



## Comparing the Effectiveness of Bird Scaring and Netting as Mitigation Control Measures of Quelea Bird Damage in Subsistence Paddy Rice Farms in the Argungu Floodplain (Fadama) Area

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### ABSTRACT:

Red-billed Quelea *Quelea quelea* is the most widespread and best-known avian pest species in Africa. Methods of controlling Quelea birds ranged from traditional to more modern mechanical, chemical and electrical noise-making devices. In this study, we tested the effectiveness of two methods as control measures of Quelea bird raids on paddy rice crops in Argungu floodplain (fadama) paddy rice farms. The Quelea bird visitation rate was used to assess the effectiveness of bird scaring and netting methods of control. The netting method of bird control appeared to be more effective as a control measure against the Quelea bird raid on the paddy rice crop. Government and non-governmental organisation support for subsistence farmers with nets is highly recommended.

Keywords: Quelea bird, Paddy rice, Visitation rate, subsistence farmers, effectiveness

### Introduction:

Rice *Oryza sativa* is one of the most important food crops in the world (Bambaradeniya and Amarasinghe, 2003; Odoukpé et al, 2023). Rice is the primary source of nutrition for over half of the global human population and constitutes one-fifth of the world's grain supply (Elphick, 2010; Odoukpé et al, 2023). Rice is grown in over 100 countries (Platt et al, 2021), and it has many natural pest such as weeds, insects, rodents, fish, birds, molluscs, and crustaceans, Microorganisms such as phytophagous nematodes, fungi and viruses (Odoukpé et al, 2023). The most well-known of these natural pests for rice fields is undoubtedly birds (Odoukpé et al, 2023).

The most widespread and best-known avian pest species in Africa is undoubtedly the Red-billed Quelea *Quelea quelea* (Linnaeus, 1758) (Lanza and Nistri, 2005; Odoukpé et al, 2023). As a small passerine bird of the weaver family Ploceidae, native to sub-Saharan Africa, Red-billed Quelea, *Quelea quelea* is the world's most abundant wild bird species, with an estimated adult breeding population of 1.5 billion pairs. Some estimates of the overall population have been as large as 10 billion (Mpala et al, 2015). There are three subspecies of red-billed quelea: the nominate form Q. q. quelea occurs in West Africa, Q. q. aethiopica ranges in East Africa, and Q. q. lathamii restricted to southern Africa (Cheke et al, 2013). All three of the subspecies are migrant pests which follow rainfall systems. In general, Quelea birds breed 2 or 3 times a year, but up to 5 times per annum in East Africa (Cheke and Sidatt, 2019).

Damage caused by pests has been estimated to millions of dollars worldwide (Zalucki et al, 2012). The red-billed Quelea *Quelea quelea* is the most important avian pest of small grain crops in Africa, causing damage up to the equivalent of US\$ 88.6 million per annum as at 2018 prices (Cheke and Sidatt, 2019).

The most popular and effective control measure of Quelea menace is using chemical substance such as fenthion (Queletox) and other organophosphate avicides by aerial and / or ground-spraying (Cheke and Sidatt, 2019), such expensive chemical control is far beyond the means local subsistence farmers. Measures to control quelea birds without using chemical have included the use of (a) explosives/fire-bombs; (b) a variety of mass trapping methods, sometimes keeping the birds for food; (c) cultural control; (d) quelea resistant crops; (e) protecting vulnerable crops with repellents and netting and (f) scaring the birds, including the use of falcons (Cheke and Sidatt, 2019). Allan (1997) described a variety of methods whereby nets were used to cover crops and thus prevent birds from attacking them and Elliott and Bright (2007) recommended covering rice fields with nets to reduce quelea damage in Nigeria.

Besides being expensive, chemical control of pest has been recognized as nonpoint source of environmental pollution (land, air and water). Adopting alternative measures of pest control is crucial to save environment and biodiversity. Therefore, it is essential to recognize the importance of other control measures that subsistence farmers can afford and are less inimical to the environment and other species. In this study, we aim at assessing effectiveness of netting and bird-scaring methods on Quelea bird control in Argungu floodplain (Fadama) rice fields.

## Methodology:

### Study Area;

Argungu is located on latitude 12.75°N longitude 4.54°E in the Northwestern part of Nigeria (Kebbi state), and mostly characterized by lowland with a highland area of up to 300 m dissected by large flowing river (River Sokoto). Geologically, the area is of sedimentary rock composing of undifferentiated sands, gravels, clays (mostly in the upland areas) and floodplains around the riverine communities (Adelana et al. 2008). Thus, two types of soil can be identified in the area: sandy soil in the upland area and clayey and hydromorphic (clay, clay loam, sandy loam, loamy sand) in the floodplain (Fadama) area. The climate of the area is tropical continental type; with two clear marked seasons, the dry and wet seasons resulting from two contrasting air masses, the tropical continental and tropical maritime originating from the Sahara Desert and the Atlantic Ocean, respectively. The wet season lasts May–October. While the dry season lasts November–April. The mean annual rainfall is 800 mm. The average temperature is 27°C which can rise to above 40°C in the dry season.

### Data Collection;

Two irrigated paddy farms of approximate size 50x50m separated with approximate distance of 200m were surveyed. Surveyed farm A was equipped with scarecrows, flag-waving and loud noises, while farm B was covered with 20x20m mesh net. Data on bird activities was collected on fixed point observation of the bird visitation to each farm (Totland 1994; Couvillon et al, 2015). In each farm, one observer recorded the number of quelea bird flock visit to each farm within a day for 20-minute in the morning from 06:00 to 08:00am and in the evening from 05:00 to 07:00pm for two weeks.

### Data Analysis

Bird visitation rate to the farms as a proxy of effectiveness of each control method was measured as the number of bird flock recoded per 20-minute observation period in the morning and evening within a day in each study farm. Comparison of the visitation rate to each farm between the periods of the day morning and evening and between the farms A and B was carried out using Wilcoxon Signed Rank Test Z in SPSS package version 26 at probability significant level of 0.05.

## Results

An average of  $19.180 \pm 0.589$  and  $6.180 \pm 0.291$  Quelea bird flocks per 20-minute were recorded in surveyed farms, ( $n = 256$ ,  $18.290 \pm 0.841$ ) and ( $n = 90$ ,  $6.430 \pm 0.477$ ) for the morning survey and ( $n = 281$ ,  $20.070 \pm 0.81$ ) and ( $n = 83$ ,  $5.930 \pm 0.339$ ) for evening survey (Table 1). Quelea bird visitation rate per 20-minute was statistically significantly high in the evening than in the morning in paddy rice farm equipped with scaring control measure Wilcoxon Signed Rank Test ( $Z = 75.500$ ,  $P = 0.004$ ) Figure 1, while bird visitation rate per 20-minute was not statistically significantly different between morning and evening period of the day in the paddy rice covered with net control measure Wilcoxon Signed Rank Test ( $Z = 23.500$ ,  $P = 0.389$ ) Figure 2. Overall, Quelea bird visitation rate was statistically significantly high in the paddy rice farm equipped with scaring control measures than the paddy rice farm covered with net control measure Wilcoxon Signed Rank Test ( $Z = 21.062$ ,  $P = 0.000$ ) Figure 3.

Table 1. Quelea bird flock visitation rate per 20-minute observation period in morning and evening for paddy rice farm A and B.

Days	Farm A		Farm B	
	Morning Survey (Rate/20-minute)	Evening Survey (Rate/20-minute)	Morning Survey (Rate/20-minute)	Evening Survey (Rate/20-minute)
1	22	26	6	7
2	20	21	5	7
3	18	22	8	8
4	17	19	9	5
5	23	23	5	5
6	22	21	6	6
7	21	22	7	5
8	15	19	9	7
9	14	16	4	6
10	16	16	7	5
11	20	22	6	8

12	19	20	9	5
13	14	17	4	5
14	15	17	5	4
	n=256	n=281	n=90	n=83
Mean ±SE	18.290 ±0.841	20.070 ±0.81	6.430 ±0.477	5.930 ±0.339

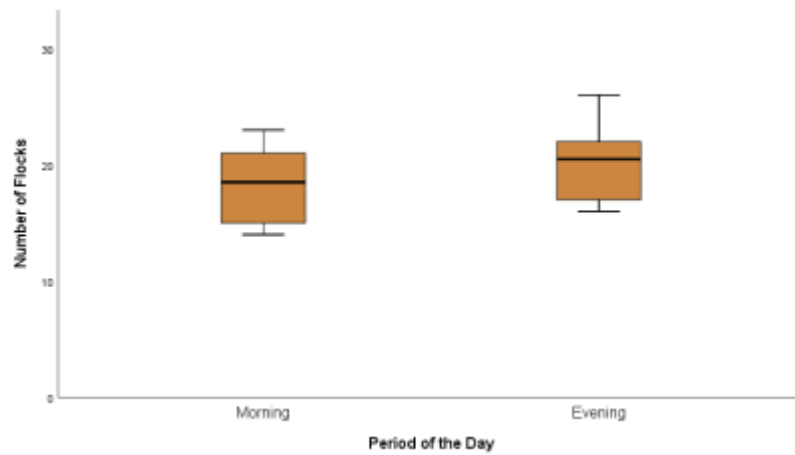


Figure 1. Quelea bird visitation rate between morning and evening period to the paddy rice farm A, equipped with scaring control measure.

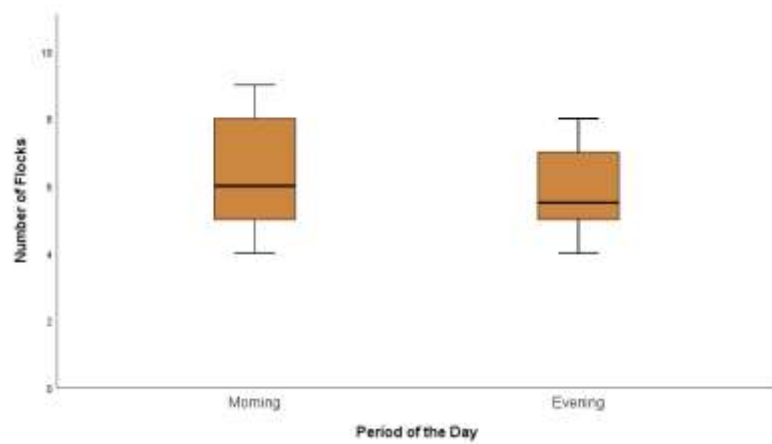


Figure 2. Quelea bird visitation rate between morning and evening period to the paddy rice farm B, covered net control measure.

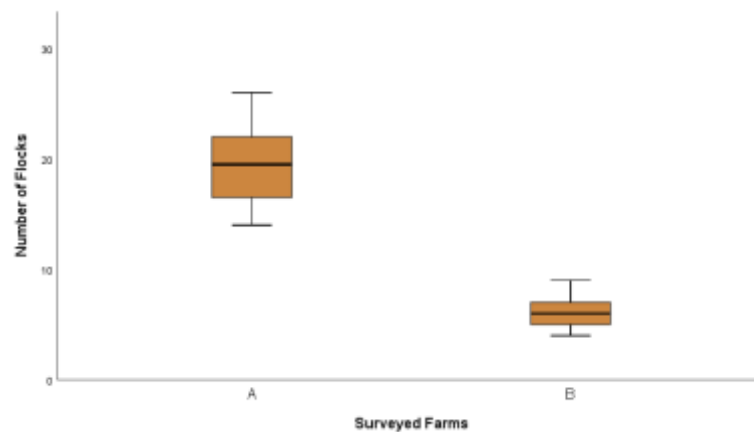


Figure 3. Quelea bird visitation rate between paddy rice farms equipped with scaring and net control measures.

## Discussion and Conclusion

Farmers are suffering from crop-raiding by huge population swarms of *Quelea* birds and finding it difficult to manage and control swarm raids in raid-prone regions of sub-Saharan Africa (Maurice et al, 2019). Making a good choice of control measure is crucial to minimise the loss incurred by farmers from the bird raid of their farm yield. In this research we highlighted that the repellent capacity of the scaring method is far less compared to the netting method. Visitation of birds is more frequent in the evening than in the morning. This indicated that bird crop raiding is more severe in the evening than in the morning in the raid-prone paddy farms. Scaring the birds is usually the only option open to the subsistence farmer, but other methods can be considered (Maurice et al, 2019). Covering paddy farms with net as a control measure appeared to be more promising than the scaring method of control. The alternative is to act against the birds away from the crops, and this may require co-operative action. Paddy rice farmers need to cooperate and accept other alternative methods that are more effective, such as using netting rather than the traditional scaring method. Although opting for other alternative methods other than the traditional scaring method of *Quelea* bird control could be costly for subsistence farmers. Intervention from the government and non-governmental and other international organisations to provide support to subsistence farmers with nets and other mechanical options is highly recommended.

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