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Influence of Seed Treatment of Neem Based Formulations and Chemical on Populations of Cereal Cyst Nematode, *Heterodera avenae* Infecting Wheat and Barley

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ABSTRACT: Cereal cyst nematode, *Heterodera avenae* is a serious pest of wheat and barley. To combat this disease, six treatments were undertaken i.e. seed treatment with neem based formulations (Neem seed kernel power (NSKP) v/w 10% -Neemark v/w- 10%, Neem oil- 10 mi/kg seed) and chemicals i.e. seed soaking (Carbosulfan 25 EC-2%) along with treated check (carbofuran 3G @1.5 kg ai/ha) and untreated control (Farmer's practice). It was found that the grain yield of wheat was maximum with carbosulfan treatment (40.3 q/ha) followed by the neem seed kernel powder (38.0q/ha), neemark (32.7 q/ha) and neem oil (30.7 q/ha) as compared to farmers practice (18.6 q/ha). The number of cysts per 200 c/c soil were recorded in carbosulfan (18.6) that is at par with NSKP (19.0) followed by neemark (21.6), neem oil (31.0) and L untreated check (43.3). All the treatments were showed significantly higher grain yield and reduced number of CCN counts per 200 cc soil over untreated check. In barley crop, the grain yield of RD-2035 was highest 48.7 q/ha followed by carbofuran 3G @ 1.0 kg ai/ha (36.1q/ha) and Neem oil + vermicompost 33.0 q/ha) as compared to susceptible check (16.4 q/ha). The nematode cyst counts per 200cc of soil reduced in resistant variety (7.6) followed by carbofuran (10.0), neem oil + vermicompost (14.6) as compared to farmers practice (32.3).

Key words: Management, cereal cyst nematode, *Heterodera avenae*, Wheat, Barley, Neem formulation

Wheat is one of the most important cereal crop and occupies prominent position in Indian agriculture after rice, occupying nearly 27.54 mha and producing 80.58 million toimes (Anon, 2009). Wheat (*Triticum aestivum*) and barley (*Hordeum vulgare*) are important rabi crops of Rajasthan. These crops are vulnerable to a number of pest and diseases which cause considerable reduction in yield. Amongst various disease causing agents, nematodes play an important role. The cereal cyst nematode, *Heterodera avenae*, is one of the most important plant parasitic nematodes of cereals which causes about 40-50% yield reduction and sometimes losses may increased upto 60- 65% depend upon disease severity. Annual losses by CCN was increased from 4 crore (Seshadri & Gupta, 1980; Gaur & Pankaj, 2009) to 15 crore in Rajasthan state alone (Rajvanshi & Bishnoi, 2011). Management of this nematode by chemical application causes serious concern about environment and human health. Seed treatments with neem products have been recorded as effective and economical methods for nematode management in wheat and other crops. Neem product, a rich source of bioactive chemicals had been widely proved for its nematicidal value. Therefore, present investigation was carried out to test efficiency of neem-based formulations *viz* NSKP, Neemark, Neem oil and chemicals i.e. seed soaking (Carbosulfan 25 EC) against *Heterodera avenae* on wheat. In barley, the present study was planned to see the effect of neem oil (seed treatment) and vermicompost (soil application) and its combination (neem oil + vermicompost) along with resistant variety (RD 2035) and to compare with treated and untreated check.

MATERIALS AND METHODS

A management trial was conducted at farmer's field of Jaipur district, Rajasthan, against cereal cyst nematode, *Heterodera avenae* on wheat variety Raj 1482 (Susceptible variety) with initial cyst population 41.0 cysts/200cc of soil. Six treatments were undertaken i.e.

seed treatment with neem-based formulations. Neem seed Kernel powder (NSKP) v/w 10%, Neemark v/w-10%, Neem oil- 10 ml/kg seed) and chemicals i.e. seed soaking (Carbosulfan 25 EC-2% for 2 h) along with treated check (Soil application of carbofuran 3G @1.5 kg ai/ha) and untreated check. Aqueous extract of dry neem seed kernel powder was prepared by soaking 100 g, neem seed kernel powder in 1000 ml of distilled water for 24 h and then filtered through whatman filter paper no. 1. In this extract seed were dipped for 2 h. In liquid formulation likes neemark, seed treatment was done @ 10% v/w of seed. Treated seeds were air dried and used there after.

Experiment on barley was conducted at cultivator's field of Jaipur district in naturally infested soil having initial cyst population 45.0 cysts/200cc soil with susceptible variety RD 103. The treatments were neem oil, veimicompost, neem oil + vermicompost, treated (carbofuran 3G) and untreated check along with resistant variety (RD-2035). Each treatment of wheat and barley were replicated thrice and randomized block design was used. The grain yield was taken at the time of harvesting of the crop (wheat and barley) separately. A composite sample of 200 cc soil were taken from- each treatment of wheat and barley separately after harvesting the crop and washed following Cobb's sieving and decanting technique and analyzed for final population of CCN.

RESULTS AND DISCUSSION

All the treatments significantly gave higher grain yield and reduced number of cyst counts per plant over untreated check in wheat. The highest grain yield was recorded in carbofuran 3G @ 1.5kg a.i./ha (42.6 q/ha) (Table-l). It was found that the grain yield was maximum with carbosulfan treatment (40.3 q/ha) followed by treatment with neem seed kernel powder (38.0 q/ha), neemark (32.7 q/ha) and neem oil (30.7 q/ha) as compared to farmers practice (18.6 q/ha) in wheat. The least number of cysts were recorded in carbosulfan (18.6) at par with NSKP (19.0) followed by neemark (21.6) as compare to untreated control (43.3). All the neem-based formulations were effective in reducing the population of nematodes but carbosulfan was found better. The neemark, active principle compound isolated from neem proved its bioefficacy on plant parasitic nematodes. Carbosulfan suppress nematode population and increased grain yield.

In case of barley (Table 2), all the treatments gave significantly higher grain yield and reduced number of

Table l. Effect of Seed treatment through neem based formulations and chemical for management of cereal cyst nematode, *Heterodera avenae* of wheat

Treatments	Dosages	Grain yield (q/ha)	% increase of yield over control	No. of cyst Per plant	% decrease over control	No. of cysts / 200 cc soil
Neem seed Kernel Powder v/w (seed treatment)	10%	38.0	104.3	7.6	68.3	19.0
Neemarkv/w	10%	32.7	75.8	11.3	52.9	21.6
Neemoil (seed treatment)	10 ml/kg seed	30.7	65.0	13.6	43.3	31.0
Carbosulfan 25EC (seed soaking)	2%	40.3	116.6	7.3	69.5	18.6
Carbofuran 3G (soil application)	1.5 kg a.i./ha	42.6	129.0	6.0	75.0	14.0
Untreated check	-	18.6	-	24.0	-	43.3
CD (P=0.05)		1.7		1.5		1.9

Table 2. Management of cereal cyst nematode, *Heterodera avenae* in barley

Treatments	Dosages	Grain yield (q/ha)	% increase of yield over control	No. of cyst Per plant	% decrease over control	No. of cysts / 200 cc soil
Neem oil	10 ml/kg seed	30.4	85.4	13.0	35.0	19.3
Vermicompost	10 q/ha	28.1	71.3	16.0	21.2	23.6
Neem oil + Vermicompost	10 ml/kg seed + 10 q/ha	33.0	101.2	9.3	54.2	14.6
RD-2035	Resistant variety	48.7	196.9	0.0	100	7.6
Carbofuran 3G (Treated check)	1.0 kg a.i./ha	36.1	120.1	6.6	67.5	10.0
Untreated check		16.4	-	20.3	-	32.3
CD at (P=0.05)		1.4		2.09		2.47

cysts over intreated check. The maximum grain yield was recorded in RD-203.5 (48.7 q/ha) followed by carbofuran 3G @ 1.0 kg a.i./ha (36.1 q/ha) and neem oil + vermicompost (33.0 q/ha) as compared to susceptible check RD 103 (16.4 q/ha). The cyst counts per 200cc of soil was least ill resistant variety (7.6) followed by carbofuran (10.0), neem oil + vermicompost (14.6) as compared to farmers practice (32.3).

All the neem formulations were effective in wheat for reducing the cyst but carbosulfan was found better. The neem product might have increased the tolerance level of crop plants and enabled them to resist the nematode attack. The seed soaking neem formulation was more efficient because it may have the greater chance of penetration of active ingredients into the plant system. Similar results were obtained by Dhawan and Kaushal (1988). Kaushal (1993) also observed that neem powder and neem based chemicals found effective against *H. avenae*. Vadhera *et al.* (1999) reported increased yield and reduced gall index when seed dressing was done with carbosulfan 3% (w/w). while Prasad *et al.* (1992) reported that carbosulfan @ 3% and 4% (w/w) concentration adversely affected germination and plant growth parameters in groundnut. Carbosulfan 2% & NSKP (Neem seed kernel powder) 10% showed its overall superiority by reducing number of cyst/plant and better plant growth. Neem seed kernel powder might also have increased the tolerance level of plants and develop potential to resist the nematode attack, which is in agreement with Akhtar and Mahmood (1993). Rajvanshi & Bishnoi (1998) observed that the decomposed leaves of neem, datura and aak was effective in control of cereal cyst nematode in barley. They noted that the neem compost at 12% was effective as compared to other treatments and reduced the cyst per plant.

Vermicompost is also a form of organic soil amendment that has considerable potential in crop production. Vermicompost are finely responsible for high porosity, aeration, drainage, water holding capacities and low C:N ratio. The considerable improvement in the plant growth recorded after amending soils with vermicompost has been attributed to the change in physico-chemical and biological properties. Similar results also have been reported that vermicompost decreased the numbers of galls and egg masses of *Meloidogyne javanica* (Ribiero *et al.*, 1998). Carbofuran 3G@1.5 kg a.i./ha & Raj MR-1 (resistant) were effective in controlling CCN infection at farmer's field (Pankaj *et al.*, 2010). In order to make its application cost effective, seed treatment was considered as one of the possible ways for managing nematode population.

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