Int.J.Curr.Microbiol.App.Sci (2018) *7*(4): 201-209

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 7 Number 04 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.704.022

Integrated Management of Dry Root Rot Caused by *Rhizoctonia bataticola* in Chickpea

Deepa[1*], Gururaj Sunkad[1], Mamta Sharma[2], S.B. Mallesh[1], D.M. Mannur[3] and A.G. Sreenivas[4]

[1]Department of Plant Pathology, [3]Department of Genetics and plant Breeding, [4]Department of Agril. Entomology, University of Agricultural Sciences, Raichur-584104, Karnataka, India
[2]Department of Pulse Research, International Crops Research Institute for the Semi-Arid Tropics, Patancheru 502 324, Andhra Pradesh, India

**Corresponding author*

Keywords

Integrated management, Dry root rot, Chickpea, *Rhizoctonia bataticola*

Article Info

Accepted:
04 March 2018
Available Online:
10 April 2018

A B S T R A C T

Dry root rot caused by *Rhizoctonia bataticola* (Taub.) Butler is emerging as a serious biotic constraint for chickpea production. It is the most important and widespread soil borne disease of chickpea. Among the several constraints affecting the productivity of chickpea, 10-35 per cent loss in yields are due to dry root rot diseases. Among them, dry root rot caused by *Rhizoctonia bataticola* is becoming severe in most of the chickpea growing regions of Karnataka So to find out the best management strategies for the disease through bio-control agents and fungicides, investigation was carried during *rabi* 2015-16 and *rabi* 2016-17 in the study area.

Introduction

Chickpea, *Cicer arietinum* L. is one of the most important pulse crops of India. In India, chickpea ranks second in area and third in production, perhaps is the largest producer of chickpea in the world covering 80 per cent area and 85 per cent of total production with a productivity of 844 kg/ha (www.iipr.res.in). In Karnataka, it is grown on an area of 0.92 million ha with a production of 0.57 million tonnes and the productivity is 622 kg per ha (Anon., 2016). Gulbarga, Bidar, Dharawad, Gadag, Ballari and Raichur are the major chickpea growing districts. The average production of chickpea is 15-20 quintal per hectare which is low in spite of high yielding varieties and new agronomic practices. The reasons of low yield are so many apart from other reasons the main cause of low yield of this crop is the incidence of diseases. India is the world leader in chickpea production fallowed by Pakistan. The chickpea crop is attacked by 172 pathogens (67 fungi, 22

viruses, 3 bacteria, 80 nematodes and mycoplasma) from all over the world (Nene *et al.,* 1996). Among all, only a few of them have the potential to devastate the crops.

Some of the serious disease in order of their importance is wilt *Fusarium oxysporum f. sp. ciceri)* wet root rot (*Rhizoctonia solani),* dry root rot (*Rhizoctonia, bataticola)* Ascochyta blight (*Ascocthya rabiei)* and coller rot *(Sclerotium rolfsie).*

Among the several constraints affecting the productivity of chickpea, 10-35 per cent loss in yields are due to dry root rot diseases (Mahendra Pal, 1998). Among them, dry root rot caused by *Rhizoctonia bataticola* is becoming severe in most of the chickpea growing regions of Karnataka. *Rhizoctonia bataticola* is a polyphagous soil borne pathogen infecting over 500 plant species worldwide causing huge losses. Though the fungus is seed and soil borne inoculum (Dingra and Sinclair 1994), Soil borne inoculum is more development. For soil borne pathogen, use of fungicide is not practical due to exorbitant cost and environmental hazards involved. Hence integrated management of the disease using bio-control agents and chemicals is the best alternative (Ramarethinum *et al.,* 2001). Investigations were made in the present study to devise an effective management strategy for dry root rot of chick pea.

Materials and Methods

An experiment was laid out as per randomized block design (RBD) during *rabi*-2015-16 and *rabi*-2016-17 at experimental block of Department of Plant Pathology UAS, Raichur. The susceptible variety Annigeri-1 was grown and treated eight treatments were replicated thrice with plot size of 5 X 3 m^2 with recommended agronomical practices were followed to conduct the experiment. The artificial inoculation was done by using the fungus *R. bataticola*, mass multiplied on autoclaved sand sorghum medium. Pre cultured fungal mycelia (and sclerotia) was then placed aseptically in the medium, after ten days of fully grown culture was inoculated to soil. The observations like per cent disease, grain yield were recorded.

Disease incidence (%)

Based on observations the disease incidence was calculated by following formula.

$$\text{Dry root rot incidence (\%)} = \frac{\text{Number of plants infected}}{\text{Total number of plants}} \times 100$$

Seed yield (q/ha)

At the time of harvest, chickpea plants from all the treatments and replications were collected separately. After threshing and winnowing, the net plot yield was recorded and later converted to ha and expressed as q per ha.

Test weight (g)

The test weight was also recorded by taking 100 seeds randomly from each treatment and expressed as gram. The data were subjected to statistical analysis by using standard statistical procedures.

Estimation of Benefit Cost (B: C) ratio

The economic analysis of the experiment was done by taking into consideration of market prices prevailing during 2016-17 for the produce and cost of treatment. B: C ratio was calculated by gross returns and total cost of cultivation.

$$\text{Benefit: Cost} = \frac{\text{Gross returns}}{\text{Total cost of cultivation}}$$

Results and Discussion

Disease incidence of dry root rot (%)

Disease data of *rabi,* 2015-16

Results also indicated that all the treatments were significantly superior over control. Among the treatments employed, the treatment containing seed treatment with mancozeb 50% + carbendazim 25% WS @ 3.5 g/kg followed by soil drenching of mancozeb 50% + carbendazim 25% WS @ 3 g/l water to infected and surrounding plants (T_3) recorded significantly lowest incidence of dry root rot (7.70%) when compared to all other treatments except (T_7) seed treatment with *T. harzianum* @ 5g/kg seed + *P. fluorescence* @ 5 g/kg seed followed by soil drenching of mancozeb 50% + carbendazim 25% WS @ 3 g/l water to infected and surrounding plants (9.57%). However, untreated control treatment recorded the highest incidence of dry root rot (33.45%) (Table 1).

Disease data of *rabi,* 2016-17

The experiment was repeated during *rabi*, 2016 with same set of treatments. The results obtained during *rabi*, 2016-17 followed similar trend of results as observed during *rabi*, 2015-16. All the treatments were significantly superior to untreated control. Among them, seed treatment with mancozeb 50% + carbendazim 25% WS @ 3.5 g/kg followed by soil drenching of mancozeb 50% + carbendazim 25% WS @ 3 g/l water to infected and surrounding plants (T_3) recorded significantly lowest dry root rot incidence of 8.25% and next best treatment was (T_7) seed treatment with *T. harzianum* @ 5g/kg seed + *P. fluorescence* @ 5 g/kg seed followed by soil drenching of mancozeb 50% + carbendazim 25% WS @ 3 g/l water to infected and surrounding plants (10.30%) and (T_4) seed treatment with *T. harzianum* @ 5 g/kg seed followed by soil drenching of mancozeb 50% + carbendazim 25% WS @ 3 g/l water to infected and surrounding plants and (T_6) seed treatment with *T. harzianum* @ 5 g/kg seed + *P. fluorescence* @ 5 g/kg seed followed by soil application of enriched *T. harzianum* + *P. fluorescence* 2.5 kg/250 kg FYM during sowing were on par with each other by recording dry root rot incidences of 20.59% and 20.47%, respectively. The highest incidence of 36.25% was recorded in untreated control treatment (Table 1).

Pooled disease data (*rabi,* 2015-16 and *rabi,* 2016-17)

The results on pooled data indicated that the treatment combination seed treatment with mancozeb 50% + carbendazim 25% WS @ 3.5 g/kg followed by soil drenching of mancozeb 50% + carbendazim 25% WS @ 3 g/lit water to infected and surrounding plants (T_3) was significantly superior in recording least disease incidences of dry root rot (7.97%) from rest of the treatment combinations (Table 1).

The next best treatments were seed treatment with *T. harzianum* @ 5 g/kg seed + *P. fluorescence* @ 5 g/kg seed followed by soil drenching of mancozeb 50% + carbendazim 25% WS @ 3 g/lit water to infected and surrounding plants (T_7) (9.93%) and seed treatment with *T. harzianum* @ 5 g/kg seed followed by soil drenching of mancozeb 50% + carbendazim 25% WS @ 3 g/lit water to infected and surrounding plants (T_4) and seed treatment with *T. harzianum* @ 5 g/kg seed + *P. fluorescence* @ 5 g/kg seed followed by soil application of enriched *T. harzianum* + *P. fluorescence* 2.5 kg/250 kg FYM during sowing (T_6) were on par with each other but significantly different from untreated control (34.85%) (Table 1 and Fig. 1).

Per cent reduction in disease

The highest reduction in dry root rot (77.60%) disease incidence was observed in the treatment combination of seed treatment with mancozeb 50% + carbendazim 25% WS @ 3.5 g/kg followed by soil drenching of mancozeb 50% + carbendazim 25% WS @ 3 g/lit water to infected and surrounding plants (Table 1). Seed treatment with *T. harzianum* @ 5 g/kg seed + *P. fluorescence* @ 5 g/kg seed followed by soil drenching of mancozeb 50% + carbendazim 25% WS @ 3 g/lit water to infected and surrounding plants showed per cent reduction of 71.50% for dry root rot.

It was comparatively less in other treatments *viz.*, Seed treatment with *P. fluorescence* @ 5 g/kg seed followed by soil application of enriched *T. harzianum* @ 2.5 kg/250 kg of FYM during sowing (29.32%), seed treatment with mancozeb 50% + carbendazim 25% WS @ 3.5 g/kg (33.68%) and seed treatment with *P. fluorescence* @ 5 g/kg seed followed by soil drenching of mancozeb 50% + carbendazim 25% WS @ 3 g/lit water (33.80%) (Table 1).

Treatments for integrated disease management

Sl. No.	Treatment details
T_1	Seed treatment with *T. harzianum* @ 5 g/kg seed followed by soil application of enriched *T. harzianum* 2.5 kg/250 kg FYM during sowing
T_2	Seed treatment with *P. fluorescence* @ 5 g/kg seed followed by soil application of enriched *T. harzianum* 2.5 kg/250 kg FYM during sowing
T_3	Seed treatment with mancozeb 50% + carbendazim 25% WS (Sprint) @ 3.5 g/kg followed by soil drenching of mancozeb 50% + carbendazim 25% WS (Sprint) @ 3 g/l water to infected and surrounding plants
T_4	Seed treatment with *T. harzianum* @ 5 g/kg seed followed by soil drenching of mancozeb 50% + carbendazim 25% WS (Sprint) @ 3 g/l water to infected and surrounding plants
T_5	Seed treatment with *P. fluorescens* @ 5 g/kg seed followed by soil drenching of mancozeb 50% + carbendazim 25% WS (Sprint) @ 3 g/l water to infected and surrounding plants
T_6	Seed treatment with *T. harzianum* @ 5 g/kg seed + *P. fluorescence* @ 5 g/kg seed followed by soil application of enriched *T. harzianum* + *P. fluorescence* 2.5 kg/250 kg FYM during sowing
T_7	Seed treatment with *T. harzianum* @ 5 g/kg seed + *P. fluorescence* @ 5 g/kg seed followed by soil drenching of mancozeb 50% + carbendazim 25% WS (Sprint) @ 3 g/lit water to infected and surrounding plants
T_8	Seed treatment with mancozeb 50% + carbendazim 25% WS (Sprint) @ 3.5 g/kg
T_9	Untreated control

Table.1 Integrated management of dry root rot of chickpea during *rabi*, 2015-16 and *rabi*, 2016-17

Sl. No.	Treatments	Disease incidence (%)			
		2015-16	2016-17	Pooled Mean	Reduction over control
1	T_1	21.90 (27.26)	23.55 (29.03)	22.27	36.09
2	T_2	24.27 (29.51)	25.00 (30.0)	24.63	29.32
3	T_3	7.70 (16.11)	8.25 (16.69)	7.97	77.60
4	T_4	22.59 (28.38)	20.59 (26.99)	21.59	38.04
5	T_5	26.00 (30.66)	25.15 (26.67)	25.55	33.80
6	T_6	22.33 (28.20)	20.47 (26.90)	21.40	38.59
7	T_7	9.57 (18.04)	10.30 (18.72)	9.93	71.50
8	T_8	22.10 (28.04)	24.12 (29.41)	23.11	33.68
9	T_9	33.45 (34.11)	36.25 (33.38)	34.85	
S.Em±		**3.12**	**3.08**		
CD (P=0.05)		**9.06**	**8.94**		

T_1	**Seed treatment with *T. harzianum* @ 5 g/kg seed followed by soil application of enriched *T. harzianum* @ 2.5 kg/250 kg of FYM during sowing**
T_2	Seed treatment with *P. fluorescence* @ 5 g/kg seed followed by soil application of enriched *T. harzianum* @ 2.5 kg/250 kg of FYM during sowing
T_3	Seed treatment with mancozeb 50% + carbendazim 25% WS (Sprint) @ 3.5 g/kg followed by soil drenching of mancozeb 50% + carbendazim 25% WS (Sprint) @ 3 g/lit water to infected and surrounding plants
T_4	Seed treatment with *T. harzianum* @ 5 g/kg seed followed by soil drenching of mancozeb 50% + carbendazim 25% WS (Sprint) @ 3 g/lit water to infected and surrounding plants
T_5	Seed treatment with *P. fluorescence* @ 5 g/kg seed followed by soil drenching of mancozeb 50% + carbendazim 25% WS (Sprint) @ 3 g/lit water to infected and surrounding plants
T_6	Seed treatment with *T. harzianum* @ 5 g/kg seed + *P. fluorescence* @ 5 g/kg seed followed by soil application of enriched *T. harzianum* + *P. fluorescence* @ 2.5 kg/250 kg of FYM during sowing
T_7	Seed treatment with *T. harzianum* @ 5 g/kg seed + *P. fluorescence* @ 5 g/kg seed followed by soil drenching of mancozeb 50% + carbendazim 25% WS (Sprint) @ 3 g/lit water to infected and surrounding plants
T_8	Seed treatment with mancozeb 50% + carbendazim 25% WS (Sprint) @ 3.5 g/kg
T_9	Untreated control

Table.2 Yield and economics of integrated disease management trial on chickpea as influenced by dry root rot disease during *rabi*, 2015-16 and 2016-17

Sl. No.	Treatment	Test weight (g)	Mean yield q/ha	Cost of cultivation (` ha^{-1})	Treatment cost (` ha^{-1})	Total cost of cultivation (` ha^{-1})	Gross returns (` ha^{-1})	B:C ratio
1	**T_1**	24.0	7.96	25,000	450	25,450	55,720	2.22
2	**T_2**	26.19	8.05	25,000	360	25,360	56,350	2.25
3	**T_3**	38.90	12.26	25,000	1,225	26,225	85,820	3.40
4	**T_4**	20.00	9.25	25,000	675	25,675	64,750	2.01
5	**T_5**	16.90	7.20	25,000	660	25,660	50,400	2.39
6	**T_6**	29.13	10.06	25,000	810	25,810	70,420	2.81
7	**T_7**	37.50	11.20	25,000	1,110	26,110	75,600	3.02
8	**T_8**	19.34	7.76	25,000	300	25,300	54,320	2.17
9	**T_9**	15.60	5.74	25,000	0	25,000	40,180	1.60
	S.Em±	**1.11**	**0.47**					
	CD @ 0.05%	**3.34**	**1.42**					

Fig.1 Integrated management of dry root rot of chickpea per cent incidence and yield

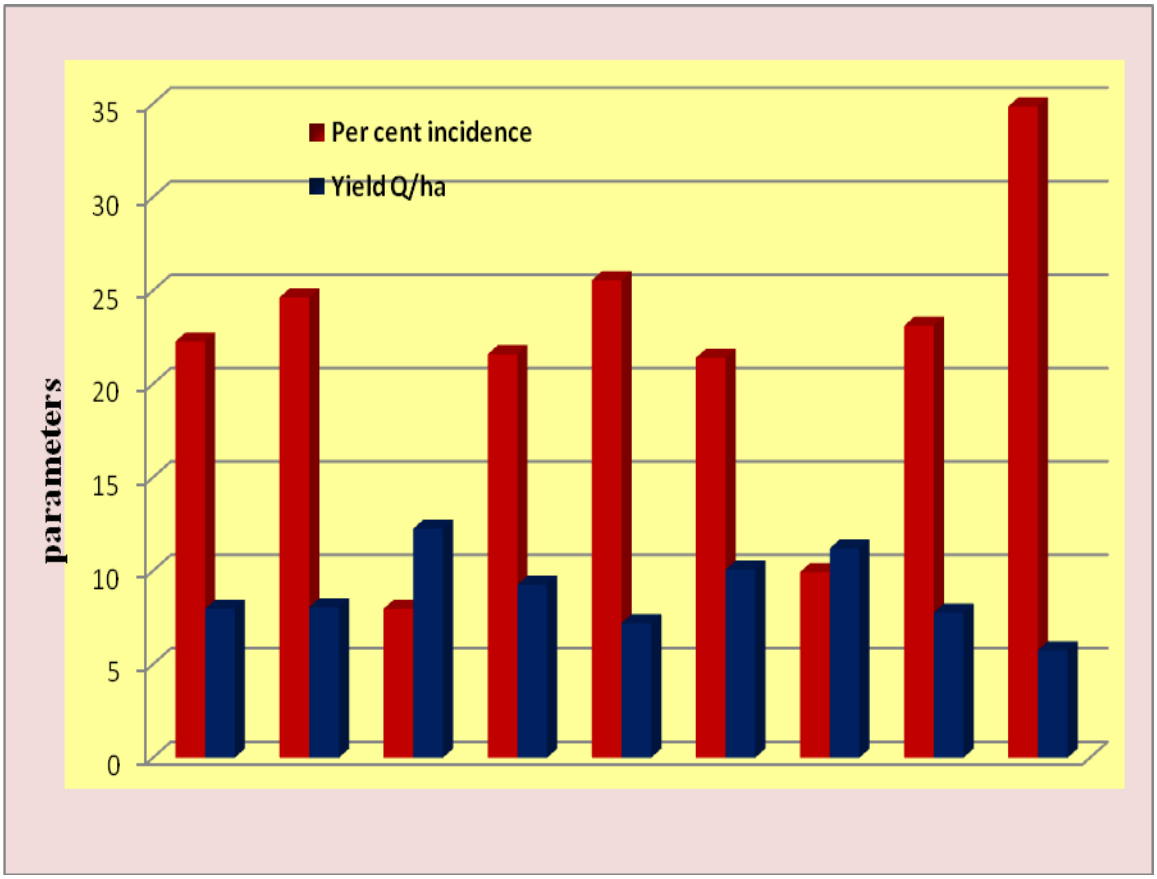

Plate.1 Integrated management of dry root rot of chickpea

T_3- Seed treatment with Mancozeb 50% + Carbendazim 25% WS (Sprint) @ 3.5 g/kg followed by soil drenching of Mancozeb 50% + Carbendazim 25% WS (Sprint) @ 3 g/lit water to infected and surrounding plants

T_9- Untreated control

Overall field view

Field experiments conducted during *rabi*, 2015-16 and *rabi*, 2016-17 indicated that the treatment containing seed treatment with mancozeb 50% + carbendazim 25% WS @ 3.5 g/kg followed by soil drenching of mancozeb 50% + carbendazim 25% WS @ 3 g/l water to infected and surrounding plants was significantly superior in recording least disease incidences of dry root rot from rest of the treatment combinations. The next best treatments was seed treatment with T. *harzianum* @ 5 g/kg seed + *P. fluorescens* @ 5 g/kg seed followed by soil drenching of mancozeb 50% + carbendazim 25% WS @ 3 g/l water to infected and surrounding plants. Khan *et al.*, (2012) tested eight fungicides against dry root rot fungus, among them mancozeb, carbendazim, copper-oxy-chloride and benomyl completely inhibited the growth of the fungus compared to control. Further, in fungicidal trails on management of dry root rot of chickpea caused by *R. bataticola*, carbendizim (0.2 per cent) used as seed treatment, soil drenching and seed treatment plus soil drenching recorded lowest disease incidence of 15.6 per cent highest grain yield of 192 q/ha respectively (Vijay Mohan *et al.*, 2006).

Yield data on yield and test weight

Mean yield data of dry root rot of chickpea during *rabi*, 2015-16 and 2016-17 indicated that the treatment combination seed treatment with mancozeb 50% + carbendazim 25% WS @ 3.5 g/kg followed by soil drenching of mancozeb 50% + carbendazim 25% WS @ 3 g/lit water to infected and surrounding plants recorded significantly highest seed yield of 12.26 q/ha and test weight of 38.90 g which is significantly different from rest of the treatment combinations evaluated. Next best treatment was seed treatment with *T. harzianum* @ 5 g/kg seed + *P. fluorescence*@ 5 g/kg seed followed by soil drenching of mancozeb 50% + carbendazim 25% WS @ 3 g/lit water to infected and surrounding plants recorded yield and test weight of 11.20 q/ha and 37.50 g, respectively. Further, seed treatment with *T. harzianum* @ 5 g/kg seed + *P. fluorescence* @ 5 g/kg seed followed by soil application of enriched *T. harzianum* + *P. fluorescence* 2.5 kg/250 kg FYM during sowing recorded the seed yield and test weight of 10.06 q/ha and 29.13 g, respectively. However, the lowest seed yield and test weight was observed in untreated control (5.74 q/ha and 15.60 g) (Table 2 and Fig. 1).

Benefit cost ratio (B: C)

In integrated disease management trial, economics was worked out by taking into consideration of the total cost of cultivation, cost of treatment and gross returns. The highest benefit (3.40) was obtained in seed treatment with mancozeb 50% + carbendazim 25% WS @ 3.5 g/kg followed by soil drenching of mancozeb 50% + carbendazim 25% WS @ 3 g/l water to infected and surrounding plants. The other effective treatment was seed treatment with *T. harzianum* @ 5 g/kg seed + *P. fluorescence* @ 5 g/kg seed followed by soil drenching of mancozeb 50% + carbendazim 25% WS @ 3 g/l water to infected and surrounding plants recorded BC ratio of 3.02 (Table 2).

Nagamani *et al.*, (2011) conducted experiment on dry root rot of chickpea and reported that seed treatment with carbendazim @ 2g/kg of seed+ seed treatment with *T. viride* @ 4 g/kg of seed + soil application of FYM fortified with *T. viride* recorded least disease incidence with highest yield and BC ratio. Further, Integrated management study of root rot disease of chickpea under field condition showed that soil application of *T. harzianum* @ 5 kg in 500 kg neem cake/ha in furrow 5 days prior to sowing resulted in higher seed germination lowest disease

incidence and gave highest yield (Dhingani and Solanky, 2016).

References

Anonymous, 2016, Annual *kharif* pulses group meet. All India co-ordinated research project of pigeonpea (ICAR), 22nd-24th May, P: 406.

Dhingani, J. C. and Solanky, K. U., 2016, Integrated management of root rot disease [*Macrophomina phaseolina* (tassi.) goid] of chickpea through bioagents, oil cakes and chemicals under field conditions in south Gujarat conditions. *Pl. Archi*., 16 (1): 183-186.

Dhingra, O. D. and Sinclair, J. B., 1994, Basic plant Pathologt Methods. CRS press, London. Pp: 443.

Khan, R. A., Bhat, T. A. and Kumar, K., 2012, Management of chickpea (*Cicer arietinum* L.) dry root rot caused by *Rhizoctonia bataticola* (Taub.) Butler. *Int. J. Res. Pharmac. Biomed. Sci.*, 3(4): 1539-1548.

Mahendra Pal, 1998, Diseases of pulse crops, their relative importance and management. *J. Mycol. Plant. Pathol.*, 28(2): 114-122.

Nagamani, P., Viswanath, K. and Kiran babu, T., 2011, Management of dry root rot caused by *Rhizoctonia bataticola* (Taub.) Butler in chickpea. *Curr. Bio.*, 5(3): 364-369.

Nene, Y. L., Sheila, V. K. and Sharma, S. B., 1996, A World list of chickpea and pigeonpea pathogens. *ICRISAT, 5th edition.* 1-27.

Ramarethinam, S., Morugesan, N. and Marimuthu, S., 2001, Compatibility Studies of fungicides with *Trichoderma viride* used in the Commercial formulation- Bio- CURF. *Pestology* (25):2-6.

Vijay-Mohan, S. M., Prasad, M., Barnwal, M. K. and Kudada, N., 2006, Fungicidal management of dry root rot disease and yield of chickpea. *J. Appl. Biol*., 16: 42–44.

How to cite this article:

Deepa, Gururaj Sunkad, Mamta Sharma, S.B. Mallesh, D.M. Mannur and Sreenivas, A.G. 2018. Integrated Management of Dry Root Rot Caused by *Rhizoctonia bataticola* in Chickpea. *Int.J.Curr.Microbiol.App.Sci.* 7(04): 201-209. doi: https://doi.org/10.20546/ijcmas.2018.704.022