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RESPONSE OF MAIZE SEED GERMINATION AND PLANT GROWTH TO AMENDMENTS OF LEAF POWDERS OF THREE MULTIPURPOSE PLANT SPECIES IN SUDANO-GUINEA SAVANNAHS OF NGAOUNDERE CAMEROON

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Abstract: In order to contribute of introducing indigenous plant species in soil fertility management, trials were conducted in pot and field at the University of Ngaoundéré to study the effect of leaf powders of *Tithonia diversifolia*, *Terminalia glaucescens* and *Annona senegalensis* on seed germination and plant growth of maize (*Zea mays* L.). Leaf powder samples were mixed with 0.5 kg of soil in pots at three doses (10, 20 and 30 g), then watered with distilled water every two days after sowing. For the plant growth, field experiments were carried out in 4 m x 1 m plots each, separated by 25 cm wide. Data were collected on germination rate in the pot and plant growth in the field. The results showed that the powders of the three plant species and their mixtures did not show toxic effects on seed germination at all three doses because the germination rate was higher than 50%. For all treatments and at all doses, the germination rate reached 100% at 12 DAS, with the exception of the control (80% of germination) and the three mixtures (AS+TD, AS+TG et AS+TD+TG) at the high dose (30g). Growth parameters such as plant height, leaf number and neck diameter, and plant biomass for all treatments were significantly ($p < 0,001$) higher than those of control, and the best amendment was the powder mixture of *A. senegalensis* and *T. glaucescens*, with height value of 103.07 cm, leaf number of 14.33, neck diameter of 14.49 mm, and plant biomass of 98.57g. Compared to the control, all treatments improved the soil C, N and P contents, and the best improvement provided by the mixture of leaf powders of *A. senegalensis* and *T. glaucescens*, with soil C, N and P contents of 2.40, 2.14 and 0.09% respectively. The three plant species leaf and their mixture under the conditions of these trials have been of great potential for improving the availability of soil nutrients by providing the quantity necessary for cultivation of maize without the addition of chemical fertilizers. These results would contribute to the agroforestry plant species choice to domesticate for management of soil fertility of the Ngaoundere savannahs of Cameroon in particular and those of Sudano-guinea savannahs in general.

• Introduction

In the savannahs of Ngaoundere, anthropic activities due to population growth lead to the degradation of natural ecosystems, which results in a decline in soil fertility. Thus, to alleviate this problem of soil degradation, it is necessary to promote appropriate alternative technologies, such as the use of leaf powder from plant species. Hence, the objective of the present work, which is to evaluate the response of leaf, powders of three species and their mixtures on germination and growth of maize.

• Material and method

This study took place at Bini-Dang (Ngaoundere III) in the Adamawa province. Plant material consisted of leaf powders of *Tithonia diversifolia* (TD), *Terminalia glaucescens* (TG) and *Annona senegalensis* (AS) on seed germination and plant growth of maize. The germination test was carried out in a pot; the experimental design applied is a split-plot with three replicates. The growth test is a completely randomised block with three replicates. The treatments applied for each of the two experiments are control, TD, TG, AS, TD+TG, TD+AS, TG+AS, TD+TG+AS, 8 treatments. The parameters evaluated in the pot are the germination rate and in the field the height of the plants was measured, the number of leaves was counted, the diameter at the glue was measured. The collected data were subjected to the analysis of variance (ANOVA) 5% probability threshold using the STATGRAPHIC.5 software.

• Results and discussions

The content of the different elements (table 1) varies significantly between treatments. It can be seen that the contents of Carbon, Nitrogen, Phosphorus vary between 1.57%, 1.45%, 0.02% for the initial soil to 2.40%, 2.14%, 0.09% for the treatments amended with the powders of the TG + AS leaves. However, only the control has lower values than all other treatments.

The results obtained indicate that the chemical characteristics of the leaves vary from one plant species to another. The leaf powders of these three species and their mixtures did not show toxic effects ($TG > 50\%$) on seed germination at all three doses.

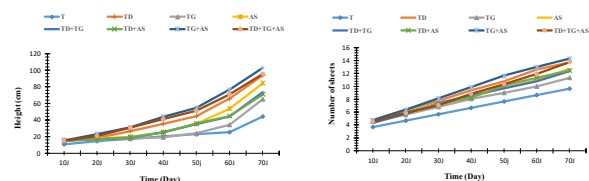
Growth parameters such as height, number of leaves and crown diameter were significantly ($p < 0.001$) higher than the control and the best amendment was the mixture of *T. glaucescens* + *A. senegalensis* powders, with values of 103.07 cm height, 14.33 for number of leaves and 14.49 mm crown diameter.

The results show that compared to the control, all treatments improved soil C, N and P content.

Table 1. C, N and P content of the initial soil and after three months of growth in different treatments

Treatments	Carbon (%)	Nitrogen (%)	Phosphorus (%)
Initial	1,44 ± 0,02	1,36 ± 0,16	0,01 ± 0,004
T	1,57±0,01 ^b	1,45±0,005 ^b	0,02±0,005 ^b
TD	2,38±0,02 ^c	2,09±0,005 ^c	0,08±0,005 ^c
TG	2,31±0,01 ^c	1,55±0,05 ^b	0,04±0,005 ^b
AS	2,34±0,01 ^c	2,07±0,01 ^c	0,07±0,005 ^c
TD + TG	2,35±0,01 ^c	2,02±0,01 ^c	0,05±0,05 ^b
TD + AS	2,35±0,005 ^c	2,01±0,01 ^c	0,05±0,05 ^b
TG + AS	2,40±0,01 ^c	2,14±0,03 ^c	0,09±0,05 ^c
TD + TG + AS	2,37±0,02 ^c	2,11±0,01 ^c	0,08±0,05 ^c
F	964,22***	857,32***	44,84***
P	0,0000	0,0000	0,0000

The numbers with different letters in the columns indicate that the values are significantly different. *** $p < 0,001$.



• Conclusions

The aim of this study was to evaluate the effects of the leaf powders of *Tithonia diversifolia*, *Terminalia glaucescens* and *Annona senegalensis* on germination and growth of maize (*Zea mays* L.). The powders of these three species and their mixtures did not show toxic effects (germination rate > 50%) on seed germination at all three doses (10g, 20g and 30g). Growth parameters such as height, number of leaves and crown diameter varied significantly between treatments. The *T. glaucescens* + *A. senegalensis* mixture improved all growth parameters: height (106.9 cm), number of leaves (14) and crown diameter (14.9 mm). The reported biomass data differed significantly between treatments ($p < 0.001$). The C, N and P contents of the powders of these three species differed significantly from those of the pre-cultivation site soil. At the end of cultivation, all treatments of *T. diversifolia*, *T. glaucescens*, *A. senegalensis* and their mixtures improved soil C, N and P contents. The application of *T. glaucescens* + *A. senegalensis* was better for the increase of these chemical elements (C: 2.40%, N: 2.14% and P: 0.09%). The use of the leaf powders of these plant species contributes to the improvement of the soils of the Sudano-Guinean savannahs of Ngaoundere Cameroon in general and Dang in particular.

