

Original Research Article

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Evaluation of seed setting aggregatum onion (*Allium cepa* var. *aggregatum*) types under Tamil Nadu conditions

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ABSTRACT

Multiplier onion or Aggregatum onion (*Allium cepa* var. *aggregatum*) is one of the important bulbous vegetable cultivated in India. Onion is mainly propagated through bulbs and approximately 1000 kg of bulb is required for planting in one hectare of area. Huge quantities of onion bulbs are wasted for propagation purpose. By switching over from bulb propagation method to seed, there is a saving of seed bulb to a tune of 1000 kg/ha. As Aggregatum onion is being cultivated in 30,000 hectares in Tamil Nadu, a saving of 30,000 tonnes bulbs could be obtained. In addition to this, the bulbs must be bolder in size with attractive pink in colour for consumer attraction. Considering the bottlenecks, breeding programme was initiated to develop a seed setting onion type with attractive pink coloured bulbs to meet the demands of domestic and export markets. Based on the results of different phases of evaluation, the overall performance of Aggregatum onion culture Aca 15 is better for the highest mean yield per hectare (19.10 t) when compared (15.10 t) to the check variety Co (On)5 and the per cent increase over CO(On) 5 (Check) is 20.94. The organoleptic evaluation was done based on nine point hedonic scale. Based on the organoleptic test, Aca15 recorded maximum score 9 points for colour and flavour and 8 points appearance, texture and taste. However, the check variety Co(On)5 recorded 7 points for colour, appearance, texture and taste. The bulbs are bolder in size, attractive pink in colour. Each clump has 5 - 7 bulblets. Dry pinkish scale leaves are arranged compactly on the bulbs and bulblets and moderately resistant to purple blotch disease and thrips under field condition. Considering the best performance on bulb yield and quality Aca15 is released as CO 6 during 2020 for the benefit of onion growing regions of Tamil Nadu and other South Indian states.

Keywords

Aggregatum
onion,
CO 6,
Seed,
Bulb

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Introduction

Multiplier onion or Aggregatum onion (*Allium cepa* var. *aggregatum* L.) is one of the important bulbous vegetable cultivated in India. Commercially, there are two types of onion are being cultivated in India viz.,

common onion or big onion (*Allium cepa* var. *cepa* L.) which is cultivated in larger scale in Maharashtra and Karnataka. The second type of onion is known as aggregatum onion or multiplier onion or small onion (*Allium cepa* var. *aggregatum* L.). The aggregatum onion produces many number of smaller sized

bulbs in cluster form and mostly preferred for their tolerance to pest and diseases and longest storage life than common onion (Brewster, 2008, Anbukkarasi *et al.*, 2012, Anbukkarasi *et al.*, 2013, Pugalendhi *et al.*, 2011a, Pugalendhi *et al.* 2011b.). Onion possess Quercetin and volatile sulfur compounds which helps in anemia, skin disorders, stomach cancer, eye infection, prevent asthma attack (Ahmed and Bassuorry, 2009 and Lanzotti *et al.*, 2012). The bulb provides 2.0 g protein, 72 mg calcium and 54 mg phosphorus. It also contains vitamins *viz.*, thiamine, riboflavin and niacin and is used for its medicinal value especially in the case of heart problems (Mettananda and Fordham, 2001 and Shabina *et al.*, 2020).

During 2018-19, onion is cultivated in an area of 21.85 lakh ha with the production of 232.62 lakh tons (National Horticultural Board, 2019). The major Onion producing states are Maharashtra, Madhya Pradesh, Karnataka, Bihar, Rajasthan, Andhra Pradesh, Haryana, West Bengal, Gujarat and Uttar Pradesh in the country. These States account for almost 90% of the total onion production of the country. The aggregatum onion is one of the most important commercial vegetable crop grown in South India especially in Tamil Nadu and Karnataka. Large scale cultivation of onion is being done through drip fertigation method (Savitha *et al.* 2008, Savitha *et al.*, 2010 and Savitha *et al.*, 2012). The aggregatum onion accounts for nearly 75 percent of the total onion produced in Tamil Nadu with an average productivity of 12 tonnes per hectare. Onions contain phenolics and flavonoids that have potential antiinflammatory, anticholesterol, anticancer and antioxidant properties. Onion is highly nutritional and it is used for lowering the toxigenicity of oils. It also shows chemopreventive effects and lowers down the risk of effect on gastric cancer.

Onion is mainly propagated through bulbs

and approximately 1000 kg of bulb is required for planting in one hectare of area. Huge quantities of onion bulbs are wasted for propagation purpose. Co(On)5 is propagated through seeds (Veeraragavathatham *et al.*, 2006 and Pugalendhi and Thangamani, 2011). By switching over from bulb propagation method to seed, there is a saving of seed bulb to a tune of 1000 kg/ha. As aggregatum onion is being cultivated in 30,000 hectares in Tamil Nadu, a saving of 30,000 tonnes bulbs could be obtained. In addition to this, the bulbs must be bolder in size with attractive pink in colour for consumer attraction. Considering the bottlenecks, breeding programme was initiated to develop a seed setting onion type with attractive pink coloured bulbs to meet the demands of domestic and export markets.

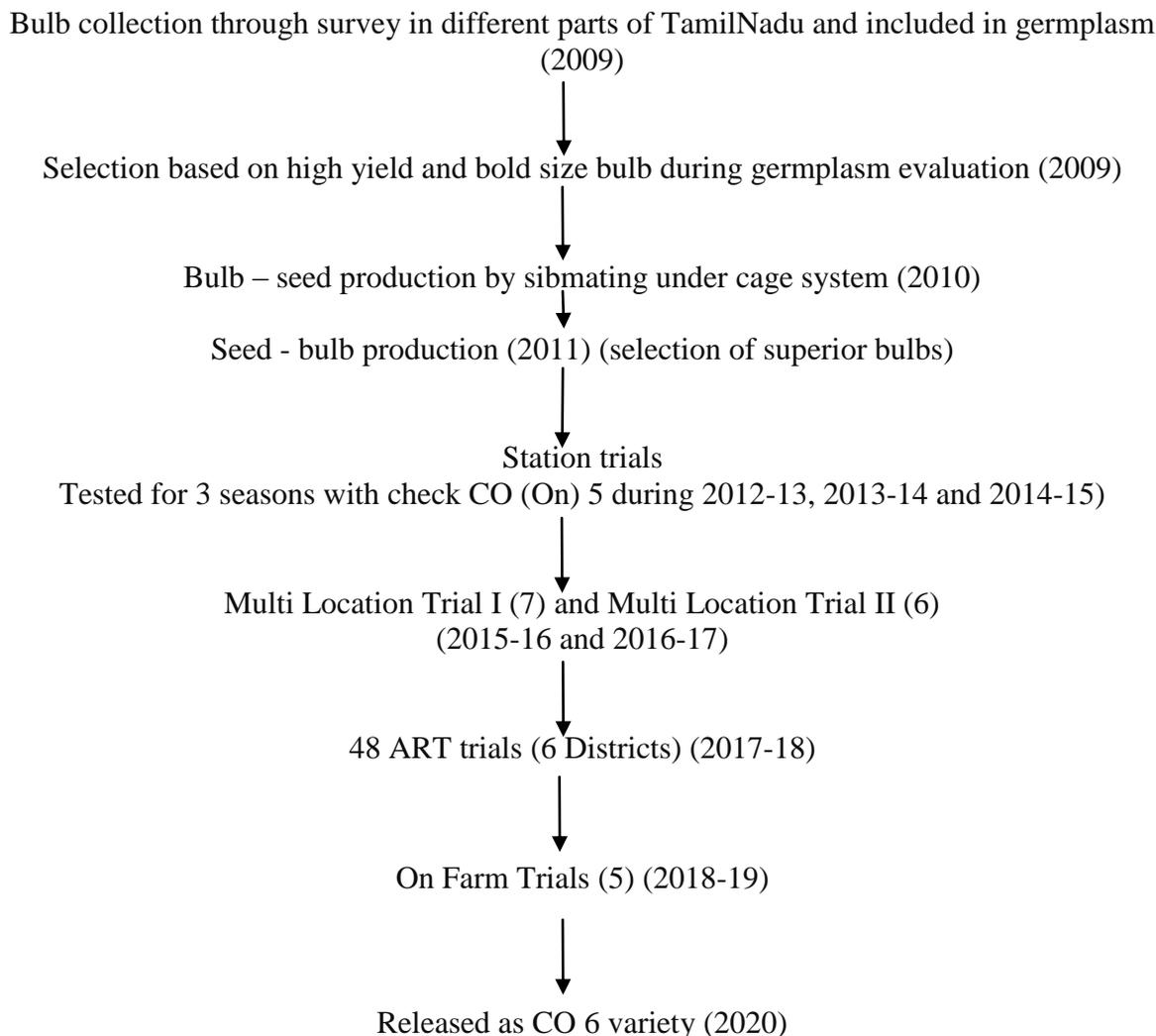
Materials and Methods

The breeding of aggregatum onion is carried out at College Orchard, Department of Vegetable Crops, HC&RI, TNAU, Coimbatore. The survey has been made for the collection of bulbs in different parts of Tamil Nadu and the collected accessions were included in germplasm. The collected accessions were raised individually to study their performance for growth and yield parameters. The selection is done based on high bulb yield and bold sized bulbs and resistant to major pest and diseases. The bulbs of better performing accessions were raised for seed production by caging technique. The seeds obtained from the individual accessions were thrashed and cleaned and used for raising bulb crop in the subsequent season for the selection of identical superior bulbs. The best accession was compared with the check variety CO (On)5 for three seasons. Based on their performance Multi Location Trial (MLT), Adoptive Research Trial (ART) and On Farm Trials (OFT) were conducted. The statistical analysis was done by adopting the standard procedures of Panse and Sukhatme

(1985). The critical difference was worked out at five per cent (0.05) probability. The pooled mean analysis was carried out with

AGRES software package and MS Excel spreadsheet.

Details of Evolution



Results and Discussion

Yield is a complex trait influenced by many factors. In onion, the important yield contributing characters are mean weight of bulblets and bulb diameter. The variations in marketable yield of different varieties could be due to their differences in genetic make-up (Pavlovic *et al.*, 2003) and agro ecological adaptations. In Aca15, the maximum clump weight (72.30, 80.20 and 89.80 g) was

recorded during 2012, 2013 and 2014. Clump weight is the most important component that contributes directly to the yield of aggregatum onion (Shoba Thingalmaniyan *et al.*, 2017). The highest clump weight in this accession may be due to its genetic character and adaptability to agro-climatic conditions by the place of the experiment. Results of the present findings are in accordance with the findings of Boukary *et al.*, (2012) and Moulin *et al.* (2012).

The percent purple blotch incidence was less (11.50, 12.70 and 11.90) in Aca15 when compared to Co (On)5 (12.70, 14.00 and 16.30) the check variety respectively during 2012, 2013 and 2014. Similarly, the percent thrips incidence was also lesser (36.70, 39.30 and 40.20) when compared to Co (On)5 (55.30, 57.70 and 56.50) respectively during 2012, 2013 and 2014 (Table.1). During the process of varietal development, 69 trials were conducted, of which 13 MLT, 48 ART and 50 OFT in onion growing regions. In Aca15, the mean bulb yield is 19.10 t/ha, while Co(On)5 (Check variety) recorded 15.10 t/ha and the per cent increase over Co(On)5 is 20.94.

In MLT-1, the highest bulb yield of 14.70 (t/ha) was recorded in Aca15 than the check variety Co(On)5 (11.20 t/ha). Similarly in MLT-2, the highest bulb yield of 16.87 (t/ha) was recorded in Aca15 than the check variety CO (On)5 (13.13 t/ha) (Table.2). In Adaptive Research Trial, the highest clump weight (93.22 g), bulb yield per plot (13.23 kg/plot) and total bulb yield (19.51 t/ha) was recorded in Aca15. However, the lowest clump weight (75.25 g), bulb yield per plot (10.27 kg/plot) and total bulb yield (15.29 t/ha) was recorded in Co(On)5 (Table.3). The overall performance of aggregatum onion culture Aca15 is better for highest mean yield per hectare (19.10 t) when compared (15.10 t) to the check variety Co (On)5 and the per cent increase over CO(On) 5 (Check) is 20.94

(Table.4). Mean performance serves as an important criterion in eliminating the undesirable types in a selection programme. The results of the present investigation revealed that there exists significant difference for growth, yield and quality characters among the different cultivars of multiplier onion (Shoba Thingalmaniyan *et al.*, 2017 and Fathima *et al.*, 2019).

The crop performs differently under varied agro-climatic conditions and various cultivars of the same species grown even in the same environment give different yields as the performance of a cultivar mainly depends on the interaction of genetic makeup and environment (Boukary *et al.*, 2012). Ijoyah *et al.* (2008) evaluated the yield performance of four onion varieties and found that some other varieties performed better than the commonly grown onion varieties by the farmers. The quality parameters, viz., TSS, ascorbic acid and pyruvic acid contents mainly decide the quality and nutritive value of onion bulbs. Total soluble solids, an important quality criterion for onions, contribute towards flavours (Sharma *et al.*, 1996) and processing quality. With respect to quality parameters, Aca15 recorded the highest TSS content with 15.4 °B with ascorbic acid content of 10.80 mg/g (Table.5). The higher TSS value in these genotypes may be due to its inherent characteristics. Similar results were observed by Pavlovic *et al.*, 2003.

Table.1 Performance of aggregatum onion cultures for bulb yield, purple blotch and thrips incidence

Particulars	2012		2013		2014	
	Aca15	CO(On)5 (Check)	Aca15	CO(On)5 (Check)	Aca15	CO(On)5 (Check)
Average clump weight(g)	72.30	69.20	80.20	70.00	89.80	69.70
Total yield (t/ ha)	20.00	15.10	20.50	15.80	22.80	17.80
Per cent purple blotch disease incidence	11.50	12.70	12.70	14.00	11.90	16.30
Per cent thrips incidence	36.70	55.30	39.30	57.70	40.20	56.50

Table.2 Performance of aggregatum onion cultures in Multilocational trials

S.No.	Centres	Average clump weight (g)				Total yield (t/ha)			
		MLT 1 (2016)		MLT 2 (2017)		MLT 1 (2016)		MLT 2 (2017)	
		Aca 15	CO(On)5 (Check)	Aca 15	CO(On)5 (Check)	Aca 15	CO(On)5 (Check)	Aca 15	CO(On)5 (Check)
1.	HC & RI, Periyakulam	91.60	73.25	95.60	78.30	21.26	16.10	20.80	17.00
2.	ARS, Bhavanisagar	89.80	69.80	7.00	24.00	19.50	14.50	4.20	3.60
3.	KVK, Sirugamani	102.00	75.00	--	--	12.50	10.00	--	--
4.	RRS, Paiyur	53.50	44.50	135.60	123.40	3.10	2.08	14.46	9.72
5.	TCRS, Yethapur	89.40	77.60	--	--	22.60	17.10	--	--
6.	KVK, Sandhiyur	92.60	77.30	--	--	21.80	16.10	--	--
7.	ARS, Vrinjipuram	39.23	41.21	--	--	2.17	2.54	--	--
8.	KVK, Vamban	--	--	91.70	76.90	--	--	21.60	16.30
9.	VRS, Palur	--	--	91.60	78.50	--	--	20.00	17.00
10.	AC & RI, Killikulam	--	--	89.85	78.81	--	--	20.15	15.14
Mean		79.73	65.52	85.23	76.65	14.70	11.20	16.87	13.13

Table.3 District wise performance of aggregatum onion cultures in Adoptive Research Trials (2017-2018)

Sl. No.	Centre	No. of trials	Average clump weight (g)		Bulb yield/plot (Kg)		Total bulb yield (t/ha)	
			Aca 15	CO(On)5 (Check)	Aca 15	CO(On)5 (Check)	Aca 15	CO(On)5 (Check)
1	Erode*	10	122.10	90.00	37.54	29.15	15.04	11.66
2	Coimbatore	8	91.16	72.47	9.32	7.12	20.65	16.00
3	Tiruppur	8	91.25	74.36	9.36	7.67	20.97	16.12
4	Madurai	2	84.66	71.46	7.50	5.71	20.30	15.80
5	Theni	10	81.70	68.57	7.11	5.21	19.28	16.32
6	Cuddalore	10	88.45	74.62	8.56	6.78	20.80	15.84
Mean		48	93.22	75.25	13.23	10.27	19.51	15.29

* Plot size adopted is 5 m x 5 m, all other districts 3 m x 2 m was followed

Table.4 Overall performance of aggregatum onion cultures for mean bulb yield per hectare (t)

Particulars	No. of trials	Mean bulb yield per hectare (t)	
		Aca 15	CO (On)5 (Check)
HC & RI, Coimbatore	3	21.10	16.58
MLT	13	15.79	12.16
ART	48	19.51	15.40
OFT	5	19.96	16.20
Overall Mean	69	19.10	15.10
Per cent increase over CO(On) 5 (Check)	-	20.94	-

Table5 Quality parameters and organoleptic evaluation of aggregatum onion cultures

Particulars	Aca15	CO(On)5
Quality parameters		
TSS° (Brix)	15.40	13.20
Ascorbic acid content (mg/g)	10.80	8.07
Organoleptic evaluation*		
Colour	9	7
Appearance	8	7
Flavour	9	8
Texture	8	7
Taste	8	7
* Based on nine point hedonic scale		

Table.6 Artificial screening for Purple blotch disease (spore suspension method) and Thrips incidence

SL. No.	Cultures	No. of plants inoculated	No. of plants expressed symptoms					
			Purple blotch disease by spore suspension method			Thrips incidence		
			10 days	20 days	30 days	10 days	20 days	30 days
1	Aca15	10	5	5	5	6	6	6
2	CO(On)5 (Check)	10	5	6	6	7	7	7

The organoleptic evaluation was done based on nine point hedonic scale. Based on the organoleptic test, Aca15 recorded maximum score 9 points for colour and flavour and 8 points appearance, texture and taste. However, the check variety Co(On)5 recorded 7 points for colour, appearance, texture and taste. In onion, bulb colour is an important character because it decide the consumer preference. The difference in the bulb colour of variety is due to their genetic nature. These results were in conformity with the findings of Boukary *et al.* (2012) and Azoom *et al.* (2014). The bulbs of Aca15 are bolder in size, attractive pink in colour. Each clump has 5 - 7 bulblets. Dry pinkish scale leaves are arranged compactly on the bulbs and bulblets and moderately resistant to Purple Blotch and Thrips under field condition (Table.6).

The major reasons for the low productivity of onion are the paucity of varieties adapted to different agro-climatic situations and growing conditions and the incidence of pests and

diseases. Among the pests, onion thrips is important and it is not only a damaging pest but also act as a vector for viral diseases. Based on the consistent performance for bulb yield, quality and seed setting type, Aca15 is released as CO 6 during 2019-20 for the benefit onion growing regions of Tamil Nadu.

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