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Studies on identification of suitable onion genotypes for processing

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Abstract
An experiment was conducted at College of Horticulture, Bengaluru during *Rabi* season of 2016-17. In the study onion bulbs of 28 genotypes were procured with good size and shape. The quality parameters *viz*., bulb colour, number of centres, TSS, firmness, moisture percentage, dry matter, reducing sugars, non-reducing sugars, total sugars and pungency were analysed in an experiment. All 25 genotypes were noticed with white colour, ON 14-09 with red and white colour, Arka Sona with yellow and Rose Onion with red colour. A single centered bulb was registered in Bhima Shweta (1.00) followed by ON-15-27 (1.20) and ON-15-42 (1.40). The highest TSS was recorded in genotype Arka Sona (23.15%) followed by Rose Onion (19.35%) and Arka Swadista (18.90%) among the white onions genotypes none of the genotypes recorded maximum compared to Rose Onion. The firmness of bulb was registered maximum in GJWO-3 (9.85kg/cm^2) followed by Telagi White (9.74 kg/cm^2) and Arka Swadista (9.62 kg/cm^2). The maximum moisture content of bulb was recorded in Telagi White (86.50%) followed by ON-15-42(86.45%) and BSS-255 (86.27%). The percentage of dry matter content was registered maximum in Arka Sona (21.34%) and Arka Swadista (19.15%). Among the genotypes, maximum reducing sugar was noticed in the genotype GWO-1 and ON-15-29 (3.67% each). Of different genotypes, maximum non-reducing sugar and total sugars were recorded in the genotype Rose Onion (4.12 and 6.34%, respectively). However, maximum pungency (pyruvic acid) was documented in case of Rose Onion (6.55µmol./gram of FW) followed by Arka Sona (6.54 µmol./gram of FW) and Arka Swadista (5.95µmol./gram of FW). Therefore, from the study, it was noticed that genotypes Arka Sona, Arka Swadista and Rose Onion were found suitable for processing with good quality characters.

Keywords: Studies on identification suitable onion genotypes processing experiment was conducted

Introduction
Onion (*Allium cepa* L.) is an important biannual bulbous vegetable crop belonging to the family Alliaceae. This crop is mainly grown for local consumption and export purposes, it is an indispensible item in every kitchen as vegetable and spice cum condiment used to flavour many of the food stuffs. Therefore, onion is popularly referred as 'Queen of the Kitchen'. In addition to these, onion is used as salad and pickle. Apart from that recently onion is being employed by processing industry to a greater extent for preparing dehydrated onion products like powder and flakes. Besides, onions are served as raw salad, cooked, fried, dried or roasted as vegetable cum spice and commonly used to flavor the preparation of dishes, soups, spreads and stir-fry. The small bulbs and shallots are used to prepare pickles, value added with vinegar or brine solution to serve the whole peeled small onion during dining. The dehydrated bulb, onion powder, onion rings and flakes are in great demand in the market. The dried onion flakes can be regained by cooking in water during preparation of food.

White onion is a type of dry onion that has pure white skin, sweet and mild white flesh having 42 calories, 1.3g protein, 1.2g fibre, 100g vitamin-C and acts as anti-oxidants. However, dehydration industries demand for white onion varieties with globe shape of bulb and high TSS (>18^{0}B). But Indian white onion genotypes are having TSS range from 11to13 ^{0}brix. The sulfur compounds present are responsible for typical odour cum flavour and are also active anti-microbial agents, which supports the immune health. Moreover, onion is an important source of several phyto-nutrients as flavonoids, thio-sulfates and other sulphur compounds recognized as important elements of the Mediterranean diet.

Hence, a proper selection of suitable cultivars of white onion is very essential to meet the international standards of quality at competitive prices and these new varieties of onion are required to be tested for their suitability in processing.

Materials and methods

An experiment was carried out in the College of Horticulture, Bengaluru, Karnataka. In an experiment bulb of 28 genotypes were used for the analysis, procured with good size and shape. The quality parameters *viz*., bulb colour, number of centres, TSS, firmness, moisture percentage, dry matter, reducing sugars, non-reducing sugars, total sugars and pungency were tested in an experiment. The recorded data was statistically analyzed at 5 per cent level of significance following the standard procedure.

Results and discussion

Bulb shape

Among twenty eight genotypes evaluated, globe shape bulbs were observed in Bhima Shubra, Bhima Safeda, BSS-255, KSP-1120, Pocha White, GWO-1, GJWO-3, Arka Sona, ON-15-01, ON-15-27, ON-15-29, ON-15-42, ON-16-22, ON-16-25, ON-16-27,ON-16-29, ON-16-30 and ON-16-32. The flat globe shape was observed in Pusa White Round, ON-14-09 and Bengaluru Rose Onion. However, broad oval bulb shape was noticed in Bhima Shweta, Akola Safeda, Telagi White, Arka Swadista and Phule Safed. Whereas, flat bulb shape was observed in Pusa White Flat and ON-15-06 (Table.1).

However, dehydration purpose tall globe shape bulbs are invariably preferred for their easier handling in the slicing machine. The bulb shape directly depends on the difference between polar and equatorial diameter of bulb within a cultivar. The results were similar to Rivera *et al*. (2015) [13], Sahu (2017) [14] and Ananthan and Balakrishnamoorthy (2007) [1].

Bulb colour

Among the genotypes evaluated with respect to bulb skin colour, Bhima Shweta, Bhima Shubra, Bhima Safeda, Pusa White Round, Pusa White Flat, BSS-255, KSP-1120, Pocha White, GWO-1, GJWO-3, Akola Safeda, Telagi White, Arka Swadista, ON-15-01, ON-15-06, ON-15-27, ON-15-29, ON-15-42, ON-16-22, ON-16-25, ON-16-27, ON-16-29, ON-16-30, ON-16-32 and Phule Safed were noticed with white colour. Whereas, ON-14-09 revealed red and white colour, Arka Sona with yellow and Bengaluru Rose Onion with red colour. Similar findings were recorded by Rivera *et al*. (2015) [13], and Ratan *et al.* (2017) [12].

Total soluble solids [TSS (^{0}Brix)]

A significant variations in total soluble solids were observed among the cultivars. The highest TSS was recorded in genotype Arka Sona (23.15 ^{0}B) followed by Bengaluru Rose Onion (19.35 ^{0}B) and Arka Swadista (18.90 ^{0}B). Whereas, ON-16-22 (11.78 ^{0}B), ON-14-09 (11.87 ^{0}B) and ON-16-25 (11.99 ^{0}B) were registered the lowest TSS. The variations in the TSS of genotypes might be due to varietal character, these results were similar to Mahajan and Gupta (2016) [9], Utagi *et al*. (2015) [16] and Lakshmipathi (2016) [7].

Table 1: The qualitative parameters of different genotypes of white onion

S. No.	Genotypes	Bulb colour	Bulb shape	TSS (^{0}Brix)	Firmness (kg/cm^2)	Dry Matter (%)	Moisture (%)
1.	Bhima Shweta	W	Broad oval	14.75	9.41	16.39	83.13
2.	Bhima Shubra	W	Globe	15.20	9.06	13.23	79.72
3.	Bhima Safeda	W	Globe	15.40	9.45	15.29	82.89
4.	Pusa White Round	W	Flat globe	15.35	9.49	16.27	82.83
5.	Pusa White Flat	W	Flat	15.15	9.53	15.05	85.36
6.	BSS-255	W	Globe	16.40	9.12	15.83	86.27
7.	KSP-1120	W	Globe	16.60	8.23	15.49	84.31
8.	Pocha White	W	Globe	15.60	8.70	14.41	83.17
9.	GWO-1	W	Globe	15.60	9.41	13.55	82.47
10.	GJWO-3	W	Globe	17.40	9.85	16.87	84.28
11.	Akola Safeda	W	Broad- oval	14.80	9.47	13.61	84.45
12.	Telagi White	W	Broad - oval	14.35	9.74	11.78	86.50
13.	Arka Swadista	W	Broad-oval	18.90	9.62	19.15	76.30
14.	Arka Sona	Y	Globe	23.15	9.09	21.34	78.27
15.	ON-14-09	LR	Flat globe	11.87	8.38	16.36	83.26
16.	ON-15-01	W	Globe	12.45	8.71	15.27	82.00
17.	ON-15-06	W	Flat	12.58	9.22	13.73	84.90
18.	ON-15-27	W	Globe	13.94	8.84	14.74	82.00
19.	ON-15-29	W	Globe	13.25	8.87	12.47	78.13
20.	ON-15-42	W	Globe	13.22	8.65	14.66	86.45
21.	ON-16-22	W	Globe	11.78	9.56	15.37	84.62
22.	ON-16-25	W	Globe	11.99	9.28	14.02	83.87
23.	ON-16-27	W	Globe	13.05	9.10	16.18	84.07
24.	ON-16-29	W	Globe	12.25	9.28	14.20	82.35
25.	ON-16-30	W	Globe	12.81	9.48	14.94	86.10
26.	ON-16-32	W	Globe	12.66	9.35	16.87	82.79
27.	Phule Safed	W	Broad oval	15.40	9.41	12.52	84.89
28.	Bengaluru Rose Onion	R	Flat globe	19.35	9.18	18.86	76.50
Mean		-	-	14.83	9.22	15.50	82.99
SEm±		-	-	1.31	0.11	0.65	0.69
CD at 5%		-	-	3.81	0.32	1.89	1.99

Firmness (kg/cm^2)

The maximum firmness of bulb was indicated in GJWO-3 (9.85 kg/cm^2) followed by Telagi White (9.74 kg/cm^2) and Arka Swadista (9.62 kg/cm^2). However, minimum firmness was registered in KSP-1120 (8.23 kg/cm^2) and ON-14-09 (8.38 kg/cm^2). More the firmness maximum will be the shelf-life of bulbs under storage these results are similar to Mallor *et al.* (2011) [10] Lakshmipathi (2016) [7] and Suhas (2016) [15].

Dry matter (%)

The maximum percentage of dry matter content was measured in Arka Sona (21.34%), Arka Swadista (19.15%) and Bengaluru Rose Onion (18.86%) followed by GJWO-3 and ON-16-32 (16.87%) each. While, lowest was recorded in Telagi White (11.78%). These findings were similar to the findings of Lakshmipathi (2016) [7] and Ratan *et al*. (2017) [12].

Moisture (%)

The maximum moisture percentage of bulb was recorded in Telagi White (86.50%) followed by ON-15-42 (86.45%) and BSS-255 (86.27%). However, minimum moisture percentage was registered in Arka Swadista (76.30%). These results are similar to Kukanoor (2005) [6].

Reducing, non-reducing and total sugars (%)

Among the genotypes, maximum reducing sugar was noticed in the genotype GWO-1 and ON-15-29 (3.67% each). Whereas, Bhima Safeda recorded the minimum reducing sugar of 2.17 per cent. An increase in reducing sugars may be due to increased phenolic compounds accumulation after the synthesis of starch. The maximum non-reducing sugar was in Bengaluru Rose Onion (4.12%) and minimum was in genotype GWO-1(2.46%). While, the maximum total sugar was registered in the genotype Bengaluru Rose Onion (6.34%) was on par with BSS-255 (6.33%) and ON-16-27 (6.31%). However, Pusa White Round recorded the minimum total sugar of 5.09 per cent. The variation in the sugar level of different genotypes might be due to character of genotype. Similar findings were reported by Kukanoor (2005) [6], Ashok *et al.* (2013) [3] and Archana (2017) [2].

Pungency (µmol./gram of FW)

Of different genotypes a significant difference was found with pungency. The maximum pungency (pyruvic acid) was documented in case of Bengaluru Rose Onion (6.55µmol./gram of FW) followed by Arka Sona (6.54 µmol./gram of FW) and Arka Swadista (5.95µmol./gram of FW). Whereas, ON-16-30 recorded the minimum pungency (5.10 µmol./gram of FW). This may be due to high temperature during growth period and sulphur fertilizer, which are responsible for increase in the synthesis of volatile sulphur compounds and production of more pungency in onion. Similar results were obtained by Mallor *et al.* (2011) [10], Gallina *et al.* (2012) [4] and Lakshmipathi (2016) [7].

Table 2: The bio-chemical parameters of different genotypes of white onion

S. No.	Genotypes	Reducing sugars (%)	Non-reducing sugars (%)	Total sugars (%)	Pungency (Pyruvic acid µmoles/g of FW)	Phenolics (mg/g)
1.	Bhima Shweta	2.36	2.81	5.17	5.38	2.74
2.	Bhima Shubra	2.41	3.29	5.70	5.37	2.39
3.	Bhima Safeda	2.17	3.88	6.05	5.36	2.77
4.	Pusa White Round	2.20	2.89	5.09	5.11	2.57
5.	Pusa White Flat	2.95	3.21	6.16	5.12	2.84
6.	BSS-255	3.17	3.16	6.33	5.21	2.40
7.	KSP-1120	3.08	2.95	6.03	5.38	2.51
8.	Pocha White	2.86	2.98	5.84	5.54	2.37
9.	GWO-1	3.67	2.46	6.13	5.73	2.72
10.	GJWO-3	2.52	2.86	5.37	5.45	2.84
11.	Akola Safeda	2.35	2.84	5.18	5.41	2.85
12.	Telagi White	2.90	3.24	6.14	5.38	2.82
13.	Arka Swadista	2.18	2.72	5.90	5.95	2.86
14.	Arka Sona	2.40	2.69	6.09	6.54	1.62
15.	ON-14-09	3.29	3.00	6.29	6.08	3.38
16.	ON-15-01	2.48	3.45	5.93	5.17	2.54
17.	ON-15-06	2.74	2.94	5.67	5.28	2.61
18.	ON-15-27	3.50	2.67	6.16	5.10	2.58
19.	ON-15-29	3.67	2.51	6.18	5.16	2.51
20.	ON-15-42	3.01	2.89	5.90	5.30	2.38
21.	ON-16-22	3.16	2.73	5.89	5.15	2.75
22.	ON-16-25	3.58	2.58	6.16	5.22	2.49
23.	ON-16-27	3.62	2.69	6.31	5.16	2.61
24.	ON-16-29	2.58	3.07	5.65	5.20	2.58
25.	ON-16-30	2.25	3.24	5.48	5.01	2.69
26.	ON-16-32	2.27	3.08	5.35	5.44	2.59
27.	Phule Safed	2.24	3.40	5.64	5.27	2.67
28.	Bengaluru Rose Onion	2.22	4.12	6.34	6.55	5.06
Mean		2.85	3.01	5.86	5.43	2.70
SEm±		0.12	0.14	0.08	0.20	0.12
CD at 5%		0.35	0.41	0.24	0.58	0.35

Phenolics (mg/g)

Among the genotypes, maximum phenolic content was obtained in the case of Bengaluru Rose Onion (5.06 mg/g) followed by ON-14-09 (3.38 mg/g). However, Arka Sona (1.62 mg/g) recorded the minimum phenolic content. The quantity of phenolic content variation not only due to the cultivar and also with the growth stage and environmental conditions and these results were obtained similar to Gawad *et al.* (2014) [5] and Liguori *et al.* (2017) [8].

Phenolics are the most wide spread secondary metabolite in plant kingdom. These diverse groups of compounds have received much attention as potential natural anti-oxidants in terms of their ability to act as efficient radical scavengers (Narendhirakannan and Rajeswari, 2010) [11].

Conclusion

In the present investigation, the results showed a significant difference among the genotypes for all the traits. The genotypes Arka Sona, Bengaluru Rose Onion and Arka Swadista were found to be the best among all the cultivars with respect to quality parameters such as total soluble solids, dry matter content and pungency of bulbs. Hence, these genotypes have better processing qualities which can be utilized for dehydration and processing purpose.

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