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Evaluation of Onion Landraces (*Allium cepa* L.) of Karnataka for Yield and Quality Parameters during *Rabi* Season

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ABSTRACT

The experiment Evaluation of onion landraces (Allium cepa L.) of Karnataka for yield and quality parameters during Rabi season was carried out during Rabi seasons 2015-16 at College of Horticulture, Kolar, Karnataka. In present investigation twenty five landraces were collected from all over Karnataka and evaluated by following RCBD with two replications. The growth characters appeared significant differences among the landraces evaluated. The genotype Kotturu Local exhibited maximum plant height (64.89 cm) and leaf length (60.21 cm). The maximum leaf width was noticed in the genotype Bellary Red (12.80). Of different genotypes, no double bulbs were registered in case of Kumata Sweet Onion, Thumbaraguddi Local, Rampur Local and Arka Kalyan. While, Bengaluru Rose Onion registered lowest collar thickness of 1.11 cm followed by Kumata Sweet Onion (1.16 cm). However, the genotype maximum number of rings per bulb was recorded in cultivar Mogalahalli Local (10.00) and Arka Kalyan (1.10) registered minimum number of centres. The quality parameters like TSS (16.80 ºbrix) and pungency (6.50 µmol./g FW) was recorded maximum in genotype Kumata Sweet Onion. While, dry mater content was observed maximum in GBD-Bindu (21.75 %). No bolting per cent was recorded in Belagavi White Onion and Thumbaraguddi Local. With respect to yield parameters, The maximum average ten bulb weight was recorded in Kadarakoppa Local (1230.00 g). However, the maxmum bulb yield per hectare was obtained in genotype Kottur Local (35.34 t/ha). Considering the performance of different landraces with respect to growth, yield and quality traits Kotturu Local, Bellary Red and Kadarakoppa Local were performed best for Rabi season cultivation.

Key words: *Allium cepa, Yield, Genotype, Onion*

INTRODUCTION

Onion (*Allium cepa* L.) is one of the most important vegetable crop whose leafy portion as a vegetable, bulbs as salad and spice are used daily. In Karnataka, onion is produced throughout the year and cultivated in an area of 159.60 million hectares with the production of 2395.60 million tonnes and productivity of 15.40 tonnes per hectare.

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In India, total production of onion is 16,813 metric tonnes, obtained in an area of 1051.50 million hectare. While, Maharashtra state stands first with production of 4,660 metric tonnes and Gujarat recorded highest productivity of 24.40 tonnes per hectare. Moreover, onion cultivars reveal wide variation in their yielding ability and potential when grown under varied agro-climatic zones of the country.

In India, of total annual onion production about 50 per cent comes from *Rabi* season harvested in April to May, 30 per cent from late *Kharif* season harvested in January to February and remaining 20 per cent from *Kharif* season onion harvested in October to November months. The *Rabi* season crop harvested in April to May is stored all over the country and slowly made available for domestic supply as well as for export up to October to November. There is a critical gap of supply in the country from October to December and as a result the onion price shoot up every year. Therefore identifying the suitable genotype with high adoptability is more important to catch market demond with high yield.

During *Rabi* season, cultivation of onion is undertaken on large scale in the Karnataka owing to suitable climatic conditions. However, due to more profitability in growing onion during *Rabi* season, it is gaining popularity among the farmers. In addition there are few varieties of onion are suitable for cultivation during *Rabi* season and some local types available all over Karnataka which are suitable for *Rabi* season with high yield and good quality. Therefore keeping the above points in view, the present investigation was undertaken to ascertain the yield potential of 25 landraces and also to study their processing qualities under irrigated situation during *Rabi* seasons in the Eastern Dry Zone of Karnataka.

MATERIALS AND METHODS

In order to collect the onion genotypes for the present investigation, an exploration was under taken and visited farmers fields of major onion growing areas in many districts of Karnataka. One Landrace was collected from Bidar district (Bidar Local), two landraces from Bagalkot district (Jamakandi Local and Kadarakoppa Local), one landrace from Belagavi district (Belagavi White Onion), one landrace from Dharwad district (Telagi White Onion), four landrace from Bellary district (Kotturu Local, Thumbarguddi Local, Rampur Local and Bellary Local), five landraces from Chitradurga district (Challakere Local, Molakalmuru Local, Mogalahalli Local and Hanumanthanahalli Local), three landraces from Chikkamagaluru district (Kadur Local, Kadur Local-2012 and Kadur Local-RVG), two landraces from Uttarakannada district (Kumata Sweet Onion and Handhigona Local), six landraces from Chikkaballapura district (Bengaluru Rose Onion, Chinthamani Local, Cheluru Local, Gouribidanuru Local, GBD Bindhu and Bagepalli Local) and one variety Arka Kalyan was collected from Indian Institute of Horticulture Research (IIHR), Hesaraghatta, Bengaluru. Totally 25 landraces were used in the present investigation to evaluate for various growth, yield and quality traits. The experiment was laid out in Randomized Block Design with two replications during *Rabi* 2015-16. The seeds of different onion genotypes were sown in plastic pro-trays filled with coir pith as a rooting media during first week of November 2015 in low cost polyhouse and transplanted in the 31st December 2015. In each experimental plot consisted of 10 rows for every treatment. The plot size was 2.0 mx 1.5m. The plants were transplanted at a row to row spacing of 15 cm and plant to plant spacing of 10 cm. The recommended dosage of fertilizers were applied with following the production practices during the cropping period. Observations were recorded on five randomly selected plants in each treatment. The measurements on vegetative parameters were recorded on plant height (cm), number of leaves, leaf length (cm), leaf width (cm), collar thickness (cm), neck thickness (cm), number of rings, number of centers. The quality parameters like TSS, pungency, dry mater

content, yield characters like average bulb weight (g) ten bulb weight, bulb yield (t/ha), marketable bulb yield and unmarketable bulb yield (t/ha).

RESULTS AND DISCUSSION

The results of growth parameters of onion landraces are presented in Table 1. A significant variations were observed among the landraces and variety with respect to vegetative growth, yield and quality. Similarly, different varieties were evaluated at different localities and reported[5,8,9].

The Maximum plant height and leaf length was registered in Kotturu Local (64.89 and 60.21 cm). The Landrace Bellary Red recorded maximum number of leaves (12.80) which was statistically on par with Kotturu Local (12.65). Among the landraces, Belagavi White Onion (0.00 %) and Thumbaraguddi Local (0.00%) recorded no bolting which was followed by Kadur Local-2012 and Kadur Local (0.65 % each). While, Maximum bolting per cent was observed in Cheluru local (22.60 %).

Table 1: Growth attributes in different onion landraces

Sl. No.	Landraces/ Genotypes	Plant height (cm)	Number of leaves	Leaf length (cm)	Bolting (%)	Split bulbs (%)	CT (cm)	NT (cm)
1	**Bidar Local**	60.45	12.40	56.54	03.55 (10.86)	01.71 (07.52)	1.30	0.49
2	**Jamakandi Local**	56.94	11.80	52.48	00.75 (4.94)	00.60 (04.38)	1.40	0.64
3	**Belagavi White Onion**	57.14	10.00	52.18	00.00 (0.40)	01.37 (06.73)	1.22	0.52
4	**Kumata Sweet Onion**	53.24	10.20	49.79	03.70 (11.06)	00.00 (00.40)	1.16	0.49
5	**Bellary Red**	63.14	12.80	55.68	02.05 (8.23)	04.25 (11.88)	1.26	0.56
6	**Handhigona Local**	54.50	8.80	50.24	03.65 (11.00)	06.52 (14.79)	1.30	0.42
7	**Kadur Local-2012**	51.81	10.60	47.98	00.65 (4.54)	01.18 0(6.23)	1.35	0.62
8	**Gouribidanuru Local**	56.42	10.50	52.34	21.50 (27.61)	05.26 (13.26)	1.30	0.46
9	**Cheluru Local**	55.19	10.00	50.21	22.60 (28.37)	04.16 (11.76)	1.25	0.39
10	**Bagepalli Local**	50.10	9.50	43.21	09.20 (17.66)	03.25 (10.34)	1.21	0.39
11	**Kotturu Local**	64.89	12.56	60.21	03.80 (11.21)	04.65 (12.45)	1.33	0.51
12	**GBD- Bindhu**	57.84	11.00	53.21	17.60 (24.80)	05.20 (13.17)	1.20	0.45
13	**Molakalmuru Local**	61.80	12.60	56.81	03.20 (10.18)	02.45 (08.98)	1.40	0.39
14	**Hanumanthanahalli Local**	56.24	11.40	52.89	03.35 (10.54)	04.06 (11.60)	1.41	0.46
15	**Kadur Local**	60.74	11.50	55.87	00.65 (4.61)	04.65 (12.46)	1.52	0.46
16	**Challakere Local**	56.84	12.00	53.65	01.30 (6.53)	02.30 (08.72)	1.37	0.47
17	**Kadur Local-RVG**	54.64	10.20	50.15	01.20 (6.26)	02.50 (09.07)	1.21	0.47
18	**Chintamani Local**	50.84	10.20	45.68	08.20 (16.64)	07.65 (16.05)	1.16	0.46
19	**Bengaluru Rose Onion**	46.94	10.20	42.87	11.05 (19.41)	03.72 (11.10)	1.11	0.44
20	**Mogalahalli Local**	45.15	10.86	41.28	04.00 (11.53)	05.40 (13.42)	1.66	0.41
21	**Thumbaraguddi Local**	48.75	12.90	43.12	00.00 (0.40)	00.00 (00.40)	1.45	0.57
22	**Telagi White Onion**	62.54	9.80	56.54	03.40 (10.62)	02.82 (09.66)	1.60	0.56
23	**Kadarakoppa Local**	54.18	10.90	49.87	01.65 (7.35)	01.38 (06.75)	1.40	0.57
24	**Rampur Local**	59.20	12.41	50.18	02.85 (9.70)	00.00 (00.40)	1.24	0.50
25	**Arka Kalyan (check)**	57.13	12.15	51.10	01.75 (7.60)	00.00 (00.40)	1.30	0.53
SEm±		**2.17**	**0.46**	**3.35**	**0.64**	**0.48**	**0.05**	**0.04**
CD at 5%		**6.32**	**1.33**	**11.76**	**1.87**	**1.44**	**0.15**	**0.13**

SEm-Standard error of mean;CD-Critical difference, Values given in parenthesis are arc sine transformed

Of different genotypes, no double bulbs were registered in case of Kumata Sweet Onion (0.00 %), Thumbaraguddi Local (0.00 %), Rampur Local (0.00 %) and Arka Kalyan (0.00 %) followed by Jamakhandi Local (0.60 %). Whereas, Chintamani Local recorded the highest double bulbs percentage of 7.65. Both of these bolting and split bulb characters are considered as undesirable, which negatively affect the quality of onion bulb. Among different genotypes, Bengaluru Rose Onion registered lowest collar thickness of 1.11 cm followed by Kumata Sweet Onion (1.16 cm). While, The maximum collar thickness was recorded in Mogalahalli Local (1.66 cm). With respect to neck thickness lowest was recorded

in the genotype Bagepalli Local (0.39 cm) which was on par with Cheluru Local (0.39 cm). Whereas, Kadur Local-2012 recorded maximum neck thickness of 0.62 cm. However, minimum collar and neck thickness were desirable trait for extending storage life. Similar findings obtained by Mahantesh *et al.,* 2005; Sharma, 2009; Khar *et al.,* 2007; Yadav *et al.,* 2009; Trivedi Dhumal, 2010 and Ram *et al.,* 2011.

Table 2: Quality attributes in different onion landraces

Sl. No.	Landraces/ Genotypes	Rings /bulb	Centers /bulb	TSS (° brix)	Pungency (Pyruvic acid µmoles/g FW)	Dry matter (%)
1	**Bidar Local**	8.50	3.30	11.91	4.60	16.65
2	**Jamakandi Local**	8.30	1.60	13.22	5.44	16.52
3	**Belagavi White Onion**	8.20	1.60	13.60	5.21	14.00
4	**Kumata Sweet Onion**	5.20	3.80	16.70	6.50	15.50
5	**Bellary Red**	9.40	2.60	11.90	5.02	14.13
6	**Handhigona Local**	7.90	3.22	12.30	4.80	15.90
7	**Kadur Local-2012**	8.70	2.80	12.60	4.60	12.95
8	**Gouribidanuru Local**	7.40	2.90	16.24	6.12	20.44
9	**Cheluru Local**	6.90	2.40	15.80	5.80	20.07
10	**Bagepalli Local**	8.60	2.90	14.30	6.40	19.53
11	**Kotturu Local**	9.40	2.90	11.77	5.64	13.55
12	**GBD- Bindhu**	8.00	2.84	14.33	6.36	21.75
13	**Molakalmuru Local**	8.00	3.00	12.12	4.91	14.75
14	**Hanumanthanahalli Local**	8.00	3.70	13.00	5.74	11.50
15	**Kadur Local**	8.90	2.85	13.24	4.64	13.05
16	**Challakere Local**	8.65	2.45	12.98	4.87	12.75
17	**Kadur Local-RVG**	9.30	3.90	13.75	4.94	15.65
18	**Chintamani Local**	8.30	3.90	14.12	5.70	19.30
19	**Bengaluru Rose Onion**	9.30	2.90	15.46	6.30	19.50
20	**Mogalahalli Local**	10.00	3.30	12.20	4.60	14.70
21	**Thumbaraguddi Local**	9.50	2.40	11.84	4.25	15.55
22	**Telagi White Onion**	8.40	2.90	12.10	4.80	14.25
23	**Kadarakoppa Local**	8.00	3.70	13.45	5.40	14.80
24	**Rampur Local**	9.30	1.30	12.56	5.10	11.80
25	**Arka Kalyan (check)**	8.00	1.10	12.77	5.60	13.25
SEm±		**0.53**	**0.26**	**0.34**	**0.24**	**1.61**
CD at 5%		**1.54**	**0.78**	**1.43**	**0.74**	**4.73**

SEm-Standard error of mean;CD-Critical difference

With respect to quality parameters (Table 2) maximum number of rings per bulb was recorded in case of cultivar Mogalahalli Local (10.00) followed by Thambaraguddi Local (9.50). While, Kumata Sweet Onion registered lowest number of rings per bulb of 5.20. of different genotypes Arka Kalyan (1.10) registered minimum number of centres followed by Rampur Local (1.30). While, highest number of centres per bulb recorded in Kadur Local-RVG and Chinthamani Local (3.90 each). The similar findings were noticed by Mahantesh *et al*[5]., Sharma[9], Trivedi and Dhumal[10] and Ram *et al*[8].

The total soluble solids was found to be maximum in Kumata Sweet Onion (16.70 ° brix) which was on par with Gouribidanuru Local (16.24 ° brix) and Cheluru Local (15.80 ° brix) followed by Bengaluru Rose Onion (15.46 ° brix). However, lowest total soluble solids was recorded in Kotturu Local (11.77 ° brix). Mahantesh *et al*,[5], Hosmani *et al.*[3], Trivedi and Dhumal[10] DAS (2015) and Ram *et al.*[8] reported that the significant differences were noticed with respect to total soluble solids among varieties and hybrids.

The pungency varied from 4.25 to 6.50 µmol./g FW, Of different cultivars, the maximum pungency (pyruvic acid) was recorded in case of Kumata Sweet Onion (6.50 µmol./g FW) followed by Bagepalli Local, (6.40 µmol./ g FW each). Whereas, Thumbaraguddi Local registered the minimum pungency of 4.25 µmol. Per gram of fresh weight. Similar results were obtained by Mallor *et al.*[6] and Gallina *et al*[2].

The highest dry matter content was noticed in GBD-Bindu (21.75 %) followed by Gouribidanuru Local (20.44 %). Whereas, minimum dry matter content was recorded in Hanumanthanahalli Local (11.50 %). These results are in agreement to earlier workers[7]. These findings are similar to findings of Balakrishnamoorthy[7], Mahantesh *et al.*[5] and Hosmani *et al*[3].

Regarding yield attributes (Table 3), the highest bulb width was recorded in Rampur Local (6.16 cm) which was on par

with Molakalmuru Local (6.15 cm), Hanumanthanahalli local (6.05 cm) and Challakere Local (6.04 cm) followed by Kadarakoppa Local (5.95 cm). Whereas, genotype Chinthamani Local recorded the lowest bulb width (3.39 cm).The length of bulb was found to be maximum in Kadur Local-RVG (5.19 cm) followed by Rampur Local (5.09 cm). However, minimum length of bulb was recorded in Bagepalli Local (3.07 cm) which was on par with Chinthamani Local (3.18 cm).

The maximum average ten bulb weight was recorded in Kadarakoppa Local (1230.00 g) followed by Kotturu Local (1120.00 cm). However, lowest ten bulb weight was recorded in Bagepalli Local (347.50 cm). The maxmum bulb yield per hectare was obtained in genotype Kottur Local (35.34 t/ha) followed by Bellary Red (33.16 t/ha). While, lowest bulb yield per hectare recorded in Gouribidanuru Local (12.34 t/ha). Sharma[9] reported that highest bulb yield manifested by Baswant-780 was accompanied by better growth, larger size bulbs and maximum bulb weight. Thus, it could be concluded that bulb yield is dependent on vigour of plant and yield components. The variations in the yields of the different cultivars grown under similar conditions has been reported from several places[4,5,8,9].

Table 3: Yield attributes in different onion landraces

Sl. No.	Landraces/Genotypes	Bulb width (cm)	Bulb height (cm)	Avg. Bulb weight (g)	Ten bulb weight (g)	Total bulb yield (t/ha)	Marketable yield (t/ha)
1	**Bidar Local**	5.97	5.06	89.70	847.00	19.67	18.37
2	**Jamakandi Local**	4.98	4.25	61.35	565.00	13.83	12.93
3	**Belagavi White Onion**	5.26	4.16	87.65	915.00	17.84	16.85
4	**Kumata Sweet Onion**	4.96	5.04	82.70	800.00	15.50	14.18
5	**Bellary Red**	5.25	5.01	106.85	1035.00	33.16	31.05
6	**Handhigona Local**	5.75	4.46	98.90	1047.50	22.16	19.84
7	**Kadur Local-2012**	4.76	4.68	86.85	664.50	24.03	21.19
8	**Gouribidanuru Local**	5.41	5.01	39.20	354.00	12.34	11.04
9	**Cheluru Local**	4.66	5.11	40.05	377.50	14.51	12.87
10	**Bagepalli Local**	4.29	3.07	35.30	347.50	15.28	13.53
11	**Kotturu Local**	6.00	5.00	116.05	1120.00	35.34	32.10
12	**GBD- Bindhu**	5.21	3.40	40.21	354.50	12.97	11.85
13	**Molakalmuru Local**	6.15	5.01	87.90	847.00	28.50	25.24
14	**Hanumanthanahalli Local**	6.05	4.90	86.15	843.00	24.21	22.00
15	**Kadur Local**	5.35	4.51	118.20	1190.00	29.16	26.3
16	**Challakere Local**	6.04	4.96	97.05	883.50	32.34	29.93
17	**Kadur Local-RVG**	5.00	5.19	61.80	587.00	26.84	23.84
18	**Chintamani Local**	3.39	3.18	42.12	357.00	18.01	17.03
19	**Bengaluru Rose Onion**	4.35	4.01	38.55	375.50	16.50	15.16
20	**Mogalahalli Local**	5.25	4.35	113.90	1025.00	13.50	12.26
21	**Thumbaraguddi Local**	5.45	4.30	74.12	712.00	20.30	17.68
22	**Telagi White Onion**	4.85	4.70	114.20	971.00	19.66	18.81
23	**Kadarakoppa Local**	5.95	4.65	130.00	1230.00	32.50	29.70
24	**Rampur Local**	6.16	5.09	106.65	1055.00	31.53	29.39
25	**Arka Kalyan (check)**	6.05	4.95	122.20	1045.00	29.91	27.26
SEm±		**0.20**	**0.18**	**4.55**	**38.02**	**1.94**	**2.24**
CD at 5%		**0.58**	**0.5**	**13.28**	**111.07**	**5.67**	**6.55**

SEm-Standard error of mean;CD-Critical difference

The variation in genetic constitution may be attributed to varied growth parameters which in turn resulted in different synthesis and utilization efficiency of photosynthetic product thereby differences in yield characters of varieties Mohanty and Prusti[7] have also reported the variation in growth and yield traits of different varieties.

During *Rabi* season, maximum marketable bulb yield per hectare was documented in case of Kotturu Local (32.10 t/ha) followed by Bellary Red (31.05 t/ha).

Whereas, minimum marketable bulb yield per hectare was recorded in Gouribidanuru Local (11.04 t/ha).

CONCLUSION

In the present study based on the results it is concluded that among all the genotypes Kotturu Local during *Rabi* season proved to be superior with respect to growth, yield and quality characteristics for cultivation under Eastern Dry Zone of Karnataka (Zone-V). The genotypes Kotturu Local, Bellary Red, Kadarakoppa Local performed well with respect to yield and its attributes in during *Rabi* season. For quality parameters like total soluble solids and dry matter content of bulbs, cultivars Kumata Sweet Onion Gouribidanuru Local, Bengaluru Rose Onion, Cheluru Local and GBD-Bindhu found to be the best among all the cultivars. Hence, the genotype having better processing qualities can be utilized for dehydration and processing purpose.

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