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Short communication

Evaluation of onion varieties under low hill conditions of Himachal Pradesh

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ABSTRACT

An experiment was conducted to identify promising varieties of onion suited for cultivation under low hill conditions of Himachal Pradesh. Ten varieties were evaluated at Research Farm of the Institute of Biotechnology and Environmental Science, Dr. Y.S. Parmar University of Horticulture and Forestry, Neri, Hamirpur, for two consecutive seasons (2010-2011 and 2011-2012). The farm is located at an altitude of 620m above mean sea level, with average mean maximum and minimum temperatures of 31.3^{0}C and 12.4^{0}C, respectively, and is a representative site of the low hill region of Himachal Pradesh. Standard package of practices was followed for raising the crop as recommended by the University. Observations were recorded on various horticultural traits, viz., plant height, number of leaves per plant, days to harvest, neck thickness, bulb diameter, bulb weight, TSS, and total yield. In addition, all the varieties were screened for resistance against purple blotch disease. Maximum days to harvest (129.33 days) were seen in the variety Holland Louis, while, variety Agrifound Rose showed minimum number of days (109). Varieties Palam Lohit, Nasik Red, N-53 and Agrifound Dark Red recorded significantly higher bulb yield (275.00, 240.67, 239.25 and 232.37 q/ha, respectively) than the other varieties evaluated. None of the varieties was able to resist the disease totally; however, 'Agrifound Dark Red' was moderately resistant, exhibiting just 13.78% disease incidence. Varieties Palam Lohit, Nasik Red and Agrifound Dark Red had medium bulb size and higher yield. These can be advocated for commercial cultivation under low hill conditions of Himachal Pradesh.

Key words: Onion, varieties, evaluation, yield, Purple Blotch

Onion (*Allium cepa* L.) is an important vegetable and spice consumed by almost all sections of the society round the year. In Himachal Pradesh, onion is grown over an area of 2.2 thousand hectares, with production of 36.3 thousand metric tons. Productivity of onion in Himachal Pradesh, however, is only 16.5 t/ha (sfacindia.com, 2012). Several factors play a significant role in onion production, and genotypes can be considered as one of the important factors. Many new hybrids/ varieties of onion have been released by the public and private sectors in the market, but information on their performance, especially under low hill conditions, is lacking. Farmers opt for cultivating specific hybrids/varieties solely on recommendation of vendors, which leads to uncertainty in yield and, sometimes, total crop failure. Among several other factors, diseases are the most important associated with low productivity in onion. Purple blotch, caused by *Alternaria porri*, is one of the serious fungal diseases affecting onion, causing yield losses upto 50% (Srivastava *et al*, 1994). The crop in our region is highly prone to this disease that appears by the end of March (with onset of summer) and results in huge losses of the crop. Therefore, it is necessary to evaluate the performance of hybrids/varieties before recommending them for cultivation so that farmers can fetch assured returns on their investment. Thus, to identify promising varieties suited to low hill conditions of Himachal Pradesh, an evaluation trial was conducted during 2010 - 2012 using 10 onion genotypes.

The experimental site is located at an altitude of 620m above mean sea level at latitude 31^{o}682 N and longitude 76^o 522 E. The mean minimum and maximum temperature ranged between 12.4^{o}C to 31.3^{o}C. Average humidity remained 60.91%. The area experiences annual rainfall of 69.4cm, a majority of it occuring during the monsoon season. The soil in the experimental area was clay-loam, with pH 6.6 and 0.38% organic matter content. Soil N and P were low while K was medium. The experiment was laid out in Randomized Block Design with three replications in each

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treatment. Germplasm obtained from various sources is tabulated hereunder:

Sl. No.	Variety	Source
1.	Nasik Red	NHRDF
2.	Holland Louis	Local Market
3.	Palam Lohit	Palampur
4.	Agrifound Light Red	NHRDF
5.	Agrifound White	NHRDF
6.	NHRDF Red	NHRDF
7.	N-53	NHRDF
8.	Agrifound Dark Red	NHRDF
9.	Agrifound Rose	NHRDF
10.	Century Selection	Local Market

Seeds of these ten varieties of onion were planted in the nursery bed in October for raising the nursery. Eight-week old healthy seedlings were transplanted on flat beds at a spacing of 15cm x 10cm in a plot of 3.0 x 3.0 sq.m. during the last week of December for both years of experimentation. Recommended cultural practices were followed to raise the crop successfully. All observations pertaining to crop traits, viz., plant height (cm), no. of leaves/ plant, neck thickness (cm), bulb diameter (cm), bulb size index (cm^2), bulb weight (g), days to bulb initiation, days to harvest, total soluble solids (^oB), and yield, were made on 10 randomly selected healthy seedlings in each plot. Bulb yield was noted on plot basis. Data obtained during the two years were analyzed and pooled as per the standard procedure of Gomez and Gomez (1984). In addition, all the cultivars under study were screened for disease severity to purple blotch on the basis of a 0-4 scale (0- No infection, 1-, 2-, 3- and 4). Per cent disease index was calculated as per McKinney (1923). Varieties were rated as resistant to highly susceptible (depending upon level of disease severity exhibited by them) as given below:

Sl. No.	Disease severity (%)	Disease reaction
1	0-5	Resistant (R)
2	5-15	Moderately resistant (MR)
3	15-25	Moderately susceptible (MS)
4	25-40	Susceptible (S)
5	> 40	Highly susceptible (HS)

Pooled analysis of variance (Table 1) revealed significant mean square estimates for all the characters studied. This not only explained differences observed over the years of testing, but also indicated degree of variability among the varieties. Mean performance of the varieties during the two year of study is presented in Table 2. Variety Palam Lohit showed maximum plant height (70.33cm), closely followed by 'Century Selection', whereas,

Table 1. Pooled analysis of variance for various traits in onion

Source of variation	d.f.	Mean sum of squares									
		Plant height (cm)	NLPP	Neck thickness (cm)	Bulb diameter (cm)	Bulb Size index (cm^2)	Bulb weight (g)	TSS (^oB)	Days to bulb initiation	Days to harvest	Bulb yield (q/ha)
Replication	2	2.25	2.11	0.01	0.10	7.73	18.36	0.10	1.44	6.03	13.37
Treatment	9	313.56*	10.75*	0.09*	0.70*	52.45*	1806.77*	6.16*	68.33*	170.89*	2996.31*
Error	18	30.82	1.90	0.02	0.09	4.82	21.19	2.65	14.27	27.12	131.20

*Significant at 5% level

Table 2. Mean performance (pooled) of onion varieties under low hill conditions of Himachal Pradesh

Variety	Traits									
	Plant height (cm)	NLPP	Neck thickness (cm)	Bulb diameter (cm)	Bulb Size index (cm^2)	Weight of bulb (g)	TSS (^oB)	Days to bulb initiation	Days to harvesting	Bulb yield (q/ha)
Nasik Red	62.67	11.00	0.99	5.26	22.62	67.89	12.66	53.33	121.00	240.67
Holland Louis	64.16	9.33	1.38	6.13	27.15	88.46	11.00	61.33	129.33	215.26
Palam Lohit	70.33	11.67	0.85	5.56	26.85	70.93	12.33	53.00	115.77	275.00
Agrifound Light Red	57.33	9.00	0.82	5.70	23.20	62.53	10.55	47.66	112.66	220.25
Agrifound White	53.00	7.00	1.18	4.43	18.82	54.99	11.33	50.33	113.00	174.67
NHRDF Red	57.50	8.00	1.22	4.72	18.54	60.39	11.10	56.66	123.33	185.75
N-53	49.00	12.33	1.10	5.63	22.85	65.92	12.00	49.33	115.00	239.25
Agrifound Dark Red	64.00	8.33	0.94	5.86	25.40	79.64	13.00	51.66	117.00	232.37
Agrifound Rose	39.00	6.67	1.13	4.25	13.18	40.22	14.16	45.60	109.00	144.75
Century Selection	65.00	8.00	1.29	5.20	21.00	66.00	11.62	59.00	124.00	192.00
Mean	57.11	9.13	1.09	5.27	21.78	65.70	12.85	52.00	118.26	203.41
SE(m) ±	4.53	1.13	0.13	0.30	1.79	3.76	1.33	3.09	4.25	9.35
CD *(P=0.05)*	9.61	2.39	0.28	0.64	3.80	8.97	2.82	6.54	9.01	19.83

'Agrifound Rose' registered the shortest plants (39.00cm). Cultivar N-53 produced maximum number of leaves/plant (12.33), at par with 'Palam Lohit' and 'Nasik Red'. On the contrary, 'Agrifound Rose' recorded minimum number of leaves/plant (6.67), followed by NHRDF-Red and Century Selection.

Thickest neck (1.38cm) was recorded in cultivar Holland Louis, while, 'Agrifound Light Red' registered the thinnest neck (0.82cm). Varieties 'Nasik Red' (0.99cm), 'Agrifound Dark Red' (0.94cm) and 'Palam Lohit' (0.85cm) also displayed a thinner neck than other varieties. Bhonde *et al* (1992) too found thinner neck in 'Agrifound Light Red' in a late kharif season trial, which supports our findings.

Biggest bulb (6.13cm diameter) was noticed in cultivar Holland Louis, whereas, 'Agrifound Rose' expressed the lowest bulb diameter (4.25cm). Rest of the varieties exhibited moderate bulb diameter. Similarly, highest bulb-size index (27.15cm^2) was observed in cv. Holland Louis, which was at par with cultivars Palam Lohit (26.85cm^2) and Agrifound Dark Red (25.40cm^2). The heaviest bulb (88.46g) was observed in 'Holland Louis', which was at par with 'Agrifound Dark Red' (79.64g). On the other hand, 'Agrifound Rose' possessed the lightest bulb (40.22g), followed by 'Agrifound White' (54.99g). Rest of the varieties showed medium bulb weight. Thin neck, coupled with small to medium bulb size was detected in 'Palam Lohit', 'Agrifound Light Red' and 'Nasik Red' by Patil and Kale (1985). Minimum days to bulb initiation (45.00 days) were seen in cv. Agrifound Rose, closely followed by 'Agrifound Light Red' and 'N-53' (49.33), while, the variety Holland Louis took maximum (61.33) number of days to bulb initiation. Similarly, minimum number of days to harvest (109.00 days) were seen in cv. Agrifound Rose, which was at par with 'Agrifound Light Red' (112.66 days), 'Agrifound White' (113.00 days), 'N-53' (115.00 days), 'Palam Lohit' (115.77 days) and 'Agrifound Dark Red' (117.00 days). Variety Holland Louis showed maximum number of (129.33) days to harvest. Highest total soluble solids content (14.16^{0}B) was observed in cv. Agrifound Rose, which was statistically at par with cultivars Agrifound Dark Red, Palam Lohit and N-53. Lowest TSS was recorded in cv. Holland Louis.

Table 3. Reaction of onion varieties to Purple Blotch under natural epiphytotic conditions

Variety	Disease severity (%)	Disease reaction
Nasik Red	70.49	HS
Holland Louis	83.73	HS
Palam Lohit	20.77	MS
Agrifound Light Red	32.32	S
Agrifound White	60.34	HS
NHRDF Red	43.28	HS
N-53	65.67	HS
Agrifound Dark Red	13.78	MR
Agrifound Rose	18.23	MS
Century Selection	80.52	HS

MR: Moderately resistant, MS: Moderately susceptible, S: Susceptible, HS: Highly susceptible

Bulb yield among cultivars ranged from 144.75 to 275.00 q/ha. Highest yield was obtained in Palam Lohit (275.00 q/ha), which was significantly higher than yield of other cultivars. Cultivars Nasik Red (240.67 q/ha), N-53 (239.25 q/ha) and Agrifound Dark Red (232.37q/ha), respectively, were observed to be the next best performers. High yield obtained in these cultivars may be attributed to better vegetative growth in terms of plant height and number of leaves per plant, thereby enhancing photosynthetic efficiency of the plant (Mohanty and Prusti, 2002); whereas, moderate yield of 220.25 and 215.26 q/ha was realized 'Agrifound Light Red' and 'Holland Louis', respectively. Bhagchandani *et al* (1972), Singh *et al* (1991) and Sharma (2009) also reported better performance in cvs. Nasik Red, N-53 and Agrifound Dark Red than in the other cultivars.

Results of the experiment on screening of onion cultivars for resistance to purple blotch disease showed that none of the varieties resisted the disease totally; however, 'Agrifound Dark Red' was moderately resistant, exhibiting just 13.78% disease incidence. Similar results were obtained by Kumari and Singh (2012) who reported disease intensity of 6.36% when seedlings of this cultivar were inoculated with spores of the pathogen. Rest of the cultivars exhibited moderate to high susceptibility reaction towards the disease.

On the basis of observations recorded over two successive years, it is concluded that cultivars Palam Lohit, Agrifound Dark Red and Nasik Red perform better over the other varieties in terms of bulb size, total soluble solids and marketable yield under low-hill, subtropical conditions of Himachal Pradesh.

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