CHEMICAL AND BIOLOGICAL MANAGEMENT OF WILT AND ROOT ROT OF CHICKPEA

K. KANAKA DURGA, M. SUDHA RANI, A. PADMASRI, V. SANDEEP VARMA

Abstract: An experiment was conducted to study the efficacy of bioagents on wilt and root rot in chickpea at Seed Research and Technology Center, Rajendranagar, Hyderabad during rabi, 2011-13 using two varieties i.e., JG 11 and Annegiri. Wilt and root rot incidence was noticed in both varieties. Seed treatment with Tebuconazole @ 1 ml/kg seed was found superior in minimising the incidence of wilt on JG 11 (8.78%) and Annegiri (6.03%). Seed treatment with *Pseudomonas fluorescens* @ 10 g/ kg seed + foliar spray of *P. fluorescens* @ 6-10 g/ l resulted in less wilt incidence recording 10.06 and 11.17 per cent in JG 11 and Annegiri, respectively. Seed treatment with *P. fluorescens* @ 10 g/ kg seed was found effective in reducing root rot on JG 11 (24.58%) and Annegiri (24.50%). Seed treatment with Tebuconazole @ 1 ml/kg seed recorded maximum seed yield of 10.05 q/ha and 12.66 q/ha in JG 11 and Annegiri, respectively besides producing good quality seed with maximum germination and good seedling vigour.

Introduction: Chickpea is the major rabi pulse crop of Andhra Pradesh and is generally grown on residual soil moisture in black cotton soils. The potentiality of grain legumes is not realized due to number of constraints including seed quality. Chickpea wilt incited by *Fusarium oxysporum f. sp. ciceri* and root rot caused by *Macrophomina phaseolina* are the two major important diseases causing heavy yield losses. The wilt causing pathogen is both soil and seed borne and causes heavy loss to the tune of 20 to 100% [6] depending upon the stage of infection and wilting. Chemical management of these two diseases by systemic fungicides is uneconomical and environmentally hazardous. Hence there is a necessity for the use of non hazardous and eco friendly measures for the management of these two diseases. With this backdrop, the present investigation was carried to study the efficacy of bio-agents on management of wilt and root rot.

material and Methods: Field experiment was conducted at Seed Research and Technology Center, Rajendranagar, Hyderabad during rabi 2011-13 in a split plot design with three replications and spacing of 30 x 10 cm with two varieties of chickpea namely JG 11 and Annegiri. The biocontrol agents viz., *Trichoderma viride* @ 10 g/kg seed, soil application of *T. viride* @ 2 kg/acre, *Bacillus subtilis* @ 5 g/kg seed, Benomyl @ 2 ml/kg seed, *Pseudomonas fluorescens* @ 10 g/kg seed, combination of *T. viride* @ 10 g/kg seed + soil application of *T. viride* @ 2 kg/acre, combination of *B. subtilis* @ 5 g/kg seed + Benomyl @ 2 ml/kg seed, AMISTAR *(Azoxystrobin)* @ 1 g/kg seed, Tebuconazole @ 1 ml/kg seed, *P. fluorescens* @ 10 g/kg seed + foliar spray of *P. fluorescens* @ 6-10 g/l, *P. fluorescens* @ 10 g/kg seed + soil application of *P. fluorescens* @ 3 kg/acre were imposed along with control. The incidence of wilt and root rot was recorded at fortnightly intervals after the initial incidence of wilt and root rot. Per cent wilt and root rot incidence is calculated as total number of wilt or root rot affected plants / total plant stand x 100. Data on plant height, branches per plant, pods per plant, seed yield per plant, seed yield per hectare and test weight was recorded on five randomly selected plants in each treatment. Similarly the data on seed quality characters like germination, root length, shoot length, total seedling length and seedling vigour index I was calculated with the harvested produce. Germination (BP method) was tested under laboratory conditions [4] and expressed in percentage. After recording germination, ten normal seedlings were selected at random in each replication for recording seedling length in centimeters (cm). Seed vigor index I was calculated with seedling length [1]. Average values were computed and the data was subjected to statistical analysis [9]. Results and Discussion During the crop growth period, wilt and root rot incidence was noticed on both JG 11 and Annegiri varieties. Among both the varieties, wilt and root rot incidence was more on JG 11 as compared to the Annegiri variety (Tables 1). The wilt incidence ranged from 8.78 to 25.70 per cent in JG 11 and 6.03 to 21.16 per cent on Annegiri variety, while the % root rot ranged from 24.58 to 54.33 per cent on JG 11 and 24.50 to 44.50 per cent on Annegiri variety. The untreated control showed 25.70 and 21.16 per cent wilt incidence and 54.33 and 44.50 per cent root rot incidence in JG 11 and Annegiri, respectively. Seed treatment with Tebuconazole @ 1 ml/kg seed was found superior in minimising the incidence of wilt on JG 11 (8.78%) and Annegiri (6.03%). Seed treatment with *P. fluorescens* @ 10 g/ kg seed + foliar spray of *P. fluorescens* @ 6-10 g/ l resulted in less wilt incidence recording 10.06 and 11.17 per cent in JG 11 and Annegiri, respectively. Similar results of reduced wilt incidence of 6.03 and 7.28 per cent was found with Tebuconazole @ 1 ml/kg seed and seed treatment with *P. fluorescens* @ 10 g/ kg seed + soil application of *P. fluorescens* @ 3 kg/acre on Annegiri. These results are in confirmity with the findings of [10] who reported reduced wilt incidence with *P. fluorescens* and increased yield in brinjal. Similar reduction of

wilt incidence by seed treatment with *P. fluorescens* + soil application of the same for the control of coriander wilt under field conditions was reported [8]. In the present study, antagonists and chemicals were applied individually and the results were found effective in reducing wilt, these may be used in combination. Similarly for root rot, seed treatment with *P. fluorescens* @ 10 g/ kg seed, seed treatment with *P. fluorescens* @ 10 g/ kg seed + foliar spray of *P. fluorescens* @ 6-10 g/l and Benomyl @ 2 ml/kg seed were found highly effective in reducing root rot incidence on JG 11 and the per cent root rot incidence found was 24.58, 25.76 and 31.67 in the increasing order of efficacy as against the control which recorded 54.33 per cent. While the seed treatment with *P. fluorescens* @ 10 g/ kg seed was found equally effective in controlling root rot in Annegiri (24.50 %). Seed treatment with *P. fluorescens* @ 10 g/ kg seed + soil application of *P. fluorescens* @ 3 kg/acre (27.85%) followed by seed treatment with Benomyl @ 2 ml/kg seed (30.17%) were observed to be effective in reducing root rot incidence on Annegiri as against the control which recorded 44.50%. The highest seed yield was recorded with Tebuconazole @ 1 ml/kg seed (10.05 q/ha) followed by seed treatment with *P. fluorescens* @ 10 g/ kg seed + foliar spray of *P. fluorescens* @ 6-10 g/l (9.32 q/ha) and seed treatment with Benomyl @ 2 ml/kg seed (9.27 q/ha) in JG 11. Seed treatment with Tebuconazole @ 1 ml/kg seed (12.66 q/ha) followed by seed treatment with *P. fluorescens* @ 10 g/ kg seed + soil application of *P. fluorescens* @ 3 kg/acre (11.73 q/ha) and soil application of *T. viride* @ 2 kg/ acre (11.76 q/ha) recorded maximum seed yield in Annegiri (Table 1). Considerable yield increase was observed in all the biocontrol agents treated plots over control. These results are in confirmity with the findings of [2] who reported effective control of *F. oxysporum* by seed treatment with *P. fluorescens*. Similar results were reported [3] by soil application of *T. viride* and seed treatment with *T. viride*. Good quality seed is the most important basic and critical input for sustainable agriculture besides other inputs. Among several seed quality parameters, germination and vigour are considered to be most important to adjudge the economic viability of any seed lot. In JG 11, Tebuconazole @ 1 ml/kg seed, *P. fluorescens* @ 10 g/ kg seed + foliar spray of *P. fluorescens* @ 6-10 g/l and Benomyl @ 2 ml/kg seed produced good quality seed with high germination (99.1, 99.1 and 97.3%) coupled with seedling length (19.7 cm, 20.8 cm and 20.8 cm) and seedling vigour index (2949, 2066 and 2022). Signinificant effects of *P. fluorescens* as growth promotion had already been reported [11]. In Annegiri, Tebuconazole @ 1 ml/kg seed, *P. fluorescens* @ 10 g/ kg seed + soil application of *P. fluorescens* @ 3 kg/acre and soil application of *T. viride* @ 2 kg/ acre produced good quality seed with high germination (99.1, 98.7 and 100%) coupled with seedling length (29.4 cm, 27.9 cm and 26.8 cm) and seedling vigour index (2907, 2756 and 2684) (Table 1). Seed treatment with *P. fluorescens* was effective in reducing the *Fusarium moniliforme* infection and increasing seed germination [5]. In another study, *T. harzianum* and *T. viride* were proved to be highly effective in inhibiting mycelial growth of *M. phaseolina* and decreasing root rot incidence under field conditions [7]. On the basis of the above, it can be concluded that biocontrol agents which possess growth promoting ability along with fungicides could be included in the wilt and root rot management. It may be concluded that commercial formulation of *P. fluorescens* used as a seed treatment provided a good disease control against both wilt and root rot of chickpea. It can be used either with foliar spray of the same @ 6-10 g /l nor with Tebuconazole or Benomyl for the management of wilt and root rot in chickpea.

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Table I: Wilt and root rot incidence, seed yield, germination and vigour index of chickpea (JG 11 and Annegiri

Treatments	Wilt incidence (%)		Root rot incidence (%)		Seed yield (q/ha)		100 seed weight (g)		Germination (%)		Seedling Vigour Index	
	JG 11	Annegiri	JG 11	Annegiri	JG 11	Annegiri	JG 11	Annegiri	JG 11	Annegiri	JG 11	Annegiri
T. viride @ 10 g/ kg seed	12.06	10.72	44.48	33.72	8.31	11.03	23.19	22.27	99.6	99.1	1954	2619
Soil application of *T. viride* @ 2 kg/ acre	15.08	9.76	36.90	36.38	8.35	11.76	23.06	22.92	98.2	100.0	1832	2684
B. subtilis @ 5 g/ kg seed	18.21	14.60	37.82	33.81	8.68	10.80	23.90	22.80	97.3	98.2	1723	2681
Benomyl @ 2 ml/kg seed	11.65	14.66	31.67	30.17	9.27	11.45	22.55	21.06	97.3	98.7	2022	2601
P. fluorescens @ 10 g/ kg seed	14.43	18.33	24.58	24.50	8.53	11.36	21.81	21.72	99.1	98.7	1958	2605
Combination of *T. viride* @ 10 g/ kg seed + soil application of *T. viride* @ 2 kg/ acre	22.21	11.96	35.26	32.57	8.48	11.67	23.82	22.54	99.6	98.7	1885	2662
Combination of *B. subtilis* @ 5 g/ kg seed + Benomyl @ 2 ml/kg seed	13.41	19.16	48.80	37.72	8.99	10.70	21.68	21.57	100.0	98.7	1916	2524
AMISTAR *(Azoxystrobin)* @ 1 g/kg seed	14.70	15.13	42.07	31.97	8.92	10.65	22.28	22.83	97.3	99.1	1883	2665
Tebuconazole @ 1 ml/kg seed	8.78	6.03	34.68	27.88	10.05	12.66	23.54	23.21	99.1	99.1	1949	2907
P. fluorescens @ 10 g/ kg seed + foliar spray of *P. fluorescens* @ 6-10 g/l	10.06	11.17	25.76	43.05	9.32	10.90	22.61	22.57	99.1	97.8	2066	2559
P. fluorescens @ 10 g/ kg seed + soil application of *P. fluorescens* @ 3 kg/acre	13.23	7.28	38.58	27.85	8.62	11.73	22.10	23.01	98.7	98.7	1907	2756
Control	25.70	21.16	54.33	44.50	8.44	10.45	23.45	23.54	96.4	100.0	1671	2449
Mean					8.83	11.26	22.83	22.50				
					CD	CV	CD	CV				
Varieties					0.91	13.54	1.07	6.07				
Treatments					1.58		1.60					
Varieties x Treatments					2.24		2.26					

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Seed Research & Technology Centre, ANGRAU, Rajendranagar, Hyderabad

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