



Research Article

TREATMENT OF MAIZE SEED WITH COW- PRODUCTS: AN ECO-FRIENDLY MANAGEMENT OF MAIZE CYST NEMATODE (*Heterodera zeae*)

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Received: May 05, 2018; Revised: May 10, 2018; Accepted: May 12, 2018; Published: May 15, 2018

Abstract- The agro-climatic conditions of Rajasthan are most favourable for maize production and multiplication of maize cyst nematode, *Heterodera zeae*. It is responsible for severe losses in maize production. Thus, looking to its importance, present investigations were undertaken to find out the effect of cow product viz., butter milk, cow milk, and cow urine were tested as seed treatment at 1, 2 and 4 % to check the infection of maize cyst nematode, *H. zeae* on maize. Results of cow products trial revealed that seed treatment with cow urine at 4 percent was found best followed by cow urine at 2 percent and butter milk at 4 percent to improve plant growth of maize and to reduce the infection of maize cyst nematode, *H. zeae* on maize.

Keywords: Cow products, *Heterodera zeae*, butter milk, cow milk, and cow urine

Citation: Kumhar R.N., et al., (2018) Treatment of Maize Seed with Cow- Products: An Eco-Friendly Management of Maize Cyst Nematode (*Heterodera zeae*). International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 10, Issue 9, pp.-5969-5971.

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Academic Editor / Reviewer: Mayurkumar K Kanani

Introduction

Maize (*Zea mays* L.) is considered as the queen of cereals and cultivated under the wide range of agro-climatic conditions all over the world including India. Maize has multidimensional utilization and mainly used as food, feed and fodder and as an industrial raw material for starch and processed food industries. Maize suffers from number of insects (Stem borer, Shoot fly, Mites and Termites etc.) and diseases caused by fungus and bacteria (Downy mildew, Maydis leaf blight, Post flowering stalk rot, *Curvularia* leaf spot, Bacterial sheath and leaf blight etc.) including nematodes in India [1, 2]. Nematodes also interact with other disease-causing agents (pathogens and soil insects) and adversely affect the quantity and quality of maize production. Among nematodes, Maize cyst nematode, *Heterodera zeae* is considered as one of the most important nematode pests of maize in India and abroad [3, 4]. The severity of losses caused by *Heterodera zeae* on maize is higher in Rajasthan due to favourable soil conditions, monocropping and ignorance of management practices in maize. Maize cyst nematode, *H. zeae* cause 17-29% yield losses on maize in India at varied inoculum levels and soil conditions [5]. A number of management practices have been developed and included in package of practices on maize, however, work on eco-friendly management of *Heterodera zeae* on maize is lacking. Therefore, to fill this gap of knowledge, present investigations have been proposed to find out eco-friendly management of maize cyst nematode, *Heterodera zeae* on maize by use of cow-products.

Materials and Methods

An experiment was carried out to find out management module of maize cyst nematode, *H. zeae* on maize through cow products i.e., Cow milk, Cow urine and Butter milk (Fermented) as seed treatment applied at 1, 2 and 4% (w/v) against maize cyst nematode, *Heterodera zeae* on maize. A treated chemical (acephate 75 SP at 2 % w/w) and untreated checks were also taken for comparison of experimental results. The experiment was laid out using following procedure in completely randomized design and each treatment was replicated five times.

Maintenance of culture

Heterodera zeae cysts were collected and kept on Baermann's funnel assembly in distilled water with some pieces of fresh maize roots for proper hatching. Freshly hatched larvae thus obtained were inoculated in root zone of maize and plants were maintained in 12" sized earthen clay pots from which inoculum was used for various experiments.

Sowing

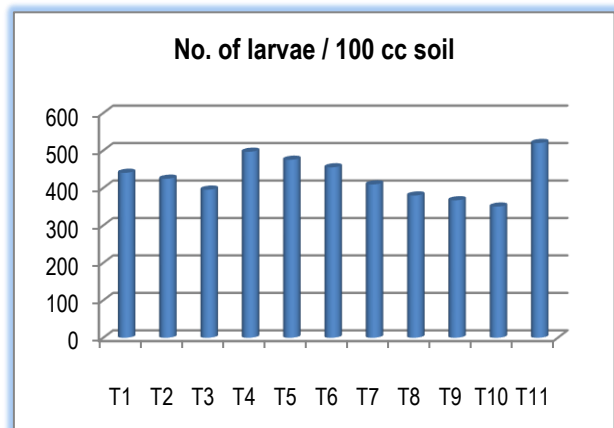
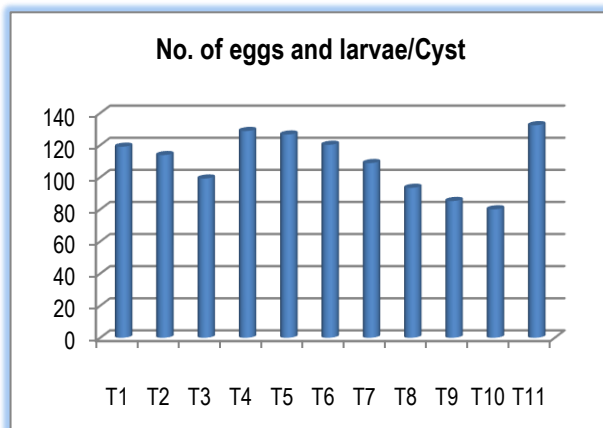
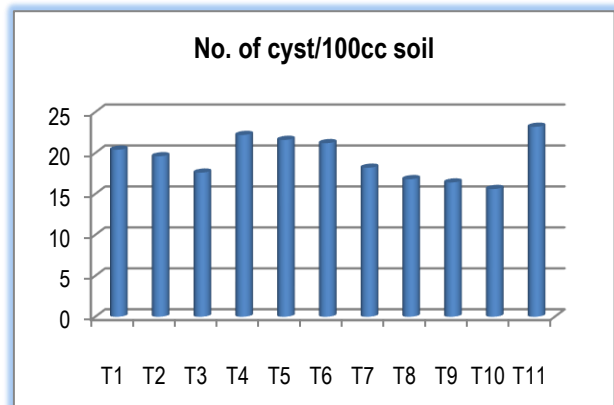
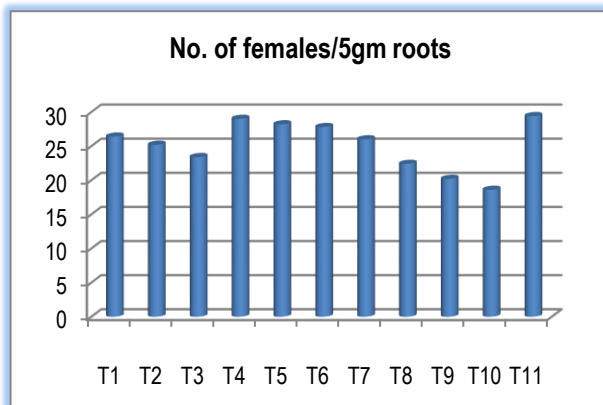
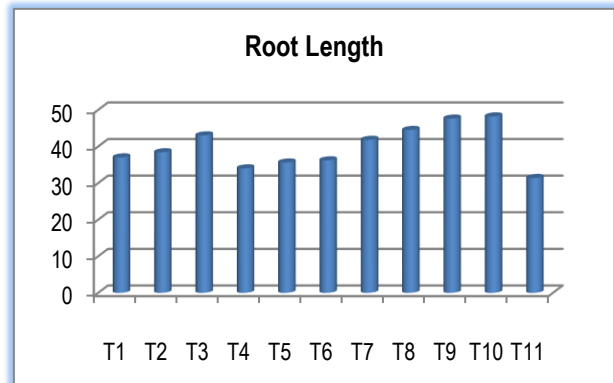
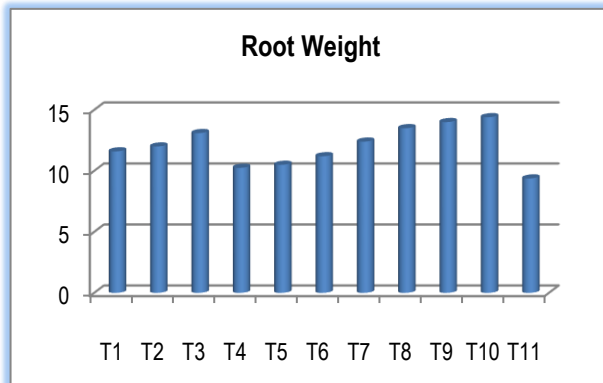
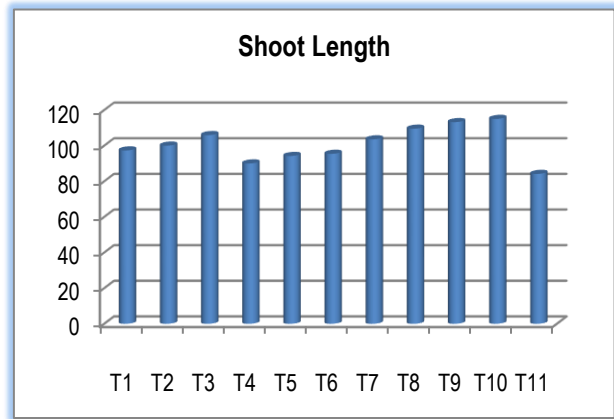
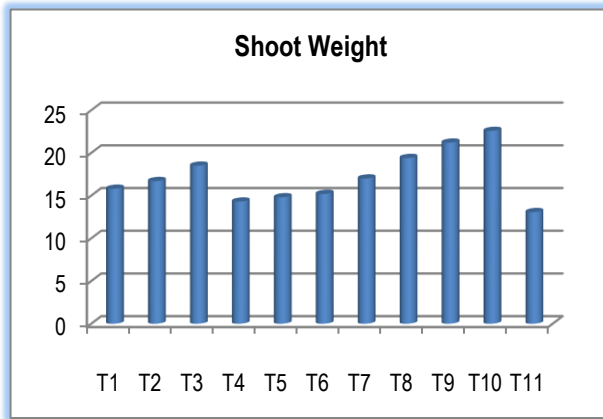
Earthen clay pots of 6" size was taken and filled with equal quantity of steam sterilized soil. The weighed quantity of seeds was taken in a beaker and treated with 0.1 percent carbendazim and required quantities of cow products were added and mix thoroughly to provide uniform coating of cow products over seeds were sown with three seeds of maize (Pratap Makka-3) in each pot and watered regularly. After 7-10 days of germination, one plant in each pot, nearly of equal size was maintained and others were removed carefully without disturbing the one to be maintained. Each experimental pot was tagged properly.

After care

Care was taken right from sowing till harvest of experiments the crop. To avoid insect damage, spray of malathion (0.05 %) or imidacloprid 17.8 SL (0.10 %) were given as and when required. Thinning was done to maintain desired plant population after 7-10 days of germination. Weeding and hoeing was done timely to avoid weeds and to maintain proper aeration in soil. The recommended doses of nitrogenous and phosphatic fertilizers were applied for proper growth of plants. Pots were randomly rotated to eliminate the effect of sun and shade. Irrigation was made as and when required throughout the course of experimentation.

Harvesting

Harvesting of plants was done after 45 days of sowing. The entire root system along with soil was carefully taken out from pots and kept in water for half an hour.



The root system was then gently washed under running tap water to remove all the adhering soil particles. Observations on plant growth parameters viz., shoot length (cm), shoot weight (g), root length (cm) and root weight (g) as well as nematode parameters viz., number of females / 5 g root, number of cysts / 100 cc soil, number of eggs & larvae / cyst and number of larvae / 100 cc soil were

recorded.

Estimation of initial and final soil population (cyst and larvae)

For estimation of initial soil population, samples collected from the experimental pots were brought to the laboratory and thoroughly mixed.

100 cubic centimetre soil was kept in bowl, poured water, stirred thoroughly and passed through 16 and 100 mesh sieves. The catch of sieve was carefully transferred in a beaker and later on a blotting paper and examined under stereoscopic binocular microscope for counting of cysts. The filtrate of 100 mesh sieve was further passed through 200, 325 and 400 mesh sieves [6] and catch of 400 mesh sieves was placed over Baermann's funnel assembly [7]. After 24 hours, the nematode suspension was drawn from the funnel in a beaker and population was counted under microscope.

Results and Discussion

The activity of plant parasitic nematodes is governed by host plant, climate and soil environment etc. Seed treatment with cow products *i.e.*, Butter milk (Fermented), Cow milk and Cow urine, a good tool for reducing pest and disease density, infectivity and host proneness. In comparison to chemicals, cow products are helping in building of soil fertility, comparatively economical, having beneficial effect on succeeding crop, harmless to beneficial soil microbes, non-pollutant, no extra care and precautions involved. Therefore, in present investigation cow product (butter milk, cow milk and cow urine) were used as seed treatment at 1, 2 and 4 % w/v for the management of maize cyst nematode, *H. zeae* infecting maize. Results revealed that shoot length of maize enhanced when cow products were applied as seed treatment. Among cow products tested, cow urine at 4 percent (113.20 cm) was found to be the best with respect to shoot length followed by cow urine at 2 percent (109.50 cm) and butter milk at 4 percent (105.90 cm). Cow milk at 1 percent (90.20 cm) was found least effective. Almost similar trend was noticed with respect to shoot weight, root length and root weight. The results of present investigation are in accordance with the findings of previous workers who reported that seed treatment with cow products improved plant growth infested with different plant diseases and pests. The effect of cattle urine and cow dung slurry as seed soaking and observed the improvement in germination and growth of *Khirni* [8]. The best performance of cow urine (2%) by recording highest seed quality parameters of cluster bean [9]. The effect of priming with botanicals and animal waste on germination and seedling vigour in sorghum (*Sorghum bicolor* L.) [10]. Maximum seed germination percentage was observed in coconut water at 3% followed by cow urine at 3%. However, different cow products exerted different reaction with respect to plant growth parameters. This may perhaps be due to variation in their nematocidal value, activity of soil microbes, phytotonic effect and environmental conditions etc. Nematode reproduction parameters were also recorded to interpret the experimental findings. Results showed that seed treatment with cow products reduced number of females / 5 g root, number of cyst / 100 cc soil, number of eggs & larvae / cyst and number of larvae / 100 cc soil of *H. zeae* on maize. It has been observed that higher dose of cow products provided better response with respect to nematode reproduction over the lower dose. Among different treatments, minimum number of females per 5 g root (20.20) was recorded with cow urine at 4 percent followed by cow urine at 2 percent (22.40) and butter milk at 4 percent (23.40). Maximum females / 5 g root (29.00) was obtained in cow milk at 1 percent. Similar trend was observed with regards to number of cysts per 100 cc soil, number of eggs and larvae per cyst and number of larvae per 100 cc soil. Several workers have earlier reported efficacy of cow products for the management of different pests and diseases on different crops. Though, no reference was found on effect of cow products against plant parasitic nematodes. However, there are number of references which showed efficacy of cow products against the insects and fungal pathogens which provide the hypothesis that these products might be effective against nematode. Therefore, in present investigation cow products were tested against *Heterodera zeae* on maize. Modified *panchagavya* mixture was most effective for the management of panama disease of banana [11]. Effectiveness of whey at 30 % concentration against powdery mildew (*Podosphaera xanthii*) on cucumber [12]. *Panchagavya* + cow urine in combination with NSKE proved next best over spinosad in controlling shoot fly in sorghum [13]. These studies revealed that seed treatment with cow products not only reduced disease infection but also enhanced the plant growth characters. The cow urine distillate was found to possess antifungal property against different pathogens. It's potential to affect vegetative growth as well as reproductive phase of pathogens. It is proved that

cow urine distillate possesses active components found to be inhibitory to the vegetative growth and germination of fungal spores of pathogens. Cow urine distillate could be used as an alternate spraying agent to control plant diseases. Thus, it is advocated that cow products can be effectively employed as seed treatment on maize to promote plant growth and to reduce the infection of plant diseases including nematodes after validation and further testing of these products against important phytonematode.

Application of research: Nematode management

Research Category: Eco friendly Management

Abbreviations: g- gram, cm- centimetre, %- per centage, NSKE- neem seed kernel extract, cc- cubic centimetre, w/v- weight by volume, w/w- weight by weight,

Acknowledgement / Funding: Author thankful to Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, 313001 Rajasthan.

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Research project name or number: Studies on Survey and Eco-friendly Management of Maize Cyst Nematode, *Heterodera zeae* on Maize (*Zea mays* L.)

Author Contributions: All author equally contributed

Author statement: All authors read, reviewed, agree and approved the final manuscript

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

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