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INFLUENCE OF ORGANIC MANURES AND UREA ON NEMATODE PESTS OF *CELOSIA ARGENTEA*

by
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Summary. Five organic manures, cow dung, poultry dung, horse dung, burnt township refuse and citrus wastes were applied at rates of 10 or 20 t/ha respectively to soil of known nematode infestation. *Celosia argentea* was subsequently grown for 8 weeks. Combinations of cow and poultry manures with urea were applied to soil on which *C. argentea* was grown. Burnt township refuse, poultry and cow manures significantly increased green leaf yield and reduced nematode infestation in the soil. Although citrus waste reduced nematode infestation, it adversely affected crop establishment. Combinations of urea with poultry and cow manures increased leaf yield and controlled plant parasitic nematodes as both organic manures and urea did when applied singly.

Celosia argentea L., an herbaceous vegetable crop is an important source of proteins, minerals and vitamins especially in rural areas where animal protein sources are scarce (Oke, 1965; Oyenuga and Fetuga, 1975). It can be grown all the year round provided there is adequate soil moisture. The green leaves are harvested either by up-rooting whole plants when about five weeks old or by sequential cutting of shoots. In the latter method, the crop lasts up to 12 weeks in the field.

The main nematode pests of this vegetable cause lesions, necrosis and galling on the roots thereby debilitating the plants and reducing the green leaf yield. Root knot nematode, *Meloidogyne* spp. infection on *C. argentea* is manifested by conspicuous galls all over the root system (Caveness and Wilson, 1975), a general chlorosis of leaves, stunted growth and purple colouration of leaves and stem. Lesions and necrosis on roots characterise attack by root lesion nematode, *Pratylenchus* spp., the spiral nematode, *Helicotylenchus* spp., or other ectoparasitic nematodes (Babatola, 1981). Wilson (1962) also reported root knot nematode attacks on *C. argentea*. Three varieties, TLV8, Local Green and Local Red were found to be highly susceptible to the root knot nematode *M. incognita* (Kofoid *et* White) *Chitw.* race 1 both in the field and in the shadehouse (Babatola, 1981). Attempts were made to control nematodes attacking this plant by use of organic manures and urea.

Materials and methods

Five organic manures, cow dung, poultry manure, horse dung, citrus residue and burnt township refuse were applied to the soil at two rates (10 and 20 tonnes/ha). Poultry and cow manures were selected on the basis of their performance in terms of yield and nematode control and relative availability and easy applicability.

Table I - *Nematode population at harvest (Pf) in 200 ml soil and their multiplication rates (m) in plots treated with organic manures (m = Pf/Pi).*

Treatments	M. incognita	P. brachyurus	Helicotylenchus spp.
10 tonnes/ha cow manure (CM)	183 (pf) 0.45 bc (m)	6 0.27 e	119 0.46 b
20 tonnes/ha CM	204 0.48 e	4 0.02 a	86 0.44 ab
10 tonnes/ha poultry manure (PM)	178 0.60 cd	3 0.07 a	124 0.41 ab
20 tonnes/ha PM	104 0.28 ab	4 0.05 a	99 0.34 a
10 tonnes/ha citrus residue (CR)	83 0.18 a	3 0.02 a	142 0.43 ab
20 tonnes/ha CR	148 0.17 a	8 0.20 b	101 0.29 a
10 tonnes/ha horse manure (HM)	209 0.66 d	8 0.44 d	196 0.96 d
20 tonnes/ha HM	110 0.52 c	3 0.06 b	188 0.79 c
10 tonnes/ha burnt township refuse (BTR)	181 0.51 c	3 0.14 b	205 0.84 cd
20 tonnes/ha BTR	138 0.36 b	3 0.02 a	105 0.53 b
Control	462 4.43 e	59 2.46 e	304 2.35 e

Figures in the same column with same letters are not significantly different at P = 0.05.

In a second experiment, poultry and cow manures and urea were applied singly and in combinations of each organic manure with urea. The poultry and cow manures were applied singly at the rate of 20 tonnes/ha each while the urea was applied singly at the rate of 60 kg/ha. The combinations of either poultry or cow manure and urea were 10 tonnes/ha + 30 kg/ha; 15 tonnes/ha + 15 kg/ha and 5 tonnes/ha + 45 kg/ha of poultry or cow manure and urea respectively. Plot size was 2x1.5 m. A gram of *C. argentea* seeds cv TLV8 was planted seven days after organic manures were incorporated into the soil. Each treatment was replicated four times and plots were laid out in a randomised block design. Harvesting was done by cutting at two weekly intervals. After the third harvest (9th week) plants were uprooted and washed clean of soil particles and the roots were scored for levels of galling according to Taylor and Sasser (1978).

Soil samples were taken before the application of organic manures and thereafter every month. The soil samples were assayed for plant parasitic nematode population changes by modified Baermann technique (Whitehead and Hemming, 1965).

Multiplication rates (m) of nematodes were computed with the formula $m = \frac{Pf}{Pi}$ where Pf is final population and Pi is the initial population.

Table II - *Green leaf yield of* Celosia argentea *and root gall index at final harvest.*

Treatments	First harvest tonnes/ha	Total green leaf yield tonnes/ha	Mean root gall index
10 tonnes/ha cow manure (CM)	12.3 c	25.7 cd	2.50* bc
20 tonnes/ha CM	16.4 e	27.6 de	2.7 c
10 tonnes/ha poultry manure (PM)	12.3 c	27.1 de	2.00 b
20 tonnes/ha PM	15.8 d	27.9 de	1.50 ab
10 tonnes/ha citrus residue (CR)	3.4 a	8.8 a	1.00 a
20 tonnes/ha CR	4.1 a	7.6 a	1.25 ab
10 tonnes/ha horse manure (HM)	14.4 d	23.6 c	2.00 b
20 tonnes/ha HM	14.5 d	26.6 cde	2.50 bc
10 tonnes/ha burnt township refuse (BTR)	16.7 e	27.8 de	2.00 b
20 tonnes/ha BTR	16.7 e	29.2 e	2.25 b
Control	8.8 b	16.3 b	4.75 d

Figures in the same column with the same letters are not significantly different at P = 0.05. (* 1 = Immune; 5 = Above 100% root system galled).

Table III - *Nematode population at harvest (Pf) in 200 ml soil and their multiplication rates (m) encountered in plots treated with organic manures and urea (m = Pf/Pi).*

Treatments	*M. incognita*	*P. brachyurus*	*Helicotylenchus* spp.	*Xiphinema* spp.
PM 20 tonnes/ha	133 (pf)	22	2	2
	0.29 b (m)	0.48 c	0.11 a	0.25 a
CM 20 tonnes/ha	259	4	5	1
	0.45 c	0.07 a	0.22 ab	0.12 a
PM 10 tonnes/ha +	118	3	3	2
30 kg/ha Urea	0.33 bc	0.07 a	0.18 a	0.33 a
CM 10 tonnes/ha +	192	3	17	2
30 kg/ha Urea	0.45 c	0.25 b	0.62 d	0.33 a
PM 15 tonnes/ha +	206	9	12	1
15 kg/ha Urea	0.42 bc	0.47 c	0.70 d	0.16 a
CM 15 tonnes/ha +	489	65	23	0
15 kg/ha Urea	0.66 d	0.48 c	0.59 d	0.00 a
PM 5 tonnes/ha +	71	5	16	1
45 kg/ha Urea	0.19 a	0.31 b	0.64 d	0.25 a
CM 5 tonnes/ha +	145	3	19	0
45 kg/ha Urea	0.25 ab	0.16 ab	0.42 c	0.00 a
Urea 60 kg/ha	62	3	10	0
	0.13 a	0.09 a	0.30 b	0.00 a
Control	916	47	83	8
	3.88 e	2.88 d	2.59 e	1.33 a

Means followed by the same letters along each column do not differ significantly by Duncan Multiple Range Test at P = 0.05.

Results and discussion

All organic manures reduced soil populations of *M. incognita*, *Pratylenchus brachyurus* (Godfrey) Filipjev *et* S. Stekhoven and *Helicotylenchus* spp. within a month after application. *P. brachyurus* populations were generally low throughout the treatments (Table I).

Although citrus residue effectively controlled nematodes (Tables I and II), seed germination and subsequent establishment were adversely affected. This poor establishment was apparently responsible for the very low yield recorded for the two levels of the manure (Table II). Burnt township refuse, cow, poultry and horse manures significantly increased green leaf yield and reduced root knot infection (Table II). However, burnt township refuse needed to be sieved of broken bottles and metal scraps to make it safe to handle.

Nematode populations were reduced both by sole applications of poultry and cow manures and urea and the various combinations a month after application. Slight increases in nematode populations due to subsequent build up were observed by the end of crop harvest. *Xiphinema* spp. populations were generally low in all the treatments (Table III).

Green leaf yield of sole applications of poultry and cow manures and urea were generally high and comparable with the combinations of 10 tonnes/ha each of the two manures with 30 kg/ha of urea (Table IV). The combination of 45 kg/ha of urea with 5 kg/ha each of poultry and cow manures adversely affected root galling but did not support high yields as the yields were lower than the yields of plots treated with higher doses of manures.

Table IV - *Green leaf yield of* C. argentea *under different organic manures and root gall index at final harvest.*

Treatments	Yield tonnes/ha*	Mean root gall index
20 tonnes/ha Poultry Manure (PM)	28.650 a	1.8 ab
20 tonnes/ha Cow manure (CM)	26.295 a	2.6 bc
10 tonnes/ha PM + 30 kg/ha Urea	26.380 a	2.0 ab
10 tonnes/ha CM + 30 kg/ha Urea	24.625 ab	2.2 b
15 tonnes/ha PM + 15 kg/ha Urea	20.763 b	2.8 c
15 tonnes/ha CM + 15 kg/ha Urea	22.713 b	2.2 b
5 tonnes/ha PM + 45 kg/ha Urea	18.563 bc	1.8 ab
5 tonnes/ha CM + 45 kg/ha Urea	15.965 cd	2.0 ab
60 kg/ha Urea	24.920 ab	1.6 a
Control	12.188 d	4.8 d

* Same letters after figures in each column indicate lack of significant differences at P = 0.05.

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