

NUTRITIVE POTENTIALS OF *Centrosema pubescens*, *Mimosa invisa* and *Pueraria phaseoloides* LEAF MEALS FOR GROWTH RESPONSES OF CHICKEN

F.C. NWORGU and G.N. EGBUNIKE⁺

Federal College of Animal Health and Production Technology, Institute of Agricultural Research and Training. PMB 5029 Ibadan, Nigeria

+ Animal Physiology Laboratory, Department of Animal Science. University of Ibadan, Ibadan, Nigeria

E-mail: fcnworgu@yahoo.com

Abstract

Nutritive potentials of *Centrosema pubescens*, *Mimosa invisa* and *Pueraria phaseoloides* leaf meals (LM) were determined and evaluated using different types of chicken within the years 2004-2009. The diets were formulated to contain 0, 20/25, 30/40, 60/75 and 80/90g LM/kg feed and 120 to 150 birds were used in each experiment. Each treatment was replicated three times. All ingredients in each experiment were of constant weight, except the soybean and groundnut cake which test ingredients replaced some percentages weight for weight. The experimental design used was completely randomized design for the chicks and completely randomized block design for the growing pullets and cockerels. Data on feed intake and weight gain were subjected to one-way ANOVA and comparisons were made using Duncan's Multiple Range Test. Results revealed that the LM are rich in crude protein (21.36-23.34%) and ash (4.25 – 9.14%). The most available mineral elements were potassium (0.45-1.85%) and calcium (0.60 – 1.726%). The concentration of tannin was highest in the LM (1.57-3.35g/100gDM) unlike oxalate (0.037-0.065g/100gDM). The poorest LM in terms of nutritive value and chicken performance was *Mimosa invisa* leaf meal (MLM), while the best was *Centrosema pubescens* leaf meal (CLM). Inclusion of 40 – 60gCLM/kg feed for Black Nera chicks and finisher pullets and 75gCLM/kg feed for broiler starters and finishers resulted to significant ($P<0.05$) reduction in feed intake and weight gain. Feed intake and weight gain of broiler starters and finishers and cockerel growers fed 20 – 60gMLM/kg feed supplements significantly ($P<0.05$) and progressively decreased with increased dietary concentration of MLM supplement. Broiler starters and finishers fed 30-90PLM/kg feed had increased feed intake, which was progressive, unlike their weight gain which depressed significantly ($P<0.05$) with increased concentration of *Pueraria phaseoloides* leaf meal (PLM). Hence, 20 and 25gCLM/kg feed is recommended for pullet chicks/growing pullets and broiler chicken, respectively, while PLM and MLM are not recommended, for chicken nutrition due to depression in growth rate.

Keywords: Nutritive potential, legume leaf meal, growth responses, chicken.

45

46 **Introduction**

47 The rising cost of poultry feeds has continued to be a major problem in poultry
48 industry in developing countries, as feed cost is about 65 to 70% of the total cost of
49 production (1) compared to 50 to 65% in the developed countries (2). High cost of
50 conventional protein sources has necessitated the use of leaf meal supplements in
51 poultry production. These leaf meals are readily available and cheaper than the
52 conventional protein sources. Leaf meal supplements have been included into the
53 diets of poultry as a means of reducing the high cost of conventional protein sources
54 and to improve profit margin (3,4,5,6). The importance of legume leaf meals in
55 poultry has been recognized by farmers because of their relatively high content of
56 proteins, some minerals and vitamins (3,7). D'Mello (8) indicated that a distinguished
57 feature of tropical legumes in comparison with their temperate counterparts is the
58 occurrence of a diverse array of non-protein amino acids in sufficient concentrations to
59 precipitate adverse effects in farm animals.

60 Different leaf meals have been incorporated into poultry diets, including those of
61 *Leucaena leucocephala* (9), *Cnidoscolus aconitifolius* (10), *Manihot esculenta* (11,12),
62 *Centrosema pubescens* (13, 7), *Microdemis puberula* (14) among others. Onwudike
63 (15) recommended dietary addition of 5% of *Leucaena leucocephala* leaf meal
64 (LLLM) for improvement of body weight gain in chicks. Scott *et al.* (16) reported that
65 dietary inclusion of LLLM more than (50g/Kg) caused reduced growth of broiler
66 chicken and low egg production. Nworgu and Fapohunda (6) reported that 2.5%
67 MLM reduced weight gain, while 7.5% significantly ($P < 0.05$) reduced feed intake.
68 Ngodigha (13) reported reduction in feed intake when broiler chickens were fed 15%
69 *Centrosema pubescens* leaf meal (493.88g/bird) compared to 529.00, 532.51 and
70 516.40g/bird at 0.0, 5.0 and 10.0%, respectively. Hence, the objective of this study
71 was to assess the growth responses of chickens fed different leaf meal supplements.

72 **Materials and Methods**

73 The experiments were carried out at Bora Poultry Unit of Federal College of animal
74 Health and Production Technology, Institute of Agricultural Research and Training
75 (IAR&T)

76 Ibadan, Nigeria. The experiments were carried out between the years 2004 to 2009
77 with the mean annual rainfall of 1398mm and mean monthly temperature of 22.71°C
78 and average monthly relative humidity of 75.54%. A total of 120 to 150 birds were

79 used in each experiment. Tender leaves of *Centrosema pubescent*, *Mimosa* *invisa* and
80 *Pueraria phaseoloides* were harvested from and around the paddocks in IAR&T. The
81 leaves were detached from the vines/stems and were air and sun-dried for 2-3 days to
82 a moisture content of about 12% (4). The dried leaves were milled/ground using a
83 hammer mill with a sieve/screen size of 2.0-3.0mm. Samples of the leaf meals were
84 collected for proximate and chemical analyses, while some were incorporated into the
85 diets. Diets A,B,C, D and E contained 0,20/25, 30/40, 60/75 and 80/90g/kg feed of
86 each forage meal, respectively. The diets were formulated according to NCR (18) and
87 ARC (19) and ingredients were constant, except the test ingredient (the leaf meal),
88 soybean meal and groundnut cake. The test ingredient replaced some percentages of
89 soybean and groundnut cake in each experiment weight for weight. Gross
90 composition of control diets is presented in Table 1. The birds were randomly allotted
91 to the aforementioned dietary treatments in each experiment. Each treatment was
92 replicated three times in a completely randomized design, but for growing
93 pullets/pullet finishers and cockerel finishers, completely randomized block design
94 was used. Data on feed intake were taken on daily basis, while weight gains were
95 taken on weekly basis. Routine management practices and medication were taken as
96 and when due.

97 Proximate and mineral composition of the test ingredients were determined by the
98 procedures of Boehringer (20) and proximate composition of the diets was determined
99 by the methods of AOAC (21), while their metabolisable energy (ME) was
100 determined by the methods of outlined by Carpenter and Clegg (22). Gross energy of
101 the test ingredients was estimated by the method of AFRC (23). Phytate was
102 determined by the technique of Igbedioh *et al.* (24), while tannin was evaluated by the
103 method outlined Hagerman and Ler (25) and oxalate by the procedures of Talapatra
104 and Prince (26).

105 Data on feed intake feed, weight gain and feed conversion ratio were subjected to
106 one-way ANOVA analysis of variance procedure of SAS (27). Duncan's Multiple
107 Range Test (28) was used in assessing the significant differences among the
108 treatments.

113 Results

114 The results revealed that the leaf meals (LM) studied are rich in crude protein (CP).
115 The crude fibre (CF) contents of these LM are moderate, most especially for *C.*
116 *pubescent* leaf meal (CLM), while *P. phaseoloides* leaf meal (PLM) is very high in
117 CF (Table 2). The CLM and PLM are rich in ash, while *M.invisa* leaf meal (MLM) is
118 very low in ash. The CLM and MLM are rich in calcium, potassium and phosphorus.
119 The PLM had the least calcium and potassium. The LM have moderate concentrations
120 of magnesium and sodium, while the concentration of phosphorus in the PLM is the
121 lowest. The concentrations of zinc and iron of the LM are moderate. The
122 concentrations of oxalate, phytate and tannin in these LM are presented in Table 2.
123 The most available anti-nutritional factor was tannin.

124 Feed intake, weight gain and feed conversion ratios of Black Nera chicks, Black Nera
125 growing pullets, broiler starters and finishers fed graded levels of *Centrosema*
126 *pubescens* leaf meal were significant ($P<0.05$) (Table 3). Dietary inclusion of 2 to 6%
127 CLM supplements for Black Nera chicks resulted to increased feed intake and
128 depression in both weight gain and feed conversion ratio compared to the birds placed
129 on control diet. However, the best performance for Black Nera growing pullets in
130 terms of weight gain was observed on the birds placed on 2% CLM, which also had
131 elevated feed intake. Dietary inclusion of 2.5 to 5.0% CLM for broiler starters and
132 finishers resulted to elevated feed intake which depressed at 7.5% (Table 3).

133 Inclusion of more than 20g/kg *Mimosa invisa* leaf meal to the diets of cockerel chicks
134 resulted to lower feed intake and depressed weight gain and feed conversion ratio
135 (Table 4). Similar scenario was observed for cockerel growers fed graded levels of
136 *Mimosa invisa* leaf meal. Dietary inclusion of *Mimosa invasa* leaf meal in broiler
137 starters and finishers diets resulted to significant ($P<0.05$) reduction in feed, weight
138 gain and feed conversion ratio, which were progressive. Broiler starters and finisher
139 fed graded levels of *Pueraria phaseoloides* leaf meal had reduced weight gain and
140 feed conversion ratio which were significant ($P<0.05$) and progressive compared to
141 control (Table 5).

142

143 Discussion

144 The leaf meals (LM) studied are moderate in crude fibre (CF), except PLM. The
145 relatively high CP and low CF with high concentration of ash will necessitate the use
146 of CLM and PLM as protein and mineral supplements in chicken production. **Aletor**

147 and Omodara (29) revealed that some tropical legumes have higher nutritive value
 148 and that the availability of the component amino acids in the small intestine would be
 149 more when the leguminous forage materials are fed dried than when fresh. The CP
 150 value of CLM in this study is higher than the report of Aletor and Omodara (29), but
 151 similar to that of Nworgu *et al.* (30) (19.6%) and Raharjo *et al.* (31) (21.4%). Wilson
 152 and Lansbury (32) reported that *C. pubescens* contained 20.0% CP, with CF of 30.0%,
 153 while Nworgu and Ajayi (33) noted that *C. pubescens* harvested at 12 weeks after
 154 planting contained 18.70% CP, 11.80%CF, 6.98% ash and other extract of 4.42%.
 155 Dougall and Bogdan (34) highlighted that *M. invisa* leaves contained 16.2 and 37.2%
 156 of CP and CF, respectively. The gross energy (GE) of the LM was 4354, 4419 and
 157 4628Kcal/kg, for CLM, PLM and MLM, respectively. These values are in harmony
 158 with the reports of Skerman *et al.* (36) who reported that tropical legumes have GE of
 159 4326-4802Kcal/Kg. Raharjo *et al.* (31) reported that GE of CLM was 3885Kcal/kg,
 160 while that of PLM was 3872Kcal/kg. The variations in the CP,CF GE and EE could
 161 be attributed to the age of cutting, climatic conditions, methods of processing and
 162 analyses. Concentrations of calcium and potassium which were highest in the CLM
 163 and MLM are in line with the submission of Aletor and Omodara (29) who stated that
 164 calcium, potassium and sodium were the most available mineral elements in forage
 165 meals. Calcium and phosphorus concentrations for CLM in this study are higher than
 166 that reported by Raharjo *et al.* (31) whose value were 0.72 and 0.23% for calcium and
 167 phosphorus, respectively, but they are in harmony with the reports of Gohi (37) and
 168 Leche *et al.* (38) who reported 0.78 – 1.36% for calcium and 0.13-0.45% for
 169 phosphorus. Neme and Nery (39) reported that MLM contained 0.14% phosphorus
 170 which is lower than reported in this study. The report of Dougall and Bogdan (34) on
 171 the calcium content of MLM (1.10%) is slightly lower than reported here (1.26%).
 172 The calcium content of PLM in this study is relatively lower than the results of Neme
 173 and Nery (43), Skerman *et al.* (39) and Lowry *et al.* (40) (0.36 – 1.72%). The values
 174 of phosphorus and magnesium reported in this study are lower than the values of
 175 Lowry *et al.* (40).
 176 The diets for the chickens met the nutritional requirements of the birds are in line with
 177 standards of NRC(18). Dietary inclusion of *Centrosema pubescens* meal in the diets of
 178 broilers, cockerel chicks/finishers and pullet chicks/growers significantly ($P<0.05$)
 179 resulted to reduced feed intake unlike the broilers fed graded levels of *Pueraria*
 180 *phaseoloides* leaf meal (PLM). At both phases, feed intake of broilers fed 30-

181 90PLM/kg feed increased with increased dietary inclusion of PLM supplements. This
182 observation for the broilers fed PLM supplements is contrary to the submission of
183 Nworgu (7), Esonu *et al.* (14), Udedibe and Opara (46). The increased feed intake for
184 the broiler fed PLM supplements is associated with the lightweight of the PLM leaf
185 meal and its lower energy. However, the weight gain of the broilers fed PLM
186 supplements significantly ($P<0.05$) and progressively decreased with increased
187 dietary concentrations of PLM. This observation is not in line with the reports of
188 Ngodigha (13), Omeje *et al.* (42) and Ogbonna and Oredein (45).

189 Dietary inclusion of 20-60kg *Mimosa invisa* leaf meal (MLM) in cockerel finishers,
190 broiler starters and finishers resulted to depressed weight gain and feed conversion
191 ratio which were significant ($P<0.05$) and progressive. Poor performance of these
192 birds is attributed to the presence of mimosine in the MLM (44), low acceptability
193 (36) and poor digestibility (8). These results are in harmony with the reports of
194 Udebibie and Opara (46), but contradict, the submission of Ogbonna and Oredein
195 (45).

196 Black Nera pullets tolerated the dietary inclusion of CLM in their diets more than the
197 Black Nera chicks, as they had improved growth rate. Inclusion of 2-6g CLM/kg feed
198 in the diets of the Black Nera chicks resulted to 15.93 – 30.90% depression in growth
199 over control. This result is contrary to the report of Omeje *et al.* (42) who concluded
200 that 50-100gCLM/kg feed resulted to elevation of weight gain. However, this result
201 agrees with earlier observations that dietary inclusion of leaf meal of *L. leucocephala*,
202 (4 and 8) and *Alchornea cordifolia* (46) depressed feed intake, weight gain and feed
203 conversion ratio. Dietary inclusion of 25g CLM/kg feed for broiler starters resulted
204 to 26.34 and 9.60% increase in weight gain over control and 75g CLM/kg feed,
205 respectively. However, for broiler finishers, the increase in weight gain for
206 25gCLM/kg feed was 56.12% due to prolonged feeding, as the feeding was
207 continuous from starter to finisher phase (i.e. 7 weeks). These results are contrary to
208 the reports of Omeje *et al.* (42), but agree with the submission of Odensi *et al.* (5)
209 when broiler chicks were fed graded leaves of *Tithonia diversifolia* and Daghir (17)
210 who recommended 2% of *L. leucocephala* leaf meal for broiler starters and 3% for
211 chick starters. Donkoh *et al.* (10) recommended 25g *Cindoscolus aconitifolius* leaf
212 meal per kilogramme of feed for optimal chickens performances, while Nworgu and
213 Fapohunda (12) Nworgu *et al.* (43) concluded that 25gMLM/kg feed was adequate for
214 broiler chicks and finisher maximum performance.

215 Conclusion

216 The leaf meal (LM) studied are rich in crude protein (21.36 – 23.24%) and ash (4.25-
217 9.14%). The most available mineral elements were potassium (0.45-1.8%) and
218 calcium (0.60-1.26%). *Centrosema pubescens* leaf meal (CLM) is the most
219 outstanding in mineral profile, nutritive value and chickens performance, while
220 *Mimosa invisa* leaf meal (MLM) is the poorest. Broiler starters/finishers, cockerel
221 chicks/growers and pullet chicks/finishers tolerated the CLM, CLM and PLM
222 supplements differently. Dietary inclusion of 40-75g CLM/kg feed and 30-60
223 gMLM/kg feed resulted to depressed feed intake in the chickens, unlike the inclusion
224 of 30-90PLM/kg feed which improved feed intake. Dietary inclusion of 75g CLM/kg,
225 30-60MLM/kg and 30 – 90PLM/kg feed resulted to depressed growth performance.
226 For improved performance and adequate growth rate, it is advisable to include
227 20gCLM/kg feed in the diets of pullet chicks and growing pullets, while 25g CLM/kg
228 feed is adequate for broiler chicks and broiler finishers. However, it is not advisable to
229 include MLM and PLM in the diets of pullet chicks/growers, cockerel chicks/finishers
230 and broiler chicks/finishers due to poor growth rate.

231

232

233

234

235

236

237

238

239

240

241

242

243

244

245

246

247

248

Table 1: Gross composition of control diets

Ingredients%	Pullet Chicks (0-6wks)	Growing pullets (8-16wks)	Broiler chicks (1-5wks)	Broiler finishers (5-8wks)	Cockerel chicks (0-9wks)	Cockerel growers (10-18wks)	Broiler chicks (0-4wks)	Broiler finishers (4-8wks)	Broiler starters (0-4kws)	Broiler finishers (4-8wks)
<i>Centrosema pubescens</i>										
<i>Mimosa invasa</i>										
<i>Pureria phaseoloides</i>										
Maize	31.6	20.3	48.0	51.5	30.0	24.3	44.0	45.3	46.8	48.8
Corn bran	21.0	23.4	14.0	17.2	26.6	22.0	13.0	13.8	10.0	11.0
Palm kernel cake	12.0	21.0	-	-	9.0	20.4	-	-	5.2	5.2
Coca pod husk	8.5	9.5	-	-	10.0	8.0	5.0	5.0	-	-
Soybean meal	14.6	11.0	21.2	17.5	13.0	11.1	20.6	20.0	20.4	19.4
Groundnut Cake	6.5	6.5	9.5	7.0	4.0	6.4	10.0	9.0	10.3	9.3
Leaf meal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fish meal	2.0	3.5	4.0	3.0	4.2	3.5	4.0	3.5	4.0	3.0
Bone meal	2.0	2.5	2.5	3.0	2.3	3.5	2.6	2.6	2.5	2.5
Oyster shell	1.0	1.5	-	-	-	-	-	-	-	-
Salt	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Vitamin-mineral premix*,+ Lysine	0.2	0.2	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.3
Methionine	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1
Calculated analysis										
Crude protein(%)	19.0	18.9	22.0	18.8	18.7	20.3	22.0	21.2	22.6	21.3
Crude fibre(%)	6.9	8.8	4.5	4.4	6.8	7.6	5.4	5.4	4.3	4.4
Metabolisable energy (Kcal/kg)	2640	2526	2936	2966	2646	2436	2882	2889	2909	2932
Determined analysis										
Crude protein (%)	20.5	20.7	22.6	20.1	19.2	18.9	22.2	20.0	23.6	23.6
Crude fibre (%)	8.2	6.9	4.6	4.6	6.8	7.6	5.0	4.6	3.8	3.9
Metabolisable energy (Kcal/kg)	2740	2700	3100	3195	2700	2500	3001	3004	3000	3012

* Vitamin-mineral premix provides per kg of diet: Vit A=10000iu, Vit D3= 1500iu; Vit E=3iu, Vit

B12=0.08mg; Vit.K=2mg; Ribofl=3mg; Production acid=6mg; Niacin=15mg; chlorine=3mg; Folic acid=4mg, Mn=8mg, Zn=0.5mg; iodine=1.0mg; Co=1.2mg; Cu=10mg and Fe=20mg.

+ Vit.-mineral premix provides per kg diet: Vit A=12,500,000iu, Vit D3=2,500,000iu; Vit E=25,000iu; Vit.K = 2.00mg; Vit.

B1=2.00mg; Cu=6.00mg; Fe=40.00mg; iodine=1.00mg; Cobalt=0.2mg; Selenium =0.15mg; Choline chloride = 500.00mg.

• For cockerels and pullet chicks/growers

+ For broiler starters/finishers.

262
263

Table 2: Proximate chemical composition of experimental test ingredients (% DM Basis)

Fraction	Experiment Test Ingredients		
	<i>Centrosema</i> leaf meal	<i>Mimosa</i> leaf meal	<i>Pueraria</i> leaf meal
Dry mater	88.99	89.99	89.90
Crude protein	23.24	23.34	21.36
Crude fibre	8.80	11.29	21.52
Ether extract	3.32	2.38	3.20
Ash	9.14	4.25	8.00
Nitrogen free extract (NFE)	55.50	58.74	45.92
Calcium	1.22	1.26	0.60
Potassium	1.85	1.60	0.45
Phosphorus	0.54	0.38	0.12
Magnesium	0.30	0.24	0.28
Sodium	0.17	0.15	0.11
Zinc (mg/kg/DM)	40.01	40.00	20.00
Iron (mg/kgDM)	20.01	10.11	80.10
Oxalate (g/100g DM)	0.037	0.065	0.060
Phytate (g/100g DM)	0.48	0.37	0.32
Tannin (g/100g DM)	2.81	1.57	3.35
Gross energy (kcal/kg)*	4354	4628	4419

• Estimated by AFRC

264
265

Table 3: Feed intake and growth responses of chickens fed graded levels of *Centrosema pubescens* leaf meal

Dietary level of leaf meal (g/kg)	Source of leaf meal	Type of chicken	0	20	25	40	50	60	75	SEM
Feed intake and weight gain (g/bird)										
Centrosema Pubescens	Black Nera chicks (0-6 wks)		964 ^d	1010 ^a	-	984 ^c	-	998 ^b	-	3.3
			339 ^a	285 ^b	-	234 ^d	-	248 ^c	-	4.1
	Black Nera growing pullets/finisher pullet (8-16wks)		6469 ^b	6658 ^a	-	6093 ^d	-	6199 ^c	-	1.8
			699 ^c	740 ^a	-	719 ^b	-	734 ^{ab}	-	5.8
Feed conversion ratio	Broiler chicks/starters (1-5 wks)		2300 ^b	-	2420 ^a	-	2410 ^a	-	2260 ^b	12.2
			1009 ^c	-	1369 ^a	-	1285 ^{ab}	-	1238 ^b	27.7
	Broiler Finishers (5-8 weeks)		3210 ^a	-	3100 ^a	-	3200 ^a	-	2860 ^b	30.9
			792 ^b	-	1001 ^a	-	985 ^a	-	562 ^c	24.0
Feed conversion ratio	Black Nera chicks (0-6wks)		2.8 ^c	3.5 ^b	-	4.2 ^a	-	4.0 ^a	-	0.11
	Black Nera growing pullets/finisher pullets (8-16wks)		9.3 ^a	9.0 ^{ab}	-	8.5 ^b	-	8.4 ^b	-	0.51
Feed conversion ratio	Broiler chicks/starter (1-5 wks)		2.3 ^a	-	1.8 ^b	-	1.9 ^b	-	1.8 ^b	0.07
Feed conversion ratio	Broiler finisher s (5-8 wks)		4.16 ^b	-	3.19 ^d	-	3.3 ^c	-	5.1 ^a	0.17

266 abcd: Means with different superscripts on the same horizontal row differ
267 significantly(P<0.05),WKS=weeks Numerator = Feed intake; Denominator = Weight gain
268

269 **Table 4: Feed intake and growth responses of chickens fed graded levels of**
 270 ***Mimosa invisa* leaf meal**

Dietary level of leaf meal (g/kg)

Source of leaf meal	Type of chicken	0	20	30	40	60	SEM
Feed intake and weigh gain (g/kg)							
<i>Mimosa invisa</i>	Cockerel chicks (0-9wks)	$\frac{2908^c}{517^d}$	$\frac{3142^a}{644^a}$	-	$\frac{2706^d}{553^c}$	$\frac{3082^b}{588^b}$	$\frac{3.0}{3.5}$
	Cockerel growers/finisher (10-18weeks)	$\frac{8800^a}{1058^a}$	-	$\frac{8783^b}{853^b}$	-	$\frac{8166^c}{820^c}$	$\frac{3.3}{15.7}$
	Broiler chicks (0-4 wks)	$\frac{1282^a}{538^a}$	$\frac{1235^b}{504^b}$	-	$\frac{1174^d}{505^b}$	$\frac{1204^c}{403^{bc}}$	$\frac{1.6}{5.5}$
	Broiler finisher g/bird (4-8 wks)	$\frac{3741^a}{659^a}$	$\frac{3642^b}{413^b}$	-	$\frac{3371^d}{400^c}$	-	$\frac{2.0}{3.0}$
Feed conversion ratio							
	Cockerel chicks (0-9wks)	5.6 ^a	4.9 ^c	-	5.1 ^b	5.2 ^b	0.09
	Broiler chicks (0-4 wks)	8.3 ^b	-	10.2 ^a	-	10.0	0.82
	Broiler finisher (4-8wks)	2.4 ^b	2.5 ^b	-	2.3 ^b	3.0 ^a	0.03
	Broiler finisher (0-4 wks)	5.9 ^a	8.8 ^b	-	8.4 ^b	8.6 ^b	0.05

271 Abcd: means with different superscripts on the same horizontal row differ significantly (p<0.05);

272 WKS = Weeks ; Numerator = Feed in take; Denomminator = Weight gain

273 **Table 5: Feed intake and growth responses of chickens fed graded levels of**
 274 ***Pueraria phaseoloides* leaf meal.**

Dietary Level of Leaf Meal (g/kg)						
Source of						
Lead meal	Type of chicken	0	30	60	90	SEM
Feed intake and weight gain						
<i>Pueraria phaseoloides</i>	Broiler	<u>1202^b</u>	<u>1122^b</u>	<u>1234^a</u>	<u>1246^a</u>	<u>0.7</u>
	starter(0-4	536 ^a	479 ^b	453 ^c	399 ^d	0.7
	wks)					
	Broiler	<u>4306^d</u>	<u>4387^c</u>	<u>4492^a</u>	<u>4446^b</u>	<u>0.7</u>
	finisher (4-8	1466 ^a	1370 ^b	1354 ^c	1341 ^d	0.6
	wks)					
Feed conversion ratio						
	Broiler	2.2 ^c	2.3 ^c	2.7 ^b	3.1 ^a	0.22
	starter					
	(0-4 wks)					
	Broiler	2.9 ^b	3.2 ^a	3.3 ^a	3.3 ^a	0.24
	finisher					
	(4-8 wks)					

275 **abcd: Means with different superscripts on the same horizontal row differ**
 276 **significantly (P<0.05)**

277 **Numerator = Feed intake; Denominator = Weight gain; WKS = Weeks**

278

279 **References**

- 280 **1. AFRC., 1990.** Agricultural and Food Research Council: 750.
- 281 **2. AOAC., 1990.** Association of Official Analytical Chemists. Official Methods of
- 282 Analyses. 15th Edition, Washington, D.C.
- 283 **3. ARC., 1995.** Agricultural Research Council. In: World Poultry Journal 57:225-243.
- 284 The nutrient requirements of farm livestock, poultry, 2nd Edition (London,
- 285 Agricultural Research Council).
- 286 **4. Aletor V.A. and Omodara O.A., 1994.** Studies on some leguminous browse
- 287 plant, with particular reference to their proximate, mineral and some endogenous
- 288 anti-nutritional constituents. Animal Feed Science and Technology 46:343-348.
- 289 **5. Boehringer., 1979. Mannheim GmbH Diagnostica 6800.** Mannheim Germany,
- 290 Cat. No. 124974.

- 291 **6. Carpenter K.J. and Clegg K.M., 1956.** The metabolisable energy of poultry feed
292 stuff in relation to their chemical composition. Journal Science, Food and Agriculture
293 7:45-48.
- 294 **7. Daghir N.J., 1995.** Feedstuffs used in hot regions. In: Poultry production in hot
295 climates. Daghir, N.J. (ed): 1st Edition CAB International Wallingford UK: 125-154.
- 296 **8. Donkoh A., Atuahene C.C., Poku-Prempeh Y.B. and Twinn I.G., 1999.** The
297 Nutritive value of chaya leaf meal (*Cnidoscolus aconitifolius* (Mill) Johnston):
298 Studies with broiler chickens. Animal Feed Science and Technology (Netherlands)
299 77 (1-2):163 – 172.
- 300 **9. Dougall H.W. and Bogdan A.V., 1966.** The chemical composition of some
301 leguminous plants grown in the herbage nursery at Kitale, Kenya. East African
302 Agricultural and Forestry Journal 32:45-49.
- 303 **10. D'Mello J.P.E., 1995.** Leguminous leaf meals in non-ruminant nutrition. In:
304 Tropical legumes in animal nutrition. 1st Edition. A.B. International, Wallingford,
305 Oxon, U.K.247-280.
- 306 **11. D'Mello J.P.F., 1992.** Nutritional Potentialities of fodder trees and fodder shrubs
307 as protein sources in monogastric nutrition. Legume trees and other fodder trees as
308 protein sources for livestock. Food and Agriculture Organization, Rome. 1st
309 Edition. Speedy, A and Puglies, P.H. (eds.) :115-127.
- 310 **12. Esonu B.O., Iheukwumere F.C., Iwuji T.C., Akanu N and Nwugo O.H., 2003.**
311 Evaluation of *Microdesmis puberula* Leaf meal as feed ingredient in broiler starter
312 diets. Nigerian Journal of Animal Production 30(1): 3-8.
- 313 **13. FAO., 1992.** Legume tree and other fodder trees as protein sources for
314 livestock. FAO Animal Production and Health Paper 102: 14-18.
- 315 **14. Gohi B., 1981.** Tropical feeds FAO Animal Production and Health Series No. 12:
316 529.
- 317 **15. Hagerman A.E. and Ler I.G., 1983.** Precipitation method for the qualitative
318 determination of tannins. Journal of Agriculture, Food and Chemistry 26: 809-812.
- 319 **16. Igbedioh S.O., Olugbemi K.T.A. and Akpapunam M.A., 1994.** Effect of
320 processing methods on phytic acid level in bambara nut and pigeon pea. Chemistry
321 50:147-151.
- 322 **17. Leche T.I., Groenendyk G.H., Westwood N.H. and Jones M.W., 1992.**
323 Composition of animal feedstuffs in Australia. 1st Edition. Division of Animal
324 Production, CSIRO: 78-84.

- 325 **18. Lowry B.J., Petheram J.R. and Tangendjaja B., 1992.** Plants fed to village
326 ruminants in Indonesia, Canberra. aciartechnical reports, no. 22:60.
- 327 **19. McDonald P., Edward R.A. and Greenhalgh J.P.D., 1994,** Evaluation of food.
328 In:Animal nutrition. 4th edition. Longman Scientists and Technical, England: 260-283.
- 329 **20. Natanman R. and Chandrasekaran D., 1966.** Subabul leaf meal (*Leucaena*
330 *leucocephala*) as a protein supplement for broilers. Indian Vet. Journal 73 (10): 1042
331 – 1042.
- 332 **21. Neme A.A. and Nery J.R., 1965,** Influence of mineral fertilizers and lime on the
333 yield and chemical composition of perennial forage legumes. Proceedings 9th Grassl,
334 Congr. Sao Paulo, Brazil: 655-670.
- 335 **22. Ngodigha E.M., 1994.** Incorporation of *Centrosema pubescens* in broiler diets.
336 Effects on performance characteristics. Bulletin Animal Health Africa 42:159-161.
- 337 **23. Nworgu F.C., Adebowale E.A., Oredein O.A. and Oni A., 1999,** Prospect and
338 economics of broiler production using two plant protein sources. Tropical Journal of
339 Animal Science 2 (1): 159-166.
- 340 **24. Nworgu F.C. and Faphunda J.B., 2002,** Performance of broiler chicks fed
341 mimosa (*Mimosa invisa*) leaf meal supplements.Proceeding of 27th Ann. Conf. of
342 Nigerian Society of Animal Production (NSAP), Held at the Federal University of
343 Technology Akure, Nigeria on the 17th – 21st March, 2002. Aletor V.A. and Onibi
344 G.E. (eds.): 128 – 131.
- 345 **25. Nworgu F.C., 2004.** Utilization of forage meal supplement in broiler production.
346 Ph.D. Thesis University of Ibadan, Ibadan – Nigeria: 136-146.
- 347 **26. Nworgu F.C., Egbunike G.N. and Osayomi O.J., 2001.** Performance of
348 growingrabbits fed a mixture of leaf meals and concentrates. Tropical Animal
349 production Investigation 4:37-48.
- 350 **27. Nworgu F.C. and Ajayi F.T., 2005,** Biomass, dry matter yield, proximate and
351 mineral composition of forage legumes grown as early season feeds. Livestock
352 Research for Rural Development (17):
353 <http://www.utafoundation.org/irrd1711/nwor/7121.htm>
- 354 **28. Nworgu F.C., Egbunike G.N., Ononogbu C.E., Fapohunda J.B. and Ogbonna**
355 **J.U., 2003.** Effect of mimosa (*Mimosa invisa*) leaf meal supplements on broiler
356 finishers performance. Proceedings of the 8th Annual Conf. of Animal Science
357 Association of Nigeria. Held at Federal University of Technology, Minna, Niger

State on September 16 – 18th. Olatunji, E.A., Ayanwale B.A., Shiawoya Ed. And
 Aremu A (eds): 36-39.

29. Nworgu F.C. and Egbunike G.N., 1999. Performances characteristics of broilers
 fed diets with soyabean meal and groundnut cake as protein sources. Tropical Animal
 Production Investigation 2 (1): 51-59.

30. Odunsi A.A., Farinu G.O., Akinola J.O and Togan V.A., 1999, Growth,
 carcass characteristics and body composition of broiler chicks fed wild sunflower
 (*Tithonia diversifolia*) forage meal. Tropical Animal Production investigation 2:205 –
 211.

31. Ogbonna J.U. and Oredein A.O., 1998. Growth Performance of cockerel chicks
 fed cassava leaf meal. Nigeria Journal of Animal Production 25(2): 129-133.

32. Ogbonna J. U. and Adebawale, E.A., 1993. Effects of sun-dried cassava peel
 meal as replacement for maize and wheat offals on performance and nutrient
 utilization of
 cockerels. Nigerian Journal of Animal Production 20(1&2): 61-70

33. Onwudike O.C., 1995. Use of the legume tree crops: *Gliricidia sepium* and
Leucaena leucocephala as green feeds for growing rabbits. Animal Feed Science and
 Technology 51:153-163.

34. Omeje S.I., Odo B.I. and Egwu P.O., 1997. The effects of *Centrosema*
pubescens as leaf meal concentrate for broiler birds. In Book of Abstract of the 22nd
 Annual Conference of NSAP, held at Abubakar Tafawa Balewa University, Bauchi,
 Nigeria: 136-137.

35.S.A., Opoku R.S. and Atuahene C., 1990. *Gliricidia speium* leaf meal as an
 ingredient in layers diets. Animal Feed Science and Technology 29:302-308.

36. Raharjo Y.C., Cheeke P.R., Patton N.M. and Supriyati K. 1986. Evaluation of
 tropical forages and by-product feeds for rabbit production. Nutrient digestibility and
 effects of heat treatment. Journal of Applied Rabbit Research 9:56-66.

37. Reyes B., 1955. The digestibility of *Centrosema pubescens* and *Purearia*
javanica. Philippine J. Agric. 30:27-27.

38. Ross E. and Enriquez F.O., 1969. The nutritive value of cassava leaf meal.
 Poult. Sci. 48:846-853.

39. SAS., 1989. Statistical Analysis System, Institute Inc. SAS/START user's guide
 version. 6th Edition, SAS Inst. Inc. Cary. NC. 846.

- 391 **40. Scott M.L., Nesheim M.C. and Young R.J., 1982.** Nutrition of chicken. Scott,
392 M.L. and Ithaca, N.Y. (eds.). 1st Edition: 25-50.
- 393 **41. Steel R.G. and Torrie J.H., 1980.** Principles and procedures of statistics. A
394 biometrical approach. 2nd Edition, McGraw Hill Book Co. Inc., New York.
- 395 **42. Silva H.O., Fonseca R.A-da, Guedes-Filho-R-des and da – Fonseca R.A.,**
396 **2000.** Productive traits and digestibility of cassava leaf meal in broiler diets without
397 addition of enzymes. Revista-Brasillerra-de Zootecnia. 29(3): 823-829.
- 398 **43. Skerman P.J., Cameroon D.G. and Riveros F., 1988.** *Centrosema spp.* In:
399 Tropical Forage legumes. 2nd Edition, FAO Plant production and protection Series,
400 No. 2. Rome – Italy. Skerman (ed.): 237-257.
- 401 **44. Talapatra E.L. and Price B.L., 1948.** Oxalate: Its chemistry and nutritional
402 significance. World Review of Nutrition and Dietetics, Krager, New York: 51-55.
- 403 **45. Tackie A.M. and Flenscher J.E., 1995,** Nutritive value of wild sorghum fortified
404 with *Leucaena leucocephala* (Wh.Lam). Bulletin Animal Health Africa 47: 223-275.
- 405 **46. Topps J.H., 1992.** Potential composition and use of legume shrubs and trees as
406 fodder for livestock in the tropics. Tropical Journal of Agricultural Science
407 Cambridge 118:1-8.
- 408 **47. Udedibie A.B.I. and Opara C.C. 1998.** Responses of growing broilers and
409 laying hens to the dietary inclusion of leaf meal from *Alchornia cordifolia*. Animal
410 Feed Science and Technology 71: 157 – 164.
- 411 **48. Wilson A.S.B. and Lansbury T.J., 1958.** *Centrosema Pubescens*: Ground cover
412 and forage crops in cleared rainforest of Ghana. Empire Journal of Experimental
413 Agric. 26: 351-364.
- 414