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YIELD AND CHEMICAL COMPOSITION OF WILD SUNFLOWER *(TITHONIA DIVERSIFOLIA* HEMSL A. GRAY) AND THE FEEDING VALUE OF WILD SUNFLOWER FORAGE MEAL IN BROILER CHICKEN DIETS

G.O. FARINU; A. A. ODUNSI; J.O. AKINOLA AND V.A. TOGUN
Department of Animal Production and Health
Ladoke Akintola University of Technology
P. M. B. 4000, Ogbomoso, Nigeria.

Target Audience : Poultry farmers, animal science researchers, feed millers, animal nutritionists

ABSTRACT

An experiment was conducted to determine the forage yield and chemical composition of the green leaf, senescenced leaf and inflorescence fractions of the wild sunflower and the value of wild sunflower forage meal (WSFM) as a feed resource in broiler chicken diets. Results showed that crude protein and ether extract contents were higher in green leaf compared to senescenced leaf or inflorescence while solube sugars, ADF and NDF were lower in the green leaf compared to either senescenced leaf or inflorescence. Inclusion of WSFM in broiler starter diets indicated that feed intake, weight gain and feed conversion ratio were similar up to 5 % while they were significantly depressed at 7.5 % and 10.0 % levels. Crude protein retention was adversely affected by the 10 % WSFM diet. The cost of feed consumed per kg weight gain was in favour of WSFM inclusions up to 10 %.

Key words: Wild sunflower forage meal, nutrient compostion, feed resource, poultry, nutrient retention, broiler.

DESCRIPTION OF PROBLEM

In Nigeria today, the commercial poultry industry is experiencing a number of difficulties including the prohibitive prices and non-availabilty of the conventional feed ingredients used in formulating chicken diets. The scarcity and escalating prices of maize and the protein supplements such as soyabean meal, groundnut cake and fish meal, are responsible for the rising cost of feeding poultry. Total or partial replacement of these ingredients in finished feeds by locally available and cheaper feed resources could bring about a substantial reduction in the cost of production, thereby making commercial poultry production a viable enterprise.

Wild sunflower *(Tithonia diversifolia* Hemsl-A. Gray) has crude protein concentration greater than 8 % DM and could be cultivated by resource poor farmers who could manipulate planting density to acheive maximum yield (1). On the whole, this feed resource has some attributes to qualify it as a

cheaper substitute. It is abundant in nature.
It also has a limited processing demand and it is not in competitive demand for human consumption (2). With the above in mind, this study was carried out to determine the forage yield and chemical composition of the various parts of the wild sunflower, and also to partially replace maize in broiler starter diets with wild sunflower forage meal (WSFM) so as to reduce the cost of poultry diets. It is hoped that this would make commercial poultry production economically viable, and also enable small scale poultry farmers to produce some of the feed ingredients needed to formulate cheaper diets.

MATERIALS AND METHODS

Experimental location

The experiment was carried out at the Ladoke Akintola University of Technology Teaching and Research Farm. Ogbomoso, 80 km south of Ilorin (Lat. 8^0 26'N; long, 4^0 29'E). where annual rainfall of 1173 mm is usually experienced with June to October rainfall accounting for over 73 % of this amount (1). The top (0-15 cm) of the sandy loam soil on which the wild sunflower was grown had a pH of 6.7 (H_2O), 0.69 % organic carbon, 0.94 % total nitrogen and 37.0 ppm available phosphorus (1)

Land preparation and planting

From mid to late July 1993, 1994 and 1995, twenty-day old (post emergence) wild sunflower seedlings were uprooted close to the trial site and transplanted on a well cultivated 0.4ha plot at a spacing of 30 x 10cm to provide a population density of 33.3 x 10^4 plants/ha. Previous experience indicated that, of the densities investigated on the farm (8.3 x 10^4 to 100 x 10^4 plants/ha), the planting arrangement used in this study ranked among the best in terms of whole plant, leaf and inflorescence DM yields (1).

Forage Yield

Forage yield was determined from ten random 1.8 x 2.4m samples taken from within the plot, at first inflorescence opening in 50 - 80 % of plants, about 116 days after transplanting. Plants were cut with a sharp knife at the ground level and weighed fresh. Sub samples were taken and separated into the stem (inflorescence stalk inclusive), leaf (green and senescenced with the stalks) and the inflorescence fractions and weighed. Each component was oven-dried at 80^0C for 48h and weighed for DM estimation. The remaining plants were harvested, spread on a concrete slab in the poultry house and air dried to constant weight. The leaf and inflorescence portions were removed manually and stored in large sacks that permitted air circulation until required for feeding trials.

Forage Meal Feeding Trial

The dried leaf and inflorescence portions of the wild sunflower harvest of 1995 were ground into a forage meal (WSFM), thoroughly mixed and included

in five broiler diets based on white maize/fullfat soyabean meal at 0.0, 2.5, 5.0, 7.5 and 10.0 % dietary levels (Table 1) Each diet was given to a group of 45 one-day old unsexed chicks of commercial Arbor acre strain of broilers. Each group was divided into three replicates of 15 chicks and housed in floor littered pens using a complete randomised design. The birds were weighed at the beginning of the trial and subsequently on weekly basis. Feed and water were supplied *ad libitum*. Weekly feed intake, weight gain and feed conversion ratio were computed on replicate basis.

At the 28 days of age, 2 birds per replicate were moved to metabolic cages for nutrient retention studies. Weighed quantities of feed were supplied and excreta collected between 33 and 35 days using the total collection method. Excreta samples were oven-dried at 70°C, weighed and ground prior to chemical analysis. The feeding trial lasted 5 weeks.

Table 1: Composition of experimental broiler starter diets containing graded levels of wild sunflower forage meal (0-5 weeks)

	WSFM in diets (%)				
Ingredients	**0**	**2.50**	**5.00**	**7.50**	**10.00**
Maize	60.0	57.91	55.82	53.73	51.65
Soyabean meal	32.75	32.34	31.93	31.52	31.10
WSFM[1]	0.00	2.50	5.00	7.50	10.00
Fixed ingredients[2]	7.25	7.25	7.25	7.25	7.25
Total	100.00	100.00	100.00	100.00	100.00
Chemical Analysis (% DM)					
Crude protein	20.94	20.56	20.73	20.56	20.81
Crude Fibre	3.00	4.00	3.00	5.00	5.00
Ash	5.00	6.00	6.00	8.00	8.00
Ether extract	14.00	10.00	9.00	8.00	10.00
NFE	44.00	45.44	50.87	47.44	43.19
Feed Cost[3] (N/kg)	28.24	27.83	27.44	27.03	26.62
ME (KJ/kg)[4]	12.70	12.25	12.56	11.87	11.68

1. WSFM contains 18.4% crude protein, 12.0% crude fibre, 5.0% ether extract, 14.0% ash and 50.6% nitrogen free extractives.
2. Fixed ingredients supplied to each diet (%) fish meal, 3.0; bone meal, 2.25; Oyster shell, 1.25; salt 0.25; methionine, 0.25 and a pre-mix, 0.25 providing the following per kg of diet: Vitamin A, 20,000 I.U., D.1750 I.U.;E. 715 mg: K, 7.5 mg; B_1, 2.0 mg; B_2 6.25 mg; B_6, 0.75 m; B_{12}, 20 ug; niacin 20.0mg; pantothenic acid, 7.5mg; folic acid, 1.0 mg; Se, 0.025mg, Zn, 11.25mg; Fe, 12.5mg; Co, 0.05mg.
3. Based on the ruling open market prices of the feed ingredients at the time of study with price of WSFM assumed to be ₦ 8.00
4. Calculated ME of the diets but short of whatever ME contributed by WSFM

Analytical Procedures

Dried samples of the leaf and inflorescence components were analysed for crude protein (N x 6.25), crude fibre, ether extract and ash by standard methods (3), while solube sugars, acid detergent and neutral detergent fibres were determined (4). Samples of the diets, WSFM and excreta were also analysed for proximate composition (3).

Statistical Analysis

Data collected were subjected to analysis of variance and treatment means were compared using the Duncan's multiple range test (5)

RESULTS AND DISCUSSION

The DM yield data for the whole plant, leaf and inflorescence during the 1993 to 1995 planting seasons are presented in Table 2. Dry matter yields of the whole plant and leaf fractions decreased consistently with the year of planting. Dry matter yield of the inflorescence was highest in 1993 and 1995 but lowest in 1994 and it did not follow the same pattern as whole plant and leaf. It has been observed in the study area that the plant starts flowering once it attains a particular age irrespective of the vegetative growth (1) The DM yield of leaves of wild sunflower during 1993 and 1994 exceeded the 2.30 and 2.38 t/ha for pigeon pea (6)

Table 2: Annual Dry matter yield of whole plant, leaf and inflorescence components of wild sunflower grown at a population density of 33.3 x 100^4 plants/ha from 1993 to 1995 (t/ha)

Plant Part	1993	1994	1995	Mean
Whole Plant	8.67	7.23	6.40	7.43
Leaf	2.68	2.60	1.51	2.26
Inflorescence	0.24	0.11	0.24	0.20

The chemical composition of the wild sunflower plant portion is shown in Table 3. The green leaf had the highest value for crude protein and ether extract when compared to the senescenced leaf or inflorescence. The senescenced leaf had the highest ash content. The inflorescence fractions had the highest concentrations of crude fibre, nitrogen free extract, acid and neutral detergent fibres. The proximate composition of WSFM (Table 1) shows that its CP of 18.4% is lower than the value of 24.5% for pigeon pea leaf meal (PPLM) (6) while the 5.0 % ether extract were similar. The CP value for WSFM is also lower than the 29.15% of leucaena leaf meal (7) while the ether extract content of WSFM is higher than the 2.6 % also reported for leucaena leaf meal.

Table 3: Average chemical composition of green leaf, senescenced leaf, and inflorescence of wild sunflower (% DM)

Component	Green Leaf	Senescenced leaf	Inflorescence
Ash	13.83	16.17	6.25
Crude protein	16.77	6.92	10.79
Crude fibre	11.50	16.33	22.33
Ether extract	5.25	3.83	2.41
Nitrogen free extract	52.65	56.75	58.22
ADF	9.00	12.00	20.00
NDF	14.00	18.00	36.00

Values are means of two determinations

Data on the performance and nutrient retention of broiler chickens fed WSFM diets are given in Table 4. WSFM is currently being browsed by ruminants without any noticeable ill-effect. However, findings in this trial indicate that the performance of the other broiler chicks as per feed intake and weight gain became poorer with increase in WSFM. The depression in feed consumed is similar (8) and is probably related to the bitter taste of the leaves. The reduced weight gain could be directly associated with the pattern of feed intake. It was reported (9) that growth of chicks was favoured when sorghum and soyabean were partially substituted in the diets up to 10% by cassava foliage. Higher levels (15 and 20%) did not increase weight gains nor protein efficiency ratio. Furthermore, addition of pigeon pea leaf meal to layers diet (6) increased intake and up to 7.5% did not adversely affect egg production but 10% caused a decrease in egg production. Feed conversion ratio deteriorated with increasing WSFM level, indicating a decrease in WSFM utilisation by the birds

Table 4: Effect of wild sunflower meal on performance and nutrient retention of 5 week old broilers

	WSFM in diets (%)					
Parameter	0	2.5	5.0	7.5	10.0	SEM
Performance						
Feed intake (g/day)	65.83^{a}	65.42^{a}	65.13^{a}	63.32^{b}	61.63^{b}	3.54
Weight gain(g/day)	37.38^{a}	37.05^{a}	36.46^{ab}	34.43^{b}	33.73^{c}	2.05
Feed conversion ratio	1.76^{a}	1.76^{a}	1.79^{a}	1.84^{b}	1.87^{b}	0.89
Mortality (%)	2.22	4.44	4.44	4.44	0.0	-
Feed cost/kg gain(kg)	49.59	49.14	49.03	49.60	48.69	0.05
Nutrient Retention (%)						
Dry matter	81.42^{a}	79.92^{a}	78.18^{a}	76.53^{b}	75.58^{b}	3.50
Crude protein	71.83	68.15^{a}	66.88^{b}	66.34^{b}	63.06^{c}	1.89
Ether extract	92.77	90.61	91.08	86.37	90.23	1.76
Crude fibre	28.43	22.87	31.35	38.35	39.80	1.28

SEM- Standard error of mean

^{a,b,c} - Means with different superscript on a row are significantly different ($P<0.05$).

The decrease in dry matter and crude protein digestibilities could be attributed to higher levels of fibre in the diet which hindered enzymatic digestion (10). It might also be due to the associated effect of bitterness of the meal on feed consumption (1). Ether extract and crude fibre did not follow any descernible trend.

At the levels of WSFM fed, there was no sign of ill-health or mortality due to dietary treatments. This is in agreement with previous findings on laying chickens (8). However, it contrasts studies with sesbania (*Sesbania sesban)* leaves (12) and with aquatic plants (*Elodea canadenisis* and *Hydrilla verticillata)* forages (13). In the latter studies, heavy mortalities due to the presence of toxic principles were recorded with broilers.

CONCLUSION AND APPLICATIONS

The results of this study indicate that:

(1) The unconventional feed ingredient, WSFM may be used in broiler diets up to 5% with no adverse effects on feed intake, weight gain and feed conversion ratio.

(2) Feed cost/weight gain (Table 4) allows its use up to 10% at the expense of maize by resource poor poultry farmers.

(3) The yield and chemical composition of wild sunflower plant compare well with other forage plants such as pigeon pea and leucaena which have been fed elsewhere.

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