Anita Zapałowska [1], Wacław Jarecki [2]

[1] Department of Agriculture and Waste Management,
University of Rzeszów, Ćwiklińskiej 1a St., 35-601 Rzeszów, Poland
e-mail: azapalowska@ur.edu.pl
[2] Department of Crop Production, University of Rzeszów,
Zelwerowicza 4 St., 35-601 Rzeszów, Poland,
e-mail: wjarecki@ur.edu.pl

Effects of various compost types on corn growth and yield

INTRODUCTION

Organic waste represents a valuable resource for recycling and reuse, particularly in its application as an agricultural fertilizer. Many organic wastes are nutrient-dense, providing essential elements that promote crop growth. In modern agricultural practices, a sustainable approach involves establishing a closed- loop system that recycles nutrients from organic waste, thus presenting a viable alternative to conventional mineral fertilizers. Corn (*Zea mays*)- a globally significant crop due to its roles in human food supply, animal feed, and biofuel production- serves as an ideal model for assessing such sustainable practices. This study aimed to evaluate the impacts of six different compost types, each derived from distinct municipal organic waste sources, on the growth, yield, and physiological performance of GS210 corn. Specifically, the study compared the effects of these organic composts to those of traditional NPK mineral fertilization and an unfertilized control. The central hypothesis proposed that organic compost fertilization could substitute NPK mineral fertilization without compromising grain yield or quality.

MATERIALS AND METHODS

The seed of the GS210 corn variety (Agro Seed Sp. z o. o., Brzezie, Poland) was used. The seeds were initially treated with the following two active substances: metalaxyl and prothioconazole.
The experiment was conducted using six compost variants and two control treatments- one without fertilizer and another with NPK mineral fertilization:
A- Control;
B-Soil + Polifoska®8 + Pulrea + INu;
C-Soil + Compost 1,
D-Soil + Compost 2;
E-Soil + Compost 3;
F-Soil + Compost 4;
G-Soil + Compost 5;
H-Soil + Compost 6.

The experiment followed a single-factor design with four replicates. The primary factor under investigation was organic fertilization, with treatments C, D, E, F, G, and H, compared against control treatments A and B.
The compost underwent chemical analysis, while the plants were evaluated through biometrical assessments, including chlorophyll fluorescence, gas exchange measurements, and Soil Plant Analysis Development (SPAD).

RESULTS

It was demonstrated, that key indices of chlorophyll fluorescence, such as Fv/Fm (0.80, 0.80, 0.81) (Fig.1), Fv/F0 (4.07, 3.99, 4.03) (Fig.2), and photosynthetic efficiency (PI: 4.62, 4.22, 5.21) (Fig.3), were highest in compost-treated plants, indicating enhanced photosynthetic performance. Among growth parameters, NPK fertilization showed the greatest benefits, with plant height reaching 188.9 cm, cob length 17.5 cm (Fig.4), grains per cob 324, and a thousand-grain weight (MTZ) of 285.2 g (Fig.5). The grain protein content also increased under mineral fertilization (9.5%) compared to the control (8.5%). Organic fertilizers performed slightly lower in terms of yield but still surpassed the control, with grain protein contents ranging from 9.1% to 9.3%. Compost treatments involving sewage sludge and garden waste, such as Compost 2 and Compost 4 (D, F), demonstrated comparable results to NPK in certain parameters, especially in photosynthesis and grain count. However, composts made solely from garden waste (E) showed reduced effectiveness during corn's rapid growth stages.

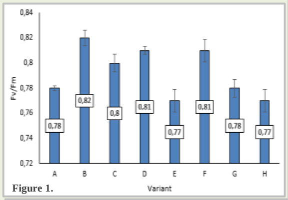

Figure 1.

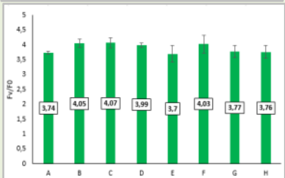

Figure 2.

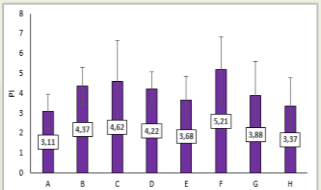

Figure 3.

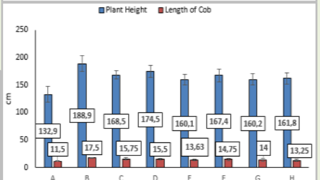

Figure 4.

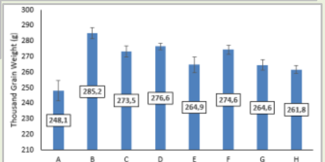

Figure 5.

CONCLUSIONS

While NPK mineral fertilization produced the highest growth and yield, certain compost variants proved effective alternatives, particularly for improving soil and plant health. The findings suggest that combining organic fertilizers with mineral nitrogen could optimize corn production, warranting further study to refine these approaches for sustainable agriculture.