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A note on the effect of feeding local forages to commercial layers on egg production and yolk colour

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ABSTRACT

The effect of feeding *Arachis glabrata, Leucaena leucocephala, Calliandra calothyrsus* or *Desmodium* spp. leaves to commercial layer on egg production and yolk colour was compared with the effect of feeding an artificial yolk pigmentor (Carophyl ®). Percent hen-day production averaging 77.4 and 74.7%, respectively for hens fed on *Desmodium* spp. and *Leucaena leucocephala* leaves, were significantly ($P<0.05$) higher than egg production in the control group. No significant difference was recorded among treatment groups for shell thickness. Yolk colour in groups fed forage leaves ranges between 6.76 and 9.83 and was significantly better than in control group (2.35). It was concluded that any of the studied forage leaves could be used to supply xanthophyll to commercial layers with no detrimental effect on egg production and quality.

KEY WORDS: layers, egg production, yolk colour, forage leaves, artificial pigmentor

INTRODUCTION

One of the major problems facing African table eggs producers is that of convincing the local consumer that eggs produced in modern poultry farms are of comparable quality with eggs from village scavenging hens. In general the local reference is the size of the egg usually around 35-45 g and particularly the colour of the yolk that must be dark yellow. In many countries, carotenoid pigments improving the colour of the egg yolk as well as the shanks and beaks of layers are found in yellow maize, lucerne meal, maize gluten meal (Leeson and Summers, 1997) and artificial pigmentors. According to Sunde (1992) the sales of pigmentors in the USA amount to about $ 150 millions/year while in Europe some $ 100

millions are spent yearly. In Tropical Africa however, lucerne and maize gluten meals are not readily available and maize is the main source of xanthophylls. As maize used by local feed manufacturers is mainly white and not usually very rich in pro-vitamin A, the solution to better egg yolk colouring is the utilisation of artificial pigments. Artificial pigments are usually expensive and therefore out of reach for most of those farmers who make their own feed from basic ingredients. However, it could be possible to include some locally produced forages to improve the xanthophyll content of layer feeds without increasing the cost of feeding or reducing the production level. In addition, reports by Téguia et al. (1993) had shown that adding small amount of leaves to broiler diet could have a positive effect on production.

Leaves of perennial peanuts (*Arachis glabrata*) are widely used for ruminant nutrition (Moore et al., 1981) but may have a value for poultry, particularly for egg yolk colouring and additional protein. Téguia et al. (1997) however reported that weight gain by broiler chickens was depressed and feed conversion ratio was increased when perennial peanut replaced above 200 g maize kg^{-1}. *Leucaena leucocephala* and *Calliandra calothyrsus* introduced some few years ago as a feed supplement for ruminants during the dry season in the Western Highlands of Cameroon are known to be rich in carotene. *Desmodium* spp. are widely spread natural legume found in the country, particularly *Desmodium uncinatum* and *Desmodium inturtum*.

The objective of the present work was to study the effect of adding *Arachis glabrata Benth, Leucaena leucocephala, Calliandra calothyrsus or Desmodium* spp. to layer feed on egg quality and production of commercial layers.

MATERIAL AND METHODS

Animals

One hundred and eighty 53-week old Bridomat layers were randomly distributed to 30 groups of 6 birds housed in pairs in Californian type cages of the University Experimental Farm. Birds were immunised against Newcastle disease, infectious bronchitis, Gumboro disease, cholera and fowl pox.

Feeding

The experimental farm layer feed was formulated to contain (%): crude protein 17; crude fibre 3.5; Ca 3.5; P 0.45 and 2641 kcal ME/kg.

Fresh green leaves of *Arachis glabrata, Leucaena leucocephala, Calliandra calothyrsus* were collected daily from the University of Dschang Experimental

Farm while a mixture of fresh *Desmodium inurtum and Desmodium uncinatum* leaves were collected daily from the farm surroundings. No particular attention was given to the age of leaves. Samples of forage species were oven dried at 50°C for 48 h and analysed for crude protein, crude fibre, crude fat according to AOAC (1980), dry matter (105°C for 24 h) and ash (500°C over night). All the leaves were finely cut into very small pieces using a knife.

Five groups of 36 birds were given in each experimental or control diets. Birds in control group were given per hen daily 167 g of layer feed containing 0.1 g Carophyl/kg, while birds in experimental groups were given 153 g of layer diet and 14 g of forage leaves per hen per day.

Data collection

During a six-week experimental period, data were collected on daily egg production and egg weight. After every 7-day period, 2 eggs per replicate for a total of 12 eggs per treatment were randomly selected, individually marked, refrigerated at +4°C for 24 h then used for egg quality study. Each egg was weighed to the nearest 0.1 g using an electronic Mettler PE 160 scale and broken for the following measurements:

- yolk colour using a Roche Yolk Colour Fan graduated from 1 to 15
- albumen height using Haugh unit according to USDA system where eggs are ranked AA for values equal or above 72, A for values between 60 and 71 and B for values from 31-59
- shell thickness to the nearest 0.01 mm at 2 different points of the equator of the egg using a Ames 25 M-5 micrometer (Walthman, Mass, USA) after the shell had been thoroughly washed then oven dried at 40°C for 24 h
- shell weight after the drying using the electronic scale.

The percent hen-day egg production and the % egg shell were then calculated.

Data were analysed using a completely randomized design with 5 treatments replicated 6 times each. The least significant difference test was used for mean separation in case of significant difference (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Table 1 summarises the chemical composition of the forage leaves. The percent of DM was lowest for *Desmodium* spp. and highest for *Leucaena leucocephala.* Except for *Calliandra calothyrsus* leaves, the CP content of all forages was above 20% of DM. The crude fibre content of *Arachis glabrata* was almost twice that of

the other leaves whose values were bellow 16%. The highest crude fat content was recorded with *Calliandra calothyrsus* and the lowest with *Arachis glabrata*. The wide variations observed in the chemical composition of samples confirmed earlier report by Téguia et al. (1999) for the browse species. The values obtained for *Desmodium* spp. leaves were in the range reported by Skerman (1982). The N content of *Leucaena leucocephala* and *Calliandra calothyrsus* was respectively lower and higher than values previously reported by Téguia et al. (1999) for samples from the same farm plots. The difference may be attributed to the age of leaves.

The data of egg production are given in Table 2. Hens fed *Desmodium* or *Leucaena leucocephala* leaves had significantly ($P<0.05$) higher rate of egg production than those fed the control diet. With 73% hen-day egg production, birds on *Arachis glabrata* ration were comparable with those on *Leucaena leucocephala* and *Calliandra calothyrsus* diets on one hand and to the control group on the other. For average egg weight, birds receiving *Calliandra calothyrsus* produced significantly ($P<0.05$) lighter eggs than those of the control group, however, comparable with eggs from all the other groups fed on green leaves. There was no significant ($P>0.05$) difference between the control group and the groups fed either *Arachis glabrata, Leucaena leucocephala* or *Desmodium* spp. leaves for average egg weight (Table 2).

TABLE 1

Chemical composition of *Arachis glabrata, Leucaena leucocephala, Calliandra calothyrsus* and *Desmodium* spp. leaves, % DM

Leaves	Dry matter	Crude protein	Ash	Crude fibre	Crude fat
Arachis glabrata	84.08	21.22	10.44	27.42	3.41
Calliandra calothyrsus	84.91	18.81	9.27	12.49	5.28
Leucaena leucocephala	90.90	23.01	8.00	15.80	4.01
Desmodium spp.	54.10	24.14	6.68	14.40	5.00

TABLE 2

Egg production and characteristics of eggs from laying hens fed *Arachis glabrata, Leucaena leucocephala, Calliandra calothyrsus* and *Desmodium* spp. leaves

Treatments	Average egg weight, g	% hen day production	Egg shell %	Shell thickness mm	Yolk colour
Control	65.9 ± 3.6^{a}	70.1 ± 9.8^{c}	8.88 ± 0.33^{b}	0.368 ± 0.01^{a}	2.35 ± 0.0^{d}
T1 (*Arachis*)	65.1 ± 4.6^{ab}	73.0 ± 11.2^{bc}	8.97 ± 0.52^{ab}	0.367 ± 0.01^{a}	6.76 ± 0.5^{c}
T2 (*Leucaena*)	65.3 ± 3.3^{ab}	74.8 ± 11.0^{ab}	8.84 ± 0.18^{b}	0.364 ± 0.01^{a}	9.83 ± 0.0^{a}
T3 (*Calliandra*)	64.1 ± 2.6^{b}	73.5 ± 2.7^{bc}	9.11 ± 0.27^{a}	0.368 ± 0.01^{a}	9.09 ± 0.5^{ab}
T4 (*Desmodium*)	65.1 ± 2.3^{ab}	77.4 ± 7.6^{a}	8.90 ± 0.73^{ab}	0.363 ± 0.73^{ab}	8.64 ± 0.7^{ab}

^{abc} means with same letter in the same column are not significantly different at $P<0.05$

The increase in egg production in the groups of hens fed leaves as compared with the control group may be related to the effects of additional nutrients such as proteins contained in the forages. Reports of Téguia et al. (1993, 1997) had shown that adding small amounts of leaves to broiler chicken diet could have a positive effect on production parameters. Although feeding of leaves to layers seemed to have a detrimental effect on egg weight, the total egg mass benefited from adding leaves to the diets.

All the eggs produced during this experiment had Haugh unit values above 72 and were therefore ranked AA according to the USDA (1984) standards. For yolk colour, eggs from all the birds fed forage leaves had significantly ($P<0.05$) higher pigmentation values than the control group of birds receiving the artificial pigmentor. Among the leaves, *Leucaena leucocephala* ranked highest with an average value of 9 on a scale of 1 to 15 but comparable to *Calliandra calolthyrsus* and *Arachis glabrata* ranked lowest with an average value of about 7 (Table 2). The difference observed between hens fed different types of leaves may be attributed to a more efficient absorption and deposition of oxycarotenoids from *Leucaena* and *Calliandra* (Henckcn, 1992).

Values of shell thickness were very similar for all treatments as the absolute value of differences among them were less than 10^{-2} mm. Average percent egg shell of eggs from hens receiving the control ration or *Leucaena leucocephala* was significantly ($P<0.05$) lower than that of eggs from hens fed on *Calliandra leucocephala* leaves. However, there was no significant ($P>0.05$) difference between *Arachis glabrata, Calliandra calothyrsus* and *Desmodium* spp. for percent egg shell. The control diet, and the diets with *Arachis, Leucaena* or *Desmodium* leaves were also comparable for percent egg shell. The percent egg shell in all the groups was lower than the 11% suggested by North (1984) for a newly laid egg, but this could be related to the age of layers as the proportion of shell material deposited decrease with the age of birds.

CONCLUSIONS

The results suggest that *Leucaena* and *Desmodium* leaves significantly improved percent hen day production and any of the studied forage leaves could be used to supply xanthophyll to commercial layers and that with these dietary levels, there was no detrimental effect on egg quality.

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STRESZCZENIE

Wpływ żywienia zielonkami na produkcję jaj i zabarwienie żółtek u kur nieśnych

Porównano produkcję jaj i wybarwienie żółtek u kur nieśnych, którym podawano liście *Arachis glabarta*, *Leucaena leucocephala*, *Calliandra calothyrsus* lub *Desmodium* spp., bądź dietą kontrolną zawierającą barwnik Carophyl®. Nieśność kur żywionych dietą z liśćmi *Desmodium* spp. i *Leucaena leucocephala* była istotnie (P≤0,05) większa (odpowiednio 77,4 i 74,7%) niż w grupie kontrolnej. Rodzaj skarmianej diety nie miał wpływu na grubość skorupy jaj. Wybarwienie żółtek było istotnie (P≤0,05) lepsze w grupach żywionych mieszanką z dodatkiem zielonek niż w grupie kontrolnej (6,76-9,83 vs 2,35). Wydaje się, że wszystkie badane zielonki mogą być używane jako źródło barwnika dla kur nieśnych bez ujemnego wpływu na produkcję i jakość jaj.