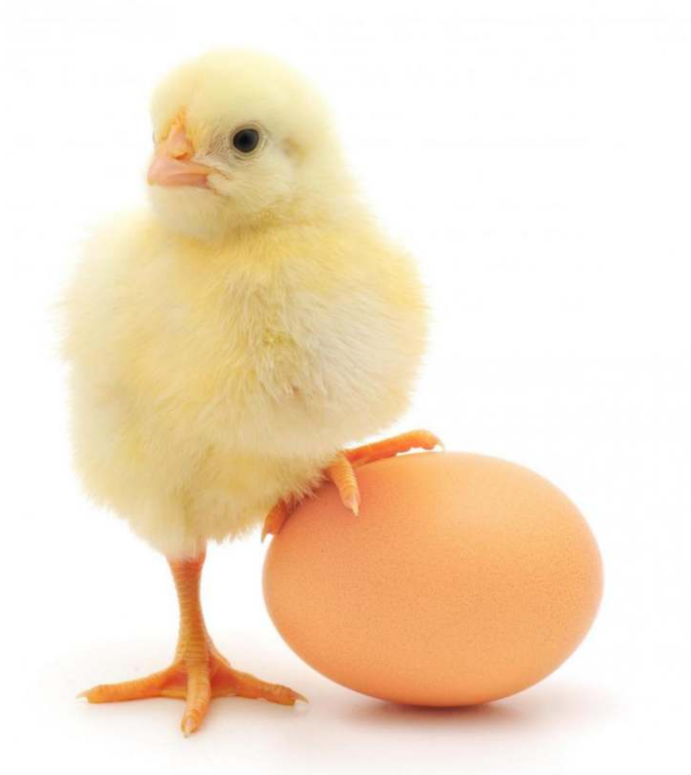
ISSN 1682-8356
ansinet.org/ijps



INTERNATIONAL JOURNAL OF POULTRY SCIENCE

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

International Journal of Poultry Science 5 (11): 1061-1068, 2006
ISSN 1682-8356

The Effect of Climate on Poultry Productivity in Ilorin Kwara State, Nigeria

Obayelu Abiodun Elijah[1] and Adeniyi Adedapo[2]
[1]Department of Agricultural Economics, University of Ibadan, Ibadan, Oyo state, Nigeria
[2]Department of Geography, University of Ilorin, Ilorin, Kwara State, Nigeria

Abstract: An empirical analysis of the relationship between climatic elements, poultry feed intake, egg production and disease outbreaks in Ilorin Kwara State Nigeria was carried out using climatological data and data from poultry farmers over a period of five years (2000-2004). Data on temperature, rainfall, wind speed and relative humidity for every month in the selected years were obtained from the department of Ilorin International Airport, and analyzed. While data on poultry egg production, poultry feed intake as well as disease outbreak were collected through a stratified random sampling of 120 poultry farmers in Ilorin metropolis. The results of the analysis using both descriptive and inferential statistics such as mean, coefficient of variation, multiple regression analysis show that climatic variables (temperature, rainfall, wind speed and relative humidity) in Ilorin contribute about 81%, 96% and 43% to the variance in poultry egg production, feed intake and outbreak of diseases of poultry production respectively. While temperature has an inverse relationship with poultry feed intake, high relative humidity in the study area usually encourage outbreak of poultry diseases which invariably reduce egg production. In order to improve poultry productivity in Ilorin, the poultry farmers need to establish appropriate housing and sanitation practices to minimize the effect of heat and the occurrence and spread of diseases. Poultry birds must properly be confined so as to protect them from physical hazards, rain and extremes of heat and cold in order to enhance productivity. Farmers should select poultry breeds that are adaptable to the kind of climate operating in the study area. There is also the need to feed the birds with sufficient ration so as to meet their nutritional requirement.

Key words: Climate, Ilorin, Nigeria, poultry, weather and productivity

Introduction

Poultry are birds such as the domestic fowl, Turkey, Duck, Goose, Ostrich etc which render economic service to man. Their production is one of the livestock production with significant contribution to human food (Demeke, 2004). Poultry plays an important role in the diet and economy of Nigerian. It is the primary supplier of eggs and meat and as a source of income and employment to people compared to other domestic animals (Avila, 1985). They are raised with relatively low capital investment and readily available household labour. Scavenging village chickens have cultural, social, nutritional, economic and sanitary functions in human life. For instance poultry egg contains 74% water, it is a good source of high protein and it is often used by nutritionist as a standard reference for evaluating other protein foods. One egg supplies 11% of the recommended daily protein intake for adults. The fat of egg is readily digestible and is made up of both saturated and unsaturated fatty acids. Poultry eggs are low in calories but contains many vitamins. They are used in various food industries, confectionery and for producing cosmetics and vaccines. One poultry egg weighing 55g/day meets the 50% of protein requirements of a child up to 5 years of age (Ponapa, 1982). Studies have shown that the level of performance of poultry does not only depends on inherited capacity but also to a great extent upon the environment (Campbell and Lasley, 1975). The environmental conditions affecting the performance, health productivity of a chicken include temperature, relative humidity, light, sunshine prevailing at a given time, housing system and ventilation. High temperature and humidity have some negative effects on poultry such as an increase on poultry body temperature; a decrease on feed consumption (Cowan and Michie, 1978; Howlider and Rose, 1987) and feed efficiency. High temperature also results to a reduction in poultry live weight (Mowbray and Sykes, 1971), growth speed and high mortality (Arjona *et al*., 1988) in addition to a decrease on productivity and quality of the eggs (Ozbey and Ozcelik, 2004). Furthermore, harsh rearing environment and imbalanced feeding do not permit expression of the full genetic potential of exotic breeds (Barua and Howlider, 1990). Other environmental factors affecting the performances of layer chicken include feed utilization and body weight (Harms *et al*., 1982), water availability (Oluyemi and Roberts, 1979), tier of cages (North, 1984), and infection (McNitt, 1983).

Temperature is an important bio-climatic factor affecting the physiological function of layer-chickens (McDowell, 1972) though the effect on egg production rate depend on age of laying hens. The effect is more evident at old age when birds are exposed to a cold climate. When

Table 1: Temperature and its effects on egg production

Effects	Temperature (°C)
11 - 26	Good production.
26 - 28	Some reduction in feed intake.
28 - 32	Feed consumption reduced and water intake increased; eggs of reduced size and thin shell.
32 - 35	Slight panting.
25 - 40	Heat prostration sets in, measures to cool the house must be taken
40 and above	Mortality due to heat stress

Source: Kekeocha, 1985: Poultry production handbook. London, Macmillan Publishers Ltd.

temperature falls below the thermo neutral zone of below 12.8°C (which is rarely experienced in the tropics) egg production becomes uneconomic difference (Oluyemi and Robert, 1979). Charles (1980) opine that feed intake of a laying hen decreased by 1.5g a day for every degree centigrade rise in temperature above 30°C, decreased egg production by about one egg per bird a year for every degree rise in temperature above 25-30°C and that the depressive effect of environmental temperature by heat stress significantly increases water consumption, reduces egg production, egg weight, shell weight, shell thickness causing a significantly higher production of shellers or very thin-shelled eggs. The optimal laying temperature according to Kekeocha (1985) is between 11° and 26°C. A humidity level above 75 percent will cause a reduction in egg laying (Table 1). Better productivity of chickens depends on the roofing sheets of the poultry house. Poultry house that is roofed with asbestos will generally reduced the heat stress on the birds and enhanced better performance (Awoniyi, 2003).

The climatic problems affecting poultry farmers reviewed above not withstanding, almost all poor households including the landless own poultry agreed that poultry keeping is an excellent tool in poverty alleviation due to the quick turnover and low investment. This implies that if poultry production is improve, it will create opportunity for the development of the poor segments of the society (Permin *et al.*, 2000; Gueye, 1998; Todd, 1998; Quisumbing *et al.*, 1995). The major objective of this study therefore centred on the analysis the effect of climatic factors on production parameters of poultry in Ilorin Kwara State, Nigeria. The findings will enhance the productivity of poultry not only in Ilorin Nigeria but in other countries yet to go into poultry production on commercial scale and those already in the business.

Materials and Methods

Study Area: The study area of this research work is Ilorin, the capital city of Kwara State. Ilorin is located on latitude 8°30' N and longitude 4° 35'E. The town which occupies an area of about 100km^2 (Oyegun, 1992) and the total population 532.088 people (Nigeria, 1991 population census) is situated at a strategic point between the densely populated South-Western and the sparsely populated Middle Belt area of Nigeria. It is located in the transitional zone between the deciduous woodland of the south and dry savannah of North of Nigeria (Jimoh, 2003) making the town a good site for livestock production with all thing being equal. Ilorin climate is characterized by both the wet and dry seasons each lasting for about six months. The raining season begins towards the end of April and lasts till October while the dry season begins in November and ends in March. Days are very hot during the dry season; from November to January, temperatures typically range from 33°C to 34°C, while from February to April, the temperature is between 34.6°C and 37°C. The total annual rainfall in Ilorin is about 1318mm with the mean temperature being between 30°C-33 ₵ (Ilorin Atlas, 1958). Relative humidity at Ilorin in the wet season is between 75 and 80% while in the dry season it is about 65% (Tinuoye, 1990). The daytime is always sunny with the sun brightly shinning for about 6.5 - 7.7 hours daily from November to May (Olaniran, 1983). The climate supports tall grass vegetation, which is interspersed with short scattered trees (Guinea Savanna). Hence, it provides high quantity of feed for livestock animals. The only trees able to survive in this climate are those which are biologically suited to withstand dry conditions. Such trees have deep roots and they are adapted to conserve moisture in the dry season. The baobab, acacia, shears butter trees are typical examples of trees in the area. The vegetation on the other hands is dominated by derived savannah comprising of tall grass interspersed with scattered trees. Noticeable grasses that grow in the area include spear grass, elephant grass, and goat weed of height 3-5 metres. Chicken species available in Ilorin include Gallus gallus (Red Jungle Fowl), Gallus sonnerati (Gray Jungle Fowl) and Gallus lafayuttii (Cylon Fowl) beside the indigenous chickens The vegetation provides reasonable quantity of feed for livestock animals especially during the rainy season. The common climatic elements of interest are temperature, relative humidity, rainfall and wind speed which affect livestock production mainly in the tropical area.

Types of data and methods of data collection: Climatological data and data on poultry production are collected in the study. Climatological data on temperature, rainfall, relative humidity, day length period and wind speed and direction were collected for the period of five years, (2000 to 2004) from the Meteorological Department, Ilorin International Airport.

Table 2: Descriptive analysis of climatological data of Ilorin, Kwara State

		Temp.	Rainfall	Wind speed	Relative Humidity
2000	Jan.	34.4	34.8	115	65
	Feb.	34.7	0	129	35
	Mar.	36.9	19.6	133	61
	Apr.	34	45.9	176	73
	May	33	105.6	155	76
	Jun.	30.6	194.2	123	84
	Jul.	29.7	81	132	82
	Aug.	28.6	185	126	89
	Sep.	30	281.7	124	87
	Oct.	30.9	42.5	113	83
	Nov.	35	0	107	72
	Dec.	34.4	0	119	55
	Mean	32.7	82.5	130	71.8
	Std. Dev.	2.62	91.8	19.1	15.7
	C.V	8.00	111	14.7	21.9
2001	Jan.	34.2	0	104	50
	Feb.	35.9	0	127	50
	Mar.	37.2	13.8	169	70
	Apr.	35.5	53.3	178	72
	May	33.2	146	154	77
	Jun.	31	137	147	83
	Jul.	29	85.1	156	86
	Aug.	28.4	57	166	88
	Sep.	29.7	174	137	87
	Oct.	32.7	31.9	116	80
	Nov.	35.5	0	130	70
	Dec.	35.5	0	118	67
	Mean	33.2	58.1	142	73.3
	Std. Dev.	2.99	63.4	23.3	13.0
	C.V	9.01	109	16.5	17.8
2002	Jan.	32.3	7.2	126	39
	Feb.	36.5	0	133	57
	March	36.7	28.4	188	70
	April	34	127	178	75
	May	33.5	45.8	168	74
	June	31.7	96.8	160	79
	July	29.5	160	143	86
	Aug.	28.5	258	149	88
	Sept.	29.8	93.3	132	84
	Oct.	30.9	155	94.9	85
	Nov.	34.1	5.9	61.9	76
	Dec.	34	0	115	50
	Means	32.6	81.4	138	71.9
	Std. Dev	2.65	81.9	35.7	15.5
	C.V	8.11	101	26	21.6
2003	Jan.	34.8	-	106	61
	Feb.	36.6	-	143	71
	March	37.1	25.3	148	64
	April	33.8	81.5	175	74
	May	33.1	98	164	75
	June	30.2	371	135	84
	July	29	94.2	146	85
	Aug.	29	80.7	154	86
	Sept.	29.7	400	121	85
	Oct.	31.9	126	122	82
	Nov.	34	18.4	111	76
	Dec.	34.3	0	112	55
	Means	32.8	129	136	74.8
	Std. Dev	2.82	141	22.1	10.4
	C.V	8.61	109	16.2	13.9
2004	Jan.	34.1	2.1	111	58
	Feb.	36	-	131	58
	March	35.9	45.1	148	62
	April	34.1	77.5	190	73
	May	31.7	210	148	81
	June	30.1	310	136	83
	July	29.1	192.5	137	86
	Aug.	29.5	157	150	86
	Sept.	29.7	188	122	86
	Oct.	31.1	104	116	84
	Nov.	33.1	9.2	113	76
	Dec.	34.4	0	100	75
	Mean	32.4	118	134	75.7
	Std. Dev.	2.51	102	23.9	10.8
	C.V	7.76	86.5	17.9	14.3

Table 2 Cont.

Note: Std. Dev.= Standard Deviation, C.V = Coefficient of Variation. Source: Author's computation, 2005

These climatic elements are selected due to their effect on poultry production. While temperature is indicative of thermal stress, relative humidity affect breathing and food intake and utilization. Rainfall affects both the quality and quantity of feed while wind speed has an impact on outbreak of diseases. Information on poultry farming with respect to egg production, feed intake, and outbreak of diseases on the other hands, were collected through the primary source.

Sampling frame and techniques: The study area (Ilorin) was divided into four major zones based on the distribution of poultry farming. These zones are Adewole, Gaa Akanbi, Sango and Tanke. With the use of questionnaire, data were collected from these four areas. In the administration of the questionnaire, stratified random sampling technique was adopted based on the result obtained from the pilot survey conducted by the researcher. A total of 120 questionnaires were distributed among the poultry farmers with 30 in each of the sampled unit

Data analysis: Both the descriptive and inferential statistical methods were adopted in the analysis of data. While some of the descriptive statistics include the use of mean, standard deviation and coefficient of variation those of the inferential statistics employed include the use of multiple regression models to find out whether relationship exist between climatic elements and egg production, feed intake and outbreak of diseases on poultry animals in the study area.

The regression model is of the form

$$Y = a+ X_1 b_1+X_2 b_2+ \ldots\ldots\ldots\ldots X_4 b_4 + e \qquad (1)$$

Where

Y = Dependent variable and the independent variables (X) are as follow:

X1 = ambient temperature

X2 = humidity

X3 = rainfall

X4 = wind speed and direction

a = constant

b = regression coefficient e = error term

Table 3: Effect of climate on poultry feed intake

Location	Wind		Temperature		Relative Humidity		Day length		Total
	No	%	No	%	No	%	No	%	
Adewole	-	-	18	60	4	13.3	8	26.7	30
Gaakanbi	-	-	15	80	6	20	9	30	30
Sango	-	-	20	66.7	-	-	10	33.3	30
Tanke	-	-	16	53.3	2	6.7	12	40	30
Total	-	-	69	57.5	12	10	39	32.5	120

Source: author's field survey, 2005

Table 4: Descriptive analysis of egg production

Month	2000	2001	2002	2003	2004
Jan.	1155	1268	1333	1360	2006
Feb.	1270	1370	1504	1801	1868
March	1140	1270	1170	1802	1896
April	1210	1380	1305	1807	1758
May	1467	1501	1111	1954	2564
June	1100	1260	980	1855	2666
July	1340	1480	960	1800	1684
Aug.	1500	1502	1110	2001	1500
Sept.	1205	1390	560	1999	954
Oct.	1130	1230	310	1854	999
Nov.	1240	1365	320	2115	968
Dec.	1400	1455	213	2119	1201
Mean	1260	1370	906	1870	1672
Std.Dev.	135	98.4	443	200	581
C.V	10.7	7.17	48.9	10.7	34.7

Source: Author's Computation 2005.

In order to identify the climatic factors that are critical to poultry production, stepwise multiple regression analysis was further used as employed by Olaniran (1983) in the analysis of the relationship between monsoon factor and rainfall seasonality in Nigeria, and Ifabiyi (1999) on predicting borehole yield on the Precambrian basement complex and sedimentary rocks in West Central Nigeria. Trend analysis of data collected on poultry production such as egg production were further analyzed using Mann-Kendall statistics as used by Giles and Flocas (1984) (see equation 2).

In the Mann-Kendall method, the data on egg production are represented as a series Xi (I = 1…..N). The value of the first term of the series, X_1 is then compared with values of all later terms in the series, from the second (X_1) to the last term (X_n). The number of all the later terms whose values exceed X_I is counted and denoted by n_1. Comparison is next made between the value of the second term X_2 and the values of all the later terms and the number of later terms that exceed X_2 is counted and denoted by n_2. This procedure continued for each term of the series ending with X_{n-1} and its corresponding number N-1. A statistics P is then computed as fowls:

$$P = \sum_{I=1}^{n-1} n$$

and the Mann- Kendall statistics (r) is derived by the equation

$$r = [4p / N(N-1)] - 1 \qquad (2)$$

Two tailed test was employed to test for significance by using a desired probability level (tg) and compare this with the theoretical value

$$(r)_t = 0 \pm tg\sqrt{\frac{4N + 10}{9N(N-1)}} \qquad (3)$$

Results and Discussion

Descriptive analysis of climatological data: The descriptive characteristics of the climatological data collected from Meteorological Department International Airport, Ilorin is presented in Table 2 below. Temperature has the highest mean of 33.15°C in 2001 and lowest mean of 32.4°C in 2004. This has the implication of reduction in poultry feed intakes in these years (2000-2004) in line with Smith (1974) that says temperature between 21°C and 38°C decreases feed intake and utilization. At the mean temperature of 33.15°C in 2001 and 32.4°C in 2004, poultry feed consumption was observed to dropped in the study area, weight gains were also lowered. There was a reduction in egg production and egg size with deterioration in shell quality. This was also in line with the range of temperature of 32.4°C to 33.15°C observed by Anderson (1998) for the manifestation of the above characteristics. Rainfall has its highest mean of 129mm in 2003 and lowest mean of 81.4mm in 2002. This shows that 2003 is the wettest year. The implication of this is high quantity and quality of ingredients of poultry feed like maize, Soybean etc. Wind speed has its highest mean of 142mls in 2001 and lowest mean of 130mls in 2002. The relative humidity has it highest value of 71.8% in 2000. This high relative humidity induced the outbreak of diseases in poultry through the creation of conducive breeding environment for disease pathogens. Also shown in Table 2 is the standard deviation. Rainfall was highly variable with a value of 91.8mm in 2000, 63.4mm in 2001, 81.9mm in 2002, 141mm in 2003, 101.89mm in 2004, followed by wind speed 35.7m/s in 2002, 23.9mm in 2004, 23.3m/s in 2001 while temperature has the standard deviation value of 2.6°C in 2000, 2.9°C in 2001, 2.8°C in 2003 and 2.5°C in 2004. On the pattern of relative variation, rainfall has the highest value (111%) in 2002 followed by relative humidity (10.4%) in 2004 while the least temperature was observed as 7.76% in 2004. However,

Table 5: Effect of climate on poultry egg production

Location	Wind		Temperature		Relative Humidity		Day length		Total
	No	%	No	%	No	%	No	%	
Adewole	-	-	15	50	5	16.7	10	33.3	30
Gaakanbi	-	-	12	40	8	26.7	10	33.3	30
Sango	-	-	18	60	4	13.3	8	26.7	30
Tanke	-	-	16	53.3	6	20	18	26.7	30
Total	-	-	61	50.8	23	19.2	36	30	120

Source: author's field survey, 2005

Table 6: Effect of Climate on Poultry diseases

Location	Period						Total
	Nov. - Feb.		March - April		May - October		
	%	%	%	%	%	%	
Adewole	10	33.3	4	13.3	16	53.3	30
Gaakanbi	12	40	6	20	12	40	30
Sango	8	26.7	9	30	13	43.3	30
Tanke	4	13.3	8	26.7	18	60	30
Total	34	28.3	27	22.5	59	49.2	120

Source: Author's field survey, 2005

only rainfall (111%) has high relative variation while other variables have very low variation because their values are less than 33%. Therefore, rainfall can be regarded as heterogeneous variable because it has values greater than 33% while other variables, temperature, wind speed and relative humidity are homogenous, variables having values less than 33%. This shows that the examined climatological parameters are less variable except rainfall.

Results of the descriptive Statistics of poultry farmers respondents indicate wind as affecting egg production perception on the effect of climate on poultry production

Climate and Feed Intake: From Table 3, about 57.5% of the respondents in the study area indicates that temperature affect their poultry feed intake and utilization, 10% indicates relative humidity, 32.5% indicates day length period while non agreed that wind has effect on poultry feed intake. The results of the response show that temperature has greater effect on feed intake and utilization. At high temperature, the thermal stress of livestock animals increases. Hence, the feeding appetite of the animals reduces. Also, at high temperature the metabolic activities of the animals is reduced. Some enzymes in the birds can not function at high temperature thereby reducing the rate of digestion and feed intake. This finding is in line with Loosh and Blake (1999), Willamson and Payne (1978) who reported that high ambient temperature decreases feed intake and utilization in livestock animals except in a laying hen where high ambient temperature increases feed intake and metabolic heat production (Smith, 1975)

Climate and egg production: Comparison of the rates of egg production between year 2000 t0 2004 in Table 4 shows that poultry egg production has it highest mean of 1,872 in 2003 and lowest mean value of 906 in 2002. The reduction in the number of egg produced in year 2004 may not be unconnected with the rise in temperature and relative humidity recorded that year. As evident in Table 5 about 50.8% of the total respondent shows that temperature affect their egg production, followed by about 30% respondents who indicate day length as a factor affecting their poultry egg production, 19.2% indicates relative humidity and none of the respondents indicate wind as affecting egg production. High temperature does not only affects egg sizes, but also the rate of egg droppings. and egg cracks due to inability of the bird to take adequate feed necessary to manufacture eggshell at under this kind of condition. This finding is in line with Anderson, (1998) who reported that temperature between 29^{o} to 35^{o}C reduces egg size and shell quality.

Climate and outbreak of diseases: Table 6 shows that about 49.2% of the respondents indicate that diseases outbreak is common between the months May to October, 28.3% indicate between the months November to February while 22.5% indicate between the months March - April. The result shows that highest percentage of the respondents (49.2%) indicate that poultry diseases are common in the months between May - October. The implication of this is that these months (May-October) are the raining months. Rainfall and relative humidity are relatively high during these months. This invariably, provides a conducive environment for breeding of disease parasite. Some of the poultry disease common in these months are coccidiosis fowl cholera and ascaris a warm (endoparasite.) disease.

Results of the regression analysis

Egg production: The result of the analysis of climatic

Table 7: Trends in egg production in Ilorin (2000-2005) using Manu-Kendall rank statistics

Year	Coefficients
2000	0.1515 xx
2001	0.1212 xx
2002	-0.6970 x
2003	-0.6970 x
2004	-0.5152 x

significant levels. 90% (x), 95%(xx) and 99% (x xx). Source: Author's computation, 2005

elements and egg shows that R^2 which is the multiple coefficient of determination for the collective effect of all of the independent variables (Temperature, rainfall, wind speed and direction and relative humidity) is 0.813. This implies that about 81.3% of the variance of the dependent variable (egg production) are been explained by the independent variables. In other word, only 18.7% (i.e. 100-81.3) of egg production is not explained by the independent variables. Also, the F- Ratio value of 6.53 shows that a significant relationship exist between egg production and the selected climatic elements at 5% level.

Similarly the data was subjected to stepwise multiple regression to determine the contribution of some of the independent variables and identify the one having highest contribution. The computed result shows that all the variables contribute about 90.2% variation in poultry egg production, while the combine effect of relative humidity (X4), rainfall (X2) and temperature (X1) contribute about 0.1% (90.2-90.1). Relative humidity (X4) and rainfall (X2) contribute about 88.255. This implies that temperature(X4) contributes only about 1.9% (90.1-88.2). Therefore, relative humidity (X4) has the highest contribution (88.2%). Using the standardized coefficient the regression equation is shown below:

y = 1008 + 1.29 rainfall + 0.393 temp. + 0.0552w/s - 0.770 R/H (4)
(R^2=0.813,SE=338.86).

From the above equation it can be deduced that X_2 (rainfall) has the highest standardized coefficient and also highest t-value (3.981) while relative humidity (X4) has a negative value (-0.770) showing an inverse relationship. This means that as relative humidity increase, egg production decreases. High relative humidity encourages outbreak of diseases which invariably reduces egg production.

Feed intake: Regression result on feed intake shows that R^2 is 0.963. This implies that 96.3% of the variance of the dependent variable (feed intake) is been explained by the independent variable (Temperature, Rainfall, Wind speed, and relative humidity). The F- Ratio value is 38.874 . This shows that a significant relationship exist between feed intake in poultry and the selected climatic elements at 5% level. Employing the stepwise multiple regression model shows that all the climatic variables (Temperature, rainfall, wind speed and relative humidity) contribute about 96.3% to the variance of feed intake. It also shows that wind speed, rainfall and temperature contribute about 98.1%. The relative humidity contribute an insignificance value of about 0.00%. Wind speed and temperature contribute about 97.8%. This is an indication that rainfall contributes about 0.3% (98.1-97.8). In addition, temperature is found to contributes about 97.2% showing that it has the greatest effect on feed intake. Using the standardized coefficient, temperature (X_1) has the greatest beta value (regression coefficient) though negative (-0.813). This shows that temperature has an inverse relationship with feed intake. At high temperature, the feed intake reduces because more energy is required to conserve the heat caused by high temperature. Hence, a decrease in rate of feed intake.

Using the standardized coefficient, the regression equation is shown below:

Y = 465.252 + 0.122 rainfall + 0.073 w/s + 0.072 RH – 0.813 Temp. (5)
(R^2 = 0.963; SE = 6.01)

Outbreak of diseases: The result of the regression analysis on the effect of the climatic elements on the outbreak of diseases shows that R^2 is 0.433. The implication is that about 43.3% of the variance of the outbreak of diseases is been explained by the climatic elements. The rate of explanation is however small. The F-Ratio value is 1.147 and it was not significance at either 1%, 5% and at 10% levels when tested. This shows that there is no significant relationship between climatic variable selected and the outbreak of diseases. This might be as a result of proper management strategies such as proper cleaning and application of vaccine which usually reduce outbreak of diseases of poultry animals. The results of the standardized coefficient of the regressing model is presented thus:

Y = - 3.072 + 0.842 rainfall + 0.198 temp. + 0.012 R/H - 0.252 wind speed. (6)
(R^2 = 0.433; SE = 2.62)

The manu kendall statistics: Table 7 above shows that the result obtained from data on egg production from 2000-2004 using Manu-Kendall statistics. The statistics confirms a significant decline at the 95% probability level from 2000-2001 but from 2002-2004, the statistics confirms a significant decline at the 90% probability level. This shows a differential pattern of change in the egg production from 2000-2004 which can be attributed to variation in climatic elements.

Conclusion and recommendations: This study becomes imperative because it provides insight to climatic effects on poultry production in Ilorin Kwara state, Nigeria and provide the prospect on the necessary precaution that can be taken in order to enhance productivity of poultry in the area as well as assisting other policy makers in their decisions for effective poultry managements. The result of the multiple regression analysis revealed that a strong relationship exists between the selected climatic elements, egg production and feed intake in poultry animal. The relationship between climatic elements and the outbreak of disease in poultry was negative. The trends in egg production using Mann-Kendal rank statistics also revealed that a strong variation exists in the egg production.

Base on the result and findings from the research work, it is recommended that the following points be taken into consideration.

Poultry farmers should provide temporary confinement for their birds because of inclement climate and condition under which the health, safety or well being of the animals could be jeopardized. The farmers should make sure that they select species that are suitable and can resist the prevailing climatic condition in the study area as well as to the prevailing diseases. There is also the need for the establishment of appropriate housing, sanitation practices to minimize heat and the occurrence and spread of diseases. There is the need for proper feed ration that is sufficient to meet nutritional requirements of the bird.

References

Anderson, K.E., 1998. Hot Weather Management of Poultry. Retrieved on 15 November 2006 from http://www.Tracker-outdoors.Com/poultry.

Awoniyi, T.A.M., 2003. The Effect of Housing on Layer-chicken's Productivity in the 3-tier Cage. Int. J. Poult. Sci., 2: 438-441.

Avila, M., 1985 Intra and inter-household decision-making in the Mangwende and Chivi Communal Areas: Preliminary results, Farming System Research Unit, Harare.

Arjona, A.A., D.M. Denbow and W.D. Weaver, 1988. Effect of heat stress early in life on mortality in broilers exposed to high environmental temperatures just prior to marketing. Poult. Sci., 67: 226-231.

Barua, A. and M.A.R. Howlider, 1990. Prospect of native chickens in Bangladesh. Poult. Adv., 23: 57-61.

Campbell, J.R. and J.F. Lasley, 1975. The Science of Animals that Serve Humanity. Mc Graw Hill Co., USA,pp: 369-394.

Charles, D.R., 1980. Environment for poultry. Vet. Rec., 106: 307-309.

Cowan, A. and A. Michie, 1978. Environmental temperature and broiler performance. The use of diets containing increased amounts of protein. Br. Poult. Sci., 19: 601-605.

Demeke Solomon, 2004. Egg production and performance of local and White Leghorn hens under intensive and rural household conditions in Ethiopia. LRRD 16: 2.

Giles, B.D. and A.A. Flocas, 1984. Air temperature variation in Greece, Part 1: Persistence, trend and fluctuation. J. Climatatol., 4: 531-539.

Gueye, E.F., 1998. Village egg and fowl meat production in Africa. Worlds Poult. Sci. J., 54: 73-86.

Harms, R.H., P.T. Costa and R.D. Miles, 1982. Daily Feed Intake and Performance of Laying Hens Grouped According to Their Body Weight. Poult. Sci., 61: 1021- 1024.

Howlider, M.A.R. and S.P. Rose, 1987. Temperature and the growth of broiler. Worlds Poult. Sci. J., 45: 228-236.

Ifabiyi, I.P., 1999. Predicting boreholes yield on the Precambrian Basement complex and sedimentary Rocks in West Central Nigeria, in Review of growth and change. Int. J. Rev. Growth and Change vol. 3 No 1.

Ilorin Atlas, 1958. Geography Department University of Ilorin.

Jimoh, H.I., 2003. Erosion Tolerance Range of Land use surfaces: Implication on Land Resource use and Management Techniques in Ilorin Nigeria. Int. J. Environ. Stud., 60: 446.

Kekeocha, C.C., 1985. Poultry production handbook. London, Macmillan Publishers Ltd.

Loosh, J.K. and H.E. Blake, 1999. The Tropical Environment and Animal Poduction in Animal Production in the Tropics (eds) J.K Loosh, V.A Oyenuga, G.M Babatunde Henemann Education Books Nig. Plc., pp: 1-10.

McDowell, R.E., 1972. Improvement of livestock production in warm wet climate. W. H. Freeman and Company San Francisco U. S. A., p: 3-22.

McNitt, J.I., 1983. Livestock husbandry Techniques. Gramada Publishing Limited great Britain copyright 1983, p: 215-222.

Mowbray, R.M. and A.H. Sykes, 1971. Egg production in warm environmental temperature. Br. Poult. Sci., 12: 25-29.

North, M.O., 1984. Commercial chicken production manual. 3rd edition. Avi publishing Company Inc. West Port C.T.

Olaniran, O.J., 1983. The Monson factor and the Seasonality of rainfall distribution in Nigeria. Malaysian J. Trop. Geogr., vol. 7, pp: 42.

Olaniran, O.J., 1982. Physiological climate of Ilorin, Nigeria. Arch. Met. Geoph. Biokl. , Ser. B., 31: 289-299.

Oluyemi, J.A. and F.A. Robert, 1979. Management and housing of adult birds, In, Poultry production in warm wet climates, pp: 49-106.

Oyegun, R.O., 1992. Pocket map of Ilorin. The gateway (Unpublished).

Ozbey, O. and M. Ozcelik, 2004. The effect of high environmental temperature on growth performance of Japanese quails with different body weights. Int. J. Poult. Sci., 3: 468-470"

Permin, A., G. Pedersen and J.C. Rise, 2000. Poultry as a Tool for Poverty Alleviation: Opportunities and Problems related to Poultry Production at Village Level. Newcastle Diseases Control in Village Chickens. SADC Planning Workshop. Maputo, Mozambique, 6-9 March. ACIAR Proceedings No.103:143-147.

Ponapa, C.G., 1982. Eggs in child's Nutrition. Poult. Adv., 51-53.

Quisumbing, A.R., L.R. Brown, H.S. Feldstein, L. Haddad and C. Pena, 1995. Women the key to food Security. Food policy Statement Number.21.Retrieved on 15th November 2006 from http://www. cgiar. org/ ifpri / fps /Fps 21.htm.

Smith, K., 1975 Principles of Applied Climatology. McGraw-Hill. London.

Tinuoye, A., 1990. Climatic condition in dry and wet years at Ilorin. Unpublished B.SC dissertation, Department of Geography University of Ilorin, Nigeria.

Todd , H., 1998. Women climbing out of poverty through credit: or what do cow s have to do with it? Livest. Res. Rural Dev., Vol. 10 (3).

Williamson, G. and W.J.A. Payne, 1978. An Introduction to Animals Husbandry in the Tropics Third Edition. Trop. Agri. Series, pp: 2-27.