# The current research investigations to use a plant extract to control Root Knot nematodes in commercial cultivation of roses in Kenya

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## Introduction

The economy of Kenya depends on agriculture. Agriculture accounts for 28% of the Gross Domestic Product (GDP). Over 70% of the foreign exchange earnings come from this sector. The rural poor, who are about 80% of the country's total population and have a meager income, depend on the agricultural sector which creates over 75% of the labor force thus contributing in poverty alleviation.

The main agricultural exports include coffee, tea, pyrethrum and processed or fresh horticultural crops. The fresh horticultural crops are mainly cut flowers, french beans, mangoes, avocadoes, pineapples, passion fruit, pawpaws, and strawberries. The cut flowers followed by french beans form a major export component of fresh horticultural crops.

As a main producer of cut flowers, Kenya ranks fourth in the world after Holland, Israel and Columbia. The favorable cool climate rich volcanic soils and available cheap labor provides conditions ideal for rapid growth of floriculture which, in 1993 earned Kenya foreign exchange amounting to U.S. $49,655,000 (Table 1). The main cut flowers for export are roses, carnations, chrysanthemums, statice, alstroemerias, tuberose, ornithogalums, arabicums, molucella, eryngium, gypsophilas, orchids, and asparagus fern.

One of the identifiable constraint against flower production in Kenya is the degeneration and loss of vigor of plants caused by Root Knot nematodes. Symptomatology include reduction in root growth, visible cysts on the debilitated roots, reduction of feeder roots and unthrifty appearance of the plants. Degeneration and/or death of plants due to Root Knot nematodes cause a great financial loss to the farmer.

As a control strategy against Root Knot nematodes, farmers use healthy, certified, pest-free planting materials. In case of roses, the scions are grafted onto nematode-resistant rootstocks. These are planted in areas which have been treated with pesticides including Methyl bromide prior to planting of the grafted seedlings. However, despite these precautions, nematode infestations subsequently establish and become a serious problem to warrant chemical control measures during the growth of the plants. Drenching the infested areas with nematicides such as Furadan (carbofuran), Nemacur (fenamiphos), and Temik (aldicarb), albeit expensive, becomes a common practice.

This paper highlights preliminary investigations which have been carried out in Kenya to use an extract from a Khaki week, *Tagetes minuta*, to control root-knot nematodes in commercial cultivation of roses in Kenya.

*Tagetes minuta* is a weed that was inadvertently introduced from the Tropical America to East Africa between 1914 and 1918. (Blundel 1987). Although the weed is adapted to areas of high elevations, it is nevertheless widely distributed in Kenya, abundantly occurring between an altitude of 760 and 2210 m above sea level.

## Materials and Methods

*Tagetes minuta* plants were collected from the wild. These were cut into 2 to 3 inches length. The cut pieces were placed in 200 liter drums filled with water. Pieces of *Tagetes minuta* plants were left in the drums for seven days to ferment. After seven days (7), the fermented solution was decanted and used for drenching the soil for nematode control in rose plants grown either in glasshouses or in the open.

The rose plants, with symptoms of nematode infestations, were growing in rows on raised beds. Each row was 27.0 m long and 0.5 m wide. Ten (10) liters of the fermented solutions was used to treat soil and the root areas of the plants in each row. The solution was evenly poured from the watering can to the treated area. Treatments were repeated at two weekly intervals. The experiment had been in progress for five months when it was subsequently adopted as a regular farm practice for control of Root Knot nematodes.

Pieces of *Tagetes minuta* from which the fermented solution was decanted were also spread evenly on the rows; during weeding, pieces of *Tagetes minuta* were incorporated on the top layer of soil and allowed to decompose.

In another experiment, the fermented solution was distilled at about 98° C. The distillate was used to treat the soil as described above.

## Results

Control of Root Knot nematodes in rose flower beds with *Tagetes minuta* extract was found to be as effective as Furadan, Nemacure, and Temik. Rose plants which had feeder roots destroyed by Root Knot nematodes showed a significant recovery one month after treatment of the soil with an extract from *Tagetes minuta*. Growth of plants was vigorous following control of Root Knot nematodes with the *Tagetes minuta* extract. The number and size of visible cysts on roots were reduced significantly. Normal healthy plants, showing little or no symptoms of nematode infestations, were maintained with a two weekly soil drenching with *Tagetes minuta* extract throughout the five

months period that trials has been in progress. It was clear that *Tagetes minuta* extract could successfully replace chemical pesticides for the control of Root Knot nematodes.

The distilled extract was found as effective as the fermented extract indicating that the active principle was thermostable since distillation at 98° C did not affect the activity of the extract. The extract could also be stored for about a week without loss of efficacy.

Whereas labor and chemical pesticides cost the farmer approximately U.S. $1,200 per month for application of chemical treatment to one hectare of rose plants to control Root Knot nematodes, it only cost a total U.S. $200 per month when *Tagetes minuta* extract was used. This implied that the plant extract was not only environmentally friendly but was cost-effective.

Discussion and Conclusions

The current methods widely used in Kenya to control plant parasitic nematodes in glasshouses or in the field is through use of pesticides. There is therefore a significant dependence on pesticides to sustain commercial cultivation of roses in the country. Notwithstanding their importance, pesticides are costly, pollute the environment and water supplies, and pose health risks to workers. According to the United Nations' World Health Organization, out of 20,000 deaths resulting from pesticide poisoning in the world, there are an estimated 700 pesticide-related deaths a year in Kenya (G. Gikaru an F. Ajai, 1990). Further more, continuous use pesticides lead to pesticide resistance and the elimination of predators which normally keep in check pest outbreaks.

In an attempt to avoid over-dependence on pesticides, growers in Kenya are turning to natural plant extracts to control agricultural pests and diseases. Natural plant extracts have been demonstrated to constitute a cost-effective non-chemical means of controlling pests. For example, neem cake, the residue remaining after the neem oil has been pressed out of the seeds of the neem tree, *Azadiricata indica,* has been shown to have nematicidal properties against *Meloidogyne incognita* (Verma 1986). Similarly, a plant extract from pot marigold, *Calendula officinalis,* has been demonstrated to have nematicidal properties against Root Knot nematodes, *Meloidogyne sp.*, on tomato Goswani and Vijayalakshmi, 1986).

Other plant that have been reported to be used to control general pests such as aphids, mites, scale insects, weevils caterpillars, etc., include *pyrethrum, Chrysanthemum cinerariaefolium;* Mexican marigold *Tagetes erecta; tobacco leaves, and wood ash* (G. Gikaru and F. Ajayi, 1990)

Preliminary trials reported in this paper have indicated that *Tagetes minuta* extract may constitute an effective replacement for

chemical pesticides, including pre-plant soil treatment with methyl bromide, for control of plant parasitic nematodes particularly Root Knot nematodes that attack roses in the production fields. However, additional research is needed to provide comparative data on the efficacy of the extract, in relation to chemical pesticides, against Root Knot nematodes, and to develop and improve the extraction and application technology of the active ingredient(s) of the extract. Other areas of further research may include the use of *Tagetes minuta* extract in Integrated Pest Management (IPM) strategy.

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References

Blundel M. I. 1987. Collins Guide to the Wild Flowers of East Africa, page 178

Goswani B.K. and Vijayalkshmi K. 1986. Nematicidal properties of some indigenous plant materials against Root Knot nematodes, Meloidogynd incognita on tomato. Indian J. Nematol. 16(1): 65-68

Grace Gikaru and Femi Ajayi, 1990. Farmers fight pests the natural way. African Farmer Number 5, November 1990: 28-30

Verma R.R. 1986. Efficcy of organic amendments against Meloidogyne incognita infesting tomato. Indian J. Nematol. 16(1): 105-106

Table 1, Total volume and value of horticultural products, in relation to cut flower, exported by Kenya in 1993[a].

| Commodity | Volume exported (kg) | Total foreign (in Ksh) | exchange earned: - (in U.S. $ approx) |
|---|---|---|---|
| Cut flowers | 23,645,999 | 2,482,798,395 | 49,656,000 |
| Other Horticultural crops | 38,460,811 | 2,293,531,048 | 45,870,600 |
| Total | 62,126,810 | 4,776,329,443 | 95,526,600 |

*a: Source of information: Horticultural Crops Development Authority, Nairobi*