

Original Research Article

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## Impact of Front Line Demonstrations on Yield Enhancement and Disease Reduction in Kharif Onion through *Trichoderma* in Kannauj District of Uttar Pradesh, India

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### ABSTRACT

Front line demonstration is an important tool for transfer of technology to end users that directly impact on adoption and area expansion of the technology. Kharif Onion is grown in the district for higher income but the productivity is low due to lacking in knowledge of cultivation technology, lacking of high yielding variety and no management of soil borne disease. For increasing the productivity of the kharif onion and adoption of improved technologies, Front line demonstrations on yield enhancement by managing the soil borne diseases through enriching the soil with *Trichoderma* with variety N-53 were conducted at 120 farmers' fields on 18 ha area. The demonstrations were carried out at Kannauj district of Uttar Pradesh under Central plain agro-climatic zone during kharif season of 2011-12 to 2016-17 for six years. The improved technologies gave higher yields and recorded a mean yield of 176.18 q/ha which was 15.92 percent higher than that obtained with farmer's practices yields 150.68 q/ha. The improved technologies resulted higher mean net income of Rs. 140145/ha with a cost benefit cost ratio of 3.48 as compared to local check (Rs. 112329/ha, 2.95).

#### Keywords

Kharif onion,  
*Trichoderma*, FLD,  
Yield

#### Article Info

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### Introduction

Onion (*Allium cepa* L.) also called as “queen of kitchen” is one of most important commercial vegetable crop grown in India. It belongs to the family Alliaceae is valued for its bulbs having characteristics odour, flavour

and pungency. The genus *Allium* is very large comprising of more than 500 spp. usually perennial bulbous plants. Out of these, *Allium cepa* (onion) is the major cultivated species grown all over the world. Green leaves of onion and bulbs are used for fresh consumption as greens in salad (Lannoy,

2001) and also cooked as raw material in many ways in curries, fried, boiled, baked and used in making soups, pickles etc. (Straub and Emmet, 1992). The pungency in onion is due to volatile compound allyl propyl disulphide. The nutritive values of onions vary among varieties and generally it contains moisture, carbohydrates, protein, fibre, and energy. Apart from these, also contains minerals like calcium, potassium, phosphorus, sodium, iron and vitamins like vitamin A, vitamin C, niacin, thiamin and riboflavin. Onion is one of the most widely used vegetable due to its flavoring and seasoning the food, both at mature and immature bulb stage.

In the world, India ranks first in total area and is grown in 1.32 million ha and ranks second after China with total production of 22.07 million tonnes, contributing for 12.3 per cent of total production. The average productivity is 167.81 q/ ha (Anonymous 2018), which is low in comparison to other countries. India exported 2182826.23 MT of fresh onion to the world for the worth of Rs. 3467.06 crores during the year 2018-19 (Anonymous 2019).

In India it is largely cultivated in Maharashtra, Karnataka, Madhya Pradesh, Rajasthan, Bihar, Gujarat, Andhra Pradesh, West Bengal, Haryana and Uttar Pradesh. Maharashtra is the leading producer, accounts for 38.15 per cent of area and 29.55 per cent of total production. Karnataka accounts for 14.59 per cent of area and 11.63 per cent of production, while Madhya Pradesh accounts for 11.51 per cent of area but gave about 16.97 per cent of production. In Uttar Pradesh the crop is grown on 26.85 thousand hectare area with production of 439.64 thousand tonnes. (Anonymous, 2018). The average productivity in UP is 163.7 q/ ha, which is low in comparison to national productivity. In district kannauj onion is grown on about 1471 ha area with 21302 tonnes production. The productivity of district is 144.8 q/ha which is

low as compared to average national productivity due to poor agronomic practices, lack of sustainable supply of improved seed material, high cost of seed, disease and pest problem and inadequate storage (Singh and Singh, 2016). The most important constraints of kharif onion production in the study area are the diseases like purple blotch caused by *Alternaria porri*, white rot caused *Sclerotium rolfsii* on stem base and leaf base (wet) rot caused by *Sclerotinia sclerotiorum*, commonly prevailing in almost all onion growing pockets of the world, which causes heavy loss in onions under field conditions. Biological control of plant pathogens through antagonistic microorganisms is a potential, ecofriendly and a sustainable approach for managing the diseases and enhancement of the yield. In this context, the present investigations were carried out with the objectives, to increase the productivity of onion crop, to study the feasibility of onion var. N- 53 for kharif season, to study effect of *Trichoderma* on disease incidence, to study the technology gap, extension gap and technology index and work out the economics of production.

## **Materials and Methods**

The frontline demonstrations on integrated disease Management were conducted with the farmer participation in Kharif onion at adopted villages of KVK Kannauj during kharif season of 2011-12 to 2016-17 for six years. Each demonstration was conducted on of 0.2 ha area while farmer plot adjacent to the demonstrated plot served as control of 0.2 ha were also maintained for the comparison. The demonstrations were conducted on 20 farmer's field at 4.0 ha area during every year. The technologies used for study is good agriculture practices, improved variety of onion N-53 for kharif season and *Trichoderma viride* as soil applicant and carbendazim as seed and bulb treatments. Seeds of onion

variety N-53 @ 18-20 kg were sown in the nursery in the first week of March. After 60 days, bulbs were up rooted after irrigation before 4-5 days. It was kept in shade for planting in kharif. After the peak period of rains, the fields were started to prepare. Soil is enriched with *Trichoderma viride*. @ 2.5 kg /ha after 15 days composing in the 200 kg well rotted FYM and mixed in soil at the time of field preparation and onion sets were also treated with *Trichoderma viride* @ 10g/kg seed. Onion sets were sown at a distance of 20 x 15 cm. Inter culture operation were adopted at 20-25 and 40-45 days after planting. Irrigations were given according to the need. Crop was fertilized @ 120:60:80 kg NPK per ha. A field day was conducted before a month of crop harvesting by KVK scientists at demonstration farmer's fields. After attaining the maturity and bulbs has achieved proper size, the crop was then harvested.

The data collected from the farmers regarding production cost, gross and net returns, B: C ratio from both demonstrated plots and check plots were compiled and calculated to work out the economic feasibility of the demonstrated technology against the farmer's practice. The data on disease intensity were also recorded from both demonstrated plots and check plots to calculate reduction in diseases by using the formulae given below.

Per cent disease reduction

$$\frac{\text{Disease intensity in Check} - \text{Disease intensity in demo}}{\text{Disease intensity in check}} \times 100$$

The yield of demonstrated plots was compared with check plots yield and potential yield of the crop variety to estimate the yield gaps which are further categorized to assess the technology and extension gap. The Technology gap, Extension gap and Technology index were calculated by using the following formulae as suggested by

Eswarprasad *et al.*, (1993) and Samui *et al.*, (2000).

$$\text{Technology Gap} = \text{Potential yield} - \text{Demonstrated yield}$$

$$\text{Extension Gap} = \text{Demonstrated yield} - \text{Farmer's yield (Local check)}$$

$$\text{Technology Index} = \frac{\text{Potential yield} - \text{Demonstrated yield}}{\text{Potential yield}} \times 100$$

### Results and Discussion

The data presented in table 1 revealed that demonstration yield of kharif onion var. N-53 and plots enriched with *Trichoderma* were better in comparison to local check. The kharif onion var. N-53 gave an average yield of 176.18 q/ha as compared to check yield (150.68 q/ha) which was 15.90 % was higher over check (farmer's practice).

The yield improvement was noticed due to effect of good climate and reduction in disease incidence. It is evident from the table 2 that average reduction in disease incidence of purple blotch caused by *Alternaria porri* was (30.99 %), white rot caused *Sclerotium rolfsii* on stem base (51.72 %) and leaf base (wet) rot caused by *Sclerotinia sclerotiorum* (49.08 %).

The results are in accordance with the findings obtained by Ojha and Singh, (2013), Kulkarni and Rathod (2018), Gupta *et al.*, (2015), Gaharwar *et al.*, (2017) and Hiremath and Nagraju (2010) for onion crops. Similar yield enhancement in different crops through front line demonstrations were reported by Balai *et al.*, (2013) in vegetables and Arora (2012) in potato.

### **Technology gap**

The yield of FLDs and potential yield of variety was compared to estimate the Technology gap, Extension gap and technology index. The technology gap which is the difference between potential yield and yield of demonstration plots, was about 73.83 q./ha on an average. The yield gap between demonstrated technology and potential yield needs to be minimized through FLDs. The variation in technology gap during the demonstration years may be due to dissimilarity in the soil fertility status, varied climatic condition of the area, disease intensity and management practices. Hence, more location specific recommendations and precise use of technology in the fields are necessary to bridge the technology gap as supported by Singh *et al.*, (2011).

### **Extension gap**

An average extension gap (25.49 q/ha) between demonstrated technology and Farmer's yield was mostly due to gap of awareness about improved variety, its seed availability, disease management and use of improved production technology.

The maximum extension gap (33.44 q/ha) was noticed in 2013-14 while it was lowest in the year (22.26 q/ha) in 2011-12. The results are in conformity with the findings of Teggelli *et al.*, (2015), who stated the progressive use of improved crop production technologies with high yielding variety will subsequently change this alarming trend of galloping extension gap. Hence to minimize Extension gap needs to educate the farmers more about good agricultural practices (GAP).

The technology index showed the feasibility of evolved technology at the farmers' field. The lower was the value of technology index, more was the feasibility of the technology demonstrated (Sagar and Chandra, 2004). The

technology index varied from 22.79 per cent to 35.88 per cent. The highest technology Index 35.88 % was noticed in the year 2012-13. However, in the present study no gradual reduction of technology index in successive years was observed which might be due to variation in yield in different years. The average technology index value 29.33 % might be due to precise use of demonstrated technologies in the field and suitable climatic conditions during demonstration period. As technology index denotes the gap between technology generated at research farm and farmer's field, lower the technology index will be more feasible (Jeengar *et al.*, 2006 and Hiremath and Nagraju, 2010).

### **Economic analysis**

The data obtained regarding the economic analysis for the demonstrated technology was presented in table 3 showed economic analysis of data since 2011-12 to 2016-17. The data revealed that, monetary returns were directly influenced by the market price of onion bulbs and cost of production during the successive years of demonstrations. During all the years of demonstrations, the increased gross monetary return, net monetary returns and Benefit: Cost ratio was obtained in the demonstrated technology over local check of farmers. The maximum net return (Rs.233280/ha) was recorded in 2014-15 with maximum BC ratio (5.1) whether, minimum BC ratio (2.30) was recorded in 2015-16 under demonstrated technology. An average net returns of Rs 140145/ha and B:C ratio 3.48 was obtained in the demonstrated technology over farmers check with Net monetary return Rs 112329 and B:C ratio 2.95. The higher returns were due to higher bulbs yields obtained in the demonstrated technology over farmer's practice. The results are in confirmation with the findings of Hiremath and Nagraju (2010) and Singh and Singh (2018).

**Table.1** Productivity, technology gap, extension gap and technology index of kharif onion crop under demonstrations

Year	No. of farmers	Area	Potential yield (q/ha)	Demon. Yield (q/ha)	Check Yield (q/ha)	% increase over control	Technology Gap (q/ha)	Extension Gap (q/ha)	Technology Index (%)
2011-12	20	4.0	250	164.63	142.37	15.6	85.37	22.26	34.15
2012-13	20	4.0	250	160.30	137.41	16.7	89.7	22.89	35.88
2013-14	20	4.0	250	176.70	143.26	18.9	73.3	33.44	29.32
2014-15	20	4.0	250	193.02	166.10	16.2	56.98	26.92	22.79
2015-16	20	4.0	250	192.70	168.26	14.5	57.3	24.44	22.92
2016-17	20	4.0	250	169.7	146.7	13.5	80.3	23.00	32.12
				<b>176.18</b>	<b>150.68</b>	<b>15.90</b>	<b>73.83</b>	<b>25.49</b>	<b>29.53</b>

**Table.2** Average disease intensity of different diseases under FLDs

Year	Purple Blotch			White rot			Wet rot		
	Demon.	Check	Disease reduction (%)	Demon.	Check	Disease reduction (%)	Demon.	Check	Disease reduction (%)
2011-12	16.28	19.26	15.47	8.38	11.23	25.38	7.26	10.28	29.38
2012-13	15.76	19.85	20.60	6.55	11.85	44.73	6.52	10.52	38.02
2013-14	15.31	20.15	24.02	6.59	13.52	51.26	6.12	12.58	51.35
2014-15	14.5	21.58	32.81	5.79	12.69	54.37	5.98	11.89	49.71
2015-16	13.05	23.25	43.87	4.65	13.22	64.83	5.23	13.28	60.62
2016-17	11.85	23.32	49.19	4.53	14.98	69.76	4.84	13.98	65.38
Average	<b>14.46</b>	<b>21.24</b>	<b>30.99</b>	<b>6.08</b>	<b>12.92</b>	<b>51.72</b>	<b>5.99</b>	<b>12.09</b>	<b>49.08</b>

**Table.3** Economics of kharif onion production under FLDs

Year	Demonstrations				Farmer's Practice			
	Gross Cost (Rs/ha)	Gross Return (Rs/ha)	Net Return (Rs/ha)	BCR	Gross Cost (Rs/ha)	Gross Return (Rs/ha)	Net Return (Rs/ha)	BCR
2011-12	58314	131704	73390	2.30	56814	113896	57082	2.10
2012-13	58314	160300	101986	2.70	56814	137410	80596	2.40
2013-14	51268	176700	125432	3.40	49268	143260	93992	2.60
2014-15	56250	289530	233280	5.10	55650	249150	193500	4.50
2015-16	57150	289050	231900	5.06	56400	252390	195990	4.47
2016-17	95368	169700	74882	2.35	93868	146700	52812	1.60
Average	<b>62777</b>	<b>202831</b>	<b>140145</b>	<b>3.48</b>	<b>61469</b>	<b>173801</b>	<b>112329</b>	<b>2.95</b>

The increased crop yield and less disease intensity in demonstrated plots showed the feasibility of demonstrated technology and suitability of onion var. N-53 and soil treatment with *Trichoderma*.

The increased in yield may be due to suitable high yielding demonstrated kharif onion variety N-53 with integrated disease and nutrient management technology contributed for increased crop yield over check. The findings are supported by Bharathi *et al.*, (2015).

The average productivity (176.18 q/ha) obtained under FLD on production technology and disease management for kharif onion crop var. N-53 during the six successive years from 2011-12 to 2016-17, over farmer's practices (150.68 q/ha) created greater awareness and motivated the other farmers to adopt appropriate production technology of kharif onion in Kannauj district.

The demonstrated technology increased onion bulbs yield with higher monetary net returns and B:C ratio. The technology gap and technology index values also reduced in demonstrated technology. These technologies were found to be increase in the yield and also found an average 25.49 q/ha of extension gap between demonstrated technology and local practice, thus, it could be said that FLDs were the most effective tools for transfer of technology at grass root level to bridge the extension gap and enhance the yield.

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