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ANALYZING VERTICAL IMPACT AND EXTENSION GAP OF INTEGRATED DISEASE MANAGEMENT MODULE AGAINST *FUSARIUM* WILT IN CHICKPEA THROUGH FIELD DEMONSTRATIONS IN MADHYA PRADESH

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Abstract

Study was carried out in Harda district falls under Central Narmada Valley agro climatic region of state Madhya Pradesh in central India. The district is situated 302 m higher from the sea level with geographic position between 210 53' & 220 36' Longitude and between 760 47'& 770 20' Latitude. The district feels maximum temperature up to 48^0C and minimum up to 6^0C and covers dominantly medium to heavy black soils and 1267.7 mm average annual rainfall. Chickpea is a very important pulse crop in district but due to improper adoption of improved disease management technology its productivity is far below the average productivity of the state. The 36 Front Line Demonstration (FLD) at farmers' field in the villages of Harda district during 2014-15 to 20116-17. Total 36 farmers were selected randomly from three blocks namely Harda, Timarani and Khirkiya in each year. The study was conducted to observe the vertical impact (yield enhancement) and extension gap in chickpea against the existing disease management practices by farmers. During 1st year (2014-15) the integrated disease management module against *fusarium* wilt disease in Chickpea performed well with an average yields of 14.60 q/ha over the farmers yield (12.20 q/ha) means an average 19.67 per cent yield was reaped from demonstrated plot. On the basis of 1st year result the demonstration was continued during 2015-16 and 2016-17. The three year average data reveals that grain yield of chickpea was increased by 2.40 q/ha (2014-15), 3.40 q/ha (2015-16) and 2.60 q/ha (2016-17) over the yield obtained by farmers' practice. The average yield of chickpea was increased over farmers practice 2.80 q/ha of worth Rs. 12320/ha (calculated as per MSP of chickpea for year 2017-18 Rs 4400/q) as additional return from demonstration fields over farmers' practice. This increase was with an average additional cost of Rs. 2400 per ha which is very less and even small and marginal farmers could also afford. An extension gap ranging from 2.40-3.40 kg per hectare was found between demonstration plots and farmers practices during the different years of trials.

Key words: Chickpea, Extension gap, Front line demonstration, Net return, yield.

Introduction

Chickpea is high value legume crop suitable for proteins supplement crop for human and animals both. It is widely use for making numerous dishes with multidimensional use in human diet in India and abroad. India is the largest producer of chickpea with about 63per cent of the total area under chickpea production lying in India. Chickpea is a highly nutritious grain legume crop. The country produces almost 70 lakh tones of chickpea. In India highest production has been received from Madhya Pradesh by 39 per cent followed by Maharashtra (14 per cent), Rajasthan (14 per cent), Andhra Pradesh (10 per cent), Uttar Pradesh (7 per cent), Karnataka (6 per cent) and 10 per cent other remaining states & Union Territories of India (Kumar, *et al.* 2011).

The pulses are the integral part of the cropping systems of the farmers all over the country because these crops fit in well in the crop rotation and crop mixtures followed by them. Chick pea contributes about 50 per cent of the total pulse production of India. It is used for human consumption as well as for feeding to animals (Yadav, 2009). Pulses being legumes fix atmospheric nitrogen into the soil thus, improve the soil fertility. They also play an important role in crop rotation, mixed and intercropping as they help to maintain the soil fertility along with checking the soil erosion as they have more leafy growth and close spacing. They also add good organic matter into the soil in the form of leaf mould.

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Besides these, they also supply additional fodder for cattle, which improve their health and milk production (Singh *et al.,* 2016).

The national and state (Madhya Pradesh) productivity of chickpea (*Cicer arietinum* L.), was 799 kg/ha and 711 kg/ha respectively during 2011-12 (Anonymous 2011). The Harda district of MP is falls under Central Narmada Valley agro climatic region of Madhya Pradesh which as lot of potential to get higher yield of chickpea. The present productivity of chickpea in Harda district during 2013-14 to 2015-16 was recorded 1196.75 kg/ha which is relatively less than their yield potential *i.e.* 2500 kg/ha. The reason of low productivity of chickpea in Harda district may be due to use of non improved varieties, higher seed rate and traditional method of sowing in the district imbalanced use of fertilizers, poor crop management and plant protection measures. Thus, there was urgent need to make aware the farming community about use of improved varieties' certified seed to increase the production and productivity of chickpea crops in the district. In this way the intrusion as front line demonstration was conducted by scientists of Agricultural Science Centre of Harda district to introduce and disseminate improved high yielding varieties of chickpea crop to increase the crop yield during 2013-14 to 2015-16. Thus, the present study was completed on yield performance analysis of Chickpea (*Cicer arietinum* L.) through front line demonstrations at farmer's fields in Madhya Pradesh.

This evident from Table No 1 that the chickpea crop is most important pulse and having highest contribution in total pulses production of India with 41.20 percent contribution during year 2016-17. Chickpea seems as backbone of pulses and needs more attention to maintain this production status in future to fulfill the pulse need of our country in holistic manner.

Table No-2 reflects the area, production & productivity of chickpea in Madhya Pradesh which is highest contribution among all pulse growing state of our country that is why strengthening of chickpea production may ascertain the major contribution in pulse production system in India. In India highest production has been received from Madhya Pradesh by 39 percent. Considering these important facts and needs of crop present study was completed with sole objective to assess the vertical impact and extension gap under chickpea production in harda district of Madhya Pradesh during 2017-18.

Materials and methods

The 36 Front Line Demonstrations (FLDs) on 15 ha area were conducted at farmers' field in the villages of Harda district during 2014-15-to 20116-17. Total 36 farmers were selected randomly from three blocks namely Harda, Timarani and Khirkiya in each year. The study was conducted to observe the vertical impact (yield enhancement) and extension gap in chickpea against the existing disease management practices by farmers. The farming situation of demonstration fields was medium to heavy black soil, irrigated, low in nitrogen and potash nutrients with Soybean–Chickpea crop sequence. The demonstrations were consist of improved high yielding varieties of chickpea as JG-130, JG-63 and JG-14, recommended dose of seed 75-80 kg/ha, line sowing with seed drill. The integrated disease management module

Table 1: Production Statistics of Major Pulse Crops in India

Pulses/Year	2014-15 Unit: (000 Tones)	Share in Total Production	2015-16 Unit: (000 Tones)	Share in Total Production	2016-17 Unit: (000 Tones)	Share in Total Production
Chickpea	**7330**	**42.74 %**	**7060**	**43.18 %**	**9120**	**41.20 %**
Pigeon Pea	2810	16.38 %	2560	15.65 %	4230	19.11 %
Urd	1960	11.42 %	1950	11.92 %	2890	13.05 %
Moong	1500	08.74 %	1590	09.72 %	2130	09.62 %
Other Pulses	3550	26.69 %	3190	19.52 %	3770	17.03 %
Total Pulses	**17150**		**16350**		**22140**	

Source: Directorate of Economics and Statistics (DES): Based on 2nd Advance Estimates for 2016-17

Table 2: Area, Production & Productivity of Chickpea in Madhya Pradesh

Production Statistics of Chickpea in Madhya Pradesh			
Year	**Area Unit:(000 ha)**	**Production Unit: (000 tones)**	**Productivity Unit: (Kg/ha)**
2011-12	2629	2845	1083
2012-13	2722	3321	1221
2013-14	3482	2555	809
2014-15	2933	4509	1537
2015-16	2621	3294	1256

Source: http://mpkrishi.mp.gov.in/Compendium/AreaProduction_DifferentCrop.aspx

as soil application *Trichoderma virdae* culture @ 10 kg/ ha before sowing + seed treatment done with fungicide @ 4:1 ratio *i.e. Trichoderma virdae* 4g + Vitavax powder 1g/kg seed followed by one deep summer ploughing (9" deep) and soil test value based fertilizer application. The regular visits by respective scientists to FLDs plots were also made to ensure timely application of critical inputs and crop management guidance. The extension activities like field days and group discussion and sangosthies were organized at the demonstration sites as to motivate and make awareness about demonstrated technology around the different demo locations among farmers of the locality. The feedback from the farmers was also collected for further improvement. The trials were regularly monitored and data of crop yield from each demonstration and farmer's fields were collected after harvesting the crop. Different parameters as suggested by Dayanand *et* al. (2012) were also used for calculating gap analysis. In order to estimate the technology gap, extension gap and technology index the following formula was used as per described by Samui *et al*. 2000.

Extension Gap = Demonstration yield-Farmer's yield

Additional cost = (Cost occurred in demo plot) - (Cost of control plot or farmers field).

Additional Net Return = (Net return received from demo plot) - (Net return received from control plot).

Result and discussion

The results of all FLDs plots over different three year periods are given in table 3. The performance of demonstration plot was found better fetched good yield in comparison to control plot or farmers field in different years. The grain yield of chickpea was increased by 2.40 q/ha (214-15), 3.40 q/ ha (2015-16) and 2.60 q/ha (2016-17) over the yield obtained under control plot or farmers' practice clearly being mentioned (table 3). These results clearly reveals that due to knowledge and adoption of the integrated disease management module against *Fusariun* wilt disease of chickpea as soil application *Trichoderma virdae* culture @ 10 kg/ha before sowing +seed treatment done with fungicide @ 4:1 ratio *i.e. Trichoderma virdae* 4g + Vitavax powder 1g/kg seed followed by one deep summer ploughing (9" deep) and soil test value based fertilizer application an appropriate technology could enhance the yield of by 19.67 percent (2014-15), 17 per cent (2015-16) and 11.87 per cent during year 2016-17 respectively over the yield obtained under farmers' practice. The present results are in line with the findings of Singh *et* al. (2013) and Singh *et al.* 2016.

Economic analysis: Economic returns were also observed with function of grain yield and farmers fetched price in mandi which varied year to year as mentioned at the bottom of table-3. The gross return of demo plots were observed more than farmers field returns as Rs 9120/ha (2014-15), Rs 13600/ha (2015-16) and Rs 32300/ ha during (2016-17) respectively.

The average gross return of demo plot which was more than farmers field or control plot during three year was observed Rs 12340/ha. This financial increase was with an extra expenditure or additional cost of Rs. 2720/ ha (2014-15), Rs 1850/ ha (2015-16) and Rs 2600/ha in year 2016-17 in demo plots yearly and an average extra expenditure for three years was Rs 2400/ha given in table-4 which is very less and even small and marginal farmers can also afford it for adoption of this module in chickpea.

The benefit-cost ratio was observed higher under demonstration plots than the farmers' practice during all three years (table 3). The average B: C ratio of chickpea

Table 3: The comparative economic analysis of chick pea production on farmers filed and demonstration field

Economic parameters	Research Parameters							
	Farmers practice (Control T_1)				Improved practice (T_2) (The Integrated Disease Management Module against *fusarium* wilt in Chickpea)			
	Year 2014-15	Year 2015-16	Year 2016-17	Average value	Year 2014-15	Year 2015-16	Year 2016-17	Average value
Cost of cultivation/ha	16000	16500	25450	**19316.67**	18720	18350	28050	**21706.67**
Production (q) /ha	12.20	20.00	21.90	**18.03**	14.60	23.40	24.50	**20.83**
Gross return (Rs/ha)	46360	80000	120450	**82270**	55480	93600	134750	**94610**
Net return (Rs/ha)	30363	63500	94960	**62941**	36760	75250	106700	**72903.3**
B:C Ratio	2.89	4.84	4.73	**4.15**	2.96	5.10	4.80	**4.29**

1. Farmers fetched Price for Year 2014-15 (Rs 3800/q) 2. Farmers fetched Price for Year 2015-16 (Rs 4000/q)
3.Farmers fetched Price for Year 2016-17 (Rs 5500/q)

Table 4: The economics of additional cost and additional return occurred in demonstration plots under chick pea production.

Economic parameters	Research Parameters			
	Improved practice (T_2) (The Integrated Disease Management Module against *fusarium* wilt in Chickpea)			
	Year 2014-15	Year 2015-16	Year 2016-17	Average value
Additional Cost (Rs/ha)	2720	1850	2600	**2400**
Additional Net Return (Rs/ha)	6397	11750	11740	**9962.33**

production was found under demo plots 4.29 which are higher than to farmers practice or control plot *i.e.* 4.15 mentioned in table-3. The results are in conformity with the findings of Verma *et al.* (2014) and Singh *et al.* 2016.

The farmer's sangosthies, trainings, field days and regular monitoring of the fields by the concern scientists for giving scientific advisories found useful to change the attitude, skill and knowledge of farmers towards the Integrated Disease Management Module against *fusarium* wilt in chickpea cultivation.

The highest net return (Rs. 11750) was observed during the year 2015-16 than the other years. This might be due to less disease infestation and good weather conditions. The average additional return was received Rs 9962.33/ha which shows the effectiveness and integrated disease management module against *Fusarium* wilt disease in chickpea.

Table 5: Economics of extension gap analysis of chickpea production during 2014-15 to 2016-17

Years	Crop	Area (ha)	Yield q/ha (FLD Plot)	Yield q/ha (Farmers Plot)	Extension Gap (q/ha)	Yield Increase (%) in FLD Plot
2014-15	Chickpea	5	14.60	12.20	2.40 (III)	19.67
2015-16	Chickpea	5	23.40	20.00	3.40 (I)	17.00
2016-17	Chickpea	5	24.50	21.90	2.60 (II)	11.87
Total/Average		**15**	**20.83**	**18.03**	**2.8**	**16.18**

*The value shown in parenthesis refers to respective ranks

Extension gap analysis: The maximum extension gap was recorded in chickpea in year 2015-16 followed by year 2016-17 and 2014-15 shown in table-5 with respective ranks. This result again reveals that if we give more emphasis on technical extension services that may enhance the productivity of chickpea varieties in black soil condition of Harda district and an Average extension gap was observed 2.80 q/ha, which emphasized the extension need to make farmers aware and educate the farmers about the Integrated Disease Management Module against *fusarium* wilt in Chickpea in *Rabi* season through various extension activities like FLDs, trainings, sangosthies, field visits, diagnostic visits, group discussion for adoption of improved chickpea cultivation technologies to minimize the extension gap which resulting to improve productivity of chickpea pulse crop. The research finding of Singh *et* al. 2017 is also support to these findings and explanation referred.

Conclusion

The integrated disease management module against *fusarium* wilt disease in Chickpea performed well with an average yields of 14.60 q/ha over the farmers yield (12.20 q/ha) means an average 19.67 per cent yield was increased in demonstrated plot. The three year average grain yield of chickpea was increased by 2.40 q/ha (2014-15), 3.40 q/ha (2015-16) and 2.60 q/ha (2016-17) over the yield obtained by farmers' practice. The overall average yield (2014-15- to 2016-17) of chickpea was increased over farmers practice 2.80 q/ha of worth Rs. 12320/ha shows the profitable vertical impact as additional return from demonstration fields over farmers' practice. This additional return was received by an average additional cost of Rs. 2400 per ha, which is very less and even small and marginal farmers can also afford. The front line demonstrations at farmers' field considered as primary source of information about the improved practices of chickpea cultivation. An extension gap ranging from 2.40-3.40 kg per hectare was found between demonstration plots and farmers practices during the different years of trials. This gap may be reduced by laying demonstration covering to all farmer categories including progressive farmers for speedy and wider dissemination of the recommended practices among farming community and helps in improving the productivity and profitability of the farmers. The extension activities like field days and group discussion and sangosthies, diagnostic visits, trainings would be organized at the demonstration sites to motivate and make aware them about the integrated disease management module against *fusarium* wilt disease in Chickpea around the different demo locations of the locality for better improvement in productivity as vertical impact and minimization of extension gaps between scientific recommendation and farmers practices.

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