



A Survey on Pesticide Awareness and Management Practices in Tanzania

Mwema Felix and Alice Sharp

Abstract— Pesticides are chemicals that are applied on crops and plants to control pests. They are toxic chemicals so one needs to exercise careful attention when using them. Poor pesticide management practices and violation of safety rules have however continued to suffice. This could cause undesired effects to the pesticide users, food consumers, non-target organisms, and the environment. We surveyed how aware people in Tanzania, are of pesticides and their associated health effects. We used an online-based comprehensive semi-structured survey to collect data from people in Tanzania. Questionnaire had a mixture of compulsory and non-compulsory questions. We received response from one hundred fifty-seven people. Ninety-four people reported that agriculture was one of their main activities while sixty-three people reported that agriculture was not one of their main activities. We found that their pesticide management practices are poor. Poor management practices were identified on storage of inventories, disposal of empty containers, disposal of obsolete pesticides, and the use of protective gears. Although respondents are aware that pesticides could harm them and the environment, still their management practices are unsatisfactory. This could probably be due to negligence. We recommend that there is a need to increase tailor-made motivational and awareness programs to pesticide users and the population at large on good agricultural practices and good pesticide management practices.

Keywords— About four key words or phrases in alphabetical order, separated by commas.

1. INTRODUCTION

Like in the Greater Mekong Sub-region (GMS), food, water, and a healthy environment are vital components [1-4] to human well-being in Sub-Saharan Africa, Tanzania is no exception. With over 70% of the population depending on rain-fed agriculture [5], Tanzania is among the lowest income countries with the majority of the people living in poverty [6] which is below a poverty line of less than US\$ 2/day [7].

Tanzania has a population of 51 million people [8] and a land area of 880,000 km² [9]. The country has had an increase in competition for land and water resources for agricultural production to meet the growing food demand due to the increase in population. The situation in Tanzania is similar to the global situation where by the world food demand is high [10]. More food is therefore needed to feed the global population currently estimated at 7 billion people [11]. The global population is however increasing rapidly: estimated at 8 billion people by the year 2050 [11] and 9 billion people by the year 2070 [12]. The increase in population has caused an

increase in competition for global land and water resources [13].

Despite of competition for land and water resources, agriculture has been the backbone of the country. The agricultural gross domestic product (GDP) increased at 4.4% annully during 1998–2007 [5]. To meet food demand, there has been a need for the agricultural expansion. For the past forty years, the expansion has increased the quantity of food and improved the quality of food worldwide [14]. According to Food and Agriculture Organization (FAO) projections, the global agricultural area is expected to expand from an area of 5.1 billion ha to 5.4 billion ha in 2030 [15].

During the expansion processes, the main concern is the way agriculture is practiced (performed). This is because failure to follow recommended practices [16] could lead to undesired effects to the environment, humans, and other living organisms [17].

One of the main concerns in agriculture is the use of pesticides. They are toxic chemicals that are intended to kill or repel target pests [18]. They are used to reduce production losses caused by pests [19]. They are toxic chemicals so one needs to exercise careful attention when using them.

The use of pesticides has increased globally with 45%, 25%, and 30% of the global pesticides being used in Europe, USA, and the rest of the world combined respectively [20, 21]. The increased use of pesticides could be attributed by the increase in pests as well as pesticide policies that offers incentives to farmers who use pesticides [22].

Despite of pesticides being toxic, their judicious use could reduce their associated negative effects [23]. In addition, the use of less toxic pesticides could improve the environmental performances [24]. However, poor pesticide application and management practices [25],

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misuse, and violation of safety rules [26] continue to threaten the health of farmers, consumers, and the environment [27]. Poor practices have led to contamination of pesticides on/in food crops [28] and in the environment [27]. Poor practices have also led to the increase in pest resistances [29].

It is estimated that in Tanzania 1,000 people die every year from pesticide poisoning [30]. Pesticide poisoning is a concern not only in Tanzania but it is also a concern in Thailand. Thailand has 42% of the working population depending on agriculture [31]. It is estimated that 39,600 farmers are poisoned yearly [32]. Despite of the poisoning cases, majority of Thai farmers continue to use pesticides inefficiently [31, 33]. In addition, there is no significant difference between the use of less hazardous and hazardous pesticides by the farmers who follows good agricultural practices (GAP) standards [34]. Although the majority of Thai maize farmers posses high knowledge, positive attitude, and good agricultural practices, they however, bears herbicide poisoning symptoms which is caused by unsafe practices [31, 35] such as not using protective gears when spraying [36] and the use of banned pesticides e.g. endosulfan [37].

Since pesticide exposure is inevitable amongst farm and agricultural workers [38, 39], and since food, water, and a healthy environment are essential to human well-being, this study surveyed how aware people in Tanzania, are of pesticides and their associated health effects. The goal of the study is to promote agricultural sustainability in the country. This means that the present generation should meet their agricultural needs without jeopardizing the possibility of future generations to meet theirs [40]. This is very important because the country depends on agriculture, and the majority of the population depends on agriculture [5]. Therefore, any potential harm caused by pesticides to the people (i.e. farmers, consumers) and the environment would significantly have severe impacts to the economy of the country.

2. METHODOLOGY

An online-based comprehensive semi-structured survey was used for collecting data from people in Tanzania. The questionnaire included closed and open-ended questions. Respondents were asked to respond to the questionnaire referring to as back as to ten years. Data collected were analyzed for descriptive statistics using Microsoft Excel spreadsheets.

3. RESULTS AND DISCUSSION

We received response from one hundred fifty-seven people. Ninety-four respondents (59.87%) reported that agriculture was one of their main activities (AMA) while sixty-three respondents (40.13%) agriculture was not one of their main activities (ANMA). The average age of all respondents combined is 39.31 ± 0.86 years (Table 1). Majority of the respondents (90.44%) had received a university education (Table 2). Respondents by region-wise were from Dar es Salaam (36.31%), Arusha (19.11%), Tanga (7.01%), and Morogoro (5.10%). These

are in fact agricultural dominated regions (Fig. 1).

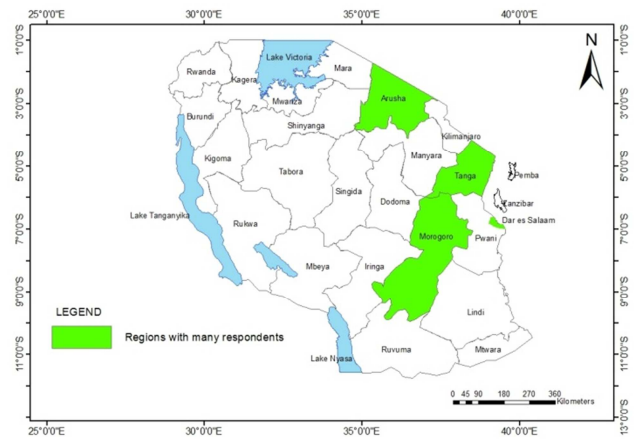


Fig. 1. Map of Tanzania showing regions [41]

Table 1. Age of the respondents

Age (years)	AMA	ANMA	Overall
Mean	40.46	37.56	39.31
Standard Error	1.17	1.21	0.86
Standard Deviation	11.33	9.57	10.73
Minimum	24	23	23
Maximum	64	65	65

Table 2. Level of education of the respondents

Level of education (n)	AMA	ANMA	Overall
University degree	86	56	142
Advanced diploma	4	3	7
Diploma	1	4	5
Secondary education	2	0	2
Primary education	1	0	1

We asked the respondents: when was the first time they heard about pesticides and their associated effects. We found that 86.17% of those agriculture is one of their main activities and 79.37% of those agriculture is not one of their main activities, for the first time, had heard about general information related to the usage of pesticide and their associated risks more than ten years ago (Fig. 2). This shows that most of the respondents were aware of the existence of pesticides for a quite some time. However, none of those agriculture is one of their main activities and 3.17% of those agriculture is not one of their main activities had heard about general information related to the usage of pesticide and their associated risks within the past two years.

We also asked the respondents if they were getting pesticide related information on regular basis through various means such as training, newspapers, televisions, radios, etc. We found that 56.38% of those agriculture is one of their main activities and 38.10% of those agriculture is not one of their main activities had heard some general information about pesticides recently within a year while 21.28% of those agriculture is one of their main activities and 26.98% of those agriculture is not one of their main activities had heard some general information about pesticides more than ten years ago

(Fig. 3). This suggests that recently, there has been some sought of awareness programs regarding the use of pesticides in the country.

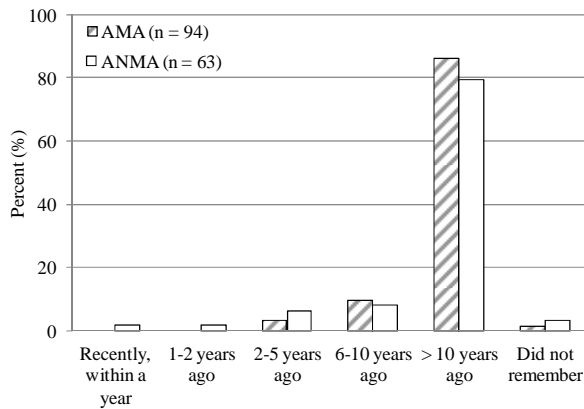


Fig. 2. Respondents who had heard general information related to the usage of pesticide and their associated risks (for the first time)

We assessed the use of protective gears with main focus on past few years. We found that only 15.96% of those agriculture is one of their main activities and 14.29% of those agriculture is not one of their main activities used all required protective gears while working with pesticides. Also, 39.36% of those agriculture is one of their main activities and 25.40% of those agriculture is not one of their main activities did not wear any protective gear when working with pesticides (Fig. 4): a practice which has negative consequences on their health. This is very dangerous because unsafe practices [31, 35] such as not using protective gears when spraying [36] could have serious negative impacts on pesticide users (i.e. the person who is spraying).

We also assessed the use of protective gears with main focus on present practices. We found that 15.96% of those agriculture is one of their main activities and 17.46% of those agriculture is not one of their main activities are currently using all required protective gears, while 34.04% of those agriculture is one of their main activities and 17.46% of those agriculture is not one of their main activities do not use any protection gear when working with pesticides (Fig. 5).

We found that 84.04% of those agriculture is one of their main activities and 82.54% of those agriculture is not one of their main activities are at risk of being poisoned due to the failure of not following recommended practices when working with pesticides. The none use of protective gears which could be due to either cost or unavailability of protective gears is one of the main concerns that need not be undermined.

We further found that more of those agriculture is one of their main activities are currently not using protective gears when working with pesticides. Under normal circumstances, it is expected that those agriculture is one of their main activities could be more aware of the importance of using protective gears through meetings conducted by agricultural associations than those

agriculture is not one of their main activities who engage in agricultural activities occasionally and more often are not members of agricultural associations, still they are not using any protection.

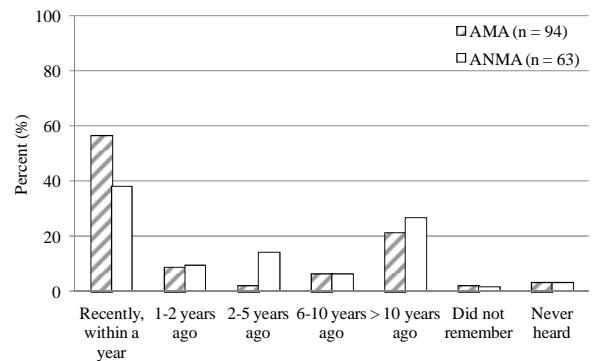


Fig. 3. Respondents who had heard general information about pesticides (on regular basis) through various means such as training, newspapers, televisions, and radios.

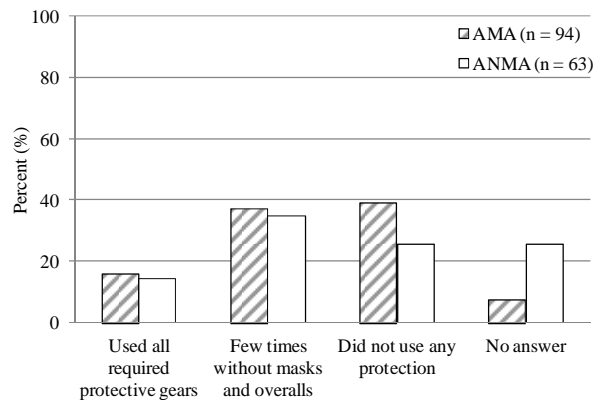


Fig. 4. Respondents who used protective gears when working with pesticides (in the past)

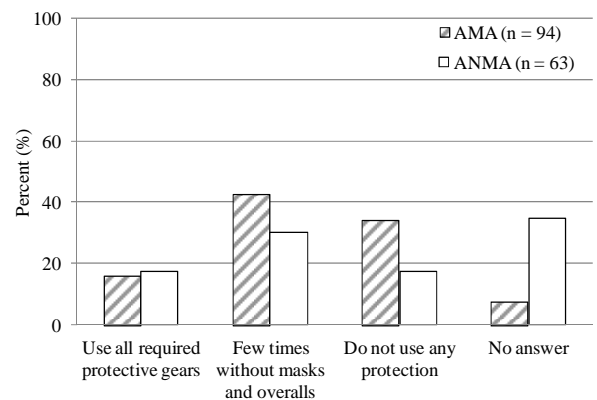


Fig. 5. Respondents who use protective gears when working with pesticides (presently)

Fig. 4 and Fig. 5 further reveal that there is a reduction by 5.32% (of those agriculture is one of their main activities) and 7.94% (of those agriculture is not one of their main activities) in the number of respondents who did not use any protective gear in the past but are currently using protective gears. This means that more

respondents are currently using protective gears when comparing their past and present pesticide management practices.

We assessed disposal practices of pesticide empty containers. We found that only 10.64% of those agriculture is one of their main activities and 11.11% of those agriculture is not one of their main activities would dispose empty containers in a privately-owned special disposal locations as instructed or else would keep empty containers in secured areas (Fig. 6). Also, 70.21% of those agriculture is one of their main activities and 66.67% of those agriculture is not one of their main activities would dispose empty containers in the soil either in a landfill or by burying underground. This increases the chances of any remained pesticides in the containers to be found in the soils and the environment. This practice is dangerous because while in the environment, pesticides could be transported from one point to another [42] thus there is a chance to be found in consumable food and groundwater [43, 44].

We also found that 13.83% of those agriculture is one of their main activities and 11.11% of those agriculture is not one of their main activities would dispose pesticide by burning (Fig. 6). This is dangerous because the burning of pesticides empty containers or pesticide treated biomass oxidizes nitrogen, sulphur, chlorine and phosphorous fragments to toxic compounds that when inhaled could kill humans [45]. In addition, inefficient burning could lead to the yield of polycyclic aromatic hydrocarbons (PAHs) and semi-volatile organics and unburnt parental residues [46].

We assessed disposal practices of obsolete pesticides. We found that only 15.96% of those agriculture is one of their main activities and 15.87% of those agriculture is not one of their main activities would dispose obsolete pesticides in a privately-owned special disposal locations as instructed or else would keep obsolete pesticides in secured areas. Also, 81.91% of those agriculture is one of their main activities and 73.02% of those agriculture is not one of their main activities would dispose obsolete pesticides in the soil either in a landfill or by burying underground (Fig. 7). This practice is dangerous because it increases the chances of obsolete pesticides to be found in the environment. While in the environment, pesticides are subjected to translocation [42] which increases their chance to be found in consumable food and groundwater [43, 44].

We also found that less than 2.13% of those agriculture is one of their main activities and less than 11.11% of those agriculture is not one of their main activities did not know where to dispose obsolete pesticides. Those who did not know where to dispose obsolete pesticides could potentially dispose it anywhere. This also increases the possibility of pesticides to be found in non-target sites. However, to the best of our knowledge, the country has no system to collect and properly dispose off empty containers and obsolete pesticides.

We assessed storage of pesticide inventories. We found that 86.17% of those agriculture is one of their main activities and 93.65% of those agriculture is not one of their main activities would store pesticide

inventories either in a special designated storage area, keep outside the house, or other places such as garage. Also, 13.83% of those agriculture is one of their main activities and 6.35% of those agriculture is not one of their main activities would store pesticide inventories in other areas such as kitchen, bedroom, and above the cupboard: areas within the reach of children (Fig. 8). Storage of pesticides in the kitchen, bedroom, and above the cupboard increases the chances of home pesticide exposure to children [47]. This practice is dangerous because reference [48] found that early childhood exposure to pesticides increases the risk of childhood leukemia.

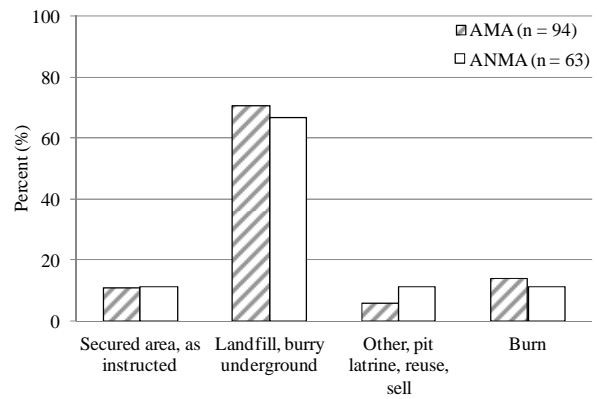


Fig. 6. Disposal of pesticide empty containers.

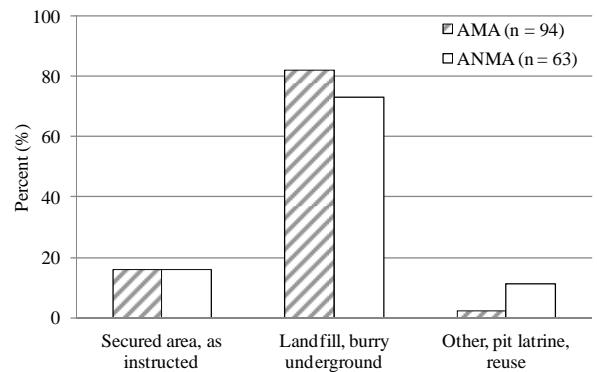


Fig. 7. Disposal of obsolete pesticides.

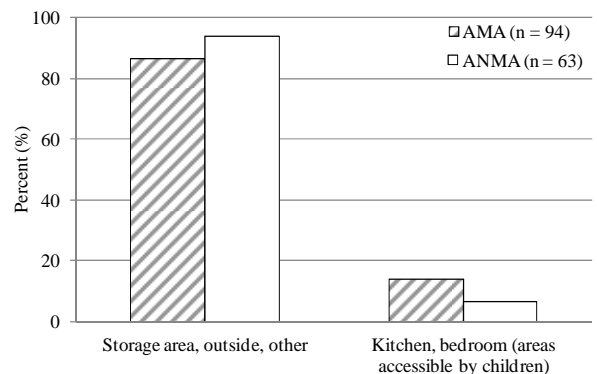


Fig. 8. Storage of pesticide inventory.

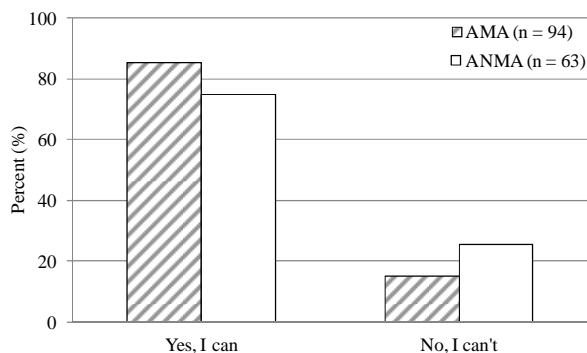


Fig. 9. Identification of negative health effects associated with the use of pesticides.

We assessed whether respondents were able to identify negative health effects associated with the use of pesticides such as death, skin cancer, cancer, loss of vision, etc. We found that 85.11% of those agriculture is one of their main activities and 74.60% of those agriculture is not one of their main activities were able to identify negative health effects associated with the use of pesticides, while 14.89% of those agriculture is one of their main activities and 25.40% of those agriculture is not one of their main activities were not able to identify negative health effects associated with the use of pesticides (Fig. 9).

Although Fig. 9 shows that most respondents were aware of the ill-effects of pesticides, still, some respondents exercised a potential risk to their health and the environment from the way they (would) handle pesticides. There is no doubt that pesticides solve apparent problems such as hunger by reducing the loss of agricultural produce by eliminating pests and that companies involved make money (profits), still it should be noted that at the end of the spectrum they create undesirable problems and untreatable diseases to farmers, non-farmers, suppliers, consumers, environment, and the ecosystem at large.

We assessed measures taken by respondents after accidentally contacted pesticides on their skin (body). We found that 63.83% of those agriculture is one of their main activities and 98.41% of those agriculture is not one of their main activities only washed their skins but did not seek medical help, while 36.17% of those agriculture is one of their main activities and 1.59% of those agriculture is not one of their main activities both washed their skins (body) and sought medical help when accidentally contacted pesticides (Fig. 10). Fig. 10 further reveal that more of those agriculture is not one of their main activities only washed pesticides from their skins, but more of those agriculture is one of their main activities both washed and sought medical help.

We assessed measures taken by respondents after accidentally contacted pesticides in their eyes. We found that 97.87% of those agriculture is one of their main activities and 42.86% of those agriculture is not one of their main activities only washed their eyes but did not seek medical help, while 2.13% of those agriculture is one of their main activities and 57.14% of those agriculture is not one of their main activities both washed their eyes and sought medical help when accidentally

contacted pesticides (Fig. 11). Fig. 11 further reveal that more of those agriculture is one of their main activities only washed pesticides from their eyes, but more of those agriculture is not one of their main activities both washed and sought medical help.

Although our survey was carried out online and most of our respondents have university education, the findings in Fig. 10 and Fig. 11 agree with reference [49]. One hundred twenty-one head of households in Arumeru district in Arusha region, northern Tanzania were interviewed [49]. Most of the interviewee had received primary education (basic education). Pesticide handling practices such as storage and the use of protective gears, pesticide disposal and calibration of instruments prior to pesticide application were assessed. Seventy-nine percent of the farmers who had been poisoned in the past did not seek proper medical help. Our findings and that of reference [49] suggest that level of education might not influence knowledge on pesticide management and practices. In addition, Fig. 10 and Fig. 11 also agree with reference [50] and [51] that many victims of pesticide poisoning, mostly in rural areas, often remain at home without seeking proper medical help until the poisoning subdue by itself.

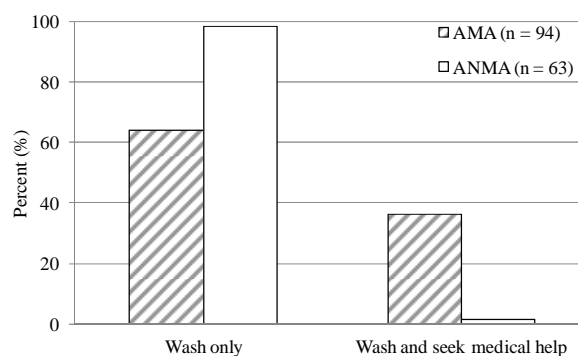


Fig. 10. Respondents who washed and sought medical help after accidentally contacted pesticides on their skins (body).

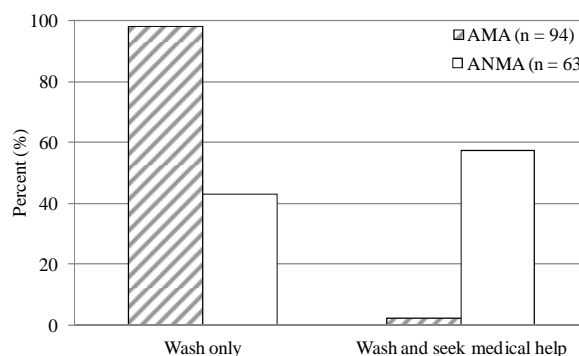


Fig. 11. Respondents who washed and sought medical help after accidentally contacted pesticides in their eyes.

We assessed opinions of the respondents if it is important for pesticide users to use protective gears when working with pesticides. We found that only 1.0% of those agriculture is one of their main activities responded that it is very important while 3.17% of those agriculture is not one of their main activities responded

that it is very important (Fig. 12). This shows that majority of the respondents know the importance of using protective gears when working with pesticides. However, they could be lacking motivation. Therefore, we recommend more tailor-made motivational and awareness programs on safety use of pesticides.

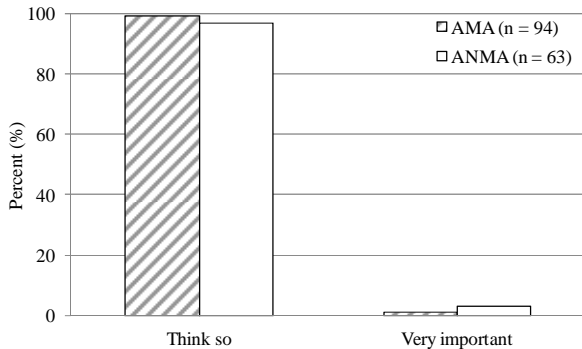


Fig. 12. Respondent's opinion on importance for pesticide users to use protective gears when working with pesticides.

4. CONCLUSION

We surveyed how aware people in Tanzania, are of pesticides and their associated health effects. Results reveal that pesticide management practices are poor. This could severely deteriorate environmental health and quality, as well as human health. Failure to follow recommended pesticide disposal practices and the non use of protective gears could be due to their cost and/or unavailability. In addition, having some of the respondents who would poorly handle pesticides is a risk that needs an immediate attention. However, majority of the respondents are aware that pesticides could harm them and the environment, still their management practices are unsatisfactory (unacceptable). This could probably be due to negligence.

We recommend more tailor-made motivational and awareness programs to pesticide users and the population at large on good agricultural practices and good pesticide management practices. This could somehow reduce negligence (i.e. these people could change their practices from bad to good). Consequently, it would help to improve their health, environmental health and the quality of the ecosystem.

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