



Impact of Pre-Planting Weed Control on Diversity Nematodes in the Rhizosphere of Corn Plants

Elly Liestiany¹, Muhamad Indar Pramudi²

Plant Protection Study Program, Department of Plant Pests and Diseases, Faculty of Agriculture, Lambung Mangkurat University

Corresponding author: muhammadindarpramudi@ulm.ac.id

Orcid: <https://orcid.org/0000-0003-1058-6423>

<https://orcid.org/0000-0003-1085-5873>

Received: 26 Jun 2025; Received in revised form: 25 Jul 2025; Accepted: 03 Aug 2025; Available online: 10 Aug 2025

©2025 The Author(s). Published by Infogain Publication. This is an open-access article under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

Abstract— This study aims to determine the impact of several pre-planting weed control methods on the diversity of plant parasitic nematode species and their population levels in the rhizosphere of corn crops. The research was conducted from March to June 2024. On farmer's land in Binuang, Tapin Regency. The land observed is land No tillage + glyphosate, No tillage +sulphosate, Minimal tillage (on tractor), Minimal tillage (on tractor) + Oxadiazon, Minimal tillage (on tractor) + Butachlor, Conventional tillage (hoeing), Control (natural / no tillage). Observations based on the results of soil samples taken when the corn crop was harvested. The soil samples were Extraction using a modified Baerman funnel (Dropkin 1991). Results of extraction of parasitic nematodes found identified based on morphological characteristics up to genus. Identification of nematodes refers to the books: Pictorial Key to Genera of Plant Parasitic Nematodes (Maiet al.1975). The results of research on the impact of pre-planting weed control on nematode diversity from corn rhizosphere samples found 16 nematode genera, *Criconemella*, *Ditylenchus*, *Hemicycliophora*, *Hemicycl*, *Heterodera*, *Hirschmanniella*, *Longidorus*, *Meloidogyne*, *Paratylenchus*, *Pratylenchus*, *Psilenchus*, *Rotylenchus*, *Trichodorus*, *Tylenchorhynchus*, *Tylenchulus*, *Tylenchus*, and there are variations in the genus and population of nematodes in each soil sample.



Keywords— Genus Nematoda, Corn Diversity, Control, Soil

I. INTRODUCTION

Nematodes are soil fauna that play a role in the release of nutrients mobilized by soil microflora, are involved in the decomposition of organic matter, mineralization of nutrients, regulation of soil biota population density, and occupy a very important position in the food chain (Neher, 2001, Biswal, 2022). Some nematodes are parasitic to plants, but some are nonparasitic to plants.

Plant-parasitic nematodes are an important type of pathogen, causing significant losses to crops in agricultural production systems in tropical and subtropical regions. Losses can reach 20-25%, sometimes even causing complete crop failure (Ogbuji 1987, Lucet al1995). Nematode attacks result in a reduction in normal root function, resulting in a reduction in the transport of

nutrients to the aboveground plant tissue (Dropkin 1991). According to Wawan and Junaidi (2009), if a plant is heavily infected by nematodes, the normal root system will be reduced and cause the vascular bundle tissue to be completely disrupted, resulting in the plant wilting easily, especially in dry conditions, and the plant often becomes stunted, growth is inhibited and experiences chlorosis.

Non-parasitic plant nematodes are free-living nematodes in the soil and are not pathogenic to plants. These nematodes live and reproduce in organic matter. Nematodes are relatively easy to identify in soil organisms. Nematodes have a permeable cuticle, which allows them to respond to pollutant reactions (Neher, 2001). Some nematodes exhibit inactive resistance when the environment is unsuitable for growth. Nematodes have a relatively short generation time compared to other soil

organisms, making them more responsive to environmental changes.

Nematodes require food, oxygen, water, and a suitable habitat for their development. Several pre-planting practices, such as soil cultivation, fertilization, and pesticide application, will impact nematodes. Pre-planting weed control using various methods will impact the presence of nematodes in the plant's rhizosphere.

The aim of this study was to determine the impact of several pre-planting weed control methods on the diversity of nematode species and their population levels in the rhizosphere of corn plants.

II. RESEARCH METHODS

Sampling

The study was conducted using direct exploration. Soil samples were taken from farmers' fields in Binuang District, Tapin Regency. The study period was from February to July 2024. Four samples were randomly selected for each treatment plot. Soil samples were collected after harvest, at a depth of 0-20 cm, or in the rhizosphere. The soil samples were collected using a small shovel and then placed in plastic bags.

Nematode extraction

Extraction was performed using a modified Baerman funnel (Dropkin 1991). 100 grams of soil was taken from the rhizosphere of corn plants E dissolved in one liter of distilled water. The soil solution was shaken on an orbital shaker for 15 minutes, then 100 ml of the soil

solution was slowly poured into a filter paper-lined filter attached to the funnel and left to stand for 24 hours.

Nematode Identification

The extracted suspension was poured into a petri dish and observed under a stereomicroscope. Nematode identification was based on morphological and morphometric characteristics, body shape and size. The morphological characteristics used as parameters for identification were head shape, stylet shape, knob shape, tail shape, and the presence or absence of bursae. Morphometric identification was performed by measuring and comparing body length, stylet length, and the distance or location of the vulva within the female's body length.

Identification of nematodes refers to the books: Pictorial Key to Genera of Plant Parasitic Nematodes (Mait *et al.* 1975), Dan Classification and Key to their Identification (Castillo *et al.* 1972).

Population Calculation

Nematode population density was calculated by taking a 10 ml soil suspension sample from a total of 100 ml. The suspension was poured into a counting dish and observed under a stereomicroscope. Observations for each soil sample were repeated three times.

III. RESULTS AND DISCUSSION

The study identified 16 nematode genera in soil samples from the rhizosphere of corn plants. There was variation in the genus and nematode populations in each soil sample. The results of the observations are shown in Table 1.

Table 1. Results of observations of the genus and population of nematodes in each soil sample.

No	Types of nematodes	Population of every 100 grams of soil sample						
		A	B	C	D	E	F	K
1	<i>Criconemella</i>			1	4	5	16	1
2	<i>Ditylenchus</i>	3	13	3	1	5	10	
3	<i>Helicotylenchus</i>	1	1	25	5	33	69	1
4	<i>Hemicycliophora</i>			3				
5	<i>Heterodera</i>	1	5		2	9	8	3
6	<i>Hirschmanniella</i>	2	3	1	3	9	3	
7	<i>Longidorus</i>						8	
8	<i>Meloidogyne</i>	10	25	17	1	46	17	8
9	<i>Paratylenchus</i>						1	
10	<i>Pratylenchus</i>	32	26	45	12	54	58	16
11	<i>Psilenchus</i>				1	1		

12	<i>Rotylenchus</i>	1	4	2		10	5	8
13	<i>Trichodorus</i>					1		
14	<i>Tylenchorynchus</i>					3	2	
15	<i>Tylenchulus</i>	11	4	8	8	27	19	13
16	<i>Tylenchus</i>	36	20	26	4	56	45	1

Information : Treatment:

- A. No tillage + glyphosate
- B. Without soil treatment + sulphosate
- C. Minimal tillage (on tractor)
- D. Minimal tillage + Oxadiazon
- E. Minimum tillage (on tractor) + Butachlor
- F. Conventional soil cultivation (hoeing)
- G. Control (natural / no tillage)

In the rhizosphere of corn plants planted on land without tillage (control), eight nematode genera were found, were found, *Meloidogyne* (8 tails/100 g soil), *Rotylenchus* (8 tails/100 g soil), *Tylenchulus* (13 heads/100 g soil), *Pratylenchus* (16 heads/100 g soil), *Heterodera* (1 head/100 g soil), *Criconemella* (1 head/100 g soil), *Helicotylenchus* (1 tail/100 g soil), in *Tylenchus* (1 tail/100 g of soil). The nematode population is relatively low, this is due to the lack of soil cultivation before planting, resulting in a more compact soil structure. Nematodes are soil biota that require oxygen to breathe and require sufficient space to move and reproduce. The nematode population in agricultural land is influenced by several interrelated factors. Amir *et al.* (2024) stated that the cultivation methods used by farmers also contribute to the nematode population. This is in line with research by Nisa *et al.* (2022) which states that changes in edaphic and ecological factors of the environment can affect the density, frequency, and diversity of nematodes.

Conventional soil cultivation (hoeing) affects the presence and increase of nematode populations. This is evident in the increase in populations of the genus *Meloidogyne*, *Tylenchulus*, *Pratylenchus*, *Heterodera*, *Criconemella*, *Helicotylenchus*, And *Tylenchus*. Except *Rotylenchus* whose populations decreased slightly with hoeing. Hoeing increases the amount of oxygen entering the soil. Furthermore, the loose soil pores facilitate nematode movement and reproduction.

No-till treatment accompanied by glyphosate application significantly increased the nematode population. *Pratylenchus* and *Tylenchus*, *Meloidogyne* slightly increased, while other nematodes whose development was inhibited were *Ditylenchus*, *Helicotylenchus*, *Heterodera*, *Hirschmanniella*, And *Rotylenchus*, Nematode

development is inhibited because glyphosate can inhibit the population of plant parasitic nematodes in several types of corn plants.

No-till treatment is accompanied by a sulphosate significant increase in nematode population *Ditylenchus*, *Meloidogyne*, *Pratylenchus*, dan *Tylenchus*. Genus *Helicotylenchus*, *Heterodera* and *Hirschmanniella* its development is stagnant, while *Rotylenchus* and *Tylenchulus* growth is stunted.

Minimal tillage with a tractor before planting had a positive impact on several nematodes. Significant population increases were observed in the genus *Helicotylenchus*, *Meloidogyne*, *Pratylenchus*, and *Tylenchus*.

Minimal tillage with a tractor carried out before planting and accompanied by the application of oxadiazon caused a decrease in the population of the genus *Heterodera*, *Meloidogyne*, *Pratylenchus*, and *Tylenchulus*. This treatment does not inhibit the development of the genus population. *Criconemella*, *Ditylenchus*, *Helicotylenchus*, *Hirschmanniella*, *Psilenchus*, and *Tylenchus*.

Minimal tillage with a tractor before planting, accompanied by the application of Butachlor, had a positive effect on nematode population growth. The population increase was significant, particularly in the genus *Helicotylenchus*, *Meloidogyne*, *Pratylenchus*, *Tylenchulus* and *Tylenchus*.

In this corn plantation there are four dominant nematode genera, *Helicotylenchus*, *Meloidogyne*, *Pratylenchus* and *Tylenchus*.

Soil cultivation with a hoe or tractor will increase nematode populations. The application of butachlor does not inhibit the development of these four nematodes, but oxadiazon has a negative effect. Glyphosate and sulphosate only hinders development *Helicotylenchus*, but does not inhibit population growth *Meloidogyne*, *Pratylenchus* and *Tylenchus*.

According to Mulyadi (2009), *Helicotylenchus*, *Meloidogyne* and *Pratylenchus* are parasitic nematodes in corn plants, so it can be seen in this study that the three genera of nematodes are developing well.

Meloidogyne spp. have a very broad host range. These nematodes are found in more than 3,000 plant species worldwide, including legumes, cereals, vegetables, fruit trees, ornamentals, woody plants, shrubs, and grasses. Some species generally have a specific host range. More than one species may be found in a habitat. *Meloidogyne* (Shurtleff *et al.* 2000).

Tylenchus is a parasitic nematode in chickpeas (Luc, Sikora & Bridge (1995), but in this study *Tylenchus* can develop well. *Tylenchus* has a wide host range and most of it is unknown. *Tylenchus davaine* often found associated with moss, where as *Tylenchus costatus* found on swollen plant roots.

Criconebella is a parasitic nematode in corn plants (Mulyadi 2009). In natural soil, only one nematode of the genus was found. *Criconebella* Each 100 grams of soil. Tillage increased the population to 16 individuals per 100 grams of soil, but growth was inhibited by the application of the herbicides butachlor and oxadiazon.

In the land applied with glyphosate and sulphosalt, no nematodes of the genus were found. *Criconebella*. The nematodes found in this study can cause damage to corn roots, especially in less fertile or poorly structured soils. Therefore, controlling parasitic nematodes through proper soil management is crucial to effectively reduce crop losses.

IV. CONCLUSION

Based on the results of observations on the impact of pre-planting weed control on the diversity of nematodes from corn rhizosphere samples, 16 genera were found, *Criconebella*, *Ditylenchus*, *Hemicyclophora*, *Heterodera*, *Hirschmanniella*, *Longidorus*, *Meloidogyne*, *Paratylenchus*, *Pratylenchus*, *Psilenchus*, *Rotylenchus*, *Trichodorus*, *Tylenchorhynchus*, *Tylenchulus*, *Tylenchus* nematodes and there are variations in the genus and population of nematodes in each soil sample.

REFERENCES

- [1] Amir F. Wiludjeng W. Noni R and Latief I. 2024. *Nematodes associated with rice plant (Oryza sativa L.)* In Sumbergepoh Village, Lawang, Malang Regency. *Journal of Tropical Agrotech* 12(4): 757–768.
- [2] Biswal, D. 2022. Nematodes as ghosts of land use past: elucidating the roles of soil nematode community studies as indicators of soil health and land management practices. *Applied Biochemistry and Biotechnology*. 194(5):2357–2417.
- [3] Bridge, J., D. L. Coyne and J. K. Kwoseh. 2005. *Nematode Parasitic of Tropical Root and Tuber Crops (Excluding Potatoes)*. In M, Luc., R. A. Skor and J. Bridge (eds). *Plant Parasitic Nematodes in Subtropical and Tropical Agriculture*. 2nd edition. CABI Publishing. Cambridge USA. P. 221-259.
- [4] Bongers, T., R. Alkemade, dan G. W. Yeates. 1991. Interpretation of disturbance-induced maturity decrease in marine nematode assemblages by means of the maturity index. *Marine Ecology Progress Series*. 76: 135-142.
- [5] Burhanuddin. 2014. The Effect of Soil Tillage and Herbicide Systems on Nutrient and Organic Material Loss Due to Erosion in the Integrated Field Laboratory of the Faculty of Agriculture, University of Lampung. (Thesis). University Lampung. Lampung. 42 pages.
- [6] Coyne, D.I. 1994. Nematode Pests of Cassava. *African Crop Science Journal* 2(4): 355-359.
- [7] Dropkin, V.H. 1996. Introduction to Plant Nematology. Translated by Supratoyo: Gadjah Mada University Press. Yogyakarta.
- [8] Fitriyah WM. Swibawa IG and Solikhin. 2016. The Effect of Tillage Systems and Weed Management on the Feeding Groups of Soil Nematode Communities in Corn Plantations (*Zea mays L.*) In the Integrated Field Laboratory of the Faculty of Agriculture, University of Lampung *J. Tropical Agrotechnology*. 2: 146 – 150.
- [9] Freckman, D. W. and C. H. Ettema. 1993. Assessing nematode communities in agroecosystems of varying human intervention. *Agriculture Ecosystem and Environment* 45: 239-261.
- [10] Gafur, A. Dan I G. Swibawa. 2004. Methods in Nematodes and Soil Microbe Research for Belowground Biodiversity Assessment. In: F.X Susilo, A. Gafur, M. Utomo, R. Evizal, S. Murwani, I G. Swibawa (eds.), Conservation and Sustainable Management of Below-Ground Biodiversity in Indonesia. Universitas Lampung. Lampung. 117-123.
- [11] Goodey, J. B. 1963. Soil and Freshwater Nematodes. Methuen CO. LTD. London.
- [12] Luc, M., R.A. Sikora and J. Bridge. 1995. Plant Parasitic Nematodes in Subtropical and Tropical Agriculture. Translator: Supratoyo. Gadjah Mada University Press. Yogyakarta.
- [13] Mai, W. F. dan H. H. Lyon. 1975. Pictorial Key to the Genera of Plant Parasitic Nematodes. Comstock Publishing Associates, Cornell University Press.
- [14] Mai, W. F dan H. H. Lyon. 1975. Pictorial Key to the Genera of Plant Parasitic Nematodes. Comstock Publishing Associate, Cornell University Press. 220 p.
- [15] Mulyadi. 2009. Agricultural Nematology. Gadjah Mada University Press, Yogyakarta. UGM. 16p.
- [16] Neher, D. 2001. Role of Nematodes in Soil Health and Their Use as Indicators. *J. Nematol.* 33: 161-168.
- [17] Nisa, R. U., A. U. Nisa, A. A. Hroobi, A. A. Shah, & A. Y. Tantray. 2022. Year-long assessment of soil nematode diversity and root inhibition-indicator nematode genera in rice fields. *Biology*. 11(11):1–20.

- [18] Ogbuji, 1987. Consideration of Nematodes in Integrated Pest Management of tropical crops Integrated Pest Management for tropical crops in Nigeria.
- [19] Rachman, A., U. Kurnia, and A. Dariah. 2004. Soil Conservation Technology on Sloping Dry Land. Center for Soil and Agroclimate Research and Development (Puslitbangtanak). West Java.
- [20] Sagita, L., B. Siswanto, and Hairiah K. 2014. Study of nematode diversity and density in various land use systems in the Konto Sub-Das. *Journal of Soil and Land Resources* 1(1): 53-63.
- [21] Sastroswignyo, S. 1990. *Plant Nematology*. Bogor Agricultural Institute. Bogor. 246 pp.
- [22] Smart, G. C. and K. B. Ngonyen. 1988. Illustrated Key for The Identification of Common Nematodes in Florida. University of Florida. Florida. 91 p.
- [23] Soemarno. 2010. Soil Ecology. Study material for the Faculty of Agriculture, Agroecosystem Management. Available online at <http://marno.lecture.ub.ac.id/files/>.
- [24] Swibawa, I G. 2001. Diversity of nematodes in soil in various types of land use in the ASB-BENCHMARK area of Way Kanan. *Journal of Tropical Plant Pests and Diseases*. 1(2): 54-59.
- [25] Swibawa, I G. 2010. Soil nematode communities in corn fields after 23 years of continuous application of no-till cultivation systems. In: Proceedings of the National Seminar on Soil Biodiversity – I: Soil Biodiversity Management to Support Sustainable Tropical Agricultural Production. 2010. University of Lampung. Bandar Lampung, June 29-30, 2010, pp. 147-161.
- [26] Utomo, M. 2012. No-Tillage: Dryland Agricultural Management Technology. Research Institute of the University of Lampung. Bandar Lampung. 110 pp.
- [27] Wawan and Junaidi. 2009. Symptoms of Nematode Attacks. <http://blogspot.com>. Accessed on September 27, 2010.
- [28] Widyati, E. 2013. Dynamics of microbial communities in the rhizosphere and their contribution to forest plant growth. *Plantation Forest Technology*. 6(2): 55-64.
- [29] Yeates, G. W., T. Bonger, R. G. M. De Goe, D. W. Freckman dan S. S. Georgieva. 1993. Feeding habits in soil nematode families and genera and outline for soil ecologists. *Journal of Nematology*. 25(3): 315-331.