

EFFECT OF NITROGEN FERTILIZATION APPLICATION AND MATURITY OF WILD SUNFLOWER ON CHEMICAL COMPOSITION AND RUMEN DEGRADATION CHARACTERISTICS IN SHEEP

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Target Audience: Animal nutritionist, agronomist.

ABSTRACT

This study was conducted to investigate the influence of three levels of Nitrogen (N) fertilizer application (0, 125 and 250kg N/ha) and stage of maturity on chemical composition and degradation characteristics of wild sunflower forage meal in West African Dwarf sheep. Nitrogen (0, 125 and 250 kg N/ha) as NPK was applied to field plots of established wild sunflower (*Tithonia diversifolia* (Hemsl). A Grey). Sunflower fertilized with 250 kg N/ha had lower neutral detergent fiber (NDF) than those not fertilized (57 vs 35). Leaf crude protein increased with increased N applied. Crude protein content of leaf decreased and NDF increased with maturity. NDF and crude protein degradation were improved with increased N application. This increase in CP increased N disappearance in the rumen as measured by in-sacco study. This might result in increased problem with utilization of wild sunflower N by the ruminants. Dry matter, nitrogen and neutral detergent fiber degradation declined with delayed harvest. Based on chemical composition and the effect of maturity on degradation characteristics of wild sunflower, 125kg N/ha was considered adequate and the forage could be harvested between the ages of 7-8weeks after the onset of flowering.

Key words:

DESCRIPTION OF PROBLEM

The wild sunflower, *Tithonia diversifolia* (Hemsl). A. Gray) had been used as an ornamental plant in part of Sri Lanka and India (1). It has however been processed into good quality silage for beef cattle (2) with feeding value of about 60-80% that of corn silage. It has also been used as a cheap source of egg yolk colorant in laying pullets (3). The forage is widely distributed in the southwest, middle belt and southeastern parts of Nigeria. It is commonly found along roadsides. The protein in cultivated sunflower meal has been found to contain a high methionine than soybean. The perennial Mexican sunflower has been describe as a desirable plant for

livestock feeding (4) because of its palatability and prolific seed production for revegetation. Generally, wild sunflower is present in pastures and crop farms where they compete for light, water and fertilizer and are therefore considered as weeds (5). Information is available on forage yields (6) and mineral composition. However, literature on study that investigated the effect of fertilization and maturity on direct feeding value of wild sunflower is scanty. This study was designed with the objective of investigating three levels of N application and stage of maturity on forage chemical composition and degradation characteristics of wild sunflower forage meal in West Africa dwarf sheep.

MATERIALS AND METHODS

Site

The study was carried out at the Ladoko Akintola University of Technology, Teaching and Research farm. The site is on latitude 80 26' and long. 40 29°E. Average annual rainfall is 1173mm and usually occurred between June and October. The topsoil (0-15cm) is sandy loam, with a pH of 6.7(H₂O), 0.69% organic carbon, 2.94% total nitrogen and 37.0ppm available phosphorus. The experimental site was under fallow for ten years and dominated by gamba and wild sunflower.

Land preparation and planting

During the wet season of 1993-1995 twenty-day old, post emergence wild sunflower seedlings were transplanted to well mechanically cultivated plots of 0.4ha each at a spacing of 10x30cm resulting in a plant population density 33.3x10⁴ plants/ha. This spacing was chosen based on earlier trial (6). Each plot had one of the N levels imposed on it. The fertilizer was applied by broadcast method when the plant was one week old.

Nitrogen was applied in the form of (NPK) at 0, 125 and 250kg N/ha. Weeds were controlled by hand hoeing or rouging about four weeks after transplanting.

Sampling of forage

This was determined from randomized 1.8x2.4m quadrant samples taken from within the plot every week over a period of ten weeks. Ten plants were cut with a sharp knife at ground level and weighed fresh. Sub samples were taken and separated into the edible portion (inflorescence stalk, green leaf) and stem. The edible portion was spread on a concrete slab and air-dried. The edible portions were stored in large sacks on a raised platform until required for analysis and degradation.

Chemical Analysis

Air-dried samples of edible portion (green leaf, inflorescence stalk) were

bulked and ground through 2.5mm hammer mill and divided into two portions. The first half was used for degradation study while the second half was re-ground through 1.0mm sieve for laboratory analysis. Laboratory analysis for crude protein (C) was by Kjeldahl method (7) and neutral detergent fibre (NDF) by the method described (8).

Insacco degradation

Dry matter, crude protein and neutral detergent fibre degradation were determined using the nylon bag technique (9). Air-dried sample was ground to pass a 2.5mm screen and 3g were weighed into 9*18cm nylon bags having a pore size of 41microns. Bags were incubated in duplicate in the rumens of three fistulated WAD rams fed on a ration of *Panicum maxim* and wheat bran at a ratio 70 : 30. Incubation was for 12, 24, 48 and 72h. After incubation, bags were removed from the rumens and washed under running cold tap water until the rinsing water became clear and dried at 48°C for 48h. Washing losses were estimated by soaking in warm water at 37°C for thirty minutes followed by washing and drying as before. DM, CP and NDF degradation was calculated as residual weight loss in each component.

Statistical analysis

Data on nutrient composition were analysed as a randomized complete block using general linear model (GLM) in (10). Means were separated (11). Interaction between the fertilizer levels and stage of maturity was also investigated.

RESULTS AND DISCUSSION

Addition of 125 or 250kg N/ha resulted in a 22-percentage unit decline in NDF. NDF concentration however increased with advancing stage of maturity. Nitrogen content also decreased with maturity (Table 1).

The increase in fibre contents and decreased N with advancing growth was expected. (12) who reported that an increased plant physiological maturity results in increased fibre? Ruminants are subjected to nitrate poisoning when forage nitrate exceeding 0.9-1.8% of DM (13). Although nitrate content of the forage was not measured in this study, CP has been associated with fertilizer rate. (14) reported increased CP and nitrate levels with increased N application of alfalf. Higher level of CP in wild sunflower may make its use in ration formulation difficult (15), particularly if more of this CP is in the soluble form. If protein fed exceeds protein required by ruminants, excess protein will be lost through urine and faeces (16). In this study, CP increased linearly with increased level of N applied. The effect of this increased CP has been reported to interfere with silage fermentation quality (17). Samples from plots receiving 250kg N/ha had a higher DM disappearance than the control, with difference being significant at 72h

(Fig 1). There were significant difference in N and NDF degradation, with differences at 12 and 48h for N and at 48 and 72h for NDF. With a higher CP present in fertilized wild sunflower than unfertilized one, high CP disappearance might be expected.

Figure 1: Effect of three Nitrogen fertilizer levels on degradation characteristics of Wild sunflower leaves

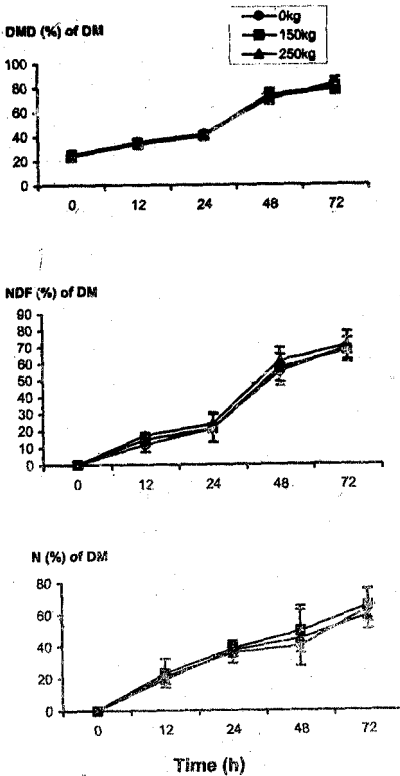


Table 1: Influence of rate of nitrogen fertilizer application and stage of maturity on (N and NDF) composition and degradation characteristics of wild sunflower.

	Fertilizer levels kg N/ha									
	0		125		250		SE			
Nitrogen (%)										
Nitrogen (N)	1.67c		1.79b		1.95a		0.1			
Neutral detergent fiber (NDF)	57.2a		34.94a		34.66c		0.8			

	Stage of maturity (weeks)										
	1	2	3	4	5	6	7	8	9	10	SE
DM	79.6 ^a	73.9 ^b	73.8 ^b	73.1 ^b	72.5 ^c	72.2 ^c	71.9 ^d	71.8 ^d	69.8 ^e	57.5 ^f	1.7
N	64.3 ^a	62.3 ^b	60.3 ^c	58.3 ^d	56.2 ^e	53.8 ^f	53.2 ^f	52.7 ^g	50.2 ^h	49.2 ⁱ	1.4
NDF	56.6 ^a	50.5 ^b	48.3 ^c	46.4 ^d	44.9 ^e	37.7 ^f	36.9 ^g	36.3 ^g	34.2 ^h	25.2 ⁱ	0.9

DM= dry matter, N= nitrogen and NDF= neutral detergent fiber.

Generally, NDF, DM and CP degradation values decreased with advanced maturity of the plant (Table 1). This agreed with the report (12) that degradation reduces as plant matures. This is because of increased lignification associated with advance plant maturity. In this study, nitrogen application up to 250kgN/ha to wild sunflower resulted in a small reduction of NDF. This increased in CP solubility increased N disappearance in the rumen as measured *in sacco*. This would result in increased CP utilization of wild sunflower forage meal by ruminants (14). This suggests that moderate application to wild sunflower is an acceptable mangement practice in terms of enhaced forage quality.

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