Evaluating the effect of nematodes on crop production in Eastern Tigray, Northern Ethiopia

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***Abstract*-The study was conducted at Dibla Sihet tabia, Ganta Afeshum District, Eastern Tigray, Ethiopia with the objectives to identify the type of nematodes available, to determine the negative impact of nematodes on crop production and asses farmers control measures of nematodes in the study area. An investigation of plant parasitic nematodes associated with wheat, bean and potato was conducted, 24 Soil samples (8 samples for each crop) were collected from wheat, bean and potato crop fields and 200g each soil samples were analyzed in Mekelle University Pathology laboratory. The PPN found according to their total population were *Pratylenchus* (32), *Hoplolaimus* (16), *Rotylenches* (9), *Radopholus* (32), *Ditylenchus* (19), *Helicotylenchus* (4), *Longidorus* (6) on wheat, bean and potato crops. Semi-structure questionnaire were used and 42 respondents were interviewed and the educational status of the respondents was 12th completed (14.28%), 10th completed (16.66%), elementary school (38.09%), read and write (7.14%) and illiterate (23.81%) and 87.5, 56.25, 50, 18.75 and 12.5% of the interviewees revealed potato, wheat, barley, carrot and green paper in descending order, respectively were the most affected vegetable and cereal crops in the study area. 87.5, 31.25,12.5 and 43.75% each of the respondents reported production loss, reducing market supply, famine and decline in market price and lowering product demand, respectively were the major negative impact of nematodes mostly found on potato production. Among 42 respondents, 18 (42.85%), 13(30.95%), 3(7.14%) and 5(11.90%) have reported <5%, 5-10%, 10-20% and >20% of the annual crop products were lost on ground due to nematode attacks and concluded cultural methods (75%), chemical methods (18.75%), physical methods (6.25%) and host-plant resistance (6.25%) were among the control measures of nematode species that decrease the risk of crop damage practiced in the study area.**

Key words- Control measure, Crops, Genera, Loss, Nematode, Respondents

I. INTRODUCTION

Hunger and malnutrition are the chronic problems of human's everyday life and more than 791 million people from developing countries have fallen undernourishment in the year 2012-2014 [14]. Africa has the highest prevalence of undernourishment and Ethiopian people remains in a state of hunger [3]. Everyday reality for more than 800 million people, and 15 million people, mostly children, die as a consequence each year [5]. Nematodes are among the most serious constraints to crop productivity and caused 12% annual yield loss of food and fibre crops worldwide [12]. Plant parasitic nematodes are microscopic animals that attack crops. Every species of plant has at least one species of nematodes that parasitizes it [31]. The consequence of plant-parasitic nematodes (PPN) on agricultural productivity is immense. Almost every crop is affected by PPN [35]. The global average estimate of annual damage caused by nematodes, based on 37 life sustaining crops, is US$ 358.24 billion, which is about 12.6% (9-15%) of total crop production [2] and [22]. Moreover, this amount is certain to increase when additional loss studies on crops of regional importance are included. Rice is one of the most important crops in the world, and estimates show that about US$ 35 billion is lost due to 17 species of PPN [24]. Species of the root-knot nematode genus, Meloidogyne, are estimated to cause a global loss of US$ 157 billion [1].With a 30-100% reported crop loss within Africa, it is not difficult to recognize that the 20 species of this genus recorded from Africa alone are undermining the continent's agriculture [28].Staple crop productivity is small scale in Ethiopian agriculture and is impacted by a number of factors, among which crop diseases are the most critical. The limited studies conducted so far on crop diseases shows that problems caused by PPN in Ethiopia have a serious impact on crop productivity [7], [20], [44] and [49]. Keeping in view of these immense effects of plant-parasitic nematodes (PPN) on global agriculture, the study has been conducted with the objectives: to identify the type of nematodes available, to determine and aware the negative impact of nematodes on crop production and to asses farmers control measures of nematodes on yield loss of crops in Dibla Sihet tabia, Ganta Afeshum district, Eastern Tigray, Ethiopia.

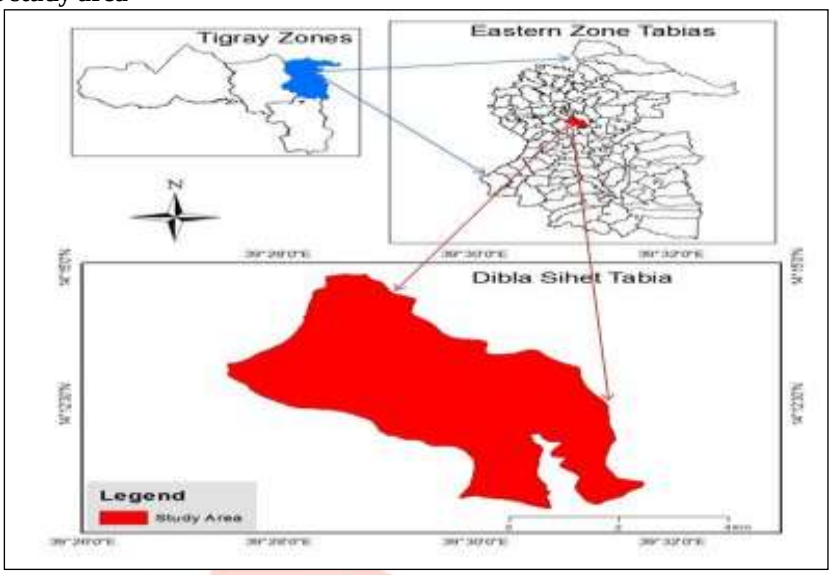
II. MATERIALS AND METHODS

2.1. *Description of the study area*

The current study has been conducted in Dibla Sihet tabia, Wereda Ganta Afeshum, Eastern Tigray, Ethiopia. Dibla Sihet tabia is situated 10km distance North East of Adigrat town. Eastern Tigray is found in Northern part of Ethiopia, which is about 818 km far from Addis Ababa and about 116 km from Mekelle city, the capital city of Tigray Regional State. It is located in altitude range from 2000 - 3000 meter above sea level (m.a.s.l.) and geographically it is located 014º16'34'' N latitude and 039º27'51''E longitude. It has a uni-modal rainfall distribution with the highest rain falling from June to early September. Annual average rainfall of this zone ranges from 450 mm – 600 mm and the minimum and maximum temperature is 6 and 21ºC. Eastern Tigray is bordered by Afar region on the east, central zone on the west, south eastern on the south, Eritrea on the north. The income of

the inhabitants is depends on farming, trading through micro and small enterprises, honey, irrigation, chicken and livestock production. This zone consists seven (7) districts or Weredas, namely Atsbi-Wemberta, Kilte-Awlalo, Saesi-Tsaedaemba, Hawizen, Ganta-Afeshum, Glomekeda and Eurob with a total population of 169,719 and total area of 13,268.99 km^2. Among these districts, Dibla Sihet tabia, Wereda Ganta Afeshum is selected for the study.

Fig. 1: Location of the study area



2.2. *Sampling methods*

Survey was the first critical step towards understanding types of nematodes available, Population density, Abundance and Frequency of occurrence of PPN. It enables researchers to identify and provide host ranges of prominent PPN and provides a better understanding of the extent of the pathological problems they cause. Any nematode management or control programme depends on accurate identification of the nematodes involved. Intensive survey was conducted from April to May 2017 to acquire information on availability of plant parasitic nematodes. 24 Soil samples (8 samples for each crop) were collected from different crop fields such as wheat, bean and potato and soil samples were collected to a depth of 0-15cm using a systematic zigzag pattern sampling method with the aid of a soil auger along four cardinal directions at the base of each plant. Collection of samples was carried out according to the standard used by [39] with some modifications. Samples were sealed in plastic bags and transported in a cooled insulated container to Mekelle University Pathology laboratory. The samples were kept in a cold room at 5-8 °C until they were processed for nematode extraction within a week. 42 respondents were interviewed about major crops affected by nematodes, farmer's awareness about negative impact of nematodes on crop production and production loss due to nematodes in the study area.

2.3. *Extraction and counting of nematodes*

The soil extraction was conducted according to the standard reported by [13].Two hundred grams of soils were placed in the funnel and water was added slowly to moist the soil and left for 24 hours for extraction. After 24 hours, the sieve containing soil was removed, water was collected into a measuring beaker and the volume of water was recorded. Each sample was mixed well and 2 ml suspension was transferred into a counting chamber. The number of nematodes were counted and recorded. Individual nematodes were picked up from extraction and transferred on a temporary mounts in water on a glass slide for diagnosis. The gathered nematodes were preserved in 5% formaldehyde solution and permanently mounted with glycerin. The presence of nematodes in each sample was identified based on taxonomic characters and morphological measurements under light microscope [16].The existence of stylet in plant-parasitic nematodes allows the removal of saprophytic from plant parasitic nematodes. In addition to the survey result, semi structure questionnaires were administering to collect information using personal interview. Basic questions were asking to respondents that explain their entire background in relation to age, sex, land holding, educational status, family size, farming practices and input used that may have impacts to their day to day live activities and livelihood. The results were discussing with identification, awareness, and sustainable control methods of crop nematode.

2.4. Data analysis

IBM SPSS Statistics 20 software for interviewed data about major crops affected by nematodes, farmer's awareness about negative impact of nematodes on crop production, production loss due to nematodes and educational status of the respondent. Per centage frequency of occurrence (FO), population densities (PD) and abundance (A) of the extracted nematodes were determined using the following equations:

1. Percentage frequency of occurrence (FO) = n/N × 100
   Where, n = Number of positive samples N = total number of samples.
2. Population densities (PD) = number of nematodes/total number of samples
3. Abundance (A) = Total number of individuals of the nematodes in all the sampling units/number of sampling units in which the spices nematode occurred.

III. RESULTS AND DISCUSSION

2.5. *Types of Nematodes available in the study area*

Total seven genera of plant parasitic nematodes were detected where, three genera each from Wheat and Bean and five genera from Potato in Dibla Sihet tabia, Ganta Afeshum Wereda (Table 1).

Table 1. Population densities of plant parasitic nematodes in Dibla Sihet tabia, Ganta Afeshum

Nematode	Common name	Available nematode genera			Total population
		Wheat	Bean	Potato	
Pratylenchus	Lesion nematode	12	5	25	32
Hoplolaimus	Lance nematode	16	-	-	16
Rotylenches	Reniform nematode	4	5	-	9
Radopholus	Burrowing nematode	-	3	29	32
Ditylenchus	Stem and bulb nematode	-	-	19	19
Helicotylenchus	Spiral nematode	-	-	4	4
Longidorus	Needle nematode	-	-	6	6

The highest occurrence was recorded by the Lesion nematode (*Pratylenchus spp*.) and Burrowing nematode (*Radopholus spp*.) having a population density of 12 (wheat), 5 (bean) and 25 (potato) and 3 (bean) and 29 (potato), respectively. This was followed by Stem and bulb nematode (*Ditylenchus spp*.) having a population of 19 in the samples extracted from potato plant. The Lance nematode (*Hoplolaimus spp*.) was in the third rank which was attained a population of 16 in the samples extracted from wheat plant. Other nematodes encountered were, reniform nematode (*Rotylenches spp*.), Needle nematode (*Longidorus spp*.), spiral nematode (*Helicotylenchus spp*.) which were recorded having the lowest population density in the study area. From the survey study, the *Pratylenchus spp*. and *Radopholus spp*. might have a great importance because of their wide distribution. This finding is in agreement with [31] survey revealed the frequent occurrence of *Pratylenchus spp*. in Enset, coffee and potato in Ethiopia. Similar observation was reported by [36] as they find out eight PPN genera (*Criconema spp*., *Helicotylenchus spp*., *Hemicyclophora spp*., *Longidorus spp*., *Meloidogyne spp*., *Paratylenchus spp*., *Pratylenchus spp*. and *Rotylenchulus spp*.) associated with khat crop. Among these nematode genera, *Meloidogyne* (80%), *Helicotylenchus* (60%), *Longidorus* (53.3%) and *Pratylenchus* (46.6%) were the most abundantly presented PPN genera with their per cent frequency of occurrence from soil. This variety could be similarly associated with the cropping pattern of khat, that is mostly intercropped with Solanaceous and other vegetables mainly (tomato, pepper, cabbage, potato, and sweet potato), cereals (maize and sorghum) and groundnut grown by Hararghe farmers. [31]has reported *Helicotylenchus spp*., *Heterodera spp*., *M. incognita*, *M. ethiopica*, *Pratylenchus spp.* and *Tylenchus spp*. associated with tomato, lettuce, sweet pepper, onion and sweet basil are the earliest PPN present in Ethiopia. [6] also discovered fifteen PPN genera associated with coffee, C. arabica, recently grown in South West of Saudi Arabia. Potato is an important tuber crop in Ethiopia with a total area of 66 745.61 ha [10]. *Meloidogyne javanica* has been the only PPN reported on potato but existence of *Pratylenchus spp.*, *Helicotylenchus spp*. and *Tylenchus spp*. have also been reported [40]. Similarly, [42] revealed the occurrence of *Anguina tritici*, *Pratylenchus spp*., *Tylenchus spp*., *Tylenchorhynchus spp.* in wheat seed and [40] and [15] reported the existence of *Helicotylenchus spp*., *Longidorus spp*., *Pratylenchoides spp*., *Scutellonema spp*., *Tylenchorhynchus spp*., *Tylenchus spp*.in barley seed. Consistent with the present study, [21] surveyed the expansion of root-knot nematodes in the Western (Bako, Ambo and Guder), Southern (Butajira and Alaba) and Central (Koka, Meki, Ziway, Melgaewondo, Melkassa, Upper Awash, Melkasedi and Melkawerer) parts of Ethiopia and they found widely distributed root-knot nematodes on tomato, pepper, onion, snap bean, cabbage, beetroot, carrot and potato. The most frequently found species were *M. incognita* (53.3%) followed by *M. ethiopica* (14.9%) and *M. javanica* (12.8%). Incomparable surveys in search of species of EPN have been conducted in Ethiopia, and three species, *Steinernema yirgalemense*, *S. ethiopiense* and *Heterorhabditis bacteriophora*, have been recorded [29] and [23]. *Steinernema yirgalemense*, identified and reported first from Ethiopia, was the dominant EPN species in the country [23] with 18 (6.3%) positives from a total of 288 soil samples. Recently, [41] isolated three strains of *Steiner nematid* (Dero-1, Dero-8 and Mosisa-1), in the Western part of the country, which were later identified as *S. ethiopiense*.

Table 2. Frequency of occurrence (%) and population density (%) of PPN associated with Wheat, Bean and Potato found in Dibla Sihet tabia, Ganta Afeshum, Tigray, Ethiopia.

Nematode genera	No. of positive samples	Frequency of occurrence (FO)	Total nematodes recorded	Population density (PD)	Abundance
Pratylenchus	16	66.6	32	1.33	200
Hoplolaimus	4	16.66	16	0.66	400
Rotylenches	4	16.66	9	0.375	225
Radopholus	8	33.3	32	1.33	400
Ditylenchus	5	20.83	19	0.79	380
Helicotylenchus	1	4.16	4	0.166	400
Longidorus	1	4.16	6	0.24	600

Pratylenchus spp. and *Radopholus spp*. were the most encountered with a frequency of occurrence (66.6 and 33.3%), respectively followed by *Ditylenchus spp.* (FO = 20.83%), *Hoplolaimus* and *Rotylenches* (FO = 16.66% each) and *Helicotylenchus* and *Longidorus* (FO = 4.16% each). From among the total individual nematodes recorded in Dblasaet tabia farmers training centre (FTC), *Pratylenchus* and *Radopholus* were the most prominent genera with a population density of 1.33 each followed by *Ditylenchus spp.* 0.79, *Hoplolaimus* 0.66, *Rotylenches* 0.375, *Longodorus* 0.24 and *Helicotylenchus* 0.166. From among the total

individual nematodes recorded in Dblasaet tabia farmers training centre (FTC), *Longidorus* has the highest abundance 600 followed by *Hoplolaimus*, *Radopholus* and *Helicotylenchus* 400 each and *Ditylenchus* (380), *Rotylenches* (225) and *Pratylenchus* 200 (Table 2). The nematodes community structure was characterized by using the absolute frequency, absolute density and prominence value [30]. Inline to the current study, [36] have reported the abundance of prevalent nematodes such as *Pratylenchus* (787), *Meloidogyne* (668), *Helicotylenchus* (353) and *Longidorus* (180) with 80, 60, 53.3, and 46.6% frequency of occurrence per 150 composite soil samples, respectively. [6] also reported population density (PD) of plant parasitic nematode genera associated with coffee in their study as *Rotylenchulus spp.* (90), *Ditylenchus* (75), *Rotylenchus spp.* (53), *Paratylenchus spp.* (50), *Hoplolaimus* and *Longidorus* (20 nematodes/200 cm^3 soil each). The root cause for the abundance of prevalent nematodes in the study area was due to sandy loam soil which is ideal for nematodes reproduction and infectivity. Agreement results were reflected by [8] and [4] who confirmed sandy soil favors the abundance and greater damage of crops by many species of plant parasitic nematodes and [27] coined out sandy loam soil is ideal for nematode reproduction and infectivity.

To understand the skill and view of respondents, basic questions were asking that explains major crops affected by nematodes. The assessment was included 42 respondents for the interview and the respondents have been selected based on the knowledge and experience they have in the agriculture field.

Table 3. Educational status of the respondents in Dibla Sihet tabia, Ganta Afeshum, Tigray, Ethiopia

Educational status	Frequency	Per cent	Valid Percent	Cumulative Percent
Illiterate	11	26.2	26.2	26.2
Adult literacy program	3	7.14	7.14	33.34
Elementary school	17	40.5	40.5	73.84
Junior school	5	11.9	11.9	85.74
10^{th} complete	3	7.14	7.14	92.88
12^{th} complete	3	7.14	7.14	100.0
Total	**42**	**100.0**	**100.0**	-

The educational status of the respondents was 12^{th} completed (7.14%), 10^{th} completed (7.14%), elementary school (40.5%), read and write (7.14%) and illiterate (26.2%) (Table 3). According to the interview feedback of the respondents, the major crops affected by nematodes in the study area were Wheat, Barley, Teff and Maize from cereal crops and Cabbage, Carrot, Potato, and Green pepper from vegetable crops. From cereals, the highest per cent nematode infested crop was Wheat (*Triticum aestivum*) with 56.25% followed by Barley (*Hordeum vulgare*) with 50%. Maize (*Zea mays*) and Teff (*Eragrostis teff*) were the least with 6.25% each. From vegetable crops, highest per centage was Potato (*Solanum tuberosum*) with 87.5%, followed by Cabbage (*Brassica oleracea*) 25% and Green pepper (*Capsicum spp.*) with 12.5% (Table 4).

Table 4. Major crops affected by nematodes in Dibla Sihet tabia, Ganta Afeshum, Tigray, Ethiopia

Major crops affect	**Cereals**				**Vegetables**			
by Nematodes	Wheat	Barley	Teff	Maize	Cabbage	Carrot	Potato	Green pepper
Interview (%)	56.25	50	6.25	6.25	25	18.75	87.5	12.5

This is relevant to the results of [42] in wheat seed infested by *Anguina tritici*, *Pratylenchus spp.*, *Tylenchus spp.*, *Tylenchorhynchus spp.* and [40] and [15] in barley seed infested by *Helicotylenchus spp.*, *Longidorus spp.*, *Pratylenchoides spp.*, *Scutellonema spp.*, *Tylenchorhynchus spp.*, *Tylenchus spp.* and [37] in Teff infested by *paratylenchus spp.*, *Pratylenchus spp.* and [43] in maize infested by *Xiphinema brevicolle*, *X. americanum*, *Pratylenchus zeae*, *P. brachyurus*, *P. coffeae*, *Aphelenchoides indicus*, *A. rutgersi.* [21] also reported the effect of *M. incognita* (53.3%) followed by *M. ethiopica* (14.9%) and *M. javanica* (12.8%) on Tomato, Pepper, Onion, Snap bean, Cabbage, Beetroot, Carrot and Potato. In support of the current findings, [46] determined the species that cause crop damage include *D. gigas*, *D. destructor*, *D. angustus*, *and D. africanus*. However, most species within this genus are fungal-feeders in the soil associated with some plants and broad beans.

2.6. Negative impact of nematodes on crop production

Although PPN are among the most widespread pests, data on their economic impact is limited, especially for crops grown in resource poor areas. In the tropical and sub-tropical climates, crop production losses attributable to nematodes were estimated at 14.6% compared with 8.8% in developed countries [47].Plant parasitic nematodes can kill crops, particularly annual host plants, when they occur at high population densities. At lower densities, yield loss may also occur without notable changes to the plant, making loss assessment difficult. The extent of yield loss due to nematode damage depends on the nematode density at planting, the nematode species, susceptibility and tolerance of the host crop and the soil environment. As a result, in Ethiopia, as in many other countries where there are few expert nematologists, PPN have not yet received considerable attention as major factors impacting agriculture [25].Particularly, the respondents in the study area have lack of scientific knowledge to explain the nematode type, structure, symptom, feeding and management and degree of crop damage and loss, though 93% of them have awareness about the negative impact of nematode on crop production.

Table 5. Farmer's awareness about negative impact of nematodes on crop production in Dibla Sihet tabia, Ganta Afeshum, Tigray, Ethiopia

Negative impact	**Quantitative**	**Qualitative**

	Yield loss	Reducing market supply	Famine	Decline in market price	Reduce product attractiveness
Interview (%)	87.5	31.25	12.5	43.75	43.75

From the present findings, 87.5% of the beneficiary farmers reported production loss is the major negative impact of nematodes and 31.25% and 12.5% respondents noticed reduction in market supply and famine, respectively. Whereas, 43.75% each respondents revealed that decline in market price of the product and lowering product demand were the other qualitative negative impact of nematodes mostly found on potato production (Table 5). Even though there are phenomenal indications that PPN causes serious crop loss in Ethiopia, quantitative evaluation of production loss and crop damage surveyed is limited [23] and [25]. The current result is consistent with [12] who conducted closer investigation on crop yield loss assessment and reported PPN risk crops of citrus from fruit crops, tomato and pepper from vegetable crops, Enset from root and tuber crops, and haricot bean from pulse crops threshold study.

Table 6. Production loss due to nematodes

Loss range	Frequency	Per cent	Valid per cent	Cumulative per cent
<5%	18	42.85	42.85	42.85
5-10%	13	30.95	30.95	73.82
10-20%	3	7.14	7.14	80.84
>20%	5	11.90	11.90	92.84
0%	3	7.14	7.14	100
Total	42	100	100	-

Despite limited progress in recognizing the impact of PPN on the Ethiopian agricultural economy, the seriousness of the problem has not received much attention primarily because of a lack of expertise in the field of nematology. Among 42 interviewed respondents, 18 (42.85%) have reported less than 5% of the annual crop products were lost on ground due to nematode attacks. About 13(30.95%), 3(7.14%) and 5(11.90%) of the respondents revealed 5-10%, 10-20% and greater than 20% crop loss encountered annually, respectively (Table 6). This result is in agreement with [26] who reported, 5-l0% of crop production is lost due to nematodes in developed countries today.

2.7. Farmers awareness on control measures of nematodes

A comprehensive survey and integrated management of nematodes is highly essential to boost the productivity of high value crops and vegetables [33]. The respondents from the study area have described some control measures of nematode species that decrease the risk of crop damage include cultural methods, physical methods, use of chemicals, and host-plant resistance discussed as below.

1. Cultural method

About 75% of the respondents in the study area have reported they were utilizing cultural practices to mitigate the damage of nematodes in their crops. Among the cultural control techniques of nematodes include crop rotation, use of nematode free plant material, soil amendments, manuring, sanitation by remove, deep cultivation and use of improved crop varieties. Cultural methods have an advantage over chemical means of control because the resources and infrastructures they demand are consistent and applicable to the resource poor community. [45] have reported similar findings of cultural practices helpful to mitigate crop damage such as crop rotation, fallowing, flooding, antagonistic plants, soil amendments, deep cultivation and improved crop husbandry and [26] reported periodic crop rotation (*Longidorus, paratyenchus*), selecting resistant crop varieties, water immersion (*Pratylenchus*) and crop rotation (*Radopholus*) among the important cultural management techniques useful to control the risk of crop damage from nematodes.

2. Chemical methods

Although the applicability and effectiveness of nematicides is well known in Ethiopia, but very few trials have been made because of high cost and toxicity to humans. In the current study, 18.75% of beneficiaries have informed, chemical method (nematicide application) is the convenient technique they utilized. Furthermore, the respondents pointed out that, the chemicals under utilization were access limited, toxic to environment, expensive and non economic to the farmers engaged in agronomic practices. This is convenient to the findings of [26] who utilized soil fumigation and nematicides (*Pratylenchus*), fumigation with 1, 2-dibromoethane (*Paratylenchus*), use of nematicides such as aldicarb and fenamiphos (*Trichodorus*). [17] described, they have treated corm of banana with chemical nematicides to control the burrowing nematode *Radopholus similis*. At Melkawerer Ethiopia, three nematicides such as Terracur (*Sunsulfothion*), Nemacur (*Phenamiphos*) and Nemapaz (DECP), were tested for their efficacy and phytotoxicity on the susceptible variety of Dwarf Cavendish. All treatments resulted in considerable reduction of nematode infections and higher yields and Nemapaz treatment with repeated applications at 3-month intervals gave the best results followed by Terracur. [18] also tested five nematicides with different application rates, Phenamiphos 5% and 10%, Aldicarb 15%, Carbofuran 10%, Ethoprophos 10%, Granulars and DECP 75% EC. Varieties used in the trial were one susceptible cv., Dwarf Cavendish, and the other moderately resistant cv., Poyo. The result indicated that the susceptible cv. Dwarf Cavendish showed a higher yield increment than resistant cv. Poyo.

3. Physical methods

In the present study, 6.25% of the respondents revealed they were utilizing cleaning and sanitizing nematode affected materials. This is the cheapest technique the farmers utilized regularly and accessibly. [26] also revealed sanitation practice (*Ditylenchus*), sanitation and use of clean seed (*Anguina*), sanitation and cleaning (*Aphelenchoide*) and sanitation (*Heterodera*).

4. Host resistance

Very few attempts have been made with regards to host resistance and utilization of improved crop varieties. The use of host resistance for the management of pests is preferable to chemical control since it is environmentally safe and inexpensive once developed. Among the interviewed respondents, 6.25% of them revealed utilization of improved crop varieties are the renowned options for the increment of productivity and reducing of nematode damage on crops. In support of the current findings, [26] selected and utilized resistant crop varieties (*Pratylenchus*), crop rotation (*Radopholus*) and use of resistant variety (*Ditylenchus*).

IV. CONCLUSION

From results of the present study, it can be concluded that, this survey sheds light on the presence of some serious plant parasitic nematode genera such as *Pratylenchus, Hoplolaimus, Rotylenches, Radopholus, Ditylenchus, Helicotylenchus, Longidorus* on wheat, bean and potato in Dibla Sihet tabia, Ganta Afeshum Wereda, Eastern Tigray, Ethiopia. Further studies are needed to identify the species of these genera, their pathogenicity to cereals and vegetables and recommend their feasible control measures.

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