Assessment of Physical Properties and Bulb Pungency in Cluster Onions Grown in Sri Lanka

I.R. Liyanage, G.T.N. Gunasekara, M.V. P. Jayasundara, E.K.E.C.Nayana, and H.N.K. Gunathilake

Grain Legumes and Oil Crops Research and Development Centre, Angunakolapellessa,

INTRODUCTION

Cluster onion is botanically included in the Liliaceae family. It has been known for thousands of years probably originated in Central Asia. Cluster onion is considered as one of the most popular condiments in Sri Lanka not only because of its culinary importance but also due to its medicinal value. Several number of cluster onion cultivars are grown in Sri Lanka and some of them are Thinnavely Selection (TVS), Thellulla Selection and Vethalen. Total annual production of 63,675 mt comes from the 4994 ha land extent and 19,841 mt of cluster onion is imported to Sri Lanka annually. Cluster onions are mostly grown in Jaffna, Puttalam, Vauniya, Nuwaraeliya and Monaragala districts (AgStat, 2016). Compared to big onion, cluster onion has a good demand but the farm gate price is far below the retail price.

Cluster onion is primarily consumed for its ability to enhance the flavor of the foods. The determination of pyruvic acid content as an indicator of the pungency level in the onion is the most established method. Pungency level and total soluble solids are important quality attributes of onion bulbs. At present there are no reported information available on the variation in the physical properties and pungency level of cluster onion varieties and promising lines grown in Sri Lanka. Such information will be helpful to the food technologists and breeders. The objectives of this study were to determine the physical properties, pungency level, pH and total soluble solids (TSS) values of three varieties and two promising lines of cluster onions.

MATERIAL AND METHODS

Cluster onion bulbs were obtained from a cluster onion breeder from Grain Legume and Oil Crops Research & Development Centre, Angunakolapellessa. Soil type was Reddish Brown Earth and these bulbs were grown in the 2016/17 *Maha* season in poly-tunnels and agronomic practices were same for all the varieties and two cluster onion lines. Cluster onion varieties were namely TVS, Thelulla and Vethalan, whereas

***** Short Communication***

ANKCLO2015/2 and MICLO11-4 were the two lines used in the study. Cleaned dried samples were refrigerated until further analysis. All the reagents used in this study were of analytical grade.

Polar and equatorial diameter of bulblets (determined using 50 random samples of each cultivar), number of bullets per cluster and fresh weight of bulblets (determined using 10 random samples of each cultivar), and number of bulblets per 100 g were taken as physical properties of cluster onion. Ten randomly selected bulbs of each cultivar were used for the analysis of pyruvic acid, TSS and pH. The selected bulbs were cut longitudinally into two pieces. Out of these, one half was immediately chopped and homogenized with water (1:1). For the determination of pyruvic acid, 1 ml of the diluted onion solution (0.5 ml onion juice, 1.5 ml of 5% Trichlroacetic acid) and 18 ml of distilled water were mixed on a vortex apparatus. It was then added with 0.0125% 2,4-Dinitrophenylhydrazine (prepared in 2N HCl). The reaction mixture was placed in a water bath at 37°C for 10 min and after removing the samples from the water bath, 5.0 ml of 0.6N NaOH was added within one minute time. The absorbance was measured at 515 nm using UV absorbance spectrophotometer (Model Jenway 6300). Standard series (0.25, 0.2, 0.15, 0.1, 0.05, 0.025 and 0.010 µmoles pyruvate/ml) was prepared using 0.1 M sodium pyruvate stock solution (Ketter and Randle, 1998). TSS was measured using a hand refractometer and pH was measured using a pH meter.

RESULTS AND DISCUSSION

The physical properties of cluster onions are given in Table 1. The number of bulblets per cluster varied significantly from 4.6 to 8.3, where both cluster onion lines and Vethalen received significantly lower number of bulblets per cluster compared to TVS and Thelulla. Fresh weight of cluster onion bulblets varied significantly among cultivars where variety Vethalen received the highest fresh weight, where as cultivar Thelulla and TVS received lower fresh weights. Number of bulblets per 100 g of cluster onion varied significantly among samples, and line ANK CLO2015/2 had large bulblets, which considered an important character for consumers. Because consumers willing to buy cluster onions with large bulblets compared to that of small bulblets. Polar diameter and equatorial diameter of cluster onions varied significantly in the range of 16.71-22.04 mm and 10.71-16.71 mm, respectively. Cluster onion lines ANKCLO 2015/2 and MICLO11-4 displayed significantly higher values for polar and equatorial diameter than others.

Table 1. Physical properties of cluster onion

Cultivar	No of bulblets/ cluster	Fresh wt of bulblet(g)	Bulblets/100g	Polar diam-eter(mm)	Equatorial diameter(mm)
TVS	6.9[a]	1.84[c]	79[b]	16.84 [c]	12.51[c]
THELULLA	8.3[a]	1.03[c]	101[a]	16.71[c]	10.71[d]
VETHALAN	4.9[b]	4.93[a]	29[c]	19.38[b]	14.82[b]
ANK CLO2015/2	4.6[b]	3.80[b]	23[d]	22.04[a]	16.71[a]
MICLO11-4	4.6[b]	2.93[b]	32[c]	21.85[a]	16.49[a]

Means in the column with different superscript are significantly different at $\rho \leq 0.05$.

The pyruvic acid content, TSS and pH are given in the Table 2. The pyruvic acid content of cluster onions varied significantly among the varieties tested and lines and was observed in the range of 9.82-12.76 µmoles g-1 (Table 2). The variety TVS and lines ANKCLO2015/2 and MICLO11-4 received significantly higher pungency level compared to Thelulla. Highly pungent cluster onions are popular in Sri Lanka an also pungency is known to differ with variety, stage of maturity, type of soil, soil moisture and other growing conditions (Dhumal et al., 2007). Pungency and TSS are important attributes of onion bulb quality for processing and storage. Percentage TSS varied significantly among the varieties from 16.67 to 20.33, where variety Vethalen and two lines ANKCLO2015/2 and MICLO11-4 received significantly higher TSS% compared to Thelulla. TSS is an important parameter as it contributes to the flavor, texture and storability of onion. Among tested types pH value of cluster onion varied significantly from 5.92 to 6.19, where variety TVS received the lowest pH and Vethalen and other two cluster onion lines received significantly higher pH values.

Table 2. The pyruvic acid content, TSS and pH of Cluster onion

Cultivar	Total Pyruvate (µmoles g-1)	TSS (%)	pH
TVS	12.76[a]	18.67[b]	5.92[c]
Thelulla	9.82[c]	16.67[c]	5.94[bc]
Vethalan	11.10[bc]	20.33[a]	6.07[ab]
ANK CLO2015/2	12.17[ab]	19.67[ab]	6.12[a]
MICLO11-4	12.01[ab]	19.67[ab]	6.19[a]

Means in the column with different superscript are significantly different at $\rho \leq 0.05$.

All the three popular varieties of cluster onion included in the present study differ in terms of physical properties, pungency, TSS and pH. Pungency of onion bulbs highly contributes to the postharvest life and the quality of processed products. The studies on pungency, TSS, pH and their association will definitely help to improve the quality of cluster onion bulbs through breeding programs. However, breeding onion for desired pungency is a time consuming and a very challenging task.

CONCLUSIONS

Selected cluster onion varieties and lines had significant differences in physical properties, pungency level, TSS and pH values. Among the tested varieties and lines, variety Thelulla had the smallest bulblets and cluster onion line ANKCLO2015/2 exhibited to have the largest bulblets in a cluster. Both ANKCLO2015/2 and MICLO11-4 lines showed significantly higher polar and equatorial diameters compared to other tested types. Among the tested cluster onions, TVS, ANKCLO2015/2 and MICLO11-4 received significantly higher pungency levels compared to Thelulla. Variety Vethalen and other two cluster onion lines had significantly higher TSS % compared to Thelulla, which considered as an important quality attribute of cluster onion for processing and storage.

REFERENCES

AgStat. 2016. Pocket hand book of agricultural statistics. Department of Agriculture, Peradeniya, Sri Lanka: 19-22.

Dhumal, K., S. Datir and R. Pandey. 2007. Assessment of bulb pungency level in different Indian cultivars of onion (Allium cepa L.). Food chemistry. 100 : 1328-1330.

Ketter, C.A.T. and W.M. Randle. 1998. Pungency Assessment in Onions. In Tested studies for laboratory teaching, Eds. S. J. Karcher. pp. 177-196. Proceedings of the 19th Workshop/ Conference of the Association for Biology Laboratory Education.