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Proximate Compositions and Phytochemical Properties of Sweet Potato (*Ipomoea batatas* L.) Tuber as Affected by Harvesting Period

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Sweet potato (*Ipomoea batatas* L.) is one of the most important crops in the world. The main nutritional components in tubers of sweet potato are carbohydrate, protein, lipid, vitamin, mineral as well as phytochemical constituents. Orange-fleshed sweet potato and purple-fleshed sweet potato have been attracting food technologists owing to their high content of carotenoid, anthocyanin and pleasant organoleptic properties.The main objective of study was examining the proximate composition and phytochemical property of sweet potato (*Ipomoea batatas* L.) at different harvesting periods. Two different cultivars of sweet potato (*Ipomoea batatas* L.) including orange-fleshed sweet potato and purple-fleshed sweet potato were investigated at 105, 110, 115, 120, 125 days after planting. Our results revealed that at the 120th day of planting, the most proximate composition and phytochemical content were accumulated at highest levels. The harvesting period was recommended at 120th day to obtain the best sweet potato quality.

Keywords: Orange-fleshed sweet potato, purple-fleshed sweet potato, proximate composition, phytochemical content, harvesting, quality

INTRODUCTION

Sweet potato (*Ipomoea batatas* L.) is main food crop of rural area. It provides numberous nutritional benefits after rice, wheat, maize, sorghum and potato. Sweet potato has unique attributes such as adoptability in wider topography, ability to grow in subsidiary condition, good productivity in short planting time, and balanced nutritional composition (Satheesh et al., 2019). It's rich in dietary fibers, minerals, vitamins, antioxidants such as phenolic acids, anthocyanins, tocopherol and b-carotene (Ramesh et al., 2011). It has distinctive flesh colours like cream, deep yellow, orange and purple (Teow et al., 2007). Purple-fleshed sweet potato (*Ipomoea batatas* L.) has purple to dark purple pulp. It is rich source of dietary fiber, minerals, vitamins and antioxidants (Yoshimoto et al., 2005; Shao and Huang, 2008; Wu et al., 2008; Liu et al., 2009; Ahmed et al., 2010; Katayama et al., 2011). Purple-fleshed sweet potato provides not only nutrients but also phytochemical elements to achieve health benefits. It has a great amount of total phenolic, flavonoid, anthocyanin and antioxidant activity (Aoran Li et al., 2019). Anthocyanin in purple-fleshed sweet potato is significantly higher than that in ordinary orange-fleshed sweet potato (Enicole et al., 2010), strawberry or red cabbage (Lu et al., 2010). Anthocyanin in purple-fleshed sweet potato had different pharmacological activities such as antioxidant, antiinflammatory, antimutagenic, anticarcinogenic, chemopreventive, antihyperglycemic, memory enhancement, free

radical scavenging, lower insulin resistance (Kusano and Abe, 2000; Yoshimoto et al., 2001; Oki et al., 2002; Matsui et al., 2002; Konczak-Islam et al., 2003; Kano et al., 2005; Saigusa et al., 2005; Suda et al., 2008; Wu et al., 2008; Zhang et al., 2009; Lim et al., 2013; Sugata et al., 2015; Hu et al., 2016). Meanwhile, orange-fleshed sweet potato is relatively rich in β-carotene (Haskell et al., 2004). It contains huge amounts of minerals, vitamins, dietary fiber, phytochemical constituents contributing a great positive effect on human health such as antioxidant, anticancer, cardiovascular and blindness prevention (Ahmed et al., 2010; Mohammad et al., 2016). It can be processed into juice or composite flours in making bakery and complementary foods (Hagenimana et al., 2001). Sweet potato has a low glycemic index due to low digestibility of the starch making it suitable for diabetic or overweighed people (Ellong et al., 2014).The influence of nitrogen fertilizer application on nutrient composition of sweet potato varieties was examined (Anthony et al., 2009). Sweet potato cultivars grown and harvested at different times were evaluated (José et al., 2016). Amha and Baruch (2016) had an evaluation of proximate composition of sweet potato [*Ipomoea batatas* (L.) Lam] for better utilization through agro-food processing chain. Othman et al. (2017) confirmed that the harvesting season had a major effect on the total carotenoid content. Objective of our study focused on the observation of the proximate composition and phytochemical component accumulated at different harvesting periods.

MATERIALS AND METHODS

Material

Two cultivars of orange-fleshed sweet potato and purple-fleshed sweet potato were examined at 105, 110, 115, 120, 125th days after planting. This research was conducted in Vinh Long province, Vietnam. After collecting, they must be quickly conveyed to laboratory for experiments. They were subjected to washing and chemical analysis.

Researching method

Two cultivars of orange-fleshed sweet potato and purple-fleshed sweet potato were sampled at 105, 110, 115, 120, 125th days after planting. At harvest, the following characteristics were evaluated: moisture content (%), carbohydrate (%), protein (%), lipid (%), beta-caroten (mg/100g), anthocyanin (mg/100g) and total phenolic (mg GAE/100g).

Nutritional and phytochemical analysis

Proximate composition of sweet potato starch was examined according to the standard method described by AOAC (2010). Carotenoid content (mg/100g) was estimated by acetone-petroleum ether extraction followed by spectrophotometric measurement (Mohammad et al., 2016). Anthocyanin (mg/100g) was determined by using high-performance liquid chromatography(Garzón GA et al., 2009). Total phenolic (mg GAE/100g) in sweet potato extracts was estimated by the Folin-Ciocalteu colorimetric method (Blainski et al., 2013).

Statistical analysis

The experiments were run in triplicate with three different lots of samples. The data were presented as mean±standard deviation. Statistical analysis was performed by the Statgraphics Centurion version XVI.

RESULTS

Estimation of the harvesting period has great influence on vegetative production, quality, productivity and tuber biomass (José et al., 2016). In our research, the proximate composition and phytochemical content of two sweet potato cultivars were significantly changed at 105, 110, 115, 120, 125 days of planting. The best quality of sweet potato should be harvested at 120th days to obtain the highest nutrients and micronutrients (table 1 and 2).

Table 1: Effect of planting period on the proximate composition of orange-fleshed sweet potato starch

Planting (days)	105	110	115	120	125
Moisture (%)	70.82±0.00^{a}	70.14±0.02^{ab}	69.85±0.01^{b}	69.70±0.02^{bc}	69.58±0.02^{c}
Carbohydrate (%)	24.26±0.01^{c}	24.57±0.03^{bc}	24.85±0.02^{b}	25.32±0.01^{a}	25.07±0.01^{ab}
Protein (%)	2.20±0.02^{b}	2.29±0.00^{ab}	2.35±0.01^{ab}	2.42±0.00^{a}	2.44±0.02^{a}
Lipid (%)	0.17±0.00^{a}	0.18±0.01^{a}	0.20±0.03^{a}	0.21±0.02^{a}	0.20±0.03^{a}
Beta caroten (mg/100g)	3.12±0.03^{c}	3.51±0.02^{bc}	3.85±0.02^{b}	3.97±0.01^{ab}	4.16±0.01^{a}
Total phenolic (mg GAE/100g)	113.46±0.01^{b}	117.84±0.00^{ab}	121.60±0.03^{ab}	127.30±0.00^{a}	128.01±0.02^{a}

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%).

Table 2: Effect of planting period on the proximate composition of purple-fleshed sweet potato starch

Planting (days)	105	110	115	120	125
Moisture (%)	70.65±0.02^{a}	70.44±0.01^{ab}	70.19±0.03^{b}	70.01±0.03^{bc}	69.83±0.01^{c}
Carbohydrate (%)	24.31±0.03^{c}	24.65±0.00^{bc}	24.92±0.01^{b}	25.26±0.00^{a}	25.04±0.00^{ab}
Protein (%)	2.18±0.01^{c}	2.24±0.02^{ab}	2.31±0.00^{ab}	2.44±0.01^{a}	2.45±0.03^{a}
Lipid (%)	0.19±0.02^{c}	0.22±0.00^{a}	0.23±0.02^{a}	0.24±0.01^{a}	0.24±0.01^{a}
Anthocyanin (mg/100g)	4.24±0.00^{c}	4.79±0.01^{bc}	5.14±0.01^{b}	5.75±0.03^{ab}	6.02±0.00^{a}
Total phenolic (mg GAE/100g)	117.82±0.02^{b}	119.62±0.03^{ab}	122.78±0.00^{ab}	128.43±0.02^{a}	128.46±0.00^{a}

Note: the values were expressed as the mean of three repetitions; the same characters (denoted above), the difference between them was not significant (α = 5%).

In one research, José et al. (2016) concluded that the harvesting time of 150 days after planting was more productive. Makanjuola et al. (2018) proved that an increase of protein, ash, fat, carbohydrate and dieatary fibre of all starch samples was noticed during the sprouting process while the moisture content decreased. Mohammad et al. (2016) had a comparison of the proximate composition, total carotenoids and total polyphenol content of nine orange-fleshed sweet potato varieties.

CONCLUSION

Sweet potato is a rain-fed vegetable crop grown in the tropical regions. It is one of the major staple food security promoted tuber crops in the world It's an excellent source of eible energy in versatility, high yield, hardiness, and wide ecological adaptability. Defining the harvesting period to obtain the highest nutritional and phytochemical values of sweet potato is very important in crop management. In this research, we have successfully observed the accumulation of proximate composition and phytochemical component at different harvesting periods.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

Nguyen Phuoc Minh arranged the experiments and also wrote the manuscript.

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