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Effects of Seasonal Changes on Performance of Laying Birds in Borgu Local Government Area of Niger State

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Abstract: *Structured questionnaire was used to elicit information on the perception of 20 randomly selected commercial poultry farmers about climate change in Borgu Local Government Area of Niger State. The study's aim was to identify the climate change parameters on egg production, determine the effect of climate changes on egg production; evaluate egg production trend since 10 years past and evaluate the severity of climate change on egg production while the hypothesis tested the significant relationship between climate change and egg production. Data collected were analyzed using frequencies counts and percentages. The relationships between climate parameter changes and egg productivity were established using correlation procedure of SPSS. Secondary data of climatic parameters from meteorological station of National Institute of Freshwater Fisheries Research, New-Bussa was also utilized for the study. Temperature (^{0}C), relative humidity (%), rainfall (mm) and open pan evaporation (mm) were the climatic elements used in this study. Most of the poultry farms in this study are situated in Dogo-geri (70.0%).The results revealed that 55% of the farms had been in production for 15 years and above. Only one farm recorded less than 40% percent production in 2008 and 2009. The trend of egg production shows an increase along the years. In the year 2000, 81.8% of the farms recorded between 40-69% production while 95.0% recorded 70% egg production and above in 2009. Prolonged dry spell and drying of water sources was observed as very severe by 25.0% and 40.0% of the respondents, respectively. Improved housing design (10.0%) as well as good feed and water (20.0%) were favoured by most of the respondents to cope with climate change. However, majority (60.0%) use combination of strategies to cope with climate change. The Correlation between yearly productivity of eggs and the effects of climate change on egg production in this study did not follow any specific pattern. Commercial egg producers are negatively affected by changing climate. Livestock insurance as well as provision of social amenities and availability of ecological fund had been suggested by the farmers as government intervention to prevent adverse effect of climate change on egg production. This research recommends that decisions on the policies, programmes and eligibility procedures concerning the Adaptation Fund should be expedited to provide additional resources required by Nigeria for climate adaptation.*

Key Words: *seasonal change, favourable season, laying birds, egg production, New-Bussa*

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I. Introduction

Egg production industry has continued to be the major livestock industry in Nigeria. Egg production is a major index of performance of commercial poultry business in Nigeria (Jull, 1988 and Apata, 2006). Oluyemi and Robert (1979) reported that egg accounts for about 90% of the income from poultry industry. Egg production continues to record a steady rise because eggs are universally accepted and are no discriminated against as there are only fewer religious or social taboos associated with them than there are with products of other livestock (Smith 1995). Osinowo (1998) observed that apart from the provision of direct employment and a livelihood to thousands of people, the laying hen industry provides a remarkably high quality nutritious food especially animal protein in discrete convenient and handy packets known as eggs. Carnagey (2005) reported that egg had been recognized as one of the best ways of supplying good quality animal protein for human consumption to fulfil their nutrient requirement. It also asserted that every part of an egg is useful for one thing or the other even the by-product, the shell can be used for fertilizer. Egg contains vitamin A and D, thiamin and riboflavin in substantial amount (Jull, 1988). Economic losses associated with egg production are important when evaluating the profitability of the commercial poultry layer industry. This is largely associated with environmental/climatic factors which causes shell defects or results in deteriorated internal quality and hence reduce the shelf life of the egg. Apart from the economic loss, this also have far reaching effects on the health of the consumers. In Germany, 8% of the total table eggs produced are lost to these incidences of egg cracks

(Folkers 1976). This could have resulted from climatic change. Hunton (1982) reported a loss of 13 billion of eggs estimated at $667 million/annum in the World's 22 leading egg producing countries while Roland (1998) put the total economic losses as high as $478 million in the US alone.

If the needed animal protein is to be made available to the populace, then the dire need to cut down avenues of losses in egg production due to climate changes becomes paramount as we increase egg production numerically. Hence it is important to evaluate the losses associated with climate change in egg production in a developing country like ours with huge food deficit. This will provide records which will assist extension policy makers to rise up more efficiently to the challenges of climate change. Poultry products especially egg represent important food for improving nutritional and health status, particularly for at-risk population like children, pregnant women and weakened persons (Olaniyi*et al.,* 2004). Egg is a reference sample food, perfectly balanced, containing most essential amino acids and important minerals like calcium, potassium, magnesium, iron and zinc including vitamins A and B complex. Daghir (2008) identified diseases, feed and feeding, husbandry practices, breeding and marketing as the constraints to poultry production in Nigeria. All these are influenced greatly by climate changes.

Climate change is emerging as one of the most important challenges of the 21st century. Since 1850, 1995-2006 ranked among the 12 warmest years of global surface temperature. According to the recent report of the Inter-governmental Panel on Climate Change (IPCC) (2001), more intense and longer droughts have been observed over wider areas since the 1970s, particularly in the tropics and subtropics. The frequency of heavy precipitation events has increased over most land areas, and widespread changes in extreme temperatures have been observed over the last 50 years. Recent trends show a tendency towards greater extremes: arid or semi-arid areas in northern, western, eastern and parts of southern Africa are becoming steadily drier and increased magnitude and variability of precipitations and storms.

Climate change is a change in the statistical distribution of weather over periods of time that range from decades to millions of years. It can be a change in the average weather or a change in the distribution of weather events around an average (for example, greater or fewer extreme weather events). Climate change may be limited to a specific region, or may occur across the whole Earth. It can be caused by recurring, often cyclical climate patterns such as El Niño-Southern Oscillation, or come in the form of more singular events such as the Dust Bowl. In recent usage, especially in the context of environmental policy, climate change usually refers to changes in modern climate. It may be qualified as anthropogenic climate change, more generally known as "global warming" or "anthropogenic global warming" (AGW). Climate change is the result of the influence of many factors including the dynamic processes of the Earth itself, external forces including variations in sunlight intensity, and more recently by human activities. External forces that can shape climate are often called climate forcing include such processes as variations in solar radiation, deviation in Earth's orbit, and the level of greenhouse gas concentration (Kolbert, 2006). Some climate models indicate that towards 2050, temperatures in tropical forest areas will increase by up to 2^0C from their 1970 levels. CTA (2008) added that these, combined with predicted rainfall changes and secondary factors such as increased fire and pest outbreaks, could produce severe consequences.

There are a variety of climate change feedbacks that can either amplify or diminish the initial forcing. Some parts of the climate system, such as the oceans and ice caps, respond slowly in reaction to climate forcing because of their large mass. Therefore, the climate system can take centuries or longer to fully respond to new external forcing. Climate change also has indirect effects on poultry production. Higher mean temperature will increase pest developmental rates and fecundity; and the frequency of outbreaks. This increases the range of insect pests and diseases which could affect poultry (and consequently egg) production. Also, alteration in the wind pattern is expected to change the spread of wind borne pests and of bacteria and fungi that are poultry disease agents. Adaptation strategies are fundamental to offset the impact of changes that have either made themselves felt or are widely regarded as inevitable. Hence, of the role of extension in educating the farmers on the adaptation strategies is very crucial. Therefore, this study was carried out to evaluate the effect of climate change on commercial poultry egg production in Niger State. The study will help to direct the focus of extension to the challenges of climate change in egg production in Nigeria.

II. Methodology

Structured questionnaire was used to elicit information on the perception of 20 randomly selected commercial poultry farmers about climate change in New-Bussa area of Niger State. Questions that bother on egg production parameters of poultry farms; observable climatic parameter changes and means by which farmers control the adverse effect of climate change was included in the questionnaire. Data collected were analyzed using frequencies counts and percentages (SPSS, 2008). The relationships between climate parameter changes and egg productivity were established using correlation procedure of SPSS (SPSS, 2008). Secondary data of climatic parameters from meteorological station of National Institute of Freshwater Fisheries Research,

New-Bussa was also utilized for the study. Temperature (^{0}C), relative humidity, rainfall and open pan evaporation were the climatic elements used in this study. The seasonal changes in New-Bussa and the other North-central States in Nigeria were grouped into four seasons: late dry (January-March), early wet (April-June), late wet (July-September) and early dry (October-December).

III. Results and Discussions

Tables 1a and b showed New-Bussa weather report for ten years (2000 – 2009). It was observed that there were wide fluctuations in the climatic parameters over the years. The amount of rainfall received during the early dry season was very scanty and the relative humidity was very low for all the years except for year 2003 that had 81.57% and 62.48% in the morning and evening, respectively. There is occurrence of diurnal temperature changes in all the four seasons. The temperature range in the night is generally lower than that of the day. These changes on its own pose a management problem for the poultry farmers because the requirement for the animal stability changes with temperature regime.

Table 2 poultry production parametersshowed the production parameters of poultry farms in New-Bussa. Most of the poultry farms in this study are situated in Dogo-geri (70.0%). About 55% of the farms had been in production for 15 years and above while 65 % of the respondents are of tertiary education. The respondents were Directors of the farms (25%), Managers (65.0%) and attendants (10.0%). 10 % of these farms kept less than 200 birds in their farms while 50.0% keep 1000 laying birds and above. Isa Brown 50 % is the prominent breeds of laying birds kept in the farms.

Table 3 showed the percentage egg production in ten years. Only one farm recorded less than 40% percent production in 2008 and 2009. The trend of egg production shows an increase along the years. In the year 2000 81.8% of the farms recorded between 40-69% production while 89.5% recorded 70% egg production and above in 2009. Various strategies were adopted by farmers to cope with climate change in the egg production industry. These include improved housing, improved production system (battery cages, deep litter system), medication, heat provision, improved housing design, drug administration, early disposal of the eggs, good feed and water provision, prompt waste disposal, provision of fan, planting of trees for shade, improved storage of eggs and use of improved breeds.

Results in Table 4 revealed that provision of heat as well as good feed and water were favoured by most farmers to cope with climate change as indicated by 15 and 20 % of the respondents respectively. However, majority (55.0%) use combination of strategies to cope with climate change. Only 35.0% of the respondents had access to information on the means to control the effects of climate change. Respondents get information on climate change mostly from personal observation (50%) and through radio (25%). The result also indicates a high dependency on personal observation and radio in the study area.

Table 5 showed the relationship between yearly productivity of eggs and the effects of climate change on egg production in New-Bussa. The relationship between increase in temperature and egg production in the ten years studied was mostly low, negative and non-significant ($P<0.05$). The same trend was also obtained for prolonged dry spell and prolonged rainfall except in 2006 and 2007 where negative and relatively high correlations were obtained between egg productivity and prolonged dry spell. Prolonged rainfall had negative and moderate (-0.501, $P<0.01$) relationship with egg production in 2006. Yearly rainfall beginning early showed a non-significant relationship with egg production in 2002, 2003, 2004, 2005, 2008 and 2009. In 2000 and 2001, the relationship was positive and significant (0.504 and 0.429, respectively).

The yearly rainfall beginning late had a negative and significant relationship with egg production in 2005, 2006 and 2007. The relationship between drying of water source and egg productivity was moderate and negative in 2004 (-0.405, $P<0.05$), 2005 (-0.528, $P<0.01$) and 2006 (-0.421, $P<0.05$). The Correlation between yearly productivity of eggs and the effects of climate change on egg production in this study did not follow any specific pattern. This is possible because of the high variability in the pattern of climatic elements in New-Bussa as shown in Table 1a and 1b.

Table 1a: New-Bussa weather reports for ten years (January-June)

Seasons	Year	Relative humidity		Temperature (0C)		Rainfall	Open pan evaporation
		10am	4 pm	Maximum	Minimum		
Late dry (January- March)	2000	20.71	16.38	35.8	18.7	NIL	NA
	2001	21.06	13.84	33.6	17.97	NIL	10.91
	2002	23.53	17.98	32.69	18.81	9.95	10.41
	2003	71.57	52.48	35.36	19.02	NIL	10.1
	2004	14.59	11.99	32.61	17.26	13.6	13.05
	2005	20.19	15.45	25.01	18.94	NIL	11.57
	2006	16.84	12.33	36.59	17.94	NIL	9.84
	2007	17.02	10.49	33.62	16.03	0.03	11.19
	2008	17.51	12.92	33.17	16.40	NIL	11.19
	2009	11.5	11.1	36.02	16.88	NIL	12.11
Early Wet (April-June)	2000	65.65	39.80	36.2	24.16	13.19	NA

2001	69.07	49.69	34.16	23.74	21.10	10.91
2002	77.69	59.93	35.95	24.90	11.23	9.6
2003	75.10	69.04	35.88	24.04	8.5	8.65
2004	65.67	45.83	34.64	22.85	16.41	10.7
2005	62.36	42.65	35.02	22.13	3.70	8.68
2006	56.21	40.92	34.78	21.38	3.72	7.93
2007	64.34	48.90	34.32	21.64	15.46	8.8
2008	56.62	40.8	35.22	21.52	13.85	8.97
2009	60.26	44.0	35.7	22.13	9.28	9.01

Table 1b: New-Bussa weather reports for ten years (July-December)

Seasons	Year	Relative humidity		Temperature (0C)		Rainfall	Open pan evaporation
		10am	4 pm	Maximum	Minimum		
Late Wet (July-September)	2000	85.43	73.80	30.12	21.81	12.47	5.43
	2001	88.05	79.23	30.43	22.08	20.46	5.79
	2002	89.83	89.34	30.61	22.21	10.47	NA
	2003	81.24	68.16	30.25	22.29	14.83	NA
	2004	79.19	68.5	30.33	22.4	14.46	6.35
	2005	81.12	67.49	30.33	20.43	5.61	5.26
	2006	80.16	68.6	30.53	20.45	7.93	5.73
	2007	77.57	66.24	30.07	20.77	15.48	6.08
	2008	79.57	68.71	30.6	21.53	17.2	6.53
	2009	76.51	66.98	31.03	20.15	19.4	7.06
Early Dry (October-December)	2000	47.76	36.35	32.33	17.77	19.55	6.35
	2001	38.33	30.04	32.95	17.5	NA	7.35
	2002	73.97	62.07	31.26	17.99	20.87	NA
	2003	36.27	27.75	32.44	18.56	11.18	37.04
	2004	35.16	21.33	34.22	18.81	6.93	8.37
	2005	32.73	27.16	33.58	15.4	0.18	7.22
	2006	35.59	30.43	31.3	15.51	0.31	6.95
	2007	32.82	24.01	34.37	15.54	4.15	7.23
	2008	34.39	31.83	32.98	15.24	12.71	7.98
	2009	41.71	36.87	32.87	16.21	21.67	7.16

Table 2: Production parameters of poultry farms in New-Bussa

Variable (%)				
Farm location				
Wawa	Dogo-geri	NIFFR QTR	PHCN QTR	
2(10.0)	14(70.0)	3(15.0)	1(5.0)	
Number of years in production				
1-5	6-10	11-15	Above 15	
2(10.0)	2 (10.0)	5(25.0)	11 (55.0)	
Status of respondents				
Attendant	Manager	Director		
2 (10.0)	13 (65.0)	5 (25.0)		
Educational status of respondents				
Primary	Quranic	Secondary	Tertiary	
2 (10.0)	0 (00.0)	5 (25.0)	13 (65.0)	
Number of birds kept in the farm				
Less than 200	200-500	501-1000	1001-2000	Above 2000
2(10.0)	4(20.0)	10 (50.0)	5 (25.0)	1(5.0)
Breed of birds kept in the farm				
Shika Brown	Isa Brown	Harco	Bovans Near	Yaffa
1 (5.0)	10(50.0)	5 (25.0)	3(15.0)	1 (5.0)

Table 3: Percent egg production in ten years

	Years									
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Number of respondents	11	16	18	15	17	20	19	20	18	20
Less than 40% production	-	-	-	-	-	-	-	-	1(5.6)	1(5.0)
Between 40-69% production	9 (81.8)	9 (56.3)	2 (11.1)	4 (26.7)	4 (23.5)	5 (25.0)	6 (31.6)	7 (35.0)	6 (33.3)	9 (45.0)
70% and above	2 (18.2)	7 (43.7)	16 (88.9)	11 (73.3)	13 (76.5)	15 (75.0)	16 (82.2)	16 (80.0)	17 (94.4)	19 (95.0)

Table 4: Observable climatic parameters changes

Variable (Percent)				
Do you observe climate change in your area over the years?				
Yes	No			
18(90.0)	3(10.0)			
Control measures used to alleviate the effect of climate change on the farm				
Heat provision	Improved housing design	Drug administration	Good feed and water provision	Combinations of many of these factors
1 (5.0)	2 (10.0)	1 (5.0)	4(20.0)	12 (60.0)
Suggestion as government intervention to prevent adverse effect of climate change on egg production				
Livestock insurance	Utilization of ecological fund	Provision of social amenities	Combinations of the three suggestions	
3(15.0)	5(25.0)	2(10.0)	10 (50.0)	
Access to information on the means to control the effects of climate change				
Yes	No			
7(35.0)	13 (65.0)			
*Source of information on climate change				
Personal observation	Extension workers	Radio	Television	Agric shows/Exhibition
10 (50.0)	3 (15.0)	5(25.0)	1 (5.0)	1 (5.0)

*Multiple responses

Table 5: Correlation between yearly productivity of eggs and the effects of climate change on egg production

Yearly productivity	Increase in Temperature	Prolonged dry spell	Prolonged rainfall	Yearly rainfall beginning early	Yearly rainfall beginning late	Yearly rainfall ending early	Yearly rainfall ending late	Drying of water source
2000	0.039NS	0.03 NS	0.293 NS	0.504**	0.251 NS	0.101 NS	0.491**	0.188 NS
2001	0.19 NS	0.049 NS	0.302 NS	0.429*	0.202 NS	0.173 NS	0.465*	-0.032 NS
2002	-0.021 NS	-0.068 NS	0.124 NS	0.315 NS	0.058 NS	0.002 NS	0.348 NS	-0.106 NS
2003	-0.112 NS	-0.158 NS	-0.033 NS	-0.104 NS	-0.159 NS	-0.032 NS	-0.026NS	-0.319 NS
2004	-0.198 NS	-0.245 NS	-0.083 NS	-0.163 NS	-0.237 NS	-0.083 NS	-0.087NS	-0.405*
2005	-0.309 NS	-0.371 NS	-0.227 NS	-0.309 NS	-0.388*	-0.208 NS	-0.229NS	-0.528**
2006	-0.291 NS	-0.637 **	-0.501 **	-0.567**	-0.494**	-0.483*	-0.517**	-0.421**
2007	-0.236 NS	-0.476 *	-0.379 NS	-0.542**	-0.509**	-0.349 NS	-0.382*	-0.178 NS
2008	0.201 NS	0.166 NS	-0.038 NS	-0.286 NS	0.018 NS	0.074 NS	-0.238NS	0.095 NS
2009	0.062 NS	0.056 NS	-0.016 NS	0.252 NS	0.002 NS	0.079 NS	-0.219NS	0.03 NS

NS Correlation coefficient is not significant; ** Correlation coefficient is significant at 0.01 level; *Correlation is significant at 0.05 level.

Table 6 shows the measures of severity of climatic parameters as observed in New-Bussa. Increase in temperature was observed to be very severe by 60.0% of the respondents. About one-third of the respondent could not class the severity of climatic parameters in this study. Prolonged dry spell and drying of water sources was observed as very severe by 25.0% and 50.0% of the respondents respectively.

Table 6: Measure of severity of climatic parameters observed in New-Bussa

Parameter	Very severe	Severe	Slightly severe	Not severe	No effect	Don't know
Increase in temperature	12 (60.0)	3 (15)	2 (10.0)	1 (5.0)	1 (5.0)	1(5.0)
Prolonged dry spell	5 (25.0)	3(15.0)	2 (10.0)	1 (5.0)	1 (5.0)	8 (40.0)
Prolonged rainfall	1 (5.0)	6 (30.0)	3(15.0)	2 (10.0)	1 (5.0)	7 (35.0)
Yearly rainfall beginning early	1 (5.0)	3 (15.0)	4 (20.0)	5 (25.0)	1(5.0)	6 (30.0)
Yearly rainfall beginning late	1 (5.0)	6 (30.0)	4 (20.0)	1 (5.0)	1 (5.0)	7 (35.0)
Yearly rainfall ending early	3 (15.0)	5 (25.0)	4 (20.0)	1 (5.0)	1 (5.0)	6 (30.0)
Yearly rainfall ending late	0 (0.0)	3 (15.0)	5(25.0)	4 (20.0)	1 (5.0)	7 (35.0)
Drying of water sources	10 (50.0)	5 (25.0)	3 (15.0)	1(5.)	1 (5.0)	0 (0.0)

Figures in parentheses are percentages

IV. Conclusion and Recommendations

Commercial egg producers are negatively affected by changing climate. They resorted into using various mitigating strategies to cope with the effects. Livestock insurance and provision of social amenities had been suggested by the farmers as government intervention to prevent adverse effect of climate change on egg production.

This paper recommends that poultry farmers should organize themselves into functional associations. This will encourage knowledge sharing with regards to the use of various mitigating strategies amongst them. Also, farmers will be able to approach insurance companies for coverage. In addition, social amenities (water,

electricity, good road network) should be properly fixed by the government while breeds tolerant to climatic change should be developed by relevant research institute in the country.

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