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EVALUATION OF DIFFERENT MODULES AGAINST CHICKPEA (*CICER ARIETINUM* L.) DISEASES

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Abstract

Collar rot, *Fusarium* wilt and dry root rot are three important diseases of chickpea. These form disease complex and known to cause severe damage to the crop. The present investigation was carried out by Krishi Vigyan Kendra during *Rabi* season 2012-13 and 2013-14 at village Kakraua in Bundelkhand region. The field experiments comprised of 5 treatment module and control (untreated check). These modules were $\mathbf{T_1}$: Crop rotation + deep summer ploughing + variety JG 16 + RDF, $\mathbf{T_2}$: $\mathbf{T_1}$ + seed treatment with the carbendazim (1.0g) + thiram (2.0g) per kg seed, $\mathbf{T_3}$: $\mathbf{T_1}$ + *Rhizobium* and PSB, $\mathbf{T_4}$: $\mathbf{T_1}$ + seed treatment with *Trichoderma viride* @ 5.0g/kg seed + soil application of *Trichoderma viride* @ 4.0 kg/ha and $\mathbf{T_5}$ was integration of all the treatments. The lowest disease incidence were recorded in Module 5 *i.e.* collar rot (1.77 %), *Fusarium* wilt (2.17 %) and dry root rot (1.77%). Similarly, highest emergence per cent (88.13), number of healthy pod/plant (62), 100 seed weight (21.55g) and highest yield increase 53.10 per cent were found in also module 5. It also gave the highest net return of ¯ 20390 with 1:3.6 cost benefit ratio followed by module 3, module 2, module 4 and module 1.

Key word: chickpea, wilt, dry root rot, collar rot, modules.

Introduction

Chickpea (*Cicer arietinum*. L.) is the oldest and third most important pulse crop in world and is believed to be originated in South-eastern Turkey. 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 Despite the high total production, yields of chickpea are low due to many biotic and abiotic constraints. Among the several yield limiting factors the seed and soil borne diseases such as collar rot (*Sclerotium rolfsii*), *Fusarium* wilt (*Fusarium oxysporum* f. sp. *ciceris*), and dry root rot (*Rhizocotonia bataticola*) are the major constraints in successful cultivation of the chickpea crop.

Highlight
- ❖ Chickpea is the important crop
- ❖ Suffers many seed and soil borne diseases
- ❖ Differen modules evaluated
- ❖ Module 5 was found very effective

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Wilt is the major disease occurs in all chickpea growing areas of the Indian sub-continent (Y.L. Nene, 1979), however, recently collar rot and dry root rot emerging as a major threat to chickpea production (Haware, *et al.,* 1986 and Y.L. Nene, 1996). These diseases have become more important in recent years due to drastic climate change which makes the crop more susceptible.

Intensive use of chemical for protection of crop is not only injurious to human health but also polluting the environment. Hence, scientists are steadily looking out for non perilous and eco-friendly measures for plant disease management. Integrated management strategies should include solution to maintain plant health. These strategies includes minimum use of chemicals for checking the pathogen population, encouragement of beneficial biological agents to reduce pathogen inoculums, modification of cultural practices and use of resistance varieties (Bender and Barhate, 1998)

So that, the present investigation was undertaken to minimize the diseases incidence and develop an economically, justified and sustainable system of crop protection that leads to maximum productivity of chickpea.

Material and methods

In order to evaluate the efficacy of integrated use of cultural, biological and chemical practices for the effective management of collar rot, wilt and dry root rot diseases in chickpea. The experiment was conducted during the post rainy season at farmers' field at Kakraua village in Datia district of Madhya Pradesh during *Rabi* 2012-13 and 2013-14. Chickpea wilt resistant variety JG-16 was taken with a seed rate of 75 kg/ha for the experiments. Chickpea seeds were treated with fungicide followed by T. viride before sowing. Mass multiplication on FYM was done according to Kousalya and Jeyaranjan (1988). The crop was sown in third week of October at 30 × 10 cm spacing. The basal application of NPK @ 20, 60 and 40 kg/ha was given in the form of Urea, SSP and MOP. The crop was maintained adopting standard agronomic practices recommended by Fujdar Singh and Diwakar (1995). The experiments were conducted in a randomized block design and replicated thrice. The field experiments comprised of 5 treatments module and control (untreated check). The treatment modules were:

Treatments	Modules
T_1	Crop rotation + deep summer ploughing + variety JG 16 + RDF
T_2	T_1 + Seed treatment with carbendazim (1.0g) + thiram (2.0 g) per kg seed
T_3	T_1 + PSB (Jawahar PSB, JNKVV, Jabalpur) and *Rhizobium* culture (Jawahar *Rhizobium*, JNKVV, Jabalpur) @ 5.0g each/kg seed as a seed treatment.
T_4	T_1 + Seed treatment with *Trichoderma viride* (Jawahar *Trichoderma*, JNKVV, Jabalpur) @ 5.0g/kg seed + soil application of *Trichoderma viride* @ 4.0 kg/ha with 200 kg farm yard manure (FYM) was applied as basal application at the time of field preparation.
T_5	T_2 + T_3 + T_4 *Trichoderma viride* @ 4.0 kg/ha
T_6	Untreated check where seed was sown with imbalanced fertilizer (9.0 kg N and 23 kg P_2O_5)

The per cent field emergence was calculated based on following formula:

No. of seed germination / No. of seed sown × 100.

The collar rot incidence recorded since field emergence of chickpea, wilt incidence and dry root rot incidence was recorded at 30 days intervals till harvest. In each plot, number of diseased plants counted and per cent disease incidence in each treatment was calculated by using the following formula:

Disease incidence (%) = No. of plants infected / Number of plants examined × 100

The benefit cost ratio was calculated on the basis of prevailing market prices of chickpea and other inputs. Benefit cost ratio was calculated as follows:

BCR= Gross return/Total cost

Result and discussion

In the present investigation cultural practices alone and their combination with chemical and *Trichoderma viride* were taken up to study their effect on *Fusarium oxysporium* f. sp. c*iceris*, *Sclerotium rolfsii* and *Rhizoctonia bataticola* wherein, an attempts were also made to see the impact on per cent mortality and also any stimulatory or inhibitory effect on the seed germination and growth parameter like healthy root nodules, pod formation, seed weight and also on yield with economic analysis. The pooled data of two seasons revealed that the entire module tested were found significantly superior over the untreated (control) against all three major diseases in terms of protection and production (table 1).

Disease incidence

The lowest per cent disease incidences of all three diseases were recorded in module 5 (table 1) which has integration of all the modules. M_1, M_2, M_3 and M_4 gave 27.83, 73.65 and 24.74 and 50.40 per cent management of collar rot disease over the unprotected field, respectively. However, their integrated effects resulted in 82.26 per cent management of disease thereby given 71.90, 23.04 and 73.06 and 59.12 per cent additional management of disease over M_1, M_2, M_3 and M_4, respectively against all the three diseases. (table 1).

All the modules reduced the incidence of dry root rot in chickpea at farmers' field. M_5 (64.76 per cent) and M_2 (60.84 per cent) were the most effective modules in reducing the establishment of *Rhizocotonia bataticola* followed by M_4 which was statistically at par with M_3. The lowest disease incidence reduction was found in M_1 (5.43 per cent).

The wilt incidence reduction by different modules ranged 37.85 per cent to 82.26 per cent as compare to control. The highest reduction in wilt incidence (82.26 per cent) was found in module 5 followed by module 4 (71.95 per cent) and lowest of 37.85 % reduction was in

Table 1: Effect of various modules on disease incidences in chick pea field (Pooled data of 2012-13 and 2013-14).

Treatments	Disease incidence (%)					
	Collar rot	Per cent reduction	Dry root rot	Per cent reduction	*Fusarium* wilt	Per cent reduction
Module 1: Crop rotation + Deep Summer ploughing + variety JG 16 + RDF	6.30 (14.54)	27.84	3.14 (10.12)	25.77	6.50 (14.77)	46.85
Module 2: Module 1 + Seed treatment with combination of *Carbendazim* + *Thiram* (1:2))+ seed treated with *Trichoderma viride* @ 5.0g/kg seed	2.30 (8.71)	73.65	1.30 (6.53)	69.27	5.17 (13.34)	57.73
Module 3: Module 1 + Culture treatment with *Rhizobium* and PSB)+ seed treated with *Trichoderma viride* @ 5.0g/kg seed	6.57 (14.85)	24.74	2.57 (9.21)	39.24	7.60 (16.00)	37.86
Module 4: Module 1 + Seed treatment with *Trichoderma* @ 5.0g/kg seed + soil application @ 4.00 kg/ha	4.33 (12.01)	50.40	2.17 (8.46)	48.70	3.43 (12.57)	71.95
Module 5: Module 1 + Module 2 + Module 3 + Module 4	1.77 (7.61)	79.73	1.17 (6.13)	72.34	2.17 (8.46)	82.26
Control	8.73 (17.19)	00	4.32 (11.87)	0.00	12.23 (20.46)	00
SE (±)	0.289		0.225		0.168	
CD at 5%	0.910		0.709		0.529	

Table 2: Crop performance in various modules (Pooled data of 2012-13 and 2013-14).

Treatments	Germi-nation (%)	No. of healthy Pod/plant	100 seed weight	Yield kg/ha	% yield increase
Module 1	84.4 (66.74)	58.233	21.41	17.5	20.69
Module 2	86.27 (68.25)	58.35	21.48	20.00	37.93
Module 3	85.27 (67.43)	61.20	21.52	20.1	38.62
Module 4	85.00 (67.29)	60.13	21.453	19.5	34.48
Module 5	88.13 (69.84)	62.00	21.55	22.20	53.10
Control	79.57 (63.13)	45.07	21.29	14.5	0.00
SE (±)	0.103	0.229	0.018	0.258	
CD at 5%	0.323	0.722	0.042	0.814	

module 3. *Trichoderma viride* was found most effective which is in accordant with report of Pandey and Upadhyay (1999) and De *et al.* (1996) found that coating of chickpea seed with Carbendazim was more effective in reducing wilt and increasing seed yield by 25.9 to 42.65 per cent. Due to synergistic effects of both the chemicals seed treatment with thiram (0.15%) + carbendazim (0.1%) were found most effective against *F. oxysporum* f. sp. *ciceris* (Gupta *et al.,* 1997).

Germination

Highest seed germination (88.13 %) was observed in Module 5 which has integration of all the treatments. Whereas, seed treatment with combination of carbendazim and thiram (module 2) were showed 86.27% seedling emergence. In Module 3, 85.27 %t seed germination was observed where seed treatment with Rhizobium, PSB and *Trichoderma spp*. The lowest germination per cent (79.57 %) was noted in untreated check. table 2

Grain weight

The highest 100 grain weight was recorded in module 5 (21.55 g) which was significantly at par with module 3 (21.52 g) followed by module 2 (21.48 g), module (21.45 g) and module 1 (21.41 g). The lowest seed weight was noted in control. table 2

Yield

Among the 5 treatments tested against collar rot (*Sclerotium rolfsii*), *Fusarium* wilt (*Fusarium oxysporum* f. sp. *ciceris*), and dry root rot (*Rhizocotonia bataticola*), the highest yield (22.20 q/ha) was recorded in module 5. The second highest yield (20.10 q/ha) was recorded in module 3 which include culture treatment with *Rhizobium* and PSB + seed treated with *Trichoderma viride* @ 5.0g/kg seed followed by module 2 (20.0 q/ha), module 4 (19.5 q/ha) and module 1 (17.5 q/ha). The lowest yield (14.5

Table 3: Economics of different modules (Pooled data of 2012-13 and 2013-14).

Treatments	Cost of Treat-ments (−)	Cost of culti-vation (−)	Gross return (−)	Net return (−)	Increase net return (−)	Cost benefit ratio
Module 1:	2400	17400	56000	38600	7200	3.22
Module 2:	3100	18100	64000	45900	14500	3.54
Module 3:	2900	17900	64320	46420	15020	3.59
Module 4	3700	18700	62400	43700	12300	3.34
Module 5:	4250	19250	71040	51790	20390	3.69
Control (No treatments)	—	15000	46400	31400	—	3.09

q/ha) was recorded in control. Therefore, integrated approach of all treatments was more effective in managing the disease incidence and increasing the growth parameters like root nodules, grain weight and yield. This may be due to longer and more effective protection provided by these treatments to the germinating seeds and also may be due to synergistic effect. A similar effect has been observed by enhancing plant growth by production of stimulatory factor was provided by Windham *et al.* 1986; Bharati *et al.* 2004; and S. C. Dube *et al.* 2010.

Return and benefit cost ratio

The module 5 provided the highest gross return (Rs. 71040 /ha) followed by module 3, module 2, module 4 and module 1. The lowest gross return (Rs. 46400 /ha) was computed from untreated check. Similarly, module 5 gave the maximum net return (− 51790 /ha) followed by module 3, module 2. Module 4 and module 1. The highest benefit cost ratio (3.69) was also obtained from module 5 followed by module 3. The remaining other modules gave higher net return than that of untreated control (table 3).

It can be concluded from the present study that chemical seed dressing along with mixture of bacteria and fungi may be beneficial in reducing the intensity of diseases and enhancing seed germination percentage as well as productivity of chickpea.

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