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RESEARCH PAPER

Evaluation of *rabi* onion (*Allium cepa* L.) genotypes for northern Karnataka

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Abstract: The experiment was conducted at the Main Agricultural Research Station, UAS, Dharwad during *rabi* season of 2021-22. For the study totally 37 genotypes were collected from different institutes *viz.,* Directorate of Onion and Garlic Research, Rajgurunagar, Indian Institute of Horticultural Research, Bangalore, National Horticultural Research and Development Foundation, Nasik and some Local genotypes were collected from different districts of Karnataka and were evaluated using randomized complete block design with three replications for growth and yield parameters. With regards to growth parameters, maximum plant height (64.20 cm) was recorded in NHRDF-4 and minimum was in Rampur Local (55.90 cm), while RVC-21-40 exhibited maximum number of leaves per plant (12.29) and Bellary Local had minimum (10.41). The highest leaf length (62.18 cm) was accumulated in RVA-21-15 and lowest was in Rampur Local (53.96 cm). However, with respect to neck diameter, RVA-21- 01 registered maximum (1.78 cm) and minimum was in RVB-21-20 (1.19 cm). With regards to yield parameters, RVA-21-09 documented maximum polar diameter (6.38 cm) however, lowest was observed in Arka Vishwas (4.22 cm). The genotype RVC-21-40 exhibited highest equatorial diameter (6.75 cm) of bulb, bulb weight (95.38 g), total yield (35.20 t/ha) and marketable yield (33.50 t/ha). With overall observations, RVC-21- 40, NHRDF-4 and RVA-21-09 genotypes found promising with respect togrowth and yield parameters. Hence, these genotypes can be utilized further for crop improvement programmes.

Key words : Genotype, Onion, Plant height, Yield

Introduction

Onion (*Allium cepa* L.) is one of the important commercial vegetable crop belongs to family *Alliaceae* having chromosome number 2n = 16. South-west Asia and Mediterranean region are considered as primary and secondary centers of origin, respectively due to its greater diversity in nature. It is indispensable item in every kitchen and used as vegetable, spice cum condiment due to its flavor, smell, aroma, taste and medicinal properties. Hence, it is popularly known as ''*Queen of Kitchen"*. The pungency of onion is due to presence of *allyl propyl disulphide* which is volatile, odourless and colorless in nature. It is being used to prepare chutneys, curries, pickles, salads, soups, sauces and seasoning of various foods. In the world, China ranks first with respect to area and production followed by India. In India, it is grown in an area of 1.43 million hectares with production of 26.09 million tonnes with productivity of 18.23 tonnes per hectare (Anon., 2021). Karnataka state occupies second position in area (1.66 lakh hectare) and third in production (25.58 lakh tonnes) (Anon., 2018). The major growing districts in the state are Chitradurga, Gadag, Vijayapura, Bagalkot, Dharwad and Haveri. In Karnataka, it is being grown predominantly under *kharif* season (Janakiram *et al*., 2019). But, during last few years because of occurrence of heavy rains, continuous cloudy weather with drizzling rains and high moisture content of soil favors the spread of the diseases like anthracnose, twisting and crinkling lead to failure of crop. But, it is possible to get higher yield with quality produce by cultivation of onion under *rabi* season by identifying the suitable genotypes. Keeping these in view, the present investigation on "Evaluation of *rabi* onion (*Allium cepa* L.) genotypes for northern Karnataka" was undertaken.

Material and methods

The present investigation was carried out at All India Network Research Project on Onion and Garlic, Main Agricultural Research Station, UAS, Dharwad, during *rabi* 2021-22. The experimental area located in Northern Transitional Zone (Zone VIII) of Karnataka state, situated at $15^0$26' North latitude, 75^0 07' East longitude and at an altitude of 678 meter above the mean sea level. Experimental material consists of 37 genotypes (Table 1) collected from different institutions and Local genotypes. The genotypes were evaluated by adopting randomized complete block design with three replications for growth and yield parameters. Five plants from each genotype were randomly tagged and observations were recorded at harvest on plant height (cm), number of leaves per plant, leaf length (cm) and neck diameter (cm) of bulb, polar and equatorial diameter (cm), bulb weight (g), total and marketable yield (t/ha).The data were analyzed statistically and results are presented in Table 2 and 3.

Results and discussion

Growth parameters

The plant height of genotypes reported at the time of harvest ranged from 55.90 to 64.20 cm and a general mean of 60.47 cm (Table 2). Among the genotypes assessed, the maximum plant height (64.20 cm) was exhibited in NHRDF-4 genotype and which was on par with NHRDF-Red (64.06 cm). Whereas, minimum plant height (55.90 cm) was established in Rampur Local. The observed variations in plant height are might be due to genetic constitution of the genotypes. A similar variation in plant height with respect to onion genotypes was noticed by Hosamani *et al.* (2010) and Umamaheswarappa *et al.* (2018).

Table 1. Details of genotypes used for experimentation

Genotype	Source of collection
RVA-21-07	ICAR- DOGR, Pune
RVA-21-09	ICAR- DOGR, Pune
RVA-21-15	ICAR- DOGR, Pune
RVA-21-19	ICAR- DOGR, Pune
RVA-21-01	ICAR- DOGR, Pune
RVA-21-03	ICAR- DOGR, Pune
RVA-21-05	ICAR- DOGR, Pune
RVB-21-20	ICAR- DOGR, Pune
RVB-21-24	ICAR- DOGR, Pune
RVB-21-26	ICAR- DOGR, Pune
RVB-21-12	ICAR- DOGR, Pune
RVB-21-14	ICAR- DOGR, Pune
RVB-21-16	ICAR- DOGR, Pune
RVC-21-32	ICAR- DOGR, Pune
RVC-21-34	ICAR- DOGR, Pune
RVC-21-38	ICAR- DOGR, Pune
RVC-21-40	ICAR- DOGR, Pune
RVC-21-42	ICAR- DOGR, Pune
Agrifound Light Red	NHRDF, Nashik
NHRDF-3	NHRDF, Nashik
NHRDF-4	NHRDF, Nashik
NHRDF-Red	NHRDF, Nashik
Bhima Red	ICAR- DOGR, Pune
Bhima Raj	ICAR- DOGR, Pune
Bhima Dark Red	ICAR- DOGR, Pune
Bhima Kiran	ICAR- DOGR, Pune
Bhima Light Red	ICAR- DOGR, Pune
Arka Vishwas	ICAR- IIHR, Bangalore
Arka Niketan	ICAR- IIHR, Bangalore
Rampur Local	Rampur (Chitradurga)
Double Red Local	Dharwad (Dharwad)
Telagi Local	Telagi (Vijayapura)
Bellary Local	Bellary (Bellary)
Sira Local	Sira (Tumakuru)
Somapur Local	Somapur (Dharwad)
Puna Pursangi	Pune
Bhima Shakti	ICAR- DOGR, Pune

At the time of harvest, number of leaves per plant varied from 10.41 to 12.29 with a general mean of 11.16 (Table 2). Among the genotypes assessed, RVC-21-40 genotype was exhibited higher number of leaves per plant (12.29) and which was on par with NHRDF Red (12.05). While, least number of leaves per plant (10.41) was reported in Bellary Local. The observed variation in number of leaves per plant is could be attributed to genetic makeup of genotypes. The outcome of the results is in line with the reports of Behera *et al.,* 2017, Umamaheswarappa *et al.* (2018) and Sarkar *et al.* (2015).

The leaf length of genotypes ranged from 53.96 to 62.18 cm with a general mean of 58.06 cm at the time of harvest (Table 2). Among the genotypes assessed, RVA-21-15 genotype accumulated maximum leaf length (62.18 cm). While, Rampur Local registered minimum leaf length (53.96 cm). The observed variations in leaf length of each genotype is might be due to inherent capacity of genotypes which causes more assimilation of photosynthates in bulbs along with environmental conditions. These results are in conformity with the findings of Trivedi and Dhumal (2010), Hosamani *et al*. (2010) and Khosa *et al*. (2013).

The data presented in table 2 shows significant differences among the genotypes for neck diameter of bulb and it ranged from 1.19 to 1.78 cm and a general mean of 1.52 cm. Among the genotypes assessed, RVA-21- 01 genotype shown highest neck diameter (1.78 cm) of bulb. While, RVB-21-20 genotype expressed lowest neck diameter (1.19 cm) of bulb. The variations in neck diameter of bulb may be due to genotypic character and climatic condition. Such similar variations in neck diameter of onion genotypes were also confirmed by Dwivedi *et al.* (2012), Hosamani *et al*. (2010), Khosa *et al*. (2013) and Sarkar *et al.* (2015).

Yield parameters

Genotypes showed significant differences with equatorial diameter of bulb and it varies from 4.77 to 6.75 cm with a general mean of 6.10 cm. Among the genotypes analyzed, maximum equatorial diameter of bulb (6.75 cm) was observed in RVC-21-40 genotype and it is statistically on par with RVA-21-01 (6.74 cm). While, RVC-21-32 genotype expressed minimum equatorial diameter of bulb (4.77 cm) (Table 3). The observed variations in enlargement of equatorial diameter of bulb might be due to genotypic character of genotypes. The outcome of results is in consistent with the works of Hosamani *et al.* (2010), Lakshmipathi (2016) and Sharma (2009). Further, it is observed that the number of leaves per plant influenced the equatorial diameter. The similar relationship with number of leaves per plant with equatorial diameter was also reported by Trivedi and Dhumal (2010).

Onion genotypes showed significant disparity with respect to polar diameter of bulb and ranged between 4.22 to 6.38 cm and a general mean of 5.51 cm (Table 3). RVA-21-09 genotype recorded highest polar diameter (6.38 cm) and lowest polar diameter (4.22 cm) was established in Arka Vishwas. The observed variations in enlargement of polar diameter might be due to genotypes, photosynthetic activity and translocation of photosynthates to bulb. The outcome of results are in consistent with the works of Hosamani *et al.* (2010), Lakshmipathi (2016) and Sharma (2009), respectively.

The data presented in Table 3 shows that, the genotypes differed significantly with respect to weight of bulb and data ranged from 58.14 to 95.38 g and a general mean of 76.29 g. Among the genotypes evaluated, RVC-21-40 genotype registered maximum bulb weight (95.38 g). While, Somapur Local documented minimum weight of bulb (58.14 g). The observed variations in bulb weight in each genotypes might be due to genetic makeup, plant vigor, number of leaves per plant, assimilation of photosynthates and bulb characters. The observed variations in bulb weight with genotypes were also confirmed by Hosamani *et al.* (2010) and Trivedi and Dhumal (2010).

The data on total yield per hectare depicted in table 3 shows significant differences with genotypesand it varies from 9.47 to 35.20 t/ha and a general mean of 20.46 t/ha. The maximum total yield (35.20 t/ha) was established RVC-21-40 genotype while, minimum total yield (9.47 t/ha) was accumulated in NHRDF-Red genotype. A significant difference may be due to genetical character of individual cultivars. This may also be contributed by higher individual bulb weight and size of bulb. These results are in accordance with findings of Lakshmipathi (2016).

Table 2. Mean performance of onion genotypes for growth parameters

Genotype	Plant height (cm)	No. of leaves per plant	Leaf length (cm)	Neck diameter of bulb (cm)
RVA-21-07	61.31	10.80	58.02	1.56
RVA-21-09	61.65	10.73	58.14	1.41
RVA-21-15	63.92	11.47	62.18	1.46
RVA-21-19	60.35	11.11	56.80	1.43
RVA-21-01	62.43	11.43	57.67	1.78
RVA-21-03	61.02	11.13	57.69	1.60
RVA-21-05	63.13	11.28	61.70	1.63
RVB-21-20	61.35	11.54	57.79	1.19
RVB-21-24	61.43	11.25	59.78	1.69
RVB-21-26	59.23	11.36	56.90	1.62
RVB-21-12	57.98	10.94	57.75	1.54
RVB-21-14	59.37	10.98	58.97	1.49
RVB-21-16	60.71	11.35	59.02	1.53
RVC-21-32	59.55	11.74	57.96	1.53
RVC-21-34	58.68	11.08	57.38	1.56
RVC-21-38	59.94	11.62	56.63	1.62
RVC-21-40	59.54	12.29	57.21	1.65
RVC-21-42	61.23	10.77	60.73	1.47
Agrifound Light Red	61.85	11.49	60.85	1.61
NHRDF-3	61.34	11.78	59.54	1.42
NHRDF-4	64.20	11.78	61.91	1.64
NHRDF-Red	64.06	12.05	61.44	1.76
Bhima Red	61.84	10.76	58.66	1.57
Bhima Raj	60.44	11.43	58.68	1.45
Bhima Dark Red	56.42	10.60	54.86	1.53
Bhima Kiran	57.42	10.98	54.11	1.51
Bhima Light Red	57.27	10.90	55.27	1.47
Arka Vishwas	59.97	10.89	56.73	1.30
Arka Niketan	61.22	11.44	57.98	1.33
Rampur Local	55.90	10.50	53.96	1.43
Double Red Local	59.07	10.90	55.78	1.38
Telagi Local	60.91	10.85	57.66	1.48
Bellary Local	60.86	10.41	58.15	1.34
Sira Local	59.06	10.81	56.12	1.51
Somapur Local	60.31	10.53	58.02	1.51
Puna Pursangi	60.44	11.10	58.14	1.50
Bhima Shakti	61.91	10.81	57.93	1.63
Mean	60.47	11.16	58.06	1.52
S.Em. ±	1.49	0.28	1.10	0.08
C.D. @ 5 %	4.22	0.78	3.12	0.22

Table 3. Mean performance of onion genotypes for yield and yield attributing parameters

Genotype	Bulb characters				
	Equatorial diameter (cm)	Polar diameter (cm)	Weight (g)	Total yield (t/ha)	Marketable yield (t/ha)
RVA-21-07	5.36	5.53	68.70	18.67	18.00
RVA-21-09	6.64	6.38	78.90	19.20	18.45
RVA-21-15	6.43	5.96	78.50	20.61	19.68
RVA-21-19	5.96	5.58	81.50	17.95	17.17
RVA-21-01	6.74	5.96	90.97	23.33	19.17
RVA-21-03	6.33	5.58	93.11	27.00	26.49
RVA-21-05	6.29	5.38	74.83	15.33	11.39
RVB-21-20	5.25	4.66	62.14	15.47	14.19
RVB-21-24	6.09	5.67	79.52	21.52	18.11
RVB-21-26	5.66	5.62	80.78	25.33	24.29
RVB-21-12	6.25	5.37	83.12	21.20	18.48
RVB-21-14	6.16	5.62	80.89	21.67	20.55
RVB-21-16	6.06	5.25	73.35	16.99	14.72
RVC-21-32	4.77	4.38	86.50	22.67	21.39
RVC-21-34	6.25	5.56	79.05	19.68	17.60
RVC-21-38	6.43	5.33	84.77	22.32	20.05

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RVC-21-40	6.75	5.67	95.38	35.20	33.50
RVC-21-42	6.16	5.96	94.50	26.99	24.40
Agrifound Light Red	6.36	5.18	78.14	17.07	15.73
NHRDF-3	6.68	5.91	75.70	18.75	14.53
NHRDF-4	6.30	5.79	70.47	18.13	16.80
NHRDF-Red	6.24	5.63	60.62	9.47	7.92
Bhima Red	6.21	5.57	78.29	22.88	20.95
Bhima Raj	6.18	5.52	66.47	12.67	11.05
Bhima Dark Red	6.25	5.79	80.36	20.00	19.05
Bhima Kiran	6.31	6.07	83.38	25.33	24.05
Bhima Light Red	5.96	5.65	66.17	16.53	15.33
Arka Vishwas	5.18	4.22	76.14	21.52	20.03
Arka Niketan	5.91	4.68	64.22	11.84	9.47
Rampur Local	6.08	4.52	64.47	10.53	3.65
Double Red Local	5.36	4.89	58.36	22.67	20.39
Telagi Local	6.49	6.29	68.49	23.33	22.29
Bellary Local	5.29	5.32	58.31	17.33	16.03
Sira Local	6.52	6.01	81.01	22.67	21.09
Somapur Local	5.83	5.24	58.14	25.60	23.87
Puna Pursangi	6.61	6.20	84.35	27.56	25.44
Bhima Shakti	6.26	6.09	82.99	22.00	20.72
Mean	6.10	5.51	76.29	20.46	18.54
S.Em. ±	0.13	0.15	1.86	1.09	0.53
C.D. @ 5 %	0.36	0.40	5.26	3.07	1.48

The onion genotypes showed significant variations for marketable yield per hectare and it ranges from 3.65 to 33.50 t/ha with a general mean of 18.54 t/ha (Table 3). The maximum marketable yield (33.50 t/ha) was documented in RVC-21-40 genotype followed by RVA-21-03 (26.49 t/ha). Whereas, Rampur Local reported minimum marketable yield (3.65 t/ha). The variation in marketable yield among the genotypes might be due to genotypes and climate. The observed higher marketable yield in RVC-21-40 genotype is due to more number of leaves per plant, equatorial diameter of bulb and bulb weight. The outcome of the results are in line with the findings of Pal and Singh (1988), Patil (1997) and Balareddy (1999).

Conclusion

Based on evaluation of *rabi* onion genotypes for yield and yield attributing characters among 37 genotypes, RVC-21- 40, NHRDF-4 and RVA-21-09 genotypes were found better performers with respect to growth and yield parameters. Hence, these genotypes could be used as source for further crop improvement programme and ultimately to increase yield and productivity.

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