Dissemination of Agro-meteorological Advisory Service using Sorghum Forage Farming for Crisis Resolution and Food Security in Taraba State: Case Study of Ardo-Kola and Bali LGAs

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ABSTRACT

Sorghum forage farming could be expanded to marginal areas where water resources are limited. In this need assessment study, GIS capability was used to produce land suitability map for sorghum forage farming integrating spatial and biophysical attribute data. In addition to experimental plots in the study areas using suitable cultural practices and AAS, collection of 21 soil samples in a systematic, georeferenced soil survey was made. Spatial overlay of soil site characteristics, slope and rainfall, was performed to reveal marginal lands, as well as other non-productive lands clusters that has a potential to grow sorghum forage. A total of 11 genotypes of Sorghum varieties were acquired from IAR Zaria beside the local var (Jalingo Dawa) for the experimentation. Prior to farmer field school on green and brown days, was a radio broadcast of the idea of Agro-meteorological Advisory Service and the benefits to the farmer-headers in the state. Results reveal that Bali and Ardo-Kola has a lot of unused and marginal lands, as well as other non-productive lands clusters. 7.4 % (16761.3hectares) and 17.2% (157380.7 hectares) which falls within the slope range greater than 10% can be foraged in Ardo Kola and Bali respectively. SFF given the chance, can overcome the scarcity of forage in Bali and Ardo- Kola LGAs. It can be concluded that, SFF can stand heavy grazing, reduce animal roaming, encourage ranching and eliminate farmers-herders crisis when blended with AAS.

Keywords: Agrometeorological advisory service, Crisis resolution, Food security, Sorghum forage farming, Marginal lands.

INTRODUCTION

More than two decades now the world had been directly or indirectly weighed down by the monster called Climate Change (Adelalu, Benjamin, Garba and Wuyep, 2015) that obviously threatens global food production and potentially exacerbates food insecurity in every part of the world. Recently, beyond climate change is the effect of COVID-19 on global food security. The combined impact of the duo (climate change and COVID-19) on national economy of developing nations especially poverty ravaged countries will leave much to be desired. Government efforts to cushion effect of climate change on national economy and human livelihood manifested in the implementation of various policies in many parts of the world and Nigeria is not left behind. Operation Feed the Nation, Green Revolution Programme, Fadama Irrigation Development Projects, Agricultural Development Projects and the Ten-year National Ranch Development Plan. All These programs and policies are targeted by various levels of governments to fight food insecurity and associated crisis.

Herdsmen and farmers’ crisis have remained the most principally resource-use crisis in Nigeria. Farmers-headers crises in Nigeria occur as a result of resources scarcity (Beetseh, 2018). Farmers-herders crisis in

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Nigeria has persisted and it stands a threat to national food security, livestock production and eradication of poverty, with farmers often regarded as the most vulnerable (Dimelu, Salifu, Enwelu and Igbokwe, 2017).

As population soar in Nigeria and with the recent skirmish due to Boko Haram and insurgency in the Northeast, many migrated to seemly peaceful areas like Taraba. This has led to increase interaction between the plant- human environment interfaces, hence the need to protect public health, increase food safety and food security of the nation with regards to the FAO goal towards a sustainable environment (FAO, 2018). It is no longer news that farmers have encroached confiscated land designated to grazing and on the other hands herders often destroys and graze on cultivated land wittingly or unwittingly, pollute water sources and trespass on farmlands to feed their cattle.

Taraba state is endowed with natural resources, vast land, water, animal, and human resources. However, amidst plenty, food insecurity and incessant crisis ravage the government effort to sustainable agricultural and economic development. The Government quest by Federal Ministry of Agriculture and Rural Development (FMARD) in 2015 to import fast growing grass from Brazil to produce a massive hectare of grass was undoubtedly not unconnected to alleviate the problem of farmers and herders in the Nation. Nevertheless, Sorghum forage farming is a better option because grass farming has implication (introduction of new pest and diseases) but SFF served dual purposes producing fodder for animal and feed for human (Adelalu, Yusuf and Benjamin, 2020).

Early pioneering works on sorghum and forage –fed animal production include Agyo (2011) wrote on the degradation of sorghum stover fortified with cowpea grains in the rumen of Yankasa sheep in Kano. Gefu and Amodu (2004) examined forage production and management in Nigeria. Mohammed, Muhammmed and Baba (2015) assessed forage resources of the Zange grazing reserve in Zaria. Muhammed, Kallah, Otchere, Tanko, Olorunju (1992) discussed the effect of stage of maturity and nitrogen fertilizer level on hydrocyanic acid, calcium, phosphorus and zinc content of sorghum almum in Kano. Muhammed (2007) gave a comprehensive discussion on the voluntary intake and digestibility of Columbus grass (sorghum almum) by Yankassa sheep. Beetseh, 2018 had described the relationship between Fulani herdsmen and farmers in the incessant land crises witnessed in Nigeria and how it affects livelihood security in the state, Ovenaone, (2020) have identified distribution of persons affected by conflict, causes of conflict, emphasized the need of early identification and management of crises in the state. Of recent, Hammanjoda, Barau and Bakari (2020), determine the diversity of flora, yield and composition of forage in the Taraba state. It was discovered that there remained interspersion of forage species which includes grasses, forbs and shrubs with few trees that constitutes feed resources of a natural rangeland. This depicts the leanness of the forage bank of the study area. However, none of these research works used this sorghum cultivar as forage and fodder to foster peace between farmers and headmen in the country as climate change and limit the productivity and carrying capacity of the soil.

As a result of multiple interests on land use by several stakeholders, challenges by global warming and climatic change have, either independently or collectively, affected the forage and animal resource negatively. Wise use of weather and climate information can help to make better-informed policy, institutional and community decisions that reduce related risks and enhance opportunities, improve the efficient use of limited resources and increase crop, livestock and fisheries production (Surende and Ramana, 2021). Ramakrishnan and Guruswamy (2009) observed that, if spatial soil information was available, GIS professionals could assess site suitability for developmental purposes, effective agricultural research, and advisory programs. Application of demonstrative agrometeorology advisory service using some selected sorghum varieties for complementary animal feeds and food crop diversification to cushion the ever-increasing demand for forage that often vortex crisis in the state was the intent of this research.

With the current situation of farming and as greater attention is being given to environmental issues, sorghum is a crop with advantages offering genuine value. Sorghum requires only modest quantities of inputs and can help secure forage supplies, covering both quantity and quality, particularly when farming and weather conditions are difficult and water resources limited. Forage sorghum has been boosted by recent innovations offering significant prospects for progress. There is ongoing and dynamic development of new varieties, with genetic advances improving features such as earliness, productivity, feeding value and adaptation to limited water resources. With a diverse range of types of forage sorghum available, the right forage can be found to cope with many different soil-climate situations and to meet objectives for better animal farming (Alexis, 2016). This research inspires new initiatives aiming at bringing agrometeorological innovation to scale using some selected sorghum cultivars in marginal or unproductive sterile lands. Agenda 21 of the United Nations Conference on Environment and Development (UNCED) describes some of the technologies and techniques that need to be developed to provide for human needs while carefully managing natural resources. SFF is a sure tool/technique that will provide for human needs while carefully managing natural resources. Among other forage and fodder crops like pennisetum, lablab, cowpea, soybeans and maize, sorghum stand out (Adelalu, et al, 2020). Rainfall is not a limiting factor for sorghum in the state, it proves that sorghum is drought tolerant crops. As an alternative, sorghum is one of grain crops which is more suitable to be cultivated on dry land or paddy fields during the dry season.

The aim of this present project is to provide AAS to cushion the side effect of climate change using SFF in Taraba for holistic crisis resolution. The specific objective is to map land clusters (sterile, unused marginal) yet suitable for sorghum forage cultivation based on rainfall and land conditions in Ardo-Kola and Bali. This need assessment study is part of a larger project aiming at providing AAS to cushion the side effect of climate change challenges in Ardo Kola and Bali. Agronomy and management used which can have influence on the crop productivity other than the varieties selected is beyond the scope of this research.

Statement of the Research Problem

Food security in many developing countries has been threatened by several factors such as unequal land distribution, ineffective land reform policies, inefficient agricultural value chains, and an increasing number of climate disasters. In Nigeria, these threats are exacerbated by rapid population growth and extreme weather events, which have resulted in farmer-herder conflicts in most agrarian communities.

For some years now, there has been a raging battle between herdsmen and farmers in the middle belt of Nigeria: Benue, Jos and Taraba. This is not unconnected to declining productivity and increasing land degradation in grazing areas and the serious need to feed the growing population. In Taraba state, glaringly all the government effort to advance the state and to fight food insecurity are frustrated due to incessant clashes between farmers and headsmen. It is against this backdrop that this participatory research was executed.

Taraba state is a border state located in the North-Eastern part of Nigeria and one of the important entry points into the country. It is a hub for livestock activities with a significant number of nomadic settlements. The state projected livestock population for 2018, is 23,549,584 million; 5,577,980 cattle, 3,061,666 sheep, 3,686,973 goats, 3,212,973, 3,212,979 pigs and 8,009,986 poultry (Ayi, Daniel, and Mabel, 2020). There is urgent need to increase fodder production to accommodate the feed requirements of Tarabian's Livestock. Extensive system of production may not be a viable option. Land areas for grazing and feed availability are severely limiting factors in the high livestock producing zones of Nigeria (Ibrahim, 2018). Due to the peculiarity of the activities of the herdsmen, they move from one place to another in search of pasture. In this process, the herdsmen have reportedly encountered cattle rustlers and made complaints to the relevant authorities who fail to investigate the issue, hence their purported reason for carrying arms about (Ibrahim, 2018). During their journey, they frequently trespass farmlands owned by locals in their host communities, destroying crops and valuables. Attempts by farmers to prevent them from causing havoc are met with stiff and violent resistance. Most times, the farmers are overpowered, injured and killed, while others are evicted from their homes. Sometimes, the herdsmen are accused of taking these opportunities to steal, rape, raze houses and kill innocent members of the communities they pass through (Akinkuolie, 2018). However, Taraba has a lot of unused and marginal lands, as well as other non- productive lands that have potential to support production of forage plants in order to overcome the scarcity of forage in the communities that often faced with crisis. Increments in fodder production can be achieved by increasing yield per unit area of land not only by expansion of grazing areas (Muhammad and Abubakar 2004) because of the present trend in competitive land use and demographic changes. Here lies the task of AAS to cushion the side effect of climate change challenges in the state.

Agro-meteorological adversary services have been employed in many developed nations to cushion the side effect of climate change challenges (Weiss *et al*, 2000; Sivakumar, 2006). It is against this backdrop that this research looks into dissemination of AAS using sorghum forage farming (SFF) for crisis resolution and food security in the study areas.

MATERIALS AND METHODS

Study Area

Taraba State is regarded as the nature's gift to the nation. It is an agrarian state because of the fertile soil and this makes agriculture very important for their livelihood and survival, and has inevitably attracted herdsmen and farmers from other middle belt states. This research was conducted in Ardo-Kola and Bali LGAs in Taraba State. In each senatorial district, two local governments were purposefully chosen. The two LGA lies between latitude 8˚30'N to 9˚20'N of equator and longitude of 11˚ 10'E to 11˚44'E of the Greenwich Meridian with elevation ranging from 118 to 1440 m above sea level. These two regions were selected based on the facts received from Taraba Agricultural Development Program (TADP). The locations had the greatest number of farmers and harbor herds of cattle with marginal lands. The purposive selection of these two regions helps increase the chances of variation in the data collected, making our samples more representative.

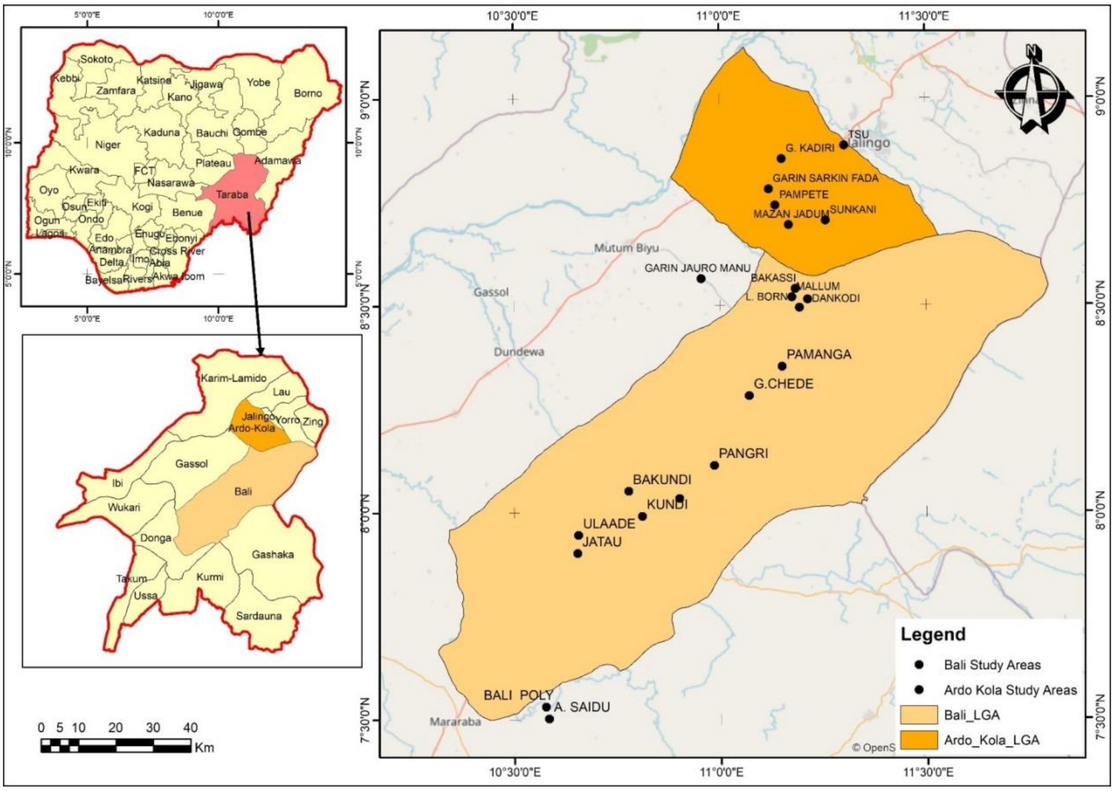

Figure 1: Study Area Location and Villages

DATA AND METHODOLOGY

Table 1: Data used for the Study

S/N	Type		Format	Date	Source
1	Rainfall	Ardo-Kola	Digital/Analogue (harmonized)	1999-2022	COA/TSU/TARCMA usgs.worldclim.data/ UBRB
		Bali	Digital/Analogue (harmonized)	1999-2022	UBRB usgs.worldclim.data/ UBRB
2	Soil Map		Digital/in situ	2022	Worldmap.havard.edu/data/geonade.
3	Slope Map		Digital	2022	SRTM
4	Sorghum Yield		GroundTruth/ (Archive)	1999-2022	TADP

Baseline Assessment: Pre-field Experimentation

The research commenced by the sensitization of farmers. Through enquiry and radio broadcast, Agrometeorological Advisory Service idea was made known to the farmers and headers in the state. Target population was sorghum farmers and herdsmen in the state. Using the cooperatives platforms and personal contact of the stakeholders in Taraba Agricultural Development Program (TADP) in the state and radio interactive session (Rock FM) some farmers in the state were reached. The communities were informed first the importance of AAS. Identification of used and unused, sterile and marginal lands and their owners through Transect Walk. Establishment of two demonstrating plots across the selected communities (T.S.U and Bali Poly) were done in the months of July and August respectively. A total of 11 genotypes of Sorghum was acquired from IITA Ibadan and IAR Zaria for the experimentation apart from the Jalingo Dawa. Plantations on some land clusters identified by farmers in the communities as sterile and unproductive were planted with the 12 varieties.

Based on the spatial distribution of the soil site data, it was possible to produce soil characteristics maps using Kriging methods. According to Harasheh (1994) the use of GIS allows the construction of models from which a new thematic map (e.g. Land suitability map) can be produced from a set of thematic maps. Based on Al-Mashreki et al. (2015), the suitable criteria for sorghum are classified into five classes: Very Suitable (S1), Suitable (S2), Marginally Suitable (S3), Not Suitable Currently (N1), and Not Suitable Permanently (N2). The criteria described in Al-Mashreki et al. (2015) rely on many factors, but in this study, four factors are considered: rainfall, soil type, soil parameters and land slope following Nitisapto, Muttaqin, Kusumo, Gunardi, and Attaqy, 2016). Soil type and land slope data were downloaded from Worldmap.havard.edu/data/geonade.and classified into soil type and land slope map. The slope was developed by using data from the original Shuttle Radar Topography Mission (SRTM) and the digital elevation model (DEM). To map the marginal lands clusters but suitable for sorghum forage farming in the state, thematic maps showing the spatial distribution of attributes were constructed based on different GIS functions. Fuzzy membership functions were used to standardize criteria maps. Higher pixel score indicates a higher suitability level for that pixel. Suitable ranges of the factors that determine the lowest and greatest suitability levels were determined based on the available factors. Standardized factor maps were developed also using the decision support tool of IDRISI software. The criteria were ranked according to their significance following expert opinions and literatures. AHP constructs a pair-wise comparison matrix by assigning values in the range of 1–4 for each factor against every other (Saaty, 1980) which finally gives in

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eigenvector weights indicating the relative importance of the various factors considered (Rahmani, and Ghods, 2018). After weightings and rating of all criteria over the hierarchy was obtained, standardized criteria maps were multiplied with these criteria weights (Ayoade, 2017) at each level of the hierarchy by relating weighted linear combination in order to produce an overall marginal clusters land but that are suitable for sorghum forage business following the equation below.

$SI= \sum Wi*Xi$,

Where: SI = Suitability Index, Wi = weight of factor I, and Xi = normalized criterion score.

The map produced was reclassified as currently less suitable (<0.2), Moderately Suitable (0.2–0.6), and most suitable (>0.6) (Van Ranst and Debaveye, 1991).

RESULTS AND DISCUSSION

Dissemination of Agro-meteorological Advisory Service using Sorghum Forage Farming.

The radio program of about one hour was designed to bridge the gap between AAS providers and rural end users in the state. Radio and farmer's forum interactive discussion ranged from issues on weather conditions, soil and nutrients status, pest management ideal and recommendation, sorghum cultivars to plant for various field conditions. The radio program was rounded up by responding to some critical questions that were raised by the farming communities. Radio Audience's questions range from date of onset for sorghum production purposes, to farming in respond to weather.

a. Issues on Weather Conditions and AAS provision

The unstable status of the weather conditions of the state was highlighted. Advisories for all the weather sensitive agricultural operations from sowing to harvest especially for sorghum was discussed. The reduced rainfall and implication for food security was stressed. The effect of rainfall and land use change capable of vortex crisis was not left untouched. Farmers in the state are not unaware of the erratic nature of rainfall and the ever-increasing temperature. On the green day of farmers-field school, answers to some questions on this aspect confirmed their knowledge on rainfall variability and occurrence.

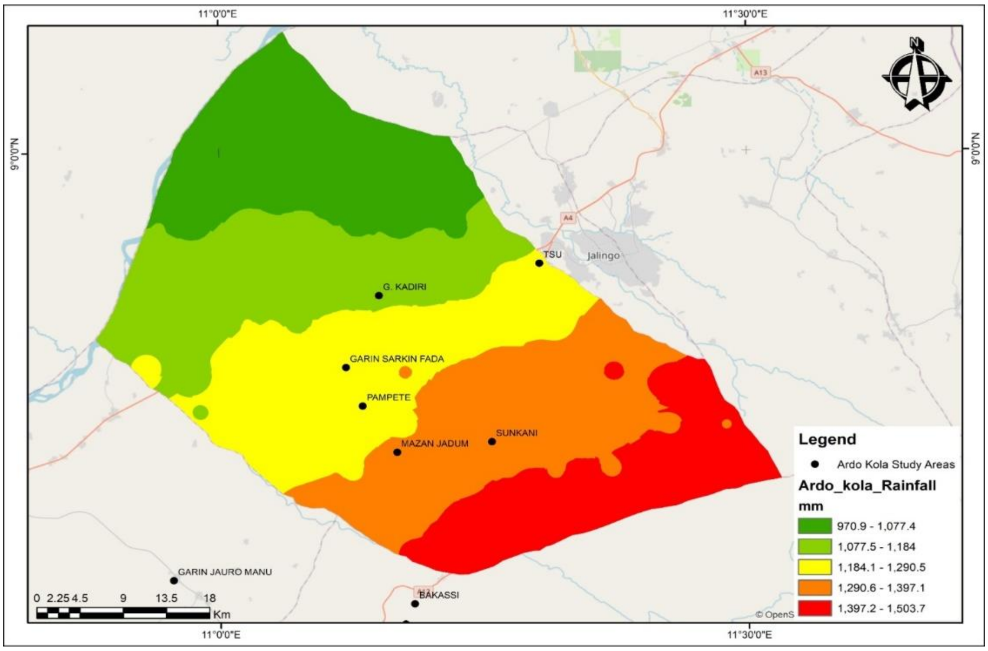

Fig 2: Rainfall Distribution in Ardo-Kola LGA

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Table 2: Rainfall and Area Extent in Ardo-Kola LGA

Value	Class (mm)	Area (Hectare)	Percentage
1	970.9-1077.4	54588.6	24
2	1077.5 – 1184	47562.21	21
3	1184.1-1290.5	43267.77	19
4	1290.6-1397.1	37008.63	16
5	1397.2-1503.7	43542.27	19
Total		225969.48	100

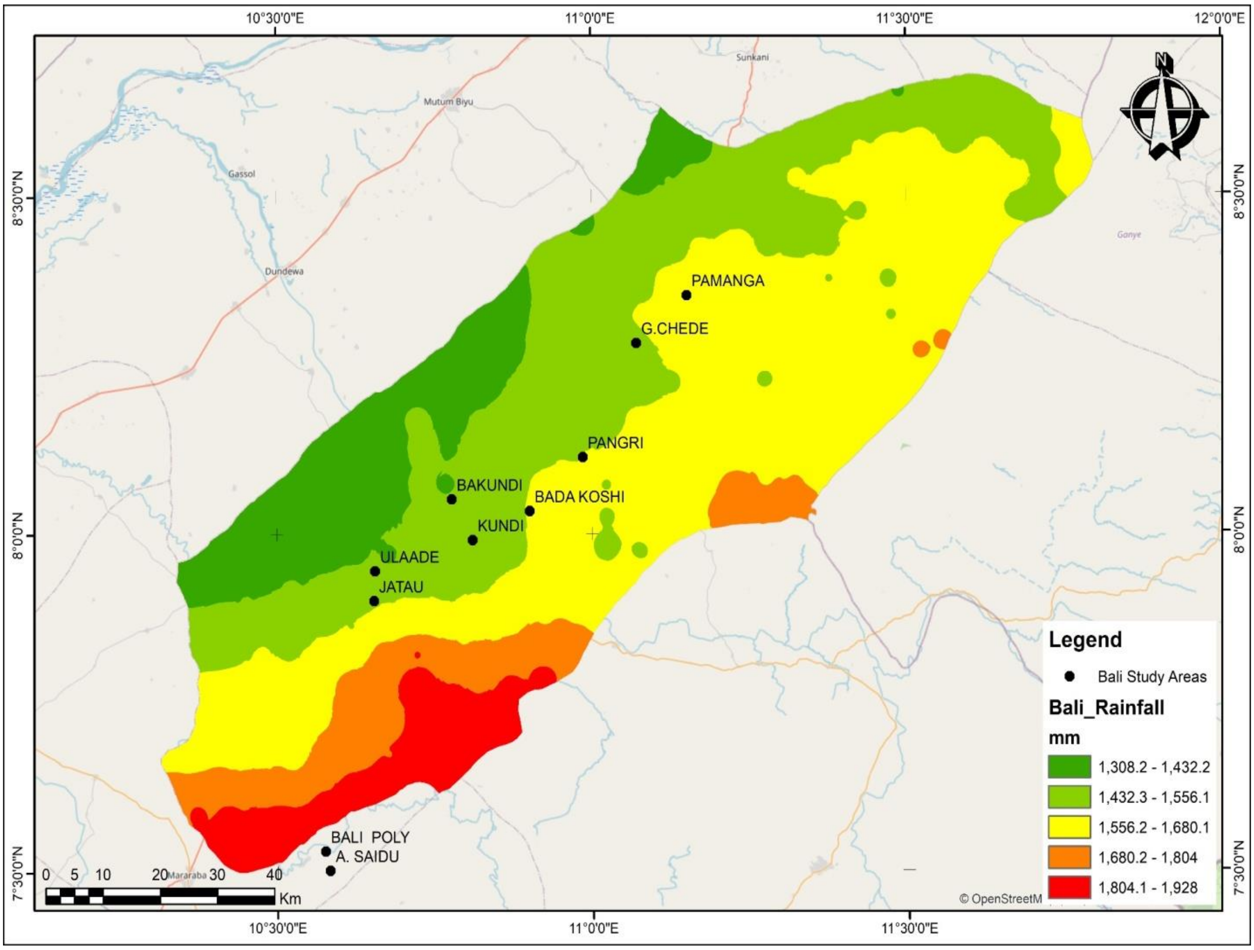

Figure 3: Rainfall Distribution in Bali LGA

Table 3: Rainfall and Area Extent in Bali LGA

Value	Class (mm)	Area (Hectare)	Percentage
1	1308.2 – 1432.2	191411.73	21
2	1432.3 – 1556.1	193429.35	21
3	1556.2 – 1680.1	333823.95	37
4	1680.2 – 1804	109982.43	12
5	1804.1 – 1928	85066.02	9
Total		913713.48	100

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b. Issues on Soil Conditions and AAS provision.

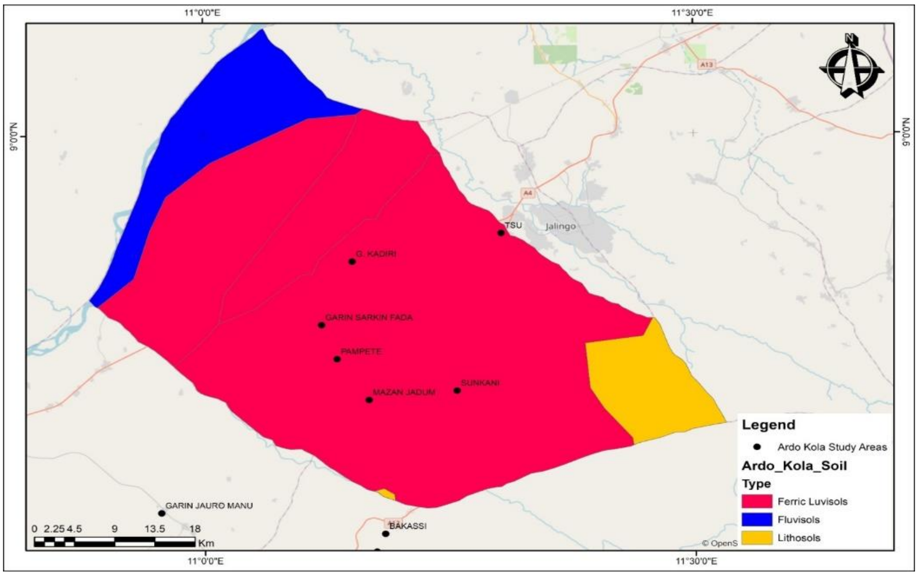

Figure 4: Soil Types and Distribution in Ardo- Kola

Table 4: Soil Types and Area Extent in Ardo-Kola

Value	Type	Area (Hectare)	Percentage
1	Fluvisols	24666.12	11
2	Ferric Luvisols	186956.37	83
3	Lithosols	14347.80	6
Total		225970.29	100

Figure 4 and Table 4 Show the soil types and area extent in Ardo-Kola. Fluvisols, Ferric Luvisols and Lithosols constitutes about 11, 83, and 6% of the total land mass of the study area. Ferric Luvisols with about 186956.37 hectares in Ardo -Kola support the growth of sorghum. Base on biomass performance of the cultivars tested, SAMSORG 43, CSR 01 and Kaduna (Kaura) varieties are other options that could be planted apart from local common Jalingo dawa. This when implemented can lessen the problem of forage scarcity vortex crisis in the study area.

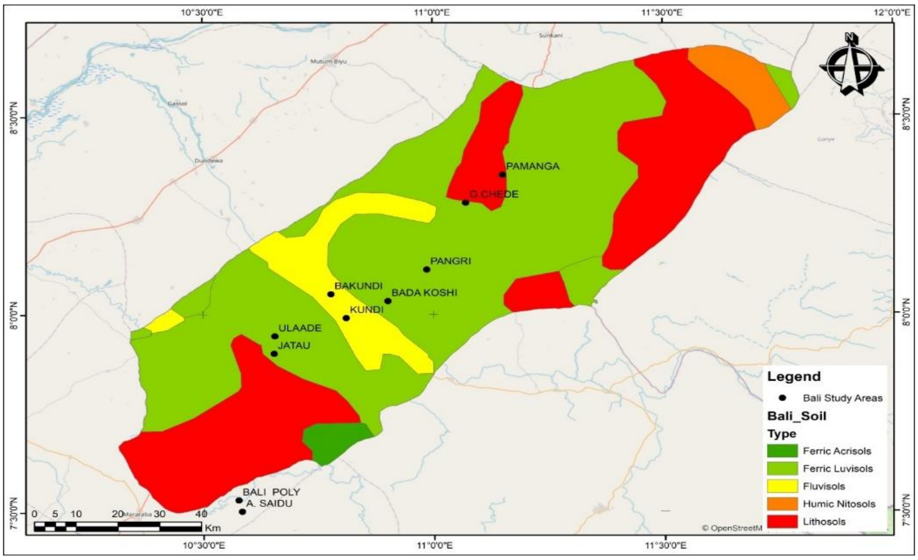

Figure 5: Soil Types and Distribution in Bali LGA

Table 5: Soil Types and Area Extent in Bali LGA

Value	Type	Area (Hectare)	Percentage
1	Fluvisols	74178.81	8
2	Ferric Luvisols	520414.74	57
3	Lithosols	279284.67	31
4	HumicNitosols	27212.49	3
5	Ferric Acrisols	12680.91	1
Total		913771.62	100

Figure 5 and Table 5 above show the soil types and area extent in Bali LGA. Apart from Fluvisols, Ferric Luvisols and Lithosols found in Ardo-Kola, other available soil types in Bali LGA are; Humic Nitosols Ferric Acrisols even though in small percentage. Again, Ferric Luvisols constitutes major portion of the land area in Bali with about 520414.74 hectares (57%). Base on biomass performance of the cultivars tested, SAMSORG 43 and Kaduna (Kaura) varieties are other options that could be planted apart from local common Jalingo dawa. The plain and fertile soil, and the consistent annual flood of the rivers and streams within the area makes the land a conducive area for seasonal farming and grazing, and all season’s fishing (Taraba State at a Glance: tarabastate.gov.ng/about/, 2018).

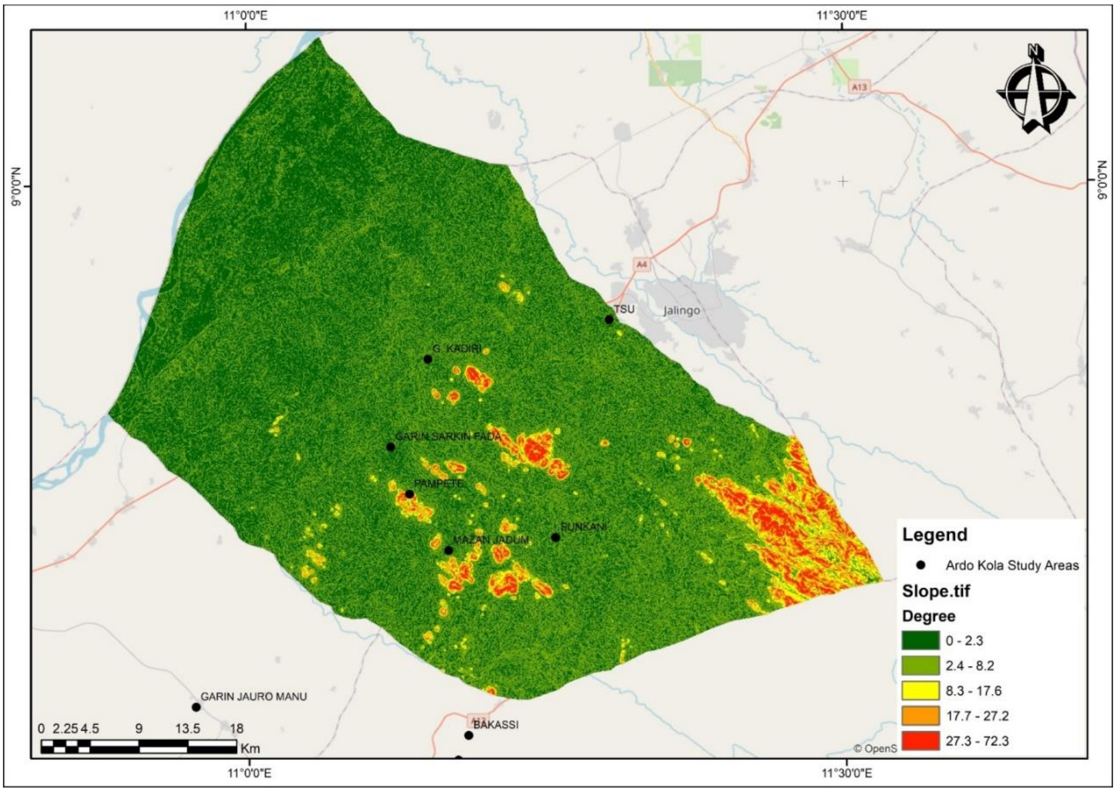

Figure 6: Relief Distribution in Ardo- Kola LGA

Table 6: Relief and Area Extent in Ardo-Kola LGA

Value	Class (degree)	Area (Hectare)	Percentage
1	0-2.2.3	114159.2	51
2	2.4-8.2	95039.9	42
3	8.3 – 17.6	6582.0	3

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4	17.7 – 27.2	6426.3	3
5	27.3 – 72.3	3753.0	2
Total		225960.4	100

Figure 6 and Table 6 reveal relief and area extent in Ardo-Kola LGA. Soil type and landscape have significant and direct influence on agricultural production and management.

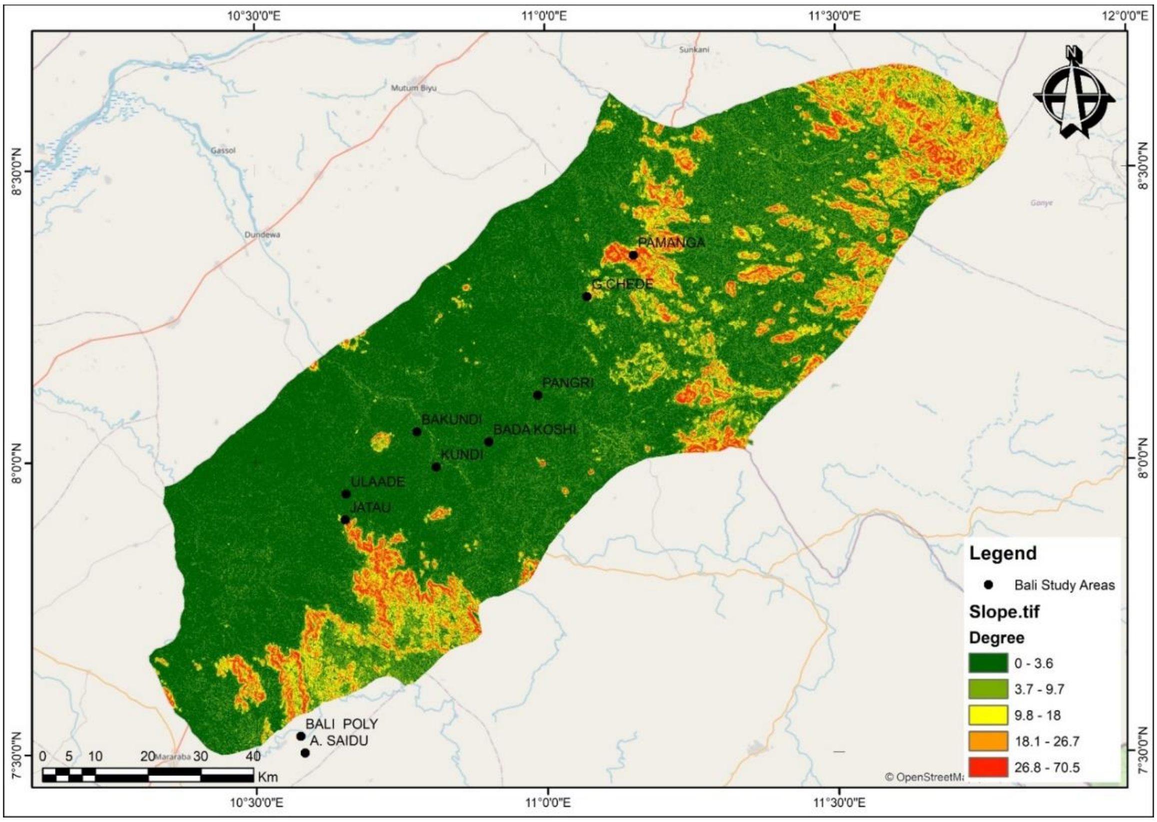

Figure 7: Relief Distribution in Bali LGA

Table 7: Relief and Area Extent in Bali LGA

Value	Class (degrees)	Area (Hectare)	Percentage
1	0 – 3.6	571050.8	62
2	3.7 – 9.7	185346.8	20
3	9.8 – 18	69999.9	8
4	18.1 – 26.7	57455.6	6
5	26.8 – 70.5	29925.2	3
Total		913778.4	100

Based on the Digital Elevation Model (DEM) and the topographic map, the slope map of the study areas has been produced (Fig. 7 and 7). However, the slope gradient has a range between 0 to over 70 percent across the study areas. The steepest slope is the most susceptible location to soil erosion by both water and gravity and therefore not suitable for cropland. According to Harasheh (1994), the thickness of the soil layer decreases with the increasing slope. He added that the slope gradient has an impact on the soil loss and stability. This suggest that the greater the slope gradient the higher the potential for runoff and soil loss. FAO (1981) posited that field crops generally require flat land; only a slight slope between 0% and 8% is resistant to erosion. When the slope gradient is very steep (40%), soil sediment losses remain at high levels after cultivation abandonment because slope gradient is the main factor controlling soil erosion (Rasheed and Venugopal, 2009). This suggest that in Ardo Kola and Bali 93 and 82% (209,199.1 and 756397.6 hectares) respectively are Flat land, arable and cultivable land. Good for all cropping including sorghum crop, all things being equal. 7.4 % (16761.3hectares) and 17.2% (157380.7 hectares) which falls within the slope range greater than 10% can be foraged in Ardo Kola and Bali respectively (Table 5 and 6). This portion of the land area may not be suitable for most farming practices however have application for foraging. Integration of forages into farming systems especially in this area deem unfit for cropping with these special breeds introduced will lessen stress from scarcity for forage for animal use in the state.

Suitability Map of Sorghum Forage in the Study Areas

This section presents the suitability map of sorghum forage cultivation over Bali and Ardo- Kola LGA based on rainfall, slope, soil type and soil parameters thematic maps of the region, (Figure 8 and 9), in addition to field surveys analysis.

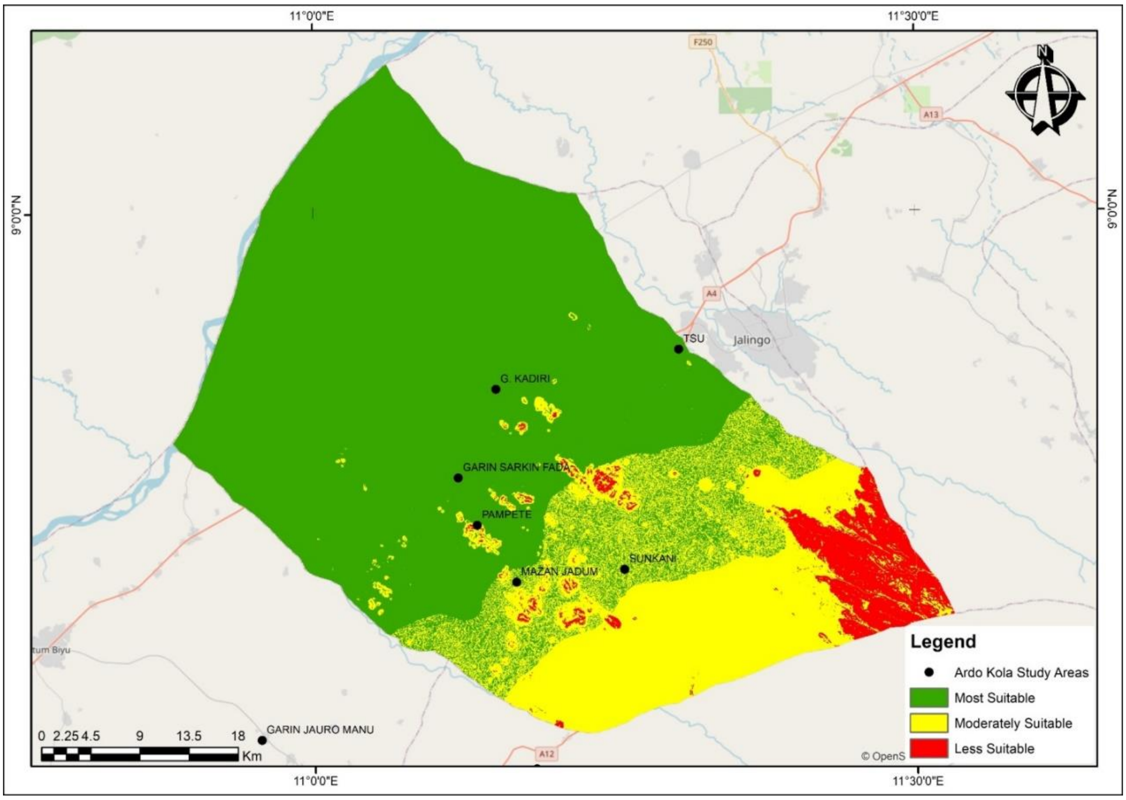

Figure 8: Sorghum Forage Suitability map in Ardo- Kola

Table 8: Sorghum Forage and Area Extent in Ardo-Kola

Suitability Class	Area (Hectares)	Percentage (%)
Most Suitable	158068.72	70.01
Moderately Suitable	56697.44	25.11
Less Suitable	11007.85	4.88
Total	225774.00	100.00

Table 8 reveals the suitability map for the Ardo-Kola LGA in Taraba State. As expected, about 158068.72 hectares (70%) of land area in the region is most suitable. Both in grain yield and biomass production are readily viable. Less than 5%, mostly rocky area is not good for sorghum cultivars. The area in this axis

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include Maihula, Mazan Jadun etc.

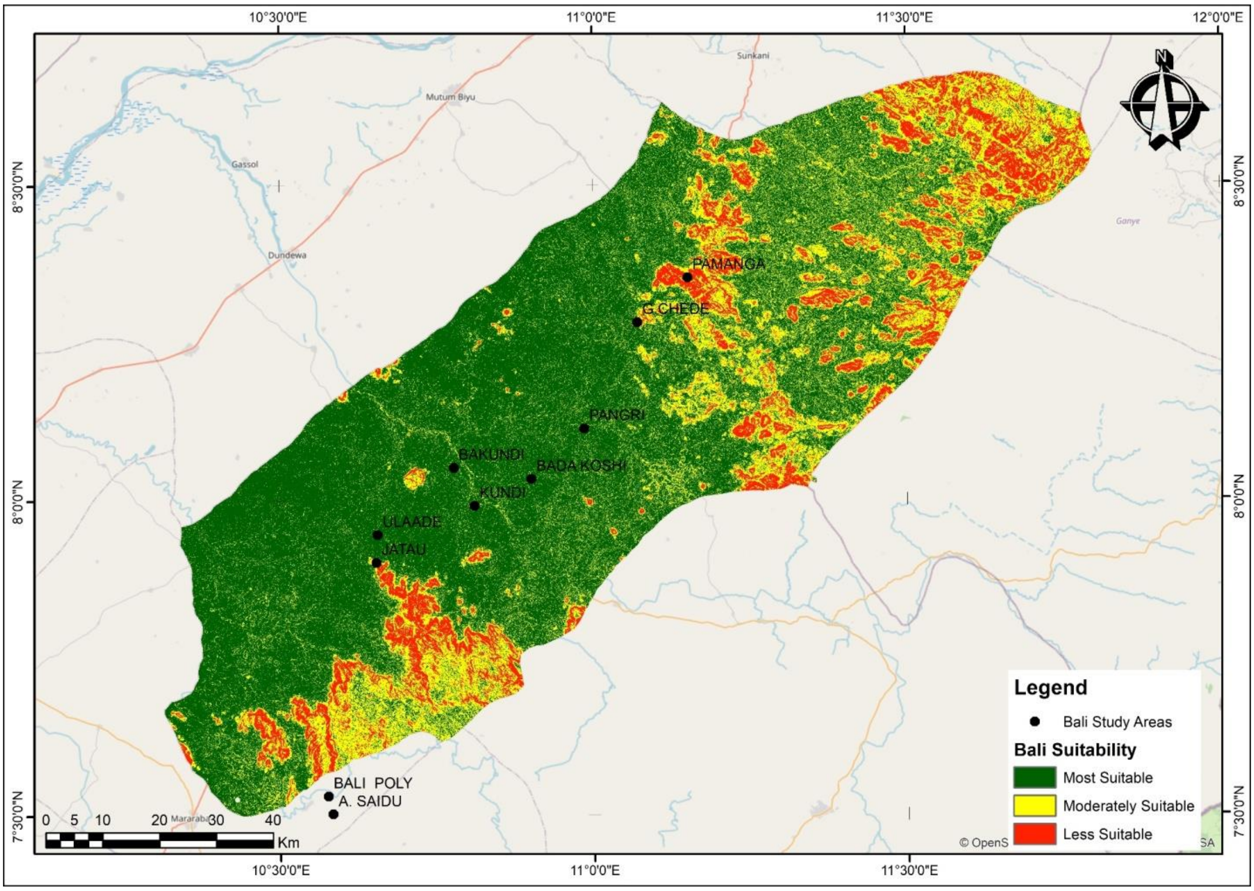

Figure 9: Sorghum Forage Suitability map in Bali LGA

Table 9: Sorghum Forage and Area Extent in Bali LGA

Suitability Class	Area (Hectare)	Percentage (%)
Most Suitable	570678.91	62.49
Moderately Suitable	255217.06	27.95
Less Suitable	87363.30	9.57
Total	913259.28	100.00

Figure 9 and Table 9 reveal the suitability map for the Bali LGA in Taraba State. 570678.91, 255217.06 and 87363.30 hectares of the land area in the region is most suitable, moderately and less suitable respectively. Except Pamanga, all the study wards in Bali produced remarkable well both in grain yield and biomass production. Taraba land area is suitable for the cultivation of both arable and perennial crops such as yam, cassava, rice, guinea corn, maize, millet, groundnut, cowpea, beans, banana, coconut, fruit trees and vegetables, as well as animals such as cattle, sheep, goats and pig among others. It is also blessed with large volume of mineral deposits such as salt, lead, zinc, limestone and others all untapped (Taraba State at a Glance: tarabastate.gov.ng/about/, 2018).

Impact of AAS and Acceptability by the end Users in Ardo Kola and Bali LGA

This section discussed the Aftermath of AAS in 2023 Farming Season. Questionnaires were distributed to the farmers that were previously given seeds to plants on the areas deem unfit for their general cultural practice. Results as presented below.

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Prior to Farmer field school on green and brown days was a Radio broadcast of the idea of AAS and the benefits to the farmer-headers in the state using radio broadcast. April was chosen for the media discuss. The first Farmers field school -day was on October which was the Green day (Appendix). Farmers were invited to come for inspections and compares what they see with what they have in their respective farms.

Preference of the newly introduced varieties based on Grain Yield and Biomass in Ardo- Kola.

Table 10: Preference of the newly introduced varieties based on Grain Yield in Ardo- Kola (N=120).

ITEM	GRAIN YIELD	SA	A	U	D	SD	X	REMARKS
1	SAMSORG 3-90	280	96	0	46	17	3.66	Agree
2	SAMSORG 16	330	108	0	40	7	4.04	Agree
3	SAMSORG 40	375	172	–	2	1	4.58	Agree
4	SAMSORG 43	70	136	3	63	39	2.6	Disagree
5	SAMSORG 44	340	40	9	60	9	3.82	Agree
6	SAMSORG 45	400	24	0	48	10	4.02	Agree
7	SAMSORG 46	315	40	9	76	6	3.72	Agree
8	SAMSORG 49	355	96	3	38	5	4.14	Agree
9	SAMSORG 50	80	108	0	114	20	2.68	Disagree
10	CSR 01	340	116	6	28	7	4.14	Agree
11	Kaduna var (Kaura)	70	160	0	120	6	2.96	Disagree

Table 11: Preference of the newly introduced varieties based on Biomass Production in Ardo-Kola (N=120)

ITEM	BIOMASS WEIGHT	SA	A	U	D	SD	X	REMARKS
1	SAMSORG 3-90	85	68	0	100	36	2.40	Disagree
2	SAMSORG 16	50	64	0	88	49	2.09	Disagree
3	SAMSORG 40	115	76	0	44	56	2.43	Disagree
4	SAMSORG 43	200	220	0	24	13	3.81	Agree
5	SAMSORG 44	135	112	3	64	32	2.88	Disagree
6	SAMSORG 45	90	88	0	60	50	2.4	Disagree
7	SAMSORG 46	5	28	0	132	46	1.76	Disagree
8	SAMSORG 49	50	20	0	144	33	2.06	Disagree
9	SAMSORG 50	30	24	3	100	57	1.78	Disagree
10	CSR 01	190	200	0	24	20	3.62	Agree
11	Kaduna var (Kaura)	310	144	0	22	11	4.05	Agree

Table 10 and 11 above show the respondent’s view as per the grain yield and biomass performance of the newly introduced varieties in Ardo -Kola. Except SAMSORG 43, 50 and Kaura, with decision mean 2.6, 2.68, 2.96, all the other items 1,2,3,5,6,7,8 and 10 have mean well above the decision mean of 3.0. Indicating that all the farmers agreed that the new introduced varieties performed better in grain yield over the local common Jalingo dawa. However, only items 4, 10 and 11 have decision mean above 3.0. based on biomass production. This implies that Jalingo dawa biomass weight is weightier than SAMSORG 3-90, 16, 40, 44, 45, 46, 49 and 50 (Table 11).

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Preference of the newly introduced varieties based on Grain Yield and Biomass in Bali.

Table 12: Preference of the newly introduced varieties based on Grain Yield (N=150)

ITEM	VARIABLES	SA	A	U	D	SD	X	REMARKS
1	SAMSORG 3-90	350	152	6	18	31	3.71	Agree
2	SAMSORG 16	90	84	0	114	54	2.25	Disagree
3	SAMSORG 40	435	164	0	24	10	4.22	Agree
4	SAMSORG 43	60	68	3	140	50	2.14	Disagree
5	SAMSORG 44	330	132	3	44	28	3.58	Agree
6	SAMSORG 45	260	196	12	26	32	3.51	Agree
7	SAMSORG 46	15	60	0	102	81	1.72	Disagree
8	SAMSORG 49	320	152	0	38	29	3.59	Agree
9	SAMSORG 50	275	232	9	62	3	3.87	Agree
10	CSR 01	100	84	3	78	69	2.23	Disagree
11	Kaduna var (Kaura)	255	192	21	40	24	3.55	Agree

Table 13: Preference of the newly introduced varieties based on Biomass in Bali (N=150).

ITEM	VARIABLES	SA	A	U	D	SD	X	REMARKS
1	SAMSORG 3-90	55	96	3	64	82	2.5	Disagree
2	SAMSORG 16	70	84	0	48	91	1.95	Disagree
3	SAMSORG 40	170	316	9	28	20	3.62	Agree
4	SAMSORG 43	365	156	0	66	5	4.93	Agree
5	SAMSORG 44	170	104	0	64	58	2.64	Disagree
6	SAMSORG 45	75	40	3	156	46	2.13	Disagree
7	SAMSORG 46	45	16	0	200	37	1.99	Disagree
8	SAMSORG 49	155	80	0	102	48	2.57	Disagree
9	SAMSORG 50	95	96	3	122	45	2.41	Disagree
10	CSR 01	320	188	0	46	16	3.80	Agree
11	Kaduna var (Kaura)	280	244	0	26	20	4.75	Agree

Table 12 and 13 above show the farmer’s view as per the grain yield and biomass performance of the newly introduced varieties in Bali. Items 2, 4, 7 and 10 have mean values of 2.25, 2.14, 1.72 and 2.23 respectively. Item 1, 3, 5,6,8, 9 and 11have the highest mean of 3.71, 4.22, 3.58, 3.51, 3.59, 3.87, and 3.55 which indicates that SAMSORG 3-90, 40,44,45,49,50 and Kaura perform better in grain yield than the common Jalingo dawa in Bali.

Except items 3,4, 10 and 11 with high decision mean indicating a better biomass, all the other items 1,2,5,6,7,8, and 9 have mean well below the decision mean of 3.0.

Evidence of the AAS and Media Interaction

Today most marginal land clusters that long been neglected were seen planted with local sorghum varieties (plate 7-13). At the end of the farming season in the year, places like Nukkai bridge, Uware, Malum, Lankavri unpaved shoulder contours and sterile land are seen planted with local varieties. In this weather and climate-based farm Advisory service understanding and the ability to communicate timely agrometeorologial information to stakeholders at the human-animal-plant environment interface seems the key to global food security and crisis amelioration. At the heart of strengthening the food system in Taraba lies the ability to communicate timely agrometeorologial information to every farmer. This project had successfully used SFF as bait to lure two warring stakeholders in two farming communities in Taraba State to deliver agrometeorologial advisory service. It can be concluded that SFF can stand heavy grazing, reduce animal roaming, encourage ranching and eliminate farmers-herders crisis when blended with AAS.

CONCLUSION

In this need assessment research, land clusters (sterile, unused marginal) suitable for sorghum forage cultivation was analyzed based on climate and land conditions in Ardo-Kola and Bali. The study areas have a lot of unused and marginal lands, as well as other non-productive lands clusters that has a potential to grow forage in order to overcome the scarcity of forage. 7.4 % (16761.3hectares) and 17.2% (157380.7 hectares) which falls within the slope range greater than 10% can be planted with SAMSORG 3-90, 16, 40, 44, 45, 46, 49 and 50 in Ardo Kola while in Bali SAMSORG 3-90, 40,44,45,49,50 and Kaura can be planted for grain apart from the common Jalingo dawa. The portion of the land area unfit for most farming practices can have application for foraging. Integration of forages into farming systems especially in these areas deem unfit for cropping with sorghum forage or forage trees will lessen stress from scarcity of forage for animal use in the state. As an alternative crop, sorghum forage in unused and marginal land will survive dry season and can boost food and fodder need of the State. It can be concluded that topographic, climatic and edaphic factors do not limit the cultivation potential of the area for sorghum crop. However timely AAS, soil and water management practices can boost sorghum crop yield and forage for animal in the study area.

RECOMMENDATION

Managing or curbing or eradicating the incessant crises between farmers and herders in North east specifically Taraba state, bridging the gap between AAS providers and community farmers is expedient. Taraba being an agrarian state with vast land both marginal and fertile and human resource to harness need expertise to help to provide timely meteorological solution to solve their agricultural problems. For instance, in 2021 the rain just cut off and many farmers began to cry. Why because the late cropping period were grossly affected. Crop farmers like guinea corn, beans, etc were disappointed. Those who were waiting for August/ September before they planted were shocked to see the rain cut off a month after planting. A farmer that is close to AAS provider will not make such mistake and consequently bounty harvest. Seminars and workshop need be conducted for educating users of AAS in the state.

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