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EVALUATION OF *RABI* ONION (*ALLIUM CEPA* L.) GENOTYPES FOR YIELD CHARACTERS

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ABSTRACT

The present investigations were undertaken on onion (*Allium cepa* L) for evaluation of *rabi* onion genotypes for morphological characters during *rabi* season 2021-22 and 2022-23 at the Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar, Maharashtra to identify promising genotypes for yield and storage quality for *rabi* season. The experiment was carried out in randomized block design with twenty-nine genotypes and one check variety replicated two times.

The result indicated that, genotypes RHROR–11, RHROR–12 and RHROR–10 significantly exhibited better performance for the morphological characters *viz*., plant height and average bulb weight of onion while maximum polar and equitorial diameter were also recorded by the genotypes RHROR-12, RHROR-10 and RHROR-11 although minimum neck thickness were also registered by the same genotypes under investigation.

The result showed that, yield parameters like total bulb yield (kg/plot), total bulb yield (t/ha) and marketable bulb yield (t/ha) in onion crop was recorded highest in genotype RHROR–12 followed by genotype RHROR–7 and RHROR–10 in both of the year on the basis of average mean.

Key words : Onion, Polar diameter, Equatorial diameter of bulb, Marketable yield, Total bulb yield.

Introduction

Onion (*Allium cepa* L.) is an important bulb crop which, belongs to the family Alliaceae and grown widely all over the world and consumed in various forms. It is used as food, medicines, spices and condiments since early times all over the world. The edible portion of onion is bulb which develops underground. It can be used as immature and mature bulb, which can be consumed as vegetable and condiments. Cultivated onion is herbaceous annual for bulb production and biennial for seed production.

Onion has strong flavour due to presence of sulphur containing compound allyl propyl disulphide responsible for distinctive smell and pungency. Highly pungent red coloured onions are preferred in India, while less pungent yellow or white coloured ones are preferred by European and Japanese people. It is rich in medicinal compounds and is used for preparation of various Homeopathic, Unani and Ayurvedic medicines. The juice of onion is used for treating opthalmia and earache. Bulb juice is used as smelling on hysterical fits in faintness and is and also used against flatulence, dysentery and cholera heart disease. It plays an important role in reducing the insulin requirement for diabetic patients by regular use. Onion leaves and bulbs are nutritionally rich in minerals like calcium, phosphorus and potash.

To meet the growing and diverse needs of various stakeholders, right from production to the consumption chain of the bulb onion crop, development of improved varieties with a stable performance always remained a challenge to the onion breeders. Further, onion is photo-thermo sensitive for bulb development and there is a need to evaluate onion genotypes under different climatic conditions. Onion varieties differ in size, colour of skin, pungency and maturation of the bulbs. Large sized bulbs are mild in pungency and are sweet in taste compared to the small sized onions. Red coloured varieties are more

pungent than white coloured varieties and have better keeping quality. Yellow cultivars have less demand in the market. Number of varieties and genotypes are available with breeder but variability in size, shape and colour. Depending on the preference of shape, size and colour of bulb, different varieties are exported.

Materials and Methods

The present field investigation was carried out during *rabi* season at, "Scheme for Research on Onion Storage", Department of Horticulture, MPKV, Rahuri, Maharashtra *Rabi* season, 2021- 2022 and 2022-23. The experiment was laid out in Randomized Block Design with two replications having twenty-nine genotypes and one check variety *i.e.,* N-2-4-1.

The MPKV, Rahuri is situated between 19° 47' and 19° 57' North latitude and 74° 19' and 74°42' East longitudes with elevation of 525 m above the mean sea level. The plots selected for same planting date had a uniform soil depth and fertility. The soil was medium black, calcareous and well drained.

Treatment details

Twenty-nine genotypes and one check variety *i.e.,* N-2-4-1 available at "Scheme for Research on Onion Storage" was utilized for the experimentation.

S. no.	Genotype	S. no.	Genotype	S. no.	Genotype
1.	RHROR-1	11.	RHROR-11	21.	RHROR-21
2.	RHROR-2	12.	RHROR-12	22.	RHROR-22
3.	RHROR-3	13.	RHROR-13	23.	RHROR-23
4.	RHROR-4	14.	RHROR-14	24.	RHROR-24
5.	RHROR-5	15.	RHROR-15	25.	RHROR-25
6.	RHROR-6	16.	RHROR-16	26.	RHROR-26
7.	RHROR-7	17.	RHROR-17	27.	RHROR-27
8.	RHROR-8	18.	RHROR-18	28.	RHROR-28
9.	RHROR-9	19.	RHROR-19	29.	RHROR-29
10.	RHROR-10	20.	RHROR-20	30.	N-2-4-1

The thirty genotypes seeds were sown in nursery during *Rabi* season 2021-2022 and 2022-2023. All the care was taken in nursery stage for growing healthy seedlings. After attending the growth, the seedling transplanted in field in ridges and furrows. The recommended wise fertilizer was applied as basal dose.

All the genotypes were planted as a replicated twice. The weeding and other cultural practices were followed as and when required. The experiment was conducted in randomized block design.

The observation was recorded on different yield contributing characters *i.e.,* average bulb weight, days to harvest, polar and equitorial diameter of bulb, total bulb yield per plot, per hectare and marketable bulb yield.

Yield characters

Average bulb weight (g)

After harvesting, bulb weight of randomly selected five bulbs was recorded and then means weight of bulb was worked out for each replication expressed in gram.

Days to harvest

Days to harvest was calculated for each genotype from date of transplanting to harvesting of bulbs replication wise and average days worked out as days to harvest .The bulbs are harvested when it shows the symptoms like yellowing of leaves, falling of top etc. Similarly harvesting is done after it shows 50 % top fall in the plot.

Polar diameter of bulb (cm)

Polar diameter of bulb was measured by using Vernier Caliper. The five random bulbs selected from each genotype and it was measured from base of root plate to bulb neck. Then average was calculated and expressed in centimeter.

Equitorial diameter of bulb (cm)

Equitorial diameter of bulb is the diameter of the bulb when it is kept upright in natural position. The distance was measured from North to South direction horizontally. It was measured by Vernier Caliper. The bulbs used for recording polar diameter same bulbs are used for recording the equatorial diameter. The mean equatorial diameter was worked out.

Total bulb yield (kg/plot)

The total bulb yield was recorded after harvesting of crop. The weight of total harvested bulbs including marketable and non- marketable bulbs such as premature bolters, twin bulbs and rotten bulbs in kilogram from each plot was recorded. The weight of bulb in each plot computed by using electronic weighing balance. Then average was worked out for each genotype and expressed in kilograms.

Total bulb yield (t/ha)

This was calculated by multiplying hectare factor into the total weight of bulb/plot in each genotype and replication wise. Then average was calculated and expressed in ton/ha.

Marketable bulb yield (t/ha)

Marketable yield was recorded after harvest by weighing the bulbs of A+B+C grade bulbs only. It was expressed in tons per hectare.

Statistical analysis

The data recorded in respect of various observations were subjected to the statistical analysis as per procedure given by Panse and Sukhatme (1989).

Results and Discussion

Average bulb weight (g)

The data presented in the Table 1 revealed that, for average bulb weight in onion genotypes differed significantly. First year data showed the range was from 68.61 to 89.75 g. The highest average bulb weight was observed in genotype RHROR-11 (89.75 g) followed by genotype RHROR-12 (87.56 g) and genotype RHROR-10 (85.01 g) while the lowest average bulb weight recorded by genotype RHROR-20 (68.61 g).

In second year, it was ranged from 64.80 to 84.67 g. The highest average bulb weight was observed in genotype RHROR-10 (84.67 g) followed by genotype RHROR-11 (84.19 g) and genotype RHROR-3 (82.92 g) however, the lowest average bulb weight found in genotype RHROR-20 (64.80 g).

Average mean data showed that, the highest average bulb weight was observed in genotype RHROR-11 (86.97 g) followed by genotype RHROR-12 (85.17 g) and genotype RHROR-10 (84.84 g) but the lowest average bulb weight mentioned by genotype RHROR-20 (66.70 g).

Average bulb weight is an important quantitative trait as there is a positive and direct association of average bulb weight with total bulb yield. Weight of the bulb is influence by the total food reserve present in the bulb which means more the total food reserve more will be the bulb weight of onion. These outcomes are in close resemblance with the finding of Hosmani *et al*. (2010), Lakshmipathi *et al*. (2017), Ganiger *et al*. (2018), Amarananjundeswara *et al*. (2020), Shinde *et al*. (2020) and Yadav *et al*. (2021).

Days to harvest

The data in respect of days to harvest presented in Table 1 revealed that, in first year it was ranged from 120.50 to 149.50. The minimum days to harvest was recorded in genotype RHROR-12 (120.50) followed by genotype RHROR-11 (124.50) and genotype RHROR-7 (128.50 cm) however, the maximum days to harvest was mentioned by genotype RHROR-28 (149.50).

In second year, the minimum days to harvest was observed in genotype RHROR-12 (125.50) followed by genotype RHROR-7 (126.50) and genotype RHROR-11 (127.00) but the maximum days to harvest was recorded by genotype RHROR-26 (149.50).

Average mean data showed that, the minimum days to harvest was mentioned by genotype RHROR-12 (123.50) followed by genotype RHROR-11 (125.75) and genotype RHROR-7 (127.50) while the maximum days to harvest was observed in genotype RHROR-28 (147.25).

Days to harvest are also an important character as it shows the time period of crop maturity. The average time period of maturity for onion crop is approximately 4-6 months which vary from variety to variety and genotype to genotype. Lesser days to harvest shows the earliness of the crop. As early maturity is a desirable trait which fetches good return to the growers. It varies according to the purpose of production v*iz*., for bulb production or seed production. Time of harvesting is a critical stage because early or late harvesting can cause severe loss in the total yield as well as the quality of bulb can also reduce. So, harvesting at proper time is important to enhance the yield and quality of onion bulbs. Similar results were also recorded by Ijoyah *et al.* (2008), John *et al*. (2010), Ratan *et al*. (2017), Hulagannavar (2019) and Yadav *et al*. (2021).

Polar diameter of bulb (cm)

It is evident from Table 2 that, significant differences were recorded in polar diameter of bulb by onion genotypes. First year data showed that, the maximum polar diameter of bulb was recorded by genotype RHROR-12 (5.59 cm) followed by genotype RHROR-10 (5.55 cm) and genotype RHROR-11 (5.52 cm) but the minimum polar diameter of bulb depicted in genotype RHROR-5 (4.25 cm).

In second year, the maximum polar diameter of bulb was observed in genotype RHROR-12 (5.77 cm) followed by genotype RHROR-11 (5.71 cm) and genotype RHROR-19 (5.55) while the minimum polar diameter of bulb was observed in genotype RHROR-5 (4.32).

Average mean data showed that, the maximum polar diameter of bulb was observed in genotype RHROR-12 (5.68 cm) followed by genotype RHROR-10 (5.64 cm) and genotype RHROR-11 (5.61 cm) however, the minimum polar diameter of bulb was registered by genotype RHROR-5 (4.29 cm).

Polar diameter is also an important yield contributing character as it determines the size of the bulb which has a direct relationship with total bulb yield. Higher the bulb size, the more will be yield and more returns also. These results are in concarance with those noticed by Umamaheshwarappa *et al*. (2015), Amarananjundeswara

Table 1 : Mean performance of different onion genotypes for average bulb weight (g) and days to harvest (DAT).

S. no.	Genotypes	Average bulb weight (g)			Days to harvest (DAT)		
		2021	2022	Average Mean	2021	2022	Average Mean
1.	RHROR-1	75.84	70.74	73.29	137.50	133.00	135.25
2.	RHROR-2	77.99	80.06	79.03	134.00	142.50	138.25
3.	RHROR-3	77.95	82.92	80.43	135.50	139.00	137.25
4.	RHROR-4	74.94	81.16	78.05	135.00	133.00	134.00
5.	RHROR-5	82.60	76.01	79.30	134.50	129.50	132.00
6.	RHROR-6	75.06	76.61	75.84	129.50	133.50	131.00
7.	RHROR-7	79.96	80.84	80.04	128.50	126.50	127.50
8.	RHROR-8	81.99	76.14	79.07	132.00	135.00	133.50
9.	RHROR-9	75.49	78.39	76.94	133.00	129.50	131.25
10.	RHROR-10	85.01	84.67	84.84	129.00	131.00	130.00
11.	RHROR-11	89.75	84.19	86.97	124.50	127.00	125.75
12.	RHROR-12	87.56	82.79	85.17	120.50	125.50	123.50
13.	RHROR-13	79.77	75.91	77.84	130.50	136.00	133.25
14.	RHROR-14	74.61	76.38	75.50	137.00	141.00	139.00
15.	RHROR-15	82.82	79.90	81.36	135.50	131.00	133.25
16.	RHROR-16	75.51	79.60	77.56	135.00	130.00	132.50
17.	RHROR-17	75.35	69.86	72.61	143.00	147.00	145.50
18.	RHROR-18	74.48	79.15	76.81	141.00	140.50	140.75
19.	RHROR-19	80.99	77.87	79.43	137.50	135.00	136.50
20.	RHROR-20	68.61	64.80	66.70	144.00	147.50	145.75
21.	RHROR-21	75.34	77.96	76.65	148.00	142.50	145.25
22.	RHROR-22	74.56	75.08	74.82	145.50	141.50	143.50
23.	RHROR-23	76.23	71.73	73.73	147.00	141.00	144.00
24.	RHROR-24	81.44	76.48	79.11	145.00	139.50	142.25
25.	RHROR-25	79.13	75.16	77.14	139.50	144.50	142.00
26.	RHROR-26	75.70	71.81	73.75	144.00	149.50	146.75
27.	RHROR-27	71.50	79.76	75.63	146.00	141.00	143.50
28.	RHROR-28	76.97	80.15	78.56	149.50	145.00	147.25
29.	RHROR-29	77.71	72.24	74.97	146.00	140.00	143.00
30.	RHROR-30	73.64	77.21	75.42	144.50	139.00	141.75
	S.E. (±)	0.96	0.86	0.64	1.63	1.80	1.22
	C.D. at 5%	2.78	2.49	1.83	4.73	5.22	3.45

et al. (2020) and Yadav *et al*. (2021).

Equitorial diameter of bulb (cm)

The data in respect of equatorial diameter of bulb depicted in Table 2 revealed that, in first year the maximum equitorial diameter of bulb was observed in genotype RHROR-12 (6.18 cm) followed by genotype RHROR-10 (6.11 cm) and genotype RHROR-11 (6.01 cm) while the minimum equitorial diameter of bulb was mentioned by genotype RHROR-29 (4.97 cm).

In second year, the maximum equitorial diameter of bulb was recorded by genotype RHROR-11 (5.99 cm) followed by genotype RHROR-12 (5.98 cm) and genotype RHROR-10 (5.93 cm) however, the minimum equitorial diameter of bulb was recorded in genotype RHROR-5 (4.38 cm).

Average mean data showed that, the significant difference was observed the maximum equitorial diameter of bulb was recorded in genotype RHROR-12 (6.08 cm) followed by genotype RHROR-10 (6.02 cm) and genotype RHROR-11 (6.00 cm) while the minimum equitorial diameter of bulb was recorded in genotype RHROR-5 (4.88 cm).

Table 2 : Mean performance of different onion genotypes for polar diameter (cm) and equatorial diameter (cm).

S. no.	Genotypes	Polar diameter of bulb (cm)			Equitorial diameter of bulb (cm)		
		2021	2022	Average Mean	2021	2022	Average Mean
1.	RHROR-1	5.26	5.16	5.21	5.44	5.51	5.47
2.	RHROR-2	4.98	5.33	5.15	5.55	5.52	5.53
3.	RHROR-3	5.27	5.31	5.29	5.69	5.67	5.68
4.	RHROR-4	5.32	5.30	5.31	5.69	5.66	5.67
5.	RHROR-5	4.25	4.32	4.29	5.38	4.38	4.88
6.	RHROR-6	5.16	5.22	5.19	5.34	5.47	5.40
7.	RHROR-7	5.38	5.48	5.43	5.82	5.76	5.79
8.	RHROR-8	5.15	5.25	5.20	5.16	5.20	5.18
9.	RHROR-9	5.28	5.29	5.28	5.46	5.44	5.45
10.	RHROR-10	5.55	5.73	5.64	6.11	5.93	6.02
11.	RHROR-11	5.52	5.71	5.61	6.01	5.99	6.00
12.	RHROR-12	5.59	5.77	5.68	6.18	5.98	6.08
13.	RHROR-13	5.34	5.38	5.36	5.63	5.64	5.63
14.	RHROR-14	5.15	5.13	5.14	5.46	5.51	5.48
15.	RHROR-15	5.41	5.43	5.42	5.73	5.68	5.70
16.	RHROR-16	5.35	5.42	5.38	5.83	5.75	5.79
17.	RHROR-17	5.14	5.09	5.11	5.43	5.44	5.43
18.	RHROR-18	5.15	5.13	5.14	5.50	5.51	5.50
19.	RHROR-19	4.95	5.55	5.25	5.78	5.62	5.70
20.	RHROR-20	5.33	4.97	5.15	5.69	5.64	5.66
21.	RHROR-21	5.15	5.16	5.15	5.41	5.43	5.42
22.	RHROR-22	5.17	4.97	5.07	5.47	5.46	5.46
23.	RHROR-23	5.32	5.37	5.34	5.63	5.60	5.61
24.	RHROR-24	5.19	5.21	5.20	5.56	5.57	5.56
25.	RHROR-25	5.18	5.25	5.22	5.53	5.51	5.52
26.	RHROR-26	4.96	5.28	5.12	5.48	4.99	5.23
27.	RHROR-27	5.16	5.26	5.21	5.55	5.52	5.53
28.	RHROR-28	5.22	5.17	5.19	5.28	5.24	5.26
29.	RHROR-29	5.22	5.26	5.24	4.97	5.43	5.25
30.	RHROR-30	5.23	5.43	5.33	5.43	5.45	5.44
	S.E. (±)	0.04	0.02	0.02	0.03	0.02	0.02
	C.D. at 5%	0.11	0.06	0.06	0.08	0.06	0.06

Equitorial diameter is beneficial for variety selection, growth monitoring, storage optimization and transportation efficiency. These outcomes are in close resemblance with the findings of Umamaheswarappa *et al*. (2015), Amarananjundeswara *et al*. (2020) and Yadav *et al*. (2021).

Total bulb yield (kg/plot)

The data presented in Table 3 showed that, significant differences were observed for total bulb yield **(**kg/plot) by different onion genotypes. In first year, data showed the maximum total bulb yield (kg/plot) observed in genotype RHROR-12 (24.77 kg/plot) followed by genotype RHROR-10 (24.65 kg/plot) and genotype RHROR-7 (23.77 kg/plot) but the lowest total bulb yield (kg/plot) was observed in genotype RHROR-21 (17.67 kg/plot).

In second year, the maximum total bulb yield **(**kg/plot) found in genotype RHROR-12 (25.80 kg/plot) followed by genotype RHROR-7 (24.98 kg/plot) and genotype RHROR-10 (23.95 kg/plot) while the lowest total bulb yield **(**kg/plot) was noticed in genotype RHROR-17 (18.55 kg/plot).

Table 3 : Mean performance of different onion genotypes for total bulb yield (kg /plot) and total bulb yield (t/ha).

S. no.	Genotypes	Total bulb yield (kg /plot)			Total bulb weight (t/ha)		
		2021	2022	Average Mean	2021	2022	Average Mean
1.	RHROR-1	19.83	20.98	20.40	32.91	34.82	33.86
2.	RHROR-2	18.81	19.96	19.38	31.29	33.13	32.21
3.	RHROR-3	19.03	20.10	19.56	31.58	33.36	32.47
4.	RHROR-4	18.43	19.39	18.91	30.59	32.18	31.38
5.	RHROR-5	18.62	19.87	19.24	30.90	32.98	31.94
6.	RHROR-6	17.32	19.78	18.35	28.75	32.83	30.79
7.	RHROR-7	23.77	24.98	24.37	39.45	41.46	40.60
8.	RHROR-8	17.66	18.81	18.23	29.31	31.22	30.26
9.	RHROR-9	17.44	19.74	18.59	28.95	32.76	30.85
10.	RHROR-10	24.65	23.95	24.30	40.91	39.75	40.33
11.	RHROR-11	22.87	23.81	23.34	37.96	39.52	38.74
12.	RHROR-12	24.77	25.80	25.28	41.11	42.82	41.96
13.	RHROR-13	20.53	21.83	21.18	34.07	36.23	35.15
14.	RHROR-14	17.78	19.27	18.52	29.51	31.98	30.74
15.	RHROR-15	21.52	23.97	22.75	35.72	39.79	37.75
16.	RHROR-16	20.51	21.51	21.01	34.07	35.70	34.88
17.	RHROR-17	19.49	18.55	19.02	32.35	30.79	31.57
18.	RHROR-18	18.89	19.89	19.39	31.35	33.01	32.18
19.	RHROR-19	21.74	22.91	22.32	36.08	38.03	37.05
20.	RHROR-20	20.10	21.20	20.65	33.36	35.19	34.27
21.	RHROR-21	17.67	18.78	18.22	29.33	31.17	31.25
22.	RHROR-22	18.98	19.01	18.99	31.50	31.55	31.52
23.	RHROR-23	18.14	19.34	18.74	30.11	32.10	32.10
24.	RHROR-24	18.36	19.72	19.04	30.47	32.73	31.60
25.	RHROR-25	18.25	19.70	18.97	30.29	32.70	31.49
26.	RHROR-26	17.76	18.80	17.78	29.48	31.20	30.35
27.	RHROR-27	18.76	19.93	19.34	31.14	33.08	32.13
28.	RHROR-28	18.87	19.77	19.32	31.32	32.81	32.07
29.	RHROR-29	19.74	18.59	19.16	32.76	30.85	31.80
30.	RHROR-30	20.55	19.85	20.20	34.11	32.95	33.53
	S.E. (±)	20.51	21.51	21.01	1.27	1.48	0.98
	C.D. at 5%	19.49	18.55	19.02	3.66	4.29	2.76

Average mean data showed that, the maximum total bulb yield **(**kg/plot) was observed in genotype RHROR-12 (25.28 kg/plot) followed by genotype RHROR-7 (24.37 kg/plot) and genotype RHROR-10 (24.30 kg/plot) however, the lowest total bulb yield **(**kg/plot) was recorded by genotype RHROR-26 (17.78 kg/plot).

Total bulb yield (kg/plot) of bulbs from the genotypes can be attributed due to maximum plant height and number of leaves, which are important component of growth and it resulted in accumulation of maximum photosynthates in the bulb and also better per cent plant establishment. It to be observed directly proportional to the number of bulbs produced. Apart from these, it may be related to maximum polar and equatorial bulb diameter, number of bulbs per plot and bulb weight, which are major yielding contributing components. These results are in accordance with those noticed by Shivakumar (2015), Aslam (2018), Ganiger *et al*. (2018), Srivastav (2019) and Amarananjundeswara *et al*. (2020).

Total bulb yield (t/ha)

It is evident from Table 3 that, significant differences were recorded for total bulb yield (t/ha) by different onion genotypes. First year data showed that, the maximum

Table 4 : Mean performance of different onion genotypes for marketable bulb yield (t/ha).

S. no.	Genotypes	Marketable bulb yield (t/ha)		
		2021	2022	Average Mean
1.	RHROR-1	26.08	29.73	27.90
2.	RHROR-2	30.20	28.80	29.50
3.	RHROR-3	29.21	30.16	29.68
4.	RHROR-4	28.45	28.84	28.64
5.	RHROR-5	29.63	31.67	30.65
6.	RHROR-6	26.88	30.17	28.53
7.	RHROR-7	39.62	40.09	39.85
8.	RHROR-8	27.20	29.75	28.47
9.	RHROR-9	24.78	26.79	25.78
10.	RHROR-10	39.70	38.97	39.33
11.	RHROR-11	36.63	38.53	37.58
12.	RHROR-12	40.48	39.89	40.18
13.	RHROR-13	33.58	35.88	34.73
14.	RHROR-14	28.89	29.31	29.10
15.	RHROR-15	34.68	38.66	36.67
16.	RHROR-16	32.43	32.57	32.50
17.	RHROR-17	25.43	25.73	25.58
18.	RHROR-18	28.40	28.75	28.57
19.	RHROR-19	33.25	32.85	33.05
20.	RHROR-20	27.77	27.95	27.86
21.	RHROR-21	27.26	25.87	26.56
22.	RHROR-22	29.36	28.92	29.14
23.	RHROR-23	26.53	29.94	28.23
24.	RHROR-24	27.84	30.28	29.06
25.	RHROR-25	29.21	30.23	29.72
26.	RHROR-26	30.51	31.60	31.05
27.	RHROR-27	29.16	31.58	30.37
28.	RHROR-28	27.51	26.82	27.16
29.	RHROR-29	31.53	29.52	30.52
30.	RHROR-30	29.22	27.18	28.20
	S.E. (±)	0.30	0.17	0.17
	C.D. at 5%	0.86	0.51	0.49

total bulb yield (t/ha) was recorded by genotype RHROR-12 (41.11 t/ha) followed by genotype RHROR-10 (40.91 t/ha) and genotype RHROR-7 (39.45 t/ha) while the minimum total bulb yield (t/ha) was noticed by genotype RHROR-8 (29.31 t/ha).

In second year, the maximum total bulb yield (t/ha) was observed in genotype RHROR-12 (42.82 t/ha) followed by genotype RHROR-7 (41.46 t/ha) and genotype RHROR-10 (39.75 t/ha) while the minimum total bulb yield (t/ha) was observed in genotype RHROR-17 (30.79 t/ha).

Average mean data showed that, the maximum total bulb yield (t/ha) was registered by genotype RHROR-12 (41.96 t/ha) followed by genotype RHROR-7 (40.60 t/ha) and genotype RHROR-10 (40.33 t/ha) however, the minimum total bulb yield (t/ha) was recorded by genotype RHROR-8 (30.26 t/ha).

The main objective of the cultivation is to have maximum total bulb yield (t/ha) with good quality bulbs for better returns. Total bulb yield (t/ha) is responsible for commercial viability and is one of the most important quantitative traits attaining highest contribution for research purpose. The growers mainly focus on the yield potential of any variety which can help them to have better yield and good returns. It is due to maximum growth and yield contributing traits results in maximum bulb yield.

These outcomes are in close resemblance with the finding by Bhusal (2017), Bindu and Bindu (2015), Lakshmipathi *et al*. (2017), Srivastav *et al*. (2019), Jat and Vikram (2018), Amarananjundeswara *et al*. (2020) and Mareddy (2021).

Marketable bulb yield (t/ha)

The data depicted in Table 4 revealed that, significant differences for marketable bulb yield by different onion genotypes. In first year, data the highest marketable bulb yield was observed in genotype RHROR-12 (40.48 t/ha) followed by genotype RHROR-10 (39.70 t/ha) and genotype RHROR-7 (39.62 t/ha) but the lowest marketable bulb yield was observed in genotype RHROR-9 (24.78 t/ha).

In second year, the highest marketable bulb yield was recorded by genotype RHROR-7 (40.09 t/ha) followed by genotype RHROR-12 (39.89 t/ha) and genotype RHROR-10 (38.97 t/ha) however, the lowest marketable bulb yield was observed in genotype RHROR-17 (25.73 t/ha).

Average mean data showed that, the highest marketable bulb yield mentioned by genotype RHROR-12 (40.18 t/ha) followed by genotype RHROR-7 (39.85 t/ha) and genotype RHROR-10 (39.33 t/ha) while the lowest marketable bulb yield observed in genotype RHROR-17 (25.58 t/ha).

Marketable bulb yield is directly associated with final bulb yield. More the marketable bulb yield per plot more will be the total bulb yield. Selection of suitable variety for a particular area, proper cultural practices, careful harvesting and handling of onion bulbs leads to the production of more marketable bulbs. These results were close agreement with those noticed by Dewangan (2011), Bhusal (2017), Aslam (2018) and Rathod *et al*. (2021).

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