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Faculty of Natural and Life Sciences

جامعة ، سطيف 1، فرحات عباس
كلية علوم الطبيعة و الحياة

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Sahli Hanane

Seddiki Ahmed Rami

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PRESIDE	BELGUET ASSIA	MCA	UFA Sétif 1
SUPERVISOR	BENIDER CHAFIA	MCA	UFA Sétif 1
EXAMINER:	SLIMANI YASMIN	MCB	UFA Sétif 1
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ملخص

تتناول هذه الدراسة تثمين مخلفات محصول دوار الشمس (*Helianthus annuus L*) من خلال التسميد . تم تحضير أربعة مخاليط سماد باستخدام مخلفات مختلفة من دوار الشمس (الرؤوس والسيقان، مع أو بدون روث الدواجن) ومراقبتها طوال عملية النضج . تم تقييم المعايير الفيزيائية والكيميائية الرئيسية، بما في ذلك درجة الحرارة، ودرجة الحموضة، والتوصيل الكهربائي، والمادة العضوية، والكربون العضوي، والمادة المعدنية، بالإضافة إلى تحليل بيولوجي قائم على اختبار الإنبات، لتقييم تطور عملية التسميد.

أظهرت نتائج التحليل الإحصائي باستخدام اختبار **ANOVA**وجود فروق معنوية بين معاملات التسميد العضوي (الكمبوست). وقد أبدى الكمبوست المنتج من سيقان صنف **سافانا (Savana)** أداءً أفضل مقارنةً بالكمبوست المنتج من صنف **إيتاليكا** .**(Italica)** بالإضافة إلى ذلك، كان تحلل الأقراص الزهرية (الرؤوس الزهرية) لدوار الشمس أسرع من تحلل السيقان في صنف إيتاليكا. كما أدى إضافةفضلات الدواجن إلى تسريع عملية التسميد العضوي (الكمبوست) وتحسين الجودة العامة والقيمة الزراعية للكمبوست الناتج.

الكلمات المفتاحية: دوار الشمس، مخلفات المحاصيل، التسميد، المادة العضوية، الاستقرار، المحسن العضوي.

Abstract

This study focuses on the valorization of sunflower (*Helianthus annuus* L.) crop residues through composting. Four compost mixtures were prepared using different sunflower residues (heads and stems, with or without poultry manure) and monitored throughout the maturation process. The main physicochemical parameters, including temperature, pH, electrical conductivity, organic matter, organic carbon, and mineral matter, as well as a biological analysis based on a germination test, were evaluated to assess the evolution of the composting process.

The results of ANOVA statistical analysis revealed significant differences among the compost treatments. The compost produced from the stems of the Savana variety showed better performance than that of the Italica variety. Furthermore, the decomposition of the sunflower heads (discs) was faster than that of the stems in the Italica variety. The addition of poultry manure accelerated the composting process and improved the overall quality and agronomic value of the resulting compost.

Keywords: Sunflower, crop residues, composting, organic matter, stabilization, organic amendment.

Résumé

Cette étude porte sur la valorisation des résidus de culture du tournesol (*Helianthus annuus* L.) par compostage. Quatre mélanges de compost ont été élaborés à partir de différents résidus de tournesol (disque et tiges, avec ou sans fiente de volaille) et suivis durant leur maturation. Les principaux paramètres physico-chimiques, notamment la température, le pH, la conductivité électrique, la matière organique, le carbone organique et la matière minérale, ainsi qu'une analyse biologique basée sur le test de germination, ont été évalués afin d'apprécier l'évolution du processus de compostage.

Les résultats de L'analyse statistique ANOVA a révélé des différences significatives entre les traitements de compostage. Le compost produit à partir des tiges de la variété Savana a montré de meilleures performances que celui obtenu à partir de la variété Italica. De plus, la décomposition des capitules (disques) de tournesol a été plus rapide que celle des tiges chez la variété Italica. L'ajout de fiente de volaille a accéléré le processus de compostage et a amélioré la qualité globale ainsi que la valeur agronomique du compost obtenu.

Mots-clés : Tournesol, résidus de culture, compostage, matière organique, stabilisation, amendement organique.

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Introduction

Plant biomass represents an abundant renewable resource; however, only a small proportion, estimated at about 10% of global production, is currently utilized. A large quantity of agricultural residues is still disposed of through open-field burning, a practice that generates significant greenhouse gas emissions and various atmospheric pollutants, thereby contributing to environmental degradation and climate change (Lal, 2005; FAO, 2013). Among the available valorization strategies, composting is an effective biological process that transforms organic by-products into a stable amendment rich in organic matter. The resulting compost improves the physical, chemical, and biological properties of soils while promoting nutrient recycling (Bernal et al., 2009). Its application in agriculture contributes to enhanced soil fertility, carbon sequestration, and reduced dependence on synthetic mineral fertilizers, the production of which is energy-intensive and associated with substantial greenhouse gas emissions (Amlinger et al., 2008; Hargreaves et al., 2008). Therefore, composting represents a sustainable alternative for the management of organic waste and is fully aligned with the principles of circular agriculture and environmentally friendly resource management. Sunflower (Helianthus annuus L.) is an important oilseed crop cultivated worldwide for its edible oil, food value, and agronomic adaptability but also for residue valorization (Khan et al., 2020; Babu et al., 2014). Sunflower cultivation generates a substantial amount of residual biomass. On average, one tonne of harvested seeds produces between 1.5 and 2.5 tonnes of lignocellulosic residues, mainly composed of stems and flower heads (capitula). Consequently, the production of one tonne of sunflower oil can generate between 3 and 6 tonnes of agricultural residues, representing an important potential resource for valorization processes such as composting (Lal, 2005). Composting is an aerobic biological process that converts organic wastes into a stable, humified amendment suitable for soil application. It is widely recognized as a sustainable approach for recycling organic residues, reducing environmental pollution, improving soil fertility, and supporting circular agriculture (Dadhich et al., 2021; Qumbarani & Jamali, 2025). The objective of this study is therefore to evaluate the composting of sunflower residues, combined with poultry manure, and to follow the evolution of the compost through physico-chemical and biological indicators. And is to assess the maturity, stability, and potential agricultural value of the compost obtained from sunflower stalks and heads.

This thesis is structured as general Information on the Sunflower (Helianthus annuus L.) and Composting, chapter of materials and methods finally chapter results and discussion.