Technology interventions through cluster front line demonstration for enhancing yield of lentil under biotic stress and nutrient deficient soil

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Abstract
A package of technology interventions through frontline demonstration was conducted in rabi season of two consecutive years 2017-18 and 2018-19 for enhancing the yield of lentil by managing the infestation of fusarium wilt, insect attack especially aphid and poor soil nutrition at farmer’s field in following manner: Soil amendment with Trichoderma spp. (@ 5 kg/ha) and PSB (@ 5 kg/ha) incorporated in vermicompost 1 ton/ha + Seed treatment with Carbendazim @ 2 g/kg seed and Rhizobium spp. @10 g/kg seed +Spray of Imidachloprid (17.8 SL) @250 ml ai/ha. It resulted in reduction in wilt incidence (77.27%, 71.80%) and aphid population (62.5%, 52.63%) demonstration plot in comparison to farmer’s plot in the year 2017-18 and 2018-19 resulting in total increase in yield to 53.76% and 44.87% in 2017-18 and 2018-19 respectively. The technology interventions seems more viable and beneficial for farmers with higher Benefit cost ratio which increased up to 2.96 and 2.52 in demonstration plot in comparison to farmer’s plot 2.82 and 2.45 in 2017-18 and 2018-19 respectively.

Keywords: lentil, wilt, aphid, yield, benefit cost ratio.

1. Introduction
Lentil (Lens culinaris Medik) is the second most important pulse crop in terms of both area and production (Anon., 2014). In India pulses constitute an integral part of the daily diet as a direct source of protein for human beings. It is cultivated throughout Northern and Central India. It is one of the oldest crops that originated in near east and Mediterranean region. Masur or lentil is a bushy, annual shrub plant that is popular for its lens shaped seeds, which are consumed as food in stew or other forms all over the world. These seeds have a vast range of colors from yellow to red-orange to green, brown and black and also have second highest levels of proteins and fiber after soybeans. The area under lentil in India is around 1.59 m. ha with a production of 0.94 m. t and productivity 697 Kg/ha (Anonymous, 2011) [1]. Owing to biotic and abiotic stresses, the crop yield is below attainable levels. Among the biotic factors, diseases are serious threat to lentil production. Lentil suffers from a number of diseases which are caused by fungi, bacteria, viruses, nematodes and plant parasites (Khare et al., 1979) [2]. In Saharsa district of Bihar Fusarium wilt, insect pests especially aphid significantly reduce lentil production. Fusarium wilt is one of the major constraints in lentil production. 20-25% yield loss is reported due to fusarium wilt (Maheshwari et al., 2008) [3]. Under favourable environmental condition, complete crop failure is observed (Choudhary and Amarjit, 2002, Singh et al. 2017a; Singh et al. 2017b; Singh et al. 2017c; Singh et al. 2018; Tiwari et al. 2018; Tiwari et al. 2019a; Tiwari et al. 2019b; Kour et al. 2019; Singh et al. 2019) [4]. Among other biotic factors major insect pests like aphids and others also cause damage to the production of lentil in Saharsa district of Bihar. Apart from this, poor soil nutrition significantly lowers yield of lentil. The cumulative effect of all these constraints account for approximately 3.45-4.75 q/ha of lentil yield than expected 8.0-12.2 q/ha (Tripathi 2016) [5]. Several interventions like seed treatment and soil amendment with Trichoderma spp. and carbendazim suppress wilt in lentil significantly (Singh et al., 2017) [6]. Another major constraint in lentil production is the inadequate supply of nutrients and poor practices in soil.
Technology gap = Potential yield – Demonstration yield
Extension gap = Demonstration yield – Farmers’ yield

3. Result and Discussion
Assessment of technology interventions on wilt incidence, aphid population and total yield is presented in table 1. Wilt incidence in the year 2017-18 and 2018-19 in demonstration plot were 9.25 and 11.80 per cent while in farmers’ plot were 40.69 and 41.85 per cent. Aphid population per plant in demonstration plot were 6 and 9 while in farmers’ plot were 16 and 19 during the year 2017-18 and 2018-19. Total yield recorded in demonstration plot were 7.15 and 5.65 while in farmers’ plot 4.65 and 3.90 during the year 2017-18 and 2018-19. It resulted in reduction in wilt incidence (77.27%, 71.80%), aphid population (62.50%, 52.63%) in demonstration plot in comparison to farmer’s plot in the year 2017-18 and 2018-19. Wilt incidence and Aphid population in demonstration plot were significantly lower as compared to Farmer plot in both the year 2017-18 and 2018-19. Yield recorded in demonstration plot were significantly higher as compared to Farmer plot in both the year 2017-18 and 2018-19. It is assumed that lower wilt incidence, Aphid population and enhancement of soil nutrition due to Rhizobium spp. and PSB results in enhancing the total yield of lentil. Adoption of these integrated technology caused considerable increase in yield i.e. 53.76 and 44.87 during the year 2017-18 and 2018-19 respectively.

The economic viability of these technology interventions on demonstration plot and farmer’s plot was measured by calculating benefit cost ratio which are presented in table 3. Cost of cultivation in the demonstration plot was Rs. 14950 and Rs 16260 while in farmers’ plot were 11630 and 12670 during the year 2017-18 and 2018-19 respectively. Gross return obtained demonstration plot were Rs 44380 and Rs 41005 while in farmers’ plot were 32845 and 31125 during the year 2017-18 and 2018-19 respectively. Net return gained by farmer in demonstration plot were 29430 and 24745 while in farmers’ plot Rs 21215 and Rs 18455 during the year 2017-18 and 2018-19 respectively. On calculation of benefit cost ratio, 2.96 and 2.52 in demonstration plot while 2.82 and 2.45 in farmers’ plot was found during the year 2017-18 and 2018-19. Adoption of these technology interventions in better benefit cost ratio in demonstration plot than farmers’ plot. In terms of economy viability of these technologies in lentil production, net return was higher in demonstration plot as compared to farmer’s plot in both the year 2017-18 and 2018-19. Benefit cost ratio was higher in demonstration plot as compared to farmer’s plot in both the year.

Technology gap implies the gap between potential yield and demonstration yield of the crop. Potential yield of the variety (HUL-57) used in demonstration was 14g/ha. It signifies about the scientific intervention required to increase the yield of the crop. Extension gap implies about the awareness of the farmers about farming technologies, availability of agricultural inputs in that particular locality and other facility like electricity, fuel etc. Technology gap and Extension gap were calculated using formulae given by Kadian et al. (1997) and presented in table 2. In the year 2017-18 and 2018-19, technology gap calculated were 6.85 and 8.35 while extension gap were 2.50 and 1.75 respectively. This technology gap is mainly due to lack of awareness of farmer’s about improved technology. Farmer’s are also less skilled in integrating various technologies in package form.
4. Conclusion

Tripathi (2016) conducted similar kind of investigation and integrated various technologies for lentil production. After integrating various technologies they found significant reduction of wilt incidence, aphid population and higher yield in demonstration plot than farmer’s plot. They also reported higher net return and higher benefit cost ratio in demonstration plot. Singh et al. (2017) reported that seed treatment with Carbendazim and Trichoderma harzianum treatment results in reduction of wilt incidence in lentil. Rafique et al. (2016) reported that integration of systemic fungicides with biocontrol agent cause reduction of wilt incidence in lentil. Rhizobium inoculation of lentil seed enhances nitrogen availability and enhance yield (Huang et al., 2016). Ray et al. (2010), Singh and Barman (2011) and Tripathi (2016) reported technology gap and extension gap in the findings of these scientists is supporting the result of present finding.

5. References

