



Evaluation of Genotypes and Varieties against Foliar Blight Disease of Onion (*Allium cepa* L.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Onion is an important vegetable crop grown all over the world in different seasons. In India, Maharashtra is the main onion producing state followed by Karnataka, Madhya Pradesh and Rajasthan. In the UT of Jammu & Kashmir, onion is grown on an area of 2.85 thousand hectares with production of 65.27 thousand tonnes and productivity of 22.94 t/ha. The crop is affected by a number of diseases in the field as well in storage which reduces its production and productivity. Foliar blight is one such disease which is caused by the association of at least six pathogens viz.

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are *Alternaria porri*, *A. alternata*, *A. tenuissima*, *Stemphylium vesicarium*, *Colletotrichum circinans* and *Cladosporium allii-cepae*. The present investigations were undertaken for the evaluation of resistance against foliar blight disease. None of the genotypes/varieties tested, showed resistant reaction to onion foliar blight during the first year. Thirty-five varieties showed moderately susceptible reactions with disease intensity varying from 21.23 per cent (Early Supreme) to 28.69 per cent (NRCOG-659), whereas, only four varieties, viz., Brown Spansl, NRCOG-227, Phule Safed and Nasik Dark Red showed susceptible reaction (per cent disease intensity greater than 30.00). Arka Kalyan was the only variety with resistant reaction (7.50 per cent disease intensity) of the twenty-three varieties tested, during the second year, whereas, Brown Spansl was the only variety with per cent disease intensity greater than 30 (susceptible reaction).

Keywords: Onion; foliar blight disease; resistance; varieties; genotypes.

1. INTRODUCTION

Onion is an important vegetable crop in India, grown on an area of about 16.28 million hectares with annual production of 26.92 million MT according to Ministry of Consumer Affairs and Public Distribution (2020-2021). Maharashtra is the main onion-producing state followed by Karnataka, Madhya Pradesh and Rajasthan. In the UT of Jammu & Kashmir, onion is grown on an area of 2.85 thousand hectares with production of 65.27 thousand tonnes and productivity of 22.94 t/ha (Indian Agricultural Statistical Research Institute). The main bottlenecks for the optimal production of onion are pests, weeds and diseases which are major impediments in realizing the full genetic potential of the crop. The major diseases of onion are purple blotch, Botrytis blight, downy mildew, grey mold and viral diseases like onion yellow dwarf virus. An important disease of onion reported

from the UT of Jammu and Kashmir is the foliar blight of onion [1]. The major pathogens associated with the disease are *Alternaria porri*, *A. alternata*, *A. tenuissima*, *Stemphylium vesicarium*, *Colletotrichum circinans* and *Cladosporium allii-cepae*. The association of more than one pathogen with the disease hinders in effective disease management using chemicals and pesticides. Therefore, the present investigations were undertaken for screening of the available genotypes/accessions and varieties against disease development.

2. MATERIALS AND METHODS

Seeds of different onion varieties/lines and a garlic variety obtained from different sources, were sown in nursery beds in the first fortnight of November for two years for evaluation against foliar blight disease of onion.

List 1. List of genotypes and their sources

Source	Genotype/Varieties
Nunhems (Nunhems Seeds Pvt. Ltd.) Masab Tank, Hyderabad	Rojo, Early Supreme, SRO38010N, Matahari, Burgundy, SRO3800, Rio Santiago, Rio Tinto, Rio Verde, Excaliber
Indian Agricultural Research Institute, Pusa, New Delhi	Pusa Madhui, Pusa White Round
IARI, Regional Station, Katrain, Kullu, Himachal Pradesh	Brown Spansl
National Research Centre for Onion and Garlic, Pune	I Red and Light Red onion germplasm NRCOG-205, NRCOG-327, NRCOG-536, NRCOG-588, NRCOG-596, NRCOG-608, NRCOG-642, NRCOG-659, NRCOG-234, NRCOG-237 II White Onion germplasm NRCOG-W-395, NRCOG-W-430, NRCOG-W-155, NRCOG-W-227, NRCOG-W-047, NRCOG-W-208, NRCOG-W-272, NRCOG-W-416, NRCOG-W-149, Phule Safed, Udaipur-102
SKUAST-Kashmir, Jammu & Kashmir Jammu (local)	SK-1, SK-2, SK-3 N-53, Red Creole C-5, Iko hybrid,
National Horticultural Research and Development Foundation, Nasik	Agrifound Dark Red, Agrifound Light Red, Baswant-780, Arka Niketan, Arka Kalyan

Forty-five days old seedlings of each genotype/variety were sown at a distance of 15×15 cm in two progeny rows of 1 m each with five. All the recommended agronomic practices were followed as per package of practices, throughout the growing season. The data on disease intensity were recorded, at fifteen day intervals from the time of transplanting up to twenty days prior to bulb harvesting by adopting a 0-5 scale as suggested by Sharma [2] as follows:

- 0 : No disease symptoms
- 1 : Few spots towards the tip, covering less than 10 per cent leaf area
- 2 : Several dark purplish patches, covering less than 20 per cent leaf area
- 3 : Several patches with paler outer zone, covering up to 40 per cent leaf area
- 4 : Long streaks, covering 75 per cent leaf area or breaking of leaves from centre
- 5 : Complete drying of leaves or breaking of leaves from base.

The per cent disease intensity (PDI) was calculated as given below (Wheeler, [3]):

$$\text{PDI} = \frac{\text{Total sum of numerical ratings}}{\text{Number of leaves observed} \times \text{Maximum disease rating}} \times 100$$

The bulbs were harvested in the first week of May in each cropping season and yield was recorded for each variety. The genotypes/varieties were classified as resistant (per cent disease intensity < 10%), moderately resistant (per cent disease intensity 10 - 20%), moderately susceptible (per cent disease intensity 21 - 30%) or susceptible (per cent disease intensity > 30%) as per the scale given by Gupta [4].

3. RESULTS AND DISCUSSION

Forty-six onion genotypes/varieties were evaluated against foliar blight during the first year (Table 1) and twenty-three genotypes/varieties were evaluated against foliar blight during the second year (Table 2).

During the first year, the lowest disease intensity in the 7th SW was recorded in NRCOG-608 (7.30 per cent). It was, however, at par with the disease intensity in Rojo (7.81 per cent), Burgundy (8.19 per cent), SR03800 (7.37 per cent), Pusa White Round (8.63 per cent), Brown Spansl (7.32 per cent), NRCOG-588 (9.40 per

cent), NRCOG-596 (9.70 per cent), NRCOG-W-395 (8.20 per cent), NRCOG-W-227 (8.17 per cent), NRCOG-W-416 (7.48 per cent), Udaipur-102 (9.02 per cent), SK-1 (10.12 per cent), SK-2 (10.39 per cent), Agrifound Dark Red (7.98 per cent), Baswant-780 (10.08 per cent), Nasik Dark Red (8.67 per cent) and Iko hybrid (10.45 per cent). The highest disease intensity was recorded in SK-3 (13.78 per cent).

During the 9th SW, the lowest disease intensity was recorded in Early Supreme (12.00 per cent) and the highest in NRCOG-W-416 (23.42 per cent), whereas, during the 11th SW, lowest disease intensity was recorded in Early Supreme (14.77 per cent) and highest in NRCOG-205 (25.00 per cent). At the time of maturity, in the 13th SW, lowest disease intensity was recorded in NRCOG-642 (18.57 per cent) which was at par with Early Supreme (21.23 per cent), Rio Santiago (19.33 per cent), NRCOG-588 (20.45 per cent), NRCOG-W-430 (19.92 per cent), NRCOG-W-155 (19.05 per cent), NRCOG-W-047 (19.22 per cent) and NRCOG-W-208 (20.15 per cent). The highest disease intensity of 41.73 per cent was recorded in Phule Safed.

The average yield obtained was highest in Rio Tinto (280.31 q/ha) followed by Early Supreme (196.49 q/ha) and SR03800 (169.20 q/ha). The average yield obtained was considerably lower in the genotypes obtained from National Research Centre for Onion and Garlic with the lowest yield recorded in NRCOG-588 and NRCOG-W-395 (113.96 q/ha, each) followed by SRO38010N (117.47 q/ha).

During the second year, in the 7th SW, the lowest disease intensity of 0.94 per cent was recorded in Rojo, SR038010N, Excalibur and Udaipur-102, whereas, the highest disease intensity of 9.04 per cent was recorded in Red Creole C-5 (Table 2). During 9th SW, the lowest disease intensity was recorded in Arka Kalyan (4.19 per cent) which increased to 5.35 per cent in the 11th SW. The highest disease intensity in 9th SW was recorded in Burgundy (17.04 per cent) which increased to 22.89 per cent in the 11th SW. In the 13th SW, the lowest disease intensity of 7.50 per cent was recorded in Arka Kalyan which was significantly different from other varieties, whereas, the highest disease intensity was recorded in Brown Spansl (35.93 per cent). The disease intensity in Early Supreme (14.67 per cent), Rio Verde (15.17 per cent), Agrifound Darki Red (13.33 per cent), Baswant-780 (14.29 per cent), N-53 (15.29 per cent), Red Creole C-5

Table 1. Evaluation of different onion genotypes/varieties against foliar blight during the first year

Genotype/Variety	Per cent Disease Intensity at different Standard Weeks (SW)								Average Yield (q/ha)
	7 SW		9 SW		11 SW		13 SW		
Rojo	7.81	(16.23)	20.21	(26.72)	22.62	(28.39)	24.12	(29.41)	136.17
Early Supreme	11.32	(19.66)	12.00	(20.27)	14.77	(22.60)	21.23	(27.44)	196.49
SR038010N	12.46	(20.67)	18.21	(25.26)	20.49	(26.91)	21.77	(27.81)	117.47
Matahari	10.69	(19.08)	18.13	(25.20)	19.51	(26.21)	23.79	(29.19)	148.89
Burgundy	8.19	(16.63)	13.87	(21.87)	21.61	(27.70)	28.43	(32.22)	133.02
SR03800	7.37	(15.75)	21.69	(27.76)	21.96	(27.94)	24.41	(29.61)	169.20
Rio Santiago	11.17	(19.52)	12.73	(20.90)	21.32	(27.49)	19.33	(26.08)	130.49
Rio Tinto	12.85	(21.01)	22.11	(28.05)	20.33	(26.80)	23.99	(29.33)	280.31
Rio Verde	13.05	(21.18)	21.29	(27.48)	21.79	(27.83)	22.32	(28.19)	134.27
Excalibur	12.29	(20.52)	22.79	(28.51)	23.53	(29.02)	24.71	(29.81)	166.36
Pusa Madhui	10.79	(19.18)	16.60	(24.04)	18.90	(25.77)	22.63	(28.41)	167.20
Pusa White Round	8.63	(17.08)	16.26	(23.78)	21.42	(27.57)	26.99	(31.29)	154.62
Brown Spansl	7.32	(15.69)	16.20	(23.73)	23.93	(29.29)	35.62	(30.41)	153.33
NRCOG-205	5.79	(13.92)	16.39	(23.88)	25.00	(30.00)	25.87	(30.57)	136.18
NRCOG-327	7.34	(15.72)	18.97	(25.82)	17.08	(24.41)	25.42	(30.28)	128.58
NRCOG-536	11.22	(19.57)	16.72	(24.14)	20.03	(26.59)	22.26	(28.15)	159.69
NRCOG-588	9.40	(17.85)	14.93	(22.73)	15.50	(23.18)	20.45	(26.89)	113.96
NRCOG-596	9.70	(18.15)	15.21	(22.95)	17.70	(24.88)	24.44	(29.63)	145.07
NRCOG-608	7.30	(15.68)	17.88	(25.01)	17.98	(25.09)	26.80	(31.18)	163.51
NRCOG-642	9.87	(18.31)	14.69	(22.54)	15.92	(23.52)	18.57	(25.53)	126.67
NRCOG-659	12.52	(20.72)	14.68	(22.53)	17.83	(24.98)	28.69	(32.39)	149.51
NRCOG-234	12.14	(20.39)	13.09	(21.21)	18.21	(25.26)	25.12	(30.08)	144.44
NRCOG-237	12.55	(20.75)	15.82	(23.44)	21.21	(27.42)	25.64	(30.42)	133.02
NRCOG-W-395	8.20	(16.64)	14.17	(22.11)	16.07	(23.63)	21.72	(27.78)	113.96
NRCOG-W-430	11.12	(19.48)	18.48	(25.46)	22.14	(28.07)	19.92	(26.51)	118.89
NRCOG-W-155	11.74	(20.04)	19.96	(26.54)	20.19	(26.70)	19.05	(25.88)	141.73
NRCOG-W-149	12.21	(20.45)	16.94	(24.30)	21.65	(27.73)	23.17	(28.77)	156.49
NRCOG-W-227	8.17	(16.61)	18.67	(25.60)	22.11	(28.05)	33.98	(35.66)	137.47
NRCOG-W-047	11.08	(19.44)	15.92	(23.52)	22.87	(28.57)	19.22	(26.00)	134.93
NRCOG-W-208	10.69	(19.08)	19.25	(26.02)	16.81	(24.20)	20.15	(26.67)	122.22
NRCOG-W-272	11.92	(20.19)	21.49	(27.62)	22.50	(28.32)	28.62	(32.34)	154.62

Genotype/Variety	Per cent Disease Intensity at different Standard Weeks (SW)								Average Yield (q/ha)
	7 SW		9 SW		11 SW		13 SW		
NRCOG-W-416	7.48	(15.87)	23.42	(28.94)	23.54	(29.02)	24.93	(29.95)	124.13
Phule Safed	13.50	(21.56)	18.06	(25.15)	21.66	(27.74)	41.73	(27.78)	131.73
Udaipur-102	9.02	(17.48)	17.44	(24.68)	19.32	(26.07)	24.28	(29.52)	144.44
SK-1	10.12	(18.55)	17.31	(24.59)	17.85	(24.99)	26.41	(30.92)	137.78
SK-2	10.39	(18.80)	19.28	(26.05)	23.80	(29.19)	26.92	(31.25)	125.38
SK-3	13.78	(21.79)	16.93	(24.29)	23.53	(29.02)	24.41	(29.61)	131.11
Agrifound Dark Red	7.98	(16.41)	18.93	(25.79)	18.13	(25.20)	21.94	(27.93)	148.27
Baswnt-780	10.08	(18.51)	17.81	(24.96)	22.27	(28.16)	26.23	(30.81)	142.53
Arka Kalyan	11.39	(19.72)	17.31	(24.59)	18.61	(25.56)	22.87	(28.57)	143.82
Arka Niketan	13.71	(21.73)	18.54	(25.50)	22.30	(28.18)	23.55	(29.03)	148.27
N-53	11.10	(19.46)	14.57	(22.44)	16.76	(24.17)	21.83	(27.85)	148.89
Red Creole C-5	12.25	(20.49)	15.93	(23.52)	23.27	(28.84)	24.67	(29.78)	139.38
Iko Hybrid	10.45	(18.86)	19.04	(25.87)	20.91	(27.21)	21.88	(27.89)	134.27
Nasik Dark Red	8.67	(17.12)	16.89	(24.24)	16.99	(24.34)	33.56	(29.04)	147.59
Garlic	9.75	(18.19)	22.17	(28.09)	22.18	(28.09)	27.30	(31.50)	129.20
C. D. (p=0.05)	3.30		3.16		2.83		2.88		

Figures given in parentheses are transformed (angular) values

Table 2. Evaluation of different onion genotypes/varieties against foliar blight during the second year

Genotype/Variety	Per cent Disease Intensity at Different Standard Weeks (SW)								Average Yield (q/ha)
	7 SW		9 SW		11 SW		13 SW		
Rojo	0.94	(5.56)	8.61	(17.06)	18.38	(25.39)	20.66	(27.03)	396.84
Early Supreme	4.35	(12.04)	8.97	(17.43)	13.85	(21.85)	14.67	(22.52)	365.07
SR038010N	0.94	(5.56)	14.83	(22.65)	15.60	(23.26)	17.50	(24.73)	238.09
Matahari	3.98	(11.51)	10.02	(18.45)	12.12	(20.37)	18.75	(25.66)	79.37
Burgundy	5.95	(14.12)	17.04	(24.38)	22.89	(28.58)	28.75	(32.42)	260.31
SR03800	1.51	(7.06)	8.61	(17.06)	18.38	(25.39)	20.66	(27.03)	396.84
Rio Santiago	3.16	(10.24)	11.41	(19.74)	16.24	(23.77)	21.82	(27.85)	206.36
Rio Tinto	5.08	(13.03)	10.77	(19.16)	12.07	(20.33)	15.83	(23.45)	260.31
Rio Verde	5.99	(14.17)	7.76	(16.17)	10.19	(18.62)	15.17	(22.92)	238.09
Excalibur	0.94	(5.56)	10.78	(19.17)	12.67	(20.85)	17.78	(24.94)	196.84
Pusa Madhui	7.37	(15.75)	11.39	(19.72)	14.40	(22.30)	16.13	(23.68)	190.49
Pusa White Round	3.36	(10.56)	6.77	(15.08)	12.53	(20.73)	18.46	(25.45)	158.71
Brown Spansl	3.91	(11.40)	11.52	(19.84)	16.86	(24.24)	35.93	(36.83)	317.47
Phule Safed	7.21	(15.58)	9.89	(18.33)	16.37	(23.87)	21.82	(27.85)	196.84
Udaipur-102	0.94	(5.56)	9.83	(8.27)	13.62	(21.66)	17.79	(24.95)	111.11
Agrifound Dark Red	6.38	(14.63)	6.92	(15.25)	8.56	(17.01)	13.33	(21.41)	212.71
Baswnt-780	4.83	(12.70)	7.54	(15.94)	10.64	(19.04)	14.29	(22.21)	238.09
Arka Kalyan	1.01	(5.77)	4.19	(11.81)	5.35	(13.37)	7.50	(15.89)	317.47
Arka Niketan	1.00	(5.74)	11.46	(19.79)	13.00	(21.13)	21.43	(27.58)	95.24
N-53	3.48	(10.75)	5.69	(13.80)	11.44	(19.77)	15.29	(23.02)	253.96
Red Creole C-5	9.04	(17.49)	12.54	(20.74)	13.46	(21.52)	15.46	(23.15)	317.47
Iko Hybrid	4.55	(12.32)	6.61	(14.89)	11.04	(19.41)	14.66	(22.51)	284.44
Nasik Dark Red	1.68	(7.45)	11.19	(19.54)	16.86	(24.24)	21.43	(27.58)	246.93
C. D. (p=0.05)	5.19		2.69		2.63		2.39		

Figures given in parentheses are transformed (angular) values

Table 3. Performance of different varieties against onion foliar blight for two years

Rating	Disease Intensity (%)	First Year	Second Year
Resistant	< 10	NRCOG-642, NRCOG-W-430, NRCOG-W-155,	Arka Kalyan
Moderately resistant	10-20	NRCOG-W-047, NRCOG-W-208, NRCOG-588, Rio Santiago	Rojo, Excalibur, Red Creole C-5, Rio Tinto, Early Supreme, SR038010N, SRO3800, Matahari, Rio Verde, Pusa Madhui, Agrifound Dark Red, Pusa White Round, N-53, Iko hybrid, Udaipur-102, Baswant-780 Burgundy, Rio Santiago, Phule Safed, Arka Niketan, Nasik Dark Red
Moderately susceptible	21-30	Rojo, Early Supreme, SRO38010N, Matahari, Burgundy, SRO3800, Rio Tinto, Rio Verde, Excalibur, Pusa Madhui, Pusa White Round, NRCOG-205, NRCOG-327, NRCOG-536, NRCOG-596, NRCOG-608, NRCOG-659, NRCOG-234, NRCOG-237, NRCOG-W-395, NRCOG-W-149, NRCOG-W-272, NRCOG-W-416, Udaipur-102, SK-01, SK-02, SK-03, Agrifound Dark Red, Baswant-780, Arka Kalyan, N-53, Red Creole C-5, Iko Hybrid, Garlic, Arka Niketan Brown Spansl, NRCOG-W-227, Phule Safed, Nasik Dark Red	Brown Spansl
Susceptible	>30		

(15.46 per cent) and Iko-hybrid (14.66 per cent) was at par with each other. It differed significantly from the per cent disease intensity recorded in SRO38010N (17.50), Rio Tinto (15.83), Excalibur (17.78), Pusa Madhui (16.13) and Udaipur-102 (17.79) which were at par with each other. The disease intensity recorded in Matahari (18.75 per cent) was at par with Pusa White Round (18.46 per cent).

The highest average yield was recorded in Rojo and SR03800 (396.84 q/ha) followed by Early Supreme (365.07 q/ha), whereas the lowest yield was recorded in Matahari (79.37 q/ha) followed by Arka Niketan (95.24 q/ha) and Udaipur-102 (111.11 q/ha).

None of the genotypes/varieties tested, showed resistant reaction to onion foliar blight during the first year (Table 3). Seven varieties, viz., Rio Santiago, NRCOG-642, NRCOG-588, NRCOG-W-430, NRCOG-W-155, NRCOG-W-047 and NRCOG-W-208, showed moderately resistant reaction (10-20 per cent disease intensity). Thirty-five varieties showed moderately susceptible reactions with disease intensity varying from 21.23 per cent (Early Supreme) to 28.69 per cent (NRCOG-659), whereas, only four varieties, viz., Brown Spansl, NRCOG-227, Phule Safed and Nasik Dark Red showed susceptible reaction (per cent disease intensity greater than 30.00).

Arka Kalyan was the only variety with a resistant reaction (7.50 per cent disease intensity) of the twenty-three varieties tested, during the second year (Table 3), whereas, Brown Spansl was the only variety with per cent disease intensity greater than 30 (susceptible reaction). Sixteen varieties, viz., Rojo, Excalibur, Red Creole C-5, Rio Tinto, Early Supreme, SRO38010N, SRO3800, Matahari, Rio Verde, Pusa Madhui, Agrifound Dark Red, Pusa White Round, N-53, Iko hybrid, Udaipur-102 and Baswant-780 showed moderately resistant reaction (disease intensity 10-20 per cent) and five viz., Burgundy, Rio Santiago, Phule Safed, Arka Niketan and Nasik Dark Red showed moderately susceptible reaction (disease intensity 21-30 per cent).

In the present studies, the average yield obtained was highest in Rio Tinto (280.31 q/ha) followed by Early Supreme (196.49 q/ha) and SR03800 (169.20 q/ha), in the first year, whereas, in the second year, the highest average yield was recorded in Rojo and SR03800 (396.84 q/ha) followed by Early Supreme (365.07 q/ha).

Differences in the yields of various varieties under different agro-climatic conditions have been reported by different workers. Agrifound Light Red was the highest yielder with a low incidence of purple blotch in a number of studies [5-7]. N-53 has been reported to produce the highest bulb weight (90.2 g) while the smallest bulb weight was produced from Pusa Red (48.4 g) [8]. Sarkar and Jain [9]. recorded the highest bulb yield (174.39 q/ha) for Agrifound Dark Red, followed by Arka Niketan (156.40 q/ha), whereas, the lowest bulb yield (81.11 q/ha) was recorded for Agrifound Light Red in the kharif season. Mohanty et al. [10] reported that rabi cultivars grown in kharif season could produce equally good yields as that of kharif cultivars.

4. CONCLUSION

The present investigations reveal that there are significant differences in the performance of different varieties in terms of disease as well as in terms of yields. These differences can be utilized in the breeding programmes for resistance against foliar blight disease.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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