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Knowledge, attitudes, and practices on red-billed quelea (Quelea quelea) control among agro-pastoralists in Wajaale District, Gabiley Region, Somaliland

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ABSTRACT

This study examined the knowledge, attitudes, and practices (KAP) of agro-pastoral farmers regarding the control of red-billed quelea birds (Quelea quelea) in the Wajaale District, Gabiley Region, Somaliland, where recurrent invasions pose a persistent threat to cereal production and rural livelihoods. A community-based cross-sectional survey was conducted among 186 agro-pastoral farmers selected through stratified random sampling. Data were collected using a structured questionnaire and analyzed using descriptive statistics, composite KAP scores, and binary logistic regression. The results showed that farmers had a moderate overall level of knowledge, with high awareness of crop damage and collective control principles, but limited understanding of quelea ecology and certain control options. Attitudes reflected a very high perception of risk and strong support for collective and government involvement, alongside limited confidence in individual measures. Control practices were predominantly reactive and low-cost, particularly noise-based scaring, while the farmers rarely used preventive, agronomic, and technically demanding methods. Participation in coordinated community or government campaigns was comparatively high when these mechanisms were available. Binary logistic regression indicated that positive attitudes and higher knowledge levels were the only significant predictors of improved control practices. Farmers identified the scale and speed of quelea invasions, lack of timely institutional support, and information constraints as the major challenges. These findings highlight a gap between awareness of the problem and the adoption of effective control practices, underscoring the need for improved coordination and support mechanisms for sustainable Quelea management.

Keywords: knowledge, attitudes, practices, red-billed quelea, Wajaale, agro-pastoralist, Somaliland

INTRODUCTION

Agriculture remains the cornerstone of livelihoods for a large proportion of the population in sub-Saharan Africa, where it plays a central role in food security, employment, and household income (FAO, 2021). In agro-pastoral systems, cereal crops such as sorghum and maize are particularly important, but they are highly vulnerable to avian pests. Traditional crop protection in many rural settings relies heavily on scaring techniques that are often labor-intensive and only marginally effective (Cheke & Tratalos, 2007). Among avian pests, the red-billed quelea (Quelea quelea) is widely regarded as the most destructive bird species affecting small-grained cereals in Africa.

The activity and feeding patterns of Q. quelea in croplands are influenced by multiple factors, including crop type, spatial configuration of farms, and agricultural management practices (Butchart et al., 2010). Changes in cultivation timing and land-use practices further shape quelea population dynamics, sometimes intensifying the damage to crops (Ranganathan et al., 2010). These birds are highly gregarious and capable of forming massive flocks that can devastate crops during the milky and dough stages, resulting in severe yield losses for smallholder and subsistence farmers (Otieno et al., 2015). It is estimated that a single quelea flock can destroy crops over an area of approximately 1,000 ha, with annual grain losses in East Africa reaching up to USD 15 million (Mutisya et al., 2016).

In response, control strategies across Africa have ranged from traditional scaring methods to large-scale, government-led campaigns involving the aerial spraying of avicides such as fenthion. Although these chemical approaches can reduce quelea populations in the short term, they raise serious environmental and public health concerns, including non-

target species mortality and ecosystem contamination (Flora et al., 2014). Moreover, despite decades of intervention, quelea damage remains persistent, suggesting that technical control measures alone are insufficient to mitigate the damage. Long-term studies indicate that better alignment of cropping calendars with seasonal quelea population fluctuations could reduce damage; however, such strategies are rarely adopted in practice (Bright & Ogunyemi, 2000).

A key reason for the limited success of quelea control lies in neglecting the human dimensions of pest management. The Knowledge, Attitudes, and Practices (KAP) framework provides an established methodological approach for examining what people know, how they perceive risks and responsibilities, and how they act in response to a given problem (Andrade et al., 2020). In agricultural pest management, interventions that fail to account for farmers' knowledge systems, perceptions, and socioeconomic constraints are often poorly adopted or abandoned, resulting in wasted resources and continued vulnerability (Mulliè, 2000).

In Somaliland, agriculture is a critical pillar of livelihood and economic recovery following decades of conflict and institutional fragility. However, the sector remains highly exposed to biotic stress, particularly avian pests such as Quelea quelea, which pose a significant and recurrent challenge (Ministry of Agriculture, 2020). In the Wajaale District of the Gabiley Region, a major cereal-producing area, recurrent quelea invasions continue to undermine food security and farmer livelihoods despite repeated control efforts. Empirical evidence on farmers' knowledge, attitudes, and practices regarding quelea management in this context is extremely limited, which constrains the design of effective and locally appropriate interventions.

This study addresses this gap by investigating the knowledge, attitudes, and practices of agro-pastoral farmers toward red-billed quelea control in the Wajaale District. By empirically linking farmer KAP to control practices, this study provides evidence to support more effective, community-centered, and sustainable quelea management strategies in Somaliland.

BACKGROUND

Agriculture-based livelihoods in arid and semi-arid regions face increasing pressure from climatic variability and biological stressors. In Somaliland, recurrent droughts, erratic rainfall, and extreme weather events have significantly undermined agricultural and livestock productivity, exposing rural communities to heightened food insecurity and economic vulnerability (Abdullahi, 2014; Omer, 2024a, 2024b). Nearly one-third of the population experiences food insecurity and malnutrition, a situation that has progressively worsened since 2010 (Omer, 2024b). These climatic stresses interact with ecological pressures, intensifying the impact of agricultural pests and amplifying the livelihood risks for agro-pastoral households.

Globally, the expansion of agriculture and human settlements has accelerated biodiversity loss while simultaneously increasing human–wildlife interactions. Birds, in particular, represent a major threat to crop production, causing financial losses at all stages of cultivation, from sowing to harvesting. Weaver birds and related species have been shown to substantially reduce cereal yields; for example, yield losses in irrigated lowland rice systems have been documented to reduce potential production from 5 t/ha to approximately 2.8 t/ha. Within this broader context, the red-billed quelea (Quelea quelea) has emerged as one of the most destructive avian pests in sub-Saharan Africa. Extensive research has demonstrated that quelea infestations cause severe direct crop losses and generate high economic and environmental costs through repeated control efforts (Elliott & Bright, 2021).

In Somaliland, crop production is further threatened by a range of transboundary and endemic pests, including desert locusts, quelea birds (locally known as Hamare), fall armyworm, and Tuta absoluta (Abdirahman, 2019). The Red Sea coastal zone has long served as a breeding ground for desert locusts, and favorable climatic conditions frequently facilitate the spread of swarms into inland agricultural areas. Similarly, quelea birds form massive migratory flocks capable of rapidly devastating the cereal crops. In the Wajaale District of the Gabiley Region, one of Somaliland's most important cereal-producing areas, sorghum and maize are staple foods and the primary source of household income (Jama, 2021). However, agro-pastoral farmers in this district consistently report substantial crop losses due to quelea depredation, often exceeding 60% of the expected yields during severe outbreaks (Mtobesya, 2012). Current control efforts remain fragmented, combining individual farmer actions with irregular government interventions, yielding limited and unsustainable outcomes.

While the ecological and biological characteristics of Q. quelea are relatively well documented, existing research in Somaliland has largely focused on climate change impacts, resilience, and food security across sectors rather than on specific human–wildlife conflicts or pest management dynamics (Abdullahi, 2014; Omer, 2024a, 2024b; Omer & Mohamoud, 2025; Omer et al., 2025; Sharmake et al., 2022). To date, no empirical study has systematically examined the knowledge, attitudes, and practices of Somaliland farmers regarding quelea control. This gap has critical implications: without understanding how farmers perceive quelea threats, assess their capacity to respond, and choose particular control strategies, interventions risk remaining top-down, poorly adopted, and ineffective.

This study addresses this gap by applying the Knowledge, Attitudes, and Practices (KAP) framework to the specific case of quelea bird control in the Wajaale District. By generating empirical evidence on farmers' understanding of quelea ecology, their attitudes toward responsibility and control options, and the practices they employ in response to infestations, this study provides a novel contribution to the literature on pest management in Somaliland. Therefore, this study aimed to assess the knowledge, attitudes, and practices of agro-pastoral farmers regarding Quelea quelea control in the Wajaale District, Gabiley Region, and to examine how socio-demographic characteristics influence these dimensions. Through this approach, this study aims to inform more effective, locally grounded, and sustainable quelea

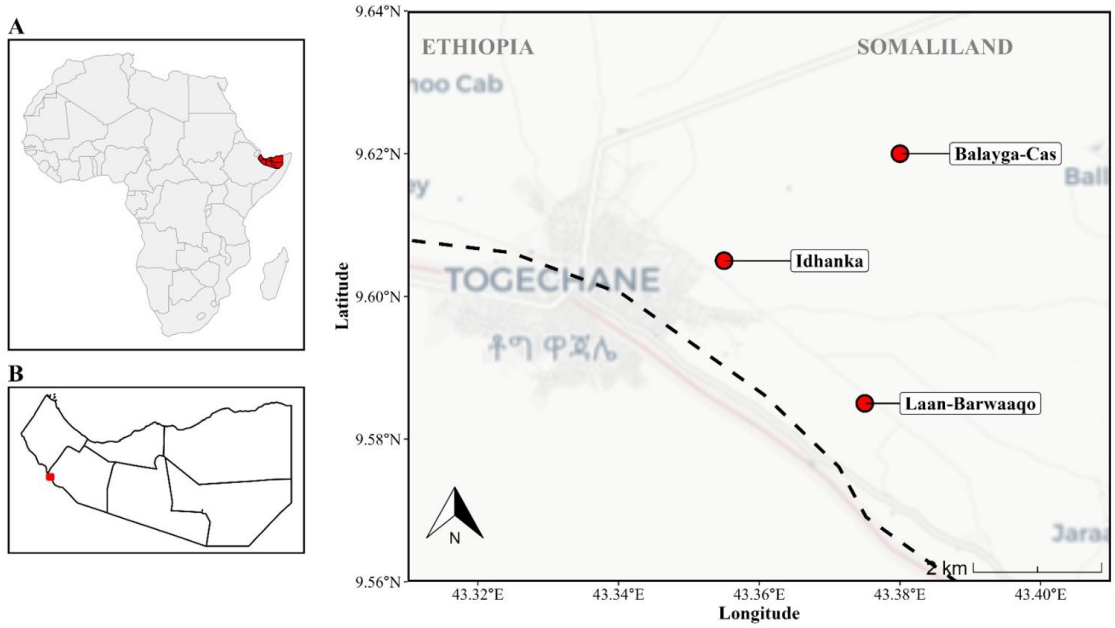

Figure 1. Map of the study area showing the three villages in Wajaale Plain (Source: Authors' own elaboration)

management strategies that align with institutional interventions and the realities of farmers.

MATERIALS AND METHODS

Study Area

The Wajaale District is located in the Gabiley Region of Somaliland, along the international border with Ethiopia (**Figure 1**). The town of Wajaale is a major transboundary trade hub, paired with Tog-Wajaale on the Ethiopian side, and forms a key commercial corridor linking Ethiopia to the Port of Berbera. The district hosts active livestock, cereal, and commodity markets and supports a predominantly agro-pastoral population whose livelihoods depend on crop production and livestock rearing. The population of the Somaliland side of Wajaale is estimated to range between 40,000 and 70,000, reflecting rapid growth associated with trade expansion and rural–urban migration (Mustafe, 2021). The population is largely Somali, with rain-fed agriculture being the main economic activity in the surrounding rural areas.

This study focuses on the Wajaale Plain (Banka Wajaale), an agriculturally productive area within the Wajaale District, comprising approximately seven villages, including Laan-Barwaaqo, Balayga Cas, and Idhanka. Sorghum and maize are the dominant crops cultivated in this area and are highly vulnerable to infestation by red-billed quelea (Quelea quelea). A community-based cross-sectional study was conducted in selected villages of the Wajaale Plain, targeting approximately 1,200 agro-pastoral farmers. The concentration of cereal farming and recurrent quelea invasions make the Wajaale District a suitable setting for examining farmers' knowledge, attitudes, and practices related to quelea bird control.

Research Design, Approach, and Sampling Procedure

This study employed a community-based descriptive cross-sectional survey to assess agro-pastoral farmers' knowledge, attitudes, and practices (KAP) regarding red-billed quelea (Quelea quelea) control in the Wajaale District, Gabiley Region, Somaliland. This design is appropriate for describing current KAP levels and examining their associations with control practices at a single point in time.

The sampling frame consisted of approximately 1,200 agro-pastoral households residing in three villages (Laan-Barwaaqo, Balayga Cas, and Idhanka). Sample size was calculated using Cochran's (1977) formula with finite population correction, assuming a 95% confidence level (Z = 1.96), a conservative population proportion (P = 0.5), and a margin of error of 7%, a finite population correction is applied to reduce the sample size:

$$N=1+N\,(n_0-1)/n_0 \quad (1)$$

where the initial estimate n_0 was derived as:

$$n_0=Z^2\,x\,P\,x\,(1\text{-}P)/e^2 \quad (2)$$

This yielded a minimum sample of 169 households, which was increased to 186 to account for a 10% non-response rate. Households were selected through simple random sampling using village-level household lists provided by local leaders. The sampling frame was a comprehensive list of local farmers and households provided by the heads of the three villages.

Population, Inclusion, and Exclusion Criteria

Participants were adult (⩾18 years) agro-pastoral farmers actively involved in cereal crop production and daily farm management, including crop protection. Eligible respondents were those directly responsible for decisions related to pest control and who were willing to provide informed consent. Individuals with limited farming involvement or those who were unavailable during data collection were excluded.

Measurement of Variables

Data was collected using a structured questionnaire comprising four key domains: socio-demographic

characteristics, knowledge, attitudes, and farming practices related to quelea bird control. Sociodemographic variables included age, sex, education level, farming experience, household size, farm size, and monthly income. These variables were considered potential explanatory factors influencing farmers' knowledge, attitudes, and control practices. Farmers' knowledge of quelea birds was assessed using 12 dichotomous items (coded as 1 = correct and 0 = incorrect), covering key aspects such as identification and biology, feeding behavior and crop damage, and appropriate control methods and timing of application. The individual responses were summed to generate a composite knowledge score of 0–12. The distribution of the knowledge score was examined, and the median value was used as a cutoff point to categorize respondents into two groups. Farmers who scored above the median were classified as having good knowledge, while those who scored at or below the median were categorized as having poor knowledge. The internal consistency of the knowledge scale was acceptable (Kuder–Richardson coefficient [KR-20] = 0.72), indicating a reliable measure of the construct.

Attitudes toward quelea bird control were measured using 12 Likert-scale statements reflecting perceptions of threat, perceived effectiveness of control methods, self-efficacy, and importance of collective action. Responses were recorded on a graded scale and summed to produce a composite score. Similar to the knowledge variable, the median attitude score was used to dichotomize respondents into favorable and unfavorable attitude categories. Respondents with scores above the median were considered to have favorable attitudes, while those scoring at or below the median were categorized as having unfavorable attitudes. The attitude scale demonstrated good internal reliability (Cronbach's $\alpha = 0.78$). Farmers' control practices were assessed using 12 items capturing the frequency and type of control methods employed, including scaring techniques, trapping, chemical control, ecological approaches, and participation in community-based activities. For analytical purposes, the practice was operationalized as a binary outcome variable. Farmers who reported using at least one intensified control method, such as trapping, chemical application, or coordinated community action, were classified as users of intensified control practices, whereas those who relied solely on basic or traditional methods were categorized as non-users of intensified control practices, following established approaches in the literature (e.g., Mariasusai et al., 2025).

Data Collection and Quality Assurance Procedures

Data were collected through face-to-face interviews conducted by four trained enumerators using a Somali-translated, pretested questionnaire. Data entry was conducted digitally using the Kobo Toolbox, with built-in logical checks to minimize errors. Quality assurance measures included daily supervisory reviews, random back-checks of 5% of respondents, and post-collection data cleaning for completeness and consistency.

Data Processing and Analysis

Data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics, including frequencies and percentages, were used to summarize the socio-demographic characteristics and responses to KAP items. Composite scores were computed for each KAP domain. basic biology and identification (3 items), feeding habits and impact (4 items), and control methods and timing (5 items). A correct answer was assigned a score of '1', and an incorrect or 'don't know' answer was assigned '0'. The total knowledge score was calculated by summing all correct answers, yielding a possible range of 0 to 12. Factors associated with good knowledge were analyzed using multivariable binary logistic regression. The outcome variable was 'Good Knowledge' (score $\geqslant$ 7/12). Predictor variables included: Farming experience ($\geqslant$ 40 years vs. < 40 years), education (any formal vs. none), age group ($\geqslant$ 50 years vs. < 50 years), and farm size ($\geqslant$ 2.1 hectares vs. < 2.1 hectares). Results are presented as Adjusted Odds Ratios (AOR) with 95% Confidence Intervals (CI). The model's fit was assessed using the Hosmer-Lemeshow test. Attitude was assessed using a set of 12 statements rated on a 5-point Likert Scale ranging from 1 (strongly disagree) to 5 (strongly agree). Six statements were positively worded, and six were negatively worded to reduce response bias; negatively worded items were reverse-coded during analysis. To identify factors associated with a positive attitude, a multivariable binary logistic regression was performed. The outcome variable, 'Positive Attitude,' was derived from the composite attitude score (dichotomized as > 3.5 vs. $\leqslant$ 3.5). Predictor variables included in the model were: Education level (any formal vs. none), farming experience ($\geqslant$ 40 years vs. < 40 years), farm size (larger vs. smaller), and age group ($\geqslant$ 50 years vs. < 50 years). Results are reported as Adjusted Odds Ratios (AOR) with 95% Confidence Intervals (CI). Farming practices related to Quelea bird control were evaluated using a list of 12 methods. For each method, farmers were asked to indicate the frequency of use on a three-point scale: "Regularly," "Rarely," or "Not at all." The practices covered scaring techniques, trapping, chemical control, ecological methods, and community actions. Factors associated with being a high adopter of control practices were analyzed using multivariable binary logistic regression. The outcome variable, 'High Practice Adopter,' was dichotomized from the composite practice score (> 1.8 vs. $\leqslant$ 1.8). Predictor variables included: Knowledge level (good vs. poor), attitude profile (positive vs. not positive), education level (any formal vs. none), farming experience (high vs. low), and farm size (larger vs. smaller). Results are presented as Adjusted Odds Ratios (AOR) with 95% Confidence Intervals (CI)."

Bivariate analyses were performed using Chi-square tests for categorical variables and independent t-tests for continuous variables to identify factors associated with the use of intensified control practices. Variables with a p-value < 0.5 in bivariate analysis, along with theoretically important variables, were included in a multivariable binary logistic regression model. Binary logistic regression was selected due to the dichotomous nature of the outcome variables (good/poor knowledge, positive/negative attitude, good/poor practices). This method allowed us to control for potential confounders and determine the independent effect of each predictor.

Table 1. Socio-demographic and farm characteristics of respondents (n = 186)

Variable	Category	n (%)
Gender	Male	142 (76.3)
	Female	44 (23.7)
Age (years)	⩽ 40	12 (6.4)
	41–50	23 (12.4)
	51–60	26 (14.9)
	> 60	125 (66.3)
Education	No formal education	170 (91.4)
	Primary or above	16 (8.6)
Household size	⩾ 7 members	170 (91.4)
Annual income	USD 300–600	165 (88.7)
Farming experience	⩾ 40 years	165 (88.7)
Farm size	⩾ 21,000 m²	141 (75.9)
Main crop	Maize & sorghum	181 (97.3)

Table 2. Knowledge of Quelea birds and control methods (n = 186)

No.	Statement	True n (%)	False n (%)	Don't know n (%)
1	Quelea birds can be identified by their large, destructive flocks	175 (94.1)	10 (5.4)	1 (0.5)
2	Quelea birds feed mostly during midday	5 (2.7)	167 (89.8)	14 (7.5)
3	Quelea birds migrate seasonally	177 (95.2)	9 (4.8)	0 (0.0)
4	Quelea birds eat mostly insects	2 (1.1)	83 (44.6)	101 (54.3)
5	A large flock can destroy a farm in one day	185 (99.5)	1 (0.5)	0 (0.0)
6	Quelea birds build solitary nests	182 (97.5)	4 (2.2)	0 (0.0)
7	Control is more effective at roosting sites	170 (91.4)	15 (8.1)	1 (0.5)
8	Scarecrows provide a permanent solution	5 (2.7)	47 (25.3)	134 (72.0)
9	Early morning is the best time to scare birds	118 (63.4)	5 (2.7)	63 (33.9)
10	Poison is the safest first control option	2 (1.1)	99 (53.2)	85 (45.7)
11	Community-wide control is more effective	174 (93.5)	11 (5.9)	1 (0.5)
12	Quelea birds have few natural predators	172 (92.5)	12 (6.4)	2 (1.1)

RESULTS OF THE STUDY

Socio-demographic characteristics of the respondents

A total of 186 agro-pastoral farmers participated in the study and were included in the analysis. **Table 1** summarizes the respondents' demographic, economic, and farm-related characteristics. Most respondents were male (76.3%), and the study population was predominantly older, with 66.3% of the respondents aged over 60 years. Formal education levels were low, with 91.4% of respondents reporting no formal education. Household sizes were generally large, with 91.4% of households having seven or more members. The annual household income was low, with 88.7% of the respondents reporting earnings between USD 300 and 600. Farming experience was extensive, with 88.7% of the respondents reporting more than 40 years of experience. Most farms were small to medium in size, with 75.9% operating between 21,000 and 30,000 m² of land. Maize and sorghum were the primary crops grown by 97.3% of the respondents. Nearly all respondents reported access to markets (99.5%). None of the respondents reported access to agricultural extension services, and all respondents reported having experienced significant quelea-related crop damage.

Knowledge of Quelea Birds and Control Methods

Farmers' knowledge of Quelea bird biology and control methods is presented in **Table 2**. Overall, the respondents demonstrated a high level of awareness of the severity and destructive potential of Quelea birds. Most correctly identified Quelea birds as moving in large flocks (94.1%) and acknowledged their ability to destroy an entire farm within a single day (99.5% of respondents). Awareness of seasonal migration (95.2%) and the effectiveness of community-wide control (93.5%) were also high. However, knowledge of basic ecology and safety control was inconsistent. While 44.6% correctly identified Quelea birds as seed-eaters, more than half (54.3%) responded "don't know." Similarly, although 53.2% correctly rejected poison as a safe first option, 45.7% reported uncertainties. Misconceptions were also observed regarding nesting behavior, with 97.5% of respondents incorrectly believing that Quelea birds build solitary nests. The mean knowledge score was 8.45 ± 2.10 (out of 12), corresponding to 70.4%, indicating a moderate overall knowledge level. As the knowledge scale included ecological, practical, and safety-related items, this aggregate score may mask variations across knowledge domains.

Factors Associated with Knowledge of Quelea Birds

Binary logistic regression was used to identify the factors associated with good knowledge of Quelea birds (**Table 3**). After adjustment, farming experience and formal education were significantly associated with good knowledge levels. Farmers with ⩾ 40 years of experience had higher odds of having good knowledge than less experienced farmers (AOR = 4.20; 95% CI: 1.75–10.08). Similarly, respondents with formal education were more likely to have good knowledge than those without formal education (AOR = 3.10; 95% CI: 1.05–9.15). Age group and farm size were not statistically significant predictors of knowledge in the adjusted model.

Table 3. Factors associated with good knowledge of Quelea birds

Variable	AOR	95% CI	p-value
Farming experience (⩾ 40 years)	4.20	1.75–10.08	0.001
Any formal education	3.10	1.05–9.15	0.041
Age ⩾50 years	0.75	0.38–1.48	0.402
Larger farm size	1.45	0.72–2.92	0.298

Table 4. Attitudes toward Quelea birds and control methods (n = 186)

No.	Statement	SD n (%)	D n (%)	N n (%)	A n (%)	SA n (%)
1	Quelea are the biggest pest threat	0	0	0	28 (15.1)	158 (84.9)
2	Damage causes severe hardship	0	0	1 (0.5)	35 (18.9)	150 (80.6)
3	Confident in protecting crops	3 (1.6)	4 (2.2)	172 (92.5)	6 (3.2)	1 (0.5)
4	Known methods are effective	1 (0.5)	4 (2.2)	81 (43.5)	87 (46.8)	13 (7.0)
5	Individual farmers can do little (R)	0	0	7 (3.8)	150 (80.6)	29 (15.6)
6	Pesticides are necessary	69 (37.1)	23 (12.4)	88 (47.2)	4 (2.2)	2 (1.1)
7	Scary is a waste of time (R)	3 (1.6)	3 (1.6)	3 (1.6)	152 (81.7)	25 (13.5)
8	Government spraying is best	1 (0.5)	3 (1.6)	79 (42.5)	77 (41.4)	26 (14.0)
9	Farmers should work together	0	1 (0.5)	1 (0.5)	90 (48.5)	94 (50.5)
10	The government should help	0	1 (0.5)	0	47 (25.3)	138 (74.2)
11	Willing to contribute	0	3 (1.6)	161 (86.6)	16 (8.6)	6 (3.2)
12	Control is more important than wildlife	0	0	175 (94.1)	6 (3.2)	(2.7)

Table 5. Factors associated with a positive attitude

Variable	AOR	95% CI	p-value
Any formal education	2.80	1.25–6.28	0.012
Farming experience	1.90	0.92–3.92	0.083
Farm size	1.45	0.80–2.63	0.224
Age ⩾50 years	0.85	0.46–1.57	0.605

Attitudes Toward Quelea Birds and Control Measures

Farmers' attitudes toward Quelea birds and their control are summarized in **Table 4**. The perceived severity of Quelea damage was uniformly high, with nearly all respondents agreeing that Quelea birds pose a major threat to farm income and household well-being. Agreement was also high regarding the importance of collective action (99.0%) and government responsibility (99.5%) for controlling Quelea birds. In contrast, confidence in individual ability to control Quelea birds was limited, as 92.5% of respondents selected neutral responses regarding self-efficacy. The participants' views on specific control methods varied, with mixed perceptions of pesticide use and government-led spraying campaigns. The composite attitude score had a mean of 3.45 ± 0.65 on a 5-point scale, indicating a moderately positive overall attitude, although neutrality was common across several items.

Factors Associated with Attitude Toward Quelea Control

Binary logistic regression was conducted to identify the predictors of a positive attitude toward Quelea control (**Table 5**). Formal education was the only variable significantly associated with a positive attitude. Respondents with formal education had higher odds of a positive attitude than those without formal education (AOR = 2.80; 95% CI: 1.25–6.28). Farming experience, farm size, and age group were not statistically significant in the adjusted model.

Practices for Controlling Quelea Birds

The reported practices for controlling the Quelea birds are listed in **Table 6**. The most frequently practiced method was noisemaking, used regularly by 97.8% of the respondents. Other individual deterrent methods, such as scarecrows and slingshots, were used less frequently. Labor-intensive or resource-dependent practices, including netting, trapping, chemical control, roost destruction, and planting trap crops, were rarely or never used by the majority of respondents. In contrast, collective action was more commonly practiced. Coordinating control efforts with neighboring farmers (65.6%) and participating in organized community or government campaigns (61.3%) were among the most frequently reported practices by the respondents. The mean composite practice score was 1.74 ± 0.30 (on a 1–3 scale), indicating a low overall adoption of diversified control methods.

Table 6. Practices used to control Quelea birds (n = 186)

No.	Practice	Regular n (%)	Rare n (%)	Never n (%)
1	Scarecrows / reflective devices	15 (8.1)	170 (91.4)	1 (0.5)
2	Noisemaking	182 (97.8)	4 (2.2)	0 (0.0)
3	Guarding fields	1 (0.5)	73 (39.2)	112 (60.3)
4	Slingshots	8 (4.3)	171 (91.9)	7 (3.8)
5	Trapping nets	2 (1.1)	2 (1.1)	182 (97.8)
6	Protective nets	1 (0.5)	1 (0.5)	184 (98.9)
7	Chemical pesticides	0 (0.0)	6 (3.2)	180 (96.8)
8	Destroying roosts	1 (0.5)	2 (1.1)	183 (98.4)
9	Trap crops	1 (0.5)	3 (1.6)	182 (97.9)

Table 6 (Continued). Practices used to control Quelea birds (n = 186)

No.	Practice	Regular n (%)	Rare n (%)	Never n (%)
10	Changing planting dates	0 (0.0)	178 (95.7)	8 (4.3)
11	Coordinating with neighbors	122 (65.6)	63 (33.9)	1 (0.5)
12	Organized campaigns	114 (61.3)	68 (36.5)	4 (2.2)

Table 7. Factors associated with intensified control practices

Variable	AOR	95% CI	p-value
Positive attitude	3.40	1.82–6.35	<0.001
Good knowledge	2.10	1.15–3.84	0.016
Education	1.65	0.85–3.20	0.140
Farming experience	1.30	0.65–2.60	0.460
Farm size	0.90	0.50–1.62	0.720

Table 8. Perceived challenges to Quelea control (n = 186)

Challenge	n (%)
Scale and speed of Quelea birds	60 (32.1)
Fear and frustration	58 (31.2)
Lack of support/information	52 (28.0)
Crop failure	16 (8.6)

Factors Associated with the Adoption of Quelea Control Practices

Binary logistic regression was used to assess the factors associated with being a high adopter of control practices (**Table 7**). Both attitude and knowledge were significantly associated with practice adoption. Farmers with a positive attitude and good knowledge had higher odds of adopting intensified control practices (AOR = 3.40; 95% CI: 1.82–6.35), while those with good knowledge were also more likely to adopt such practices (AOR = 2.10; 95% CI: 1.15–3.84, respectively). Education level, farming experience, and farm size were not significant predictors in the adjusted model.

Perceived Challenges in Controlling Quelea Birds

The challenges perceived by farmers in controlling Quelea birds are summarized in **Table 8**. The most frequently reported challenge was the scale and speed of Quelea bird attacks (32.1%), followed by fear and frustration (31.2%), and lack of timely support and information (28.0%). Crop failure was less frequently identified as the primary challenge (8.6%).

DISCUSSION

This study reveals a structural gap between threat awareness and effective action in quelea management in the Wajaale District. Farmers clearly recognize the severity of red-billed quelea invasions; however, this awareness does not translate into coordinated or preventive control practices. The findings support the characterization of a condition of "informed powerlessness," where knowledge of risk coexists with low self-efficacy and weak institutional backing. The predominantly negative attitudes toward quelea align with evidence from Kondoa District, Tanzania, where Flora et al. (2014) found that crop damage costs outweighed perceived benefits, resulting in unfavorable community perceptions of quelea. Similarly, in Wajaale, perceived economic losses dominate the farmer experience, reinforcing reactive rather than strategic responses. However, unlike contexts where harvesting quelea provides partial livelihood benefits, farmers in Wajaale reported minimal compensatory value, intensifying their negative attitudes.

The limited adoption of preventive agronomic strategies corresponds to the findings from Ethiopia. Abadi et al. (2024) documented that 69.39% of fields in the Raya Azebo District of Tigray, Ethiopia were affected, with a mean crop damage of 32.37%, and showed that synchronized planting, harvesting time, and landscape factors significantly influenced damage levels. The absence of coordinated planting calendars and extension guidance in Wajaale likely constrains the potential for similar preventive measures. More broadly, the results reflect systemic vulnerability consistent with Gayo et al. (2025), who argue that climate variability and human wildlife conflict erode household capital and weaken adaptive capacity across East Africa. In Wajaale, low income levels, limited extension services, and weak collective structures restrict farmers' abilities to implement effective control measures. Taken together, the evidence suggests that effective quelea management requires integrated, community-based strategies that combine technical knowledge transfer, institutional facilitation, synchronized agronomic planning, and mechanisms that strengthen collective efficacy, rather than solely individual responses.

This study had important strengths and limitations. Data were collected directly from farming communities in the Wajaale Plain, enhancing ecological validity. The use of trained local enumerators and engagement with community leaders likely improved the response accuracy and reduced the bias of social desirability. The instrument was systematically designed to assess all three KAP domains, and the application of composite scoring and binary logistic regression strengthened the analytical rigor by identifying independent predictors of practice, rather than relying solely on descriptive statistics. The identification of a gap between willingness for collective action and its limited implementation also provides clear and actionable insights for intervention design. However, the cross-sectional design limits causal inference, and

associations between knowledge, attitude, and practice cannot be interpreted as causal pathways without longitudinal evidence. Reliance on self-reported crop damage and control practices may introduce recall or perception bias, and future studies would benefit from incorporating direct field-based yield loss assessments or pilot plot measurements to validate reported impacts. Additionally, because the study was confined to the Wajaale District, caution is required when generalizing the findings to other agro-ecological or institutional contexts within Somaliland or beyond.

CONCLUSION AND RECOMMENDATIONS

This study demonstrates that Quelea management in the Wajaale District is constrained less by a lack of awareness than by a psychosocial bottleneck best described as informed powerlessness. Farmers clearly recognize the scale and severity of Quelea damage and can identify seasonal patterns. However, this experiential knowledge is not matched by sufficient ecological and technical understanding of effective, safe, and coordinated control measures for the species. Consequently, practices remain reactive and are predominantly limited to individual scaring techniques. The analysis shows that attitude, particularly perceived self-efficacy, plays a stronger role than knowledge alone in predicting improved control practices. Farmers express strong concerns about crop losses and acknowledge the need for collective action, yet many believe that effective solutions depend primarily on external actors. This gap between awareness and agency constitutes the central contribution of this study: it identifies psychological and institutional constraints, rather than purely agronomic factors, as the key barriers to effective Quelea management. Therefore, interventions should shift from a narrow focus on information transfer to an efficacy-building, community-based model. Establishing village-level Quelea Control Action Groups (QCAGs), supported by district extension services, can improve coordination, cost-sharing, and early warning. Institutional roles should prioritize facilitation, technical guidance, and access to shared resources over centralized control. By strengthening collective capacity and rebuilding confidence in manageable and coordinated action, quelea management can move from reactive coping to structured, community-supported resilience.

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