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Indigenous knowledge of Crop Pest with Control Practice of Farmers of Southwest Ethiopia

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Abstract

Crop production is highly affected by harmful organisms in which the quality and quantity of harvest is being deteriorate. The study was primarily aimed to assess farmer knowledge of pests with practicability of control mechanism employed by farmers. Community based cross-sectional study was carried out in May to June 2019. A validated structured questionnaire, face-to-face interview, focal group discussion with elders and key informant with experts were used for data collection. For the sake of triangulation, personal observation was conducted. The data was analysed using logistic regression using SPSS version 16.

Out of 422 farmers estimated to be included in the study 398 of them provided complete information while the remaining 24 were not found in the house during the date of interview or unable to complete the questionnaire. Consequently, almost three fourth, 295 (74.3 %) of them had excellent knowledge while the remaining 25.7 % of the farmers possessed good knowledge. Even though farmers of the age group 26–35 had a bit higher percentage of excellent knowledge (76.7 %) than the other two age groups i.e., 15–25 (71.7 %) and 36–45 (71 %), the association was not statistically significant (P = 0.85).

In an effort to control pest, majority of farmers used cultural method in the form of crop rotation, row plantation, weed control, and time of sawing. Hand removal, mimicry (for wild pests), noisemakers and creating barriers were used as mechanical pest control method.

Key words: Aphids, Army worm, Cut worm, Cabbages, Fruit fly, Hand removal, Pest, Indigenous

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1. Introduction

Ethiopian economy is dominated by agriculture contributing 42.7% to the GDP and a significant contributor to reducing poverty. Despite the huge contribution of the sector to the country's economy, the system is predominantly of subsistence, characterized by the use of traditional farming implements and practices (EIAR, 2019). The entire field operations at small scale agriculture, where about 83% of the population is involved, are carried out using hand-tools and thousands of years old tillage implements with human and animal power which mainly include oxen plow farming system particularly in open cereal dominating production system (Taffesse *et al*, 2009; EIAR, 2019). Those crops that cultivated by those small holders faces yield losses through some major contributors arthropods insects which is major constraints to agricultures production in Africa that responsible for direct and indirect losses of crops on the farm and storage (Bankole and Mabekoje, 2004).Those insect pests are classified as migratory insect pests include the African armyworm (*Spodoptera exempta*), the African migratory locust (Locusta *migratoria migratorioides*), desert locust (*Schistocerca gregaria*), and regular insect pest such as stalk borers (*Busseola fusca, Chilo partellus, Sesamia calamistis),* African bollworm (*Helicoverpa armigera),* Pea aphid (*Acyrthosiphon pisum)* are commonly occurred (Abate and Tesfahun, 2003).

For controlling agricultural pest African farmers traditionally prepare substances from concentrated hot peppers/chillies, neem leaves, jimson weed(*Daturastramonium* Lin), castor oil, papaya leaves and wood ash, clay, turmeric, wheat to get rid of caterpillars, weevils, beetles aphids, garden bugs and other pest(Girma *et al*.,1999; Sreedevi ,1999).

Therefore the current study was conducted to assess farmer knowledge of pests with feasibility of control mechanism employed by farmers. Exploring such kinds of indigenous knowledge's of farmers was helpful to establish appropriate, inexpensive means of pest managements practice for the local community as well as for the other smallholders farmers that experiencing similar problems.

2. Methods

2.1 Study area and period

The study was conducted in Southwest region of Oromia, Ilu Aba Bor Zone of Ale District which is 680km far from capital city Addis Abeba. Ale is among 14 districts found in Ilu Aba Bor zone, situated on the way to Gambella to west direction at Oromia regional state sharing boundary with Mettu district to South, Halu district to North, Becho district to East and Mettu district to West direction. It covers 8,980 hectares of land. With regard to livelihood of the community, about 96% depend on agriculture subsistent smallholder based farming system existed (District Agricultural Office, 2019). Maize (*Zea mays L.*), Sorghum (*Sorghum bicolor* (L.) Moench), Wheat (*Triticum spp.* L.) Barley (*Hordeum vulgare* L.), Teff (*Tef eragrostic mount*), Pearly millet, Potato (*Solanum tuberusom L.*), Tomato (*Lycopersicum esculentum Mill*), Cabbage (*Brassica oleracea*), Carrot (*Daucus carota L.*), Garlic (*Allium sativum* L.), Mango (*Mangefra indica L.*), Avocado (*Persia Americana*), Banana (*Musa spp*), Coffee (*Coffe arabica L.*), Ginger (*Zingiber officinale*), Turmeric (*Curcuma longa*), Haricot bean (*Phaseolus vulgaris* L.) are crops that grown in the area. Ale Woreda was purposively selected among 14 woredas found in Iluababor zone. Among 19 kebeles found in Ale district, three kebeles namely; Megela, Obo and Yachi were randomly selected. The criteria used to select these study kebele is firstly, based on their production potential, crop distribution in the, level of modern and traditional pest management controlling system they are adopting.

2.2 Study design

Community based cross-sectional study was conducted between May to June 2019.

2.2 Sample size estimation and sampling technique

By using a formula for the estimation of a proportion: $n = Z^2. P(1-P)/e^2$ (Mekonnen,2002) and P = 0.5 (because of the approximation of farmers indigenous knowledge of pest and management practice in the area is unknown), 95 % CI (1.96), 5 % margin of error (e) and contingency for non-response rate of 10 %, a maximum of 422 study subjects were required. To obtain this, 422 households were randomly selected after obtaining a list and address (house number) of every farmer from agricultural office in each kebele. The number of households to be included in the study from each kebele was determined proportionally based on the population of farmers.

2.3 Determination of knowledge of pest

Knowledge about pests was determined based on major, minor and migratory pests listed by Bekele et al., (2009). The study provides lists of pictorial key of pests and sign and symptoms shown on each part of plants attacked (Bailey, 2007). An overall knowledge score was calculated by adding up the scores for each respondent across all list of pest provided. From the total farmers knowing more than 75% of the pest has excellent knowledge, 74- 50% has good knowledge and less than 50% had poor knowledge.

2.4 Data analysis

The data obtained from the study was entered and analysed using Statistical Package for Social Science version 16. Means and standard deviations was calculated for continuous variables while crude and adjusted Odds ratio (OR) was calculated to check statistical association between the dependent and independent variables using the binary logistic regression and multivariable logistic regression models. All variables of the study were initially tested for association with poor knowledge, and practice regarding pest knowledge and practice by using the binary logistic regression model. Those which show statistical association ($P < 0.05$) were put in the multivariable analysis model to check if the association existed after controlling against all the rest of the variables. All statistical tests and generalizations were done by assuming 95 % confidence interval and 5 % level of significance.

3. Result and Discussion

3.1 Socio-demographic characteristics

Out of 422 farmers estimated to be included in the study 398 of them provided complete information while the remaining 24 were not found in the house during the date of interview or unable to complete the questionnaire. More than half, 215 (54 %) of the farmers were within the age range of 26–35 and those in the age range of 36–45 were rare i.e., 63 (15.8 %). The remaining nearly one third (30.2 %) was accounted by women of the age group 15–25. The vast majority of the farmers were married 390 (98 %) with very few single, widowed and separated cases. A little more than three fourth, 305 (76.7 %) of the respondents had four or more family members. Almost half, 192 (48.2 %) of the farmers attended primary school but 168 (42.2 %) of them were unable to read and write. Being farmers was the main occupation for the all farmers (93 %) with very few cases of civil servants and students. Orthodox religion followers were high in number, 212 (53.3 %) followed by Muslims, 179 (45 %). Most of the farmers own land (95 %) and the rest were rented (65.6 %). 384 (96.5 %) of the respondents reported as they received information related to knowledge of pest and control mechanism trough practice by themselves (87.8 %) and the rest obtained from agricultural extension workers. (Table 1).

3.2 Knowledge on pests

The farmer's overall level of knowledge about pests was categorized as excellent, good and poor. Consequently, almost three fourth, 295 (74.3 %) of them had good knowledge while the remaining 25.7 % of the farmers possessed poor knowledge. Even though farmers of the age group 26–35 had a bit higher percentage of good knowledge (76.7 %) than the other two age groups i.e., 15–25 (71.7 %) and 36–45 (71 %), the association was not statistically significant (P = 0.85) (Table 1). Similarly, in terms of receiving information about pest knowledge 74.9 % of the farmers gain knowledge through information obtained from agricultural experts (57.1 %) but the difference was not statistically significant (P = 0.14).

Table 1 Univariate analysis of association between knowledge about pests and socio-demographic characteristics among farmers of Southwest Ethiopia, 2019

Variables	Label	Frequency (%)	Excellent n (%)	Good n (%)	Crude OR (95%)	P-value
Age	15-25	120 (30.2)	86 (71.7)	34 (28.3)	1.00 (0.67–1.49)	0.85
	26-35	215 (54)	165 (76.7)	50 (23.3)	1.30 (0.95–1.79)	
	36-45	63 (15.8)	44 (71)	18 (29)	0.96 (0.56–1.67)	
Marital status	Single	4 (1)	2 (50)	2 (50)	1.00 (0.14–7.10)	0.25
	Married	390 (98)	291 (74.8)	98 (25.2)	2.97 (2.36–3.73)	
	Widowed	3 (0.75)	1 (33.3)	2 (66.7)	0.50 (0.05–5.51)	
	Separated	1 (0.25)	1 (100)	0 (0)		
Educational status	Illiterate	168 (42.2)	119 (71.3)	48 (28.7)	1.00 (0.71–1.40)	0.32
	Read and write	9 (2.3)	6 (66.7)	3 (33.3)	0.81 (0.20–2.86)	
	Primary (1–8)	192 (48.2)	150 (78.1)	42 (21.9)	1.44 (1.02–2.03)	
	Secondary and above	29 (7.3)	20 (69)	9 (31)	0.90 (0.41–1.97)	
Religion	Orthodox	6 (1.5)	4 (66.7)	2 (33.3)	1.00 (0.18–5.46)	0.13
	Catholic	1 (0.2)	1 (100)	0 (0)		
	Protestant	212 (53.3)	166 (78.3)	46 (21.7)	1.81 (1.3–2.5)	
	Muslims	178 (45)	124 (69.7)	54 (30.3)	1.15 (0.84–1.58)	
Receiving information	No	14 (3.5)	8 (57.1)	6 (42.9)	1.00 (0.35–2.89)	0.14
	Yes	384 (96.5)	287 (75)	96 (25)	2.25 (1.78–2.84)	

3.3 Pest status and associated damage in the study area

The result of FGD supplemented by personal observation confirmed that crop production in the study area was majorly covered by monoculture. Majority of the farmers replied that no more crop association was practiced on their farm in an effort to repel pest attack. The natural plant community and most other organisms are removed and replaced with a single crop–plant species. Intercropping is less practiced. This greatly reduces the natural species diversity within the habitat. According to Abate et al., (2000), planting vast areas of a country with one crop to the exclusion of other plant species enabled the insect pests feeding on the crop plant's favorable conditions for their explosive increase.

Frequently, outbreaks of insect and plant pathogen were reported. All farmers regularly checked their farm and regularly check pests and disease symptom on their crops. From time to time, pest population and number as well as invasion are ever increasing. Majority of farmers stated at present status of pest attack is even beyond their capacity to control. Among which common pest (75.2%), migratory pest (64.5%) and regular pest (77.4%) are highly affecting their crop. Most of farmers believed that, this aggressive dynamicity of agricultural pest is caused mainly due to change in climate and other inadequate government action.

Literatures confirmed that, climate change caused pest outbreaks and illness of humans, animals and crops (Mwine *et al.,* 2010; Zhang *et al.,* 2007).

Twenty two point five percent (22.5%) buy chemicals by their own without consulting experts, while 34.6% reported to development agents. Most of the farmers (87.9%) reported that no immediate action and prompt support were not given them, thus woreda agricultural offices visited them after their crop has totally devastated.

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Common pest controlling mechanisms adopted by farmers in the study area

In the study area, few farmers have been adopting cultural methods to control disease and insect pests of cereals and vegetables. Fifty five point one percent (55.1%) of respondents used crop rotation practices, mainly *solonaceae* with *cruccifreae* in vegetable and cereals with pulses in field crops. Beside to this crop rotation, tillage, using clean seed, time of planting has been used as cultural method to control pests. Respondents confirmed that, this technique significantly tackles disease and pest population on their farm and further more minimized crop yield loss. This finding was in agreement with Stoddard *et al*., (2010) who reported that cultural practices reduce the availability of alternate hosts and prevent the buildup of pests, particularly over successive seasons by breaking their life cycle

Row plantation and weed control is another cultural practices being adopted by farmers in the study area. Fifty three point six percent (53.6%) respondents were applied this techniques in an effort to reduce pest and disease population in their farm. The logic behind here is, avoiding any harboring plants, particularly weed species and allowing proper air and light circulation through recommended spacing would enable to reduce pest and disease build up. Densities of crop plants are carefully controlled to ensure optimal growth and thus a maximum economic yield. According to respondent's idea, this practice not only control pest and diseases but also guarantees to obtain marketable yield with perceived quality. Similar results have been reported by Al-Jallad *et al*., (2007) who reported that, proper plant densities/canopy architecture; sustain lower insect populations while Removal of weeds from cropping areas can help reduce the availability of alternate hosts (Hilje *et al*., 2001).

Hand removal, mimicry (for wild pests), noisemakers and creating barriers were used as mechanical pest control method by 35.4% farmers. They reported that, the feasibility of such method is rare. Some of them (29%) used this method in combination with other method. Botanical method of pest control is seldom applied to control storage pest in study area.

Using vetivar grass and neem tree to treat storage structure is common in such a way that (22.1%) adopted this technique.

Mancozed and Ridomilhave been used by 45% and 56% of respondents respectively in order to control Late blight in some *solanaceous* vegetable like tomato, potato and pepper. Sumithion 95%ULV and Endosulfan is another agrochemicals used by 48.1% of respondents to control army worm in maize and aphids in vegetables. In order to control storage pest mostly weevils, about 92% of respondents used Actelic and Malathion. Weed is another biotic pest which affect crop yield, thus 56.2% used chemicals to control it. Among registered herbicides, three of them, Round-up, 2-4-D and Glyphosate were used. Majority 84.5% of the respondent's chemical method is very effective to control pests. Similar result is reported by Lucke *et al*., (1995), that chemical application is most effective.

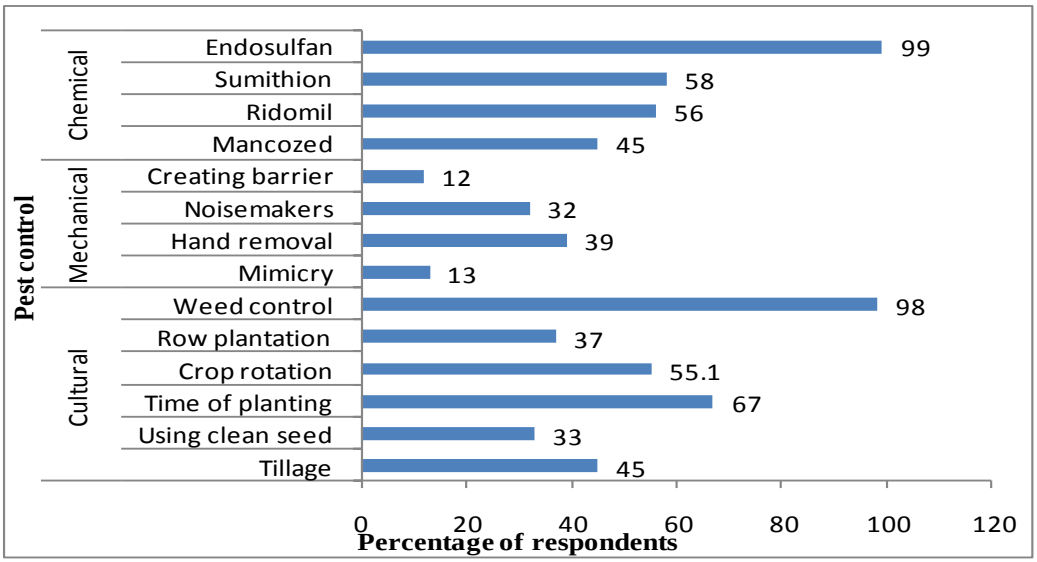

Figure 1 Common pest control mechanism adopted by farmers

Conclusion

More than half of the farmers were within the age range of 26–35 which are productive stage, farmers in the study area mostly knowledgeable in type of pest through experience. Farmers in the study area used chemical control method followed by cultural method and mechanical. From feasibility point of view, chemical method is preferred by farmers but they recognized that these methods are hazardous and caused human health risk and environmental complexities. Contrary, cultural methods are not as such effective as chemical methods.

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