Journal Of Agriculture & Ecosystem Management
Publishing Real Time
Journal homepage: www.jonages.com
JOURNAL OF AGRICULTURE AND ECOSYSTEM MANAGEMENT

Evaluation of Efficacy of Chlorpyrifos 10G and Mancozeb 80% WP For The Control of Pests, Growth And Yield Of Cucumber (*Cucumis Sativus*) In Enugu Area Southeastern Nigeria

Awere, S. U[1] Omeje, T.E.[2] and Chukwu, C.[1]

[1] *Department of Agronomy and Ecological Management Enugu state University of Science and Technology, P.M.B. 01660 Enugu Nigeria.*
[2]*Department of Agricultural Technology, Enugu State Polytechnic, Iwollo, Enugu state Nigeria.*

ARTICLE INFO

Article history: Received December 4, 2022
Received in revised form December 11, 2022
Accepted December 27, 2022
Available online February 10, 2023

Keywords:

Cucumber (*Cucumis sativus),*
Chlorpyrifos
Mancozeb
Interaction effect
Main effect.

Corresponding Author's E-mail Address:
aweresu@yahoo.com
https://doi.org/10.36265/jonages.2022.020202
ISSN– Online **2736-1411**
Print **2736-142X**

ABSTRACT

A field experiment that evaluated the efficacy of chlorpyrifos 10G and Mancozeb 80%WP for the control of pest, growth and yield of cucumber (*Cucumis Sativus)* in Enugu Area Southeastern Nigeria was conducted at the Faculty of Agriculture and Natural Resources Management Teaching and Research Farm, Enugu State University of Science and Technology, during the 2021 planting season, between July and September. The experiment was carried out using a 4x3 factorial in a completed randomized design (CRD) with twelve (12) treatment combinations replicated three (3) times. Parameters taken were; number of flowers per plant at 40days after planting (40DAP) and 60days after planting (60DAP), Vine length (cm), number of leaves per plant 50DAP, number of plants (%) infested by Aphids and black Ants%, number of dead plants(%), number of fruits per plant, number of marketable fruits per plant and fruit yield (kg/pot). The result of the experiment showed that main effect of chlorpyrifos 10G (factor A) was not significant ($P \leq 0.05$) on number of flowers 40DAP and vine length (cm) whereas there was significant ($P \leq 0.05$) main effect of chlorpyrifos on the number of plants(%) infested by Aphids and black Ants, number of leaves per plant 50 DAP, number of dead plants(%) 40 DAP, number of fruits per plant, number of marketable fruits per plant and fruit yield (kg/pot). Also, there was non-significant ($P \leq 0.05$) effect of mancozeb 80% WP (factor B) on the following parameters; number of flowers 40 DAP, vine length (cm), number of leaves per plant 50 DAP, number of dead plants(%) 40 DAP, number of marketable fruits per plant and fruit yield (kg/pot). Furthermore, there was significant ($P \leq 0.05$) interaction effect of chloryrifos 10G and mancozeb 80% WP combination on all the parameters taken except the vine length (cm).

1.0 Introduction

Cucumber (*Cucumis sativus)* is one of the most important exotic vegetables cultivated in Nigeria and one of the best food for the body's overall health (Natural news, 2014) Umeh and Ujiako 2018). Enhanced productivity depends on the efficient use of farm resources (Adeyemo and Kuhlmann 2009). The crop is a valuable conventional anti–oxidant source, rich in vitamins B6, C and K, beta carotene, Flavonoids, Manganese and Silicon (Natural news 2014).

Bulk proantioxidantducanti–oxidanttion from Jos, Plateau State sustains demand from Southern Nigeria, where these salad vegetables augment high intake of carbohydrates, hence high prices (Ayoola and Adeniran 2006). In Nigeria, Cucumber production and market rates had not been well determined. Significant yield may be quantified by factors such as fruit quality, size or prices at the market or export gates, determined by season (Okonmah 2011). Furthermore, the market standard may be less rigid but malformed fruits, small sizes or those with pest damage symptoms are not marketable. Quesada *et al.* (1995), reported that cucurbitacin and other phytochemicals induction can have a high impact, especially those associated with pests that possess high energy costs. The blend of positive and negative feedback associated with these cultivar differences may account for the difficulty in giving significant results on the dynamics of the insect-plant relationship. The striped and spotted Cucumber beetles (A *calymna vittatum* F., and *Diabrotica,* H.B, share status as Economic pests of Cucumber production and notorious challenges of control. These pests primarily account for up to 10% of annual synthetic pesticide application on conventional forms, contributing to over 35% confirmed pesticide residues on Cucumbers (Punzie *et al* 2005)

According to Hoffman et al. (2003) and McGuire and Agrawal (2005), Cucurbits produce extremely bitter cucurbitacin compounds that enhance herbivory.

Greatest yield losses occur when host crops are small with only cotyledon leaves or few true leaves, while herbivory on older plants and reproductive structures and fruits may impact heavily on yield through vectoring bacterial wilt (*Erwinia tracheiphila)* diseases (Hoffman et al. 2000), Diver and Hinmann (2008), (Bessin 2010). Pests cause yield losses between 5 to 30% (Onovo 1992) while 70% of the disease effect may lead to zero yield, Jeffrey (2001), Synder, (2012), Erika *et al.* (2015). Hoards of Cucumber beetles recorded in most studies exceed the one beetle per plant economic threshold in most cultivars in most experimental fields (Diver and Hinmann 2008)

Chlorpyrifos is an organophosphate insecticide, acaricide and miticide used primarily to control foliage and soil-borne insect pests. In August 2021, EPA released a final rule revoking all "tolerances" for chlorpyrifos, which establish an amount of a pesticide that is allowed on food. Chlorpyrifos has been widely used for decades to control pests in maize, soybeans, tomatoes, pepper, Garden eggs, fruit trees, rice, yam, cucumber, watermelon etc in Nigeria. Again, it has been in use for ticks and ticks control on dogs and kill termites and other house hold insect pests

Farmers use Mancozed against cucumber pests, such as *Perono spora* in large amounts without consideration of potential chronic human health hazards resulting from its accumulation in food and fruits. Considering the necessity of food for humans and the importance of fruit in daily diet, as well as the determination of pesticide residues in food and fruit as mandated by WHO and FAO, the residues of benomyl and mancozeb were measured. Hence this study was aimed at evaluating the correct levels of chlorpyrifos 10G and mancozeb combinations for the control of pests, growth and yield of cucumber (*cucumis sativus*).

2.0 Materials and Methods

A field experiment that evaluated the efficacy of chlorpyrifos IOG and Mancozed 80%WP for the control of pests, growth and yield of Cucumber (*Cucumis sativus*) in the Enugu Area of Southeastern Nigeria, was carried out at the Faculty of Agriculture and Natural Resources Management's Teaching and Research Farm of Enugu State University of Science and Technology, Enugu during the 2021 growing season between July and September. The University lies between latitude $06^{0}50'$– $06^{0}57'$and longitude $07^{0}15'$E – $07^{0}18'$E with a mean elevation of 450m above sea level and an annual rainfall of 1800 to 2100mm. The soil is of shale parent materials and is classified as typic paleudult and is sandy clay textural class (Anikwe et al, 2005). The area for the experiment was cleared with a cutlass and traditional hoe.

2.1 Experimental Design

The experiment was carried out using 3x4 factorial in a complete randomized design (CRD) with twelve (12) treatment combinations replicated three (3) times. Each experimental pot (replicate) contained 10kg soil on which a pair of cucumber seeds was planted.

2.2 Treatments

Twelve (12) treatment combinations used were;

0g chlorpyrifos 10G + 0g Mancozeb 80%WP (A_1B_1)
0g chlorpyrifos 10G + 5g Mancozeb 80%WP (A_1B_2)
0g chlorpyrifos 10G + 10g Mancozeb 80%WP (A_1B_3)
0g chlorpyrifos 10G + 15g Mancozeb 80%WP (A_1B_4)
5g chlorpyrifos 10G + 0g Mancozeb 80%WP (A_2B_1)
5g chlorpyrifos 10G + 5g Mancozeb 80%WP (A_2B_2)
5g chlorpyrifos 10G + 10g Mancozeb 80%WP (A_2B_3)
5g chlorpyrifos 10G + 15g Mancozeb 80%WP (A_2B_4)
10g chlorpyrifos 10G + 0g Mancozeb 80%WP (A_3B_1)
10g chlorpyrifos 10G + 5g Mancozeb 80%WP (A_3B_2)
10g chlorpyrifos 10G + 10g Mancozeb 80%WP (A_3B_3)
10g chlorpyrifos 10G + 15g Mancozeb 80%WP (A_3B_4)

2.3Treatments application

Treatments were applied weekly starting from one week after germination till harvest using a hand operated sprayer.

2.4 Data Collection

Data were collected on the number of flowers per plant 40DAP and 60DAP, Vine length(cm), number of leaves per plant 50 DAP, number of plants(%) infested by Aphids and black Ants, number of dead plants(%) 40 DAP, number of fruits per plant, number of marketable fruits per plant and fruit yield (kg/pot)

3.0 Results

The result of the experiment showed a non-significant ($P \leq 0.05$) main effect of chlorpyrifos 10G on the number of flowers per plant 40DAP, so also the main effect of Mancozeb and interaction effect of chlorpyrifos and mancozeb combinations on the number of flower per plant 40DAP. In contrast, there was significant chlorpyrifos ($P \leq 0.05$) main effect on the number of flower per plant 60DAP, so also was the interaction effect of chlorpyrifos and Mancozeb combinations on the number of flowers per plant 60DAP; whereas the same experiment showed non significant ($P \leq 0.05$) main effect of Mancozeb 80%WP on the number of flowers per plant 60DAP (Table 1).

On vine length (cm), the result of the experiment showed a non-significant ($P \leq 0.05$) effect of chlorpyrifos, mancozeb and the interaction of a combination of the two chemicals (Table 1).

Furthermore, there was a significant ($P \leq 0.05$) effect of chlorpyrifos and interaction of chlorpyrifos and mancozeb combinations on the number of leaves per plant 50 DAP, whereas there was a non-significant ($P \leq 0.05$) effect of mancozeb on the number of leaves per plant. Again, the result of the experiment showed a significant ($P \leq 0.05$) effect of chlorpyrifos and interaction of chlorpyrifos and mancozeb combinations on the number of plants (%) infested by Aphids and black Ants, whereas there was a non-significant ($P \leq 0.05$) effect of mancozeb on the number of plants (%) infested by Aphids and Black Ants. Also, the result showed a significant ($P \leq 0.05$) effect of chlorpyrifos and mancozeb on the number of dead plants (%) 40DAP, so also was the interaction of chlorpyrifos and mancozeb combinations on the number of dead plants(%) (Table 2).

The result of the experiment further showed a significant ($P \leq 0.05$) effect of chlorpyrifos and also interaction effect of chlorpyrifos and mancozeb combinations on the number of fruits per plant, number of marketable fruits per plant, and fruit yield (Kg/pot), whereas the main effect of mancozeb was non-significant on the number of fruits per plant, number of marketable fruits per plant and fruit yield (kg/Pot).

Table 1. Effect of chlorpyrifos 10G and Mancozeb 80% WP combination on the number of flowers per plant 40DAP, 60 DAP and Vine length (cm)

Treatment	Number of flowers per plant 40DAP	Number of flowers per plant 60 DAP	Vine length (cm)
0g Chlorpyrifos + 0g Mancozeb	0.88	19.30	5.52
0g Chlorpyrifos + 5g Mancozeb	1.14	22.70	7.70
0g Chlorpyrifos + 10g Mancozeb	1.73	21.70	7.03
0g Chlorpyrifos + 15g Mancozeb	1.52	13.00	5.97
5g Chlorpyrifos + 0g Mancozeb	0.71	4.70	6.53
5g Chlorpyrifos + 5g Mancozeb	0.94	8.00	4.60
5g Chlorpyrifos + 10g Mancozeb	1.52	15.30	8.35
5g Chlorpyrifos + 15g Mancozeb	1.35	13.30	5.67
10g Chlorpyrifos + 0g Mancozeb	1.59	11.00	5.45
10g Chlorpyrifos + 5g Mancozeb	0.71	8.00	4.72
10g Chlorpyrifos + 10g Mancozeb	1.18	2.30	4.12
10g Chlorpyrifos + 15g Mancozeb	1.20	17.70	4.92
F-LSD 0.05 (AB)	NS	17.80	NS

Table 2. Effect of chlorpyrifos 10G and Mancozeb 80%WP combinations on the number of leaves per plant 50DAP, number of plants (%) infested by Aphids and black Ants and number of dead plants(%) 40DAP

Treatment	Number of Leaves per plant 50DAP	Number of plants(%) infested by Aphids and black Ants	Number of dead plants 40DAP
0g Chlorpyrifos + 0g Mancozeb	27.00	10.03	3.81
0g Chlorpyrifos + 5g Mancozeb	30.00	10.03	0.71
0g Chlorpyrifos + 10g Mancozeb	38.30	10.03	0.71
0g Chlorpyrifos + 15g Mancozeb	28.00	10,03	2.84
5g Chlorpyrifos + 0g Mancozeb	22.00	0.71	0.71
5g Chlorpyrifos + 5g Mancozeb	17.70	0.71	0.71
5g Chlorpyrifos + 10g Mancozeb	27.70	0.71	0.71
5g Chlorpyrifos + 15g Mancozeb	25.00	0.71	2.84
10g Chlorpyrifos + 0g Mancozeb	22.70	0.71	3.81
10g Chlorpyrifos + 5g Mancozeb	13.30	0.71	10.02
10g Chlorpyrifos + 10g Mancozeb	15.30	0.71	3.81
10g Chlorpyrifos + 15g Mancozeb	15.70	0.71	10.02
F-LSD 0.05 (AB)	17.67	0.00	5.37

Table 3. Effect of Chlorpyrifos 10G and Mancozeb 80%WP combinations on the number of fruits per plant, number of marketable fruit per plant and fruit yield (kg/pot)

Treatment	Number of fruits per plant	Number of marketable fruits per plant	Fruit yield (Kg/Pot)
0g Chlorpyrifos + 0g Mancozeb	1.77	2.11	1.26
0g Chlorpyrifos + 5g Mancozeb	1.39	1.90	1.46
0g Chlorpyrifos + 10g Mancozeb	2.19	1.34	1.25
0g Chlorpyrifos + 15g Mancozeb	1.49	1.91	0.93
5g Chlorpyrifos + 0g Mancozeb	1.56	1.27	1.12
5g Chlorpyrifos + 5g Mancozeb	1.62	1.18	0.92
5g Chlorpyrifos + 10g Mancozeb	1.79	1.05	1.05
5g Chlorpyrifos + 15g Mancozeb	1.65	1.34	1.15
10g Chlorpyrifos + 0g Mancozeb	1.00	0.88	0.81
10g Chlorpyrifos + 5g Mancozeb	0.88	0.71	0.71
10g Chlorpyrifos + 10g Mancozeb	1.25	1.65	0.88
10g Chlorpyrifos + 15g Mancozeb	1.00	0.71	0.73
F-LSD 0.05 (AB)	1.06	1.09	0.52

4.0 Discussion

At 40 DAP, the result of the experiment showed that the number of flowers per plant reduced from 1.73 to 1.52 when 10g of mancozeb was applied alone and when it was combined with 5g of chlorpyrifos. Again at 60 DAP, the number of flowers per plant also reduced from 22.70 to 8.00 when 5g of mancozeb was applied alone and when it was combined with 5g of chlorpyrifos. This result may therefore suggest that the application of insecticide (chlorpyrifos) is not necessary if the aim is to increase flower production as a component of yield in cucumber. That is, chlorpyrifos had a negative interaction effect with mancozeb in flower production of cucmber.

The result of the experiment showing non significant ($P \leq 0.05$) interaction effect of chlorpyrifos and mancozeb on vine length may suggest that a farmer whose aim is to produce cucumber as forage crop may not apply both chlorpyrifos and mancozeb because vine length correlates with the number of leaves it may bear/contain (Table 1). This result agreed with Awere and Omeje (2019) observed that insecticide–fungicide combination is not needed in watermelon production as a forage crop.

At 50DAP, the result of the experiment showing a reduction of number of leaves per plant from 38.30 to 27.70 when 10g of mancozeb was applied alone and when it was combined with 5g of chlorpyrifos may therefore suggest that chlorpyrifos application is not needed by farmers who produce cucumber as forage crop. The result of the experiment showing a reduction in the number of plants infested by aphids and black ants from 10.03 to 0.71 when chlorpyrifos was added to mancozeb indicated that mancozeb is not needed in controlling insect pests and Ants in cucumber production.

The result of the experiment showing a significant ($P \leq 0.05$) interaction effect of chlorpyrifos and mancozeb combination indicated that application of insecticide and fungicide combination is needed in order to control the number of dead Cucumber plants in farms (Table 2). The result of the experiment showing a significant ($P \leq 0.05$) interaction effect of chlorpyrifos and mancozeb combinations on the number of fruits per plant, number of marketable fruits per plant and fruit yield (kg/pot) is a clear indication that application of both insecticide and fungicide is necessary in order to improve number of fruits per plant, number of marketable fruits per plant and fruit yield.

5.0 Conclusion and recommendation

Cucumber farmers in Enugu area of Southeastern Nigeria whose aims are to improve flower production as a component of yield should not include insecticide in fungicide application. Again cucumber farmers in Enugu area, Southeastern Nigeria whose interests are in the production of forage should not waste resources on insecticide or fungicide application in order to improve the number of leaves per plant. In cucmber production, farmers in Enugu area are advised not to add mancozeb to insecticide in an attempt to control insect pests and black ants.

Farmers in Enugu Area are advised to apply both insecticide and fungicide in order to reduce the number of Cucumber crops that die in farms. Also, cucumber farmers in Enugu Area are advised based on the result of this research to apply both insecticide and fungicide in order to improve yield and numbers of marketable fruits per plant.

References

Adeyemo, R. and Kuhlmann, F. (2009). Resource use efficiency in urban agriculture in south-Western Nigeria.*Tropicultura,* 27(1): 45-53

Anikwe, M. A. N., Onyia, V. N., Ngwu, O. E. and Mba, C. N. (2005). A textbook on Ecophysiology and Cultivation practices of arable crop. New Generation Ventures Limited Enugu Southeastern Nigeria P.71

Awere, S. U. and Omeje, T. E. (2019). Effect of different rates of insecticide and fungicide combination on the growth and yield of watermelon (*Citrus lanatus*) in Enugu Area, Southeastern Nigeria. *Journal of Experimental Research* Vol 7(2) pp38-44.

Ayoola, O. T. and Adeniran, O. N., (2006). Influence of poultry manure and NPK fertilizer on yield and yield components of crops under different cropping systems in South-West Nigeria. *African Journal of Biotechnology. 5:1336-1392.*

Bessin, R. (2010). Cucumber beetles, ENTFACT-311. College of Agriculture Food and Environment, University of Kentucky, Lexington, KY.

Clarke, S. R., and Strom, B. L. (2011) Use of semiochemicals for Southern pine beetle infestation management and resource protection; In R. N. Coulson and K. D. Klepzig (Eds). Southern Pine 286 bio-systems engineering, 129, Asheville, NC. 381-397.

Diver, S. and Hinman, T. (2008). Cucumber beetles: organic and bio-rational integrated pest management. http://attra.neat.org/attra.pub/summaries/ summary Pp133

Erika, S. R. Jean, C. B., Mark A. and Laura, C. N. (2015). Bacterial wilt of cucurbits. *Plant disease* 99(5):564-574pp.

Hoffman, M. P., Ayayapath, R., Kirkwyland, J. J. (2000). Response of pumpkin and winter squash to simulated Cucmber beetle (*Coleopteran chrysomelidae*) feeding injury. *Economic Entomology* 93(1): 136-140.

Hoffman, M. P., Ayayapath, R., Kirkwyland, J. J. (2003). Yield response of pumpkin and winter squash to stimulated Cucmber beetle feeding injury *Entomology,* 93 (1):136-140.

McGuire, R. and Agrawal, a. A. 2005. Trade-offs between the shade-avoidance response and plant resistance to herbivores. Test with mutan *Cucumis sativus Functional Ecology*, 19:1025-1031.

Natural news (2014), Ten Health Benefit of Cucumbers. http://www.matural news.com/ 036769cucumberhealth-benefitsrehydration.html

Okonmah, L. U. (2011) effect of different types of staking and their cost effectiveness on the growth yield and yield components of Cucumber (*Cucumis sativus*). *International Journal of Agric Science* 1(15):292-295.

Onovo, J. A. (1992). Survey of disease incidence and seventy of cucurbitaceous crops in the southeast." Annual cropping Scheme Report. Vegetable Research Programme. National Horticultural Resarch Institute, Mbata 47p.

Punzi, J. S., Lamont, M., Haynes, D., Epstein, R. L. (2005). USDA Pesticide data program: Pesticide residue on fresh and processed fruits and vegetables, grains, meats, milk and drinking water. *Outlook on pest management.* 131-137

Quesada, M., Bollmen, K. Stephenson, A. G. (1995). Leaf damage decreases pollen production and hinders pollen performance in *Cucurbita taxana. Ecology* 76(2):437-443.

Synder, W. (2012). Managing cucumber beetles in an organic farming system. Cornell University Cooperative extension publication 28pp.

Umeh, O. A. and Ujiako, F. O. (2018). Limitation of cucumber (*Cucumis sativus* L.). Production for Nutrition security in Southeast Nigeria. *International Journal of Agri-*