AN INDIRECT ESTIMATION OF LITTER DISAPPEARANCE IN GRASSLAND STUDY

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ABSTRACT

An indirect method for estimation of litter disappearance in grassland ecosystem has been evolved and discussed fully in the text.

INTRODUCTION

THE use of "nylon bags" technique of Shanks and Olson[1] has become a popular method for studying the litter disappearance in grassland and forest ecosystems. By placing litter samples in fine-meshed nylon bags, disappearance can be determined by repeated weighing at intervals. But because of the confinement of the dead leaves, and other plant parts, and restricted entry of the larger soil-floor-fauna, the results do not represent absolute measurements of decomposition of litter under natural conditions. This drawback prompted the present authors to attempt for an alternative reliable estimation.

MATERIALS AND METHODS

An experiment was conducted near Ratlam (23° 28′ N latitude and 74° 58′ E longitude) on a two year protected grassfield dominated by *Sehima nervosum* (Rottl.) Stapf, a perennial grass. The topography of the terrain is gently undulating and the climate is monsoonic. Total annual rainfall is 875 mm, most of which occurs during rainy season. Annual mean maximum and minimum temperatures are 31·5° C and 18·0° C respectively. Periodic record of changes in aboveground green biomass, standing dead and litter were taken for one year (June 1971 to May 1972). At each sampling date ten quadrats (size 25 cm × 100 cm) were laid randomly in the experimental site and aboveground plant parts were clipped. The clipping height was ground level. The size of the quadrat was fixed by species area curve method[2-3] and the area obtained was casted in an aforesaid rectangular size to ensure maximum accuracy[4]. The harvested samples were separated species-wise into two categories, *viz*,. aboveground green and standing dead. The ground litter was collected from the harvested plots, brought to the laboratory where it was freed of soil contamination by flotation. All the aforesaid categories were then dried in a hot air oven at 80° C for 24 hours and weighed.

RESULTS AND DISCUSSION

During rainy season, the growing phase of the vegetation, the *Sehima* grassland community comprises of fifteen species including six species of grasses and nine forbs (non-grass). In subsequent winter and summer seasons the species diversity gradually decreases. Aboveground net primary production (AGNPP) comes to about 429·2 g/m²/year and is arrived at by summing species-wise positive increments in g/m²/year[5]:

AGNPP	=	Grasses	+	Forbs	+	Standing dead*
429·2		344·4		15·2		69·6

From Table I it is evident that over the year the standing crop of litter decreased from 160 g/m² in June to 54 g/m² in late August and again in December from 250 g/m² to 208 g/m² in February. Other periods indicate the increase till it reaches a peak value in May. Obviously the period of decline represents the disappearance of the litter and the period in increase represents the input from standing dead and green forbs. Since this input can be estimated from the standing crop of biomass data, the disappearance rate of litter during the study year can be calculated by the following four steps (Table II):

TABLE I
Aboveground compartments of the Sehima *community (g/m²) 1971–72*

Sampling dates		Above-ground live biomass	Standing dead biomass	Litter biomass
June	30 ..	25·19	148·20	160·00
July	15 ..	40·07	120·50	138·00
July	31 ..	59·85	95·70	112·00
Aug.	15 ..	112·12	64·60	78·00
Aug.	31 ..	185·75	86·40	54·00
Sept.	15 ..	306·36	105·40	81·00
Sept.	30 ..	363·14	138·40	107·00
Oct.	31 ..	219·14	229·50	167·00
Nov.	30 ..	158·38	242·30	190·00
Dec.	31 ..	64·12	315·60	250·00
Jan.	31 ..	14·65	302·30	251·00
Feb.	29 ..	5·67	283·30	208·00
March	31 ..	3·66	275·00	214·00
April	30 ..	2·86	240·80	234·00
May	31 ..	1·17	209·10	275:00

* Totat value only up to peak aboveground live biomass of individual species.

TABLE II

Transfer of dry matter in different compartments of Sehima *community in* $g/m^2/year$

1. Contribution by live grasses for increment in standing dead compartment during the year		Positive increment in aboveground live grass biomass (*i.e.*, annual aboveground net production		Contribution to standing dead during active growing season		
414·0	=	344·4	+	69·6		
2. Input to litter from standing dead compartment		Initial standing dead crop		Increment in standing dead	Final standing dead crop	
353·1	=	148·2	+	414·0 − 209·1		
3. Total increase in litter compartment		Input from standing dead compartment		Contribution from green forbs		
368·3	=	353·1	+	15·2		
4. Decomposition of litter		Initial standing crop of litter		Increment in litter compartment	Final standing crop of litter	
253·3	=	160·0	+	368·3 − 275·0		

(1) First of all the input of standing dead to the litter compartment will be taken into consideration. Aboveground five grasses contribute to the standing dead compartment during the active growing season because some live parts die during this season, and after this season all the green aboveground biomass turns gradually into dead which reaches its peak in May. Summation of positive increase due to these two sources represents the total increment in standing dead compartment during the year.

(2) The loss from the standing dead compartment or input to the litter can be obtained by adding this increment in standing dead compartment to its initial standing crop (June) and by subtracting from the final standing crop of dead value (May). The resulting estimate equals the input to litter from standing dead.

(3) The litter compartment has two input sources; the standing dead and the annual input from green forbs as the latter directly moves into litter. The summation of these two values equals the increment in litter compartment over the year.

(4) Finally, the increment in the litter *plus* the initial standing crop of litter (June) *minus* the final standing crop of litter (May) gives the amount of litter disappearing during the year.

Climate plays an important role in litter accumulation. The pounding effect of rain drops during the rainy season and the wind blow effect throughout the year cause the standing dead to decline towards the litter compartment. Thus the dry matter inventory of the *Sehima* community reveals that annually 253·3 g/m^2 (about 60% of AGNPP) of organic matter disappears through litter decomposition and the minerals get released.

The 'nylon bags' technique, commonly in vogue, involves the measurement of litter disappearance under unnatural conditions such as changed moisture, temperature and aeration. Also the pore size of the nylon bag limits the entry of larger soil-floor-fauna to confined litter kept for decomposition. The present method of indirect estimation for litter decomposition is a modification and simplification of Golley's[6] attempt and seems better in correctness than the 'nylon bags' technique to deal quantitatively with the litter disappearance in natural conditions to assess the dry matter dynamics in grassland ecosystem.

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