Int.J.Curr.Microbiol.App.Sci (2020) Special Issue-10: 191-196

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-10 pp. 191-196**
Journal homepage: http://www.ijcmas.com

Original Research Article

Wilt Disease Management of Pigeonpea Caused by *Fusarium oxysporum f. sp. udu* of Eastern U.P.

Uday Partap Singh[1*] and Raj Partap Singh[2]

[1]Asha Bhagwan Bax Singh P.G. collage, Ayodhya, India
[2]A.N.D.U.A.T., Kumarganj, Ayodhya[2], India

**Corresponding author*

A B S T R A C T

Wilt disease (*Fusarium oxysporum f. sp. udum*) is one of the most destructive soil-borne diseases of Pigeon pea. Field experiments were conducted at supervision of Asha Bhagwan Bax Singh P.G. College Ayodhya, during Kharif seasons of 2017 and 2018 in the farmer's field of Ayodhya and Ambedkarnager district of Uttar Pradesh, to find out different integrated management levels of control schedule for pigeon pea wilt disease. All treatments had a significant effect on disease incidence, seed yield and disease index in both the consecutive years of experimentation. Nine Seed treatment combinations viz. T1- *Trichoderma viride* alone @ 12g/kg seed, T2- Thiram + Carbendazim + *Trichoderma viride* + Rhizobium @ 13 g /kg, T3- Thiram + Carbendazim+ *Trichoderma viride* + Rhizobium + Soil application of *Trichoderma viride* @ 10 g/kg, T4- Carbendazim 50 % WP (ST) @ 5.0 g/kg, T5- Carbendazim 25 % WP + mancozeb50 % WP (ST) @ 3.0 g/kg, T6- Neem seed cake (SA) @ 5.0q/ha.. T7- Castor seed cake (SA) @ 6.0q/ha, T8- neem seed cake (SA)+ [carbendazim 25 % WP + mancozeb 50 % WP] (ST) + azoxystrobin 23 EC (SD) + Soil application of *Trichoderma viride* @ 20 kg / ha + 1 kg/ ha +3 g / kg seed + 12 g / kg seed +12 g and T9- untreated control were evaluated against wilt disease of pigeon pea on the popular variety Bahar. T8- neem seed cake (SA)+ carbendazim 25 % WP + mancozeb 50 % WP (ST) + azoxystrobin 23 EC (SD) + Soil application of *Trichoderma viride* @ 20 kg / ha + 1 kg/ ha +3 g / kg seed + 12 g / kg seed +12 g was found most effective with minimum wilt incidence 2017 and 2018 (3.40 % and 5.50 %), reduction over control (%) 93.99 & 90.86 and disease index 61.76 & 61.48 % and recorded maximum yield 2017 and 2018 (2160 and 2100 kg/ha), respectively followed by T3- Thiram + Carbendazim+ *Trichoderma viride* + Rhizobium + Soil application of *Trichoderma viride* @ 10 g/kg, 10.90 and 11.60 % wilt incidence, reduction over control (%) 80.74 & 80.73 and disease index 55.17 & 55.26 % with yield kg/ha was 1740 kg /ha and 1860 kg/ha.

Keywords

Pigeon pea wilt, *Fusarium oxysporum* f. sp. udum, *Trichoderma viride*

Introduction

Pigeon pea is the major pulse crops grown in India. These occupy more than 50 percent of total area under pulses, and contribute 60 percent to total pulses production. The average productivity of chickpea and pigeon pea is about 800 kg/ha and 750 kg/ha, respectively, which is much lower than their potential yields. A number of factors limit

achieving this potential, biotic constraints are the most important. Some state leading centre in terms of productivity of highest Gujarat (1059 kg/ha) next Uttar Pradesh 916 k/ha and third rank of Madhya Pradesh 780 kg/ha. Whenever National productivity of this crop is quite low 780 kg/ha to varietal potential. India has 3.90 mha (80% of world acreage) with a total production and productivity of 2.89 mt (79% of world production) and around 750 kg/ha, respectively (http://www.faostat.fao.org). The productivity is 150 kg/ha lower compared to global average. In order to make the nation self sufficient in pulses productivity levels of pulses need to be increased substantially from 560kg ha-1 to 1,200 kg ha-1 by 2020 (Ali and Kumar, 2005). In spite of many interventions, per capita nutrition supply in India among the lowest in the world (OECD, 2015, Goda *et al.,* 2013). Among the biotic stresses, diseases are the major yield limiting factors causing a yield loss of about 8-10 percent and Rs 1500 crores per year. Pigeonpea is affected by more than a hundred pathogens (Nene *et al.,* 1981). The major diseases affecting pigeon pea are wilt (*Fusarium udum*), sterility mosaic (Pigeon pea sterility mosaic virus - PSMV) and Phytophthora blight (*P. drechsleri f. sp. cajani*). Under specific situations, Alternaria blight (A. *alternata, A. tenuissima*), Cercospora leaf sport (*Cercospora spp*.) also assume significant importance. Losses due to wilt and sterility mosaic in pigeon pea have been estimated to be about 302 thousand tonnes, based on the prevalence status of these diseases during 1975 to 1980 (Kannaiyan *et al.,* 1984). The grain loss due to chickpea wilt and root rot has been estimated around 10 percent (Lal *et al.,* 1992; Singh and Dahiya, 1973), In recent years, a good progress has been made in the development of wilt/ root rot resistant varieties in chickpea and pigeon pea (Dhar and Chaudhary, 2001). These have brought some stability in production in disease endemic areas. However, to further enhance the efficiency of these varieties, there is a need to provide other management options. Wilt resistant varieties of pigeonpea for northeastern plains (Uttar Pradesh, Bihar and West Bengal), which occupy a sizeable area under the crop, are not yet available. Incidentally, only a few of them cause economic losses (Kannaiyan *et al.,* 1984) and the distribution of the most important diseases is geographically restricted, among which wilt caused by *Fusarium udum* is a serious problem in the production of pigeonpea. The incidence of infection ranges from 3–94% in the field. The disease can attack at any stage of the plant, but the highest mortality occurs at the flowering and podding stage. The wilt caused by *Fusarium udum* is one of the most serious and oldest known diseases (Butler, 1906) and is known to cause heavy losses every year in India (Kannaiyan *et al.,* 1981). *Fusarium wilt* (*Fusarium udum*) is a soil-borne disease. Fusarium wilt is the most important disease of pigeonpea in India resulting in yield losses up to 67 per cent at maturity and 100 per cent in case of infection at pre-pod stage (Kannaiyan and Nene, 1981). The Fusarium wilt in pigeonpea was first reported from Bihar by Butler (1910). The similar finding of wilt disease of pigeon pea Karimi *et al.,* 2012; Kumar and Upadhyay, 2015; Mahesh *et al.,* 2010, Pawar *et al.,* 2013 and Prasad *et al.,* 2012),

Materials and Methods

The experiment were carried out at various parts of different villages in Ayodhya and Ambedkarnager of Uttar Pradesh viz. Wazidpur, Sarai Khawaja Urf Darbanipur, Chand Pur, Mainpur, Olandganj, and Muradganj district of were evaluated against wilt disease of pigeon pea the popular variety Bahar. Experiment was laid out in one village one replication. Most popular variety used

was Bahar and the gross plot size was 200 sq. metres and all packages of practices were followed for conducting the experiment. This experiment was laid out in randomized block design with four replications (2 Ayodhya and 2 Ambedkarnager). One village one replication, the soil of the farmers' field was sandy loam in texture, neutral in reaction and had low nitrogen and medium phosphorus and potassium contents. To evaluate the efficacy of new molecules/chemicals against wilt, were tested. Eight treatment Seed combinations viz. T1- *Trichoderma viride* alone @ 12g/kg seed, T2- Thiram + Carbendazim + *Trichoderma viride* + Rhizobium @ 13 g /kg, T3- Thiram + Carbendazim+ *Trichoderma viride* + Rhizobium + Soil application of *Trichoderma viride* @ 10 g/kg, T4- Carbendazim 50 % WP (ST) @ 5.0 g/kg, T5- Carbendazim 25 % WP + mancozeb50 % WP (ST) @ 3.0 g/kg, T6- Neem seed cake (SA) @ 5.0q/ha.. T7- Castor seed cake (SA) @ 6.0q/ha, T8- neem seed cake (SA)+ [carbendazim 25 % WP + mancozeb 50 % WP] (ST) + azoxystrobin 23 EC (SD) + Soil application of *Trichoderma viride* @ 20 kg / ha + 1 kg/ ha +3 g / kg seed + 12 g / kg seed +12 g and T9- untreated control. The crop was sown manually after the onset of monsoon with a spacing of 60 cm x 15 cm using a certified seed with a seed rate of 20 kg/ ha. To prevent the crop from the soil and seed-borne diseases, the seeds were treated with a combination of different fungicide, bioagents, and culture as per the treatments. The crop was fertilized with 20, 60 and 30 kg N, P_2O_5 and K_2O/ha, respectively. The harvesting was done manually with the help of sickle when the crop attained full maturity. The produce of a square meter from four randomly selected of each plot was tied into a bundle and allowed to sun drying in respective plots. The harvested bundles were weighed with the help of balance and transported to the threshing floor. Threshing of the produce of each plot was done separately by beating with wooden sticks; the seeds were then cleaned manually and weighed. Wilt incidence percent (WI %) is calculated at 60 DAS and 150 DAS, with the help of the following formulae:

Wilt incidence (WI) %=Number of plants infected by wilt disease/Total number of plants observed X 100

Seed yield of the net plot was noted down, after threshing, winnowing, and drying and calculated in q ha-1. Disease index indicates the reduction in yield of crop due to disease attack and is expressed in percent by using formulae:

Disease index (%) = Yield from treated plot-yield from the untreated plot/ Yield from treated plot X 100

Results and Discussion

There was significant difference among the treatments in wilt disease severity and yield. The data on different disease parameters is summarised in table 1. Different integrated management levels of control schedule for pigeon pea wilt disease had a significant effect on disease incidence percent, seed yield, and disease index in both the consecutive year of experimentation. Treated with T8- neem seed cake (SA)+ carbendazim 25 % WP + mancozeb 50 % WP (ST) + azoxystrobin 23 EC (SD) + Soil application of *Trichoderma viride* @ 20 kg / ha + 1 kg/ ha +3 g / kg seed + 12 g / kg seed +12 g was found best in checking the disease incidence 3.40 and 5.50, reduction over control (%) 93.99 & 90.86. and disease index 61.76 and 61.48 % year of 2017 and 2018 respectively and the better grain yield 2040 and 2160 kg/ha was recorded. While incidence of wilt disease had gone to the extent of 56.60 and 60.20 respectively in untreated plots. In

check plots reduced grain yield was recorded (780 and 832 kg/ha). The plot treated with had also shown good response with T3- Thiram + Carbendazim+ *Trichoderma viride* + Rhizobium + Soil application of *Trichoderma viride* @ 10g/kg 10.90 and 23.0 % disease incidence, reduction over control (%) 80.74 & 80.73 and disease index 55.17 and 55.26%, along with good grain yield 1740 and 1860 kg/ha. was recorded. In treatment T2- Thiram + Carbendazim + *Trichoderma viride* + Rhizobium @ 13 g/kg, disease incidence 15.60, reduction over control (%) 72.43 & 73.23 and disease index 51.25 , 51.34 % year of 2017 and 2018 respectively and the better grain yield 1600 and 1710 kg/ha was recorded. T1- *Trichoderma viride* alone @12 g/kg showed good response 16.20 and 17.24 disease incidence % reduction over control (%) 71.38 & 71.36 was observed and disease index 46.68 and 45.33 along with 1463 and 1522 kg/ha. grain yield. In the plot treated with T5- Carbendazim 25 % WP + mancozeb50 % WP (ST) @ 3.0 g/kg 20.10, 19.60% disease incidence a reduction over control (%) 64.48 & 67.44 and disease index 47.29 , 45.69 % along with 1480, 1532kg/ha grain yield. The plot treated with T4- Carbendazim 50 % WP (ST) @ 5.0 g/kg 20.24, 26.77%, disease incidence reduction over control (%) 64.24, 55.23 and disease index 48.06, 45.44, with yield 1502 & 1525 kg/ha was recorded.

Table.1 Efficacy of various treatments integration against wilt (*F. udum*) incidence and seed yield in pigeon pea during Kharif 2017-18 and 2018-19

Sl. No.	Treatments	Dose/kg	Wilt incidence (%)			Reduction over control (%)			Disease index (%)			Yield kg/ha.		
			2017	2018	Mean	2017	2018	Mean	2017	2018	Mean	2017	2018	Mean
T1-	*Trichoderma viride* alone	12 g	16.20	17.24	16.72	71.38	71.36	71.37	46.68	45.33	46.01	1463	1522	1493
T2-	Thiram + Carbendazim + *Trichoderma viride* + Rhizobium	13 g	15.60	16.11	15.86	72.43	73.23	72.83	51.25	51.34	51.30	1600	1710	1655
T3-	Thiram + Carbendazim+ *Trichoderma viride* + Rhizobium + Soil application of Trichoderma viride	10 g	10.90	11.60	11.25	80.74	80.73	80.74	55.17	55.26	55.22	1740	1860	1800
T4-	Carbendazim 50 % WP (ST)	5 g	20.24	26.77	23.51	64.24	55.53	59.89	48.06	45.44	46.75	1502	1525	1514
T5-	Carbendazim 25 % WP + mancozeb50 % WP (ST)	3 g	20.10	19.60	19.85	64.48	67.44	65.96	47.29	45.69	46.49	1480	1532	1506
T-6	Neem seed cake (SA)	5q/ha.	22.80	23.70	23.25	59.71	60.63	60.17	40.45	40.14	40.30	1310	1390	1350
T7-	Castor seed cake (SA)	6 q/ha.	24.60	23.90	24.25	56.54	60.29	58.42	35.00	34.74	34.87	1200	1275	1238
T8-	neem seed cake (SA)+ [carbendazim 25 % WP + mancozeb 50 % WP] (ST) + azoxystrobin 23 EC (SD) + Soil application of Trichoderma viride	20 kg / ha + 1 kg/ ha +3 g / kg seed + 12 g / kg seed +12 g	3.40	5.50	4.45	93.99	90.86	92.43	61.76	61.48	61.62	2040	2160	2100
T9-	Untreated control		56.60	60.20	58.40	–	–	–	–	–	–	780	832	806

The plot treated with T6- Neem seed cake (SA) @ 5q/ha. 22.80, 23.70%, disease incidence, reduction over control (%) 59.71, 60.63 and disease index 40.45, 40.14 with yield 1390, 1350 kg/ha was recorded. The plot treated with T7- Castor seed cake (SA) @ 6q/ha. 24.60, 23.90%, disease incidence, reduction over control (%) 56.54, 60.29 and disease index 35.00, 34.74 with yield 1200, 1275 kg/ha was recorded.

All these treatments were found effective in checking in disease incidence over untreated control and increased the grain yield of pigeon pea at various extent. neem seed cake (SA)+ carbendazim 25 % WP + mancozeb 50 % WP (ST) + azoxystrobin 23 EC (SD) + Soil application of *Trichoderma viride* was found best in the average of disease incidence 4.45, reduction over control (%) 92.43. and disease index 61.62 % respectively and grain yield 2100 kg/ha was recorded. followed by Thiram + Carbendazim+ *Trichoderma viride* + Rhizobium + Soil application of *Trichoderma viride* @ 10g/kg 10.90 and 23.0 % disease incidence, reduction over control (%) 80.74 & 80.73 and disease index 55.17 and 55.26%, along with good grain yield 1740 and 1860 kg/ha. was recorded, minimization of disease incidence may be one of the possible reasons for enhancement of grain yield.

References

1. Kannayian, J., Y.L. Nene, M.V. Reddy, J.G. Ryan and T.N. Raju. 1984. Prevalence of pigeonpea diseases and associated crop losses in Asia, Africa and the America. Tropical Pest Management 30(1): 62 - 71.
2. Lal, S.S., C.P. Yadava and J.N. Sachan. 1992. Assessment of pod borer damage in pigeonpea in different agro-ecological zones of Uttar Pradesh. Indian Journal of Pulses Research 5(2): 172-178.
3. Singh, K.B. and B.S. Dahiya. 1973. Breeding for wilt resistance in chickpea. In: Symposium on Wilt Problems and Breeding for Resistance in Bengal Gram. IARI, New Delhi, India. pp. 13-14.
4. Dhar, Vishwa and R.G. Chaudhary. 2001. Disease resistance in pulse crops – Current status and future approaches. In: Role of resistance in intensive agriculture (Eds. S. Nagarajan and D.P. Singh). Ludhiana: Kalyani Publishers.
5. Nene, Y.L., Kannaiyan, J. and Reddy, M.V. (1981). Pigeonpea diseases: resistance screening techniques. Information Bulletin No.9. ICRISAT, India.
6. Kannaiyan, J., Nene, Y.L. and Reddy, M.V. (1981).Influence of wilt at different growth stages on yield loss in Pigeonpea. Tropical Pest Management 27: 141.
7. http://www.faostat.fao.org.
8. Gowda, C. L., S. Srinivasn, P.M. Gaur and K.B. Saxena (2013). Enhancing productivity and productivity of pulses in India. Climate change and sustainable food security, ICAR, New Delhi, pp: 145-159.
9. Karimi, R., James, O. O. and Silim, S. N. (2012). Importance and management of Fusarium wilt (Fusarium udum Butler) of pigeonpea. Inter. J. Agronomy Agril. Res., 2 (1): 1-14.
10. Kumar, S. and Upadhyay, J. P. (2015). Development and validation of Integrated Disease Management module for Management of pigeonpea wilt caused by *Fusarium udum*. Indian J. Pl. Protec. 43 (4):

493-497.

11. Mahesh, M., Saifulla, M., Prasad, P. S. and Sreenivasa, S. (2010). Studies on cultural variability of *Fusarium udum* isolates in India. Inter. J. Sci. Nature 1 (2): 219- 225.
12. Pawar S. V., Deshpande, G. D., Dhutraj, D. N. and Dey, U. (2013). Survey of pigeonpea wilt disease in Marathwada region of Maharashtra state. A Quarterly J. life Sci., 10 (1): 175-176.
13. Prasad, P. S., Saifulla, M., Mallikarjuna, N., Thimmegowda, P. R. and Lakshmipathy, R. N. (2012). Integrated disease management of Pigeonpea wilt *Fusarium udum* (Butler). Madras Agric. J., 99 (10): 811-814.