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Analysis of Farmers' Indigenous Knowledge, Perceptions, and Practices Used in the Control of Parasitic Weed *Striga* among Maize and Sorghum Farmers in Northern Nigeria

Suleiman, M.S.[A], Lado, A.[B], Hussaini, M.A.[B], Bello, T.T.[B], Isa, H.M.[B], Ibrahim, H.[B], Dawaki, M.U.[C], Fagge, A.A.[D], Aliyu, K.T.[E], and Kamara, A.Y.[E]

[A] Department of Agricultural Economics and Extension, Bayero University Kano, Kano, Nigeria
[B] Department of Agronomy, Bayero University Kano, Kano, Nigeria
[C] Department of Soil Science, Bayero University Kano, Kano, Nigeria
[D] Centre for Dryland Agriculture, Bayero University Kano, Kano, Nigeria
[E] International Maize and Wheat Improvement Center (CIMMYT), Lusaka, Zambia

Corresponding author; email: mssuleiman.ext@buk.edu.ng

Abstract

This study examined the socio-economic impact of the parasitic weed *Striga* infestation and the effectiveness of local and conventional control measures in Nigeria's Gombe, Kano, and Jigawa States. Cross-sectional data from 925 respondents in 2020 was analyzed using descriptive and inferential statistics. Most respondents were male (94.8%), married (85%), and engaged in crop production (64%). The average landholding per household was 2 hectares, primarily used for cereal and legume cultivation, such as maize, sorghum, cowpea, and millet. The majority practiced mixed cropping (88%). Soil texture, moisture retention, color, and grass species appearance were used to assess farmland fertility. *Striga* infestation's negative effects included stunted growth (59%), yellowing of crops (57%), yield decline (51%), and soil fertility reduction (19%). Respondents considered continuous cropping (63%), low fertilization (89%), poor crop management (79%), low rainfall (45%), and high temperature (45%) as the main causes of *Striga* infestation. Farmers used various methods for control, including appropriate fertilizer application (75%) and weeding (68%). Indigenous methods like a mixture of salt and potash and *Parkia* fruit powder were also common. The effectiveness of indigenous and conventional methods showed no significant difference between Jigawa and Katsina. In conclusion, *Striga* infestation significantly threatens crop production, income, and food security. It can be managed through both conventional and indigenous methods. Efforts should focus on educating farmers about agronomic practices to mitigate *Striga* infestation and promote the adoption of *Striga*-resistant crop varieties, especially in *Striga*-prone areas.

Keywords: indigenous weed control method, knowledge, perception, *Striga*, weeds

Introduction

Background Information

Low crop productivity in many African regions is primarily attributed to biotic and abiotic factors. These include issues like diminishing soil fertility, the impact of climate change characterized by erratic shifts in rainfall and temperature, the prevalence of pests and diseases, and the infestation of *Striga* spp, a parasitic weed. *Striga* spp., specifically *S. hermonthica* (Del.) Benth. and S. asiatica (L.) Kuntze, commonly known as witchweeds, are among the most problematic and damaging weeds globally (Yacoubou et al., 2021). These plants belong to the Orobanchaceae family (formerly Scrophulariaceae) and are characterized as obligate root hemiparasites. The genus *Striga* consists of 42 species worldwide, with *S. hermonthica* and *S. asiatica* recognized as the most economically significant weeds affecting cereal crops. *Striga* targets various millet species, such as pearl millet, finger millet, foxtail millet, little millet, proso millet, *fonio*, teff, and barnyard millet, including sorghum, which are staple food and fodder crops for millions of impoverished rural families, in tropical and semiarid regions. Consequently, they are important for subsistence farmers (Yoda et al., 2021). This parasitic weed poses a significant threat to food production. *Striga*, also known as witchweed, occurs naturally in parts of Africa, Asia, and Australia; it is a prolific weed that can produce up to 50,000 seeds per plant. *Striga* weed infestation results in fluctuations in food prices, heightens the vulnerability of small-

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scale farmers and exacerbates rural poverty (David et al., 2022). In the context of Nigerian agriculture, *Striga* (witchweed) is recognized as one of the most severe impediments to increasing the production of cereals and legumes (Mrema et al., 2020), which, in turn, hampers progress toward achieving the agricultural sector's goals of ensuring food security and generating employment.

As highlighted by Dossa (2023), *Striga* affects an estimated 44 million hectares of land globally, impacting the livelihoods of over 100 million smallholder farmers. In Nigeria, around 823,000 hectares of arable land are afflicted by *Striga*, accounting for approximately 34% of the infested land in Africa. The major host plants affected are maize, cowpea, millet, sorghum, rice, and sugarcane (Lobulu et al., 2019). Maize tends to be the most severely affected crop, with an average yield loss of 1.15 tons per hectare due to *Striga* infection. In some cases, losses can be as high as 2.8 tons.ha^{-1} (Omondi et al., 2023).

The rising levels of poverty among the rural population in Nigeria are a concerning issue, with nearly 100 million people living on less than US$1 per day (Jaiyeola and Choga, 2021). This report's statistics reveal that Nigeria's northwest and northeast regions had the highest poverty rates at 77.7 and 76.3%, respectively, in 2010. These regions possess substantial agricultural potential and a labor force, yet they remain highly susceptible to poverty and food insecurity, partially due to the slow adoption of improved farm technologies (Omondi et al., 2023).

Traditional methods for controlling *Striga*, such as uprooting, burning, and manuring, have proven ineffective (Niassy et al., 2022). Consequently, crop scientists have developed modern techniques, including the heavy application of fertilizer, crop rotation, trapping crops susceptible to *Striga* parasitism, herbicide application, and utilizing crop varieties resistant or tolerant to *Striga* (David et al., 2022). However, farmers have encountered resistance to these methods due to biological and socioeconomic factors. Instead, farmers have devised and adopted various local methods to manage and mitigate *Striga* infestation in their fields. Indigenous methods like a mixture of salt and potash and *Parkia* fruit powder were also standard methods recently practiced by farmers to control *Striga* in their fields with minimal cost. *Parkia bigglobosa* (African locust bean) has shown potential for controlling *Striga*, a group of bioactive compounds, particularly saponins and tannins. Saponins possess various biological properties, including allelopathic effects, which can inhibit the growth of parasitic weeds like *Striga*. Tannins also have bioactive properties that may deter weed growth or seed germination. Other secondary metabolites, such as flavonoids and alkaloids found in *Parkia biglobosa*, may contribute to its anti-*Striga* activity in tropical lands. This study has unveiled the effectiveness of these local methods in achieving this critical goal. The findings could inform policy responses to promote using indigenous and conventional *Striga* Control Management to reverse the decline in agricultural productivity and enhance food security.

This study aimed to assess the socioeconomic impact of *Striga* infestation and community perceptions and evaluate the local and conventional methods used among farmers in Gombe, Jigawa, and Kano States, Nigeria. The findings of this study will add to the present knowledge on how smallholder farmers control notorious and parasitic grass in their farmland. The study has therefore generated valuable information on the traditional methods of *Striga* control and their dynamics as well as biophysical, socio-economic, and institutional factors affecting their utilization from farmers' perspective. Hence, understanding local measures employed by farmers to reduce the impact of *Striga* infestation will help the decision-makers and policymakers embed them when planning for any intervention in the study location or any area with similar environmental conditions.

Objective of the Study

The broad objective of the study was to determine farmers' indigenous knowledge, perceptions, and socioeconomic factors influencing the decision to utilize *Striga* management practice in Northern Nigeria to generate valuable information that would contribute to the development of crop production strategies for household food security in Nigeria. Specifically, the study aimed to (1) describe the socioeconomic attributes of the farming household; (2) identify the traditional/indigenous methods of *Striga* control/mitigation measures; (3) assess the farmer's knowledge and perceptions of the effect of *Striga* infestation on cereal crops' output; and (4) determine the socioeconomic factors influencing farmers' utilization of indigenous *Striga* control methods (ISCM).

Methodology

Description of the Study Area

The study was conducted in three states: Gombe, Jigawa, and Katsina. The States are in northern Nigeria and lie along the savanna agroecological zones. The

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climate of Northern Nigeria has a definite rhythm of wet and dry seasons, to which the whole life of the region is closely adjusted. The mean, minimum, and maximum rainfall per annum are 750 mm, 600 mm, and 1100 mm, respectively. The minimum and maximum daily temperatures are 23°C and 34°C respectively. The temperature range becomes more marked from south to north with increasing distance from the rainy low latitude coastal belt. Agriculture is the primary livelihood option for most of the region's inhabitants. Arable crops are mainly produced in the area due to low rainfall, which lasts only 3-4 months in a 12-month calendar year. Crops such as sorghum, maize, rice, millet, ground nut, and cowpea are predominantly produced among smallholder farmers. Agricultural activities are constrained by pests and diseases, low mechanization, climate change, low labor productivity, and *Striga* infestation, particularly in low fertile soils.

Sampling Procedure

A multistage sampling technique was used for the study. This involves a combination of probability and nonprobability sampling techniques. In the first stage, three States (Gombe, Jigawa, and Katsina States) were purposely selected based on the history of high *Striga* infestation in the available arable land. Purposive sampling was used to select five LGAs and five communities in each of the States based on the level of *Striga* infestation in those areas. This ensured inclusivity and easy access to the target communities and farming households. Lastly, simple random sampling was used to select nine hundred and twenty-one (921) households involved in sorghum and maize production in the states (Table 1). The sampling frame was generated based on the household head population obtained from the participating states' Agricultural Development Programme (ADP) Zonal Offices. To determine the representative sample, a sample size determination formula was used. The formula used is mathematically expressed as:

$$n = \frac{N}{1+N\,(\alpha^2)}\ (1)$$

where n = sample; N = population; and α = level of significance (α<0.05)

Data Collection

The primary data source was utilized for the study. The necessary data were elicited via household surveys, focus group discussions, and key informant interviews with community members, local leaders, and government officials. The information collected includes, among others, the socio-economic attributes of the respondents, household and community livelihood status, conventional and indigenous methods of *Striga* control, household perceptions and attitudes towards *Striga* management, and control measures and constraints militating against *Striga* management in the study area.

Data Analysis and Model Specification

The study was designed to determine the socioeconomic factors influencing households' decision to utilize ISCM. Given that the decision to use technology is a linear function of a vector of individual farmers' and households' characteristics (Xi) and an ISCM utilization is a dummy variable (Ui), the outcome variable (utilization) can be expressed as:

$$P_i = bX_i + \delta A_i + \varepsilon_i\ (1)$$

The empirical evidence on agricultural technology utilization revealed whether a farmer chooses to utilize a technology depends on individual and household characteristics (self-selection) rather than random assignment (Mohammed and Abdulai, 2022). Thus, an individual farmer's decision to utilize ISCM technology is modeled within the random utility framework, as a farmer chooses to utilize ISCM technology if the expected utility gained from utilization (U_i^A) is larger than that obtained from non-utilization U_i^N i.e. $(A_i^* = U_i^A - U_i^N) >$, with A_i^* denoting the utility difference between these two options. However, the actual utility level of A_i^* cannot be observed directly, but can be expressed by a latent variable function, such as:

$$A_i^* \quad \omega Z_i + \mu_i, A_i = 1 (if\, A_i^* > 0\ and\ otherwise)\ (2)$$

where A_i^* is a binary variable, with 1 for farmers *i* who

Table 1. Sampling frame and sample size

State	Sampling frame (11,257)	Sample size (household heads]
Gombe	3889	312
Jigawa	3765	308
Katsina	3603	301
Total	11257	921

Source: Household survey (2020).

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utilized ISCM technology, 0 otherwise; ω is a vector of parameters to be estimated; μ_i is an error term with zero mean and normal distribution, and Zi is a vector of explanatory variables assumed to influence farmers' utilization decisions. These variables include age, gender, education, household size, membership of the farmer group, participation in the on-farm trial, and access to extension services, among others.

Since farmers choose to utilize ISCM alone, the same unobservable factors may simultaneously influence utilization decisions. In this case, the error term ε_i in Equation (1), and the error term μ_i in Equation (2) may be correlated such that corr $(\varepsilon_i,\ \mu_i) \neq 0$, leading to potential endogeneity of the utilization variable in the analysis.

Results and Discussion

Socio-economic Attributes of the Respondents

The result of the farmer's social and economic attributes is presented in Table 1. Most of the interviewed farmers were aged 31-50 years old, comprising 62%, whereas 25% were aged between 20-30 years old, and 13% were between 51 - 60 years old. Further analysis of the result showed that more younger farmers participated in the study than the older ones. This implies that the young farmers were getting involved in farming activities, unlike in the past when older farmers dominated the enterprises. The study area is dominated by families of medium to large size. The interviewed households' mean, minimum, and maximum household sizes were 8, 2, and 17 persons, respectively. About 43% of the households had 6 – 9 persons. The number of individuals per household influences farming operations that need human labor. Due to the abundance of family labor, households with more family members are likely to be more efficient in farming than families with fewer members. Most (58%) respondents had farmland ranging from 0.5 to 2 ha. The average farm size recorded as 1 ha fell within the regional and national range as reported by (Camillone et al., 2020). More males (95%) participated in the study than females (5%) in all three States. The proportional difference between male and female farmers was usually attributed to social and cultural differences that negatively affect female participation in agriculture, land access, and management practices. In northern Nigeria, female farmers typically cultivate cash crops, mostly for sale, to cater to some of their social and economic needs. In contrast, their male counterparts mostly grow food crops for household consumption.

Approximately 85% of the interviewed households were married, implying that most farming households have family responsibilities to cater for. Most respondents (53%) attended primary and secondary schools, indicating they can read and write in the local language. Only (10%) had attended tertiary education and could read and write in English and local languages. Some 37.13% attended informal school. The low level of education in the study areas indicated that extension and research service providers or "change agents" are needed to verbally communicate the nature and value of any new technologies or agricultural inputs to these communities. The educated household can be used as contact farmers who could act as community-based facilitators for extension service delivery in the study areas. The major occupations practiced by most of the households were crop production and artisans 65% and 11%, respectively. This finding corroborated an earlier assertion by Suleiman et al. (2022), who reported that agriculture was Northern Nigeria's major labor employer. Only 18% of the interviewed households belong to farmers' cooperatives or other social groups. This finding implies that collective action towards self-help projects in the study area is grossly lacking. Approximately 60% of the households lack contact with development agents, implying poor access to agricultural information, innovation, and market outlets, which are all significant to sustainable growth and development. Access to agricultural credit was found to be very low in the study area, as only 13% of the interviewed households claimed to have access to credit (Table 2). This finding indicates that adopting and utilizing cost-intensive agricultural practices may not be feasible among farmers in the study area, particularly at the pace of rising rural poverty.

Major Crops Cultivated in the Region

Major crops cultivated during the farming season are presented in Table 2. Among the crops cultivated, sorghum emerges as the most widely grown, boasting a frequency of 740, solidifying its position as the top-ranked crop. Cowpea is closely followed as the second most cultivated crop, with a frequency of 689, earning the 2nd rank. Millet takes the third spot with a frequency of 678. Cassava, with a frequency of 48, occupies the 9th position in this list. These rankings offer valuable insights into the prevalence of specific crops in this agricultural context, with sorghum, cowpea, and millet being the most prominent choices and cassava being the least cultivated crop. The common crops grown in the region are commonly known to be highly susceptible to *Striga* infestation. Therefore, in areas where *Striga* is prevalent, farmers growing these crops may be at higher risk of infestation and yield losses. This finding agrees

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Table 2. Socioeconomic attributes of the interviewed households

Household attributes	Frequency	Percentage	Min	Max	Mean
Age					
20 – 30	230	25	20	60	40
31 – 40	341	37			
41 – 50	230	25			
51 – 60	120	13			
Household size					
2 – 5	227	25	2	17	8
6 – 9	400	43			
10 – 13	170	19			
14 – 17	124	13			
Farm size					
0.5 – 1	321	35	0.5	4	1
1.5 – 2	216	23			
2.5 – 3	163	18			
3.5 – 4	221	24			
Sex					
Male	877	95			
Female	44	5			
Total	921	100			
Marital Status					
Married	785	85.23			
Single	126	13.68			
Divorced	05	0.54			
Widow	05	0.54			
Total	921	100			
Education					
Informal	342				
Primary school	244	37.13			
Secondary	242	26.28			
Tertiary	93	10.10			
Total	921	100			
Major occupation					
Crop production	600	65.15			
Agro-processing	35	3.80			
Crafts and artisan	103	11.18			
Trading of grain cereals	66	7.17			
Total	921	100			
Membership					
Member	163	17.70			
Nonmember	758	82.30			
Total	921	100			
Extension contacts					
Contact	376	40.83			
No contact	545	59.17			
Total	921	100			
Credit access					
Access	120	13.00			
No access	801	87.00			
Total	921	100			

Source: Household survey, 2020.

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with Aliyu et al. (2023), who reported that farmers in Northern Nigeria are primarily engaged in arable crop production and face many challenges ranging from poor access to quality inputs, low agricultural capital, and *Striga* infestation.

Farmers' Knowledge of Striga Infestation and Its Impact on Crop Yield

The findings presented in Table 4 indicated that 97% of the interviewed respondents knew how *Striga* affected crop yield, while 87% knew about its impact on host plants. Approximately 67% of the surveyed farmers highlighted that *Striga's* effect on crop yield was particularly severe, especially on cereal crops and in areas with marginal soil fertility. Locally, they relied on indicators such as soil texture (50%), soil moisture retention (48%), soil color (42%), and the presence of certain grass species (27%) to assess the fertility status of their farmland in the study area. Furthermore, the interviewed farmers reported that crop yield losses due to *Striga* infestation ranged

Table 3. Major crops cultivated during farming season (n = 921)

Crops	Frequency*	Ranking
Sorghum	740	1st
Cowpea	689	2nd
Millet	678	3rd
Groundnut	280	4th
Maize	260	5th
Sesame	258	6th
Rice	166	7th
Soyabean	153	8th
Cassava	48	9th

Source: Household survey, 2020. *Multiple response.

Table 4. Farmers' knowledge of *Striga* infestation, soil fertility, and its impact on crop yield

Attributes	Frequency	Percentage
Awareness of *Striga* plant		
Aware	894	97.10
Not aware	37	2.90
Local knowledge of soil fertility (*)		
Soil texture	460	50
Soil moisture retention	442	48
Soil color	387	42
Appearance of some weed species	248	27
Knowledge of host plants		
Yes	800	86.86
No	121	13.14
Effect on crop yield		
Mild impact	303	33
Severe impact	618	67
Proportion of yield loss		
10% - 30%	200	22
31% – 5-%	397	43
51% - 70%	166	18
71% - 90%	67	7
≥91%	91	10

Source: Household survey, 2020. (*): Multiple responses.

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from 10% to 100%, depending on the extent of the infestation. This implies that *Striga* infestation can result in complete crop failure, affecting affected households' return on investment and food security. Similar findings were reported by Kunguni et al. (2023), who noted that a high degree of *Striga* infestation had led some farmers to abandon their farmland in Kenya.

Household Perceptions on the Causes of Striga Weed

Farmers in the study area have shown different degrees of perception regarding the various causes of *Striga* weed in their farmland. The result in Figure 2 indicates that 72.5% of the interviewed farmers have either strongly agreed or agreed that poor farmland management was the main cause of *Striga* infestation in their farm, a significant proportion of the farmers perceived inappropriate fertilizer application (90%), and continuous cultivation of cereal crop (64%) on the same parcel of land were the main causes of *Striga* weed infestation in their farmland.

The application of manure (50.49%) was the least practice mentioned by the interviewed farmers as the cause of *Striga* infestation in the study area. This practice helps typically to spread *Striga* seeds, mainly where animals are fed with *Striga* weed. This finding agrees with Gasura et al. (2019), who opined that *Striga* preferentially grows in poor soils with a degraded structure and those with a very low organic matter rate in SSA.

Figure 1. *Striga hermonthica* infestation in the main plot of maize; their purple flowers (arrow) occur in a spike; each may contain 6 to 10 flowers.

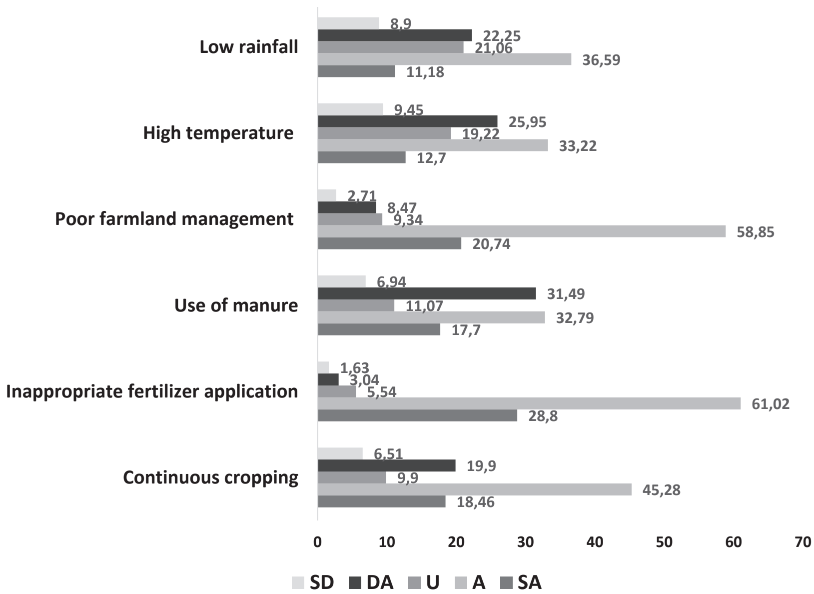

Figure 2. Household perceptions on the causes of *Striga* infestation. SD: strongly disagree, DA: disagree, U: undecided, A: agree, and SA: strongly disagree.

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Indigenous Striga Control Methods and Their Effectiveness

Indigenous *Striga* control methods and their effectiveness are presented in Table 5. Uprooting (68.4%) and removing from the field were the ISCMs farmers used the most to control *Striga* among farmers in the study area. These methods were commonly used since they were affordable and easily done. Most (47.5%) farmers used uprooting to eliminate *Striga* in their farms. This was because *Striga* weed sprouted evenly to occupy a large area within a short time after the host plant had emerged from the ground; therefore, uprooting becomes effective on young *Striga* seeds. Adding a mixture of potash and salt was practiced by 11.14% of the farmers. Farmers usually do this in areas with high *Striga* infestation, those who can afford it, and those with enough family labor. Other ISCM practices were manuring (71.23%), cereal and legume intercrop (5.95%), the addition of *Parkia* pulp powder (15.34%), improved seeds (1.7%), and early planting (0.8%). Manuring, uprooting, and intercropping were rated high because the three methods were the common practice known for *Striga* control in the three States. The practices can also improve the soil texture and moisture. A study by Kunguni et al. (2023) showed that manuring, crop rotation, and intercropping also helped improve soil fertility health and quality besides weed control. On the effectiveness of ISCM, approximately 90% of the interviewed farmers rated the indigenous methods as either effective or highly effective in combating *Striga* in their farms.

Socioeconomic Factors Influencing Farmers' Utilization of Indigenous Striga Control Methods (ISCM)

The results of the binary probit model of the determinants of households' utilization of indigenous *Striga* control methods in cereal crops are presented in Table. The results show that all the estimated coefficients are statistically significant since the Likelihood Ratio (LR) statistic has a p-value of less than 1%. The pseudo-R2 value is 45%, implying the power of the explanatory variables in explaining the variation in the dependent variable. The results revealed that the age of the household head has a negative and significant influence on the utilization of ISCM, thus suggesting that the higher the age of the farmers, the less likely they are to utilize ISCM. A plausible explanation could be that younger farmers are more likely to try out new technology and bear the risk associated with the adoption of new technology (Mohammed and Abdulai, 2022).

Membership of farmer-based organizations has a statistically significant influence on the utilization of ISCM technology, suggesting that farmers who are members of cooperative groups are more likely to adopt ISCM. This finding is consistent with the findings of Suleiman (2022), who opines that membership in social groups enhances farmers' social capital and access to improved technology in Nigeria. Contact with the extension agent positively and significantly influences farmers' utilization of ISCM. Farmers without access to extension agents may learn about new farm technologies. In the context of agricultural innovations, contact with extension agents is important for individual farmer decision-making as to whether to accept or reject agricultural technology or practice. Farmers' participation in on-farm trials for ISCM has a positive and significant influence on farmers' utilization of ISCM. This implies that farmers participating in the on-farm trials are likelier to

Table 5. Traditional methods for *Striga* management and control (n = 921)

Indigenous *Striga* control methods (*)	Frequency	Percentage
Uprooting	633	68.43
Application of manure	640	71.23
Addition of a mixture of salt and potash	103	11.14
Green manuring	81	8.76
Cereal and legume intercrop	455	49.40
Parkia pulp powder (Makuba)	143	15.34
Parkia pulp+ *Parkia* pod	103	11.14
Ash	316	34.10
Effectiveness of Indigenous *Striga* Control Methods		
Effective	647	70.25
Highly effective	209	22.70
Not effective	65	7.06

Source: Household survey, 2020. (n = 921). (*): Multiple Responses.

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Table 6. Socioeconomic factors influencing farmers' utilization of indigenous *Striga* control methods (ISCM)

Variables	Coefficient	Marginal effect
Age	-0.088 (0.002) ***	-0.009
Gender	−0.036 (0.350)	−0.022
Education	−0.004 (0.024)	−0.007
Farm size	0.007 (0.041)	0.005
Household size	−0.003 (0.011)	−0.022
Membership in farmers' organization	0.248 (0.021) **	0.088
Participation in on-farm trials	0.617 (0.012) ***	0.135
Farmers' perception of ISCM	0.001 (0.0611) *	0.021
Contact an extension agent	0.200 (0.003) ***	0.089
Constant	−0.804	
Number of observations	921	
Log-likelihood	−431.74	
LR chi^2 (17)	237.65	
Prob > chi^2	0.0000	
Pseudo R^2	0.4532	

Notes: *Denotes statistical significance at the 10% level. ***Denotes statistical significance at the 1% level. **Denotes statistical significance at the 5% level. Figures in parentheses are standard errors.

practice ISCM. This suggests that farmers who have participated in the on-farm trials are more prone to utilization of ISCM since they have seen the efficiency and effectiveness of the ISCM in managing *Striga* in cereal crops.

Farmers' perception of indigenous *Striga* control positively and significantly affects farmers' decisions to utilize ISCM. This implies that increasing farmers' positive perception of the ISCM in managing the *Striga* menace in cereal crops increases the likelihood of utilization. This finding suggests that the probability of utilizing ISCM increases once a farmer is convinced that the benefit from the indigenous method is greater than the other methods.

Discussion

In the current study, we have assessed farmers' knowledge of the effect of *Striga* infestation on crop yield and soil fertility, the causes of *Striga* infestation, and the indigenous methods used by farmers to control *Striga hermonthica* in maize and sorghum in the dryland areas of northwestern Nigeria. The farmers exhibited a high level of awareness regarding the impact of *Striga* weed on crop yield and soil fertility depletion. They firmly understood *Striga* plant behavior, lifespan, and host plants. Their knowledge of *Striga* was primarily informed by its long-term presence and detrimental effects on their farms. It is understood that the level of farmers' knowledge of *Striga* weed and its negative consequences on crop yield has led to the development of indigenous methods for its control and management. *Striga* infestation is also known to be influenced by several factors, including a decline in soil fertility, high temperature, drought, continuous cropping, mono-cropping, and inappropriate manure application. *Striga* infestation in dryland areas of Kenya is accelerated by both abiotic, biotic, and edaphic factors, and the infestation can only be minimized through effective farm management.

Studies conducted in the affected area indicate that *Striga* infestation can cause yield losses ranging from 20% to 100%, depending on the severity of the infestation and the crop species. Maize, for instance, can experience yield losses of up to 100% in severely affected fields, leading to devastating consequences for local farmers and communities reliant on this staple crop (Aliyu et al., 2023). The economic impact of *Striga* infestation extends beyond immediate yield reductions. Farmers often incur additional costs associated with controlling *Striga*, including purchasing specialized herbicides or adopting integrated management practices such as intercropping with *Striga*-resistant crops or planting *Striga*-tolerant varieties. These interventions, while helpful, may not fully mitigate the losses caused by *Striga*. Furthermore, the impact of *Striga* extends beyond individual farms to broader food security concerns. Reduced crop yields translate into diminished food availability and increased vulnerability to food insecurity among rural households.

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Although conventional methods are widely believed to be the most effective for controlling *Striga* infestation, the current study has discovered that nonconventional methods, such as ash application, the use of a mixture of salt and potash, and the use of *Parkia* pulp powder (Fishman and Shirasu, 2021), have proven to be effective in controlling *Striga* infestation in maize and sorghum farms in the study area. However, many respondents have expressed concerns about these methods' labor-intensive nature and costliness. Therefore, further research is recommended to evaluate the efficacy of these methods and explore potential ways to improve their efficiency. Furthermore, it was found that farmers who are members of social groups and those who participated in on-farm trials are more likely to adopt new technologies in the study area. Participation in on-farm trials provides farmers with firsthand information about a given technology. Thus, it is recommended that more trials be conducted in the study area to encourage more farmers to adopt the Integrated *Striga* Control Measures (ISCM) due to their demonstrated effectiveness.

Conclusions

Managing *Striga* infestation is crucial for maintaining crop production, income, and food security. Conventional and indigenous methods are available for farmers to control this weed. Our study revealed that indigenous methods were particularly effective in the study area, with farmers utilizing techniques such as uprooting, application of manure, application of a mixture of salt and potash, and application of *Parkia* fruit powder. For effective *Striga* control, it is recommended to focus on educating farmers about agronomic practices that can help mitigate *Striga* infestation. These practices can include proper crop rotation, intercropping, and organic fertilizers. By adopting these practices, farmers can minimize the conditions that promote *Striga* germination and growth. In addition to fostering agronomic practices, farmers should be encouraged to adopt effective indigenous control practices in *Striga* control. These methods are easily accessible to farmers and have been proven to reduce *Striga* infestation in sorghum and maize farms. Furthermore, promoting *Striga*-resistant crop varieties should be a priority, especially in *Striga*-prone areas. These crop varieties have been specifically developed to resist *Striga* infestation, ensuring farmers' higher yields and better income.

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