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Original Article

The Knowledge Base of the Horticulture Farmers on Pests that Affects their Produce in Thulamela Municipality - Vhembe District in Limpopo of South Africa

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Abstract *- This paper forms part of a research study conducted in the Thulamela municipality, Vhembe district, Limpopo province, and focuses on the farmers' knowledge base on pests that affect their productivity. The study targeted a population of approximately 133 smallholder farmers that produce fruits and vegetables. Farmer's perception and knowledge of pests and their management are important components for developing a sustainable action plan to control pests such as tomato leaf miner, fruit flies, and other pests. Respondents demonstrated good knowledge concerning pests that affect their productivity, but farmers do not know other pests. About 89.5% of the respondents use chemicals to control pests, while 10.5% use cultural practices and 5.3% use indigenous methods. Only 7.5% of the respondents had been trapped in their farms. The paper concludes with the following recommendations: (1.) Smallholder farmers need to be trained on the proper identification and management of pests that affect their productivity. (2.) Farmer's indigenous management practices of fruit and vegetable pests should be documented. (3.) Establishing a pest surveillance program in the various farming areas of Thulamela municipality.*

Keywords *- Fruit flies, Integrated pest management, Knowledge of farmers, Pest, Pest management*

I. INTRODUCTION

This paper focuses on farmers' knowledge of pests that affect their productivity in the Thulamela Municipality, Limpopo province. The ability of farmers to identify the different pests that affect their produce is very important in ensuring that pests are properly managed. It is very important to know farmers' knowledge of pests and pest management practices before introducing new strategies/technologies on pest identification and pest management. This paper's objective was to investigate the knowledge base of farmers on pests that affect their productivity.

According to [21], in sub-Saharan Africa, the horticultural industry is faced with numerous challenges such as pest and disease incidence. The infestation of fruit flies threatens the fruit and vegetable production sector, and they cause extensive damage and economic losses to the sector, owing to their quarantine status [32].

[18] indicated that sustainable management of any agricultural pest problem requires insight into farmers' existing knowledge, perceptions, and practices (KPP) in the production communities. To enhance farmers' role as independent decision-makers requires a realistic assessment of their existing knowledge, capabilities, and crop protection practices on-farm and an understanding of the major constraints that may militate against their efforts to improve the pest management system [25].

According to [2], to develop appropriate fruit fly control decision tools and tactics that can be designed to meet the needs of fruit producers, reliable information needs to be obtained from farmers to appreciate fruit producers' practices and to assess constraints and opportunities for decision

making at the farm level. Lack of information about farmers' knowledge, perceptions, and practices (KPP) in pest management is one of the major constraints of establishing an integrated pest management (IPM) program [18].

According to [33], pest recognition in some cases is a major problem, while in other cases, knowledge about the pest is a major constraint. [34] indicated that farmers mostly described pests related to a particular symptom or the part of the plant that has been attacked/damaged by the pest. According to [2], the use of pesticides without consideration leads to yield loss, the extinction of natural enemies of different pests, and resistance by different pests. [34] indicated that the majority of the farmers apply insecticides and pesticides to kill the pests, but most of them do not have knowledge of natural enemies, and to control pests, they remove the larvae manually while others cut/remove the affected part such as flowers. Setting research agendas and planning campaign strategies, and developing messages for communication; evaluating farmers' knowledge and perception of pests and natural enemies is very useful (Escalada and Heong, 1993).

II. MATERIALS AND METHODS

A. Study Area

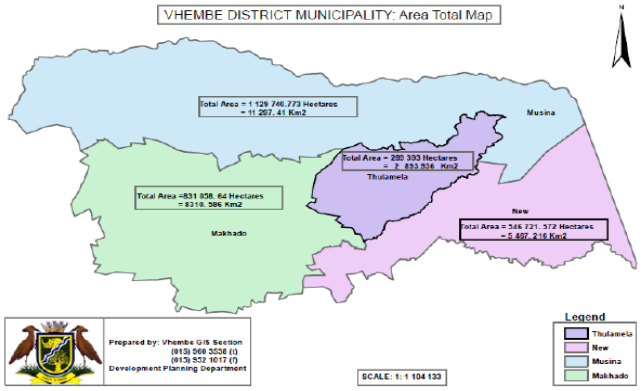

Fig. 1 Vhembe district municipality: Area total map [30]

The study was conducted in the Limpopo Province of South Africa and was focused on the Thulamela municipality - Vhembe District Municipality. Thulamela municipality is one of the four municipalities in the Vhembe district, and it covers 2893.936 km^2/ 2893 393 hectares [30]. It is situated within the Vhembe District in the far north of the Limpopo Province, and it has a population of about 497 237 [28]. The Kruger National Park forms the east boundary while sharing the border with Makhado in the south and southwest. It is the smallest municipality of four in the district, making up 10% of its geographical area [29].

B. Sample size

According to [13], the sample size is the number of participants or observations included in a study. Table 1 shows the sample size of the study. It should be indicated that some of the areas of Thulamela have been shared with the new Municipality of Collins Chabane. Thulamela municipality consists of three service Centres, namely the Khumbe service center, which includes the Tshiombo irrigation scheme with 137 hectares, with farmers engaged in mixed farming, Khumbe has about 97 horticultural farmers. The second service center is Matangari that has about 886 mixed farmers who farm with fruit and vegetables. Lastly, the Thohoyandou service center has about 417 horticultural farmers and includes the Dzindi irrigation scheme with about 105 farmers farming in 137 hectares. The centers are managed by extension managers in charge of the service centers for technical and administrative responsibility. The sample drew farmers from the Thohoyandou service center.

The sample size for horticultural farmers was calculated using a Raosoft sample size calculator [26], providing a confidence level of 95% and a margin of error of 5% (Table l.). The total sample size calculated was 201.

Table 1. Sample size calculated and determined using Raosoft sample size calculator

Name of service center	Population	Recommended sample size	Responses received
Thohoyandou Service centre	417	201	133
Total	417	201	133

Source: Own study

C. Data collection

According to [23], there are various methods used for gathering data such as observation, face-to-face interviews, self-administered methods, focus groups, and personal interviews. The data gathering method that was applied was the face to face interviews. In terms of the data gathering instruments, a structured questionnaire was utilized. The questionnaire was tested before the main data collection took place, and some changes were made to the questionnaire. The gathered data was captured and manipulated using statistical software.

III. RESULTS and DISCUSSION

This section presents the findings of the study, which covers the demographic details and the knowledge of farmers about the general practice towards managing pests in their environment.

A. Demographic information

The First demographic character is gender. Gender plays an important role in farming. Gender refers to the social roles that are played by both men and women and the

relationship between them that normally have an effect on the utilization and management of natural resources [5]. Table 2 shows that the majority of the respondents (60.9 %) were male, and according to [23], this might be because farming is male-dominated.

The age of farmers is also important because scholars say our farmers are aging. For example, according to [11], a larger proportion of smallholder farmers across the world are over 60 years old. [20] indicated that with an ageing population of farmers, it is clear that agriculture needs to attract more young people. Table 2 shows that out of the 133 respondents that were interviewed, 59.4% were elderly people who were above the age of 51; this is a concern as it shows that there is still a shortage of youth in the agricultural sector, the sector is still dominated by elderly people. More youth need to be involved in farming so that new farming techniques, technology, and knowledge from older farmers can be easily transferred to youth; youth are flexible and can easily adapt to change or to new technologies as compared to older farmers who are more resistant to change. According to [24], if more youth are retained in agriculture, they can bring in new ideas and embrace new farming technologies and business methods that can take agriculture to a higher level.

[23] indicted that it is assumed that farmers who are married are more likely to have greater financial needs that will need to be met by the farm income. As revealed in Table 2, most (63.2 %) of the respondents are married, which means that they have family responsibilities, which include dealing with financial matters of the family.

According to [3], most of the smallholder farmers are uneducated, with poor technological skills, which can be a challenge for them to access useful formal institutions that disseminate technological knowledge. The results in Table 2 shows that the majority of the respondents (42.1 %) have attended school up to the secondary level, while 33.8 % of the respondents never attended school. Educated farmers are generally more open to innovative ideas and new technologies that promote positive change [15].

Table 2. Gender, age, marital status, and level of education (n=133)

Gender	**Frequency**	**Percent**
Male	81	60.9
Female	52	39.1
Age		
15-35 years	20	15
36-50 years	34	25.5
51 years & older	79	59.4
Marital Status		
Single	39	29.3
Married	84	63.2
Divorced	3	2.3
Widow	4	3
Living together	3	2.3
Level of education		
Never attended school	45	33.8
Primary level	13	9.8
Secondary level	56	42.1
Tertiary level	19	14.3

Source: Own study

B. Pests experienced in the research area and other pests

The respondents were asked to give the pests that they experience in their area. The results are reflected in Table 3. Respondents were able to name three types of pests that are giving them problems in their area, namely: white flies, fruit fly, and *Tuta absoluta;* out of all the three pests that have been listed, whiteflies are dominating with about 78.9%. This shows that whiteflies are really a problem to farmers, they are making farmers spend more money and effort in controlling them, and they are also affecting the quality of products that farmers are producing.

Respondents were asked to list other pests that they experience in their area; the findings are reflected in Table 3. The situation of Table 3 is not desirable in the fields of respondents. For example, two out of the three types of pests show a figure of above 20%, with the exception of one pest with less than 16%. However, one pest tops them all, showing it as the most threat in their field, namely fall armyworm. The implication of this finding is that pests are a threat to crops in the study area, and they need to be managed if farmers have to reap the benefits of their sweat.

Table 3. Pests experienced in the research area and other pests (n=133)

Pests experienced in the research area	**Frequency**	**Percent**
Tuta absoluta	20	15
Fruit fly	8	6
Whiteflies	105	78.9
Other pest experienced in the area of research		
Bagrada bug	27	25
Red spider mites	17	15.7
Fall armyworm	65	60.2

Source: Own study

C. Pest management

There are different types of methods that are used to control pests, such as chemicals, cultural, biological, and integrated pest management. Farmers were asked to name the different types of methods that they use to control pests; the results are reflected in Table 4. Out of the three pests control methods listed in Table 4, chemicals (89.5%) dominates them all, this does not give a good picture as the improper usage of chemicals/pesticides pollutes the environment, kills natural enemies of pest and make pest to develop resistance to pesticides. This is a concern as only 10.5% of the

respondents had knowledge of other control methods such as cultural control and all respondents had no knowledge of the use of biological controls such as introducing beneficial insects or predators to control pests. Some control measures currently being used by farmers present an opportunity to develop an organized, sustainable, and environmentally friendly IPM package [19].

Traps are used for the detection of new pests invasions in time, for delimitation of the area of infestation, and for monitoring population levels of established pests [7]. The results in Table 4 are a concern as the majority (92.5%) of the respondents indicated that they do not have traps in their farms. This means that when there is an introduction of a new pest, they are not able to detect it on time, and also, they are not able to monitor the pests population in their area. Traps are the best way to detect and monitor the pests population in the farm/field; monitoring helps to identify pests, keeps track of changes in their population levels, and indicates when or whether to utilize controls.

[4] indicated that indigenous knowledge is the knowledge of the indigenous people inhabiting different geographical regions of the world with their own language, culture, tradition, belief, traditional stories, resources, and rituals. According to Table 4, there is hardly any indigenous knowledge available to the farmers due to a lack of knowledge transfer between generations, a lack of documentation, and a huge gap between the farming conditions of previous generations and those of the present-day generation.

About 5.3% of the respondents indicated that they use the following indigenous methods to control pests: Ashes, pepper, tobacco, sanitation, herbs such as mint, and grinding fruit flies and mixing them with water (when fruit fly smell the mixture, they fly away). [35] indicated that for the control of Fall armyworm, farmers used local/ indigenous knowledge such as the killing of larvae, adding soil to plant whorls, placing sand or ash in the whorls, intercropping, sowing multiple varieties, destroying ratoon host crops, drenching tobacco extracts, early planting, rotating maize with non-host crops, deep ploughing to kill pupa hand picking, and burn stubbles after harvesting infested crops. According to [31], farmers need to be made more aware of the value of their knowledge and motivated to share it, document it, and pass it on to the next generation.

According to [17], crop rotation means changing the type of crop grown on a particular piece of land from year to year. Crop rotation assists in reducing the build-up of pests, especially those in the soil, such as root-feeding insects and fungi [6]. The results in Table 4 give a good picture as most (81.2%) of the respondents indicated that they rotate their crops with crops such as maize and legumes. This practice is good because it enables farmers to effectively control pests and diseases, and other crops such as legumes assist with nitrogen fixation. Mixed cropping, on the other hand, has the tendency to modify the microclimate in many fruit crop farms to favor the multiplication of insect pests [12].

Table 4. Pest management, use of traps, indigenous method & crop rotation (n=133)

Pest management	**Frequency**	**Percent**
Chemicals	119	89.5
Cultural control	14	10.5
Biological control	0	0
Use of traps on the farm		
Yes	10	7.5
No	123	92.5
Use of indigenous method to control pest		
Yes	7	5.3
No	126	94.7
Crop rotation		
Yes	108	81.2
No	25	18.8

Source: Own study

D. Integrated Pest Management, scouting, and source of information

According to [9], IPM means considering all available pest control techniques and other measures that discourage the development of pest populations while minimizing risks to human health and the environment. The results in Table 5 are not a good reflection as out of 133 respondents that were interviewed, only 13% had an idea of what IPM entails. Farmers need to be educated on IPM as this is a more sustainable way of controlling pests, and it involves a combination of pest control methods such as cultural, biological, and chemicals. IPM techniques are recommended to lower production costs, reduce exposure to pesticides and improve the long-term sustainability of the agriculture system [16]. The development and diffusion of IPM knowledge and technologies are needed in order to help reduce the damage caused by pests while also reducing dependency on hazardous pesticides [14] and promoting environmental health protection.

According to [10], scouting means rapidly and systematically determining the overall crop health and estimating the presence of certain organisms/pests causing damage and reducing yield. According to Table 5 majority (78.9%) of the respondents knew the meaning of scouting. Scouting is a very important element of monitoring the pest situation or status on the farm.

[1] indicated that agricultural extension is a system of disseminating the latest ideas and farming methods to the farming community for bettering their conventional farming practices. According to Table 5, the majority (98.4%) of the respondents indicated that they get information about pest

and pest management from their extension officers. This shows that extension officers play a major role in the successful management of pests and the production of crops by farmers. Extension officers organize awareness events such as workshops, study groups, and information days in order for farmers to get recent information on different pests, new pests, and how to manage the different pests. According to [27] agricultural extension officer's duty is to reach farmers that are scattered all over the country with practical and useful information for increased agricultural production.

Table 5. IPM, scouting, and source of information (n=133)

Meaning of Integrated pest management (IPM)	**Frequency**	**Percent**
Yes	17	12.8
No	116	87.2
Meaning of scouting		
Yes	105	78.9
No	28	21.1
Source of information about pest and pest management		
Farmer organization	1	0.8
Agricultural extension officer	131	98.4
Another source	1	0.8

Source: Own study

IV. CONCLUSION and RECOMMENDATIONS

The results of the study showed that the majority of the farmers know most of the pests that affect their productivity. Even though farmers demonstrated good knowledge on pests that affect their productivity, there is still a gap as there are still other pests that affect fruit and vegetables that are not known by farmers; therefore, smallholder farmers need to be trained on the proper identification and management of pests that affect their productivity. Age and level of education are important factors that need to be considered when conducting such pieces of training.

The study revealed that the majority (89.5%) of the respondents considered the use of chemicals (pesticides) as the best method of controlling pests. Intensive use of pesticides was a good indication that insect pests were causing economic damage to crop production in the area. It was also found that farmers were very interested in sustainable farming methods but often still use chemicals due to a lack of information about other available control methods and the desire to have a high yield. Farmers also demonstrated fair knowledge for cultural pests control, and there is a need to train farmers on cultural pests control practices. Cultural insect pest management strategies such as crop rotation, orchard/field sanitation, and removal of affected crops can be used by farmers to control insect pests. The study revealed that smallholder farmers have no knowledge of the role that is played by natural enemies (biological control) in the management of pests. Therefore there is a need to train farmers or improve their understanding of the identification as well as the role that can be played by natural enemies in pest management so as to conserve them. Only 5% of the respondents indicated that they use indigenous methods to control the pest. The results of the study also showed that only 7.5% of the respondents had been trapped in their farms.

A. Recommendations

Based on the abovementioned findings, the following are recommended:

- Farmers need to be trained on the proper identification and management of pests that affect their productivity. The training should include the use of more sustainable pest control methods such as integrated pest management.
- Farmer's indigenous management practices of fruit and vegetable pests should be documented.
- Establishing a pest surveillance program in the various farming areas of Thulamela municipality for predicting pest arrival, presence, absence, or abundance.

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