Environment & Ecology 27 (4A) : 1681—1684, 2009
 ISSN 0970-0420

Assessing the Efficacy of Carbofuran (Furadan) as a Standard Nematicide for Protecting Crops in the Field

A. A. TANIMOLA AND M.I. GODWIN-EGEIN*

Department of Crop and Soil Science, Faculty of Agriculture,University of Port Harcourt
Port Harcourt, Nigeria
E-mail : migegein@yahoo.com
**Correspondence*

Abstract

The efficacy of carbofuran in the control of *Meloidogyne incognita* on cowpea was investigated to set a yardstick for the assessment of other nematicides to replace carbofuran. The effect of carbofuran was assessed based on plant height, leaf number, leaf area, fresh and dry weight of shoot and root, flower number and nutrient content of the cowpea plants. Carbofuran treated plants performed better when these growth parameters were evaluated, showing that the pesticide was effective in the control of the nematode. The results of the investigation provide some basis or yardstick for comparison when deciding on a replacement candidate for carbofuran which is still superior.

Key words : Carbofuran, Cowpea, *Meloidogyne incognita,* Growth parameters, Pesticide.

The era of synthetic chemicals in pest control should draw to a close, even though it is acknowledged that these perform better in terms of ease of application, effectiveness and possibility of storage (1) than botanical chemicals. This is desired because some inevitable hazards of these synthetic pesticides are environmental pollution, pest resurgence, pest resistance to these pesticides, lethal effect on non-target organisms and direct or indirect toxicity to man (2—5). carbofuran (furadan) shares in all these.

Carbofuran is efficacious acaricide, nematicide and insecticide (6–10) but its toxicity and human unfriendliness have earned it a ban. It is in view of the devastating effects of synthetic chemicals being used in agricultural production (especially in protection) that a shift to botanical pesticides usage is being encouraged, which is now emerging as one of the prime means of protecting crops and even the environment from pesticide pollution. Replacements are being sougnt, particularly in the realm of botanicals. But replacements should be at least as efficacious as the ones in current use.

Cowpea is one of the important crops being cultivated by man for diverse uses but have various problems that restrict its production, particularly in Nigeria (11, 12). Nematodes constitute one of the major pests of cowpea (13, 14) and the root knot nematode (*Meloidogyne* sp.) is one of the biggest culprits (15, 16). It was in this line that the root knot nematode (*Meloidogyne* sp.) and cowpea were chosen for the study.

An effective replacement, particularly in the realm of botanicals is being sought and this makes it inevitable that a basis should be there for comparison. This study, a yardstick for comparison, seeks to determine the efficacy of carbofuran (furadan) in the control of root knot nematode as it affects growth, yield and food components in cowpea. The outcome of the study will form part of the basis for the formulation of a yard tick for the assessment of a replacement for the pesticide.

Methods

The study was conducted at the University of Ibadan and experiments were in two trials. Seeds of brown variety of cowpea were used. Nematode inoculum was obtained from root knot infected roots of okra (17). Twenty-four (10 liter) pots were filled with sterilized sandy-loam soil. The completely randomized design (CRD) was used and the treatments assigned were : uninoculated, carbofuran inoculated and inoculated control. Each treatment was replicated eight times. Two seeds were planted per pot and

Table 1. Leaf number, leaf area, number of flowers and plant height of cowpea treated with carbofura. Values are means of 8 replicates. Figures with the same letter in the same column are not significantly different at $P = 0.05$ (DMRT).

Treatment	Leaf no.	Leaf area	Flower no.	Plant height (cm)
Uninoculated control	21.625a	58.565a	21.000a	27.050a
Carbofuran inoculate	22.655a	57.298a	20.250a	25.288b
Inoculated control	20.750a	57.415a	22.000a	21.650c
LSD	2.338	6.982	4.702	2.149

Table 2. Pod number, seed number and mean grain weight of cowpea treated with carboforan grain. Values are means of 8 replicates. Figures with the same letter in the same column are not significantly different at $P = 0.05$ (DMRT).

Treatment	Pods/ plant	Seed/ pod	Wt (g)
Uninoculated control	10.750a	7.380a	21.000a
Carbofuran inoculate	10.750a	6.7013a	7.278b
Inoculated control	8.875a	5.695a	5.733b
LSD	3.161	1.593	2.457

thinned to one seedling per pot at the end of the first week. At two weeks after planting, the seedlings were inoculated with 5,000 of the egg extracts per plant (except uni-noculated plants) by digging the soil up to 2—3 cm round the seedlings, exposing the root region. The soil was covered back and moisture was maintained by daily watering. Furadan (3G) obtained from Amens Chemical company, Mokola, Ibadan, was applied at a recommended dose of 3 kg a. i. /ha (active ingredient). The treatments were assessed based on their effect on growth, development, yield and food components of the cowpea plants. Growth parameters, plant height, leaf number, leaf area, and number of flowers were observed fortnightly until maturity, but emphasis was given on 2 week and 8 after planting (WAP). Data were generated from the weeks the treatments were administered to the week of maturity when growth ceased due to the determinate nature of the plant. Analysis of food components was carried out on the seeds from harvested pods. Percentage protein, moisture content fat, carbohydrates and ash content, were analyzed . Data were statistically analyzed using ANOVA and treatment means were separated using least significant difference and Duncan's multiple range test (DMRT) at 5% level of probability (18).

Results and Discussion

At 8 WAP carbofuran treated plants had the highest mean plant height compared to the inoculated control plants (Table 1). There was a significant difference between the carbofuran treated and inoculated untreated plants. Highest mean number of leaves was observed with carbofuran treated plants but this was not significantly different from both inoculated and uninoculated treatments (Table 1). Mean leaf area was highest in uninoculated control plants and least in carbofuran treated plants but no significant difference was observed among all three treatments (Table 1). Number of flowers followed the same trend as no significant difference was observed

Table 3. Shoot and root weight of cowpea treated with carbofora. Values are means of 8 replicates. Figures with the same letter in the same column are not significantly different at $P = 0.05$ (DMRT).

Treatment	Shoot		Root	
	Fresh weight	Dry weight	Fresh weight	Dry weight
Uninoculated control	46.850b	8.093a	22.573ab	3.720a
Carbofuran inoculate	53.12ba	8.104a	27.064a	3.658a
Inoculated control	30.278c	3.891c	18.045b	2.606b
LSD	6.171	1.659	5.501	0.782

Table 4. Nutrient composition of seeds treated with carbofura. Values are means of 8 replicates. Figures with the same letter in the same column are not significantly different at $P = 0.05$ (DMRT).

Treatment	Nutrient (%)				
	Protein	Fat	Mois-ture	Carbo-hydrate	Ash
Uninoculated control	43.34a	1.57a	10.43a	41.01a	3.65a
Carbofuran inoculate	40.71b	3.41a	9.64a	42.59a	3.65a
Inoculated control	38.52c	2.99a	9.235a	40.60a	2.31a
LSD	0.0182	0.0230	0.0230	0.04738	0.0364

among the three treatments. Though carbofuran treated plants showed higher plant height than those of inoculated control, those of uninoculated control showed highest heights. Significant difference occurred among treatments Table 2 shows that at 8 WAP, untreated inoculated plants showed the least number of pods which was significantly different from those of carbofuran treated and uninoculated control, which had the same number of pods. Even though uninoculated control treatment showed the highest number of seeds per pod, no significant difference was observed among the three treatments. The highest mean grain weight per plant was observed with the uninoculated control plants which was significantly different from carbofuran treated and inoculated control treatments. Carbofuran treated plants had the highest mean fresh and dry shoot weight. Significant differences were observed among this and the others with fresh weight; but with dry weight, it was only between carbofuran treated and inoculated control treatment (Table 3). Apart from protein and moisture, carbofuran treated plants showed the highest nutrient contents (Table 4). Significant differences were observed among treatments with protein and carbohydrates. Least content was observed with inoculated control in all treatments.

Treated plants performed better when growth parameters were evaluated. The treated plants had higher increases in plant height leaf number, leaf area, flower number, pods per plant and seed per pod. This observation showed that carbofuran treatment considering reduced attack by *Meloidogyne incognita* (7—9). The difference in performance observed between carbofuran treated plants and uninoculated plants may be as a result of phytotoxicity of carbofuran. The difference observed between carbofuran treated plants and the inoculated control on nutrient content implied that the treated plants had better nutrient supply, normal physiological process and may have suppressed nematode activities (8, 19). The results of the investigation provide some basis for comparison when deciding on a replacement candidate for carbofuran because carbofuran still has superior control quality.

References

1. Reijintjes C., H. Bertus and A. Waters-Bayer. 1992. *Farming for the future.*Macmillan Educ. Ltd., London, UK. 14 pp.
2. Hidetsugu I. 1972. Adverse effect of pesticide pollution. *In* F. Matsumura, G. Boush and D. J. Misato (eds). *Environmental toxicology of pesticides,* Academic Press Inc., London, UK. 563 pp.
3. Lampkin N. 1990. *Organic farming; Agriculture with a future.* Miller Freeman Plc. 715 pp.
4. George K. and G. Lance. 2004. Organic crop production overview. Pp. 1—34. *In* William Paul (ed.) *Fundamentals of sustainable agriculture.* ATTRA Publ.
5. Dhlamini Z., C. Spillane, J. P. Moss, J. Ruane, N. Urquia and A. Sonnino. 2005. Status of research and application of crop biotechnologies in developing countries : Preliminary assessment. Food and Agric. Organ., Rome. 53 pp.
6. Salawu E. O. 1988. Effectiveness of neem extract and ethoprop in controlling root knot nematodes. Bangladesh J. Sugarc. 10 : 75—80.
7. Adesiyan S. O. and T. Badra. 1985. Toxicity evaluation of three nematicides (with or without ammonium sulphate) on root knot nematodes attacking tomato. *Indian J. Nemat.* 16 : 12—15.
8. Akinlade E. A. and S. O. Adesiyan. 1982. The efficacy of carbofuran (furadan) in controlling *Meloidogyne incognita* on okra (*Abelmoschus esculentus). Nigeria J. Pesticides and Agric. Chem.* 1 : 22—27, 31—34.
9. Luc. M., J. Bridge and R. A. Sikora. 1990. *Reflection on nematology in subtropical agriculture.* CAB Int. Inst. Parasit. London, UK.
10. Tanimola A. A. and S. O. Adesiyan. 2006. Effect of carbofuran (furadan) and *Aloe vera* (L.) Burm Gel on the growth and yield of root-knot infected cowpea (*Vigna unguiculata* (L) Walp). *Environ. and Ecol.* 24 : 792–795.
11. Summerfield R. J., F. R. Minchin, E. A. Roberts and P. Hadley. 1983. Cowpea. Pp. 249—330. *In Potential productivity of field crops under different environments.* IRRI, Los Banes, Phillipines.
12. Fageria N. K., V. V. Baligar and C. A. Jones. 1991. *Growth and mineral nutrition of field crops.*Marcel Deckhez Ina. 301—318 pp.
13. Olowe T. 1992. Economic importance of nematodes of legume and cereal crops in Nigeria. Pp. 61—91. *In* B. fawole O. A. Egunjobi. S. O. Adesiyan, J. O. Babalola and A. A. Idowu (eds). *Proc. first regional symposium on the biology and control of nematode pest of food crops in Africa.*
14. Van der Berg. E., D. Mainportr, S. Kandy, B. N'Diape and P. Cadet. 2001. Plant parasitic nematodes associated with maize—bean intercropping systems in Kenya. *African Pl. Prot.* 7 : 81—84.
15. Olowe T. 1976. Research work on root-knot nematodes at the National Research Institute. Pp. 15—19. *In Proc. the Irap Res. Planning Conf. on root-knot nematodes*, *Meloidogyne* spp. 7—11 Jun. IITA Ibandan, Nigeria.
16. Richard A. A. and G. Nicholas. 1990. *Nematode parasite of pod legumes. Plant parasite nematodes in sub-tropical and tropical agriculture.* CAB Int. , Inst.

Parasit., London, UK.
17. Hussey R. S. and K. R. Barker. 1973. A comparison of methods of collecting inocula for *Meloidogyne* species including a new technique. *Pl. Dis. Rep*. 57 : 1025—1028.
18. Gomez K. A. and A. A. Gomez. 1984. *Statistical procedures for agricultural research*. John Wiley and Sons. 2nd edition. 680 pp.
19. Devi G. and P. Das. 1994. Estimation of losses in okra due to root-knot nematodes, *M. incognita* under field conditions. *J. Agric. Sci. Soc. of North East India* 7 : 109—110.