

NATIONAL AND PROVINCIAL OFFICIALS' KNOWLEDGE ON PHYTOSANITARY MATTERS FOR FOOD SECURITY IN SOUTH AFRICA

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ABSTRACT

The goal of this study was to investigate and identify the existing knowledge gaps on plant health systems of the national and provincial officials responsible for biosecurity issues and plant health matters at the Departments of Agriculture, Forestry and Fisheries (DAFF) in South Africa. In this study, stratified random sampling was used and a semi-structured questionnaire was used to collect data from 60 participants (30 each from national and provincial) from DAFF (scientists and inspectors), Department of Environmental Affairs (DEA) (biodiversity officers) and Provincial Departments of Agriculture (PDAs) (extension officers or agricultural advisors). The data was analysed statistically using the one-way frequency and Spearman's Rank correlation coefficients. The study revealed that 76.7% of the respondents at the national level have knowledge and understanding on plant health systems and only 36.7% of the PDAs respondents have such a level of knowledge. In terms of the relevant training on plant health matters, the majority of the respondents at the PDAs (80%) revealed that they were not receiving basic training on quarantine pests (pest identification and control), while only 20% of the respondents at the national authority indicated a lack of regular trainings. Thus, intensifying awareness and basic training on plant health matters, specifically for the extension officers and/or agricultural advisors, was found to be an effective tool to enhance knowledge capacity.

Keywords: Extension officers, legislation, knowledge, pest, plant health system

1. INTRODUCTION

This paper seeks to identify the level of knowledge in plant health matters or system of South Africa within the selected spheres of government which are national and provincial. Due to increased movement of plants and plant commodities that may pose plant pest risks on agriculture and biodiversity, an extensive knowledge on plant health systems is required for the protection of plants and plant products from harmful plant pests and diseases. Movement of people and goods had increased over the past decade (Petter, Roy & Smith, 2008:31). Aukema *et al.* (2011:1) reported that the introduction of quarantine pests and diseases is due to global trade and have caused a negative impact in agriculture and the environment. Therefore, knowledge on plant health regulations or phytosanitary regulations is significant within the plant health system (Republic of South Africa (RSA), 2014:4).

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This research paper made comparison on knowledge capacity of the officials at the national and provincial authorities regarding plant health and/or plant protection issues. Therefore, it is important to determine the level of knowledge capacity of national and provincial authorities. National authorities refer to the National Department of Agriculture, Forestry and Fisheries (DAFF) and the Department of Environmental Affairs (DEA). The majority of the officials who were interviewed as the national authorities work within the plant health and/or biosecurity environment and are professional scientists. This research paper also makes reference to provincial level/authority or Provincial Departments of Agriculture (PDAs). Most of the PDAs' officials are agricultural advisors and/or extension officers.

1.1 Problem statement

The spread and introduction of plant pests and diseases of economic importance have been affecting agriculture and horticulture in terms of food production and security as well as trade in South Africa. Although there are relevant international prescripts, competent authority, as well as relevant pieces of national legislation and polices, the perpetuation of introduction and spread of these pests and diseases remain a critical challenge to the agricultural sector. The knowledge gaps on plant health matters might have contributed to this challenge.

1.2 Objectives of the study

The objectives of this research paper are to:

- Investigate and identify the existing knowledge gaps on phytosanitary matters of the officials at the national authorities responsible for biosecurity issues and extension officers and/or agricultural advisors at the PDAs responsible for plant protection.
- Make recommendations to DAFF, DEA and PDAs regarding identified knowledge gaps to be addressed in order to assist national officials and agricultural advisors or extension officers for better control and management of plant pests and diseases.

2. LITERATURE

The knowledge for prevention, management and control of the plant pests and diseases is significant in order to overcome the introduction and spread within the country. Plant pests and diseases of economic importance have been affecting agriculture and horticulture in terms of food production and security as well as trade over the last decade (Flood, 2010:215). The effectiveness of the plant health management is a key factor towards supporting food security as well as domestic and international trade as was discovered by the study conducted in Uganda (Danielsen & Matsiko, 2016).

Plant pests and diseases have a large impact towards food availability and security (Oerke, 2006:31). The negative impact, economic implications and consequences caused by harmful or regulated pests to horticultural industry can be detrimental if left unattended and may affect production, trade, farmers, as well as society in general (RSA, 2014:4). The Food and Agriculture Organisation (FAO, 2001:239) also confirmed that the introduction of quarantine pests can have major trade implications amongst the trading partners.

In Africa, many countries were found to have challenges towards understanding and implementation of the international prescripts relating to plant health due to lack of required resources and/or relevant capacity (Chinappen, 2011:17). Flood (2010:229) conducted a study

on the society perceptions towards the significant of the phytosanitary measures and concluded that plant health matters are not obtaining priority as they should, especially on the impact of pests and diseases on crop losses. The negative impact caused by plant pests and diseases of economic importance may ultimately result in consequences to the farmers (RSA, 2014:4). Therefore, it is important that extension officers and/or agricultural advisors at the PDAs possess relevant knowledge on plant health matters to be able to assist and advise farmers appropriately.

The relevant national/ international prescripts for the control and management of plant pests and diseases for food production and security as well as trade are the World Trade Organisation Agreement on the Application of Sanitary and Phytosanitary Measures (WTO-SPS Agreement) as well as the International Plant Protection Convention (IPPC) (FAO, 11:1; RSA, 2014:5).

The National Plant Protection Organisation of South Africa (NPPOZA) has been established within the context of the IPPC and comprises of the following components: Plant Health (responsible for policy issues), Inspection Services (operational and enforcement), and Food Import and Export Standards (responsible for awareness and promotion) (RSA, 2014:11).

According to the RSA (2014:12), it is important to conduct training and development of staff on plant health matters including the extension officers. Plant health information and knowledge is one of the shortcomings to many small-scale farmers and extension officials at the local and provincial authorities (Cameron *et al.*, 2016:212). In South Africa, one of the responsibilities of the NPPOZA is to conduct training, awareness and promotion on plant health matters (RSA, 2014:12). However, the impact of this responsibility is not fully known within the spheres of government, which would be investigated by this study. Benard (2011:42) discovered that small-holder farmers in many African countries do confront challenges in terms of the accessibility to information as well as in obtaining appropriate updated information.

In South Africa, the relevant legislative mandate of the DAFF on the control and management of plant quarantine pests and diseases is the Agricultural Pests Act (APA), 1983 (Act No.36 of 1983) and its associated regulations (DAFF, 2015:2; Khwidzhili & Worth, 2017:81; RSA, 1983). This mandate is within the national competency and is performed by the NPPOZA which is a requirement in terms of South Africa's membership to the IPPC. The purpose of the APA with regards to phytosanitary matters is to provide for measures by which quarantine pests of plants, plant products and associated regulated articles may be prevented from entering, establishing and spreading in South Africa. The powers and functions to execute the provisions of the APA are vested to the relevant executive officers in terms of the APA (RSA, 1983). According to the National Control Measures, R.110 of January 1984, as amended by the APA, the following are some of the regulated pests which should be known by all relevant officials and extension officers since these may affect food production and security as well as trade and are subjected to official control and compulsory reporting: Fall armyworm (R. 449 of 2017), Oriental fruit fly (*Bactrocera dorsalis*, formerly known as *B. invadens*), Banana bunchy top virus (BBTV), Citrus greening: African and Asian strain, Citrus black spot, Aster yellow phytoplasmas (grapevine yellows), Karnal bunt of wheat, Golden cyst nematode, Wart disease of potatoes, and Bacterial wilt of potatoes (RSA,2017).

In sum, information and knowledge on plant health issues are significant and all national officials and extension officers or agricultural advisors should possess such knowledge to

ensure better control and management of plant pests and diseases and provide farmers with relevant and updated information.

3. METHODOLOGY

3.1 Data collection and data analysis

Stratified Random Sampling, which involves the division of a population into smaller groups, was used to determine the sample for data collection. Data was collected from the DAFF (scientists and inspectors), DEA (biodiversity officers) and PDAs (extension officers or agricultural advisors). The data were collected from a total of 60 respondents at the DAFF, DEA and PDAs respectively. This involved 30 respondents from National departments (DEA and DAFF) and 30 respondents from seven PDAs (from the total of nine provinces). The collected data was deemed to be representative from the total sample population on plant health disciplines and related fields. Research data was obtained through a semi-structured questionnaire which consisted of both qualitative and quantitative questions. The questionnaire was designed to gather information on plant health systems relating to biographical information and knowledge on plant health matters.

All fully completed questionnaires were coded and captured using the Statistical Package for the Social Science (SPSS, version 20). Incomplete questionnaires were discarded. The data was analysed statistically using the one-way frequency and Spearman's Rank correlation coefficients with the SPSS computer software. Spearman's Rank correlation coefficient is normally used to summarise the strength and direction (negative or positive) of a relationship between two variables.

4. RESULTS AND DISCUSSION

4.1 Respondent demographics

It was found that all categories of age groups are reflected across all spheres of government. The findings indicated that most of the respondents from the national authorities are youth (46.7%), whereas at the provincial level, 46.7% of the respondents were older. This finding indicates that most of the officials who work at the PDAs are older as compared to those at the national level. This finding was supported by the study conducted by Ngaka and Zwane (2017:31) in all nine provinces of South Africa. In terms of the gender balance, among the respondents interviewed at relevant national departments, there was gender balance (50% male and 50% female), whereas at the provincial level, gender was divided by 63.3% male and 33.3% female. In general, many people perceive agriculture as a field that requires more labour force hence male predominate at the provincial level (DAFF, 2017:42). Ngaka and Zwane (2017:32) also discovered that males predominate at the provincial level. The results showed that 33.3% of the participants at the national level were scientists and 97.6% of the respondents at the PDAs were extension officers and/or agricultural advisors. Plant health is science based and requires academically qualified personnel with scientific backgrounds to optimally function within such contexts. Plant health regulations must be developed in accordance with the scientific principles of the IPPC (RSA, 2014:38).

Table 1 displays the percentage of the educational background of the respondents in the relevant agricultural fields including biosecurity and plant health environment. The results in

terms of the educational background showed that the predominant educational level amongst the respondents is postgraduate degree at the PDAs (73.3%) as compared to the relevant national departments (53%). According to the Plant Health Policy of the Republic of South Africa (RSA, 2014), the relevant qualifications and technical skills required to operate in the plant health environment include plant pathology, entomology and nematology.

Table 2 shows that 50% of the respondents who are located at the provincial level have extensive experience in agriculture in general as compared to respondents at the national departments (36.7%). Ngaka and Zwane (2017:31) also conducted a study in nine provinces of South Africa and found that extension officers at the provincial level have more years of working experience.

Table 1: Number of respondents (%) regarding educational background

Respondents	Educational background of the respondents			
	Postgraduate	Degree	Diploma	Total
Departments				
National authorities (DAFF and DEA)	53	34	13	100%
PDAs	73	27	0	100%

Table 2: Number of respondents (%) regarding work experience

Respondents	Years of working experience in the sector					Total
	2 to 5 years	6 to 10 years	11 to 15 years	16 to 20 years	>21 years	
Departments						
National Authorities (DAFF and DEA)	26.7	36.7	23.3	10	3.3	100%
PDAs	10	23.3	16.7	50	0	100%

4.2 Knowledge of plant health systems, relevant international prescripts and relevant national legislation

The results on knowledge of the respondents in relation to plant health systems, relevant plant health international prescripts, and plant health relevant legislation are presented in Table 3. Plant health knowledge is an important integral part for the control and management of plant pests and diseases. It is critical that all officials, including the agricultural advisors or extension officers, are exposed to plant health matters and legislation. Khwidzhili and Worth (2017:73) found that agricultural policies and legislation are interlinked regarding sustainable agriculture, therefore, it is important that extension officers familiarise themselves with such prescripts. The results revealed that 76.7% of the respondents at the national level have more knowledge and understanding on plant health systems. However, at the PDAs or provincial level, the findings show that only 36.7% of the respondents have knowledge and understanding of the plant health system. The findings at the provincial level is supported by Cameron *et al.* (2016:212) who pointed out some of the shortcomings experienced by most of the agricultural advisors, extension officers as well as all small-scale farmers globally. However, this may be as a result of lack of exposure of the extension officers and/or agricultural advisors since 63.3% of the PDAs' respondents revealed a lack of such knowledge regarding plant health systems.

In terms of the knowledge in plant health international prescripts, the results revealed that the majority of respondents (90%) at the relevant national authorities and 50% of the respondents

at the PDAs have knowledge of the international prescripts. The results further revealed that 93.3% of the respondents at the national authority and 56.7% at the provincial level do have knowledge of the selected pieces of national legislation impacting on plant health issues. The study conducted by Cameron *et al.* (2016:221) revealed that legislation is significant as this helps farmers to be provided with the latest and updated information and knowledge. It is crucial that all government officials within the spheres of government keep abreast with the latest development to legislation. According to Flood (2010:215), plant health issues are essential for food security.

Table 3: Responses (%) of the national officials from national authorities (DAFF and DEA) and agricultural advisors or extension officers from the PDAs regarding the level of knowledge on plant health systems, relevant international prescripts and relevant national legislation

Knowledge category	National authorities' responses (%)	PDAs' responses (%)
Respondents with knowledge of plant health matters	76.7	36.7
Respondents without knowledge of plant health matters	23.3	63.3
Total	100%	100%
Respondents with knowledge on plant health international prescripts	90	50
Respondents without knowledge on plant health international prescripts	10	47.7
Respondents who are not sure of knowledge on plant health international prescripts	0	3.3
Total	100%	100%
Respondents with knowledge on plant health national legislation and policies	93.3	56.7
Respondents without knowledge on plant health national legislation and policies	6.7	40
Respondents who are not sure of knowledge on plant health national legislation and policies	0	3.3
Total	100%	100%

4.3 Provision of inputs on plant health policy issues by respondents and accessibility of plant health information by the farmers

Table 4 indicates the results on the level of provision of inputs on plant health policy and accessibility of plant health information by the farmers. The findings indicate that the majority of officials at the PDAs (66.7%) were not providing inputs on policy issues during the developmental process. At the national level, 53.3% of the respondents indicated that they were

providing inputs on policy matters. According to article IV of the IPPC, 1997, the contracting party, the NPPOZA, shall develop, issue and publish plant health regulatory framework within the context of the international prescripts (FAO, 2011:7). Considering that phytosanitary legislative framework is developed at a national level, one would expect that the majority of national officials do participate in providing inputs on policy. On the accessibility of plant health information, most technical officials (73.3%) at the national level and provincial extension officials (63.7%) indicated that accessibility to plant health information by farmers was a challenge or farmers cannot access relevant information relating to plant health issues. These findings are consistent with the study conducted by Benard *et al.* (2014:42) who found that small-holder farmers in many African countries do confront challenges in terms of the accessibility to information as well as in obtaining appropriate updated information. Wright *et al.* (2016:34) reported that the use of “Information Communication Technology” (ICT) is a viable tool for the accessibility of the information by the farmers and this tool may be used by the extension officers at provincial level. The same sentiment was supported by the study conducted by Danielsen and Matsiko (2016:351). This may be necessitated by the lack of extensive awareness amongst stakeholders on plant health matters. Plant health information is crucial for the benefit of the farmers to participate in food production and security as well as trade. Accessibility of information or advisory services by farmers through agricultural advisory or extension services can assist farmers at all categories to overcome or respond to any potential challenges confronted, such as an outbreak of quarantine pest/s. The study further found that such information is being requested from time to time by farmers.

Table 4: Responses (%) of the national officials from national authorities (DAFF and DEA) and agricultural advisors or extension officers from the PDAs regarding provision of inputs on plant health policy issues and accessibility of plant health information by farmers.

Provision of inputs and accessibility of information	National authorities' responses (%)	PDAs' responses (%)
Respondents who provide inputs on plant health policy matter	53.3	20
Respondents who do not provide inputs on plant health policy matter	46.7	66.7
Respondents who are not sure if they provide inputs on plant health policy matter	0	13.3
Total	100%	100%
Respondents who believe that the plant health information is accessible to farmers	20	33
Respondents who do not believe that the plant health information is accessible to farmers	73.3	63.7
Respondents who are not sure if the plant health information is accessible to farmers	6.7	3.3
Total	100%	100%

4.4 Participation in relevant fora by respondents

The results shown in Table 5 represent the level of participation in relevant fora by the respondents. The findings indicate that about half of the respondents at the relevant national authorities (53%) do participate in the relevant plant health fora, whereas 67% of the respondents at the PDAs do not participate in the relevant fora. Nevertheless, the majority of the respondents (83.3%) of the relevant national authorities and 70% at the PDAs feel that more involvement is required to participate in the relevant plant health fora. In South Africa, there are various plant health fora between the DAFF and relevant role-players wherein matters associated with plant pest risk management are being discussed. According to respondents from both the national authorities and PDAs, the major relevant role-players include fruits and vegetables industries, ornamental plants industry, importers and exporters, assignees, producers, and growers. Most of these fora are in relation to the control and management of plant pests and diseases in order to facilitate food production and security as well as trade.

Table 5: Number of respondents (%) regarding the participation in relevant plant health fora

Participation in plant health fora	National authorities' responses (%)	PDAs' responses (%)
Respondents who participate in relevant plant health fora	53	27
Respondents who do not participate in relevant plant health fora	43.7	67
Respondents who are not sure of participation in relevant plant health fora	3.3	6
Total	100%	100%
Respondents who are willing to participate in relevant plant health fora	83.3	70
Respondents who do not see a need to participate in relevant plant health fora	13.7	26.7
Respondents who are not sure if they want to participate in relevant plant health fora	3	3.3
Total	100%	100%

4.5 Involvement of respondents in basic training on quarantine pests

Figure 1 displays national technical officials and agricultural advisors or extension officers' responses regarding the amount of basic training they received on quarantine pests of plants. The majority of the respondents at the PDAs (80%) indicated that they have not received basic training on quarantine pests whereas only 20% of the respondents at the national authority showed that the relevant basic trainings were not being offered. However, half of the respondents (50%) at the national authorities confirmed that they do receive relevant training on plant health matters through international training. Considering the limited basic training on quarantine pests being received, this is contrary to the study conducted by Flood (2010:229)

who recommended that plant health knowledge should be intensified in order to build the capacity for strengthening and improving plant health systems. The results on training is also contrary to Article IV of the IPPC (1997) which indicates that one of the responsibilities of the NPPOs such as NPPOZA is to conduct training and development of staff. Furthermore, Ngaka and Zwane (2017:35) concluded that the majority of the PDAs were not knowledgeable and/or aware of “the knowledge of extensionists on learning networks”.

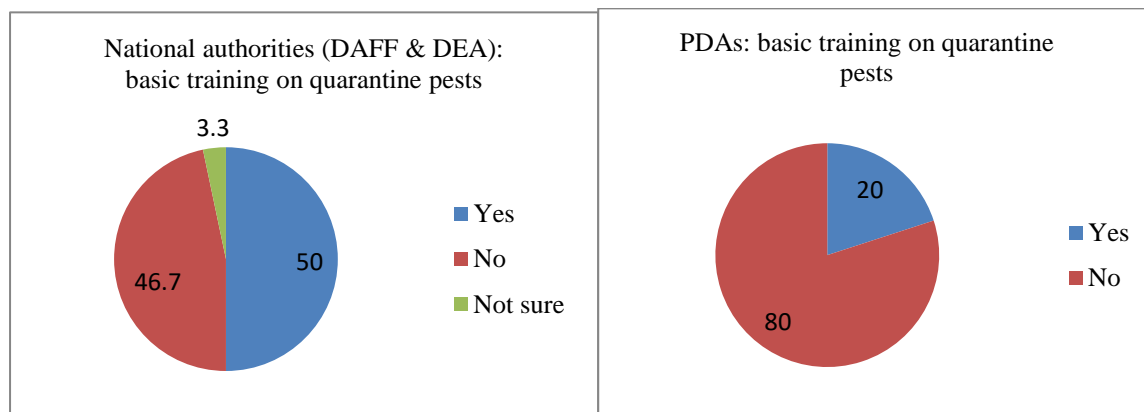


Figure 1: Officials' responses (%) from the national authorities and PDAs regarding the respondents who received basic training on quarantine pests

4.6 Correlation coefficients plant health knowledge analyses

A spearman's rank correlation coefficient was employed to determine the relationship between various variables in this study. The findings under this section are presented in Table 6.

4.6.1 Effects of education on provision of inputs on plant health policy issues

The findings show that there was a negative correlation between education and provision of inputs on plant health policy issues ($r(60) = -0.132$, $P = 0.316$). This implies that despite qualifications or education, it does not mean that government officials will have a significant impact towards provision of inputs on policy issues.

Contrary to this, it would be expected that qualifications, especially on the specialised disciplines on plant health matters, will contribute to knowledge enhancement. This is because certain universities like the University of Pretoria do offer the basic principles of plant health or crop protection, which include Plant Pathology, Entomology and Weed Science (University of Pretoria, 2015). However, one would expect that the relationship does exist, and basic knowledge is demonstrated in policy issues. However, Ebbels (2003) indicated that most graduate students and government officials worldwide are not exposed to the extensive knowledge of plant health and quarantine matters as these are not covered in their syllabus at university level.

4.6.2 Effects of place of employment on the level of knowledge and understanding on plant health system

It was found that place of employment correlated with knowledge on plant health system ($r(60) = 0.404$, $p = 0.001$). The results suggest that officials exposed to plant health matters and

work at the national authorities will have significant knowledge on plant health systems. Jele and Nxele (2016:7) confirmed this finding in a technical report. The authors indicated that plant health legislative and policy framework are administered by the national authority, and they further suggested that provincial authority could play a pivotal role in performing necessary phytosanitary procedures for pest control. However, this suggests that provincial mandate on plant health matters is not yet legislated. Similarly, in countries like Kenya, the plant health regulatory framework is embodied at a national level and the national authority does not provide for extension services (Boa, 2013:8). Therefore, it is expected that place of employment does play a role in determining the level of knowledge on plant health system.

4.6.3 Effect of basic training on quarantine pest to knowledge on plant health system

The results show that there was a correlation between knowledge of basic training on quarantine pests and knowledge and understanding of plant health systems ((r) (60) =0.329, p=0.010). The correlation is significant at the 5% level of significance and shows that basic training on quarantine pests do contribute to the level of knowledge and understanding on plant health systems. Ebbels (2003) supports the notion that training is a crucial part within the structure of the NPPOs. In this case, this will be applicable to the NPPOZA structure.

4.6.4 Effects of basic training on quarantine pests to provision of inputs on policy issues

The results indicate that there was a positive association between basic training on quarantine pests and the level of providing inputs on policy issues ((r)(60)=0.466, p=0.000). This means that the more the officials receive relevant basic trainings, it is expected that the level of knowledge will increase, which leads to active participation in providing inputs on policy issues. It is evidently shown that basic training on quarantine pests can assist both the national and provincial authorities in providing inputs on the policy issues relating to plant health matters. As already shown by Ebbels (2003), training is an essential element to enhance technical skills and knowledge on international agreements and protocols which lead to effective participation in plant health activities. This is also consistent with the correlation which was determined between the basic training on quarantine pests and understanding and knowledge on the international prescripts ((r) (60) =0.377, p=0.003).

Table 6: Spearman’s correlation coefficients on biographic information and knowledge and understanding on plant health matters (n=60)

Variables	Knowledge and understanding on plant health system	Understanding and knowledge on national legislation	Understanding and knowledge on international prescripts	Provision of inputs on policy issues
Education	0.076 ^{NS}	0.001 ^{NS}	0.055 ^{NS}	-0.132 ^{NS}
Designation	0.453**	0.403**	0.310*	0.44**
Place of employment	0.404**	0.425**	0.439**	0.504**
Work experience	0.225 ^{NS}	0.360**	0.370**	0.282*
Basic trainings on quarantine pests	0.329*	0.397**	0.377**	0.466**

Correlations are highly significantly (**) or significant (*) at p<0.05, or non-significant (NS).

5. CONCLUSIONS AND RECOMMENDATIONS

This study was the first to be conducted to investigate knowledge gaps within the spheres of government on plant health systems of South Africa. In terms of knowledge, the results of the study found that more than 70% of the respondents from national departments had knowledge on plant health matters as compared to the officials at the PDAs (less than 50%). Furthermore, the study revealed that half of the respondents from the national authorities and 20% of the respondents from the PDAs did receive basic training on quarantine pests. The study also found that 66.7% of the PDAs' respondents were not participating in the relevant plant health fora and only 43.3% of national respondents were not participating. The majority of national (83.3%) and PDAs' (70%) respondents cited the need to participate in the relevant plant health fora. An effective plant health system is critical for the proper execution and implementation of the plant health legislative framework which will also enable the national officials and extension officers to assist the farmers to assist control and manage plant pests in order to achieve food production and security as well as trade. This research study identified knowledge gaps on the current system, which needs to be improved and strengthened for efficiency and effective plant health systems. In terms of the knowledge and understanding on plant health matters, it can be concluded that there are knowledge gaps on plant health matters especially at the PDAs by the agricultural advisors and/or extension officers.

Thus, the following recommendations are provided for DAFF: NPPOZA, DEA (Biodiversity and Biosecurity unit), PDAs authorities: Agricultural advisors and/or extension officers, as well as policy and decision makers regarding the areas of improvement on plant health systems of South Africa:

- The DAFF should provide necessary basic trainings on plant health matters at all spheres of government, specifically to the agricultural advisors and/or extension officers, for capacity building to ensure rapid response to outbreak of quarantine pests as well as in providing proper and updated advisory to farmers.
- Provision of inputs on plant health policy issues by the officials within all spheres of government (national and provincial), including by the agricultural advisors and/or extension officers, who were found not to provide inputs by this study. The PDAs are mostly affected during the outbreak of plant pests. Therefore, it is advised that the officials at the provincial level should positively contribute before promulgation of any plant health regulatory framework.
- The DAFF should involve relevant PDAs officials to actively participate in all relevant plant health fora and workshops.
- Efforts should be made to intensify awareness and promotion at all spheres of government on plant health matters and ensure accessibility of plant health information to all categories of farmers, more importantly the small-scale farmers.

REFERENCES

AUKEMA, J.E., LEUNG, B., KOVACS, K., CHIVERS, C., BRITTON, K.O., ENGLIN, J., FRANKEL, S.J., HAIGHT, R.G., HOLMES, T.P., LIEBHOLD, A.M. & MCCULLOUGH, D.G., 2011. Economic impacts of non-native forest insects in the continental United States. *PLoS one*, 6(9): e24587.

- BENARD, R., 2014. Information needs of small-scale farmers in Tanzania: A case study of Kongwa district, Dodoma region. PhD Thesis, Sokoine University of Agriculture.
- BOA, E., 2013. All things come together: Towards a plant health system for Kenya. SOLINSA show case report. *CABI, Agro-Insight*.
- CAMERON, K.H., SOMACHANDRA, K.P., CURRY, C.N., JENNER, W.H. & HOBBS, S.L., 2016. Delivering actionable plant health knowledge to smallholder farmers through the plantwise program. *J. Agric. Food information*. 17(4):212-229.
- CHINAPPEN, M., 2011. A proposal for phytosanitary capacity building strategy in Africa. *Technical Report*.
- DANIELSEN, S. & MATSIKO, F.B., 2016. Using a plant health system framework to assess plant clinic performance in Uganda. *Food Sec.*, 8(2):345-359.
- DEPARTMENT OF AGRICULTURE, FORESTRY AND FISHERIES (DAFF), 2015. Strategic Plan 2015/16 to 2019/20. Department of Agriculture, Forestry and Fisheries. National Policy Mandates. Pretoria.
- DEPARTMENT OF AGRICULTURE, FORESTRY AND FISHERIES (DAFF), 2017. Agricultural education and training access barriers report [viewed December 2017]. Available from: <http://www.nda.agric.za/doaDev/sideMenu/educationAndTraining/>.
- EBBELS, D.L., 2003. *Principles of plant health and quarantine*. CABI.
- FLOOD, J., 2010. The importance of plant health to food security. *Food Sec.* 2(3):215-231.
- FOOD AND AGRICULTURE ORGANISATION (FAO), 2001. Economic impacts of transboundary pests and diseases. Economic and Development Department.
- FOOD AND AGRICULTURE ORGANISATION, 2011. International Plant Protection Convention (IPPC), 1997. New Revised Text (NRT). Food and Agriculture Organisation of the United Nations, Rome, Italy.
- JELE, J. & NXELE, E., 2016. Report on Southern Africa phytosanitary inspection workshop Held at Sheraton Hotel, Pretoria.
- KHWIDZHILI, R.H. & WORTH, S.H., 2017. Evaluation of policies promoting sustainable agriculture in South Africa. *S. Afri. J. Agric. Ext.* 45(2):73-85.
- NGAKA, M.J. & ZWANE, E.M., 2017. The role of learning networks in agricultural extension service delivery: A survey in the nine provinces of South Africa. *S. Afri. J. Agric. Ext.* 45(2):26-37.
- OERKE, E.C., 2006. Crop losses to pests. *J. Agric. Sci.*, 144(1):31-34.
- PETTER, F., ROY, A.S. & SMITH, I., 2008. International standards for the diagnosis of regulated pests. *Eur. J. Plant Pathol.*, 121(3):331-337.

REPUBLIC OF SOUTH AFRICA (RSA), 1983. Agricultural Pests Act No.36 of 1983 (Act No.36 of 1983) as amended. Republic of South Africa. Pretoria.

REPUBLIC OF SOUTH AFRICA (RSA), 2014. Plant Health (Phytosanitary) Policy of South Africa. Department of Agriculture, Forestry and Fisheries (DAFF). Pretoria: Government Gazette No.38102.

REPUBLIC OF SOUTH AFRICA (RSA), 2017. Agricultural Pests Act No.36 of 1983 (Act No.36 of 1983) as amended. Control Measures R.110 of 27 January 1984 as amended by R.1271 of 17 November 2017. Republic of South Africa. Pretoria.

UNIVERSITY OF PRETORIA (UP), 2015/16. Prospects. Natural and Agricultural Sciences.

WRIGHT, H.J., OCHILO, W., PEARSON, A., FINEGOLD, C., ORONJE, M., WANJOHI, J., KAMAU, R., HOLMES, T. & RUMSEY, A., 2016. Using ICT to strengthen agricultural extension systems for plant health. *J. Agric. Food Information*. 17(1):23-36.