Status of Climate Smart Small Ruminant Production Practices in Kwara State, Nigeria

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Abstract

This study examined the status of climate smart small ruminant production practices in Kwara State, Nigeria. About 105 small ruminant breeders were selected for the study. The data were analysed the use of frequency count, percentage, mean score, Binary Logistic Regression and Pearson product moment correlation. The result revealed that about 60% of the breeders were females and the mean years of experience in small ruminant production was 7 years. The result of most of the frequently used climate smart small ruminant production practices of the respondents showed that provision of medication to sick animals and cultivation of crops along with rearing of animals (90.5%), feeding with supplementary feeds, isolation of sick animals and vaccination of animals (92.4%); provision of shade through Planting of trees to reduce heat stress (93.3%); feeding with crop residues and building and maintenance of pens (96.2%) and grazing on pasture/grassland (97.1%). About 90.5% of the breeders have high status on the use of climate smart small ruminant production practices. Disease outbreak and high mortality (mean=2.07) was the highest ranked factors affecting the small ruminant breeders. The result of Binary Logistic Regression showed that educational level (B=3.985), membership of social group (B=6.083), access to extension services (B= 13.941) and years of experience (B= -0.544) were the determinant factors of the use of climate smart small ruminants production practices. This study therefore recommends that breeders should be provided with veterinary services and extension services.

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Introduction

Climate change is emerging chal¬lenge limiting food security and sustainable development (Allen *et al.*, 2014). The continuous change in climatic conditions and unsustainable use of natural resources has adversely affected livelihoods of people all over the universe. The change in climatic conditions has led to changes in rainfall patterns, excessive flooding and landslides (IPCC, 2007). Climate change has resulted in overall decrease in small ruminant production and increased the risk of famine (FAO, 2008). Climate change refers to alteration in the incidence of extremes of climate over a long period of time (IPCC, 2001). It includes long-standing events such as variations in temperature and precipitation patterns (Boko *et al.*, 2007).

The small ruminant production is an important source of food and income for many rural people in West Africa (Kristjanson, et al., 2014 and Nyberg *et al.*, 2015). The Small ruminant production contributes to food security and livelihoods in developing countries like Nigeria (FAO, 2019, Duku *et al.*, 2011).

According to Otaru and Iyiola-Tunji, (2014) small ruminant animals such as sheep and goats belong to the genus, Ovis and Capra respectively and have four chambered stomachs. Small ruminants are like cattle because they chew the cud or regurgitate and ruminate. The population of

goat and sheep in Nigeria was estimated to be 76 million goats and 43.4 million sheep (FMARD, 2017). The products of goat and sheep are meat and milk for consumption, and hides for leather industry.

Considering the significance of the small ruminants to food security and in order to reduce the climatic risks and threats affecting small ruminant production, it is imperative to come up with strategies to reduce the effects on small ruminants' production. Also, to ensure that small ruminants' production practice is sustainable. Therefore, it is vital to utilize the Climate Smart Strategy which is obtainable in Climate Smart Small Ruminant Production Practices.

Climate Smart Small Ruminant Production Practices are aimed to support food security taking into account the need for adaptation and the potential for mitigation. Climate Smart Small Ruminant Production approach involve the use of practices which increases resilience and stability in small ruminant production thereby helping farmers adapt to climate change risks (Oladele, 2015).

Climate smart small ruminant production practices refers to agricultural approach that sustainably increases productivity, resilience (adaptation), reduces/removes greenhouse gases emission (mitigation), and enhances achievement of national food security and development goals (FAO, 2010). Climate smart small ruminant production approach serve as a guide to the needed changes of agricultural systems, given the necessity to jointly address food security and climate change (Long *et al.,* 2016). The climate smart small ruminant production practices are expected to boost adaptive capacity, food security, and contribute to climate change mitigation in resource-poor smallholder farming systems like Nigeria.

The increasing focus on the adaptation of small ruminant farming to climate change indicates the need for climate smart small ruminant production practices which could help build resilience and see to the reduction of greenhouse gas emissions and their negative effects. Climate Smart Small ruminant production practices would address the challenges of building synergies between the related objectives of climate change mitigation, adaptation and productivity and income increase, and minimizing their potential negative trade-offs (Onada and Ogunola, 2016).

The widespread changes in climatic conditions threaten food production and livelihoods of many people in agriculture. There is increased exposure of people dependent on small ruminant production to hunger and poverty. There is need to examine the status of climate smart practices among the breeders as the adoption of potentially beneficial practices had been described to be low (Arslan *et al.,* 2013). Application of climate smart small ruminant production practices could increase the farmers' output and income, and enhance resilience and mitigation to climate change.

Based on the changing environmental and socio-economic factors, there is need to carryout systematic research on small ruminants' production practices (Kosgey and Okeyo, 2007; Rege *et al.,* 2011). There seems to be paucity of information on the use of climate smart small ruminant production practices in the Kwara State, Nigeria. This creates a great lacuna in knowledge and this is the gap this study seeks to fill. Therefore, there is a need to examine the status of climate smart small ruminant production practices in Kwara State, Nigeria.

The specific Objectives were to:

1) Identify the socioeconomic characteristics of the respondents in the study area.

2) Investigate the climate smart small ruminant production practices used by the respondents.

3) Assess the factors affecting small ruminant production in the study Area.

Hypotheses of the study:

Hypothesis 1 (HO_1)-There is no significant relationship between some selected socio-economic characteristics of the respondents and the climate smart small ruminant production practices.

Hypothesis 2 (HO_2)-There is no significant relationship between the factors affecting small ruminant production practices and the climate smart small ruminant production practices.

Methodology

The study was conducted in Ilorin East local government Area of Kwara State, Nigeria Which is one of the sixteen (16) Local government Areas in the State and is one of the local government Areas that constitute Ilorin metropolis. The total numbers of the respondents for the study consist of 105 breeders which were randomly selected from seven communities in Kwara State. Nigeria.

The climate smart small ruminant production practice was measured on a scale of Yes and No where: Yes = 1 and No = 0. In order to determine the respondents' Status/Level of use of climate smart small ruminants' production practices, any respondents that utilized at least 18 of the climate smart small ruminants production practices (represents more than 50 %) of the practices is considered as High Status while any respondent that used less than 18 of the climate smart small ruminants production practices (represents less than 50 %) is considered as Low Status. For Binary Logistic regression analysis, any respondent that utilized at least 18 (represents 50 % and above) of the climate smart small ruminant production practices was assigned a qualitative value of 1 and any respondent that utilized less than 18 of the practices (represents less than 50 %) was assigned a qualitative value of 0. The factors were measured using three-point Likert type scale of Not a Factor = 1, Less Severe = 2, Highly Severe = 3. Descriptive statistics such as frequency counts, percentage and means were used to analyse the finding of the study. The Binary logistic regression and Pearson product moment correlation (PPMC) was used for the inferential statistics.

Results and Discussion

The Socio-economic Characteristics of the Respondents

The result in Table 1 showed that 60% of the breeders were females. This implies that small ruminant production is dominated by females in the study area. This result is in contrast with the findings of Banjoko, *et al.*, (2021) who reported that about 57.5 % of the breeders in Moro LGA of Kwara State, Nigeria were males. The result also showed that the mean age of the breeders was 35.3 years. This implies that the small ruminant breeders were relatively young and agile. The result in table 1 showed that most (75.2%) of the respondents were married. About 47.6% had secondary education and about 28.6% had tertiary education. This implies that majority of the respondents were expected to be able to use the climate smart practices that require some level of literacy. Islam as indicated by 73.3% of the respondents as the dominant religion in the study area.

The mean years of experience in small ruminants' breeding practices were 7 years. The mean annual income of the respondents was N67, 272.38. This implies that small ruminant production is an important source of income for the breeders which could be combining with other supportive occupations. This result is in agreement with the findings of Banjoko, Ifabiyi, Komolafe and Opeyemi (2021) who reported that the mean annual income of

goat breeders was N65, 447.62. Slightly above half (58.1%) of the respondents do not belong to any social group/cooperative society. The main supportive occupation was trading (51.4%) and crop farming (18.1%). The result in Table 1 also showed that 81% of the respondents' rear both sheep and goat while few only rear sheep (4.8%) and goat (14.3%). This means that most of the small ruminant breeders in the study area mainly rear both sheep and goat together. The mean number of small ruminants reared was 29 goats and 27 sheep. This shows that the breeders were smallholders. Furthermore, the main rearing system was semi-intensive system (64.8%). This may be attributed to the small number animal reared by respondents. Previous study in North central zone of Nigeria by Onuwa, Sunday, Ademiluyi and Chizoba (2020) reported that semi-intensive system of rearing small ruminant animal was the main system of rearing small ruminants among the smallholder farmers. The breeders' main motive for production were for financial purpose (42.9%), consumption (17.1%) and for both financial and consumption purposes (40%). This implies that some of the small ruminant farmers in the study area had entrepreneurial mindset in engaging in the production for sales/commercial purpose. The main source of credit/finance was through personal savings (81.9%). About 67.6% of the breeders had no access to agricultural extension services in the study area. The implication of this is that breeders have inadequate access to extension services as the extension service delivery on small ruminants is inadequate in the study area. Poor extension contact was also reported by Onuwa, Sunday, Ademiluyi, and Chizoba (2020) as the major constraint to adoption of climate smart agriculture for goat production in Plateau State.

Table 1. **The Socio-economic Characteristics of the Respondents**

Variables	**Frequency (n=105)**	**Percentage**	**Mean (SD)**
I. Gender			
Male	42	40.0	
Female	63	60.0	
II. Age (years)			**35.3 Years** (7.858)
30 and below	25	23.8	
31 – 40	62	59.0	
41 – 50	14	13.3	
51 – 60	3	2.9	
61 and above	1	1.0	
III. Marital Status			
Single	25	23.8	
Married	79	75.2	
Separated	0	0.0	
Widowed	1	1.0	
Divorced	0	0.0	
IV. Educational Level			
No formal	11	10.5	
Primary	14	13.3	
Secondary	50	47.6	
Tertiary	30	28.6	

V. Religion affiliation			
Christianity	28	26.7	
Islam	77	73.3	
VI. Annual Income from rearing of ruminant			67,272.38 (12,926.971)
≤ 100,000	94	89.5	
100,001 - 300,000	6	5.7	
300,001 – 600,000	4	3.8	
≥ 600,001	1	1.0	
VII. Years of Breeding Experience			7 Years (5.311)
≤ 3	31	29.5	
4 – 6	39	37.1	
7 – 9	2	1.9	
≥ 10	33	31.4	
VIII. Household Size			6 Persons (2.296)
≤ 3	16	15.2	
4 – 6	72	68.6	
7 – 9	14	13.3	
≥ 10	3	2.9	
VIX. Membership of social group/cooperatives			
Yes	44	41.9	
No	61	58.1	
X. Other supportive occupation			
Cultivation of Crop	19	18.1	
Trading	54	51.4	
Civil servant	14	13.3	
Artisan	17	16.2	
None	1	1.0	
XI. Small Ruminant type			
Sheep	5	4.8	
Goat	15	14.3	
Sheet and Goat	85	81.0	
XII. Herd size			
Number of Goat:			29 (43.721)
≤ 50	97	92.4	
51 – 100	4	3.8	

101 – 150	0	0.0	
≥ 150	4	3.8	
Number of Sheep:			27(82.099)
≤ 50	98	93.3	
51 – 100	1	1.0	
101 – 150	1	1.0	
≥ 150	5	4.8	
Total herd size			
≤ 50	95	90.5	
51 – 100	1	1.0	
101 – 150	2	1.9	
≥ 150	7	6.7	
XIII. Breeding system			
Intensive system	18	17.1	
Semi-intensive system	68	64.8	
Extensive system	19	18.1	
XIV. Main Motive for Breeding			
Financial	45	42.9	
Family consumption	18	17.1	
Financial and family consumption	42	40.0	
XV. Sources of credits			
Personal Savings	86	81.9	
Family/neighbor	4	3.8	
Friends	2	1.9	
Cooperative society	9	8.6	
Bank	4	3.8	
XVI. Access to extension services			
Yes	34	32.4	
No	71	67.6	

Source: Field survey (2021).

Climate Smart Small Ruminant Production Practices

The results in Table 2 showed that about 90% of the respondents were used provision of medication to sick animals, cultivation of crops along with rearing of animals (90.5%), feeding with supplementary feeds, isolation of sick animals and vaccination of animals (92.4%), provision of shade through Planting of trees to reduce heat stress (93.3%), use of crop residues as feeds and, building and maintenance of pens (96.2%) and grazing on pasture/grassland (97.1%). This implies that small ruminant farmers in study have accepted the reality of climate change and its adverse effects on small ruminant production. This assertion is in accordance with Ojo and Baiyegunhi, (2020) and Onuwa *et al.* (2020) who support the use of climate smart practices

because climate change has led to the reduction in flock performance through high infestation of pest and diseases, drought and scarcity of grazing land.

Table 2. Climate smart small ruminant production practices used among respondents

Climate Smart Practices	Yes	
	Frequency	Percentage
Production Practices		
• Rears high quality breed	81	77.1
• Feeding with supplementary feeds	97	92.4
• Grazing on pasture/grassland	102	97.1
• Provision of salt lick	53	50.5
• Hay production	51	48.6
• Silage production	80	76.2
• Care and management for new born animals	90	85.7
• Deworming	93	88.6
• Vaccination	97	92.4
• Provision of medication to sick animals	95	90.5
• Feeding with crop residues	101	96.2
• Building and maintenance of pens	101	96.2
• Provision of clean water	69	65.7
• Regular cleaning of pen/house	58	55.2
• Record keeping	52	49.5
• Daily cleaning of all feeding and drinking equipment	80	76.2
• Rotational grazing	94	89.5
• Dipping/spraying to control tick, flies, mites and lice	90	85.7
• Isolation of sick animals	97	92.4
• Castration of animals	90	85.7
• Milk extraction and processing	37	35.2
Adaption/Resilience Practices		
• Provision of shade through Planting of trees to reduce heat stress	98	93.3
• Use of weather forecasting information	28	26.7
• De-stocking during dry season	94	89.5
• Storage of grass for the dry-season	91	86.7
• Rears more than one species	92	87.6
• Diversify livelihoods/supportive occupations	93	88.6
• Stocks tolerant species	91	86.7
• Farm insurance	73	69.5
• Cultivation of crops along with rearing of animals	95	90.5
• Membership of association/social group/cooperative societies	44	41.9
Mitigation/greenhouse gas reduction Practices		

• Regular compositing of dropping to prevent release of greenhouse gases	53	50.5
• Feeding the animals with grains and concentrates	56	53.3
• Daily removal of droppings from pens	87	82.9
• Regular disinfection/fumigation of pens	87	82.9
• Bury dead animals immediately	89	84.8

Source: Field survey (2021)

Status of Climate Smart Small Ruminant Production Practices

The result in Figure 1 showed that about 90.5% of the breeders used the climate smart small ruminant production practices to adapt and mitigate the effect of climate change on their production in the study area. This might be attributed to the fact that majority of the respondents have high literacy level. However, similar study by Onuwa *et al.* (2020) reported low adoption of climate smart practices among farmers rearing goat in Plateau State, Nigeria. Tiamiyu *et al.*, (2017) also reported low rate of utilization of climate smart agricultural techmiques.

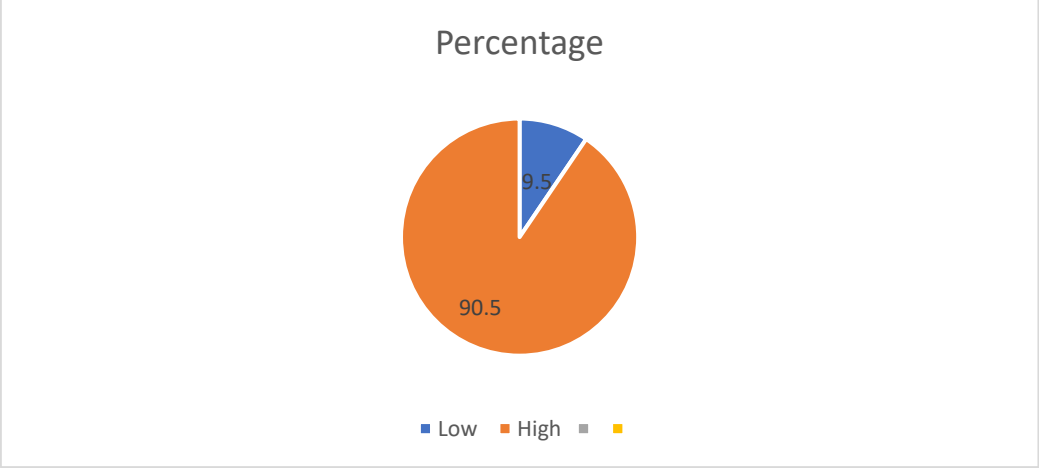

Figure 1. Status/Level of Use of Climate Smart Small Ruminant Production Practices among Respondents

Factors affecting Small Ruminant Production

The results in Table 3 showed that outbreak of disease and high mortality (mean=2.07) was ranked first, inadequate information/extension services (mean=2.05) was ranked second, lack of access to high quality breeds (mean=1.91) was ranked third, lack of grass during the dry season (mean=1.92), unavailability of modern equipment (mean=1.82), theft (mean=1.81), lack of start-up capital (mean=1.76), continuous occurrence of drought (mean=1.65), marketing problems (mean=1.53), low demand for the meat (mean=1.52), High cost of production (mean=1.50), inadequate technical know-how (mean=1.44). This result implies that outbreak of disease and high mortality and lack of adequate information/extension services the main factors affecting the breeders.

Table 3. **Factors affecting Small Ruminant Production among Respondents**

Factors	Not a Factor	Less Severe	Highly Severe		
	Freq.(%)	Freq.(%)	Freq.(%)	Mean(SD)	Rank
I. Lack of capital	29(27.6)	72(68.6)	4(3.8)	1.76(0.51)	7th
II. Lack of access of high-quality breeds	19(18.1)	76(72.4)	10(9.5)	1.91(0.52)	3rd
III. Unavailability of modern equipment	37(35.2)	50(47.6)	18(17.1)	1.82(0.70)	5th
IV. Theft	26(24.8)	73(69.5)	6(5.7)	1.81(0.52)	6th
V. Inadequate technical know how	66(62.9)	32(30.5)	7(6.7)	1.44(0.61)	12th
VI. Low demand for the meat	60(57.1)	35(33.3)	10(9.5)	1.52(0.67)	10th
VII. Lack of grass during the dry season	21(20.0)	71(67.6)	13(12.4)	1.92(0.57)	4th
VIII. Inadequate information/extension services	16(15.2)	68(64.8)	21(20.0)	2.05(0.59)	2nd
IX. Incessant occurrence of drought during dry season	50(47.6)	42(40.0)	13(12.4)	1.65(0.69)	8th
X. High cost of production	65(61.9)	27(25.7)	13(12.4)	1.50(0.71)	11th
XI. Marketing problems	61(58.1)	32(30.5)	12(11.4)	1.53(0.69)	9th
XII. Disease outbreak and high mortality	10(9.5)	78(74.3)	17(16.2)	2.07(0.51)	1st

Source: Field survey (2021).

Test of Hypotheses

Hypothesis 1: There is no significant relationship between the socio-economic characteristics of respondents and climate smart small ruminant production practices

The results of Binary Logistic Regression in Table 4 showed that educational level (B=3.985), membership of social group (B=6.083) and access to extension services (B= 13.941) had positive significant relationship with the use of climate smart small ruminant practices among the respondents while years of experience (B= -0.544) indicated inverse relationship with the use of climate smart small ruminant practices among respondents at $p \leq 0.05$ level of significance. The result indicates that higher the respondents' level of education, participation in group/cooperative society and access to extension to extension services, the more the respondents were expected to use of climate smart practices. The result further showed that the longer the respondents' years of experience, the lesser the use of climate smart.

Table 4. The Result of Binary Logistic Regression of the relationship between Socio-economic Characteristics of Respondents and Climate Smart Small Ruminant Production Practices

Variables	B	S.E.	Wald	Sig.	Exp(B)	95% C.I.for EXP(B)	
						Lower	Upper
Constant	15.013	7.297	4.233	0.040	0.000		
Gender	-0.971	1.127	0.743	0.389	0.379	0.042	3.446
Age	0.137	0.144	0.910	0.340	1.147	0.865	1.520

Marital Status	1.284	1.797	0.510	0.475	3.611	0.107	122.293
Educational level	3.985	1.507	6.993	**0.008***	53.808	2.806	1032.009
Religion	1.850	1.655	1.250	0.264	6.360	0.248	162.928
Income	0.000	0.000	3.598	0.058	1.000	1.000	1.000
Experience	-0.544	0.175	9.622	**0.002***	0.580	0.411	0.818
Household size	-0.380	0.534	0.507	0.477	0.684	0.240	1.948
Membership of social group	6.083	2.110	8.311	**0.004***	438.363	7.011	27410.238
Supportive occupation	-0.845	0.652	1.680	0.195	0.429	0.120	1.542
Ruminant type	-0.569	1.201	0.224	0.636	0.566	0.054	5.956
Rearing System	1.118	0.911	1.505	0.220	3.058	0.513	18.237
Main motive	-1.267	0.917	1.912	0.167	0.282	0.047	1.698
Source of credit	0.054	0.463	0.014	0.907	1.056	0.426	2.616
Access to extension	13.941	7.032	3.931	**0.047***	0.000	0.000	8.368

*Significant at $p \leq 0.05$.

Hypothesis 2: there is no significant relationship between the factors to small ruminant production and the usage of climate smart small ruminant production practices

The result of PPMC analysis in Table 5 showed that unavailability of modern equipment (r=0.522), inadequate technical know-how (r=0.367), low demand for the meat (r=0.435), high cost of production (r=0.295) and marketing problems (r=0.406) had positive and significant relationship with the use of climate smart practices while factors such as scarcity of grass during the dry season (r= -0.262) and lack of adequate information/extension services (r= -0.297) indicated inverse relationship with the climate smart practices at $p \leq 0.05$ level of significance. This infers that factors such as unavailability of modern equipment, inadequate technical know-how, and low demand for the meat, marketing problems and high cost of production were the push factors for increased use of climate smart small ruminant production practices in the study area. The results further showed that adequate availability of grass during the dry season and provision of information/extension services will enhance the use of climate smart practices.

Table 5. The Result of PPMC Analysis of the relationship between factors Affecting Small Ruminant Production and the Climate Smart Small Ruminant Production Practices

Factors	R Value	P Value	Remarks
I. Lack of start-up capital	-0.134	0.173	Not Significant
II. Lack of access to high-quality breeds	-0.083	0.400	Not Significant
III. Unavailability of modern equipment	**0.522****	0.000	**Significant**
IV. Theft	0.014	0.886	Not Significant
V. Inadequate technical know how	**0.367****	**0.000**	**Significant**
VI. Low demand for the meat	**0.435****	**0.000**	**Significant**
VII. Lack of grass during the dry season	**-0.262***	**0.007**	**Significant**
VIII. Inadequate information/extension services	**-0.297****	**0.002**	**Significant**
IX. Incessant occurrence of drought	0.126	0.200	Not Significant

during dry season			
X. High cost of production	**0.295****	**0.002**	**Significant**
XI. Marketing problems	**0.406****	**0.000**	**Significant**
XII. Disease outbreak and high mortality	0.003	0.979	Not Significant

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

Conclusion

Small ruminant production in the study area is dominated by females. The mean age of the breeders was 35.3 years. Majority of the breeders have formal education. The mean years of experience in breeding were 7 years. The mean annual income of the breeders was ₦67, 272.38. Slightly above half of the respondents do not belong to any social group/cooperative society. The main supportive occupation of the respondents was trading and crop farming. There is high status on use of climate smart small practices. Outbreak of diseases and high mortality, inadequate information/extension services and lack of high-quality breeds were the main factors limiting the breeders. The determinants of use of the climate smart small ruminant production practices among the breeders were level of education, participation in group/cooperative society activities, access to extension services and years of breeding experience. The factors such as unavailability of modern equipment, inadequate technical know-how, low demand for the meat, marketing problems and high cost of production were the push factors for increased use of climate smart practices in the study area.
The author recommends;

1. Government should enhance the breeders' access to agricultural extension services.
2. Breeders should be continuously exposed to climate smart technologies so as to effectively adapt to climate change.
3. There is need for provisions of veterinary services, credit facilities and inputs so as reduce the constraints affecting small ruminant famers.

Conflict of Interest

The authors declare that they have no conflict of interest.

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