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The effect of organic and mineral fertilization on soil chemical composition and the yield and quality of maize (*Zea mays* L.) grain

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INTRODUCTION & AIM

In agricultural contexts, the health of soil is pivotal to crop success, particularly evident in maize cultivation where soil conditions influence both yield and
grain quality. This study delved into the impacts of various organic and mineral fertilization methods on maize growth, grain quality, and soil chemistry.

METHOD

The experiment examined eight distinct fertilization treatments ranging from composts (CA, CB, CC) to vermicompost (VeA, VeB, VeC) to mineral fertilization (NPK) and a control group (Control).

RESULTS & DISCUSSION

Notably, Vermicompost C (VeC) emerged as highly beneficial, yielding the highest maize production and grain quality, with a thousand-kernel weight (TKW) of 297 grams. This surpassed results from mineral fertilization and unfertilized controls , which recorded TKWs of 274 grams and 277 grams, respectively (Fig.1).

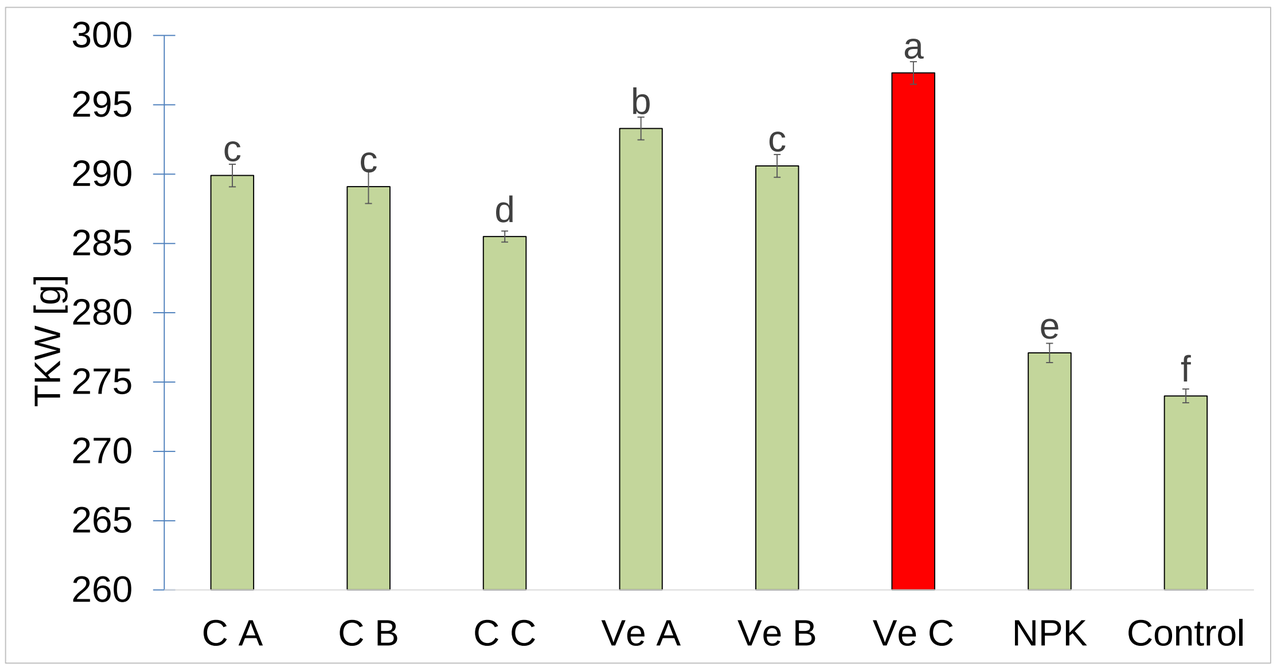

Figure 1. TKW [g]. Different letters indicate significant differences ($p < 0.05$), ($n = 3$).

Compared to the control, Vermicompost A (VeA) showed an increase of 38% (539.7 kernels) while Vermicompost B (VeB) increased by 32%. Relative to the control, grain mass per cob increased by 48% in VeA and by 40% in variant VeB, highlighting the substantial effect of the applied fertilization strategies on maize yield. A noticeable increase in cob core weight compared to the control ranged from 3.5% to 50.2% Mean cob core weight varied from 20.1 g in the control to 30.2 g in Compost A (CA). CA and VeB exhibited the highest increases (+50.2 % and +44.8 %, respectively), suggesting that these fertilization regimes were most effective in enhancing cob mass.

Vermicompost B (VeB) not only boosted yield but also enriched soil nutrients significantly. It exhibited elevated levels of nitrate nitrogen (49.3 mg/kg), phosphorus (61.8 mg/kg), potassium (156.2 mg/kg), calcium (1416 mg/kg), zinc (14.7 mg/kg), and boron (1.36 mg/kg). Moreover, its soil pH of 6.8 and moderate electrical conductivity of 0.94 dS/m indicated favorable soil conditions for maize growth.

In contrast, Vermicompost C (VeC), while lower in nitrogen and phosphorus, proved superior in zinc (17.5 mg/kg) and boron (1.53 mg/kg) concentrations, highlighting its potential as a micronutrient source. Mineral fertilization, while effective in providing ample macronutrients (nitrogen, phosphorus, potassium), fell short in micronutrient supply, particularly zinc and boron.

CONCLUSION

These findings underscore the viability of vermicompost-based fertilization strategies, especially those incorporating sewage sludge and green waste, as sustainable alternatives to traditional mineral fertilizers. Beyond enhancing crop productivity and grain quality, these organic approaches improve soil fertility, offering long-term benefits for agricultural sustainability and resilience against environmental challenges. As agriculture seeks more sustainable practices, the role of soil health and nutrient management remains critical in securing future food production.