

Standardization of *Kharif* Onion Cultivars

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Abstract

A field investigation was conducted to evaluate the cultivars of onion for bulb yield and reactions to pests and diseases during *kharif* season at AINRP on Onion & Garlic, College of Horticulture (OUAT), Sambalpur, and Odisha, India. Twenty two cultivars of onion including five national check varieties supplied by Directorate of Onion & Garlic Research, Rajgurunagar, Pune were evaluated by adopting RBD with three replications. Results revealed significantly better leaves plant⁻¹ (8.87), collar thickness (1.44 cm), average bulb weight (70.44 g), polar diameter (6.44 cm), equatorial diameter (4.53 cm) having better TSS (10.76%), tolerance to thrips infestation (2.36 thripsplant⁻¹), marketable bulb yield (223.65 q ha⁻¹) and total bulb yield (276.96 q ha⁻¹) were recorded for NRCWO-3, closely followed by Bhima Super, NRCRO-1, NRCWO-4 and the check, Bhima Red than rest of the entries tested. However, significantly heaviest bulb weight of 78.68g was recorded in entry, VG-18. Similarly during *kharif* season more than 200 q ha⁻¹ marketable bulb yield was recorded in the entries like NRCWO-3 (223.65 q ha⁻¹), Bhima Red (215.04 q ha⁻¹), NRCWO-1 (212.58 q ha⁻¹), NRCWO-4 (208.60 q ha⁻¹) and NRCWO-2 (205.54 q ha⁻¹). On the other hand, total bulb yield of more than 200 q ha⁻¹ was recorded in entry, NRCWO-3 (276.94 q ha⁻¹), Bhima Red (268.09 q ha⁻¹), NRCWO-4 (259.66 q ha⁻¹), NRCWO-2 (249.63 q ha⁻¹), Bhima Super (249.35 q ha⁻¹), NRCWO-1 (248.61 q ha⁻¹) and NRCRO-3 (242.96 q ha⁻¹). Thus, the varieties like NRCWO-1, NRCWO-3, NRCWO-4, Bhima Super, Bhima Red and NRCRO-3 may be recommended for *karif* season cultivation to obtain maximum bulb yield. Similarly cultivars like Bhima Kiran, Bhima Super, NRCRO-2 and Col-652 may be recommended for better tolerance to both Purple Blotch and Thrips infestation.

1. Introduction

In India, onion is predominantly cultivated during *rabi* about 60% followed by 20% each in *kharif* and late *kharif* season (Tripathy et al., 2013). The higher productivity could be determined by selection of suitable varieties, balanced nutrition, optimum water management as well as need based plant protection measures. Among these factors, selection of suitable variety(s) plays an important role in enhancing the yield as well as productivity. Production of onion in *kharif* and late *kharif* season is more important to have continuous supply of onion round the year. Therefore, standardization of *kharif* onion cultivars is a basic step towards the popularization for its successful cultivation. Keeping this in view, the present experiment was conducted to study the response of some improved varieties and advanced lines of common onion (*Allium cepa* L.) during *kharif* season.

2. Materials and Methods

The present field experiment was carried out at College of Horticulture (OUAT), Chiplima, Sambalpur, Odisha, India under All India Network Research Project on Onion & Garlic, during *kharif* season of 2010. Twenty two cultivars and advanced lines of onion including five national check varieties supplied by Directorate of Onion & Garlic Research, Rajgurunagar, Pune were evaluated by adopting RBD with three replications. All the twenty two cultivars were sown in the nursery on 27th June, 2010 and transplanted on 27th August, 2010 to 28th August, 2010 in a plot size of 3×2 m² with a spacing of 15×10 cm². All the recommended package of practices was adapted to all the cultivars uniformly to raise a good crop. The data was recorded on ten randomly selected plants from each treatment on vegetative parameters like plant height, number of leaves plant⁻¹, collar thickness; bulb parameters like



average bulb weight, polar diameter, equatorial diameter, neck thickness, % of bolters, % of doubles, days to bulb maturity; both marketable and total bulb yield. The data collected on various aspects were subjected to statistical analysis as per the procedure suggested by Sukhatme and Amble (1995).

3. Results and Discussion

The results on performance of *kharif* onion cultivars on vegetative, bulb yield attributes as well as reactions to pests & diseases are presented in Table 1-3. There were significant differences among the different cultivars and advanced lines tested for various aspects under study. Among the cultivars, significantly highest plant height was recorded in NRCRO-3 (63.51 cm) and was at par with Bhima Red (59.33 cm). The variety, L-28, had produced significantly highest number of leaves plant⁻¹ (9.17), closely followed by Bhima Super, Bhima Kiran, NRCWO-2, NRCWO-3, NRCRO-3, Col-652 and HOS-4 (8.53 to 8.70). On the other hand, the advanced line, NRCWO-1 had significantly highest collar thickness

(1.48 cm) while NOL-103 & NRCWO-2 have lowest collar thickness (1.10 cm).

The results on bulb parameters, i.e. average bulb weight, polar diameter, equatorial diameters and neck thickness showed significant variations among the tested cultivars (Table 1). VG -18 had produced significantly the heaviest bulb of 78.68 g than rest of the cultivars except Bhima Super, Col-652 and NRCRO-3, NRCRO-4, NRCWO-1, NRCWO-2, NRCWO-3, NRCWO-4, RO-282, HOS-4, Bhima Kiran, Bhima Red, L-28 and PKV White (61.61 g to 76.98 g). The polar diameter of the bulbs varies from 4.39 cm (RO-282) to 6.44 cm (NRCWO-3) with an average value of 5.56 cm. However, significantly highest polar diameter was recorded in NRCWO-3 than all the tested lines except Bhima Super, NRCRO-3, NRCWO-4 and Bhima Red (6.29 cm to 6.43 cm), which were statistically at par. Similarly, significant variations were also recorded for equatorial diameter which varies from 3.61 cm (RO-282) to 4.73 cm (NRCWO-4). However, Statistical parity were observed with lines such as Bhima Super, NRCRO-1,

Table 1: Vegetative growth and bulb yield attributing parameters of onion as influenced by different cultivars during *kharif* season under Odisha conditions

Sl.no.	Lines/ Variety	PH (cm)	NOL	CT (cm)	ABW (g)	PD (cm)	ED (cm)	NT (cm)
1.	Bhima Super	56.52	8.70	1.41	72.19	6.29	4.66	1.17
2.	NRCRO-1(1133)	54.58	7.90	1.40	60.05	5.62	4.35	1.18
3.	NRCRO-2 (1156)	52.50	8.17	1.40	50.95	5.24	4.23	1.01
4.	NRCRO-3 (RGO-53)	63.51	8.40	1.44	75.42	6.07	4.69	1.07
5.	NRCRO-4 (1168)	55.67	8.27	1.38	61.61	5.26	4.71	1.11
6.	NRCWO-1 (W-448)	55.82	8.07	1.48	67.39	5.56	4.63	1.08
7.	NRCWO-2 (W El Composite)	54.04	8.83	1.10	65.19	5.81	4.52	1.12
8.	NRCWO-3 (W-302)	57.41	8.87	1.44	70.44	6.44	4.53	1.21
9.	NRCWO-4 (W-009)	53.94	8.10	1.47	66.46	6.30	4.73	1.10
10.	VG 18	51.58	8.30	1.24	78.68	5.89	3.94	0.96
11.	VG 19	51.55	8.20	1.17	73.30	5.59	4.25	0.86
12.	Col. 652	56.34	8.40	1.39	63.47	5.67	4.65	1.03
13.	NOL 103	52.10	8.10	1.19	58.82	5.06	3.93	0.85
14.	NOL.115	53.95	8.13	1.10	59.86	5.51	3.82	1.13
15.	RO 252	45.90	8.13	1.47	43.08	4.72	4.01	1.18
16.	RO 282	46.31	7.50	1.13	72.26	4.39	3.61	1.07
17.	HOS 4	54.79	8.87	1.44	76.98	5.89	3.94	0.96
18.	Bhima Kiran (C)	58.33	8.53	1.42	62.98	5.22	4.48	1.15
19.	Bhima Red (C)	59.33	8.60	1.38	66.34	6.43	4.49	1.11
20.	L-28 (C)	54.83	9.17	1.47	66.70	4.98	4.63	1.11
21.	PKV White (C)	48.53	7.73	1.17	65.09	5.11	3.82	1.21
22.	Pusa White Round (C)	45.78	7.83	1.12	51.17	5.25	3.63	1.03
	Mean	53.79	8.31	1.33	64.93	5.56	4.30	1.09
	CD ($p=0.05$)	4.63	0.82	0.19	17.92	0.47	0.61	0.18

PH: Plant height; CT: Collar thickness; ABW: Average bulb weight; PD: Polar diameter; ED: Equatorial diameter; NT: Neck thickness



NRCRO-2, NRCRO-3, NRCRO-4, NRCWO-1, NRCWO-2, NRCWO-3, VG-18, VG-19, Col 652, Bhima Red, Bhima Kiran and L-28 (4.23 to 4.71 cm). The present study also indicated significantly higher bulb diameter (both polar and equatorial) among the tested lines and varieties such as Bhima Super, Bhima Red, NRCRO-3, NRCWO-3 and NRCWO-4 during *kharif* season.

In onion, neck thickness of harvested bulb play key role towards shelf life and rate of rotting under storage condition. Usually bulbs with relatively thin neck are preferred for better storage life than thickness bulbs which have lower storage life period. Hence maximum precaution should be considered while selecting the better onion variety for cultivation purpose. In the present study, the neck thickness varies significantly from 0.86 cm (VG-19) to 1.21 cm (NRCWO-3 and PKV White). However, the line VG-19 of IIHR, Bangaluru recorded significantly minimum neck thickness of 0.86 cm than rest of the tested lines including the check except the cultivars, NRCRO-1, NRCRO-4, VG-18, Col 652, HOS-4 and Pusa White Round (0.95 cm to 1.03 cm), which were at par. The

results of thin necked cultivars indicated that these cultivars could complete their growth in *kharif* season (Mohanty and Prusty, 2002)

In case of onion while selecting a good variety(s) for cultivation, it is also essential to evaluate the lines or cultivars on the basis of production of bolters, doubles, marketable bulbs, marketable yield as well as total bulb yield. On commercial cultivation of onion, both % of marketable bulbs and marketable bulb yield play a vital role than total bulb yield. The research results on these aspects presented in Table 2 revealed significant variations among the tested cultivars. Both productions of bolters as well as doubles are considered as negative parameter with respect to onion bulb production. The production of doubles varies from 0.00% (NRCWO-3) to 23.66% (HOS 4). However, the line, NRCWO-3 recorded minimum double which were statistically at par with all the tested lines except the line L-28 and HOS-4. On the other hand, the line NRCWO-3 recorded significantly highest % of bolters (2.24%) than rest of the lines except NRCWO-1 and Bhima Red, which were statistically on par. Regarding the %

Table 2: Bulb yield of onion as influenced by different cultivars during *kharif* season under Odisha conditions

Sl. no.	Lines/ variety	MY (q ha ⁻¹)	% Doubles	% Bolters	% MB	TY (q ha ⁻¹)	DTH (days)	TSS (%)
1.	Bhima Super	205.41	0.67	0.55	82.19	249.35	122.67	10.71
2.	NRCRO-1(1133)	125.72	0.32	0.00	80.30	156.39	135.33	10.13
3.	NRCRO-2 (1156)	103.30	2.90	0.00	79.33	129.44	122.00	8.95
4.	NRCRO-3 (RGO-53)	197.27	5.41	2.24	81.17	242.96	136.67	10.70
5.	NRCRO-4 (1168)	138.91	0.19	0.00	79.32	175.10	123.00	10.78
6.	NRCWO-1 (W-448)	212.58	1.64	1.66	85.76	248.61	122.00	10.47
7.	NRCWO-2 (W El Composite)	205.54	1.94	0.44	82.08	249.63	122.67	9.62
8.	NRCWO-3 (W-302)	223.65	0.00	0.36	80.42	276.94	137.33	10.76
9.	NRCWO-4 (W-009)	208.60	2.06	0.84	80.28	259.66	121.33	10.24
10.	VG 18	109.21	0.58	0.00	70.53	153.75	134.67	9.02
11.	VG 19	148.20	2.03	0.52	73.73	199.88	125.67	9.09
12.	Col.652	143.20	0.43	0.00	75.22	190.27	118.33	11.73
13.	NOL 103	122.80	1.68	1.02	72.36	170.87	137.00	8.31
14.	NOL.115	104.55	0.58	0.00	74.30	140.82	121.67	9.47
15.	RO 252	63.18	3.78	0.00	79.62	78.89	122.67	10.04
16.	RO 282	44.48	6.43	0.00	75.90	57.36	121.33	10.21
17.	HOS 4	63.77	23.66	0.00	58.79	108.23	121.00	8.90
18.	Bhima Kiran (C)	121.05	3.93	0.00	84.45	143.05	121.33	9.24
19.	Bhima Red (C)	215.04	4.48	1.68	80.23	268.09	123.33	8.71
20.	L-28 (C)	80.88	14.05	0.59	76.29	103.88	138.67	10.16
21.	PKV White (C)	99.09	5.92	0.00	71.45	138.26	126.67	10.32
22.	Pusa White Round (C)	107.58	6.12	0.00	68.97	154.04	137.00	9.67
	Mean	138.36	4.04	0.45	76.94	177.07	126.92	9.87
	CD (<i>p</i> =0.05)	39.31	7.18	1.22	8.41	42.05	13.02	1.68

MB: Marketable bulbs, MY: Marketable yield, TY: Total yield



of marketable bulbs-the critical parameter for profitable onion cultivation, the results indicated significant variations ranging from 58.79% (HOS 4) to 85.76% (NRCWO-1). However, NRCWO-1 showed statistical parity with cultivars such as Bhima Super, NRCRO-1, NRCRO-2, NRCRO-3, NRCRO-4, NRCWO-2, NRCWO-3, NRCWO-4, RO-282, Bhima Kiran and Bhima Red (76.29 to 84.45%).

The line, Col-652 of NHRDF, Nashik (118.33 days) took significantly minimum time for harvesting than rest of the cultivars, except Bhima Super, NOL-103, NRCRO-2, NRCRO-4, NRCWO-1, NRCWO-2, NRCWO-4, RO-252, RO-282, HOS-4 VG-18, Bhima Kiran, Bhima Red and PKV White (121.33 to 126.67 days), which were statistically at par. However, the cultivar, L-28 took maximum time (138.67 days) for harvesting. The variation might be due to the genetic and environmental effect.

The TSS of onion bulbs varies from 8.31% (NOL-103) TO 11.73% (Col 652) with a mean value of 9.87%. However, the cultivars such as Bhima Super, NRCRO-1, NRCRO-3, NRCWO-1, NRCWO-3, NRCWO-4, RO-282 including two check L-28 and PKV White (10.16 to 10.78%) were statistically at par with Col 652.

Significant variations among the cultivars also recorded for both marketable and total bulb yield. From commercial point of view, the marketable bulb yield in onion is more important than that of the total bulb yield. Hence, due consideration should be taken care while selection of suitable variety for commercial cultivation, particularly during *kharif* and late *kharif* seasons, which is treated as off season. The marketable bulb yield varies from 44.48 q ha⁻¹ (RO-282) to 223.65 q ha⁻¹ (NRCWO-3) with average of 138.36 q ha⁻¹. The variety, NRCWO-3 had produced significantly highest marketable bulb yield of 223.65 q ha⁻¹ than rest of the cultivars tested. However, statistical parity was observed in cultivars like Bhima Red (215.04 q ha⁻¹), NRCWO-1 (212.58 q ha⁻¹), NRCWO-4 (208.60 q ha⁻¹), NRCWO-3 (205.54 q ha⁻¹), Bhima Super (205.41 q ha⁻¹) and NRCRO-3 (197.27 q ha⁻¹). Similarly, the production of total bulb yield under by different cultivars varies from 57.36 q ha⁻¹ (RO-282) to 276.94 q ha⁻¹ (NRCWO-3), with a mean yield of 177.07 q ha⁻¹. The variety, NRCWO-3 had produced significantly highest total bulb yield of 276.94 q ha⁻¹ than the rest of the tested cultivars except NRCRO-3 (242.96 q ha⁻¹), NRCWO-1 (248.62 q ha⁻¹), Bhima Super (249.35 q ha⁻¹), NRCWO-2 (249.63 q ha⁻¹), NRCWO-4 (259.66 q ha⁻¹) and the control, Bhima Red (268.09 q ha⁻¹), which were statistical at par.

The results also indicated that during *kharif* season, more than 200 q ha⁻¹ marketable bulb yield was recorded in the entries like NRCWO-3 (223.65 q ha⁻¹), Bhima Red (215.04 q ha⁻¹), NRCWO-1 (212.58 q ha⁻¹), NRCWO-4 (208.60 q ha⁻¹)

& NRCWO-2 (205.54 q ha⁻¹). On the other hand, total bulb yield of more than 200 q ha⁻¹ was recorded in entry, NRCWO-3 (276.94 q ha⁻¹), Bhima Red (268.09 q ha⁻¹), NRCWO-4 (259.66 q ha⁻¹), NRCWO-2 (249.63 q ha⁻¹), Bhima Super (249.35 q ha⁻¹), NRCWO-1 (248.61 q ha⁻¹) and NRCRO-3 (242.96 q ha⁻¹).

The maximum bulb yield of these varieties can be mainly attributed to the growth parameters which are important components of growth & had positive as well as significant correlation with yield. The maximum bulb yield from these varieties during *kharif* season may also be due the accumulation of maximum photosynthates in the bulbs. The variations in the bulb yields of different varieties of onion have also been reported from several places (Patil et al., 1991; Bhonde et al., 1992; Khan, 1997; Mohanty and Prusty, 2002). Superiority of Bhima Super and Bhima Red as *kharif* onion has also been reported by Lawande et al. (2011).

The results on % of plant establishment, infestation of thrips as well as purple blotch incidence (Table 3) revealed significant variations among the tested lines during *kharif* season. Onion, being basically a winter crop and when cultivated during either *kharif* or late *kharif*, the crop is exposed to adverse weather condition and act as an off season crop. Therefore, the % of plant establishment is also considered an important factor to screen out the cultivars suitable for off season cultivation. The lines showing better % of establishment will definitely perform better during *kharif* and late *kharif* season. In the present study, the % of establishment varies significantly 42.75% (RO-252 & L 28) to 94.33 % (NRCWO-3) with a mean value of 69.01%. The research results indicated significantly higher % of plant establishment in cultivars like Bhima Super, NRCWO-1, NRCWO-2, NRCWO-4 and VG-19 (82.00 to 91.00%) which were statistically at par with NRCWO-3.

In onion, purple blotch (*Alternaria porii*) is a major problem in almost all parts of the country (Kareem et al., 2011), more severe during *kharif* and late *kharif* season. The results indicated significantly minimum incidence of purple blotch in cultivar Bhima Kiran (36.67%) than rest of the cultivars except NRCRO-1133, NRCRO-2, NRCRO-4, NRCWO-1, NRCWO-2, Col 652, RO-252, RO-282 and HOS 4 where statistical parity were recorded.

Similarly, the infestation of thrips varies significantly from 1.87 thrips plant⁻¹ (NOL-115) to 4.55 thrips plant⁻¹ (NRCRO-4) among the tested lines except Bhima Super, Bhima Red, Bhima Kiran, L-28, NRCRO-1, NRCRO-2, NRCWO-3, VG-18, VG-19, Col 652 and NOL-103 which were statistically at par. The present study also indicated that cultivars like Bhima Kiran, Bhima Super, NRCRO-2 and Col-652 showed tolerance to both purple blotch as well as thrips infestation under *kharif* season.

Table 3: Reaction of *kharif* onion cultivars to pests-diseases under Odisha conditions

Sl. no.	Lines/ variety	% Plant establishment	PDI (%)	Thrips plant ⁻¹
1.	Bhima Super	82.17	41.50 (40.11)	2.47 (1.72)
2.	NRCRO-1(1133)	66.92	49.11 (44.48)	2.11(1.61)
3.	NRCRO-2 (1156)	54.75	40.11 (39.11)	1.95(1.57)
4.	NRCRO-3 (RGO-53)	73.08	62.78(52.46)	4.00(2.12)
5.	NRCRO-4 (1168)	68.17	45.89(42.54)	4.55(2.24)
6.	NRCWO-1 (W-448)	82.00	36.78(37.22)	4.27(2.18)
7.	NRCWO-2 (W El Composite)	91.00	47.56(43.59)	2.63(1.76)
8.	NRCWO-3 (W-302)	94.33	66.55(54.66)	2.36(1.69)
9.	NRCWO-4 (W-009)	85.50	54.33(47.48)	2.56(1.75)
10.	VG 18	62.33	59.78(50.69)	1.98(1.57)
11.	VG 19	88.83	52.22 (46.27)	2.39(1.70)
12.	Col. 652	75.08	44.20(41.65)	2.11(1.61)
13.	NOL 103	59.50	54.00(47.37)	2.49(1.73)
14.	NOL.115	65.58	51.44(45.82)	1.87(1.54)
15.	RO 252	42.75	42.33(40.31)	5.25(2.40)
16.	RO 282	57.58	42.89(40.88)	2.80(1.81)
17.	HOS 4	57.59	41.00(39.80)	2.74(1.80)
18.	Bhima Kiran (C)	50.83	36.67(37.09)	2.51(1.73)
19.	Bhima Red (C)	80.25	55.67(48.27)	2.18(1.63)
20.	L-28 (C)	42.75	53.11(46.79)	2.18(1.62)
21.	PKV White (C)	57.17	58.78(50.05)	2.75(1.80)
22.	Pusa White Round (C)	80.08	58.00(50.05)	3.72(2.05)
	Mean	69.01	49.76(44.83)	2.81(1.80)
	CD ($p=0.05$)	13.02	8.14	0.19

PDI: Percentage of disease index

4. Conclusion

NRCWO-1, NRCWO-3, NRCWO-4, Bhima Super, Bhima Red and NRCRO-3 may be recommended for *kharif* season cultivation to obtain maximum bulb yield and profit due to their high potential. These cultivars can be further used for crop improvement programme for development of new lines suitable for *kharif* and late *kharif* season cultivation. Similarly cultivars like Bhima Kiran, Bhima Super, NRCRO-2 and Col-652 may be recommended for better tolerance to both purple blotch and thrips infestation.

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