

RESEARCH ARTICLE

Field evaluation of *Trichoderma Viride* for wilt management in chickpea crop

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SUMMARY

Chickpea is one of the important pulse crops of the Faizabad district among pulses which is affected by the *Fusarium wilt* (*Fusarium udum*) disease causing severe yield loss. An eco-friendly integrated disease management technology, particularly use of *Trichoderma* as seed and soil treatment with rotted FYM have been evaluated on large area of farmers' field during *Rabi* 2012-13 and 2013-14 in the Madhupur, Anjana and Magalsi villages of Faizabad district (Uttar Pradesh) through on farm trial. Grain yield of chick pea and incidence of wilt were significantly less under *Trichoderma* treatment and was much superior over the control. Soil and seed treatments with *Trichoderma* resulted in lowering the wilt disease and considerably increased grain yield of chick pea over farmers' practice. The use of *Trichoderma* for the management of wilt was very much appreciated by the farmers. The success of *Trichoderma* in the target villages outlines the need for its popularization in larger areas.

Key Words : On farm trial, Chickpea, *Trichoderma*

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Chickpea (*Cicer arietinum* Linn.) is an important *Rabi* pulse crop of tropics and sub-tropics. It is currently grown on about 11.5 million ha, with 96 per cent of the area in developing countries. Chick pea production has increased during the past 30 years from 6.5 million tons (1978-1980 average) to 9.6 million tons (2013-14) because of increase in grain yields from 630 to 850 kg/ha during this period. Among the pulses, chick

pea occupies 30 per cent of area with 38 per cent of annual production in India. Most significant has been the major shift in chick pea area from northern India (cooler, long-season environments) to southern India (warmer, short-season environments) during the past four decades. Chick pea is the pre dominant crop among pulses in Uttar Pradesh, occupying 5.05 lakh ha area with 378.0 thousand tonnes production chickpea area and production, respectively. In Uttar Pradesh, the crop is cultivated on marginal lands grown traditional varieties. Diseases are major biological constraints to production. Of these *Fusarium wilt* is widespread and causes heavy damage. The total loss due to wilt disease is approximately 97,000 ton per year in India (Mahesh *et al.*, 2010). Though the wilt of chick pea occurs commonly throughout the district,

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it causes severe damage in the parts of Masodha, Sohawal, Pura Bazar and Maya blocks where it grew several years. This is perhaps the most destructive fungal disease of this valuable pulse crops in the district. Continuous cropping of chick pea in the same field results in as much as 60 per cent of plant mortality due to the disease. Almost about 15-20 per cent damage to standing crop is a common feature every year in the district. However, most of the attacked plants succumb completely to wilt disease and their recovery is rare. Though the chick pea plants are susceptible to the attack of wilt disease throughout their development, the main symptoms of disease is the wilting of seedlings and adult plants if they have suffered from water shortage even though there may be plenty of moisture in the field. The wilting is characterize by gradual, sometimes sudden yellowing, withering and drying of leaves followed by drying of entire plant or some of its branches.

As the management of this soil borne disease through conventional technology such as growing resistant varieties, fungicidal seed treatment, spraying of fungicides in standing crop cannot provide a remedy for disease control. In the present scenario of non-availability of host resistance, there is need for developing cost effective and eco-friendly integrated management strategies. Use of biocontrol agent is advantageous, as they are often effective against a wide range of soil borne pathogens. Because of non judicious use of synthetic fungicides since last four decades led to several problems to human and animal health besides environmental problems, an eco-friendly location specific bioagent *Trichoderma viride* for the management of wilt in chickpea crop has been assessed and validated through on farm trials in a participatory mode with farmers of the district.

MATERIAL AND METHODS

The bioagent technology *Trichoderma viride* have validated in *Rabi* 2012-13 and 2013-14 in the Madhupur, Anjana and Magalsi villages of district Faizabad (Uttar Pradesh). On farm trials were conducted on the fields of five farmers at each village during both years (0.4 hectare area of each farmer under OFT). In case of local check plots existing practices being used by farmers were followed. In trial plots, a few critical inputs in the form of quality seeds, fertilizers, bio-agents like *Trichoderma* etc. were provided and non-monetary inputs like timely sowing in lines and timely weeding,

judicial use of irrigation, thinning etc. were also performed whereas, traditional practices were maintained in case of local checks. The participatory farmers were facilitated by KVK scientists in performing field operations like sowing, spraying, weeding, harvesting etc. during the course of training and visits. The eco-friendly treatments included in the OFT viz., seed treatment with *Trichoderma* @ 10g/kg seed (T_1), soil treatment with 5.0 kg *Trichoderma* + 125 kg FYM per hectare (T_2) and combination of $T_1 + T_2$. The data output were collected from trial plots as well as control plot and finally the disease incidence of wilt, chick pea yield (q/ha), economic indicators and benefit cost as well as incremental B:C ratio were calculated.

RESULTS AND DISCUSSION

The mean of the results of fifteen on farm trials conducted in each year during *Rabi* 2012-13 and 2013-14 in the Madhupur, Anjana and Magalsi villages of district Faizabad (Uttar Pradesh) revealed that the disease pressure was upto the level of 28.6 per cent during the crop growth stages (Table 1). Although the incidence of Fusarium wilt was confined in the range of 6.8 to 28.6 per cent but the wilt disease was reduced by the use of seed and soil treatment with *Trichoderma viride*. Incidence of wilt disease was lowest (6.8%) in the treatment where seed and soil treatment with *Trichoderma* was tested (Table 1). Yield levels were also best in this treatment with an increase of 44.70 per cent over farmers' practice. During January to February the relative humidity remained almost 85 to 90 per cent and temperature began to rise which might be the reason of good congenial conditions for Fusarium wilt disease development on farmer's fields. In few fields where irrigation was coincided with winter rains there was more than 50 per cent incidence of Fusarium wilt disease observed. However, on an average various farmers' field under studied, 28.6 per cent incidence of wilt was recorded in control fields whereas, in treated plots the disease incidence was 17.1, 10.4 and 6.8 per cent with seed treatment with *Trichoderma* @ 10 g/kg seed, soil treatment with *Trichoderma* @ 5.0 kg + 125 kg FYM and combination of both soil and seed treatment, respectively in the selected villages of Madhupur, Anjana and Magalsi of the district. The application of *Trichoderma* as a seed treatment and soil application for managing Fusarium wilt of pigeonpea was also reported by Mandhare and Suryawanshi (2005).

Table 1 : Mean results of fifteen OFT's on assessment of *Trichoderma* for the management of wilt in chickpea during Rabi 2012-13 to 2013-14

| Treatments | No. of trials | Incidence of wilt (%) | Yield (q/ha) | % increase in yield over farmer's practice |
|--|---------------|-----------------------|--------------|--|
| Farmer practice (No. soil treatment) | 15 | 28.6 | 7.30 | - |
| Seed treatment with <i>Trichoderma</i> @ 10 g/kg seed (T ₁) | 15 | 17.1 | 9.40 | 22.34 |
| Application of <i>Trichoderma</i> @ 5 kg + 125 kg FYM/ha (T ₂) | 15 | 10.4 | 11.90 | 38.66 |
| T ₁ + T ₂ | 15 | 6.8 | 13.20 | 44.70 |

Table 2 : Economics of various treatments under OFT for management of wilt in chickpea

| Treatments | No. of farmers | Economics of trial (Rs./ha) | | | |
|--|----------------|-----------------------------|--------------|------------|-----------|
| | | Gross cost | Gross return | Net return | BCR (R/C) |
| Farmer practice (No. soil treatment) | 15 | 15150 | 21900 | 6750 | 1.45 |
| Seed treatment with <i>Trichoderma</i> @ 10 g/kg seed (T ₁) | 15 | 16250 | 28200 | 11950 | 1.74 |
| Application of <i>Trichoderma</i> @ 5 kg + 125 kg FYM/ha (T ₂) | 15 | 17100 | 35700 | 18600 | 2.09 |
| T ₁ + T ₂ | 15 | 18200 | 39600 | 21400 | 2.18 |

It was clearly observed that the over population, heavy soils and prolonged fungi complex in chick pea fields are the prime factors responsible for the increased incidence of wilt. Harman *et al.* (2004) and Karimi *et al.* (2012) also reported various cultural management factors which affected the wilt infection and its spread. Seed yield of chickpea and management of wilt diseases under *Trichoderma* treatment was much superior over the control. Seed treatment, soil treatment and combination of both with *Trichoderma* resulted in lowering the wilt disease and considerably increased grain yield of chickpea upto the tune of 22.34, 38.66 and 44.70 per cent, respectively over control (farmers' practice). Hence, use of *Trichoderma* was very much appreciated by the farmers. Verma and Rai (2008) also reported that seed treatment with 4g *Trichoderma viride* formulation + 3.0 g thiram per kg seed and application of 2.0 kg *T. viride* formulation with 125 kg farm yard manure/ha have also been reported to control the disease. Soil amendment with *Trichoderma harzianum* at all pathogen levels has been reported to give a disease control of 22 - 61.5 per cent (Prasad *et al.*, 2002).

Different variables like seed, fertilizers, labourers and pesticides were considered as critical inputs for the OFT as well as farmers practice. The inputs and outputs prices of commodities prevailed during the study of trials were taken for calculating gross return, cost of cultivation, net return and benefit-cost ratio (Table 2). Economic returns as a function of grain yield and MSP sale price varied during different years. Maximum returns (Rs. 39,600/ha) was obtained due to better management of wilt disease and higher grain yield. The higher additional

returns and effective gain obtained under trial plots could be due to good management of wilt pathogen, nonmonetary factors, timely operations of crop cultivation and scientific monitoring. The highest benefit: cost ratio (BCR) was 2.18 was mainly due to better crop growth and higher yields.

Adoption of bioagent empowered the farmers for decision making for the correct application of pesticides (prior the programme, farmers were applying the pesticides indiscriminately). Now they are able to distinguish between harmful and beneficial pathogens. They understand the role of seed and soil treatment and crop management practices (like judicious use of fertilizers, application of irrigation at right time, thinning operation). The success of OFT in the target village outlines the need for its popularization in larger areas.

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