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Research Note

Efficacy of *Pasteuria penetrans* (ex Thorne) Sayre & Starr as seed treatment in controlling *Meloidogyne javanica* (Treub) Chitwood on three succeeding crops

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ABSTRACT: The bacterial parasite, *Pasteuria penetrans* (ex Thorne) Sayre & Starr was tested as seed treatment against *Meloidogyne javanica* (Treub) Chitwood in okra-cowpea-chickpea sequence. In the first crop of okra, yield increase was not significant, but 21 per cent of the juvenile population at the end of the crop carried bacterial infection to the second crop. Yield differences became evident from the second crop of cowpea, which also left 46.5 per cent less juvenile population and the incidence of bacterium increased to 29 per cent. In the third crop of chickpea, besides 52.6 per cent increase in yield, a population reduction of 57.7 per cent was recorded, 50 per cent of which carried bacterial infection.

KEY WORDS: Chickpea, cowpea, okra, *Pasteuria penetrans*, seed treatment

The bacterial parasite, *Pasteuria penetrans* (ex Thorne) Sayre & Starr, 1985 has been reported to be very effective against root-knot nematode, *Meloidogyne* spp. on several crops (Chen & Dickson, 1998). The minimum dosage of *P. penetrans* required for significant suppression of root-knot nematodes is 1 x 10^4 spores per g soil (Walia, 1994). Field application of *P. penetrans* at such level is impossible with the current method (Stirling & Wachtel, 1980) of its mass multiplication. Considering this inherent difficulty of obtaining large amounts of *P. penetrans* preparations for field use, it is contemplated that its application in small areas like nematode-infested nursery sites or seed treatment may be feasible with the improved method of its mass multiplication (Walia *et al.*, 2004). Obviously, in this kind of approach, the purpose is to disseminate the bacterium to large areas through infected seedlings/seed treatments and allow it to build-up to nematode suppressive levels through subsequent croppings.

In this study, our objective was to 'introduce' small quantities of *P. penetrans* parasite preparation through seed coat with the premise that the spores will be concentrated in the rhizosphere upon release, infect the invading nematodes, and build up further over a sequence of root-knot nematode susceptible crops.

The study was conducted in a greenhouse using big cement pots (20 kg capacity) filled with unsterilised sandy soil free from root-knot nematode and *P. penetrans* (ascertained through bioassays). *Meloidogyne javanica* (Treub) Chitwood eggs were introduced @ 18,000 per pot

Table1. Effect of seed coat with *P. penetrans* on the crop yield, disease intensity and establishment of bacterium against *M. javanica* on okra and cowpea

Treatment	Yield (g)/ pot	Gall Index (1-10 scale)	No. of final J2/100 cc soil	Per cent J2 with spores
A. First crop – Okra (cv. Varsha Uphaar) 29.04.2003 to 25.07.2003				
1. *P. penetrans*	55.216 [b]	4.165 [a]	1288 [a]	21
2. No. *P. penetrans* (only nematodes)	41.874 [b]	8.832 [b]	2250 [a]	3
3. Uninfected check (without nematodes)	69.354 [a]	-	-	-
B. Second crop Cowpea (cv. Sel. 31) 03.08.2003 to 07.11.2003				
1. *P. penetrans*	69.762 [b]	5.196 [b]	319 [b]	29
2. No *P. penetrans* (only nematodes)	56.988 [c]	7.863 [a]	596 [a]	1
3. Uninfected check (without nematodes)	98.248 [a]	-	-	-
C. Third crop – Chickpea (cv. HC -1) 16.11.2003 to 07.04.2004				
1. *P. penetrans*	10.140 [b]	5.07 [b]	220 [b]	50
2. No. *P. penetrans* (only nematodes)	6.644 [a]	8.81 [a]	520 [a]	-

Figures superscripted with the same letter are not significantly different at P = 0.05.

at sowing. The okra (cv. Varsha Uphaar) seeds were coated with a parasite preparation of *P. penetrans* (8×10^7 spores/ g powder) @ 3g per 100 seeds using gum arabica as sticker. Ten seeds were sown in each pot, which were thinned to three plants per pot after germination. After recording observations, roots were chopped into small pieces, mixed with the pot soil, and allowed to decompose for 10 days. Cowpea (cv. Sel. 31) was raised as second crop in the same pots. Similarly, a third crop of chickpea (cv. HC-1) was taken after cowpea.

In okra, maximum yield was recorded in the uninfected check (without nematodes) compared to other treatments (with nematodes). Seed treatment with *P. penetrans* enhanced yield but it was on a par with without *P. penetrans* treatment. Gall index was reduced by 53 per cent with the application of *P. penetrans*. Final juvenile population was also reduced by 43 per cent but this was not statistically significant. Among the final J2 population, 21 per cent carried bacterial spores with a spore load of 2.5 per J2, on an average (Table 1).

The results were more discernible in the second crop of cowpea. *P. penetrans* resulted in significant increase (22.4%) in the yield, besides reducing gall index (34%) and final J2 population in soil (46.5%). The incidence of *P. penetrans* at the end of the crop increased to 29 per cent and the bacterial spore load per J2 also increased to 3.71 (Table 1).

The differences became more prominent in the third crop of chickpea. Compared to nematode-infected check, *P. penetrans* increased yield by 52.6, reduced gall index by 42.4 per cent and final J2 population by 57.7 per cent. Furthermore, 50 per cent of the final J2 population in soil carried *P. penetrans* spores (Table 1).

The differences in the crop yield and final J2 population were indicated in the first crop itself (non-significant though), these became significant

in the second crop, and further amplified in the third crop. But more noticeable was the increasing levels of *P. penetrans* incidence and spore load among the juvenile population at the end of each succeeding crop. Chen and Dickson (2004) studied the build up of *P. penetrans* over a 3-year continuous cropping of peanut infested with *Meloidogyne arenaria* (Neal) Chitwood race 1. Root and pod galls were significantly reduced at 1 x 10^5 spores in the first year itself, but at 1 x 10^3 spore level, it took three years. *P. penetrans* applications were made in the soil; hence the results are not comparable with this study.

Thus, it can be inferred from this study that although very few spores of *P. penetrans* are carried through seed coat in terms of desired levels of 1 x 10^4 spores/g soil, seed coat with parasite preparation of *P. penetrans* will concentrate the spores in the rhizospheric zone allowing better adherence to the invading juveniles. Further investigations in field are warranted to test this method of application.

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