International Scholars Journals

International Journal of Medicinal Plants Research ISSN 2169-303X Vol. 11 (4), pp. 001-005, April, 2022.
Available online at www.internationalscholarsjournals.org © International Scholars Journals

Author(s) retain the copyright of this article.

Review

Chromolaena odorata in livestock nutrition

S. O. Aro[1]*, I. B. Osho[1], V. A. Aletor[1] and O. O. Tewe[2]

[1]Department of Animal Production and Health, the Federal University of Technology, Akure, Nigeria.
[2]Department of Animal Science, University of Ibadan, Ibadan, Nigeria.

Accepted 16 December, 2021

This paper seeks to review the nutritional values of *Chromolaena odorata* (C.O.), an erstwhile obnoxious plant. The food and medicinal values of this plant, aside from its agronomic importance were mentioned as part of the introductory pieces of information on its use in livestock production. The plant has assumed an enigmatic status of sort, to the herbalists, the agronomists and the livestock nutritionists alike, but recent research efforts as reviewed in this article, such as its use in the formulation of layers diets, its influence on performance, nutrient digestibility, mineral utilization, blood and biochemical indices of monogastrics as well as its acceptance and high preference score recorded on the West African dwarf goats are quickly changing the perception of the plant as a noxious weed to one of immense medicinal and nutritional potentials only waiting for mankind to continue to tap and benefit from.

Key words: *Chromolaena odorata*, agronomic, monogastrics, nutritionists, obnoxious

INTRODUCTION

A very large area of Nigerian ecological zones is populated with many plant species which have found their usefulness either directly or indirectly for humans. Some like the wild mango (*Irvingia gabonensis*), custard apple (*Annona senegalensis*) and star apple (*Chrysophyllum albidium*) provide fresh succulent fruits that have assumed the status of delicacies among the teeming population of West Africans. The leaves, stem-barks, root-barks and tuberous roots of some of these plants are directly taken as food. Others like the kolas (*Kola nitida and Kola acuminata*) bitter kola (*Garcinia kola*) and shea butter tree (*Butyrospermum paradoxum*) have become major forest trees of commercial importance.

The medicinal values of many of these plants cannot be overemphasised in the light of oral traditions and folklores from the distant past that have continued to extol the healing virtues of these plants and their extracts. One of such medicinal plant is Siam weed (*Chromolaena odorata*), whose medicinal values have been somewhat eclipsed by the notoriety it earned as a very “obnoxious weed” because of its unparalleled ability to infiltrate new lands (Hall et al., 1972). *C. odorata* (C.O.) has attracted the attention of farmers and agricultural officers alike. It has so far poised a lot of weed problems in Nigeria where it is regarded as a bad competitor with crops.

The plant grows very fast and forms a dense and impregnable foliage that can completely smother a young plantation of crops or weeds (Etejere, 1979) . The plant is also known to support a large and varied insect fauna and thus serves as a breeding ground for such insects like *Zonocerus variegatus* which has been known to destroy economic crops like cassava, plantain, banana and citrus.

These negative attributes notwithstanding, C.O. has been reported by some workers to be a very useful plant. The plant is regarded as an excellent fallow crop in arable farming (Obatolu and Agboola, 1993). Smith and Alli (2005) also reported that using the plant as a mulch is effective against weed invasion. In Cambodia, it was reported that heavy harvest always follows soil mulching with C.O. leaves owing to the ability of the plant’s essential oils to control soil nematodes and crabs in paddy fields (Litzenberger and Lip, 1961). The incorporation of the plant to the soil led to an increase in maize yield (Adetoro et al., 1998). The essential oils that make the plant repugnant to livestock have also been found to have insect repelling properties (Moni and Subramoniam, 1960).

The therapeutic properties of the plant were attested to by some natives interviewed at Idoani in Ondo State of

*Corresponding author. E-mail: sambolaro@yahoo.co.uk.

Nigeria. The results gotten from those interviewed showed that the plant is very effective in the treatment of malaria and dysentery (Aro, 1990). Also, Olaoye (1974) reported on its medicinal use for curing malaria and yellow fever and of its restricted local use for the mother's hot water bath after child delivery. A compendium of its use together with that of other medicinal plants was also given by Odugbemi (2006).

Reports on the use of this plant in livestock nutrition has ever been kept in abeyance partly because of the aversion of livestock to consume it in the fresh form due to the offensive odour of its essential oils and partly because of the death that was reported in cattle that consumed the leaves in the fresh form. These were however research efforts geared at unravelling the nutritional potentials of this plant for livestock nutrition. The thrust of this review article was to bring some of these research works to the fore.

C. ODORATA IN LIVESTOCK FEEDING

Information on the use of C.O. in livestock nutrition is very scanty. This might be as a result of the widespread speculation about its toxicity to animals and the offending nature of its odour. Reports of Madrid (1974) of the consequent death that occurred in cattle following ingestion of C.O. leaves attested to the toxic nature of C.O. to livestock. Some of the few reports of the use of the plant in livestock nutrition are as reviewed below:

Nwokolo (1987) delved elaborately on the mineral and amino acid composition of both cassava and C.O. leaf meals. Table 1 shows the mineral composition of the leaf meals from both plants. This author assayed the availability (true digestibility) of these minerals by using three week old broiler chicks and reported that the average availability of these minerals was 53.70 and 49.90% for cassava leaf meal and C.O. leaf meal, respectively.

He also reported on the amino acid composition and availability of these leaf meals in his broiler chicks' bioassay as presented in Table 2. He concluded that the values obtained for both mineral and amino acid availability could be attributed to the presence of anti-nutrient factors in both leaves, especially of tannins since they occur in high concentration in plant materials and are associated with toxicity and poor growth rate and depressed dietary nutrient utilization in monogastric animals.

C. ODORATA AND PERFORMANCE CHARACTERISTICS OF LAYING HENS

A trial was conducted by Aro (1990) on the utilization of C.O. leaf meal in layers diets with performance, egg quality characteristics, nutrient utilization, haematological and biochemical indices as the response criteria. This author reported that the offensive odour of the fresh leaves was only given off when the plant was disturbed by mere touching or bruising of the leaves and that this odour is greatly reduced when the leaves were sun-dried for subsequent milling. The dry matter, gross energy and proximate composition of C.O. leaf meal as analysed by Aro (1990) were as presented below. (Table 3)

Table 1. Mineral composition (mg/kg) of cassava and C.O. leaf meals (dry matter basis).

Mineral	Cassava leaf meal	C.O. leaf meal
Phosphorus	3,104	4,532
Calcium	12,300	11,551
Magnesium	2,612	3,202
Potassium	16,300	13,800
Copper	11	37
Zinc	119	52
Manganese	46	71
Iron	69	79

Source: Nwokolo (1987).

The C.O. leaf meal whose chemical analysis was shown above was fed to laying birds at graded level of 0, 2.5, 5 and 7.5% for 56 days and the author reported no adverse effects on layers performance in terms of feed consumption, feed efficiency, total egg production, percentage hen-day production and mortality. In fact, total feed consumed was better in all the C.O. diets than the control diet. Percentage hen-day production in the 5 and 7.5% levels of C.O. inclusion was better than the control diet. Also, the total weight change was better at 5 and 7.5% (that is, 350 and 310 g, respectively) than in the C.O. free control diet (190 g). The economic significance of this is that birds fed C.O. leaf meal aside from laying more eggs in their productive phase would also be heavier as spent layers and hence command higher price in the market when they are eventually sold or disposed of at the end of the laying period. Table 4 gives the performance characteristics of the layers fed C.O. leaf meal. This author reported that birds on C.O. diets consumed more feed than those on the C.O. free diet. This is a clear indication of the improved palatability of the leaf meal through sun-drying.

C. ODORATA AND THE BIOCHEMICAL INDICES AND BLOOD VALUES OF LAYERS

The biochemical and haematological implications of using C.O. leaf meal on laying hens was reported by Fasuyi et al. (2005). The authors pointed out that there was an initial increase in the level of haemoglobin up to 5% level of inclusion of C.O. in the diet after which there was a sharp and significant decrease in haemoglobin concentration. The use of C.O. leaf meal above 5% may therefore lead to a reduction in the oxygen carrying capacity of the blood in this species of livestock with a

Table 2. Amino acid composition and availability of cassava and C.O. leaf meals.

Amino acid	Cassava leaf meal(g/16 gN)	C.O. leaf meal(g/16 gN)
Aspartic acid	9.0	8.2
Threonine	4.1	3.5
Serine	4.3	3.5
Glutamic acid	12.1	8.0
Proline	5.0	4.5
Glycine	5.0	4.2
Alanine	5.8	4.4
Cysteine	0.5	0.8
Valine	5.1	4.1
Methionine	1.6	1.3
Isoleucine	4.1	3.2
Leucine	8.2	6.4
Tyrosine	3.7	2.0
Phenylalanine	4.8	3.7
Histidine	4.3	3.2
Lysine	6.0	4.7
Arginine	5.6	4.3
Amino acid availability (%)	77.80	65.40

Source: Nwokolo (1987).

Table 3. Dry matter, gross energy and proximate composition of C.O. leaf meal.

Nutrient	*Chromolaena odorata* leaf meal
Dry matter (%)	87.40
Crude protein (%)	18.67
Crude fibre (%)	11.67
Ether extract (%)	1.01
Ash (%)	3.63
Nitrogen free extractives (%)	65.03
Gross energy (kcal/g)	3.732

Source: Aro (1990).

Table 4. Performance characteristics of laying hens fed C.O. leaf meal.

Parameter	Level of inclusion of *Chromolaena odorata* leaf meal			
	0%	2.5%	5%	7.5%
Initial body weight (kg)	1.48	1.45	1.47	1.49
Final body weight (kg)	1.67	1.62	1.82	1.80
Total feed intake /bird (kg)	6.59	6.86	7.34	7.01
Daily feed intake/bird (g)	117.67	122.50	131.17	125.17
Feed consumed/dozen of eggs (kg)	2.38	2.76	2.41	2.51
Total egg production	199	183	216	202
Hen-day production (%)	59.23	54.47	64.29	60.12
Mortality	-	-	-	-
Weight change (g)	190.00	170.00	350.00	310.00
Total feed consumed/treatment (kg)	39.51	41.18	44.06	42.08

Source: Aro (1990).

Table 5. Nutrient digestibility and mineral utilization of layers fed varying levels of C.O. leaf meal.

Parameter	Level of inclusion of *Chromolaena odorata* leaf meal.				
	0%	2.5%	5%	7.5%	±SEM
Organic matter digestibility (%)	73.51	73.58	74.73	72.97	1.22
Dry matter digestibility (%)	69.05	70.66	69.92	68.83	1.43
Ether extract digestibility (%)	84.27^{b}	89.96^{a}	88.85^{a}	85.87^{ab}	1.22
Crude fibre digestibility (%)	37.07^{c}	43.13^{b}	45.18^{b}	51.70^{a}	4.48
Crude protein digestibility (%)	72.41^{b}	73.99^{ab}	78.02^{a}	73.18^{ab}	1.50
Crude protein intake (g)	116.23	110.41	125.47	115.46	1.29
Crude protein output (g)	37.47	31.92	37.74	34.50	1.54
Nitrogen retention (g)	12.60	12.56	14.04	12.95	0.58
% nitrogen retention	67.76	71.09	69.92	70.12	1.27
% mineral retention	69.55^{b}	85.13^{a}	81.17^{a}	82.26^{a}	2.12
M.E. (kcal/g)	2.731	2.740	2.769	2.745	0.05
M.E. corrected for nitrogen (kcal/g)	2.860	3.096	2.977	3.009	0.13

Source: Aro and Fajemilehin (2005).

concomitant decrease in performance. The work earlier reported by Sajise et al. (1974) that the conversion of oxyhaemoglobin to methaemoglobin was the root cause of sudden death of livestock that accidentally fed on C.O. leaves corroborates the report of these authors. The lower leucocyte counts in the C.O. diets than in the control suggested a probable reduction in the white blood cell count at higher inclusion of C.O. leaf meal. This may engender a higher susceptibility of the birds to diseases as a result of reduced white blood cell concentration - a pathological case of leucopaenia and a compromise of the birds' immune response. These authors concluded that an inclusion level of 5% seemed to support a desirable health status as indicated by the haematological and biochemical parameters studied.

C. ODORATA AND NUTRIENT DIGESTIBILITY AND MINERAL UTILIZATION IN LIVESTOCK

Nutrient digestibility and mineral utilization of layers fed varying levels of C.O. leaf meal were investigated by Aro and Fajemilehin (2005). The result of their investigation is as presented in Table 5.

The Table revealed the best organic matter digestibility at 5% inclusion level of C.O. leaf meal beyond which there was a decline. Dry matter and ether extract digestibilities were best at 2.5% level while crude fibre digestibility improved with increasing level of C.O. leaf meal in the diets. Nitrogen retention just like crude protein digestibility was best at 5% level while mineral utilization was best at 2.5% level.

C. ODORATA AND RUMINANT NUTRITION

The general apathy towards the use of C.O. in ruminant nutrition following the reports of its toxicity (Sajise et al., 1974) and the death of some cattle in the Philippines after its ingestion was blazed by the work of Fadiyimu et al. (2005), who fed six species of weed (*Tridax procumbens, Chromolaena odorata, Aspilia africana, Boerhavia diffusa, Ageratum conyzoides and Sida acuta*) to a group of West African dwarf goats in a bid to determine their nutrient composition and acceptability.

Their study revealed a proximate composition of C.O. as: 97.5% dry matter, 18.9% crude protein, 11.5% crude fibre, 9.1% ash, 12.8% ether extract and 47.6% nitrogen free extractives. The mineral composition and anti-nutritional factors of C.O. in this study were: Calcium-11.7%, Sodium-7.8%, Chloride-7.0%, Magnesium-8.0%, Iron-0.9%, Zinc-5.3%, tannins- 2.3% and phytin-15.7 mg/kg. C.O. ranked fourth in the mean preference index among the six weeds that were analysed and the authors recommended C.O. for inclusion in ruminants diets among the four selected weeds based on their high preference scores.

CONCLUSION

This review article tried to bring to the limelight some of the hidden potentials of this erstwhile obnoxious weed. Its successful use in layers' diets without any reported cases of mortality in the literature cited under this review, its acceptance by the West African dwarf goats and its high preference score among other local weeds in Nigeria are all points in strong support of the possibility of re-writing the age long anecdote of this plant: dubbed "the obnoxious weed" , thus paving ways for more conscious research efforts geared towards unravelling more of its veiled medicinal and nutritional qualities.

REFERENCES

Adetoro AO, Ojeniyi SO, Odedina SA (1998). Comparative effective-

ness of levels of Siam weed (*Chromolaena odorata*) and NPK fertilizer on the performance of maize in the rainforest area of southern Nigeria. Programme of activities and abstract of papers. 24th Ann. Conf. Soil Sci. Soc. Nig., Dec. 7-11, 1998. Bauchi, Nigeria. Pp: 18.

Aro SO (1990). The effects of Siam weed leaf meal (*Chromolaena odorata*) on the performance, egg quality characteristics, nutrient utilization, haematological and biochemical indices of layers. M.Sc. Thesis. Department of Animal Science, University of Ibadan, Ibadan, Nigeria. pp. 1-84.

Aro SO, Fajemilehin SOK (2005). Effect of varying levels of Siam weed (*Chromolaena odorata*) leaf meal on layers performance and nutrient utilization. Proc. 1st Annual Conf. On Dev. In Agric. & Biol. Sci., 27th April, 2005. Federal University of Technology, Akure, Nigeria. pp: 87-91.

Etejere EO (1979). Studies on the physiology and chemical control of *Eupatorium odoratum*. Ph.D. Thesis. University of Ibadan, Ibadan, Nigeria.

Fadiyimu AA, Alokan JA, Ayodele AO (2005). Nutritional composition and acceptability by West African dwarf goats of some weeds of Nigerian pastures and rangelands. Proc. 1st Annual Conf. On Dev. In Agric. & Biol. Sci., 27th April, 2005. Federal University of Technology, Akure, Nigeria. pp. 92-94.

Fasuyi AO, Fajemilehin SOK, Aro SO (2005). Nutritional potentials of Siam weed (*Chromolaena odorata*) leaf meal (SWLM) on laying hens: Biochemical and haematological implications. Pakistan J. Nutri. 4(5): 336-341.

Hall JB, Kumar R, Eveti AA (1972). The obnoxious weed-*Eupatorium odoratum* in Ghana. Ghana J. Agric. Sci. 5(1): 75-80.

Litzenberger SG, Lip HT (1961). Utilizing *Eupatorium odoratum* to improve crop yield in Cambodia. Agron. J. 53(5): 321-324.

Madrid JA (1974). Biology of *Chromolaena odorata*. *Philippine J. Weed Sci.,* (1) April, 1974.

Moni NS, Subramoniam R (1960). Essential oils from *Eupatorium odoratum*- a common weed in Kerala. Indian For. 86(4): 209.

Nwokolo E (1987). Leaf meals of cassava (*manihot esculenta)* and Siam weed (*Eupatorium odoratum*) as nutrient sources in poultry diets. Nutri. Report Int. 36: 819-826.

Obatolu CR, Agboola AA (1993). The potential of Siam weed (*Chromolaena odorata*) as a source of organic matter for soils in the humid tropics. Proc. Int. Symposium on Soil Organic Matter Dynamics and the Sustainability of Tropical Agriculture (ed. Mulongo, K. and Merckx, R.), Nov. 4-6, Leuven, Belgium. Pp:89-99.

Odugbemi T (2006). Outlines and pictures of medicinal plants from Nigeria. University of Lagos Press, Lagos, Nigeria, Pp. 1-283.

Olaoye SOA (1974). Studies on the ecology and control of *Eupatorium odoratum* in Nigeria. M.Sc. Thesis. University of Ibadan, Ibadan, Nigeria.

Sajise PE, Palis RR, Norcio NV, Lales JS (1974). The biology of *Chromolaena odorata* (L. King and Robison) 1. Flowering behaviour, pattern of growth and nitrate metabolism. Philippian Weed Science Bulletin. 1: 17-24.

Smith, MAK, Alli AL (2005). Mulching effect of tropical plant residues on weed control and maize (Zea mays L.) yield. Proc. 1st Annual Conf. On Dev. In Agric. & Biol. Sci. 27th April, 2005. Federal University of Technology, Akure, Nigeria. pp: 26-30.