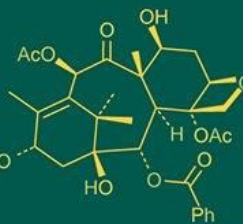
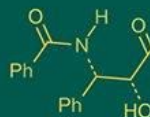


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Assessment of onion (*Allium cepa* L.) genotypes for yield and quality parameters under Chhattisgarh conditions

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Abstract

The field experiment was conducted during *Rabi* 2024-25 at the Horticultural Research cum Instructional Farm, Department of Vegetable Science, College of Agriculture, IGKV, Raipur (C.G.) to evaluate Twenty-three onion genotypes for growth, yield and quality traits under the plains of Chhattisgarh. The trial was laid out in a Randomized Block Design with three replications, and observations were recorded from five randomly selected plants per plot. Significant variability was observed among genotypes. RVC-24-38 exhibited superior performance for major growth and yield parameters, including plant height, number of leaves, leaf length, bulb diameters, bulbs per plot, average bulb weight, bulb fresh weight and marketable yield. Maximum leaf thickness, neck length and neck thickness were recorded in RVB-24-19, RVB-24-27 and RVA-24-01, respectively. For quality traits, maximum TSS (11.81%), total sugar (6.40%) and reducing sugar (3.62%) were recorded in RVC-24-42, while RVC-24-34 showed the highest non-reducing sugar (3.05%).

Keywords: Onion, genotypes, growth and yield, quality parameters etc.

Introduction

Onion (*Allium cepa* L.) is an important vegetable crop grown worldwide and is believed to have originated in Central Asia and the Mediterranean region (Mc Collum, 1976) [13]. It belongs to the family Amaryllidaceae, order Asparagales, and is a diploid species ($2n=2x=16$) comprising three groups: *A. cepa*, *A. proliferum*, and *A. cepa* var. *aggregatum* (Boukary *et al.*, 2012) [4]. It is widely used both as a condiment and as a vegetable (Kumar *et al.*, 2025) [11]. *Rabi* is the most favourable season for onion cultivation, accounting for 50-60% of the total production area. In India, onion is grown on 1.541 million hectares with a production of 24.267 million tonnes and an average productivity of 15.75 MT/ha (Anon., 2023-24) [1]. India is the second-largest onion producer globally and a major exporter to Bangladesh, Sri Lanka, Malaysia and the UAE. Maharashtra contributes 35-40% of national production. In Chhattisgarh, onion is cultivated on 22.814 thousand hectares with a production of 380.826 thousand MT and a productivity of 16.69 MT/ha (Anon., 2023-24) [2]. It contains important bioactive compounds such as catechol and 1-propenyl sulfonic acid, synthesized through Allinase, and is rich in quercetin, a strong antioxidant associated with cardiovascular protection, anticancer activity, enhanced immunity and glycaemic regulation (Augusti, 1990; Hanley & Fenwick, 1985) [3, 8]. Onion pungency is mainly attributed to allyl-propyl disulphide. Nutritionally, onions provide essential vitamins and minerals; per 100 g edible portion, they contain 86.6 g moisture, 11.1 g carbohydrates, 1.2 g protein and 50 Kcal of energy along with key micronutrients (Shankaracharya, 1974; Pareek *et al.*, 2017) [18, 15]. Genetic improvement in onion depends on the extent of genetic variability among genotypes (Mallor *et al.*, 2011) [12]. The presence of sufficient variability is essential for effective selection and successful breeding programmes; therefore, evaluating genetic variability is crucial for identifying promising genotypes and improving crop performance.

Materials and Methods

The experiment was conducted during *Rabi* 2024 at the Horticultural Research cum Instructional Farm, Department of Vegetable Science, College of Agriculture, IGKV, Raipur (C.G.). Twenty-three onion genotypes were evaluated in a Randomized Block Design (RBD)

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with three replications. Observations were recorded from five randomly selected competitive plants per plot, and mean values were calculated across replications. Data were collected for plant height, number of leaves, leaf length, leaf thickness, neck length, neck thickness, polar and equatorial diameter, average bulb weight, bulb fresh weight, number of bulbs per plot, marketable and total yield, TSS, total sugar, reducing, and non-reducing sugar.

Results and Discussion

The results of the trial pertaining to various aspects of growth, yield, and quality parameters of onion are summarized as follows.

Mean performance of genotypes for different traits

Observations for fruit yield and its contributing traits were recorded from five randomly selected, uniformly sized plants per genotype across three replications, and the averaged values were used for mean performance analysis. The mean data are presented in Table 1.

Plant height (cm)

Plant height among the genotypes ranged from 57.71 to 70.34 cm, with a mean of 61.80 cm. The tallest plants were observed in RVC-24-38 (70.34 cm), while RVB-24-25 recorded the shortest height (57.71 cm). Similar variation was reported by Naresh *et al.* (2021) ^[14] and Singh *et al.* (2021) ^[19], who recorded maximum plant heights of 78.30 cm and 76.76 cm, respectively, under Chhattisgarh conditions.

Number of leaves per plant

The number of leaves per plant ranged from 7.80 to 10.40, with a mean of 8.69. The maximum leaf count was recorded in RVC-24-38 (10.40), while the minimum occurred in RVB-24-19 (7.80). Similar variation was reported by Singh *et al.* (2021) ^[19] and Jatra *et al.* (2022) ^[10], who observed maximum values of 12.83 and 10.47 leaves per plant, respectively.

Leaf length (cm)

Leaf length ranged from 41.68 to 53.33 cm, with a mean of 45.97 cm. The longest leaves were recorded in RVC-24-38 (53.33 cm), while RVB-24-19 showed the shortest (41.68 cm). Similar variation was reported by Singh *et al.* (2021) ^[19], who observed leaf lengths up to 62.70 cm in RVB-20-08.

Leaf thickness (cm)

Leaf thickness among the genotypes ranged from 0.79 to 1.06 cm, with a mean of 0.91 cm. The maximum thickness was recorded in RB-24-19 (1.06 cm), while the minimum occurred in RVA-24-06 (0.79 cm). Similar ranges were reported by Singh *et al.* (2021) ^[19] and Jana *et al.* (2023) ^[9], who observed maximum values of 1.05 cm and 1.06 cm, respectively.

Neck length (cm)

Neck length varied from 5.70 to 9.02 cm, with a mean of 7.10 cm. The maximum neck length was recorded in genotype RVA-24-27 (9.02 cm), followed by RVC-24-42 (8.66 cm), RVC- 24-48 (8.03 cm) and RVB-24-19 (8.01 cm), while the minimum was observed in RVA-24-03 (5.70

cm). Similarly, Jatra *et al.* (2022) ^[10] reported a maximum of 9.03 cm in RVA-21-19.

Neck thickness (cm)

Pseudo-stem thickness among the genotypes ranged from 1.11 to 1.41 cm, with a mean of 1.29 cm. The minimum value was recorded in the check variety Rohit (1.11 cm), while the maximum was observed in RVA-24-01 (1.41 cm). Similar variation was reported by Singh *et al.* (2021) ^[19], who recorded maximum thickness values of 2.29 cm in RVB-20-17.

Polar diameter of bulb (cm)

The polar diameter of bulbs ranged from 4.77 to 5.84 cm, with a mean of 5.19 cm. The largest diameter was recorded in RVC-24-38 (5.84 cm), while RVB-24-19 showed the smallest (4.77 cm). Comparable variation was reported by Singh *et al.* (2021) ^[19], who observed polar diameters up to 7.78 cm.

Equatorial diameter of bulb (cm)

The equatorial diameter of bulbs ranged from 5.83 to 7.10 cm, with a mean of 6.21 cm. The largest diameter occurred in RVC-24-38 (7.10 cm), while the smallest was observed in RVB- 24-19 (5.83 cm). Comparable variability was also reported by Dinkar and Sharma (2017) ^[7] and Singh *et al.* (2021) ^[19].

Average bulb weight (g)

Average bulb weight ranged from 78.95 to 104.41 g, with a mean of 86.54 g. The highest bulb weight was recorded in RVC-24-38 (104.41 g), followed by RVA-24-06 (99.91 g) and RVA-24-09 (98.33 g), whereas the lowest (78.95 g) was noted in RVB-24-25. Comparable variability was reported by Singh *et al.* (2021) ^[19] and Jana *et al.* (2023) ^[9].

Bulb fresh weight (kg/plot)

Bulb fresh weight varied between 9.12 and 16.61 kg/plot, with an overall mean of 12.95 kg. The maximum fresh weight occurred in RVC-24-38 (16.61 kg), followed by RVA-24-06 (15.78 kg), RVA-24-09 (15.74 kg) and RVA-24-11 (15.57 kg), while RVB-24-19 recorded the minimum (9.12 kg). Similar findings were reported by Dinkar and Sharma (2017) ^[7] and Singh *et al.* (2021) ^[19].

Total Soluble Solids (TSS %)

Total soluble solids (TSS) ranged from 9.10% to 12.20%, with a mean of 9.91%. The highest TSS was recorded in RVC-24-42, while RVB-24-25 showed the lowest. Similar variation has been reported by Das *et al.* (2017) ^[5] and Singh *et al.* (2021) ^[19], underscoring the strong genotype influence on bulb quality.

Reducing sugar (%)

The reducing sugar content among the onion genotypes varied from 2.78% to 3.62%, with a mean of 3.09%. The highest value was observed in RVC-24-42 (3.62%), followed by RVC- 24-38 (3.57%), RVC-24-40 (3.54%) and RVA-24-01 (3.40%), while RVB-24-25 recorded the lowest (2.78%). Similar variability was reported by Priyadarshini *et al.* (2017) ^[16], who observed a range of 2.17% to 3.67%.

Total sugar (%)

Total sugar content among the onion genotypes ranged from 5.16% to 6.40%, with a mean of 5.76%. The maximum value was recorded in RVC-24-42 (6.40%), while the minimum occurred in RVB-24-25 (5.16%). Comparable

ranges were reported by Dethe *et al.* (2022) ^[6], who observed 5.32% to 6.41% in different genotypes.

Non reducing sugar (%)

Non-reducing sugar content varied from 2.23% to 3.05%, with a mean of 2.66%. The highest value was recorded in RVC-24-34 (3.05%), while the lowest occurred in RVB-24-19 (2.23%). Comparable variation was reported by Priyadarshini *et al.* (2017) ^[16], who observed values ranging from 2.46% to 4.12%.

Number of bulbs per plot

The number of bulbs per plot ranged from 201.33 to 288.00, with a mean of 251.16. The highest bulb number was recorded in RVC-24-38 (288.00), while the lowest was observed in RVB-24-19 (201.33).

Marketable bulb yield (q/ha)

Marketable bulb yield among the genotypes ranged from 203.00 to 369.50 q/ha, with a mean of 237.57 q/ha. The highest yield was recorded in RVC-24-38 (369.50 q/ha), while RVB-24-19 showed the lowest (203.00 q/ha). Similar yield variation was reported by Singh *et al.* (2021) ^[19]

50.62-463.80 q/ha and Jana *et al.* (2023) ^[9] 235.21-481.49 q/ha.

Total bulb yield (q/ha)

Total bulb yield among the genotypes ranged from 207.35 to 377.50 q/ha, with a mean of 293.08 q/ha. The highest yield was recorded in RVC-24-38 (377.50 q/ha), followed by RVA-24-06 (358.56 q/ha) and RVA-24-09 (357.60 q/ha) while RVB-24-19 showed the lowest yield (207.35 q/ha). Comparable findings were reported by Singh *et al.* (2021) ^[19], who observed yields ranging from 120.29 to 522.81 q/ha and Jana *et al.* (2023) ^[9], who reported a range of 240.77 to 491.49 q/ha among onion genotypes.

Bulb colour

Bulb colour was recorded through visual observation and categorized as red, light red, or dark red, with clear variability observed among the genotypes (Table 1).

Bulb shape

Bulb shape was assessed visually, revealing notable variation among genotypes, ranging from round to flat and oval forms (Table 1).

Table 1: Mean performance of growth, yield and its components in different genotypes of *rabi* onion

Genotypes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
RVC-24 (32)	62.00	9.20	44.67	0.98	7.69	1.31	5.15	6.02	90.64	13.74	10.03	2.87	5.36	2.47	281.0	298.4	312.4
RVC-24 (34)	61.67	8.10	46.05	0.86	6.95	1.32	5.11	6.06	90.97	13.15	9.37	3.20	6.25	3.05	274.0	285.8	298.8
RVC-24 (36)	60.70	8.60	43.34	0.85	7.76	1.39	5.25	6.12	85.69	13.75	10.13	2.89	5.80	2.93	283.3	299.4	312.4
RVC-24 (38)	70.34	10.40	53.33	0.81	7.00	1.28	5.84	7.10	104.41	16.61	10.97	3.57	6.19	2.62	288.0	369.5	377.5
RVC-24 (40)	61.00	8.53	46.69	0.96	7.65	1.40	5.09	6.23	82.11	11.49	12.10	3.54	6.04	2.52	279.7	254.1	261.1
RVC-24 (42)	62.01	9.23	47.03	0.93	8.66	1.36	5.14	6.17	83.69	13.57	12.20	3.62	6.40	2.78	269.7	297.4	308.4
RVC-24 (45)	59.69	9.07	46.70	0.83	6.23	1.27	5.27	6.20	90.20	13.96	9.33	2.98	5.88	2.91	287.0	306.3	317.3
RVC-24 (48)	61.68	8.40	46.37	0.84	8.03	1.35	5.30	6.28	85.79	14.40	10.17	3.18	5.52	2.34	273.3	282.6	327.4
RVC-24 (50)	62.00	8.43	46.70	0.82	6.78	1.25	5.09	5.97	82.99	12.30	10.50	3.19	5.80	2.61	247.3	266.6	279.6
RVC-24 (53)	60.01	8.47	45.13	0.84	6.65	1.21	5.02	6.18	80.24	13.04	10.00	2.82	5.63	2.81	242.0	259.2	267.6
RVB-24(19)	57.77	7.80	41.68	1.06	8.01	1.22	4.77	5.83	80.34	9.12	9.20	3.04	5.27	2.23	201.3	203.0	207.4
RVB-24(22)	58.16	8.50	42.67	1.01	8.00	1.33	4.99	5.91	79.28	9.19	9.47	3.21	5.49	2.29	208.0	204.0	210.9
RVB-24(25)	57.71	9.93	42.72	0.89	6.88	1.35	4.96	6.10	78.95	10.64	9.10	2.78	5.16	2.36	221.3	230.9	241.9
RVB-24(27)	61.39	8.27	45.71	0.94	9.02	1.29	5.18	6.13	81.64	10.48	9.17	2.87	5.28	2.29	231.7	230.6	238.2
RVB-24(30)	60.03	9.13	45.01	0.87	7.09	1.23	5.05	5.94	80.96	9.59	9.60	2.84	6.01	3.02	209.7	212.0	218.0
RVA-24 (01)	59.36	8.76	43.67	0.90	6.22	1.41	5.16	6.04	85.56	13.70	10.20	3.40	6.25	2.85	236.3	289.4	311.4
RVA-24 (03)	61.04	8.83	45.68	1.00	5.70	1.38	5.22	6.16	86.56	13.98	9.40	2.89	5.88	2.98	247.0	304.7	317.7
RVA-24 (06)	70.07	8.77	50.42	0.79	7.84	1.20	5.53	6.71	99.91	15.78	9.50	3.05	5.80	2.75	273.7	328.6	358.6
RVA-24 (09)	68.69	8.10	50.38	0.91	7.09	1.17	5.42	7.06	98.33	15.74	9.70	3.05	5.42	2.38	271.7	348.6	357.6
RVA-24 (11)	62.03	8.37	47.01	0.90	6.09	1.30	5.21	6.23	90.33	15.57	9.40	3.26	6.13	2.89	251.0	343.9	353.9
RVA-24 (13)	60.38	8.40	45.35	0.95	6.23	1.34	5.32	6.18	89.59	14.05	9.60	2.89	5.78	2.89	264.0	318.4	319.4
RVA-24 (15)	63.39	8.71	46.36	0.99	5.83	1.24	5.22	6.16	82.24	13.27	9.37	2.96	5.68	2.72	224.7	293.5	301.5
(Rohit)	60.38	7.90	44.71	0.92	6.00	1.11	5.10	6.00	79.91	10.65	9.50	2.88	5.31	2.43	211.0	239.1	242.1
Grand mean	61.80	8.69	45.97	0.91	7.10	1.29	5.19	6.21	86.54	12.95	9.91	3.09	5.75	2.66	251.16	281.13	293.08
CD (%)	7.035	1.089	5.194	0.114	1.07	0.198	0.603	0.675	12.713	2.594	0.361	0.276	0.337	0.207	27.951	51.586	58.936
CV (%)	6.899	7.5377	6.2524	8.733	8.2863	9.979	6.6209	6.104	7.722	9.9773	2.309	5.507	3.53	4.559	6.1984	11.537	13.438
1. Plant height (cm)	6. Neck thickness (cm)							11. Total Soluble Solids (TSS %)					16. Marketable bulb yield (q/ha)				
2. Number of leaves	7. Polar diameter (cm)							12. Reducing sugar (%)					17. Total bulb yield (q/ha)				
3. Leaf length(cm)	8. Equatorial diameter (cm)							13. Total sugar (%)									
4. Leaf thickness (cm)	9. Average bulb weight (g)							14. Non reducing sugar									
5.Neck length (cm)	10. Bulb fresh weight (kg/plot)							15. Number of bulbs per plot									

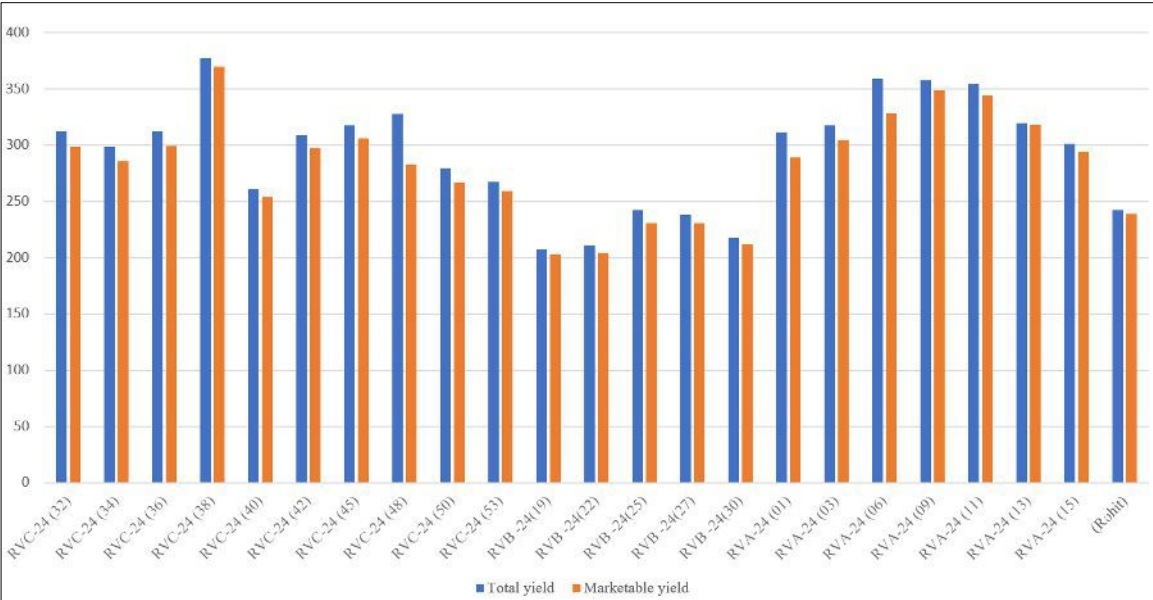


Fig 1: Genotypes with TY and MY (q/ha)



Fig 2: Bulbs of Rabi onion genotypes

Table 2: Morphological characteristics (Colour, shape) of different genotypes of rabi onion

Genotypes	Bulb colour	Bulb shape
RVC-32/2024	Light Red	Round
RVC-34/2024	Red	Flat
RVC-36/2024	Light Red	Flat
RVC-38/2024	Red	Flat
RVC-40/2024	Light Red	Round
RVC-42/2024	Red	Round /Flat
RVC-45/2024	Red	Flat
RVC-48/2024	Light Red	Flat
RVC-50/2024	Red	Round
RVC-53/2025	Red	Round
RVB-19/2024	Red	Round
RVB-22/2024	Red	Round
RVB-25/2024	Red	Round
RVB-27/2024	Light Red	Flat/ Round
RVB-30/2024	Light Red	Round
RVA-01/2024	Light Red	Flat
RVA-03/2024	Light Red	Round
RVA-06/2024	Dark Red	Round / Flat
RVA-09/2024	Light Red	Round
RVA-11/2024	Light Red	Round
RVA-13/2024	Light Red	Round
RVA-15/2024	Light Red	Round
Check Variety (Rohit)	Red	Round

Conclusion

The variance analysis revealed that there was significant variability exist among the genotypes for most of the traits that depicted potential for more genetic improvement. The genotype RVC- 24-38 recorded the highest total bulb yield, followed by RVA-24-06-26, RVA-24-09, RVA-24- 11 and RVC-24-48, demonstrating excellent performance under Chhattisgarh plain conditions.

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