



Wool Pellets as a Slow-Release Fertilizer and Potential Insect Management in Sustainable Agriculture

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Abstract

Wool biomass is a plentiful but underexploited agricultural by-product with significant promise for sustainable crop production systems. Wool, especially in pelletized form, is abundant in keratin-derived nitrogen and sulfur, making it a promising slow-release fertilizer that can improve soil fertility, water retention, and microbial activity. This review synthesizes current findings on the agronomic uses of wool, emphasizing the morphological and physiological responses of plants to wool pellet amendments and their possible impact on insect populations. Research from both field and controlled research indicates that wool pellets can markedly enhance plant growth metrics, such as biomass accumulation, root development, and nutrient uptake efficiency, mostly owing to their slow nutrient mineralization. Furthermore, wool-based supplements enhance soil structure and moisture retention, hence bolstering plant resilience amid fluctuating environmental conditions. Notwithstanding these advantages, the function of wool pellets in pest management remains little investigated. Anecdotal and preliminary data indicate potential deterrent effects; nevertheless, systematic studies on their influence on insect populations, behavior, and underlying mechanisms are scarce. This review emphasizes the dual capability of wool pellets as a biofertilizer and an element of integrated pest management systems. Nevertheless, significant research deficiencies remain, especially concerning long-term ecological consequences, economic viability, and the uniformity of pest deterrent efficacy across agricultural systems. Rectifying these deficiencies is crucial for standardizing application techniques and completely incorporating wool biomass into circular and sustainable farming processes.

Key Words: Sheep wool, Sustainable agriculture, Organic fertilizer, Plant morphology and physiology, Insect management

