Keynote Speech

Sago Palm (*Metroxylon sagu*): Most Promising Starch-producing Crop: Characters of Sago Palm Starch and its Accumulation

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Abstract

In order to achieve higher and/or sustainable production and supply for customers, to identify and quantify of starch accumulation feature is necessary. In sago palm (*Metroxylon sagu*), there are a lot of cultivars culturing and/or growing in different environmental conditions. The objective of this research is to characterize the morphological feature of sago palm starch. Amyloplast is formed near the apical portion. Its separation/division occurred abundantly and specifically in the apical portion as well as in the basal stem, middle or late growth stage. Significant difference is observed in the size of amyloplast among varieties. Number of amyloplast in cross sectional area of parenchyma tissue is also different among varieties. Starch grain size of sago palm is located in a middle among 54 plant species examined. These results suggest that the separation/division and shape of amyloplast is so specific, while the size of starch grain is located in a middle.

Starch is only product of higher plants. There are a lot of kinds of plants which produce starch. Among of them, some plants produce starch in seed (grain), root, and stem. In case of rice plant, starch accumulation is mainly in grain, however, accumulation feature and/or quality is so divers in different cultivars, culturing methods, environmental conditions and grain position within a panicle. Therefore, to identify and quantify of starch accumulation feature are of interest for higher and/or sustainable production and supply for customers. In sago palm, there are many cultivars culturing and/or growing in different environmental conditions. So, starch accumulation features appear to be different among sago palms. The objective of this research is to characterize the morphological feature of sago palm starch using sago palm stem of our previous report (references).

1. Sago Palm Starch

(1) Morphological Feature of Starch in the Stem

Separation/ Division of Amyloplast

Plastid, a cell organelle, accumulates starch to be amyloplast. In sago palm stem, amyloplast is formed near the apical portion. Below the apical portion in which tissue growth is advanced, amyloplast separation/ division is occurred abundantly(Nitta et al. 2000, 2002). Pattern of the separation/ division of amyloplast is as follows: (a) protuberance is formed near the surface, (b) basal portion of protuberance extends, (c) separation/ division is occurred in the middle portion of major axis or a little to the protuberance from it. The separation/division occurred even in the basal stem as well as middle or late growth stage. Therefore, difference of shape or size of amyloplast becomes larger as further as beyond. These proliferation features is a specific characteristics of sago palm stem.

Varietal Difference of Amyloplast size

Significant difference is observed in the size of amyloplast among varieties (Nitta et al. 2005, 2006, 2007). Major axis was longest in Wani (46.8 μm), shortest in Para Wiliha (27.7 μm). Number of amyloplast in cross sectional area of parenchyma tissue (PTN) was also different among varieties (Max. Rondo: 262.4 mm^{-2}, Min. Para Wiliha 184.4 mm^{-2}). There is no correlation between stem starch contents and amyloplast size or PTN. Significant correlation was not found between amyloplast size and PTN.

Amyloplast Formation in Sucker

Amyloplast is also formed in the apical meristem portion of sago suckers (Arai et al. 2009; Nitta et al. 2009). Their shapes are round and smooth with a few occurrence of separation and/or division. Comparing with mother stem, sucker shows early growth of parenchyma cell and tissue, and rapid starch accumulation in amyloplasts, even in the same distance from the apical meristem portion. These features may be an advantage for early growth after transplanting.

(2) Form of Manufactured Sago Palm Starch

In Japan, most of sago palm starch is used for dusting powder of raw ramen. Characteristic of the sago palm starch was surely recognized as a result that a scanning electron microscope observed the surface of raw ramen.

2. Comparison with Other Crop Starch

Sago palm starch is the 'simple starch grain' that most made an oval and a spindle-shaped cube, and major axis of amyloplast is 30-50 μm. It is bigger than the 'compound starch grain'. Ten to twenty amyloplasts accumulate in one parenchyma cell. According to our preliminary experiment, Kawasaki (1999) and Kawakami (1975), in case of 'simple starch grain', starch grain size is larger than those of wheat (20-40 μm for primary starch grain, 2-8 for secondary starch grain) and yam (20 μm), while smaller than those of potato (10-90 μm) and edible canna (40-100μm). In addition, in case of 'compound starch grain', it is larger than rice (2-8 μm), sweet potato (8-36μm), cassava (5-20 μm), and taro (0.13-0.42 μm). The starch grain size of sago palm is located in a middle when taking into consideration of Jane et al. (1994) in which examined 54 species.

Conclusion

In higher plants, starch is accumulated in amyloplast. In sago palm stem, amyloplast is formed near the apical portion. Amyloplast separation/division occurred abundantly and specifically in the apical portion as well as in the basal stem, middle or late growth stage. Significant difference is observed in the size of amyloplast among varieties. Number of amyloplast in cross sectional area of parenchyma tissue is also different among varieties. Starch grain size of sago palm is located in a middle among 54 plant species examined. Further study using sago palm under different environmental conditions will be focused on in our research.

References

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Note: A part of this work was presented in the 2nd ASEAN Sago Symposium held at October 29-31, 2012 in Kuching, Malaysia.