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Rice insect pest management in selected rice irrigation schemes in Morogoro Region, Tanzania

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This study was conducted in five randomly selected rice schemes in Morogoro region to obtain information on farmers' knowledge, attitude and practice in respect to management strategies undertaken for controlling insect pests both in rice fields and stores as an aid to reduce crop loss. A total of 150 farmers were randomly selected from 5 villages (30 respondents per village) and interviewed using semi structured questionnaires. Each village represented only one rice scheme. The study reveals that 61.3% of farmers cultivate rice under 0.5 to 1 acres showing that the crop is grown largely by small scale farmers. About 94.4% of farmers reported to have faced insect pest problems in rice fields with no farmer reported damage in store. It was reported that 82% of farmers control insect pests in their rice field when they notice their presence. Most of farmers (84%) used synthetic insecticides where some of them do nothing and others use non-chemical method. However, among those farmers who use pesticides, majority (83%) of them reported that they have never attained any training on the proper handling and application of chemicals suggesting a need for trainings to farmers on how to handle pesticides.

Key words: Rice, scheme, insect, management.

INTRODUCTION

Rice (*Oryza sativa* L.) is the staple food of over half the world's population which its demand is increasing in many countries (Hegde and Vijayalaxmi, 2013). It has been reported as the fundamental principal food supplying 20% of the calories consumed worldwide (Kubo and Purevdorj, 2004; Liu et al., 2010). The contribution of rice on per capita calories in the developing countries is around 27% (Awika, 2011). However, Basorun and Fasakin (2012) reported that there is an increase on rice consumption in Asia and Africa. The authors further reported that in many countries of Africa, rice constitutes a major part of the diet (Basorun and Fasakin, 2012). Report by Luzi-Kihupi et al. (2009) show that importance of rice in Tanzania is increasing with its consumption estimated to be 232.7 kg per year per person.

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Table 1. Background information of the respondents (%) (n = 150).

Category	Responses	Kilosa		Morogoro rural		Mvomero	
		Ilonga (n=30)	Mvumi (n=30)	Kiroka (n=30)	Mbarangwe (n=30)	Mkindo (n=30)	Average
Age (Years)	20-30	10	4	9	7	19	10
	31-40	44	28	41	36	26	35
	41-50	25	24	36	25	30	28
	51-60	21	16	9	21	19	17
	Above 60	0	28	5	11	6	10
Sex	Male	52	65	41	55	64	55
	Female	48	35	59	45	36	45
Education level	Illiterate	0	23	0	14	7	8.8
	Primary	93	73	100	79	89	86.8
	Secondary	7	0	0	7	4	3.6
	Beyond Secondary	0	4	0	0	0	0.8

Regarding to rice production in East, Central and Southern Africa (ECSA) region, Tanzania has been reported as the second largest producer and consumer after Madagascar (Benard et al., 2014; URT, 2009). The average production level reported in Tanzania is 818,000 tonnes per year (Benard et al., 2014; URT, 2009). This amount is produced from five regions which are Shinyanga, Mwanza, Morogoro, Mbeya and Tabora with some supplementary production coming from Manyara, Singida and Dodoma lands.

However, rice production in Tanzania continues to be low at 1 to 1.5 t ha^{-1} due to several factors such as lack of improved varieties, drought, poor weed control programs, insect pests, diseases and lack of effective disease control techniques (Luzi-Kihupi et al., 2009).

It has been reported that insect pests, for example stem borers, have been reported to cause crop damage to about 34.9% indicating its importance on reducing crop productivity in Tanzania (Mihale et al., 2009). Tengo and Belfrage (2004) reported that most of the research on rice has been focusing mainly on agronomic and breeding perspectives with little emphasis on rice insect pest management. This study therefore, aimed at investigating the damage caused by insect pest to rice crop and understands the management options and practices by farmers for reducing the associated damage.

MATERIALS AND METHODS

Study sites

The study was conducted in three districts of Morogoro region from October to December, 2014 where five rice schemes were selected, namely, Mvumi and Ilonga schemes located in Kilosa district, Mkindo scheme located in Mvomero district, and Kiroka and Mbarangwe schemes located in Morogoro rural district. In these schemes, where rice is an important source of food and income generation (Mwingira et al., 2009), farmers practice rain-fed and irrigated rice farming.

Sampling procedures and data analysis

Thirty rice farmers were randomly selected from each scheme for interview. Standard prepared questionnaires were used to seek information on farmers' knowledge, attitude and practice on insect pest management in rice growing areas. Basic questions on size of land owned, size of farms under rice cultivation, rice production constraints with more focus on insect pest problems, estimated crop damage, and insect pest control measures were addressed. During the interview, pictures for un-named rice insect pests were provided to farmers for reference on identification to what type of insects involved for rice damage in their fields or storage. The collected data were analysed using SPSS software version 16.

RESULTS

General farmers characteristics

Information from 150 farmers intervewed show that, 45% were female and the rest 55% were male (Table 1). Majority of respondents had their age ranging from 21 to 60 years and their education ranged from primary education, secondary education, beyond secondary education while others were illiterate (Table 1).

Rice production and land under rice farming

Results show that most farmers (61.3%) cultivate rice on small pieces of land ranging from 0.5 to 1 acre whereas 24, 10.9 and 3.8% cultivate rice in 1.5 to 2, respectively. Regarding to rice production it was reported that vast number of respondents (43.1%) produce 6 to 10 bags (each bag 100 kg) per acre. However, only 0.8% produce

Table 2. Constraints faced by rice farmers in selected five rice schemes in Morogoro Region (n= 150).

Constraints	Percentage respondents per rice scheme					Average
	Ilonga	Mvumi	Kiroka	Mbarangwe	Mkindo	
Rice insect pests	27.27	20.48	42.86	28.57	22.39	28.3
Rodent pests	32.47	28.92	32.65	39.68	34.33	33.6
Shortage of water for irrigation	19.48	4.82	12.24	20.63	0.00	11.4
High price of inputs	5.19	3.61	2.04	6.35	13.43	6.1
Delay of agricultural inputs	6.49	0.00	0.00	0.00	7.46	2.8
Rice diseases	2.60	16.87	4.08	0.00	5.97	5.9
Destruction from livestock	2.60	2.41	0.00	4.76	2.99	2.6
Birds	2.60	18.07	2.04	0.00	2.99	5.1
Weeds	1.30	2.41	4.08	0.00	1.49	1.9
Lack of capital	0.00	2.41	0.00	0.00	8.96	2.3
Total	100	100	100	100	100	100.0

31 to 35 bags and the lowest production of 1 to 5 bags produced by 17.7% of farmers. It was further observed that more than half of all respondents (52.6%) practise irrigation as their main rice framing system, whereas 33.8% practised both rainfed and irrigation, only a few farmers (13.6%) practised rainfed system. With regard to sources of rice seeds, 45.9% farmers obtain the seeds from their own store where 29.3, 18.8 and 6% of farmers obtain seeds from other farmers, voucher system, and agricultural seed agencies, respectively. However, our results show that most of farmers 54.9, 35.3, 8.3 and 1.5% who grew two, one, three and more than three rice varieties, respectively.

Rice production constraints

Reports by farmers show that majority of respondents from Ilonga, Mvumi, Kiroka, Mbarangwe and Mkindo schemes experience rice production constraints with few who reported to have not experienced rice problem in their fields. In general, the reported major six rice problems were rodent pests (33.3%), rice insect pests (28.3%), shortage of water for irrigation (11.4%), high price of inputs (6.1%), rice diseases (5.9%), birds (5.1%) and other minor constraints as shown in Table 2.

Estimated rice crop damage caused by insect pests

Results show that 23.9% of farmers experienced crop damage ranging from 41 to 50%, while 23% of farmers estimated damage at 21 to 30% and other farmers (17.7%) experienced damage at less than 20%. About 17.7% of farmers were not aware of the damage, while 10.6% of farmers experienced damage of 31 to 40%. In addition, only few farmers (7.1%) reported crop damage of above 50%. However, some few farmers (17.7%) reported that they were not aware of the amount of damage the insect caused to their rice in field.

In regard to the rice variety responses on insect pest damage, majority of respondents (73.6%) reported that all rice varieties grown in their scheme were vulnerable to insect pest damage. Basing on effect of cropping season, significant difference (p<0.001) on crop damage was observed where rice crop grown during dry seasons experienced more damage compared to rain fed rice crop.

Result shows that majority (54%) of farmers reported rice crop damage occurring in dry season while the remaining (46%) reported that the damage occurs in both rain fed and dry season. However, when farmers were asked about the most affected rice growth stage, most of farmers 64.8% reported that the most crop stage at risk was after rice transplanting. Other stages example nursery and flowering stages was 15.6 and 11%, respectively. There was few responses (1.9%) reporting on crop damage at maturity stage. Report on insect pest damage on stored paddy showed that all respondents (100%) were not aware of the damage occurring in stores and that they had not experienced any damage.

Common rice insect pests in the study areas

Results show that most farmers (33%), reported stalk eyed fly followed by rice grasshopper as the most damaging rice insect (Figure 1). Other insect pests which were mentioned by farmers that contribute to lower rice production are shown in Figure 1.

Rice insect pest management

Results show that majority of rice farmers (82%) took action in controlling insect pests so as to reduce crop damage whilst the rest 18% did not control. With regard to control techniques use, most of respondents (84%)

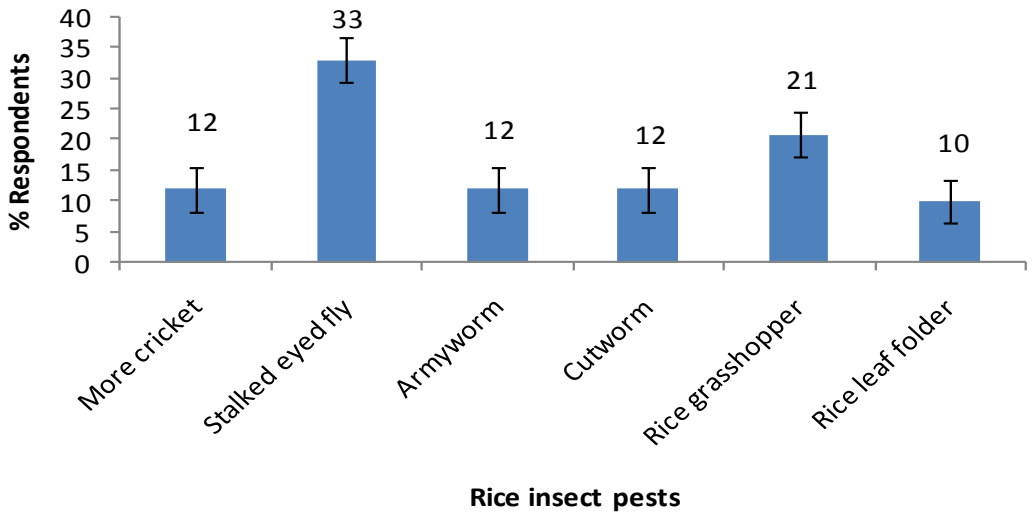

Figure 1. Responses on common rice insect pests in selected rice schemes in Morogoro region (n = 150).

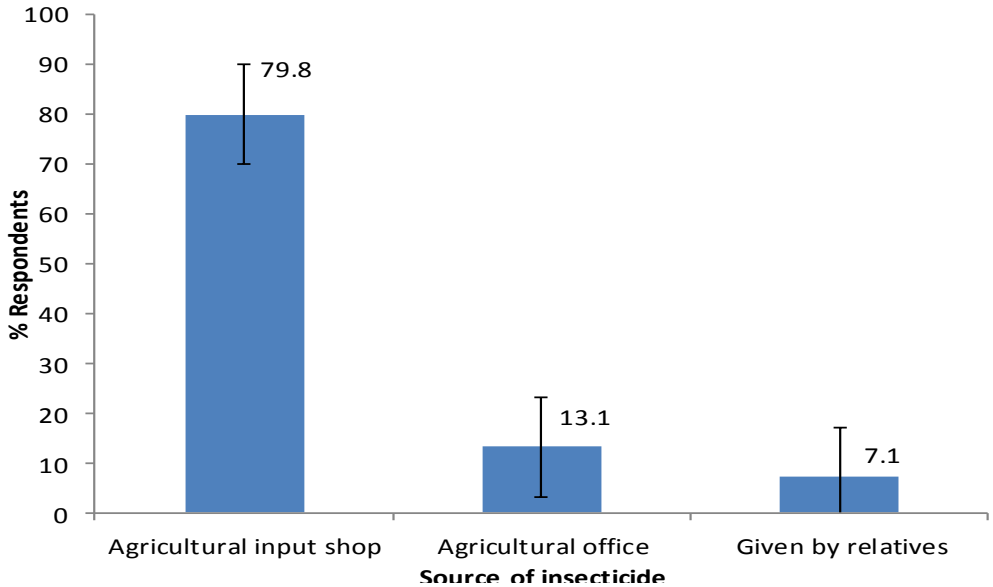

Figure 2. Sources of chemical applied by farmers for rice insect pest control (n=150).

reported to use chemicals while 16% used non chemical insect control techniques. When those respondents using chemical control were asked on the kind of insecticides used, most of farmers reported to use Karate (40.2%), Thionex (14.4%), Selectron (12.4%) and Attakan (2.1%). However, some farmers (10.3%) did not remember the chemical they used while 20.6% did not know the chemical at all.

Agricultural input shops were the main source of insecticide (79.8%) (Figure 2) and the cost incurred by those farmers who use insecticides are as shown in Table 3. Although farmers reported to use insecticides, only 16.7% reported to have been trained on proper application of insecticides while 83.3% were not trained any more. Results on those farmers attained training shows that majority of respondents (8%) were trained 2 to 5 years (Figure 3).

DISCUSSION

In the current study, it was observed that most of farmers

Table 3. The cost incurred by farmers for rice insect pest management using chemical control method (n = 150).

Control costs (Ts) spent by farmers	Percentage respondents
5000-10,000Tshs	62.2
11,000-15,000Tshs	11.1
16,000-20,000Tshs	6.7
21,000-25,000Tshs	2.2
Don't remember	2.2
Total	100.0

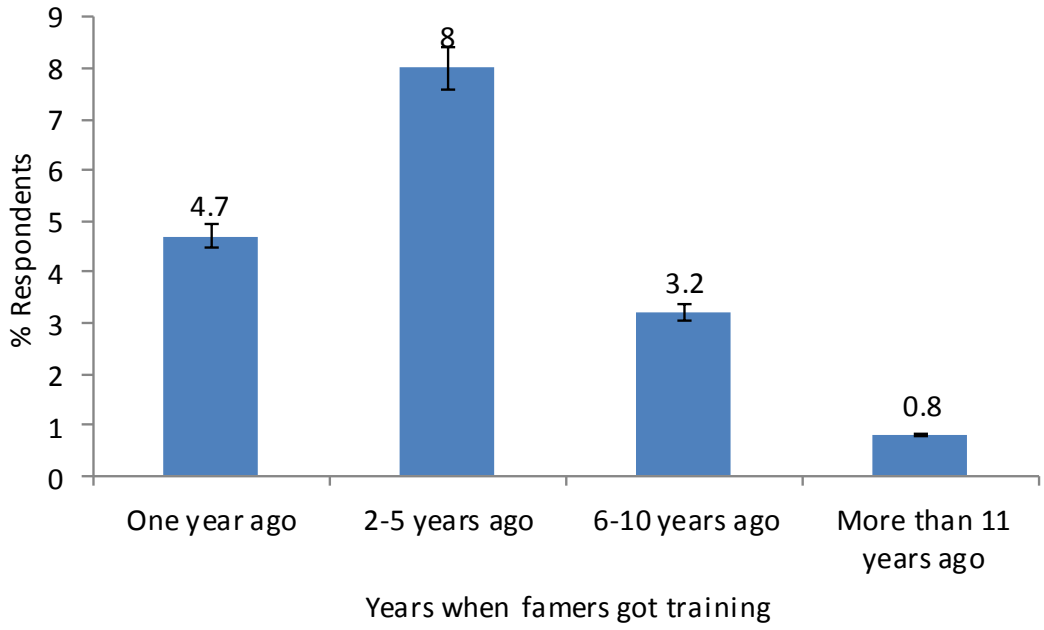

Figure 3. Time when farmers got training on application of insecticides (n=150).

used very small plots for rice production ranging from 0.5 to 1 acre. This amount of land is small compared to that reported by Wolter (2008), that the land sizes for smallholder farmers in Tanzania range from about 2.0 to 7.5 acres (or about 0.9 to 3 ha). However, our results are similar to reports by Sokoni (2008) and Mulungu et al. (2015) that smallholder farmers in Tanzania use small and fragmented plots for crop production. Studies by Mung'ong'o and Mwamfupe (2003), show farmers practice subsistence farming where crop cultivation is done for home consumption and this could be the reason why farmers in the study area cultivate small plots for rice production.

With regard to farming season, most farmers reported to practice irrigated rice farming with exception of few who depend on rainfall alone and others reported to depend on both rainfall and irrigation. CONCERN Worldwide (2008) pointed out that irrigation has been a significant aspect among rice farmers. In addition, previous studies by Kato (2007), Kangalawe and Liwenga (2005) and Ngaga et al. (2005), revealed that wetlands are potential in rice crop production.

Our results however, are different from that of Musamba et al. (2011) who reported that few farmers (22.3%) in Kilombero district practiced rice irrigation farming where majority (41.7%) of the households depends on both rain-fed and irrigation in crop production with 36% farmers depending on rain-fed agriculture only.

With regard to rice production constraints, our study found that rice farmers faced problems resulting from insect pests, rice diseases, drought, high prices of inputs and rodent pests. Insect pest was among the most constraint mentioned by farmers where all rice varieties grown by farmers were reported to be damaged by insect

pests resulting into rice yield loss and ultimately poor economic return from farmers investment. Similar reports on insect pest damage to rice crop were reported by CFC (2012) and Kadigi et al. (2008) who identified two kinds of constraints facing rice production in Tanzania, namely, biotic and abiotic. According to Musamba et al. (2011), biotic and abiotic constraints together reduce crop production and have been major obstacles for rice productivity in many areas of Tanzania. Report by IRRI et al. (2010) shows an estimation of rice yield loss due to insects in Africa ranging between 10 and 15%.

This study observed that, farmers considered stalk eyed fly, rice grasshopper, cutworm, armyworm and more cricket as the dominant insect pest threatening rice in field. The results are comparable to that of Nonga et al. (2011) which identified pests like aphids, thrips, beetles, foliar feeding caterpillars, mites, borers, cutworms, bollworms, bugs, whiteflies and leafhoppers in Manyara region.

It was reported that the most affected rice crop stage was after transplanting at high damage level with moderate damage during nursery and flowering stages. Similar result was reported by Nwilene et al. (2013) that insect pests cause considerable rice crop losses in the field and in storage. Suggestion by Nonga et al. (2011) show that farmers' knowledge and experiences on the stage at which their crops are damaged is vital since it facilitates appropriate timing to apply pesticides.

With regard to insect pest control measures used by farmers, our study found that some farmers take immediate action on rice insect pests to reduce the estimated rice damage. Most farmers used insecticides a practice which is similar to the report by Nonga et al. (2011). The authors reported that the use of chemical pesticide has become a common practice to control pests and diseases in crops cultivated in Tanzania. However, the limiting factor on proper use of insecticides is limited knowledge on the application of insecticides in their farming activities. This could be due to poor education background as was reported that most of farmers in the studied schemes were primary school leavers who could not understand pesticide labels written in English. In addition, our result also revealed that, most of farmers were not trained on the best use of the insecticides and their disposal to avoid the possible effects to the environment.

Report by Edmeades (2003) show that, the increased use of organic pesticides which apart from increasing crop production, have long term negative effects on Fauna and flora, which will then change soil characteristics and hence reduced production. Similar report by Ntow et al. (2006) stipulates that the reasons for pesticide misuse and improper handling are lack of knowledge by farmers and inadequate extension services. However, majority of farmers in the study area have shown an interest on need for training on better handling and application of insecticides for insect pest control on their rice crops.

CONCLUSION AND RECOMMENDATION

It has been observed in this study that farmers used largely chemical control method for insect pest management so as to avoid the damage and crop losses which would ultimately reduce crop productivity. However, most farmers had little knowledge on how to apply the chemicals which might contribute to environmental pollution and hence affecting beneficial insects in fields. Therefore, this study recommends on provision of trainings to farmers on safe use of agrochemicals. It also recommends that further studies especially field experimentation be carried out to verify the amount of damage caused by specific insect pest at specific season. Furthermore, field observation should be done to identify how farmers apply insecticides and evaluate the effectiveness of each of the insecticides against specific insect pest.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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