JFL

Journal of Food Legumes 33(4): 245-251, 2020

Management of pigeonpea wilt using host resistance, chemicals, soil amendments and bioagents

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Received: September 28, 2020
Accepted: February 20, 2021

Handling Editor:
Dr. Mohd. Akram, ICAR-IIPR, Kanpur

ABSTRACT

The present investigation was carried out in the laboratory and research farm of Birsa Agricultural University Ranchi on management of pigeonpea wilt. Wilt disease in Pigeonpea was found at all ten locations surveyed during *Kharif*, 2015-16 and 2016-17. Maximum wilt percent was found at Bukru (32.14%) followed by Kanadu (29.40%) and Ranchi BAU (28.63 %). Out of 19 medium entries evaluated, 13 entries showed moderately resistant reaction to wilt, Among 43 late entries, 5 entries viz., MA-6, PT0012(C), WRGE 102, CRG9701, WRGE 248 showed resistance against wilt. In host differential reaction, ICP8868, BDN-2, BAHAR genotypes showed same reaction to the three different effective isolates (Isolate – 1, 14, 35) of *Fusarium udum*, and these are grouped under variant 3 Seed treatment with Saaf @ 2.5 g/kg seed proved to be the most effective treatment in which least wilt severity per cent (15.03 %, 18.75 %) and highest yield (1491.22 Kg/ha, 1369.32 Kg/ha) were recorded during 2015-16 and 2016-17, respectively. Soil application of Neem + Musturd cake @ 5+5 q/ha proved to be the most effective treatment in which least wilt severity percent (15.97%, 13.57%) and highest yield (1510.28 Kg/ha, 1410 Kg/ha) were recorded during 2015-16 and 2016-17, respectively. Seed treatment with biocontrol agent *Trichoderma viride* (Commercial strain) proved to be the most effective treatment in which least wilt severity (23.33%, 20.89%) and highest yield (1429.65 Kg/ha and 1349.25 Kg/ha) were recorded during 2015-16 1nd 2016-17, respectively.

***Key words*:** Biocontrol, Fungicides, *Fusarium oxysporum* f.sp. *udum*, Pigeonpea, Wilt

Pigeonpea wilt is widely prevalent throughout the world and more important in India (Kannaiyan *et al*. 1984).The annual loss in pigeonpea due to wilt alone in India has been estimated to US $ 71 million (Pande *et al*. 2012). The crop suffers heavily due to *Fusarium* wilt in the major growing areas resulting in huge production losses (Reddy *et al*. 1993). The pathogen is mainly soil and seed borne. The genus *Fusarium* has a wide host range and survives for long time in field and in absence of host plant and attacks the plants at any stage. It can cause compete crop loss, especially in warm spring and dry hot summer.As such, soil borne pathogens are very difficult to control by chemicals. Keeping this in mind, there is need to explore the possibility of improving genetic base for disease resistance in addition to integration of chemical, organic amendments and biological control, which can be successfully adopted in modern agriculture. Therefore, the present study was carried out for the management of pigeonpea wilt using chemical fungicides, soil amendments, biocontrol agents and host resistance as a parameter for study.

MATERIAL AND METHODS

Field trials were conducted for two consecutive *Kharif* seasons of 2015-16 and 2016-17 using Pigeonpea variety Bahar with 4.0 m × 3.0 m plot size with spacing of 60 cm × 20 cm in Research Farm of Birsa Agricultural University, Ranchi which is situated at 23 17' North latitude and 85 19' East longitude with an altitude of 625 m above mean sea level.

Survey: Field survey was carried out in ten villages of Kanke block of Ranchi district during *Kharif* seasons, 2015-16 and 2016-17. Three to five farmers field were selected in each village. Wilt incidence was recorded during the period. The disease incidence was categorized into low (0-10%), moderate (10.1-25.0%) and high (more than 25.0%).

Host plant Resistance: A total of 19 medium and 43 late duration germplasm of pigeonpea were evaluated for resistance against *F. oxysporum*f.sp. *udum*, causing wilt under artificial epiphytotic condition in sick plot of Birsa Agricultural University, Kanke, Ranchi during *Kharif* seasons of 2015-2016 and 2016-17. A standard

procedure for sowing with 5.0 m row length and spacing of 60 cm x 20 cm in two replications was followed for evaluation of genotypes with recommended package of practices. Susceptible check Bahar was sown after every two rows of test genotypes. Data on disease incidence and yield was recorded.

Chemical Management: Field experiments were conducted with the aim to study the effect of seed treatment with fungicides for control of pigeonpea wilt in wilt sick plot. Seed treatment was carried out using six fungicides *viz*. Mancozeb (Indofil M-45), Carbendazim (Bavistin), Mancozeb + Carbendazim (SAAF), Copper oxychloride (Blitox-50), Propineb (Antracol), Chlorothalonil (Kavach) and. Control was maintained with untreated seeds. Dose of fungicides applied is mentioned in Table 4. The experiments were conducted in randomized block design (RBD) with three replications. Fertilizer dose of N:P:K:S @ 20:40:20:20 kg/ha was applied at the time of sowing. The crop was sown with recommended package of practices using moderately susceptible variety *i.e.* Bahar. Data on disease incidence and yield was recorded.

Management with biocontrol agents: Field trials were carried out with biocontrol agents viz *Trichoderma viride* (10^8 *spores/g), T. harzianum* (10^8 spores/g and *T. viride* (RAU Strain) (10^9 spores/g, *Pseudomonas spp* as seed treatment. Laboratory formulations of biocontrol agents were used @ 0.5 g/kg seed each. The experiments were conducted in randomized block design (RBD) in four replications. Treated seeds were sown in field having plot size of 3.0 m x 4.0 m with spacing of 60 cm x 20 cm, Fertilizer dose of N:P:K:S @ 20:40:20:20 kg/ha was applied at the time of sowing. Control was maintained with untreated seeds. The crop was sown with recommended package of practices using moderately susceptible variety *i.e.* Bahar. Data on disease incidence and yield was recorded.

Soil amendments: Field trials were conducted for two consecutive *Kharif* seasons of 2015-16 and 2016-17. The plot size was 3.0 mx 4.0 m with 60 cm x 20 cm spacing. Fertilizer dose of N:P:K:S @ 20:40:20:20 kg/ha was applied at the time of sowing. Four organic amendments Neem cake @ 10 q/ha, Mustard cake @ 10 q/ha, Karanj cake @ 10 q/ha, Neem+ karanj @ 5q + 5q/ha and *Trichoderma* pre-colonized FYM @ 2 t/ha were tested either alone or in combination as treatments in three replications. These powdered cakes were applied in finally prepared land three weeks before sowing. Plots without amendment served as check. The crop was sown with recommended package of practices.

RESULTS AND DISCUSSION

Wilt disease was prevalent in all the ten locations surveyed with moderate to high disease pressure during both the years.The mean wilt incidence was highest (32.14%) at Bukru followed by Kanadu (29.40%) and Ranchi BAU (28.63%). The least wilt incidence was recorded (16.69%) at Kokdoro in Ranchi district (Table 1). Incidence of the disease was most serious and wide spread in Maharashtra (22.6%), Bihar (21.4%) and Uttar Pradesh (8.2%) (Kannaiyan *et al*. 1984).

In varietal screening trial against wilt, Out of 19 medium entries,12 entries showed moderately resistant to wilt disease whereas , only five of 43 late entries namely MA-6, PT0012(C), WRGE 102, CRG9701 and WRGE 248 showed resistance. Also, 23 entries showed moderately resistant reaction against wilt disease (Table 2.1 and 2.2). These resistant sources can serve as a good source of resistant genes for breeders to incorporate in the good agronomic susceptible cultivars to obtain resistant as well as good commercial varieties for the localities. Chaudhary (2010) released long duration wilt resistant variety IPA 204 in 2009 after testing in 24 Pigeonpea growing areas across India.

To study the host differential reaction pattern of pigeonpea genotypes, experiment with three effective isolates of *F. udum* on eight pigeonpea differentials was conducted and Variant III was recognized to be prevailing in Jharkhand in present investigation (Table 3). Similar observations from Bihar and Jharkhand were also reported earlier (Raj and Singh,1996). Sources of resistance identified in one region do not perform with the same degree of resistance in other regions thereby indicating pathogenic variability in the fungus (Kumar and Upadhyay, 2014).

Table 1. Survey for wilt disease incidence in different places of Ranchi district

Sl. No	Place	Area (acre)	Wilt incidence (%)		
			2015-16	2016-17	Average
1	Ranchi (BAU)	5	29.16	28.11	28.63
2	Pithoria	15	17.97	17	17.48
3	Nagri	16	24.99	23.56	24.27
4	Hochar	9	24.84	23.77	24.3
5	Boreya	16	26.94	27.89	27.41
6	Kanadu	13	29.45	29.35	29.40
7	Badhu	12	23.15	25.14	24.14
8	Kokdoro	14	17.16	16.22	16.69
9	Bukru	9	32.15	32.14	32.14
10	Sukurhuttu	4	21.52	20.95	21.23
					Average = 24.57

Table 2.1. Sources of host resistance against wilt pathogen in medium duration pigeonpea entries

Sl. No.	Entries	Wilt incidence %*		Average	Reaction
		2015-16	2016-17		
1	GJP 1401	15.25 (22.84)**	18.23 (25.35)	16.74	MR
2	LRG 117	18.99 (25.74)	15.29 (22.91)	17.14	MR
3	AKTE 12-02	18.17 (25.22)	20.56 (26.66)	19.365	MR
4	BRG15-2	10.25 (18.66)	13.11 (21.13)	11.68	MR
5	CRG 2012-25	13.14 (21.14)	11.36 (19.45)	12.25	MR
6	LRG 170	21.1 (27.32)	23.12 (28.80)	22.11	S
7	BRG 15-1	19.43 (26.08)	19.36 (26.01)	19.39	MR
8	BSMR 243	20.52 (26.92)	21.36 (27.50)	20.94	S
9	TRG 59	18.17 (25.22)	20.12 (26.63)	19.145	MR
10	WRGE 252	12.5 (20.69)	16.12 (23.61)	14.31	MR
11	CRG 2012-30	20 (26.55)	24.21 (29.69)	22.105	S
12	RPS 2007-10	25.63 (30.38)	29.23 (33.03)	27.43	S
13	WRGE 242	25.63 (30.38)	28.12 (32.04)	26.875	S
14	BDN 2008-7	17.89 (24.97)	14.28 (22.55)	16.085	MR
15	GJP 1406	14.68 (22.42)	18.32 (25.31)	16.5	MR
16	GRG 2013	15.78 (23.39)	18.21 (24.98)	16.995	MR
17	TDRG 107	19.37 (26.10)	15.16 (23.25)	17.265	MR
18	RKPV 451-01	23.02 (28.64)	26.23 (30.80)	24.625	S
19	BAHAR(Ch)	52.5 (46.43)	60.26 (51.20)	56.38	HS
	SEm(±)	1.76	1.40		
	C.D.(P=0.05)	5.23	4.20		
	C.V. (%)	9.51	7.24		

*Average of two replications **Figures in the parentheses areangular transformed value.

In-vivo trials on evaluation of chemicals revealed that Seed treatment with carbendazim+ Mancozeb @ 2.5 g/kg seed recorded lowest wilt severity of 15.03 and 18.75 per cent and disease reduction over control of 78.5 and 71.14 per cent with highest yield of 1491.22 and 1369.32 kg/ha during 2015-16 and 2016-17, respectively.This treatment was followed by Mancozeb @ 2.5 g/kg seed which recorded wilt severity of 21.25 and 22.98 per cent with grain yield of 1462.3 and 1336.36 kg/ha during above noted years (Table 4). Similar results were also reported by Gupta *et al*(2014) and Koushik and Parthadeb (2016).

In-vivo studies on the management of wilt disease of Pigeonpea through soil amendments, soil application of Neem + Musturd cake @ 5+5 q/ha proved to be the most effective treatment in which least wilt severity percent (15.97 and 13.57) and highest yield (1510.28 kg/ha and 1410 kg/ha) and B:C ratio of 1:200 and 1:2.27 were recorded during 2015-16 and 2016-17. It was followed by soil application of Neem cake @ 10 q/ha, which recorded wilt severity (17.75 % and 18.25 %) and yield of 1473.21 and 1369.65 kg/ha with B:C ratio of 1:1.79 and 1:2.03 during the above noted years (Table 5). Raj and Singh (1996) had also observed that Neem, mustard and mahua oil cakes were most effective in reducing fungal growth of *Fusarium udum*. Padmodaya and Reddy (1999) also found similar results.

In field studies on management of pigeonpea wilt disease with four bio agents viz., *Trichoderma viride, Trichoderma harzianum, Trichoderma viride* (RAU) *and Pseudomonas spp*., the seed treatment *Trichoderma viride* (Laboratory strain) @ 0.5 g/kg seed proved to be most effective in which least wilt severity (23.33% in 2015-16 and 20.89% in 2016-17) and highest yield (1429.65 kg/ha in 2015-16 and 1349.25 kg/ha in 2016-17) was recorded. It was followed by *Trichoderma viride* (RAU,strain) @ 0.5 g/kg seed that recorded 24.12% and 25.98 % wilt severity and grain yield of 1449.58 and 1291.12 kg/ha during 2015-16 and 2016-17, respectively (Table 6). Chaudhary and Prajapati (2004) evaluated six biological control agentsagainst *F. udum* and reported that maximum colony growth inhibition in dual culture was obtained with *Gliocladium virens*(Pantnagar) and *Trichoderma viride* (Coimbatore). They also noticed that cultural filtrate of all the six biological control agents inhibited colony growth of F. udum by 18.1-53.6 % at different concentration. Seeds treated with dry powder of Trichoderma viride at 4 g/ kg before sowing significantly reduced wilt disease in all the cultivars of pigeonpea compared to untreated control (Mahalinga *et al*., 2004).

Table 2.2: Sources of host resistance against wilt pathogen in late duration pigeonpea entries

Sl. No.	Entries	Wilt incidence %*		Average	Reaction
		2015-16	2016-17		
1	ASHA	16.6 (24.03)**	15.23 (22.81)	15.915	MR
2	BAHAR	21.3 (27.39)	23.65 (29.18)	22.475	S
3	BAU 9-27	15.39 (23.08)	14.26 (22.19)	14.825	MR
4	BAU 13-2	13.14 (21.14)	15.32 (23.39)	14.23	MR
5	BDN 2	14.93 (22.55)	16.25 (24.09)	15.59	MR
6	BRG-1	27.2 (31.40)	26.32 (30.89)	26.76	S
7	BRG-2	32.43 (34.70)	38.62 (38.61)	35.525	S
8	BRG-3	20 (26.55)	22.32 (28.42)	21.16	S
9	BRG-4	20.47 (26.87)	19.26 (25.84)	19.865	MR
10	BRG-5	13.77 (21.72)	11.2 (19.76)	12.485	MR
11	BSMR 736	15.78 (23.39)	14.32 (22.44)	15.05	MR
12	BSMR 853	19.37 (26.10)	22.36 (28.36)	20.865	S
13	CO-6 (c)	15.62 (23.17)	17.68 (24.85)	16.65	MR
14	CRG 9701	6.06 (14.25)	8.32 (16.87)	7.19	R
15	DA 15-1	11.11 (19.46)	9.32 (18.02)	10.215	MR
16	DA 15-2	15.25 (22.84)	14.38 (22.56)	14.815	MR
17	ICP 2376	25.23 (30.06)	29.63 (32.89)	27.43	S
18	ICP 7119	22.5 (28.27)	24.52 (29.83)	23.51	S
19	ICP 8863	19.9 (26.47)	17.39 (24.34)	18.645	MR
20	IPA 8 F	20 (26.55)	21.32 (27.85)	20.66	S
21	IPA 15F	18.6 (25.43)	17.32 (24.28)	17.96	MR
22	JKM 189 (C)	20.39 (26.69)	25.32 (30.46)	22.855	S
23	KA 13-5	11.76 (20.04)	10.1 (18.67)	10.93	MR
24	KPL 43	14.55 (22.36)	11.39 (19.18)	12.97	MR
25	KPL 44	11.5 (19.79)	9.6 (17.87)	10.55	MR
26	MA -6	7.75 (15.90)	6.32 (15.10)	7.035	R
27	MAL 13(C)	15.78 (23.39)	18.54 (24.97)	17.16	MR
28	MAL 43	13.4 (21.42)	16.32 (24.13)	14.86	MR
29	MAL 44	24.2 (29.48)	28.96 (32.45)	26.58	S
30	RVSA 07-10	19.9 (26.44)	18.63 (25.37)	19.265	MR
31	RVSA 07-22	21.12 (27.31)	24.36 (29.64)	22.74	S
32	RVSA 07-29	22.2 (28.09)	26.52 (31.14)	24.36	S
33	RVSA 07-31	18.85 (25.68)	14.65 (22.43)	16.75	MR
34	PT 0012 (C)	10.5 (18.90)	8.23 (16.22)	9.365	R
35	WRP -1 (C)	13.58 (21.49)	16.51 (23.62)	15.045	MR
36	WRGE 65	16.66 (24.08)	17.02 (24.48)	16.84	MR
37	WRGE 102	6.06 (14.25)	9.32 (17.80)	7.69	R
38	WRGE 140	12.5 (20.69)	16.32 (23.76)	14.41	MR
39	WRGE 248	10.52 (18.32)	9.52 (18.19)	10.02	R
40	WRGE 256	13.33 (21.25)	16.49 (23.72)	14.91	MR
41	VBN -3	25.8 (30.46)	26.32 (30.92)	26.06	S
42	BA-1	19.9 (26.47)	21.69 (27.44)	20.795	S
43	BAHAR(Ch)	57.5 (49.29)	60.32 (51.21)	58.91	HS
	SEm(±)	1.81	2.03		
	C.D. (P=0.05)	5.18	5.82		
	C.V. (%)	10.40	11.39		

*Average of two replications **Figures in the parentheses are angular transformed values.

Table 3. Reaction of different effective *F. udum* isolates on pigeonpea wilt differentials

Sl. No	Genotypes	Disease incidence (%)			Disease reaction			Race Grouping
		Isolate-1 (Fou-Ran-1)	Isolate-14 (Fou-Hoc-2)	Isolate-35 (Fou-Buk-3)	Isolate-1 (Fou-Ran-1)	Isolate-14 (Fou-Hoc-2)	Isolate-35 (Fou-Buk-3)	
1	ICP 8859	51	43.72	6.22	HS	MS	R	
2	ICP 8868	62.53	50	32.21	HS	MS	S	Variant 3
3	BDN -2	56.2	43.2	33.2	HS	MS	S	Variant 3
4	BDN -1	56.21	30.21	2.15	HS	S	R	
5	ICP8863	14.12	6.32	0	MR	R	R	
6	ICP 9174	6.21	4.21	5.52	R	R	R	
7	BAHAR	77.77	44.56	37.5	HS	MS	S	Variant 3
8	ICP 8858	43.72	31.28	12.68	MS	S	MR	

Table 4. *In Vivo* evaluation of fungicides against wilt pathogen and yield in pigeonpea

Treatment No	Treatments	Dose (g/kg)	Wilt severity * (%)		Disease reduction over control (%)		Yield * (Kg/ha)		Average	Increase in Yield over control (%)		C:B ratio	
			2015-16	2016-17	2015-16	2016-17	2015-16	2016-17		2015-16	2016-17	2015-16	2016-17
T_1	Mancozeb (Indofil M-45)	2.5	21.25 (27.89)**	22.98 (27.13)	69.64	68.31	1462.3	1336.36	1399.33	87.44	89.73	1:24.64	1:24.95
T_2	Carbendazim (Bavistin)	2. 0	22.54 (27.57)	26.66 (31.88)	67.80	63.24	1427	1282.36	1354.68	82.91	82.06	1:22.01	1:21.80
T_3	Mancozeb+Carbendazim (Saaf)	2.5	15.03 (24.65)	18.75 (24.80)	78.52	74.14	1491.22	1369.32	1430.27	91.15	94.41	1:26.40	1:26.99
T_4	Copper oxychloride (Blitox- 50)	3. 0	28.99 (32.03)	27.43 (31.58)	58.58	62.18	1232.32	1259.32	1245.82	57.96	78.79	1:14.37	1:19.60
T_5	Propineb (Antracol)	2. 0	35.71 (36.74)	45.78 (41.94)	48.98	36.88	1201.32	1040.89	1121.105	53.98	47.78	1:13.31	1:11.33
T_6	Chlorothalonil (Kavach)	2.5	38.37 (38.72)	43.51 (41.06)	45.18	40.01	1176.47	1081.5	1128.985	50.80	53.54	1:10.23	1:10.26
T_7	Control	-	70. 00 (56.97)	72.53 (57.97)	-	-	780.13	704.34	742.235	-	-	-	-
	SEm(±)	-	1.37	1.90	-	-	74.49	83.00	-	-	-	-	-
	CD (P=0.05)	-	4.24	5.92	-	-	232.05	258.59	-	-	-	-	-
	CV (%)	-	6.76	8.99	-	-	10.29	12.61	-	-	-	-	-

*Average of 3 replications **Figures in the parentheses areangular transformed values.

Table 5. Effect of organic amendments - against wilt pathogen and yield in pigeonpea under field condition

Treatment No	Treatments	Dose (q/ha)	Wilt severity* (%)		Disease reduction over control (%)		Yield (Kg/ha)*		Average	Increase in yield over control (%)		C:B ratio	
			2015-16	2016-17	2015-16	2016-17	2015-16	2016-17		2015-16	2016-17	2015-16	2016-17
T_1	Neem cake	10	17.75 (24.13)**	18.25 (26.42)	73.93	76.21	1473.21	1369.65	1421.43	85.39	96.19	1:1.79	1:2.03
T_2	Mustard cake	10	20.39 (26.62)	21.69 (27.80)	70.05	71.73	1401.21	1340.22	1370.715	76.33	91.97	1:1.15	1:1.49
T_3	Karanj cake	10	22. 00 (27.98)	29.23 (33.44)	67.68	61.91	1378.23	1249.21	1313.72	73.43	78.93	1:1.09	1:1.16
T_4	Neem +Mustard (1:1)	5+5	15.97 (23.34)	13.57 (21.71)	76.54	82.31	1510.28	1410	1460.14	90.05	101.97	1:2.00	1:2.27
T_5	Neem+Karanj (1:1)	5+5	26. 40 (30.36)	30.32 (33.29)	61.22	60.48	1311.56	1244.89	1278.225	65.04	78.32	1:1.16	1:1.49
T_6	Mustard+Karanj (1:1)	5+5	29. 00 (32.46)	32. 50 (34.90)	57.4	57.64	1271.65	1204.32	1237.985	60.02	72.50	1:1.00	1:1.32
T_7	FYM	25	31.25 (33.74)	34.35 (35.63)	54.1	55.23	1240.12	1169.69	1204.905	56.05	67.54	1:1.28	1:1.38
T_8	Control	-	68.09 (55.69)	76.74 (60.36)	-	-	794.65	698.12	746.385	-	-	-	-
	SEm(±)	-	1.56	1.11	-	-	74.39	73.65	-	-	-	-	-
	CD (P=0.05)	-	4.89	3.41	-	-	227.89	225.58	-	-	-	-	-
	CV (%)	-	8.71	5.66	-	-	10.03	10.63	-	-	-	-	-

*Average of 3 replications **Figures in the parentheses are angular transformed values.

Table 6. *In vivo* evaluation of bio agents against wilt pathogen and yield in pigeonpea

Treatment No.	Treatments	Dose (g/kg)	Wilt severity* (%)		Disease reduction over control (%)		Yield (Kg/ha)*		Average	Increase in Yield over control (%)		C:B ratio	
			2015-16	2016-17	2015-16	2016-17	2015-16	2016-17		2015-16	2016-17	2015-16	2016-17
T_1	*Trichoderma viride*	0.5	23.33 (28.53)**	20.89 (25.89)	62.58	64.88	1429.65	1349.25	1389.45	70.29	68.42	1:27.42	1:27.82
T_2	*T. harzianum*	0.5	27.04 (32.35)	29.14 (33.53)	56.63	51.01	1308.57	1250.12	1279.345	55.87	56.04	1:21.59	1:22.61
T_3	*T .viride(RAU)*	0.5	24.12 (29.20)	25.98 (29.72)	61.32	56.32	1449.58	1291.12	1370.35	72.66	61.16	1:28.38	1:24.77
T_4	*Pseudomonas spp*	0.5	39.79 (39.11)	37.79 (38.11)	36.19	36.47	1125.45	1124.56	1125.005	34.06	40.37	1:12.73	1:15.99
T_5	Control	-	62.36 (51.46)	59.49 (50.18)	-	-	839.51	801.12	820.315	-	-	-	-
	SEm(±)	-	1.53	1.46	-	-	64.70	70.07	-	-	-	-	-
	CD (P=0.05)	-	4.79	4.56	-	-	201.59	218.28	-	-	-	-	-
	CV (%)	-	8.49	8.23	-	-	10.56	12.21	-	-	-	-	-

*Average of 4 replications **Figures in the parentheses are angular transformed values.

Similar results were also reported by Vishwadhar *et al*.(2006) and Pande *et al*.(2012).Integrated Disease Management (IDM) approach was carried out to combat pigeonpea wilt with a combination of fungicides, bio agents, organic amendments and different cropping systems in kharif seasons of four years *viz* ., 2006, 2007, 2008 and 2009. Based on the performance, four treatments were identified as best practices for the management of pigeonpea wilt viz .,carbendazim seed treatment @ 2 g/kg of seeds + Trichoderma viride @ 2.5 kg/ha in FYM @ 50 kg / ha recorded lowest mean wilt incidence of 11.38 per cent with highest mean yield of 969.18 kg/ha (Prasad *et al*.,2012)

Pigeopea wilt was prevalent in all surveyed areas of Ranchi district of Jharkhand. In varietal screening trials, Five entries *viz*., MA-6, PT0012, WRGE102, CRG 9701 and WRGE 248 were recorded as resistant reaction against wilt. In host differential studies, variant 3 was recognized to be prevalent in the area. Seed treatment with carbendazim 12% + mancozeb 64% @ 2.5 g/kg seed recorded lowest wilt severity and highest grain yield og pigeonpea. Soil application of Neem + Mustard cake @ 5+5 Q/ha was most effective for wilt management and gave highest yield of pigeonpea. In biological management pigeonpea wilt trials, seed treatment with *T. viride* (laboratory strain) @ 0.5 g/kg seed recorded least wilt severity and highest yield of pigeonpea. Hence, these can be included as integrated disease management in the mangagement og wilt of pigeonpea.

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