Eradication of Corn Cyst Nematode (*Heterodera zeae*) from Vetiver Germplasm for its Safe Exchange

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Vetiver (*Vetiveria zizanioides* L.), popularly known as Khas is a tall perennial grass cultivated in several parts of North and South India. Its spongy, much branched fine rootlets contain fragrant oil, which is in great demand by the perfumery industry. The dried aromatic roots are also used to make curtains and mats for desert air coolers. The roots emit scented aroma along with the cool air when moistened. Due to these qualities vetiver is in great demand and exported to several countries in the form of rooted cuttings (saplings) for cultivation. It has been reported to be a good host of *Heterodera zeae* (Arjun Lal and Mathur, 1982). Because of this, there had been persistent problem in exchanging "nematode free" planting material.

So far no treatment has been reported to completely eliminate *H. zeae* from infested vetiver roots. Therefore, the present study was undertaken with the objective of finding a treatment (thermal or chemotherapic), which would be effective from quarantine point of view.

Vetiver plants infested with *H. zeae* were collected from NBPGR experimental farm, Issapur, Delhi. Roots were gently washed under running water to remove adhering soil. After cutting about 2/3 of the shoots all the rooted cuttings were thoroughly mixed and then six of these were picked randomly for each of the treatments and associated checks. Randomly drawn root sample showed nematode inoculum @ six nematodes/ gram of root (including second and third juvenile stages).

For hot water treatment, the root systems were immersed in a thermostatically controlled hot water bath for 15 and 30 min. at 47, 50 and 53°C. For associated check, the rooted cuttings were dipped in tap water at room temperature (23°C). For nematicidal dip treatment, the roots were dipped in aqueous solutions of Dimethioate, Rogor, Formalin, Nemagon, Nemacur, Sodium hypochlorite in concentrations of 500, 1000 and 1500 ppm except in sodium hypochlorite for 15 and 30 min. Concentrations of sodium hypochlorite used were 10, 20 and 40 ml/litre of water. In control, the roots were dipped in tap water. At completion of the dip treatment, the roots were pressed between filter papers so that excess of pesticide on the roots is removed.

Following hot water or nematicidal dip treatments, the cuttings were planted in plastic pots having nematode-free soil. The pots were maintained in open. After four months of transplanting the root system of each plant and the soil around was examined for cysts and second stage juveniles. Roots were also stained to confirm the absence of juveniles wherever required.

Following the treatments of vetiver roots, all the leaves turned yellow and drooped immediately. Only during the rainy season (two months after the treatment) new green leaves started emerging in between the dead leaves. Even the highest tested temperature 53°C for 30 min. was not deleterious to revival under the experimental conditions. Immersion of vetiver plant root system for 15 min. in a water bath maintained at 50°C eradicated *H. zeae* and did not adversely affect subsequent plant growth. The ability of plant roots to withstand temperatures that are lethal to *H. zeae* provides a means of nematode elimination from the germplasm.

An exposure of roots to 1500 ppm of Dimethioate was effective in eradicating nematodes and dipping them for 30 min. resulted in death due to phytotoxicity. Treatment-wise detailed results are presented in Table 1. Bare root dips for 15 or 30 min. in 500 ppm Formalin or Nemagon were not injurious to plants and at the same time not effective in eliminating *H. zeae*. Higher concentrations or longer exposure period of the same chemicals were phytotoxic except Nemagon–1000 ppm for 15 min. which was effective and non-phytotoxic. Only highest concentration tested for Nemacur (30 min.) and sodium hypochlorite for 15 or 30 min. was effective.

The number of *H. zeae* cysts in roots was significantly reduced with different tested treatments, when compared with control. The purpose of the present study was to achieve complete nematode control without any damage

Table 1. Effect of different treatments on the survival and multiplication of *H. zeae* on vetiver roots

Treatment	Number of cysts formed	
	A	B
Hot water treatment at 47 °C	29.75	7.75
Hot water treatment at 50 °C	0	0
Hot water treatment at 53 °C	0	0
Dimethioate-500 ppm	24.25	6.25
Dimethioate-1000 ppm	6.5	4.00
Dimethioate-1500 ppm	0	P
Rogor-500 ppm	34.75	26.00
Rogor-1000 ppm	17.25	6.50
Rogor-1500 ppm	2.00	0
Formalin-500 ppm	19.0	6.50
Formalin-1000 ppm	P	P
Formalin-1500 ppm	P	P
Nemagon-500 ppm	40.25	18.00
Nemagon-1000 ppm	0	P
Nemagon-1500 ppm	P	P
Nemacur-500 ppm	40.50	31.75
Nemacur-1000 ppm	36.00	12.5
Nemacur-1500 ppm	3.75	0
Sodium hypochlorite-10 ml/l	43.50	33.50
Sodium hypochlorite-20 ml/l	32.25	32.0
Sodium hypochlorite-40 ml/l	32.0	31.25
Sodium hypochlorite-commercial	0	0
Check	50. 00	–

Each figure under the number of cysts formed is average of six replicates.

A=After 15 min. of treatment; B=After 30 min. of treatment; P=Phytotoxic

to vetivers, therefore statistical analysis was not necessary to compare efficiency of different treatments.

Soaking bare roots for 15 or 30 min. in commercially available sodium hypochlorite, resulted in eradication of nematode without any adverse effect on the plants. The disruptive effects of sodium hypochlorite on many nematode genera, including effects on cysts of soybean and potato cyst nematode are known (Esser, 1972; Wood and Foot, 1975). At very low concentrations, the chemical has been used to disperse eggs from egg masses and to surface sterilize eggs of root knot nematode (McClure *et al.* 1973; Hussey and Barker, 1973).

The results from the dip treatments tested indicate that eradication can be achieved with a thermotherapy as low as 50°C for 15 min. or with 1000 ppm Formalin, Nemagon for 15 min. or with 1500 ppm Dimethioate, Nemacur for 15 or 30 min., respectively. No phytotoxic injuries resulted from any of these treatments.

From the foregoing observations it can be concluded that the corn cyst nematode, *Heterodera zeae* was completely eliminated from infested vetiver (*Vetiveria zizanioides*) roots by giving either of the following treatments *viz.*-hot water treatment at 50°C for 15 min. or dipping the roots for 15 min. in Dimethioate (1500 ppm) or Nemagon (1000 ppm) or sodium hypochlorite (commercial) or for 30 min. in Rogor (1500 ppm). In all the treated plants, including check, new leaves emerged showing establishment of plants after 60 days of transplanting in sterilized soil. Examination of the roots and soil after four months of some of the treatments did not reveal any cyst or juvenile thus making it safe from quarantine point of view to exchange vetiver germplasm.

References

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