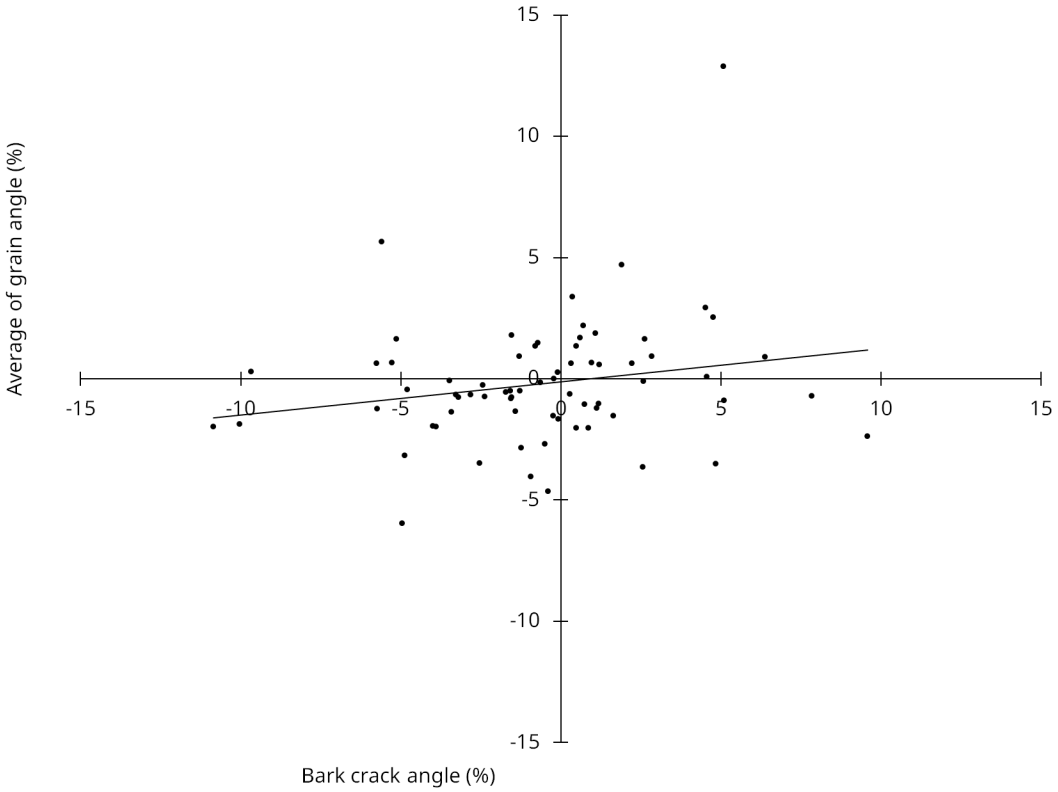

Figure 1—Relationship between average grain angle and bark crack angle. The solid line is a linear regression line.

even though they were previously considered unsuitable for barrels. On the other hand, the average TR was 28.1 percent, with considerable variation among individual trees (standard deviation = 27.3, range = 0.0–91.1). TR decreased towards the pith on the cross section, consistent with a previous report, which showed that tyloses in Japanese oak collapse over time (Sano et al. 1995).

The structural equation modeling suggested that GA and TR have positive and negative correlations with diameter growth rate, respectively. We further analyzed detailed relationships and discuss the possibility of controlling these characteristics through silvicultural practices.

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