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Author Affiliation:
Department of Agricultural Technology, The Oke-Ogun polytechnic, Saki Oyo State, Nigeria

*Corresponding author
Department of Agricultural Technology, The Oke-Ogun polytechnic, Saki Oyo State
Nigeria
Email: eniolaphenol@gmail.com

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Effect of *Hyptis suaveolens* prevalence on pasture availability for cattle production in the selected derived and rainforest agro-ecological zones of Nigeria

Eniola PO*, Jimoh AR, Babatunde KM, Ayandele Bukola

ABSTRACT

Availability of adequate feeds for Cattle production results in increased income and reduce disease infections. Thus, the study examined the effect of H*yptis suaveolens* on feed availability for Cattle production in the selected derived savannah and rainforest agro-ecological zones of Nigeria. Multi-stage sampling procedure was used to select 20% of Cattle herders from the population of 950 (190) from the derived savannah and 413 (83) from the rainforest zone to give 273 as sample size. The findings reveal that the mean age of the respondents were 42 years, mostly male and married. Majority (87.9%) of them had free range as source of feeding their Cattle while, *Hyptis suaveolens* greatly prevented proliferation of pastures, increased the cost of keeping Cattle and forced their Cattle to eat the tender parts of *Hyptis spp* as reported in the derived savannah zone by 74.7%, 73.7% & 86.3% respectively. Burning of bush (86.3%) and use of herbicides (86.3%) were used as coping strategies by Cattle herders to suppress proliferation of *Hyptis spp*. Average proportion of respondents in the rainforest zone affirmed that pastures were adequately available for Cattle production while 70.0% in the derived savannah zone stated that pastures were not adequately available for Cattle. Significant differences existed between the effect of *Hyptis spp* on Cattle production in the two zones examined ($P < 0.05$) and adequacy of pastures availability for Cattle in the two zones ($P < 0.05$). Campaign against bush burning should be encouraged while pasture seeds should be adequately provided for the Cattle herders until intensive system of keeping Cattle are embraced.

Keywords: *Hyptis suaveolens* prevalence, pasture availability, bush burning, herbicides, Cattle herders

1. INTRODUCTION

Cattle production in Nigeria mainly rely on natural pastures existing on non-agricultural lands which consists of the following; *Andropogon gayanus, Andropogon tectorum, Braciaria decumbens, Cenchrus ciliaris, Chloris gayanus, Cynodon plectostachyus, Centrosema pubescens, Cynodon dactylon, Stylosanthes guianensis, Panicum maximum,* among others. These pastures are distributed in different ecological zones of Nigeria (Onifade and Agishi, 1974; Eniola et al., 2022). Most of these pastures have been dominated by invasive weed mainly *Hyptis suaveolens* commonly called Curry leaf.

Hyptis suaveolens (L.) is among the most damaging of the invasive species invading a wide range of ecosystems in tropical and sub-tropical regions in the world (Padalia et al., 2014). *Hyptis suaveolens* is an annual herbaceous plant belonging to the family Lamiaceae. It thrives in high rainfall warm tropical and sub-tropical regions. Also, it can survive in semi-arid areas, where it propagates by means of seed. Optimal growth of *H. suaveolens* is recorded between 25 to 30°C and it can germinate at temperatures between 10 to 40°C (Felippe et al., 1983). In savannah, dominance of *H. suaveolens* is mainly associated with land from which humans have removed the vegetation by burning or over-grazing (Wulff, 1987). It grows rapidly in cultivated fields and disturbed sites, especially where mechanized farming and intense cattle grazing are practised (Holmes, 1969). This plant also grows along roadsides and watercourses. It has a strong tendency to grow abundantly in open woodlands and rangelands. The release of unpleasant scent makes it unpalatable for livestock and partly accounts for its abundance over a broad ecological range. The proliferation of Hyptis is characterized by some morphological features that enable it to grow in poor quality soils, such as the small size of its seed, seed dimorphism, auto gamic and allogamic reproduction and vigorous growth from perennating rootstocks (Raizada, 2006).

Climate change has resulted in desertification; drought and loss of biodiversity has compelled cattle pastoralist to start looking for more conducive environment where their cattle can get fresh feeds and water (International Crisis Group, 2017). This movement became more worrisome and when the pastoralists and non-citizens of the countries from especially Mali, Niger, Cameroon, Chad among others occupied reasonable areas of land across the country without recourse to the implications on the availability of feed and water resources (International Crisis Group, 2017). This action resulted into various forms of conflicts among farmers and the herdsmen thereby leading to loss of live and farm (International Crisis Group, 2018; Eniola et al., 2016). Curry leaf has prolific seed production (Raizada, 2006), easy dispersal (Parsons and Cuthburtson, 2000) and phenotypic plasticity means this species can colonize many habitats (Sharma and Raghubanshi, 2009). It produces a dense growth and releases allelochemicals, which inhibit the germination of the seeds and growth of indigenous species and reducing the prevalence of native pasture species found in the grasslands of the derived savanna zones of Nigeria. However, little literatures are available on the effect of *H suaveolens* prevalence on pasture availability for Cattle production in selected Derived and Rainforest agro-ecological zones of Nigeria, hence this study.

The general objective of this study was to assess the effect of Hyptis spp prevalence on pasture availability for Cattle production in the selected derived and rainforest agro-ecological zones of Nigeria. The specific objectives were to: Identify personal characteristics of the Cattle herders in the study area; identify the source of feeds for Cattle production in the study area; assess the effect of *Hyptis spp* proliferation on Cattle production in the study area; determine the coping strategies of Cattle herders in suppressing *Hyptis spp* proliferation in the study area and; determine the adequacy of feed availability in the study area.

2. METHODOLOGY

Multi-stage sampling procedure was used to select Cattle herders from the population of the Cattle herders in the study area. Two agro-ecological zones were randomly selected from the six zones in Nigeria; derived savannah and rainforest zones. Parts of Oyo and Kwara states that fall within derived savannah and less city were purposively selected. Also, parts of the local government areas (LGA) in Oyo and Osun States that fall within the rainforest and less city were purposively selected for the study. Fourteen LGAs in Oyo and 11 LGAs in Kwara State representing the derived savannah zone; 18 LGA in Osun State and 6 LGA in Oyo State representing the rainforest zone. List of the registered Cattle herders was collected from the local government areas and 20% from their population were randomly selected. Derived savannah 950 (190), rainforest zone 413 (83). The sample size for the study was 273. Data was collected using interview schedule which was pretested and validated as reliable data collection. Frequency counts, percentage, mean, standard deviation, chis-square and analysis of variance were used to analysis the data.

Personal characteristics of the respondents

Table 1 shows that the mean age of the respondents was 42 years while about 37.6% and 36.8% of the respondents fell between 41 and 50 years of age in the rainforest and derived Savannah zones respectively. This implies that majority of respondents were in their productive and active age. Majority 87.9% and 98.2% of the respondents were male and married in the study area respectively.

The findings of Adekola et al., (2021) show that the mean age of the Cattle herders was 43 years and mostly male. However, 86.7% and 87.3% of the respondents had between 6 and 10 households in the rainforest zone and 88.4% of the respondents in the derived savannah zone had between 16 and 20 households. It further reveals that 38.6% of the respondents had between 11- and 20-years' experience in Cattle production in the rainforest while 43.3% had between 21 & 30 years of experience in the derived savannah agro-ecological zone.

Table 1 Distribution of Respondents on their Personal Characteristics (N=273).

	Rainforest 83		Derived (190)		Total		Mean	SD
Age	F	%	F	%	F	%		
Below 20yrs	-				-	-		
20-30yrs	21	25.5	44	23.2	65	23.8		
31-40yrs	10	12.1	26	13.7	36	13.2	42.0	12.5
41-50yr	31	37.6	70	36.8	101	36.9		
51 and above	21	25.3	50	26.3	71	26.0		
Sex								
Male	72	86.7	168	88.4	240	87.9		
Female	11	13.2	22	11.6	33	12.1		
Marital status								
Single	5	6.1	-	-	5	1.8		
Married	78	93.9	190	100	268	98.2		
Years of Experience								
≤10yrs	31	37.3	54	28.4	85	31.1		
11-20yrs	32	38.6	48	25.3	80	29.3		
21-30yrs	20	24.1	88	43.3	108	39.6	13.8	6.0
31 and above	-	-	-	-	-	-		
Household size								
1-5	-	-	-	-	-	-		
6-10	72	86.7	10	5.3	82	30.0		
11-15	11	13.3	12	6.3	23	8.5	17	4.9
16-20	-	-	168	88.4	168	61.5		
21 and above	-	-	-	-	-	-		
Level of Education								
Non formal	72	86.7	168	88.4	240	87.7		
Quranic school			-	-	-	-		
Primary			22	11.6	-	-		
Secondary	11	13.3	-	-	32	11.7		

Source of feed for Cattle production in the study area

Table 2 shows that (87.9%) of the respondents had free range as source of feed in the study area while 94.5% and 74.7% of the respondents did not make use of concentrate as source of feeds for their Cattle in the rainforest and derived Savannah agro-ecological zones respectively. About 88.6% and 87.9% of the respondents neither bought fodder nor possessed pasture land for the feeding of their Cattle in the study area. Only 25.3% of the respondents received feeds support from the government as supplements. This implies that most Cattle herders made use of free range with little supporting feeds from the government. This may not solve the feed needs of Cattle and may eventually compel them to be looking for feeds elsewhere. ORFFA, (2022) infers that the major source of feeds for Cattle production in Nigeria consist of the rangeland, crop residues and collected fodder.

Table 2 Distribution of Respondents on Source of feed for Cattle production in the study area

S/N	Source of feeds	Rainforest 83				Derived 190				Total 273			
		Yes		No		Yes		No		Yes		No	
		F	%	F	%	F	%	F	%	F	%	F	%
1	Free range	72	86.7	11	13.3	168	88.4	22	11.6	240	87.9	33	12.1
2	Making use of concentrates	5	6.0	78	94.5	48	25.3	142	74.7	53	19.4	220	80.6
3	Buy fodder	11	13.3	72	86.7	20	10.5	170	89.5	31	11.4	242	88.6
4	Possessed a Pasture land	11	13.3	72	86.8	22	11.6	168	88.4	33	12.3	240	87.9
5	Supporting feeds from the government as supplement	21	25.3	62	74.7	48	25.3	142	74.7	69	25.3	204	74.7

Effect of *Hyptis suaveolens* on Cattle production in the study area

Table 3 reveals that (74.7%, 73.7% and 86.3%) of the respondents affirmed that it greatly prevented proliferation of pastures, increased the cost of keeping Cattle and forced their Cattle to eat the tender parts of the weed (*Hyptis spp*) in the derived Savannah zone, respectively. Also, (74.7%, 74.7% and 72.6%) of the respondents indicated that presence of *Hyptis spp* seriously prevented the growth of pastures, encouraged farm land invasion and promoted trekking long distance everyday so as to get pasture to feed their Cattle in the derived Savannah zone, respectively while 86.3% and 74.7% of the respondents revealed that the presence of *Hyptis spp* led to inadequate pastures which made their Cattle to be prone to pests and diseases in the derived Savannah zone respectively. However, in the rainforest agro-ecological zone, it reveals that 85.5%, 87.9% and 75,2% of the respondents stated that the presence of *Hyptis spp* did not increase the cost of keeping Cattle, their Cattle did not eat the tender parts of the weed and did not prevent the growth of pasture respectively. Also, 75.9% and 75.9% of the respondents acknowledged that the presence of *Hyptis spp* on every land did not encourage farm land invasion and it did not promote trekking long distance everyday with their Cattle to get pasture, respectively. This implies that the Cattle herders in the derived savannah zone experienced negative effects of *Hyptis spp* than those in the rainforest zone. Raizadam (2006) discloses that *Hyptis suaveolens* is an invasive plant that suppress other herbs in the environment.

Table 3 Distribution of Respondents on Effect of *Hyptis suaveolens* in Cattle Production in the Study Area

		Rainforest n= 83			Derived n= 190			Total n= 273			
S/N	Effect	Great Effect	Mild Effect	No Effect	Great Effect	Mild Effect	No Effect	Great Effect	Mild Effect	No Effect	Mean
		F %	F %	F %	F %	F %	F %	F %	F %	F %	
1	It prevents proliferation of pastures	20 24.1	43 51.8	20 24.1	142 74.7	48 25.3	- -	162 59.3	91 33.3	20 7.3	2.00
2	It increases the cost of keeping Cattle	10 12.1	2 2.4	71 85.5	140 73.7	42 22.1	8 4.2	150 54.9	44 16.1	79 28.9	2.62
3	It forces our Cattle to eat the tender parts of the weed	- -	10 12.1	73 87.9	164 86.3	26 13.7	- -	164 60.1	36 13.2	73 26.7	2.74
4	It prevents the growth of	10 12.1	11 13.3	62 74.7	142 74.7	48 25.3	- -	152 55.7	59 21.6	62 22.7	2.12

	pastures.										
5	The prominence of *Hyptis spp* on every land encourages farm land invasion	10 12.1	10 12.1	63 75.9	142 74.7	26 13.7	22 11.6	152 55.7	36 13.2	85 31.1	2.62
6	It promotes trekking long distance everyday with our Cattle so as to get pasture	10 12.1	10 12.1	63 75.9	138 72.6	26 13.7	26 13.7	148 54.2	36 13.2	89 32.6	2.62
7	Inadequate pastures make our Cattle to be prone to pests and diseases.	11 13.3	62 74.7	10 12.1	164 86.3	26 13.7	- -	175 64.1	88 32.2	10 3.66	2.87
8	It promotes conflicts with farmers.	- -	52 62.7	31 37.3	142 74.7	22 11.6	26 13.7	142 52.0	74 27.1	57 20.9	2.75

Level of the effect of *Hyptis suaveolens* prevalence on Cattle production in the study area

Table 4 shows the effect of *Hyptis suaveolens* prevalence on Cattle production in the study area. Majority of the respondents (84.3%) in the rainforest zone had low level of the effect of *H suaveolens* prevalence on Cattle production. However, 88.4% of the respondents in the derived savannah zone had high level of the effect of *H suaveolens* prevalence in Cattle production. This implies that Cattle herders in the derived savannah zone had a bad experience of the prevalence of *H suaveolens.*

Table 4 Level of the effect of *Hyptis suaveolens* prevalence on Cattle production in the study area

S/N	Level of effect	Scores	Derived savannah Mean score=9.9 Std. dev.=0.4	Rainforest Mean score=9.0 Std. dev.=0.5
1	Low	0-9.4	22 (11.6)	70 (84.3)
2	High	9.5-16	168 (88.4)	13 (15.7)

Coping strategies of Cattle herders in suppressing *Hyptis suaveolens* in the study area

Table 5 shows that 86.3% of the respondents attested that they always burnt the bush while 86.3% of them made use of herbicides as a coping strategy to suppress the spread of *Hyptis spp* in the derived Savannah agro-ecological zone. However, 100%, 86.8%, 86.8% and 100% of the respondents rarely planted pastures, cut and also sold the plant for other users on a large scale respectively in the study area. This implies that those burning and using chemicals to reduce the invasion of *Hyptis spp* are still destroying the environment. The act of burning and use of chemical breaks its dormancy and may still increase *Hyptis spp*. existence in the subsequent year. (Mishra, 2021; Kuhnt et al., 1995) avowed that medicinal significance of *Hyptis suaveolens* cannot be overlooked.

Table 5 Distribution of Respondents on Coping strategies of Cattle herders in suppressing proliferation of *Hyptis suaveolens* in the study area

		Rainforest 83			Derived 190			Total 273		
S/N	Coping strategy	Always F %	Occasion F %	Rarely F %	Always F %	Occasion F %	Rarely F %	Always F %	Occasion F %	Rarely F %
1.	Burning the bush	- -	10 12.1	73 87.9	164 86.3	3.13 13.7	- -	82 31.5	33 12.7	145 55.8
2.	Planting of Pastures	- -	- -	83 100	- -	- -	190 100	- -	- -	273 100
3.	Cutting of the plant	10 12.1	- -	73 87.9	26 13.7	- -	164 86.3	36 13.2	- -	237 86.8
4.	Use of herbicides	10 12.1	- -	73 87.9	- -	164 86.3	26 13.7	10 3.7	- -	99 36.3
5.	Using the plant as medicine	10 12.1	- -	73 87.9	- -	26 13.7	164 86.3	10 3.7	26 9.5	273 100
6.	Selling the plant for other users on a large scale.	- -	- -	83 100	- -	- -	190 100	- -	- -	83 30.4

Adequacy of pasture availability for Cattle production in the study area

Table 6 reveals that the average (50%) proportion of the respondents in the rainforest zone said that pastures were adequately available for Cattle production while 70.5% of the respondents in the derived Savannah zone stated that pastures were not adequately available for Cattle production. Sikiru, (2016) opined that feeds resources availability is not in excess for livestock consumption in Nigeria.

Table 6 Distribution of Respondents on adequacy of pastures availability for Cattle production in the study area

S/N	Adequacy of pastures	Rainforest n=83		Derived n=190		Total n=273	
		F	%	F	%	F	%
1	Very adequate	42	50.6	-	-	83	30.4
2	Moderately adequate	41	49.4	56	29.5	138	50.5
3	Not adequate	-	-	134	70.5	67	24.5

Test of significant difference between the coping strategy of Herders against prevalence of *Hyptis spp* in the rainforest and derived savannah of the agro-ecological zone

Table 7 shows that there was a significant difference between the coping strategy of Herders against prevalence of *Hyptis spp* in the rainforest and derived savannah of the agro-ecological zone at ($X=260.0$, $P < 0.05$). This implies that coping strategy of Herders against prevalence of *Hyptis spp* in the rainforest and derived savannah differs and this will eventually influence how they will source feed for Cattle production.

Table 7 Difference between the coping strategy of Herders against prevalence of *Hyptis spp* in the rainforest and derived savannah of the agro ecological zones.

	Xvalue	Df	Significance
Pearson chi square	273.00	1	0.002
Likelihood Ratio	207.858	1	0.000
Linear by linear Association	272.00	1	1.004

No of valid cases	273		

Test of significant difference between the source of feed for Cattle production in the rainforest and derived savannah zones

Table 8 shows that there is no significant difference between the source of feed for Cattle production in the rainforest and derived savannah at (t=17.788, P > 0.05). This implies that the source of feed for Cattle production in the rainforest and derived savannah zones were the same.

Table 8 Difference between the source of feed for Cattle production in the rainforest and derived savannah zones

	Sum of square	Df	Mean square	t	Sig.
Between Groups	28.062	1	28.062	17.788	0.056
Within Groups	0.07	271	0.060		
Total	28.062	272			

T-test of difference between the effect of *Hyptis spp* prevalence in Cattle production in the rainforest and derived savannah zones

Table 9 shows that there was significant difference between the effect of *Hyptis spp* in Cattle production in the rainforest and derived savannah zones at (P < 0.05). This implies that the effect of *Hyptis spp* prevalence in Cattle production in the rainforest and derived savannah zones differs. The derived Savannah agro-ecological zones had more negative effect of *Hyptis spp* in Cattle production than the rainforest zones. Thus, the more the negative effect, the more conflicts will result and the more their Cattle will suffer from pest and diseases.

Table 9 Significant difference between the effect of *Hyptis spp* in Cattle production in the rainforest and derived savannah zones

Agro-ecological zone	t	Df	Sig. (2-tailed)
Rain forest	5.1	1	0.007
Derived savannah	4.1	1	0.014

Test of significant difference between the adequacy of pasture availability for Cattle in rainforest and derived zones

There was significant difference between adequacy of pasture availability for Cattle in rainforest and derived zones at (< 0.05). This implies that there were more adequate pastures availability for Cattle production in the rainforest zone than in the derived Savannah agro- ecological zone of Nigeria. Thus, if the trend continues, there may be more influx of Cattle to the rainforest zone and this may further lead to more conflicts, banditry and desertification.

Table 10 Difference between the adequacy of pasture availability for Cattle in rainforest and derived zones

Agro-ecological zone	t	Df	Sig. (2-tailed)
Rain forest	9.2	1	0.002
Derived savannah	7.6	1	0.017

3. CONCLUSION AND RECOMMENDATIONS

The study concluded that most Cattle herders made use of free-range system as source of feeds for Cattle production with little supporting feeds from the government. Bush burning and the use of herbicides were the coping strategies used to suppress proliferation of *Hyptis spp* in the derived savannah zone. More pastures were adequately available for Cattle production in the rainforest zone and not adequately available in the derived savannah zone. Cattle herders in Savannah zone had greater negative effects of *Hyptis spp* than those in the rainforest zone. Arising from the above; weeds control experts should see to how *Hyptis spp* can be reduced or eradicated. Intensive system of keeping Cattle should be encouraged and supported by the government. Burning and the use of chemicals indiscriminately should be discouraged among Cattle herders. The three tiers of government; namely, federal, State and LGAs are encouraged to further give incentives such as pasture seeds to the Cattle herders and should also involve in its multiplication. There should be campaign to discourage the act of bush burning but use of selective herbicides that has little or no effects on the soil.

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Informed consent
The details of study explained to all participants. Oral informed consent was obtained from all the participants.

Ethical approval
Not applicable.

Conflicts of interests
The authors declare that there are no conflicts of interests.

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Data and materials availability
All data associated with this study are present in the paper.

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