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Research Article

Acacia seyal var.: *Acacia fistula* (Schweinf.) Oliv. Based Parkland Practice, Farmers Perception, and Management Techniques in Case of Jarsa Kebele, Guba Lafto District of Amhara Region, Northeast Ethiopia

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Acaciaseyal is seen as a common on-farm tree species in the Rift valley of Ethiopia, predominantly in the Guba Lafto district of northeastern Ethiopia. Maintenance and improving existing practices and incorporation of multipurpose trees in farms got a due focus to increase agricultural productivity, but the information is limited about farmers' perceptions, traditional knowledge, and practice about the species and its parkland system in the study site. The information was gathered via household interviews, focused group discussions, and key informant interview tools. Systematic random sampling technique was employed for household selection. 47 sample households were selected, and information was generated via descriptive and logistic analysis techniques. The result explored that *Acacia seyal* was considered by respondents as an invasive species and the majority of household respondents (87%) showed a negative perception of intercropping the species with annual crops due to its impact on companion crops and soil values. However, most of them (61.7%) were willing to sustain it along the boundary (83%), at an on-farm soil bund (36.2%) and at an open grazing area (19.1%) for its off-farm economic role. They retained it primarily for fuel wood purposes (95%), for cash (34%), and for livestock feed (25%). Pruning is the main management practice adopted for the species for the sake of minimizing the shade effect and to get its byproducts. Generally, farmers reflect a negative attitude to the species' productivity role in the integrated system but understand its positive socioeconomic contribution outside their crop farms. Therefore, the investigation directs, as it will be advantageous to manage the species under the off-farm growing niche for its better synchronization to the farmers, but further work needs to be conducted in large scale survey and on its economic advantage at off-farm growing conditions for a radical shift in the farming system.

1. Introduction

With ever-increasing deforestation due to anthropogenic and natural factors, loss of soil fertility and agricultural productivity has been a common phenomenon in various parts of Ethiopia [1]. The productivity of farmlands and their resilience to climatic shocks are decreasing from time to time [2]. This was well recognized, and critical interventions were being made in a sustainable way where the maintenance and improving existing practices and incorporation of multi-purpose tree species (MPTs) in farms got due focus, creating multifunctional agricultural systems which increase food production, while simultaneously enhancing social and environmental targets is necessary to cope with agricultural challenges [3].

Parkland agroforestry is a common agroforestry practice in the tropics, which is the art of growing or retaining scattered trees on cultivated land [4]. Particularly in semiarid zones of Ethiopia, it is the long-term dominant practice [5]. It has a vital role in conserving biodiversity and is an ecologically sound and economically viable option [6, 7]. It was recognized that farmers engaged in agroforestry practice

got more resilient to climate change impact due to the availability of diversified farm products, feed access to animals, sustainable farming systems, and other socioeconomic values of the system [8, 9].

Integration of perennial trees aimed not only to improve productivity and economic values but also for social, cultural, and religious meaning [4]. Most farmers in Ethiopia have long-term trends in growing perennial trees on cropland even if now a day, but fragmented land size, land tenure insecurity, and other factors related to farm owners might be hindering tree-growing activities [10]. Home gardens, woodlots, live fences, hedge raw intercropping, trees on pasture land, trees on gullies, and conservation structures and parkland are some of the common practices in the country [11–13]. Those species could be naturally growing, exotic, or cultivated trees retained or planted in farms that have great protective, productive, and socioeconomic values [14]. Compatibility to crops and productive and service value of trees are considered as the main quality characteristics of the species by most farmers to incorporate into their farms [14].

Acacia seyal is one of the native agroforestry species to the Sahelian zone of Africa and is dominantly distributed in the Rift Valley of Ethiopia in *Acacia-Commiphora* woodland [15, 16]. Likely it is seen as common on-farm trees integrated with crops in the study area. Different scholars reveal its invasiveness and negative impact on farm productivity even if reported as leguminous tree species, which has the capability of nitrogen fixation [17, 18]. Likely, research investigation on the area shows the species' negative effect on crop yield and some soil parameters [19]. Also, scholars explore that as land fragmentation increases on-farm trees abundance was reported to be reduced [20] while, in the case of the study site, Jarsa Kebele at Guba Lafto district, *Acacia seyal* seems well synchronized to farming communities, where more trees per hectare are found growing on their farmlands. Perhaps, the species contributes positively to farm productivity, and farmers may grow it intentionally for its productivity and service values. It is the relatively dominant woody species in the farmland, and the reason and social perception were not yet investigated. So, it needs an investigation on farmers' perceptions and their friendly approach to its growing and management techniques.

In other ways, consulting farmers and understanding their knowledge and perceptions is important for developing and suggesting management interventions for the sustainability of the system and for the betterment of conservation and shared production goals. Thus, this study was conducted to identify farmers' attitude and management techniques, assess socioeconomic benefits, and identify challenges related to *Acacia seyal* and its parkland system at the study site, and so it contributes information input for land use improvement and sustainability works.

2. Materials and Methods

2.1. Study Area Description. The study was conducted at Guba Lafto district, North Wollo zone, Amhara Region, northeastern Ethiopia, between 39°6′9″ and 39°45′58″ east and 11°34′54″ and 11°58′59″ north. It is situated 521 km from Addis Ababa to the north and covers an 877.85 square kilometer area [21]. It is bounded at the north by the Gidan district, the northwest by the Meket district, the northeast by the Kobo district, the east Afar regional state, the southeast by the Habru district, and the west Dawunt and Delanta districts (Figure 1).

The landscape of the area is characterized by a chain of mountains, hills, and valleys which are 35% mountainous and 30% undulating others, and 20% and 15% are flat and valleys, respectively [21]. The agroecological condition of the district is 46% midland (*Woina dega*), 17% lowland (*kola*), and 17% highland (*dega*). The altitudinal gradient is ranging from 1379 to 3200 meters above sea level. The mean monthly temperature ranges between 21°C and 25°C, and the average annual rainfall is between 800 mm and 1050 mm [22].

2.2. Site Selection Techniques. The study site was systematically selected from the district based on the availability of *Acacia seyal* species in cropland. The district consists of 34 kebeles, and from those supporting with the secondary data source, key informant interview, direction given from district agricultural experts, and evidence from transect walk, *Jarsa* Kebele was purposely selected with its unique *Acacia seyal* integrated farming system (Figure 1). Kebele, defined by Ekpuk [23] and Associate in Rural Development (ARD) [24], is "the group of villages and the lowest form of the administrative unit in Ethiopia." So, systematically the site was selected as the target surveying site. The given kebele consisted of three peasant associations (PA), and the survey work addresses all PAs as presented in Table 1.

2.3. Data Collection Techniques. Combinations of different methods were used to gather relevant information for local community perception and knowledge on *Acacia seyal* species and its parkland integration role. Household interviews, focus group discussion, and key informant interviews were strategic survey instruments to explore farmers' knowledge, perception, and practices about the species (Figure 2). Extension manuals and reports from the district agricultural office as the secondary data source and field observation for data validation were also used. A formal survey with semistructured questionnaires (open and closed questions) was administered to households of the peasant associations. The questionnaire was pretested and checked before the formal survey was undertaken for its relevancy and accuracy. Data collectors were from the development agents, researchers, and administrative workers who were external bodies to the district and were allowed to get an adequate explanation of the questionnaire content and the way of approaching farmers. Survey data were collected from three PAs in the selected kebele. From the selected PAs, sampled households were interviewed face-to-face with their residents and their farms at work. Focus group discussions (FGDs) were employed with 6 (six) households in each group. Field observation had also been carried out to the whole field activity schedule.

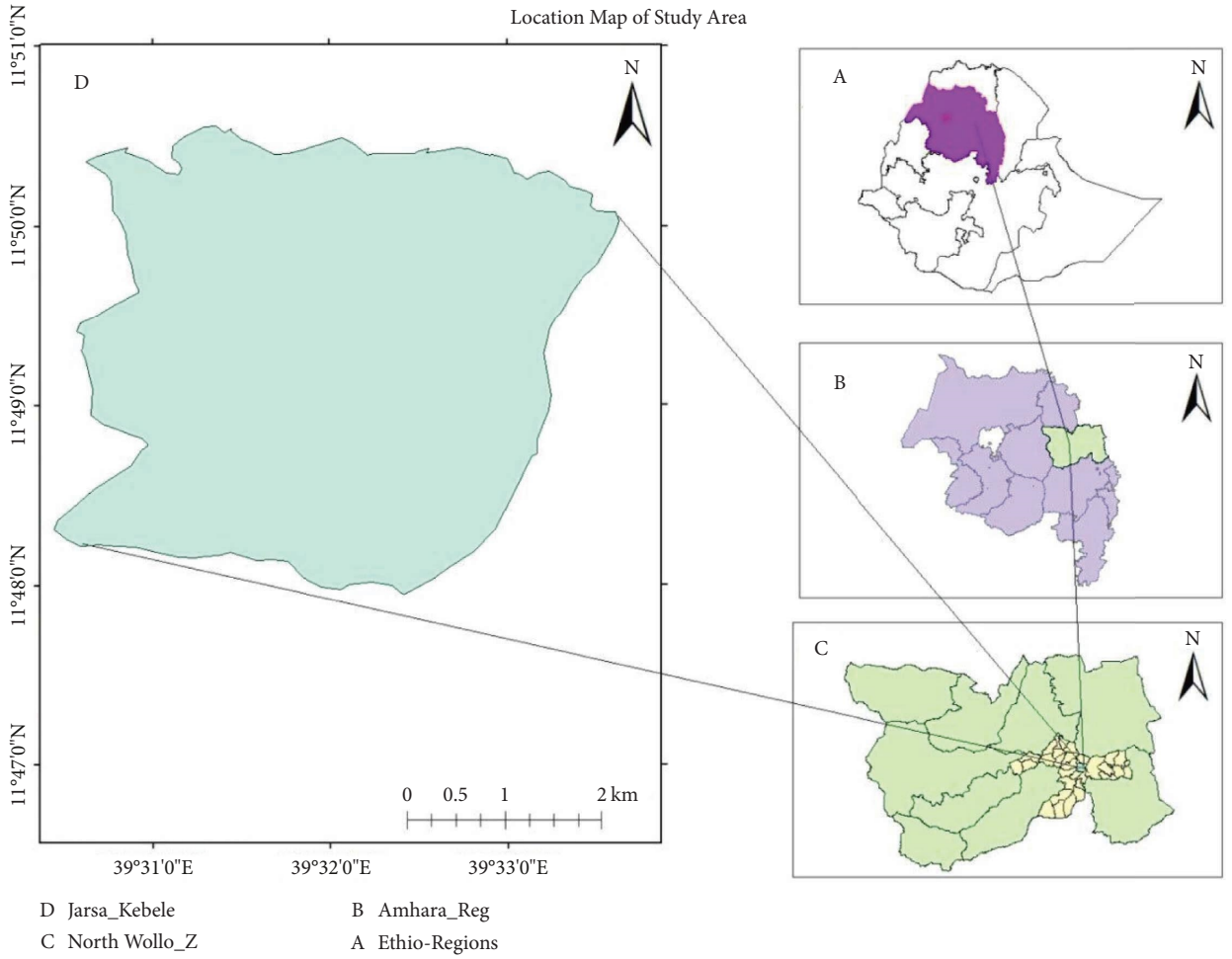

Figure 1: Geographical map showing the location of the study site.

Table 1: Household sample size proportion to peasant association of study site.

No.	Peasant association	No. of households		Total	Sample household size
		Female	Male		
1	01 subkebele	40	147	187	9
2	02 subkebele	105	297	402	19
3	03 subkebele	93	297	390	19
Total		238	741	979	47

2.4. Household Sampling Technique. Sample households were selected across three PAs via a systematic random sampling technique following Watson's [25] formula, using the list of farming communities at the kebele administration office as a sample frame. Sample household proportion to each farmer's association was carried out following Daniel [26]. Accordingly, 47 households that engaged in crop farming were selected for survey work (Table 1).

Sample size determination formula:

$$n = \frac{p(1-p)}{A^2/z^2 + p(1-p)/N/R}, \quad (1)$$

where n = sample size, N = number of populations, PP = estimated variance in population (take 15%), A = precision desired (5%), Z = confidence level (95%), and R = response rate (95%). The estimated variance in the population is determined based on the heterogeneity of the population and their responses [27, 28]. So, since the sample households were taken from the same kebele, they are almost homogeneous, and 15% of population variability was estimated.

Sample proportion to each peasant association:

$$n1 = \frac{n * N1}{N}, \quad (2)$$

where $n1$ = sample size in the first site, n = number of households in the first site, $N1$ = total number of households included in the study, and N = total number of households in all sites.

2.5. Data Analysis. Survey data were coded, entered, checked, and analyzed via descriptive statistics by using the Statistical Package for Social Studies (SPSS) version 20, and results were presented as mean and percentage by tables and graphs. Logistic regression was also employed to assess the

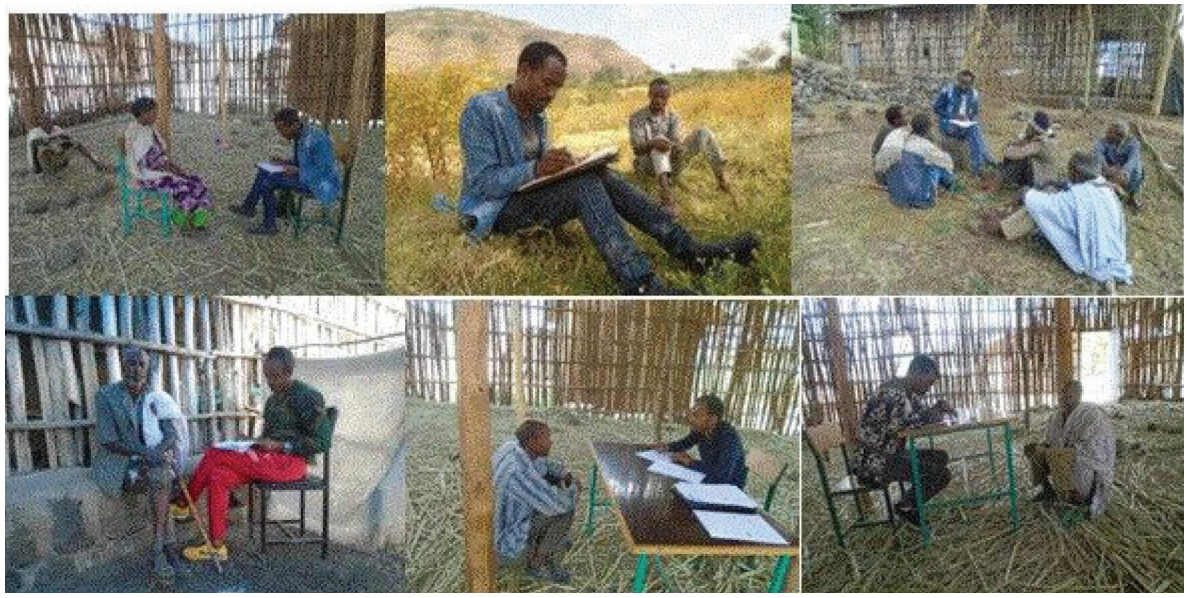

Figure 2: Individual household interview and group discussion during the social survey (Author, 2017).

effect of demographic and socioeconomic factors on the report for the willingness of the respondents to sustain *Acacia seyal* on their farm. Sex, age of respondents, marital status, educational status, total farmland size, and year of residence were considered as predictor variables, and respondents' willingness to sustain *Acacia seyal* on their farm take as the dependent variable (Table 2).

3. Results and Discussion

3.1. Demographic and Socioeconomic Characteristics of Respondents. As shown below, most respondents are male-headed (Table 3) and at the age of productive stage (19–50) (Table 4). They have five average family sizes, which imply labor might not be a problem and had a positive contribution to perennial tree growing and management [20, 29, 30]. As indicated, most farmers (51%) can read and write (Table 3). As most scholars investigated educational status, the age of respondents and family labor force found key determinant factors for their adopted farming practice and showed a positive correlation [10, 31, 32]. The majority of the respondents (89%) in the sample are represented by married. Marital status has its own effect on farming practices [33]; a farmer's unmarried rate is negatively correlated with the indicator of farm income [34]. Most of the respondents were male-headed (87%). Head of the household has its own effect on the adoption and practice of agricultural technologies, as indicated in the case of Kenyan farmers where male-headed households are more likely to use package of practices than female-headed households [35]. Households' demographic characteristics mostly aligned with studies at most Rift Valley and semiarid areas of Ethiopian farm communities [36–38].

Respondents engaged in a mixed farming system as a livelihood system. More than half of households (63.83%) are the owner of crop-cultivated land resources, while a few others also own a small fraction of grazing and woodland areas (Table 5). The land use land cover (LULC) survey conducted at North Wollo also confirms a large proportion of the areas covered by cropland and a large proportion of the communities engaged in farming activity [39, 40]. They have a small land holding size ranging from 0.125–1.25 ha each, which is very fragmented and might be hindering for the farmers from retaining woody species for fuel and other productive purposes. This, again, might influence the adoption of the parkland systems and determine species abundance and basal area in cropland [29, 30, 41]. Likely, land holding size per household is reported as less than the average of the region [42], which is the main challenge for the district in getting agricultural production [31, 43].

3.2. Acacia seyal and Other on Farm Woody Species Composition and Their Uses. According to respondents, *Acacia seyal* is the dominant perennial tree species found in cropland (95.7%), followed by *Ziziphus spina-christi* (23.4%), *Croton macrostachyus* (23.4%), and *Cordia africana* (21.3%) but they grow *Eucalyptus camaldulensis*, *Euphorbia tirucalli,* and *Acacia seyal* around their home garden (Table 6). Although *Acacia seyal* is the dominant tree species grown on their farmland, *Croton macrostachyus*, *Cordia africana,* and *Ziziphus spina-christi* are much more preferred species by local farmers for their role in soil fertility enhancement (Table 3). This might be of the great farm values they have because of compatibility with crops, and the products and service value of trees consider main quality characteristics of the species by most farmers to incorporate into their farms [14].

Most of them (87.2%) were dependent on crop residue as a source of livestock feed, but trees and grasses from the farm boundaries and rehabilitated areas were also used via cut-and-carry systems. *Cordia africana* is considered the first important forage tree species by most respondents (72%),

Table 2: Logistic regression predicting the likelihood of reporting willingness to sustain *Acacia seyal* in cropland.

	B	S.E.	Wald	Df	*P*	Odds ratio	95% CI for odds ratio	
							Lower	Upper
Sex	−36.03	16056.80	0.00	1	0.99	0.00	0.00	.
Age of respondent	−1.97	3086.77	0.00	1	0.99	0.13	0.00	.
Marital status (1)	19.27	11512.48	0.00	1	0.99	23	0.00	.
Educational status (1)	3.86	1.50	6.58	1	0.01	47.82	2.49	917.24
Total family size	0.02	0.25	0.00	1	0.93	1.02	0.62	1.67
Total land size (ha)	2.50	1.75	2.04	1	0.15	12.22	0.39	378.70
Year of residence	1.93	3086.77	0.00	1	0.99	6.94	0.00	.
Number of livestock	0.20	0.20	0.99	1	0.31	1.22	0.82	1.83
Constant	**−1.82**	**2.76**	**0.43**	**1**	**0.50**	**0.16**		

The values in bold are to show the effect of independent variables (demographic and economic characteristics) on the willingness of the farmers to sustain Acacia seyal with the companion crop.

Table 3: Marital status, household head, and educational status of respondents.

Variable	Category	Respondents in percentage
Marital status	Married	89.4
	Divorced	8.5
	Widowed	2.1
Head of household	Husband	87.2
	Wife	12.8
Educational status	Illiterate	48.9
	Nonformal education	19.1
	Elementary	31.9

and *Acacia seyal* was also nominated by a few of them (17%), while it is considered an important livestock feed, particularly at dry season (Table 6).

The majority (80.9%) agreed on home gardens and on-farm scattered trees as the major source of fuel wood, while a few others (<5%) also used wood lots as additional options. For all of them (100%), the *Acacia seyal* species is considered the first preferable woody species for fuel wood, followed by *Eucalyptus* and other *Acacia* species as an alternative fuel source (Table 5). It might be due to its extensive availability and its good fuel wood quality character [44, 45].

Acacia seyal was also taken as important cash tree species by most farmers (63.8%), followed by *Eucalyptus camaldulensis* (51.1%) and *Cordia africana* species (10.6%) (Table 5). As explained, those tree species are used as fuel wood, charcoal, timber, house construction, and agricultural tools, by which contribute as a source of income to the community. In line with this, it was reported that farmers used trees as income-generating means by selling firewood and charcoal [42].

3.3. Farmers Knowledge and Perception on Acacia seyal

3.3.1. Acacia seyal and Its Growth Character. *Acacia seyal* is the dominant perennial tree species in the study area. As respondents, the species no more existed as dominated in the nearest years ago. Before 15–20 years, *Cordia africana*, *Croton macrostachyus*, *Acacia tortiles,* and *Ziziphus spina-christi* were the common perennial tree species grown on cultivated land and elsewhere in the study area (Figure 3), but now, *Acacia seyal* colonize on large area coverage, while other native tree species became less populated. The competition effect and invasive nature are the main reason for its expansion in a short period of time, where it has fast and massive natural establishment ability.

Farmers intentionally retained a few of the trees that stood on their farmland without or with less management intervention and allowed them to grow instead of planting. Likely, farmers in Uganda retained *Acacia seyal* instead of planting it and allowed it to grow on their farms [46]. Different authors have also reported on the invasive nature of the species. In the Bale zone of southeast Ethiopia, the species recognized woody encroachment and understood its ability to control large area coverage in a short time without management intervention [18]. The reason might be its high seed germination capacity and its less water-sensitive nature compared with other species [47]. At the same time, an abundance of *Acacia seyal* seeds germinated in one rainy season and has better survival potential than other species, which allows for better colonization [48]. Its association with microorganisms such as arbuscular mycorrhizal fungi (AMF) is also reported to be related to its better survival potential even in harsh conditions, because associated microorganisms encourage it for fast growth of shoot and root biomass, improve nutrient taking, and promote its mycorrhizal symbionts [49]. Besides this, as farmers in southeast Ethiopia acknowledged, seed dispersal means like browsing animals, vehicles, flood, and wind contributing to its colonization in large areas in a short period of time [18].

3.3.2. Productive and Service Values of Acacia seyal. Even though the species has an invasive character and is reported to show a negative impact on species diversity, it has different productive and service roles to the community. More than 95% of households were dependent on the species primarily for their fuel wood consumption. However, they also used it for cash (34%) and livestock feed (25%) value as secondary and tertiary intention (Table 7). Most of them (99%) believed in its good fuel wood quality character. According to respondents, the species is considered a key

Table 4: Demographic and socioeconomic characteristics of the respondents.

Variables	Categories	Range and mean of the respondents (47)		
		Min	Max	Mean ± SD
Age and family size	<18	1	5	2.19 ± 1.07
	19–35	1	7	2.57 ± 1.41
	36–50	1	2	1.28 ± 0 .45
	>50	0	2	1.11 ± 0 .47
	Total family size per HH	3	10	5.79 ± 1.86
Land use and size per Ha	Woodland	0.016	0.25	0.11 ± 0.10
	Grazing land	0.016	0.25	0.12 ± 0.10
	Cultivated land	0.125	1.00	0.45 ± 0.26
	Total land size per HH	0.125	1.25	0.49 ± 0.29

Table 5: Commonly grown tree species and their principal use.

Intentional role of trees	List of species preferred to grow	Respondents in percentage
Soil fertility enhancement role	*Croton macrostachyus*	63.8
	Cordia africana	36.2
	Ziziphus spina-christi	8.5
	Acacia seyal	2.1
Forage value	*Cordia africana*	72.3
	Acacia seyal	17.0
Fuel wood value	*Acacia seyal*	100.0
	Eucalyptus camaldulensis	57.4
	Cordia africana	4.3
Cash value (as fuel wood and charcoal)	*Acacia seyal*	63.8
	Eucalyptus camaldulensis	51.1
	Cordia africana	10.6

Table 6: List of dominant woody species and their growing niche in the area.

Growing niche	Tree species	Respondents in percentage
Cultivated land	*Acacia seyal*	95.7
	Croton macrostachyus	23.4
	Ziziphus spina-christi	23.4
	Cordia africana	21.3
Home garden	*Eucalyptus camaldulensis*	53.2
	Euphorbia tirucalli	19.1
	Acacia seyal	14.9
Degraded area	*Acacia seyal*	27.7

source of income which enables them to cover the school cost; each bundle of fuel wood costs a minimum of 1.5 US$ in the market, and this covers more than a week of school expenditure. Likely, different scholars recognized the species as an important source of firewood due to its quality character, branches with large dry biomass, and dense wood character, which again burn well and quickly [44, 50]. Similarly, the species was reported as an essential income generation means in the case of Sudan rural farmers [51]. In other ways, none of the respondents in the study area used the species for gum resin production and medicinal values though; it was recognized as a potential species for gum resin and medicinal values where its different parts were used for the treatment of various diseases [44, 52, 53].

Most respondents (80%) used *Acacia seyal* species for different service values such as shading value for animals and humans at work, soil conservation via mulching of cuttings, and rehabilitation of degraded areas. While the majority of them (87.2%) were not believed for their soil fertility improvement role (Table 8). Likely, farmers at Abreha We-Atsbeha of Tigray ignored the species for soil fertility improvement but preferred it as the best option in soil and water conservation due to its easy survival and growing potential via little intervention [54].

Acacia seyal is used by farmers as an important feed source, especially during the dry season (46.8%). As stated by respondents, it is palatable by most livestock types, especially goats (87.2%) and cattle (12.8%). Different parts of the tree, such as leaves, seeds or pods, and flowers were provided to the animals commonly by a pruning system (91.5%) (Table 9). Likely, the species was reported by Mellisse [55] as a common forage tree species in the Asosa zone of the Benshangul region. Its preference might be due to its feed nutrition content and year-round availability [44, 56].

3.4. Farmers' Perception and Management Intervention on Acacia seyal Parkland System. Most farmers in the study area retained a few *Acacia seyal* stands on their farmland for its fuel wood, fence, and feed value with substantial management. But, the majority of them (87%) like to ignore the incorporation of the species in their crop farm because they assume that the species has a negative impact on soil and companion crop productivity (Table 10). The shading and moisture competition effect of the species was declared as the main reason (99%). Equally, scholars stated that, in the

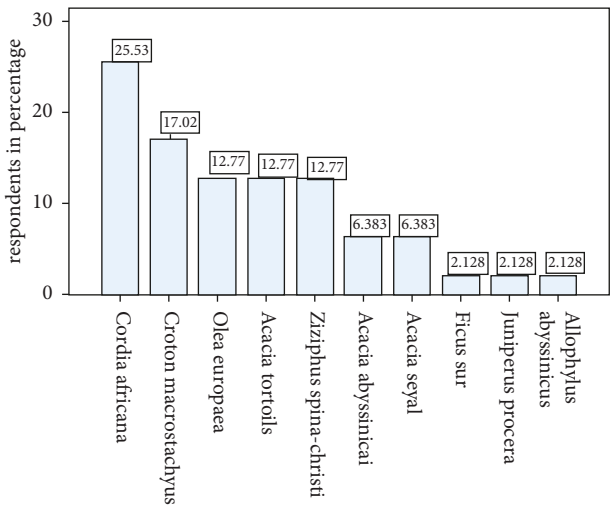

Figure 3: List of common woody species that existed before (15-20 years ago).

Table 7: Productive role of *Acacia seyal*.

Role of the species in ranking order	Frequency	Percent
Source of fuel	45	95.7
Cash value	16	34.0
Livestock feed	12	25.5
Farm utility	12	25.5

farm, trees are evaluated and intentionally domesticated in cropland for their soil improvement and productivity enhancement role [47]. Similarly, farmers in Abreha We-Atsbeha of northern Ethiopia perceived the species as bad quality for crop integration, e.g., its thick canopy, high shading effect, enhanced soil acidity, and shallow root system [54].

3.4.1. Companion Crops Integrated with Acacia seyal. *Teff* and sorghum were the two dominant cereal crops cultivated in the area, particularly during the rainy season (*Meher*). According to respondents (46%), *Teff* is a comparatively better crop to integrate with *Acacia seyal* following sorghum crop (Table 9) because, as stated, it relatively withstands the negative effect of the species. Likely, the shade-intolerant character of the sorghum crop might be challenged by the high and thick canopy character of the tree species [57].

3.4.2. Acacia seyal Parkland Practice and Traditional Management Intervention. Farmers commonly practiced (80.9%) pruning and thinning techniques for managing on-farm trees, while a few of them (12.8%) also practiced pollarding as an additional management option. Typically, pruning management gets more attention from the community to get tree byproducts, mainly fuelwood (85.1%), and to minimize shade effect on companion crops and soil, for fences, reducing bird effect at cropping season, for mulch, livestock fodder, and cash value (Table 11). This is in agreement with Abebe's [58] findings. Tree management is commonly applied to get tree byproducts and to sustain tree function. Again it is also considersed as a means to maximize system outputs [59]. Those farmers' adopted management practices which are commonly applied practices at most parkland agroforestry systems in Ethiopia [59].

Farmers undertake pruning of on-farm *Acacia seyal* trees three times per annum (Table 11). The first was before the cropping season (70.2%), which is to minimize the shading effect of trees on the soil to favour seed germination. As stated by them, it is primarily requested for sorghum crops which are mainly affected during the germination stage (99%). The second pruning was performed during the crop growing stage (42.6%) to reduce the shading impact of the species on the growth and maturity of crops. According to their understanding, this is common practice during *Teff* cropping season, where it is affected by shading at the growing stage and leads to a reduction in grain yield. Pruning was again conducted at the maturity stage of crops (46.85%) intentionally to decrease the bird effect on sorghum which was the main challenge related to on-farm *Acacia seyal*. The management systems and its intention were consistence with different authors [7].

3.5. Challenges with Acacia seyal-Based Parkland System and Farmers' Willingness for Its Sustainability

3.5.1. Challenges. Shading effect (87.2%), nutrient and moisture competition effect (21.3%), and invasive nature (10.6%) over the other species were prioritized by the farmers as the main challenges for integration of *Acacia seyal* to the crop farm. Additional constraints related to the species, such as obstacles during soil work, soil acidity increment, and bird effect during the crop maturity stage were also reported by the respondents (Table 10). In consistence with that, the species competition and bird effect impacts were reported in the case of Abreha We-Atsbeha and Adigudem of north Ethiopia [54]. Farmers in the Bale district of Ethiopia also explained the species as a disadvantage due to its shock or threatening effect on local biodiversity (45.1%), its allopathic effect, and its impression of destroying the ecosystem (23.4%) and crop productivity reduction (17.8%) [18].

3.5.2. Farmers' Willingness for Its Sustainability. Although *Acacia seyal* contributes much for its provisional and protective values, farmers reflect varying outlooks towards its parkland integration system. Above 50% of respondents showed a willingness to sustain the species in the parkland system for its productive roles, principally for fuel wood, cash, and dry season forage values, but others (38.3%) desire to completely avoid it from their crop farm by giving more weight to its disadvantages (Table 10). Similarly, most farmers (86.2%) in the Bale district of Ethiopia perceived the species as more disadvantages species compared to its advantageous values and agreed on the complete removal of it [18]. The reason for self-obligation for keeping on-farm *Acacia* species for firewood might be due to their low access to natural woodland and

Table 8: Perception of respondents on service role of *Acacia seyal* at cropland.

Variables	Categories	Perception of respondents	
		Perceptional response	Respondents in percentage
On-farm *Acacia seyal* role	Protection	Yes	80.9
		No	17.0
	Soil fertility improvement	Yes	12.8
		No	87.2

Table 9: Farmers' response on feeding system, integrated management, and preferred growing niche for *Acacia seyal*.

Variables	Category	Frequency	Percentage
Major season for feeding on the species	Summer	2	4.3
	Winter	6	12.8
	Dry season	22	46.8
	Year-round	17	36.2
Most preferable part of trees used for livestock feed	Leaf	9	19.1
	Leaf and seed/pod	28	59.6
	Leaf, seed, and flower	10	21.3
Most commonly used feeding system for livestock	Via pruning	43	91.5
	Via pruning and browsing	4	8.5
Primarily dependent livestock to feed on the species	Cattle	6	12.8
	Goat	41	87.2
The major protective role of the species	Shading value	12	25.5
	Soil erosion control as mulch	9	19.1
	Shading and as mulch	14	29.8
	Shading and moisture maintenance	3	6.4
Annual crops integrated with the species	Sorghum	16	34.0
	Teff	22	46.8
	Maize	2	4.3
	Wheat	1	2.1
	Guaya	4	8.5
Growing niche	On-farm boundary	39	83.0
	Along soil bund	31.9	31.9
	On grazing/open area	19	19.1
	On degraded area	6	12.8

Table 10: The reason to maintain *Acacia seyal*, its challenges for integrating on cropland, and farmers' willingness to sustain.

Variables	Categories	Frequency	Percentage
The main obligated reason to maintain *Acacia seyal*	For fuel	25	53.2
	For cash	12	25.5
The challenges for integrating *Acacia seyal* in cropland	Shading effect/*gama*	41	87.2
	Soil nutrient and moisture competition	10	21.3
	Invasive to other species	5	10.6
	Bird effect	4	8.5
Willingness to sustain *Acacia seyal* in a crop farm	Yes	—	61.7
	No	—	38.3

limited alternative sources of fuel wood [60]. It might also be due to its fast growth ability and good fuel quality character compared with other surrounding species. It was in line with the report from Sudan farmers who grow on-farm trees for firewood access and income source intentions [51]. But it also proved that smallholder farmers' financial capital determines their willingness for sustaining the species within their farm [61].

Logistic regression was performed to assess the effect of demographic and socioeconomic factors on the report for the willingness of the respondents to sustain *Acacia seyal* on their crop farmland. The model contains eight predictor variables (sex, age of respondent, marital status, educational status, total family size, total land size in hectares owned by the household, year of residence to the site, and the total number of livestock owned by the household) (Table 2). The model containing all predictors was statistically significant, x^2 (10, $N = 47$) = 23.42, $p = 0.009$. The model was explained between 40.6% (Cox and Snell R square) and 55.7% (Ngelkerke R squared) of the variance in willingness to

Table 11: Main objectives and preferred season for pruning management of *Acacia seyal*.

Variables	Categories	Response in percentage
Common management option	Pruning and thinning	80.9
	Pollarding	12.8
	For fuel	85.1
	For fence	27.6
Pruning objectives	Minimizing shading effect	19.2
	Reducing bird effect	19.1
	For mulch	10.6
	For fodder	4.3
	To increase tree bole height	2.1
Pruning reason at different seasons	Before cropping to avoid soil shading and crop emerging effect	70.2
	At crop growing season to avoid crop shading effect	42.6
	At the crop maturity stage to minimize the bird effect	46.8

sustain the species in cropland and correctly classified 82.2% of cases.

As shown Table 2, only one independent variable (educational status) contributes statistically significantly to the model. This predictor records an odd ratio of 47.8, which indicates respondents who are illiterate were 47 times more likely to report willingness to sustain than those educated, controlling other factors in the model. This again implies more educated people might not be willing to sustain it on their farms. So, this strengthens that farmers retain the species by giving more weight to its off-farm values since they have a small fraction of land to grow outside their farmland. As report for Sudan farmers showed, farmland size, household size, and income determined farmers' willingness was to retain or plant on-farm trees [51]. Likely, source income, extension services, family size, education, and age of respondents are reflected as determinant factors for farmers' willingness in the case of farmers in Pakistan [62].

3.5.3. Acacia seyal and Its Growing Niche Preferred by the Respondents. Even though *Acacia seyal* is seen as populated on the cultivated land, grazing areas, around the homestead, and on degraded sites of the study area, most farmers are ordered to manage it on their cropland due to their limited size of off-farm land. However, as discussed, the majority of respondents intended to cut and clear *Acacia seyal* tree stands from the central position of the cultivated land, primarily (87.2%) due to its adverse effect on companion crops (Table 10). It was in agreement with others' findings [18]. Belayneh and his colleagues [19] also confirm as the species has a negative impact on crop yield. Thus, the majority of respondents (83%) are encouraged to manage the species along the farm boundaries and in an open area as appropriate growing niches for its off-farm advantage (Table 9). Similar findings were reported by Tafere and Nigussie [30], where most farmers (60%) adopted the boundary tree-growing system.

4. Conclusion and Recommendation

4.1. Conclusion. *Acacia seyal* species is seen dominated elsewhere at the study site due to its naturally establishing ability and invasiveness character. Farmers believed that the species had no role in crop productivity and soil improvement. Though farmers perceived its adverse effect on integrating the farming system, they are ordered to retain the trees in their crop farms and homesteads primarily for their fuel wood and cash values because they have limited off-farm land access.

The species is perceived as having the potential to alleviate the fuel wood problem, which is critical to most farming communities with there is less access to fuel wood sources. It was also an important cash perennial tree species considered an alternative income source for farmers. Its abundance and year-round availability were also taken as important species for livestock fodder and considered as insurance during the long dry season, which is challenging to most farmers in other areas and countries.

Its allopathic and shading effects on companion crops and native tree species were perceived as the main challenging issues by most farmers and led to ignore its parkland integration and were the main challenges reported for its willingness for sustainability. Most farmers preferred to manage and sustain it along off-farm growing niches such as on-farm boundaries, open areas, and degraded areas. Pruning is the main management practice adopted for *Acacia seyal* in the study area for the sake of minimizing the shade effect and getting its byproducts.

Though important information was concluded from the research, the study was conducted with a certain limitation. Due to various constraints, it was investigated for the specific area of interest, and for a better understanding of farmers' perception and practice in-depth, it needs to do further as an integrated and holistic approach.

4.2. Recommendation. Sustaining *Acacia seyal* along off-farm conditions with appropriate management options is better for developing positive perception and improving its socio-economical contribution for farmers. It is also better to do survey work on a large scale and need to quantify the species' economic value to explore the land equivalent ratio and to see its economic advantage at off-farm growing conditions and make it more persuasive. Further development works on income generation options from the species,

such as honey bee and gum resin production, which promotes its values and community synchronization to the species is better to do. The government also needs to give due focus to the species and encourage farmers to sustain and manage it in the appropriate growing areas.

Data Availability

Data used to support the finding of this study will be available from the corresponding author upon the request of the responsible body.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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