



P-ISSN: 2349-8528
 E-ISSN: 2321-4902
 IJCS 2018; 6(3): 3428-3431
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 Received: 04-03-2018
 Accepted: 08-04-2018

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Evaluation of small onion varieties for their suitability in cauvery delta region in Tamil Nadu

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Abstract

A field experiment was conducted at Soil Water Management and Research Institute, Thanjavur during 2014-16 in randomized block design at two seasons (namely Summer and Kuruvai (kharif)) to select the high yield performing small onion varieties for Cauvery Delta region. Seven small onion varieties were tested with three replications in two seasons. Different varieties include CO (On) 4, CO (On) 5, Arka Bindu, Agri Found Rose, Perambalur Local, Cuddalore Local and Ottanchatram Local. The results revealed that onion varieties varied significantly with season, yield and duration. The variety Perambalur Local showed earliness in sprouting of onion seeds (5.30 days and 4.82 days in summer and kuruvai respectively) and registered highest plant height at peak vegetative, bulb formation and bulb filled stage. The difference between the plant height at vegetative stage and bulb formation stage was higher than the bulb formation and bulb filled stage for all the varieties. Perambalur Local (T₅) showed faster growth rate than other varieties followed by Arka Bindu (T₃). Also Perambalur Local (T₅) registered improved bulb parameters like neck thickness (3.25 cm and 3.67 cm), neck diameter (3.19 cm and 3.47 cm), equatorial diameter (5.18 cm and 5.88 cm), bulb weight (30.93 g and 38.13 g) during summer and Kuruvai season. Yield parameters of small onion varieties indicated that Perambalur Local variety matured first and ready to harvest on 103.80th day after sowing during summer and 96.27th day during Kuruvai and yielded 19.25 t/ha in summer and 21.48 t/ha at kuruvai season. It implies that when compared with the season, Kuruvai registered early maturation than summer while CO (On) 5 (T₂) took maximum number of 116.96 days for harvest in both the seasons. Better performance might be due to improved growth and yield parameters by prevailing of conducive climate throughout the cropping period during Kuruvai season. It was concluded from the study that onion variety Perambalur Local followed by Arka Bindu had better performance by registering improved yield characteristics and this may be recommended for commercial cultivation for Cauvery Delta region.

Keywords: Small onion; performance evaluation; bulb yield; cauvery delta region

Introduction

Onion is one of the most important crops among the vegetable crops in Tamil Nadu. In India, it was grown in 12.00 lakh ha with a production of 215.64 lakh MT during 2016-17 with an average productivity of 10.81 MT/ha (Horticulture at a glance, 2017) [4]. According to the National Horticultural Board, in Tamil Nadu onion was grown in 0.38 lakh hectares and produced 4.29 lakh tonnes in 2012-13 which is 1.6 per cent higher in area and 22.8 per cent lesser in production compared to previous year. Tamil Nadu accounted for five per cent of country's area under onion and more than 70 per cent of the area is cultivated by small onion (*A. cepa* var. *aggregatum*). Around 90 per cent of country's small onion is produced from Tamil Nadu and 10 percent from Karnataka. Both Kerala and Tamil Nadu together consumption and exports accounts the total small onion produced in Tamil Nadu. Geographically Cauvery Delta Zone lies in the Eastern part of Tamil Nadu. In this zone, rice is the predominant and principal crop. There is uncertainty in the receipt of water in the Cauvery in recent years. So the promotion of small onion cultivation will be an alternative crop by consuming less water and gives better income during Kuruvai. Under this situation it is essential to identify an alternate crop which is more income oriented and less water consuming crop when compared to paddy during Kuruvai season. Onions both Bellary and small types are the best alternate crops as they have performed well in previous Integrated Farming System trials. For commercial exploitation of onion, it is necessary to make an attempt on the collection and evaluation of onion varieties suitable for New CDZ under different seasons. A cultivar crop performs differently under different agro-climatic conditions and various cultivars of the same species grown in the same environment give different yields as the

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performance of the cultivar mainly depends on the interaction of genetic makeup and environment. The hybrid varieties have a good potential to produce double yield when compared to a local variety (Singh *et al.*, 2011) [15]. Hence, the objective of this study was to study the performance of small onion varieties that are suitable in Kuruvai and summer in this zone.

Materials and methods

A field experiment was conducted at Soil Water Management and Research Institute, Thanjavur during 2014-16 in randomized block design at two seasons to study the performance small onion varieties for their suitability in Cauvery Delta region. Seven small onion varieties were tested with three replications in Kuruvai and Summer seasons. Each variety was considered as a treatment. This includes CO 4 (T₁), CO (On) 5 (T₂), Arka Bindu (T₃), Agri Found Rose (T₄), Perambalur Local (T₅), Cuddalore Local (T₆) and Ottanchatram Local (T₇). For summer crop, small onions are planted during December - March and January - September for Kuruvai crop. The cultural practices were followed as per the recommendation from the Tamil Nadu Agricultural University crop production manual. The growth parameters such as days for sprouting, plant height at critical stages and bulb characters like neck thickness, diameter of neck,

equatorial diameter of bulb, bulb weight, days for harvesting and bulb yield were recorded in ten plants from each treatment in each replication. The data were statistically analyzed as per the method suggested (Panse and Sukhatme, 1985) [9]. The critical differences were worked out for 5 per cent (0.05) and 1 per cent (0.01) probability and the mean differences were compared using LSD test.

Results and discussion

Performance of small onion varieties on growth parameters

The mean performance of small onion varieties on growth parameters were recorded and given in the Table 1. The pooled mean on days for sprouting revealed that the varieties varied significantly at 1 and 5 per cent level of significance. The variety Perambalur Local showed earliness in sprouting of onion seeds (5.30 days during summer and 4.82 days during Kuruvai). CO 4 took maximum number of 7.23 days for sprouting during summer and in Kuruvai. The earliness in sprouting might due to prevailing of ideal temperature, relative humidity and rainfall during the cropping seasons. The results are in accordance with Rohini *et al.* (2016) [12] in small onion reported that environmental parameters influence the onion sprouting.

Table 1: Per se performance of small onion varieties on earliness in sprouting

Treatments		Days for sprouting					
		Summer			Kuruvai		
		2015	2016	Pooled Mean	2015	2016	Pooled Mean
T ₁	Co 4	7.58	6.88	7.23	6.02	6.39	6.21
T ₂	CO(On)5	6.01	6.19	6.10	5.74	5.68	5.71
T ₃	Arka Bindu	5.75	5.83	5.79	4.68	5.91	5.30
T ₄	Agri Found Rose	7.25	6.08	6.67	5.13	6.40	5.77
T ₅	Perambalur Local	4.93	5.67	5.30	4.52	5.12	4.82
T ₆	Cuddalore Local	6.27	6.73	6.50	5.37	6.11	5.74
T ₇	Ottanchatram Local	6.66	6.55	6.61	4.74	6.75	5.75
	SEM±	0.3355	0.336	0.245	0.267	0.328	0.298
	CD(p=0.01)	0.671	0.670	0.487	0.534	0.656	0.592
	CD(p=0.05)	0.485	0.476	0.340	0.383	0.469	0.420

The plant height at critical stages of the onion crop exhibited significant differences among the season (Table 2 & 3). The pooled mean data revealed that, T₅ (Perambalur Local) recorded the highest plant height at all the stages invariably in both the seasons. This is followed by T₃ (Arka Bindu), T₄

(Agri Found Rose), T₆ (Cuddalore Local) and T₇ (Ottanchatram Local) registered higher values. The performance of varieties during Kuruvai was better performance for growth parameters than the summer.

Table 2: Per se performance of small onion varieties on plant height during summer season

Treatments		Summer								
		Peak Vegetative			Bulb formation stage			Bulb filled stage		
		2015	2016	Pooled Mean	2015	2016	Pooled Mean	2015	2016	Pooled Mean
T ₁	Co 4	7.29	8.54	7.91	13.41	11.35	12.38	14.48	14.72	14.60
T ₂	CO(On)5	6.72	7.18	6.95	11.27	13.07	12.17	14.95	20.18	17.56
T ₃	Arka Bindu	10.61	10.69	10.65	13.52	15.91	14.71	17.23	21.71	19.47
T ₄	Agri Found Rose	10.18	8.84	9.51	12.96	10.18	11.57	17.15	16.95	17.05
T ₅	Perambalur Local	10.98	11.23	11.11	16.33	16.50	16.41	17.74	23.37	20.55
T ₆	Cuddalore Local	9.63	9.76	9.69	11.71	14.75	13.23	16.19	18.08	17.14
T ₇	Ottanchatram Local	9.88	10.14	10.01	13.06	13.27	13.16	16.01	16.88	16.44
	SEM±	0.5565	0.572	0.504	0.7685	0.834	0.502	0.936	1.152	0.976
	CD(p=0.01)	1.113	1.143	1.005	1.537	1.668	1.003	1.872	2.302	1.950
	CD(p=0.05)	0.799	0.810	0.713	1.093	1.188	0.718	1.334	1.643	1.391

Table 3: Per se performance of small onion varieties on plant height during Kuruvai season

Treatments	Kuruvai									
	Peak Vegetative			Bulb formation stage			Bulb filled stage			
	2015	2016	Pooled Mean	2015	2016	Pooled Mean	2015	2016	Pooled Mean	
T ₁	Co 4	8.28	7.56	14.60	15.33	13.66	14.50	20.69	21.47	21.08
T ₂	CO(On)5	7.64	8.24	17.56	12.88	13.5	13.19	21.35	19.13	20.24
T ₃	Arka Bindu	12.06	13.15	19.47	15.45	16.03	15.74	24.62	22.25	23.44
T ₄	Agri Found Rose	11.57	11.97	17.05	14.81	13.72	14.27	24.50	23.39	23.95
T ₅	Perambalur Local	12.48	13.08	20.55	18.66	20.64	19.65	25.34	26.75	26.05
T ₆	Cuddalore Local	10.94	11.86	17.14	13.38	15.19	14.29	23.13	20.92	22.03
T ₇	Ottanchatram Local	11.23	11.91	16.44	14.92	16.57	15.75	22.87	23.43	23.15
	SEm±	0.635	0.682	0.976	0.876	0.969	0.582	1.336	1.321	1.252
	CD(p=0.01)	1.269	1.361	1.950	1.751	1.936	1.163	2.671	2.642	2.503
	CD(p=0.05)	0.909	0.971	1.391	1.258	1.370	0.823	1.900	1.883	1.789

The difference between the plant height at vegetative stage and bulb formation stage was higher than the bulb formation and bulb filled stage. Perambalur Local (T₅) showed faster growth rate than any other varieties followed by Arka Bindu (T₃). The increase in plant height might be due to regulation of temperature via stomatal opening/closing and controlled transpiration by increased temperature (Kimani *et al.*, 1993)^[5] and Bindu & Bindu Podikunju (2015)^[2] also opined that optimum temperature improves the relative growth rate of the crop. According to [6] the difference in height of the plant on onion is mainly attributed to the genetic potential but also to environmental factors especially temperature and photoperiod (Tesfy *et al.* 2011)^[16].

Performance of small onion varieties on bulb and bulb yield

The yield parameters exhibited significant differences at both the seasons (Table 4a & 4b) at 5 & 1 per cent level of

significance. The bulb parameters such as neck thickness, neck diameter, and equatorial diameter of bulb and weight of bulb were varied significantly among the varieties. The highest neck thickness was registered in Perambalur Local (3.25 cm and 3.67 cm) in Summer and Kuruvai respectively. This was followed by Arka Bindu and CO (On) 5. The pooled mean analysis of neck diameter, equatorial diameter of bulb and bulb weight revealed that varieties exhibited significant variants. Among the varieties, Perambalur Local registered highest neck diameter (3.19 cm and 3.47 cm); equatorial diameter (5.18 cm and 5.88 cm) and bulb weight (30.93 g and 38.13 g). The increase in bulb diameter results in higher yield. Similar results were obtained by Shoba Thingalmaniyan *et al.* (2017)^[13] and Thamburaj *et al.* (1976)^[17]. Singh (1990)^[14] indicated the importance of bulb diameter for higher bulb yield. Similarly, analogous results were founded for diameter of bulb by Moulin *et al.* (2012)^[7] working on different varieties of melon, tomato, pepper and potato.

Table 4a: Per se performance of small onion on bulb parameters

Treatments	Neck thickness (cm)						Diameter of neck (cm)						
	Summer			Kuruvai			Summer			Kuruvai			
	2015	2016	Pooled Mean	2015	2016	Pooled Mean	2015	2016	Pooled Mean	2015	2016	Pooled Mean	
T ₁	Co 4	1.96	1.50	1.73	2.17	1.98	2.08	1.91	2.28	2.10	3.13	2.79	2.96
T ₂	CO(On)5	2.67	2.88	2.78	1.95	3.27	2.61	3.08	2.56	2.82	1.60	2.97	2.29
T ₃	Arka Bindu	3.44	2.75	3.10	3.43	3.43	3.43	3.61	2.63	3.12	3.67	3.05	3.36
T ₄	Agri Found Rose	3.03	2.08	2.56	2.98	2.76	2.87	3.49	2.01	2.75	3.43	2.83	3.13
T ₅	Perambalur Local	3.57	2.93	3.25	3.83	3.50	3.67	3.64	2.73	3.19	3.75	3.18	3.47
T ₆	Cuddalore Local	2.82	1.31	2.07	3.14	2.25	2.70	2.75	1.99	2.37	3.26	2.37	2.82
T ₇	Ottanchatram Local	2.17	2.14	2.16	2.75	2.74	2.75	2.57	2.10	2.34	3.08	2.54	2.81
	SEm±	0.179	0.144	0.159	0.181	0.177	0.176	0.180	0.139	0.157	0.188	0.165	0.179
	CD(p=0.01)	0.358	0.286	0.317	0.361	0.353	0.350	0.360	0.276	0.313	0.375	0.328	0.358
	CD(p=0.05)	0.252	0.208	0.223	0.266	0.248	0.251	0.256	0.197	0.227	0.263	0.233	0.252

Table 4b: Per se performance of small onion on bulb parameters

Treatments	Equatorial diameter of bulb (cm)						Weight of bulb (g)						
	Summer			Kuruvai			Summer			Kuruvai			
	2015	2016	Pooled Mean	2015	2016	Pooled Mean	2015	2016	Pooled Mean	2015	2016	Pooled Mean	
T ₁	Co 4	4.10	3.95	4.03	4.12	3.81	3.97	8.00	11.26	8.53	9.52	18.75	14.14
T ₂	CO(On)5	3.55	4.77	4.16	4.45	5.20	4.83	19.42	29.03	20.97	22.15	31.56	26.86
T ₃	Arka Bindu	4.66	5.31	4.99	4.64	5.44	5.04	28.63	30.52	29.34	31.89	36.28	34.09
T ₄	Agri Found Rose	4.58	4.03	4.31	4.73	4.45	4.59	17.50	22.19	18.27	24.33	25.42	24.88
T ₅	Perambalur Local	4.86	5.50	5.18	5.97	5.79	5.88	30.59	32.75	30.93	36.17	40.09	38.13
T ₆	Cuddalore Local	4.45	4.26	4.36	5.01	4.70	4.86	18.35	25.09	19.19	26.67	27.50	27.09
T ₇	Ottanchatram Local	3.77	5.09	4.43	5.56	5.32	5.44	22.07	24.89	22.52	28.97	28.73	28.85
	SEm±	0.248	0.284	0.255	0.295	0.299	0.298	1.372	1.623	1.748	1.698	1.924	1.632
	CD(p=0.01)	0.496	0.567	0.509	0.589	0.598	0.595	2.744	3.244	3.495	3.396	3.846	3.262
	CD(p=0.05)	0.355	0.409	0.352	0.416	0.427	0.428	1.956	2.311	2.493	2.422	2.748	2.327

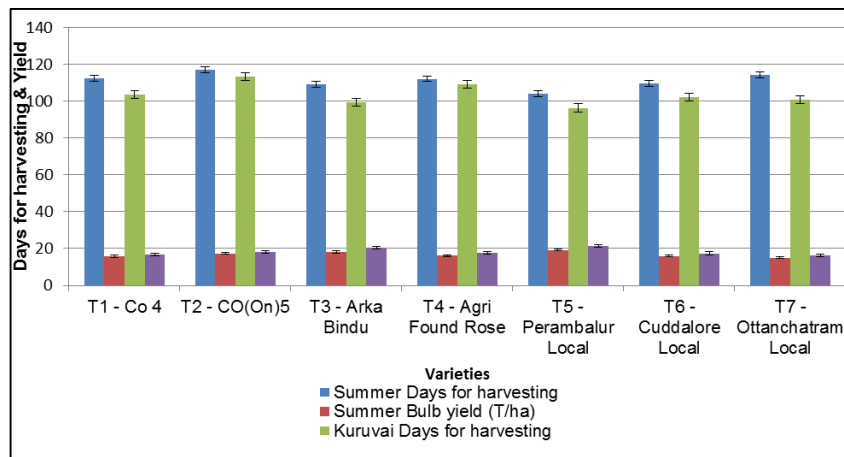


Fig 1: Performance of small onion on days taken for harvesting and bulb yield

The pooled mean revealed that variety Perambalur Local (T₅) matured first and ready for harvest on 103.80 days during summer and 96.27th day during Kuruvai. It implies that when comparing with the seasons, Kuruvai registered early maturation than summer. Treatment (T₂) took maximum number of 116.96 days for harvest in both the seasons. The difference in the bulb yield of genotypes is due to their genetic nature. These results were inconformity with the findings of Rivera Martínez *et al.* (2005) [11], Nilufar (2009) [8], Boukary *et al.* (2012) [3] and Azoom *et al.* (2014) [1].

Yield is the complex character influenced by many factors. In onion the yield associating characters are bulb weight and bulb diameter. Bulb yield per ha was highest in Perambalur Local (T₅) recorded 19.25 t/ha in Summer and 21.48 t/ha during Kuruvai. This was followed by CO (On 5) (T₂) yielded 17.40 t/ha and 20.30 t/ha during Kuruvai in Arka Bindu. The pooled mean of bolting percentage exhibited significant differences at 5 and 1 per cent level of significance. The recorded variations of varieties in marketable yield could be due to their differences in genetic make-up (Pavlovic *et al.*, 2003) and agro ecological adaptations.

It was concluded from the study that onion variety Perambalur Local followed by Arka Bindu had better performance by registering improved yield characteristics and this may be recommended for commercial cultivation for Cauvery Delta region.

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