

Original Research Article

<https://doi.org/10.20546/ijcmas.2020.912.365>

Impact of Integrated Nutrient Management on Wilt Incidence of Isabgol (*Plantago ovata* Forsk.) under Northern Dry Zone of Karnataka

Siddalingayya V. Salimath*, K. N. Kattimani, Y. K. Kotikal,
D. R. Patile and N. S. Nagarja, Jameel Jhalegar and J. Venkatesh

College of Horticulture, University of Horticultural Sciences, Bagalkot, India

*Corresponding author

ABSTRACT

Keywords

Gujarat Isabgol-2,
Vallabh Isabgol-1
and Wilt

Article Info

Accepted:
27 November 2020
Available Online:
10 December 2020

The field studies were conducted to evaluate the wilt diseases parameters of two Isabgol cultivars for commercial production in northern dry zone of Karnataka during two years 2015-16 and 2016-17. The experiment was laid out in split plot design (SPD) with sixteen INM treatment combinations at the college of horticulture, Bagalkot. Analysis of both years with pooled data exhibited higher value was recorded in Vallabh Isabgol-1 with wilt incidence as compared to Gujarat Isabgol-2. Whereas the higher wilt incidence values in integrated nutrient management treatments with respect parameters were observed in treatment N₁₁ (75 % RD of FYM (7.5 t ha⁻¹) + 75% RD of NPK (37.5:18.75:22.50 kg ha⁻¹) + *Azospirillum* (5kg ha⁻¹) + *PSB* (3kg ha⁻¹) + ZnSO₄ (15 kg ha⁻¹) + FeSO₄ (7.5 kg ha⁻¹). Higher wilt incidence on interaction effect on growth parameters were recorded in V₁N₁₁.

Introduction

In India, Isabgol occupies an area of 80,000 ha with the total production of 45,000 tonnes and productivity of 0.56 MT ha⁻¹. India is the only country with monopoly in Isabgol production and marketing in the international trade. Thus, with average export volume of 29,000 MT and it earns on an average of ₹ 520 crores annually which contribute to about 80 per cent of the Psyllium traded in the world market. So, it is called as dollar earning medicinal plant of India. Among all the countries in the world, the United States of America is the single major buyer of Psyllium husk from India, accounting for about 75 per

cent of the total exports of the material from India (Goraya and Ved, 2019) with annual trade of more than 60,000 MT.

Several diseases were reported in Isabgol from India and other parts of the world. Fusarium wilt (*Fusarium oxysporum* Schlecht.), which was reported from Arizona, North America (Russell, 1975) as well as from Haryana (Mehta *et al.*, 1985).

Elwakil and Ghoneem (1999) reported 41 species of fungi belonging to 21 genera from seed samples of blond psyllium reported from Egypt. They proved the pathogenic nature of *Fusarium oxysporum*, *Fusarium solani* and

Fusarium moniliforme with Isabgol seeds and seedlings.

Mandalet *et al.*, (2008) opined that different doses of inorganic nutrients had considerable influence on growth and yield with downy mildew interaction in Isabgol. The study included three levels of nitrogen (0, 30, 60 kg N ha⁻¹), two levels of phosphorous (0, 30 kg P ha⁻¹) and two levels of potash (0, 40 kg K ha⁻¹). The highest N supply (60 kg ha⁻¹) caused more than 65 per centage disease severity. Seed yield was influenced by N but not by P or K. In both years, the highest seed yield was obtained from 60 kg ha⁻¹ N application. According to Patel (2014), among 15 germplasm Isabgol screened none was found completely free from infection of downy mildew. HI-5 and HI-2 were found highly susceptible, whereas UR-188, MBN-29, JI-83, Niharika and MB-322 which shown resistant to minimum per cent disease intensity. Screening of 10 promising genotypes against downy mildew, bacterial blight, leaf spot, blight and root rot revealed that five genotypes of Isabgol (P-80, P6, PB-3-1, AMB2, and MIB-124) showed resistance against these diseases (Anon. 2015a). Talaviya *et al.*, (2017) screened cumin variety lines against wilt disease to find out the resistant of cultivars per lines. Out of fifteen varieties per lines tested one line (JC2000-9) was found free from disease. The recommended varieties of Gujarat State viz., GC-2, GC-3 and GC-4 were found highly susceptible to *F. oxysporum f. sp. cumini* under present investigation. Thirty coriander genotypes/varieties were screened against *Fusarium oxysporum* under artificial inoculation conditions in field. On the basis of two years observations, it was recorded that four of the genotypes/varieties were resistant (R) RCr446, RCr-684, RCr-20, RCr-41 were categorized, nineteen genotypes/varieties viz. like RCr-475, RCr480, RCr-728, UD-796 etc. and RD-154 as moderately resistant, four

genotypes/varieties viz., NS-1, J.Co-387, Co-2, and UD-529 as susceptible and rest three genotype/varieties viz., RCr-435, RCr-446, DH-205 as highly Susceptible (Jat and Ahir. 2017).

Materials and Methods

The field experiment was conducted at Department of Plantation Spices Medicinal and Aromatic Plants, College of Horticulture, Bagalkot at Haveli farm during the years 2015-16 and 2016-17.

Geographically, this experimental site lies in Northern Dry Zone (Zone-3) of Karnataka state in the agro-climatic zone of Karnataka, situated at 16° North latitude and 74°59' East longitude and at an altitude of 533.0 m above mean sea level. The soil of experimental field was red clay loamy in texture, with percentages of sand 22.60, silt 26.10 and clay 52.20 bulk density 1.25, EC 0.24 dS m⁻¹ and pH 8.22 (alkaline in reaction) with organic carbon 1.63 and available 268.02, 34.80, 273.69 NPK kg ha⁻¹. The source of seed collection was DMAPR Anandh Gujarat *i.e.* Vallabh Isabgol-1(V₁) and Gujarat Isabgol-2 (V₂). Seed were sown in 18 November 2015 and 2016 with gross plot size of 3.6 m x 1.5 m = 5.40 m² in split plot design in sixteen INM sub treatments with three replications as subplot listed below.

N₁ -RDF FYM (10 t ha⁻¹) + RDF NPK (50:25:30 kg ha⁻¹)

N₂-RDF FYM (0 t ha⁻¹) + RDF NPK (50:25:30 kg ha⁻¹) +ZnSo₄(15 kg ha⁻¹)

N₃-RDF FYM (10 t ha⁻¹) + RDF NPK (50:25:30 kg ha⁻¹) +FeSo₄(7.5 kg ha⁻¹)

N₄-RDF FYM (10 t ha⁻¹) + RDF NPK (50:25:30 kg ha⁻¹) +FeSo₄ (7.5 kg ha⁻¹) +ZnSo₄(15 kg ha⁻¹)

N₅-Vermicompost (1t ha⁻¹) + RDF NPK (50:25:30 kg ha⁻¹)

N₆-Vermicompost (1t ha⁻¹) +50% RDF NPK (50:25:30 kg ha⁻¹)+*Azospirillum*(5kg ha⁻¹) + *Azotobacter* (5kg ha⁻¹), N₇-75% RDF FYM (7.5 t ha⁻¹) + 75% RDF NPK (37.5:18.75:22.50 kg ha⁻¹)

N₈-75% RDF FYM (7.5 t ha⁻¹) +75% RDF NPK (37.5:18.75:22.50 kg ha⁻¹) + *Azotobacter* (5kg ha⁻¹) N₉-75% RDF FYM (7.5 t ha⁻¹) +75% RDF NPK (37.5:18.75:22.50 kg ha⁻¹)+ *Azospirillum* (5kg ha⁻¹)

N₁₀-75% RDF FYM (7.5 t ha⁻¹) +75% RDF NPK (37.5:18.75:22.50 kg ha⁻¹) + *PSB* (3kg ha⁻¹), N₁₁-75%RDF FYM (7.5tha⁻¹) + 75% RDF NPK (37.5:18.75:22.50 kg ha⁻¹)+*Azospirillum*(5kg ha⁻¹)+ *PSB* (3kg ha⁻¹)+*ZnSo₄*(15kg ha⁻¹)+ *FeSo₄*(7.5 kg ha⁻¹)

N₁₂-50%RDF FYM (5t ha⁻¹) + 50% RDF NPK (25:12.5:15 NPK kg ha⁻¹)

N₁₃-50% RD FYM (5t ha⁻¹) +50% RDF NPK (25:12.5:15 kg ha⁻¹) +*Azotobacter* (5kg ha⁻¹), N₁₄-50% RDF FYM (5t ha⁻¹) +50% RDF NPK (25:12.5:15 kg ha⁻¹) +*Azospirillum* (5kg ha⁻¹)

N₁₅-50% RDF FYM (5t ha⁻¹) +50% RDF NPK (25:12.5:15 kg ha⁻¹) +*PSB* (3kg ha⁻¹)

N₁₆-50%RD FYM (5t ha⁻¹) +75% RDF NPK (37.5:18.75:22.50 kg ha⁻¹) + *Azospirillum* (5kg ha⁻¹) +*PSB* (3kg ha⁻¹)+*Znso₄* (15kg ha⁻¹)+*FeSo₄*(7.5 kg ha⁻¹).

The experiment after layout then treatments were applied as per above nutrient combination, then mixed thoroughly in plots before imposing the treatments. Zinc was applied in the form of *ZnSo₄* at the time of sowing half dose of N was applied as a basal

and remaining half was applied one month after sowing as top dressing full dose of P and K were applied at the time of sowing below the seed in furrows made with the help of land hoe.

Manual thinning weeding and hoeing were done at one month after sowing to provide an ideal environment to the crop a light irrigation was given immediately before sowing, however six and seven irrigation were given as per requirement of the crop with the help of sprinkler.

The pooled data was subjected to statistical analysis of split-plot design by the Fischer's method of analysis of variance technique as given by Panse and Sukhatme (1983). The level of significance used in 'F' and 't' test was p=0.05, critical values were calculated wherever the 'F' test was significant. Scoring for wilt (*Fusarium oxysporum*) (Sagar and Jindla, 1984) disease incidence was recorded at natural field condition at different stages of crop growth (30, 60, and 90 DAP) for two years. The scoring was done by using the scale 1 to 5 (Rathore and Pathak, 2001).

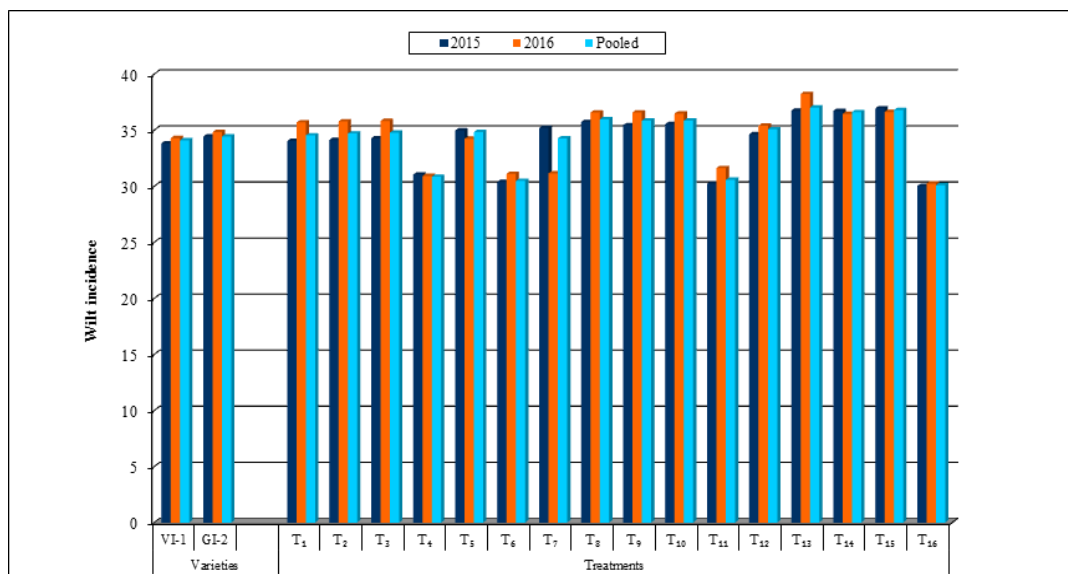
- 0. Healthy plants (no symptoms) 1.
- 1. 20 per cent plant leaf area covered 2.
- 2. >20-40 per cent plant leaf area covered
- 3. > 40-60 per cent plant leaf area covered
- 4. > 60 – 80 per cent plant leaf area covered
- 5. > 80 per cent and above leaf area affected

Scale	Reaction
0	Immune
1	Resistant (R)
2	Moderately Resistant (MR)
3	Susceptible (S)
4	Highly Susceptible (HS)

Table.1 Wilt infestation as influenced by Isabgol varieties and integrated nutrient management (0-5 scale)

Varieties	2015									2016									Pooled data																	
	30 DAS			60 DAS			90 DAS			30 DAS			60 DAS			90 DAS			30 DAS			60 DAS			90 DAS											
	V ₁	V ₂	Mean	V ₁	V ₂	Mean	V ₁	V ₂	Mean	V ₁	V ₂	Mean	V ₁	V ₂	Mean	V ₁	V ₂	Mean	V ₁	V ₂	Mean	V ₁	V ₂	Mean	V ₁	V ₂	Mean									
N ₁	11.39	10.70	11.05	27.50	28.89	28.19	33.50	34.56	34.03	13.72	10.70	12.21	29.45	31.14	30.29	36.41	34.97	35.69	12.56	10.70	11.63	28.47	30.01	29.24	34.39	34.67	34.53									
N ₂	12.01	12.01	12.01	26.97	32.13	29.55	33.63	34.62	34.12	12.68	12.68	12.68	30.47	35.87	33.17	36.22	35.33	35.78	12.34	12.34	12.34	28.72	34.00	31.36	34.61	34.80	34.70									
N ₃	10.06	10.40	10.23	29.70	33.38	31.54	34.25	34.29	34.27	12.53	12.73	12.30	30.10	34.21	32.16	35.39	36.26	35.82	11.30	11.57	11.43	29.90	33.79	31.85	34.78	34.78	34.78									
N ₄	9.61	9.65	9.63	20.76	21.29	21.02	30.34	31.74	31.04	10.19	10.32	10.25	23.96	25.86	24.91	30.71	31.13	30.92	9.90	9.99	9.94	22.36	23.58	22.97	30.43	31.25	30.84									
N ₅	11.94	10.27	11.10	28.86	31.62	30.24	34.70	35.23	34.97	12.27	12.94	12.27	33.78	29.28	31.53	32.07	36.40	34.23	12.10	11.60	11.85	31.32	30.45	30.88	34.13	35.52	34.83									
N ₆	9.48	10.45	9.97	20.69	22.52	21.60	30.37	30.39	30.38	10.55	9.48	10.02	22.82	25.20	24.01	31.23	30.97	31.10	10.02	9.97	9.99	21.75	23.86	22.81	30.58	30.37	30.47									
N ₇	10.49	9.82	10.15	31.56	29.96	30.76	34.36	36.04	35.20	12.82	12.82	12.82	35.75	29.60	32.67	26.74	35.54	31.14	11.65	11.32	11.49	33.66	29.78	31.72	32.79	35.75	34.27									
N ₈	9.62	11.95	10.78	37.13	31.10	34.11	35.01	36.43	35.72	12.28	12.68	12.48	36.61	34.04	35.32	37.80	35.34	36.57	10.95	12.32	11.63	36.87	32.57	34.72	35.96	35.99	35.97									
N ₉	10.44	12.44	11.44	38.00	34.85	36.43	34.96	35.92	35.44	12.78	13.44	13.11	34.88	33.75	34.32	37.06	36.09	36.57	11.61	12.94	12.28	36.44	34.30	35.37	35.82	35.88	35.85									
N ₁₀	10.89	10.89	10.89	33.49	33.81	33.65	35.29	35.77	35.53	12.22	12.89	12.39	35.28	35.91	35.60	36.43	36.53	36.48	11.55	11.89	11.72	34.38	34.86	34.62	35.74	35.96	35.85									
N ₁₁	9.52	9.52	9.52	20.92	21.02	20.97	30.30	30.15	30.22	9.52	9.71	9.62	23.16	24.08	23.62	31.70	31.53	31.61	9.52	9.62	9.57	22.04	22.55	22.29	30.65	30.49	30.57									
N ₁₂	10.28	11.06	10.67	32.59	31.12	31.85	33.13	36.12	34.63	12.06	12.72	12.06	31.79	33.96	32.87	37.34	33.47	35.40	11.17	11.89	11.53	32.19	32.54	32.36	34.85	35.29	35.07									
N ₁₃	10.48	13.48	11.98	37.44	37.77	37.60	36.57	36.87	36.72	13.48	14.82	14.15	39.15	39.55	39.35	37.02	39.42	38.22	11.98	14.15	13.07	38.29	38.66	38.48	36.69	37.34	37.01									
N ₁₄	11.29	13.16	12.23	33.26	33.62	33.44	37.28	36.13	36.71	12.09	14.36	12.96	34.14	36.70	35.42	35.63	37.24	36.44	11.69	13.76	12.73	33.70	35.16	34.43	36.87	36.32	36.60									
N ₁₅	11.34	14.63	12.99	36.36	37.60	36.98	37.03	36.86	36.94	14.63	13.97	14.30	35.92	39.96	37.94	35.80	37.43	36.61	12.99	14.30	13.64	36.14	38.78	37.46	36.72	36.83	36.78									
N ₁₆	9.37	9.37	9.37	20.59	20.62	20.60	30.26	29.78	30.02	9.71	9.88	9.79	23.74	23.00	23.37	31.05	29.44	30.24	9.54	9.63	9.58	22.16	21.81	21.99	30.46	29.70	30.08									
MEAN	10.51	11.24		29.74	30.08		33.81	34.43		12.10	12.26		31.31	32.01		34.29	34.82		11.30	11.75		30.52	31.04		34.09	34.43										
	S.Em	C.D at 5%		S.Em	C.D at 5%		S.Em ±	C.D at 5%		S.Em	C.D at 5%		S.Em	C.D at 5%		S.Em	C.D at 5%		S.Em	C.D at 5%		S.Em	C.D at 5%		S.Em	C.D at 5%										
	±			±			±			±			±			±			±			±			±											
Varieties (V)	0.078	0.24		0.61	1.86		0.08	0.25		0.16	NS		0.18	0.58		0.13	NS		0.11	0.36		0.23	0.73		0.08	0.24										
Nutrients (N)	0.44	1.25		0.84	2.39		0.43	1.23		0.36	1.04		0.52	1.49		0.54	1.55		0.33	0.93		0.47	1.34		0.31	0.90										
N at same V	0.62	1.77		1.19	3.38		0.61	1.74		0.52	1.48		0.74	2.11		0.77	2.19		0.46	1.32		0.66	1.89		0.44	1.27										
Vat same or different N	0.34	0.97		2.39	6.76		0.35	1.00		0.65	1.86		0.75	2.14		0.54	1.54		0.47	1.33		0.93	2.66		0.33	0.93										
	V ₁ - Vallabh Isabgol- 1									V ₂ -Gujarat Isabgol-2									N ₁ - RDF FYM + RDF NPK (kg ha ⁻¹)									N ₂ - RDF FYM + RDF NPK+ ZnSo ₄								
	N ₃ -RDF FYM + RDF NPK+FeSo ₄									N ₄ - RDF FYM + RDF NPK + ZnSo ₄ + FeSo ₄									N ₅ - Vermicompost (1 t ha ⁻¹) + RDF NPK									N ₆ - Vermicompost + 50% RDF NPK + ASP + AZB								
	N ₇ - 75% RDF FYM + 75% RDF NPK									N ₈ - 75% RDF FYM + 75% RDF NPK + AZB,									N ₉ - 75% RDF FYM +75% RDF NPK +ASP									N ₁₀ - 75% RDF FYM + 75% RDF NPK + PSB								
	N ₁₁ - 75% RDF FYM + 75% RDF NPK + ASP + PSB + ZnSo ₄ + FeSo ₄									N ₁₂ - 50% RDF FYM + 50% RDF NPK									N ₁₃ - 50% RDF FYM + 50% RDF NPK + AZB									N ₁₄ - 50% RDF FYM + 50% RDF NPK + ASP								
	N ₁₅ - 50% RDF FYM + 50% RDF NPK + PSB									N ₁₆ - 50% RDF FYM + 75% RDF NPK + ASP + PSB + ZnSo ₄ + FeSo ₄									NS = Non-significant									DAS = Days after sowing								

Fig.1 Effect of varieties and integrated nutrient management on wilt incidence of Isabgol (*Plantago ovata* Forsk.)



The per cent disease intensity (PDI) was calculated by the formula given by (McKinney, 1923).

$$PDI = \frac{\sum(\text{Class value} \times \text{Frequency})}{\text{Total number of scale plants observed} \times \text{maximum disease rating}} \times 100$$

Disease of wilt (*Fusarium oxysporum*)

The wilt incidence (*Fusarium oxysporum*) among Isabgol Varieties (Table 1), as influenced by integrated nutrient management and their interactions at different crop growth stages were recorded (Fig. 1).

The wilt incidence was significantly influenced by varieties (except at 60 DAS during 2016 non significant). The minimum wilt incidence was recorded in Vallabh Isabgol-1 which was on par with Gujarat Isabgol-2, this might be due to varietal characteristic. Similar findings were reported by Kumar *et al.*, (2009).

The wilt infestation influenced by integrated nutrient management minimum was recorded

with application of 50 % RD of FYM + 75 % RD of NPK + *Azospirillum* + *PSB* + $ZnSO_4$ + $FeSO_4$ (N_{16}) and maximum wilt infestation was recorded by supply of 50 % RD of FYM + 50 % RD of NPK + *Azotobacter* (N_{13}). The lowest disease incidence could be due to the supplying of organic manures, biofertilizers and NPK which regulates faster release of nutrients to plant helps increase growth attributes, this might have induced tolerance in plant against wilt disease, furthermore application of biofertilizers helps to release phenol content in plant which might have acted as pathogen inhibition (Anon., 2014a).

The wilt infestation influenced by varieties and integrated nutrient management at 90 DAS. Minimum wilt incidence was recorded in Gujarat Isabgol-2, supplied with 50 % RD of FYM + 75 RD of NPK + *Azospirillum* + *PSB* + $ZnSO_4$ + $FeSO_4$ (V_2N_{16}) and maximum incidence was recorded in Gujarat Isabgol-2, supplied with 50 % RD of FYM + 50% RD of NPK + *Azotobacter* (V_2N_{13}) because of the varietal moderately resistance indication and application of above INM treatments, results an good healthy growth of plant.

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How to cite this article:

Siddalingayya V. Salimath, K. N. Kattimani, Y. K. Kotikal, D. R. Patile, N. S. Nagarja, Jameel Jhalegar and Venkatesh, J. 2020. Impact of Integrated Nutrient Management on Wilt Incidence of Isabgol (*Plantago ovata* Forsk.) under Northern Dry Zone of Karnataka. *Int.J.Curr.Microbiol.App.Sci* 9(12): 3079-3084. doi: <https://doi.org/10.20546/ijcmas.2020.912.365>