



TOGO INSTITUTE OF AGRONOMIC RESEARCH

Technical report

Efficiency Test of the "APEX-10" fertilizer booster on the agronomic performance of maize in Togo



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Summary

The study's purpose is to test the agronomic efficiency of the APEX-10 fertilizer booster introduced by Togo Industries Groupe (TIG). To this end, ITRA conducted an experiment on maize at the Amoutchou agricultural research station in the Plateaux region. Six treatments were formulated and installed in a complete randomized block design: (i) a control with no fertilizer application (Control). (ii) The application of APEX-10 alone at the rate of 2ml/3liter of water/100m² (APEX-10). (iii) The application of mineral fertilizer N-P-K at the recommended rate of 200 kg of NPK 15-15-15 and 100 kg of urea (NPK). (iv) The combination of APEX-10 at 30% of the recommended fertilizer rate (APEX-10 +30%NPK). (v) the combination of APEX-10 at 50% of the recommended fertilizer rate (APEX-10 +50%NPK) and (vi) the combination of APEX-10 at 100% of the recommended fertilizer rate (APEX-10 +100%NPK). Observations were made on emergence rate, plant heights at 20, 40 and 60 days after sowing (DAS) and at harvest, and maize grain yield.

The results revealed that the APEX-10 application did not affect the good germination of the maize whose average seedling emergence rate was 97.8%. In terms of height, the application of APEX-10 alone showed a growth improvement of 35%, 33%, and 38% respectively at 40 and 60 days after sowing (DAS), and at harvest. In terms of yield, the application of APEX-10 alone exhibited a yield of 2231 kg/ha against a yield of 1648 obtained with the control, indicating a 36% increase in grain maize yield of APEX-10 alone compared to to the control without fertilization. APEX-10 + 50%NPK allowed to obtain a yield of 3996 kg/ha, statistically identical to the yield of 4123 kg/ha obtained with the application of the recommended dose of mineral fertilizers (200 kg of NPK 15-15 -15 and 100 kg of urea). It is deduced that the application of APEX-10 made it possible to reduce the dose of NPK mineral fertilizers by half to obtain the same yields as when the latter are applied in full dose. In view of these results, APEX-10 can be recommended in cropping systems by halving the doses of NPK mineral fertilizers.

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By

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Summary i

List of Figures iii

List of pictures iii

1. Introduction 1

2. Materials and Methods 2

 2.1. *Proving Ground* 2

 2.2. *Plant material* 2

 2.3. *The products used* 2

 2.4. *The treatments tested and the experimental device.* 2

 2.5. *Testing* 3

 2.6. *Observations and data collection* 3

 2.7. *Statistical analysis* 3

3. Results 4

 3.1. *Effect of treatments on corn emergence rate* 4

 3.2. *Effect of treatments on corn height at 20th* 4

 3.3. *Effect of treatments on maize height at 40th and 60th DAS and harvest* 5

 3.4. *Effect of treatments on yield* 6

Conclusion and recommendations 7

List of Figures

Figure 1: APEX-10 effect on corn emergence rate	4
Figure 2: Corn height following treatments at 20 th	5
Figure 3: Height of maize following treatments at 40 th DAS	5
Figure 4: Effect of treatments on maize height at 60 th DAS (A) and harvest (B)	6
Figure 5: Effect of treatments on grain maize yield	6

List of pictures

Photo 1: A 1 liter box of APEX-10	2
Photo 2: Seed treatment (A and B), and foliar treatment with APEX (C)	3

1. Introduction

In order to contribute to the sustainable improvement and performance of the technical means of agricultural production, ITRA, at the request of the company Togo Industries Group (TIG), tested the effectiveness of the APEX-10 fertilizer booster on the maize farming in Togo.

APEX-10 is both a fertilizer booster and a soil improvement. It is a peat extract made from 10,000-year-old active and complex natural materials. It improves the efficiency of chemical fertilizers, increases crop/plant turgor, improves nutrient retention in the soil and makes nutrients more available to the plant. It significantly reduces the potential for root loss under stressful conditions. Its use makes it possible to reduce the quantities of mineral fertilizers applied to crops.

It is in light of these advantages linked to APEX-10 that the company TIG offers it to Togolese farmers, to improve the state of organic and physical fertility of the soils under cultivation in order to increase agricultural yields. But before the product is marketed, the product should be tested in local production systems to determine its effectiveness in relation to current practices and make recommendations based on the scientific results. The present study thus aims to evaluate the effectiveness of the product APEX-10 on the growth and yield of maize in Togo.

2. Materials and Methods

2.1. Experimentation site

The trial was conducted in Amoutchou (plateau region) at the research station of the Humid Savane Agronomic Research Center of the Togo Institute of Agronomic Research. (CRASH/ITRA). The Amoutchou site has a bimodal Guinean climate with two rainy seasons. A large one (March-July) and a small one (September-November) intercalated by two dry seasons. Temperatures vary between 25 and 35°C. The average rainfall per year is 1000 mm. The soils are generally of the sandy ferralitic type with a pH between 5.8 and 7.7. The soils are generally of the ferralitic type with a pH between 5.8 and 7.7.

2.2. Plant material

The test plant is corn of the Ikenne variety. It has an average size: 2.10m at harvest with a cycle of 90 to 95 days for an average yield of 2,500 kg/ha in a peasant environment and a potential of 5,000 kg/ha.

2.3. The products used

- **APEX-10:** fertilizer booster, it is a soil amendment that boosts the use of fertilizers by plants
- **NPK:** 15-15-15 (15%N, 15%P₂O₅ , 15%K₂O) and urea (46%N) which are the fertilizers used on maize in Togo

NPK and urea are the fertilizers usually used at the local level and which have been the subject of mineral fertilizer recommendations in Togo on maize.



Photo 1: A bottle of 1 liter of APEX-10

2.4. The treatments tested and the experimental device

The effect of APEX-10 was compared to that of the recommended dose of mineral fertilizer (200 kg of NPK 15-15-15 and 100 kg of 46%N urea) on maize cultivation. The trial included a control treatment without the addition of fertilizer which served as a reference element and to compare the effectiveness of the various other treatments and of the treatments made up of combinations of APEX-10 with the recommended dose of mineral fertilizers at 30 % (APEX-10+30%NPK), at 50% (APEX-10+50%NPK) and at 100% (Table 1).

These 6 treatments were installed in a complete random block experimental design with four replicates. The elementary plot was 4.8 mx 5 m or 24 m².

Table 1: Description of treatments

Treatment	Description (Dose of fertilizer applied)
T0	Unfertilized control plot
APEX-10	Application of 2l/ha APEX-10
NPK	Recommended fertilizer dose: 200Kg NPK and 100Kg urea per ha
APEX-10+30%NPK	2l/ha APEX-10 plus 30% of the recommended fertilizer dose: 60 Kg NPK and 30 Kg urea per ha
APEX-10+50%NPK	2l/ha APEX-10 plus 50% of the recommended fertilizer dose: 100 Kg NPK and 50 Kg urea per ha
APEX-10+100%NPK	2l/ha APEX-10 plus 100% of the recommended fertilizer dose: 200 Kg NPK and 100 Kg urea per ha

2.5.2.5. Conducting the tests

APEX-10 was used to treat the seeds sown on the plots of the treatments with APEX-10 at the dose of 100 ml per 10 kg of seeds. During vegetative development, APEX-10 was applied by foliar spraying on the 21st day after sowing (DAS), 40th and 60th DAS at a dose of 2l/ha. NPK was applied as top-up fertilizer at 20 DAS and urea at 45^{DAS} at the doses corresponding to the treatments in Table 1.

Sowing was done flat on soil plowed with a tractor with a pattern of 40 cm between holes and 80 cm between rows with three seeds per hole. At emergence, thinning was done with two plants per pocket, thus leaving a crop density of 62,500 plants per hectare. The maintenance of the trials consisted of weeding by regular weeding with a hoe in order to avoid any competition in nutrients between the weeds and the maize.



Photo 2: Seed treatment (A and B), and foliar treatment with APEX-10 (C)

2.6. Observations and data collection

Observations during vegetation focused on the emergence rate of the plants, the height and the diameter at the collar of the plants at the 20th, 40th DAS and at 60 DAS and at harvest. At harvest, grain weights were recorded by plot to assess yields.

2.7. Statistical analysis

The recorded data were subjected to the analysis of variance (ANOVA) at the 5% threshold with the GenStat 12th Edition software. The comparison of the means was carried out using Duncan's test, always at the 5% threshold.

3. Results

3.1. Effect of treatments on corn emergence rate

Figure 1 illustrates the corn emergence rates under the effect of application of APEX-10 at 10 days after sowing (DAS). The result indicates that the germination rates are statistically identical ($P>0.05$). The treatments therefore did not affect seed germination. For both APEX-10 treated and untreated seeds, the average emergence rate was 97%. From these results, it is deduced that the treatment of maize seeds with APEX-10 before sowing did not prevent the seeds from germinating and emerging normally.

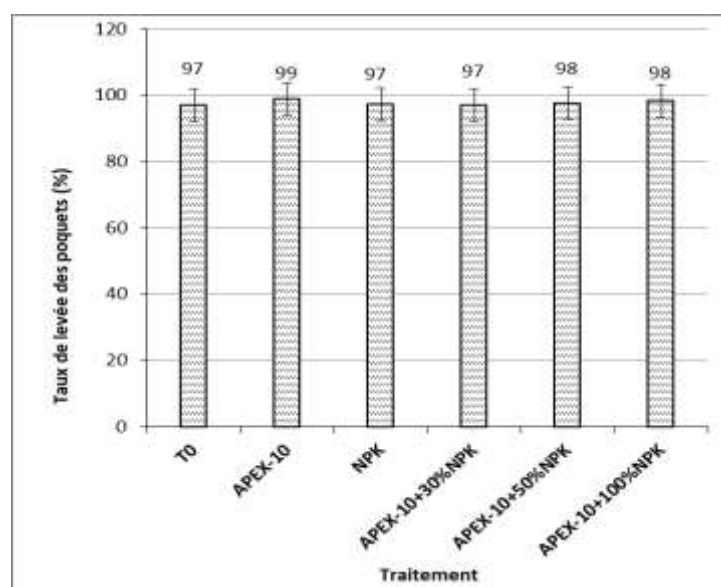


Figure 1: APEX-10 effect on corn emergence rate

3.2. Effect of treatments on the height of maize at day 20

Figure 2 illustrates the height height of maize plants at day 20 after sowing (DAS). It indicates that there is no significant difference ($P>0.05$) between the heights of the treatments. This implies that the treatments did not have different effects on plant height. Both the control plot, the APEX-10 application plot, the NPK fertilizer application plot and the different APEX-10 + NPK combinations induced the same height (19.7 on average) at 20 DAS. This result would be due to the fact that not all the plots received any fertilizer application before 20 DAS. APEX-10 application plots with seed treated with the product prior to planting did not significantly affect plant height at 20 DAS. It is concluded that at 20 DAS, APEX-10 did not influence the height of maize, which averaged 19.7 cm.

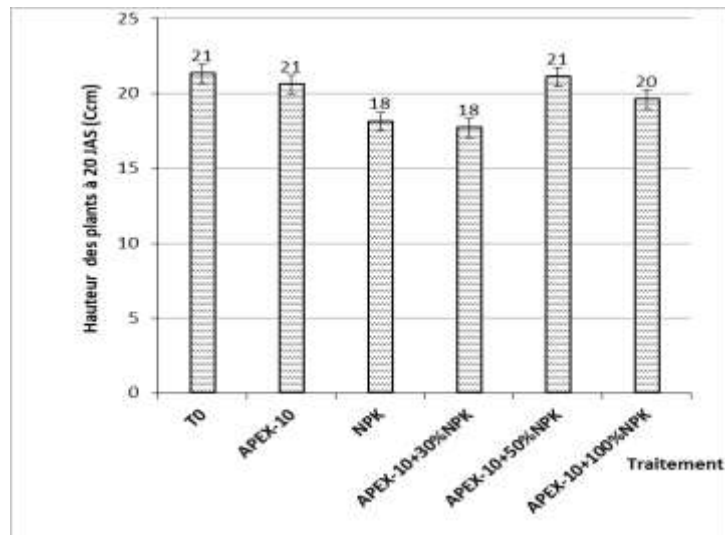


Figure 2: Height of maize following treatments at day 20

3.3. Effect of treatments on maize height at 40th and 60th DAS and harvest

The effect of the treatments on the height of the maize plants at 40th is illustrated by Figure 3. It indicates statistically significant differences between the heights of the plants induced by the various treatments with 40-DAS. On this date, the highest heights were obtained on the plots of application of NPK (87.3 cm) and the plots of application of APEX-10 combined with NPK in proportions of 50%NPK (92.4 cm) and 100%NPK (90.2 cm). The lowest height was obtained with the control plot which exhibited a height of 51.6 cm. Application of APEX-10 alone resulted in an average height of 69.8 cm that was statistically 30% higher than control (Figure 3).

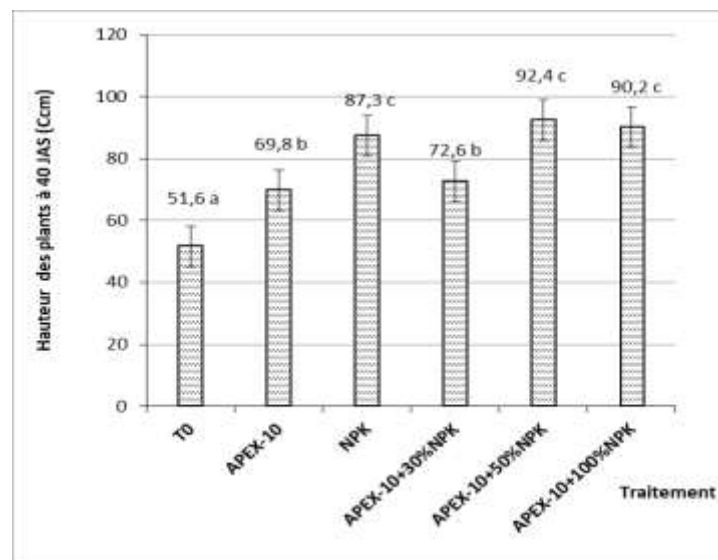


Figure 3: Height of maize following treatments at the 40th DAS

The trends obtained at the 40th DAS were maintained up to 60 DAS and at harvest (Figure 4A and 4B). Overall, the order of the effect of the treatments on the height of the plants at the 40th, 60th and at harvest is as follows: $NPK = APEX-10 + 50\%NPK = APEX-10 + 100\%NPK > APEX-10 > T0$

From these results, it is deduced that the application of APEX-10 made it possible to improve the height growth of the maize compared with the control. Its combination with 30% NPK did not significantly improve the height growth of maize. On the other hand, the combination with the half-recommended dose of NPK (APEX-10 + 50%NPK) made it possible to expect the same growth performance as the application of the full dose of NPK.

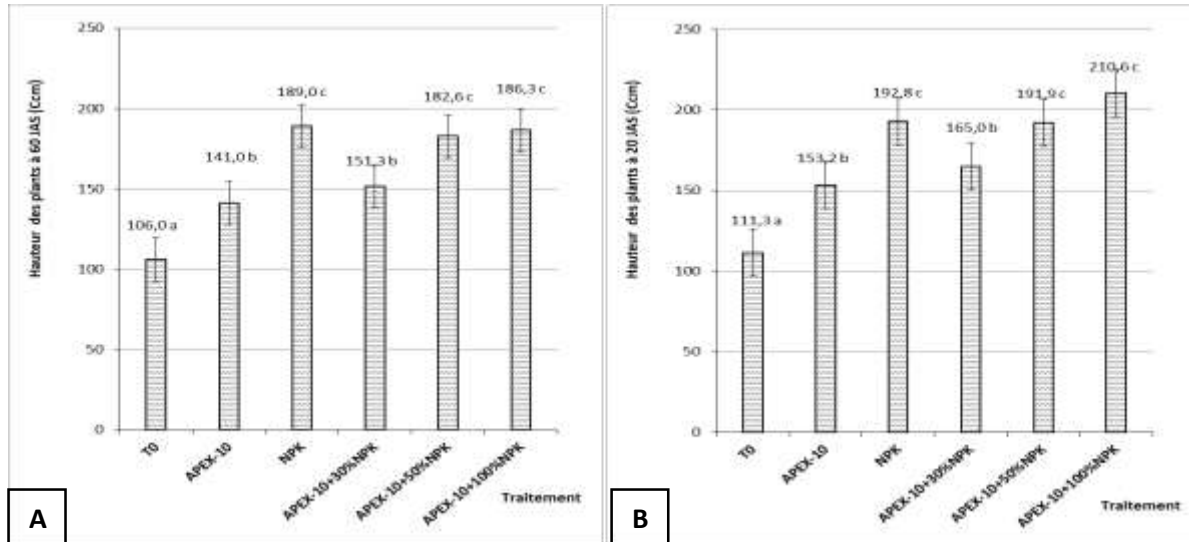


Figure 4: Effect of treatments on maize height at 60 DAS (A) and harvest (B)

3.4. Effect of treatments on yield

The corn yields induced by the different treatments in the trial are shown in Figure 5. The lowest yield (1648 kg/ha) was obtained with the control. Application of APEX-10 alone significantly ($P<0.05$) improved yield (2231 kg/ha) over the control, a 36% increase. It is inferred that APEX-10 significantly improved the yield of maize by 36% over the control. The combination of APEX-10 at 30% of the recommended NPK rate resulted in a yield of 2766 kg/ha statistically higher than the yield obtained with APEX-10.

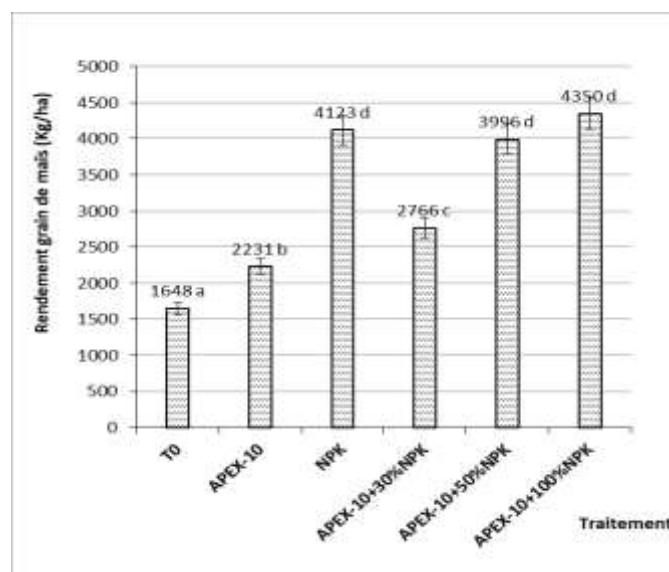


Figure 5: Effect of treatments on grain corn yield

The best yields were obtained with the NPK (4123 kg/ha), APEX-10+50%NPK (3996 kg/ha) and APEX-10+100%NPK (4350 kg/ha) treatments, which are statistically similar. It should therefore be inferred that the APEX-10 + 50%NPK treatment for which the NPK doses are reduced by half and which produced a higher yield is the best fertilization practice of the experiment. *It is concluded that the application of APEX-10 on the maize crop makes it possible to reduce the recommended doses of NPK mineral fertilizer and obtain the best yields.*

Conclusion and recommendations

This study aimed to test the effectiveness of the product APEX-10 on the agronomic performance and yield of maize in Togo. At the end of the experiment which was carried out on the ITRA support point in Amoutchou in the plateau region of Togo, the following main results were obtained:

- APEX-10 did not interfere with corn emergence rates which averaged 97.6% over the entire trial.
- In terms of vegetative performance, APEX-10 has, until harvest, improved heights by 33 to 38% compared to the control without fertilizer application. Combining APEX-10 with half the rate of NPK mineral fertilizer provided the same height performance as 100% of the recommended rate of NPK.
- The application of APEX-10 made it possible to increase grain maize yield by 36% compared to the control without fertilization. APEX-10 also made it possible to reduce the dose of NPK mineral fertilizer by half to obtain the same yields as when the latter is applied in full dose.

From these results, it is concluded that, both on vegetative growth parameters and on maize yield, APEX-10 was effective and can be recommended on crops in Togo. Its application allowed to reduce by 50% the recommended doses of NPK mineral fertilizers and to obtain the same yields as when the latter is applied at full dose. As APEX-10 is an organic product, it can be recommended to improve organic productions where the use of mineral fertilizers is not allowed.

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