



# DECOMPOSITION AND NITROGEN RELEASE OF COVER CROPS ON DIFFERENT LANDSCAPE POSITIONS

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## ABSTRACT

Decomposition and mineralization patterns of white lupine (*Lupinus albus* L.), black oat (*Avena strigosa* Shreb), crimson clover (*Trifolium incarnatum* L.) and rape (*Brassica napus* L.) were studied under field conditions at the E.V. Smith Research Center in Southeast Alabama. There were no significant differences in cover crop total carbon (C), mass loss and nitrogen (N) mineralization across landscapes. Buried materials decomposed and mineralized faster than surface applied materials. All surface applied cover crops (except black oat) immobilized varying amounts of N during the first two weeks.

## INTRODUCTION

Decomposition patterns of cover crops determine availability of nutrients to subsequent crops. These patterns may be influenced by environmental factors, plant material quality (Swift et al. 1979; Haugaard-Nielsen et al. 1998) as well as material placement.

The **objective** of this study was to determine effect of placement and landscape position on decomposition and mineralization patterns of four winter cover crops: white lupine, black oat, crimson clover and rape.

## MATERIALS AND METHODS

The study was conducted at the E.V. Smith Research Center in Southeast Alabama. Soils consist of Typic, Oxyaquic, and Aquic Paleudults, and are representative of Southeastern Coastal Plain soils. Air dried plant materials were put in nylon litterbags (at a rate equivalent to 5 t ha<sup>-1</sup>) and surface applied (Figure 1a) or buried (10 cm depth) on three landscape positions: drainageway, sideslope and summit (Figure 2). Landscape zones were developed using terrain attributes, multivariate analysis, and fuzzy K-means clustering. Litterbags were retrieved at 1, 2, 4, 6, 10, 14, 18, 22 and 26 weeks for mass and nutrient content determination.

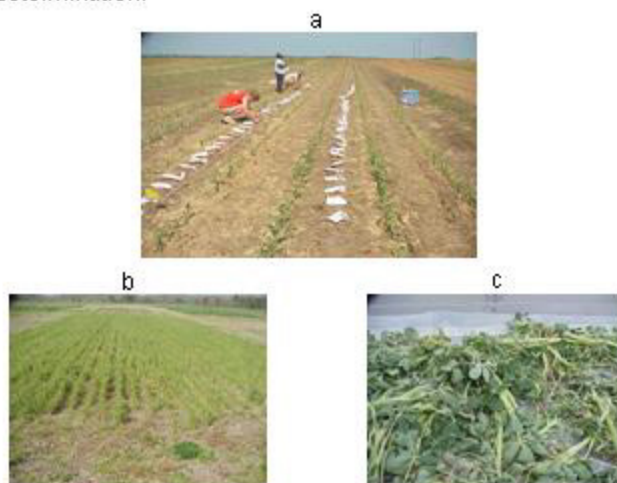


Figure 1. Surface litterbag placement (a), black oat (b) and lupine (c) at harvest

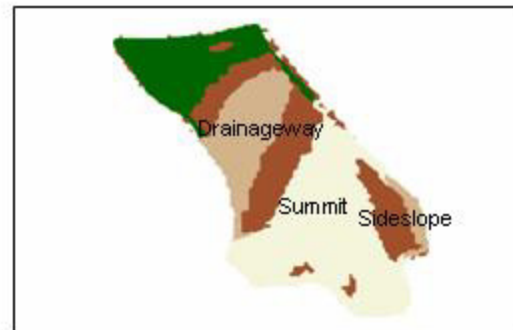


Figure 2. Soil landscape positions developed using fuzzy K-means clustering of terrain attributes

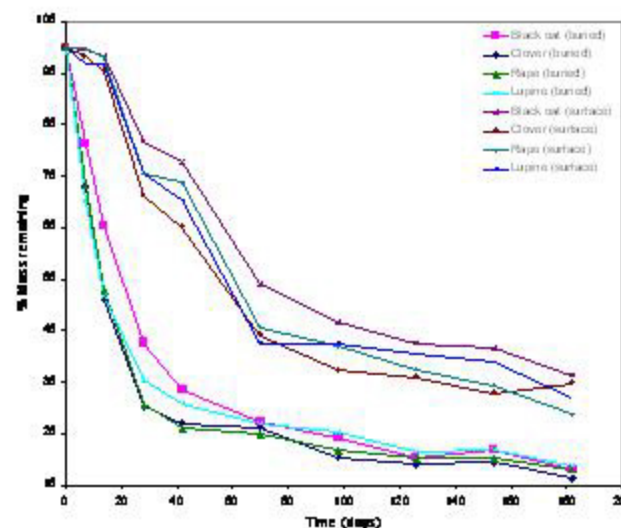
## RESULTS AND DISCUSSION

Table 1. Cover crop nutrient concentration

Material	%C	%N	C:N	%P	%K	%Ca	%Mg
Lupine	41.7	2.1	20.0	0.2	1.1	0.5	0.2
Black oat	39.2	1.7	23.1	0.3	2.1	0.4	0.2
Clover	41.0	3.8	10.9	0.3	2.1	1.0	0.3
Rape	36.8	2.7	13.6	0.3	2.5	1.4	0.3

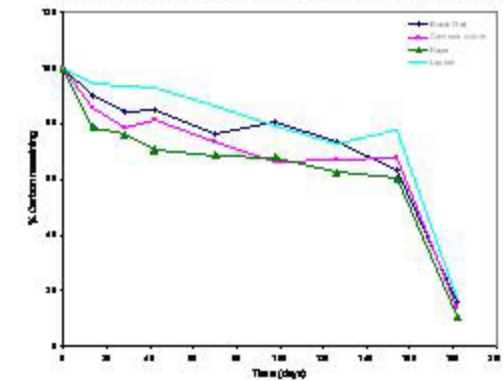
Buried materials decomposed faster than surface placed materials throughout the study period. By 126 days, all buried materials had lost equal mass while surface placed material continued to show higher mass loss by rape and clover compared to black oat and lupine (Figure 3).

Figure 3. Cover crop mass loss over time



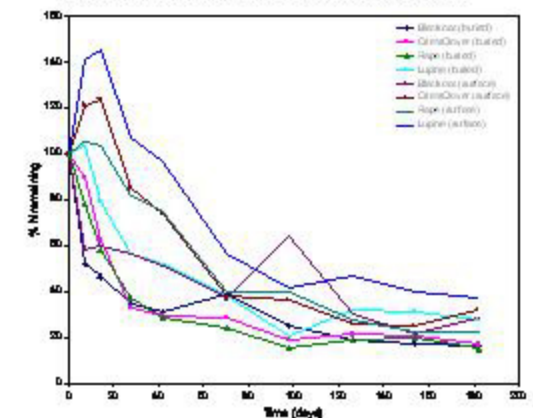
There were no significant differences in C loss between buried and surface applied material (Figure 4), but there were significant cover crop X time interactions in the order rape > clover = black oat > lupine. There were no C loss differences between cover crops at 182 days.

Figure 4. Change in cover crop total C with time



All surface placed materials immobilized N during the first two weeks except black oat. Only lupine immobilized N (one week) when buried (Figure 5), perhaps because part of the material were well formed stems that may have been lignified (Figure 1c).

Figure 5. Cover crop N mineralization



Black oat released its N significantly faster than lupine (buried and surface applied), possibly due to lack of stem formation by black oat by the time the material was harvested (Figure 1b). Clover and rape released N at similar rates.

## CONCLUSIONS

- Material placement and stage of cover crop development influenced cover crop decomposition and nitrogen release patterns. Buried materials decomposed and released N faster than surface applied materials.
- Although black oat released its nitrogen faster than other cover crops, its contribution to soil mineral N may not be significant due to its low initial total N.

## REFERENCES

Swift, M.J., O.W. Heal, and J.M. Anderson. 1979. Decomposition in terrestrial systems. University of California Press, Berkeley, California.

Haugaard-Nielsen H., A. De Neergaard, L.S. Jensen, H. Hogh-Jensen and J. Magid. A field study of nitroge dynamics and spring barley growth as affected by the quality of incorporated residues from white clover and ryegrass. Plant and soil 203(1):91-101.