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Decomposition of litter in a tropical grassland

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With 2 figures

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1. Introduction

A majority of energy fixed in primary production finds its way to the soil in the form of ad organic matter and is decomposed there by various soil organisms (Macfadyen 1963) il animals not only fragment and mix leaf litter with soil but also bring about chemical anges that enable bacteria and fungi to decompose it further (Nef 1957). These animals rate the soil, reduce immobilization of nutrients in senescent fungal tissues and influence w of energy many times through their own bodies (Van der Drift and Witkamp 1959 acfadyen 1961; Nicholson et al. 1966; Anderson 1973). The process of litter decom sition governs recycling of nutrients to roots and hence this becomes an important eco stem function. Studies on decomposition are wanting for highly dynamic and strongly asonal tropical grasslands of India.

2. Material and Methods

The study area is located within the campus of Kurukshetra University at 29°58′ N latitude d 76°51′ E longitude, approximately 250 m above mean sea level. The climate of the area is opical monsoonal (Singh and Yadava 1974). The year is divisible into a warm wet period (June to ptember), a cool dry period (October to February) and a hot dry period (March to May).

Mixed samples of litter were collected from native grassland, representing a mixture of *Aristida scensionsis* L., *Cenchrus setigerus* Vahl, *Desmostachya bipinnata* (L.) Stapf., *Dichanthium annu um* (Forsk) Stapf., *Sesbania bispinosa* Fawcett et Rendle, and *Sporobolus diander* (Retz.) auv., etc. during the month of October, 1974. Details of the grassland vegetation have been ported by Singh and Yadava (1974). These samples were air dried and then stored in polyethylene gs in the laboratory at room temperature (20 to 25 °C).

Preweighed, 5 g samples of litter were placed in litter bags (15×10 cm), constructed from brass re netting with mesh sizes of 2 mm and 90 μm. This latter mesh prevented the entry of the most edominant termite, *Odontotermes gurdaspurensis* Holmgren et Holmgren, and other mesofauna ile in the 2 mm mesh bags, these organisms could freely commute.

To determine the effect of the amount of litter kept in a bag on the rate of its decomposition 5, 10 and 15 g samples were used in 2 mm mesh bags. The litter bags were buried at 5 cm depth soil (alluvium, sandy-loam with ca. 1% $CaCO_3$) on 26. April, 1975, under a uniform grass cover ree samples of each treatment were recovered, at random, on 7. July, 8. August, 20. October d 28. February. The samples were washed under a fine jet of water using a fine mesh screen to move all the adhering soil particles and were dried to constant weight at 80 °C. The water con nt of the air dry samples was determined by drying equivalent amounts at 80 °C to constant ight on 26. April. Thus all the calculations in this paper are presented on dry weight basis.

3. Results and Discussion

Table 1. Cumulative weight loss calculated on oven dry weight basis

Data of recovery	Fine mesh	Coarse mesh
7. July 1975	4.41 ± 2.55	10.82 ± 1.15
8. August 1975	32.72 ± 2.46	52.64 ± 5.85
20. October 1975	40.66 ± 14.00	63.67 ± 7.09
28. February 1976	55.44 ± 5.38	89.17 ± 1.30

Note: The samples were buried on 26. April 1975 (% ± SE).

gurdaspurensis, found active in 2 mm mesh bags were, *Nala lividipes* Dufour., sp., *Lipaphis erysimi* Kaltenbach, *Tachys* sp., *Polyrhachis* sp., *Camponotus* sp., *rmex* sp., *Pheidole* sp., *Monomonium floricola* Jard.

results of this study are in agreement with the observations of Edwards and Heath who have reported a significantly higher rate of disappearance of mixed woodland ter in coarser mesh (7 mm) as compared to fine mesh (0.5 mm and 0.003 mm). Bo- 1964) studied the decomposition of leaf litter of Ash (*Fraxinus excelsior*) using bags mm and 1 cm mesh sizes and found no significant difference in the rate of disappear- om the two types of bags. Similarly, Curry (1969) studied the rate of decomposition rd remains in a grassland by using bags of three mesh sizes, i. e. 7 mm, 0.5 mm, and mm and recorded no significant difference in the rate of disappearance among the above mesh sizes. It appears therefore that there might be some interaction between esh size and the type of litter used for experimentation. Thus, Anderson (1973) did tect any significant difference in the rate of disappearance of beech (*Fagus sylvatica* litter enclosed in bags of different mesh sizes but there was 45% more weight loss stnut (*Castanea sativa* Mill.) leaf litter from coarse mesh bags as compared to fine bags.

present study also disclosed a significant effect of the amount of material in the litter n its weight loss as shown in Fig. 1. During early stages of decomposition, the cumu- weight loss was more in bags containing 2 g and 5 g material. However, on the last ing date there was no significant difference in litter disappearance from bags having ent amounts of material. The rate of disappearance slows down after the loss of more degradable and palatable organic matter. The bags having 10 g and 15 g material o attain peak decomposition later due perhaps to presence of material in many layers. this experiment, it may be argued that for short term experiments and for experiments lly designed to study the rate pattern, the litter quantity in bags should be small g). For a more accurate assessment of litter decomposition through litter bag experi- it seems desirable to adjust the quantity of material in bags to the quantity of litter system concerned, on surface area basis.

e instantaneous rates of decomposition calculated as percent weight loss per day from ent types of bags are given in Fig. 2. The highest rates of decomposition were attained the period 7 July to 8 August. These high rates can be attributed to availability of y of rain water and high microbial and microfaunal activity during this period. The ntaneous rates of decomposition are lower for the cool dry period (October to February) bly due to the presence of more resistant residual material, since the more labile frac- s decomposed earlier. During this period lower temperatures and decreased amount water might further limit the microbial and microfaunal activities. Number of rainy ... are set in Table 2. The

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Secondary net production
65

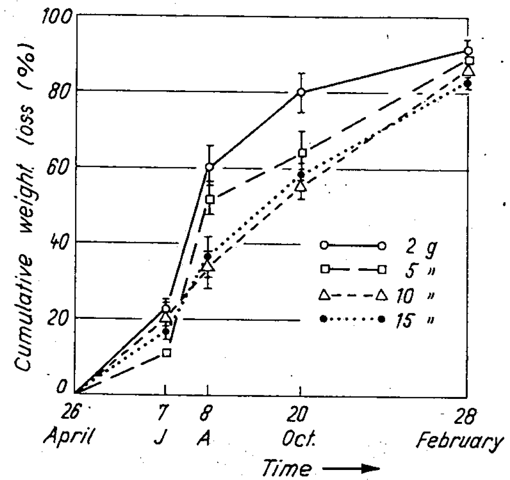

Fig. 1. Effect of the amount of litter kept in the litter bag on cumulative weight loss. Vertical bar represents 1 SE.

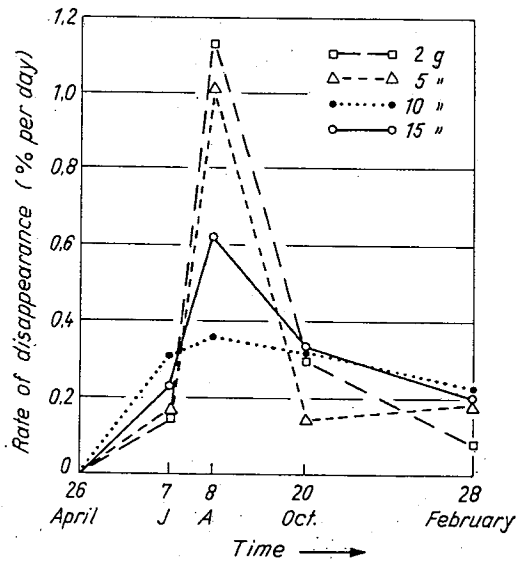

Fig. 2. Rate of disappearance of litter from bags containing different amounts of litter.

Table 2. Number and percent of rainy days, and amount of rainfall during different sampling

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5. Summary

This study reports on the rate of litter disappearance in a tropical mixed grassland by using two mesh sizes i.e. 2 mm and 90 μm and also on the effect of amount of litter kept in a bag on rate of disappearance. The samples were buried at 5 cm depth on 26. April, and three replicates of each treatment were recovered on 7. July, 8. August, 20. October, and 28. February. The rates of disappearance from bags with coarser mesh are higher as compared to fine mesh bags. The results of this study show a marked effect of the amount of material in the litter bags on its weight loss. In this study it has been noted that 59% of litter may decompose within three and one-half months and the decomposition of 90% material is completed within a period of ten months. The highest rates of decomposition were attained during the period 7. July to 8. August which is attributed to the availability of plenty of rain water and high microbial and microfaunal activity.

6. References

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