PD-AAW-689

AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C. 20523

DATE: 8/31/87

MEMORANDUM

TO: AID/PPC/CDIE/DI, room 209 SA-18

FROM: AID/SCI, Victoria Ose VO

SUBJECT: Transmittal of AID/SCI Progress Report(s)

Attached for permanent retention/proper disposition is the following:

AID/SCI Progress Report No. 3. F-49

Third Semestral Report rec'd 4/14/86

Attachment

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1' AID/SCI 3. F-49

THIRD SEMESTRAL REPORT TO AGENCY FOR INTERNATIONAL DEVELOPMENT (AID)

1. **PROJECT:** "Facultad de Agronomía", (FAUP), University of Panama/Departament of Plant Science, University of Delaware/ AID-GRANT 936-5542

2. **PERIOD:** August 1985 to February 1986

3. **TITLE:** Vicariant Fertilization for Tropical Soils

4. **PERSONNEL:**

Robustiano Alvarez	Project Coordinator and Principal Investigator
Donald L. Sparks	Co-Principal Investigator
Metodio Rodríguez	Associate Investigator
Francisco Mora	Associate Investigator

5. **OBJECTIVES:**

a) To continue physico-chemical analyses of soils chosen as representative of Oxisols, Ultisols and Andepts.

b) To perform greenhouse and field experiments with different phosphorous (P) and silicate levels with the purpose of testing the effect of natural and synthetic silicates (vicariant fertilizers) on maize growth.

c) To acquire machinery for field tests.

4/m/n

6. ACHIEVEMENTS: a) The greenhouse and field experiments with maize plants have shown that the use of natural and synthetic silicates, as vicariant fertilizers, are able to:

I) Increase the growth of maize (on a dry matter basis)

II) Save phosphorous (P) fertilizer substantially.

These results correlate well with the silicate and P adsorption studies performed in the laboratory for Ultisol and Oxisol.

The results for Andepts are not so well defined.
b) Four papers related to this research were presented at the Annual Meeting of the Soil Science Society of America (Chicago, Dec. 1985). Three of these papers were submitted for publication. A poster with the results of greenhouse and field tests was exhibited at David's International Fair with proper acknowledgement to AID.

The highlights of the findings from fertility experiments (greenhouse and field tests) are presented in next pages. Detailed report of laboratory, greenhouse and field experiments will be presented in our next comprehensive report.

c) A grain seeder was purchased for the field experiments. With it we expect to obtain faster and more uniform results.

7. OBSTACLES: As it was pointed out before changes in the seasonal rains indicate that extra time is needed to complete the programed field experiments.

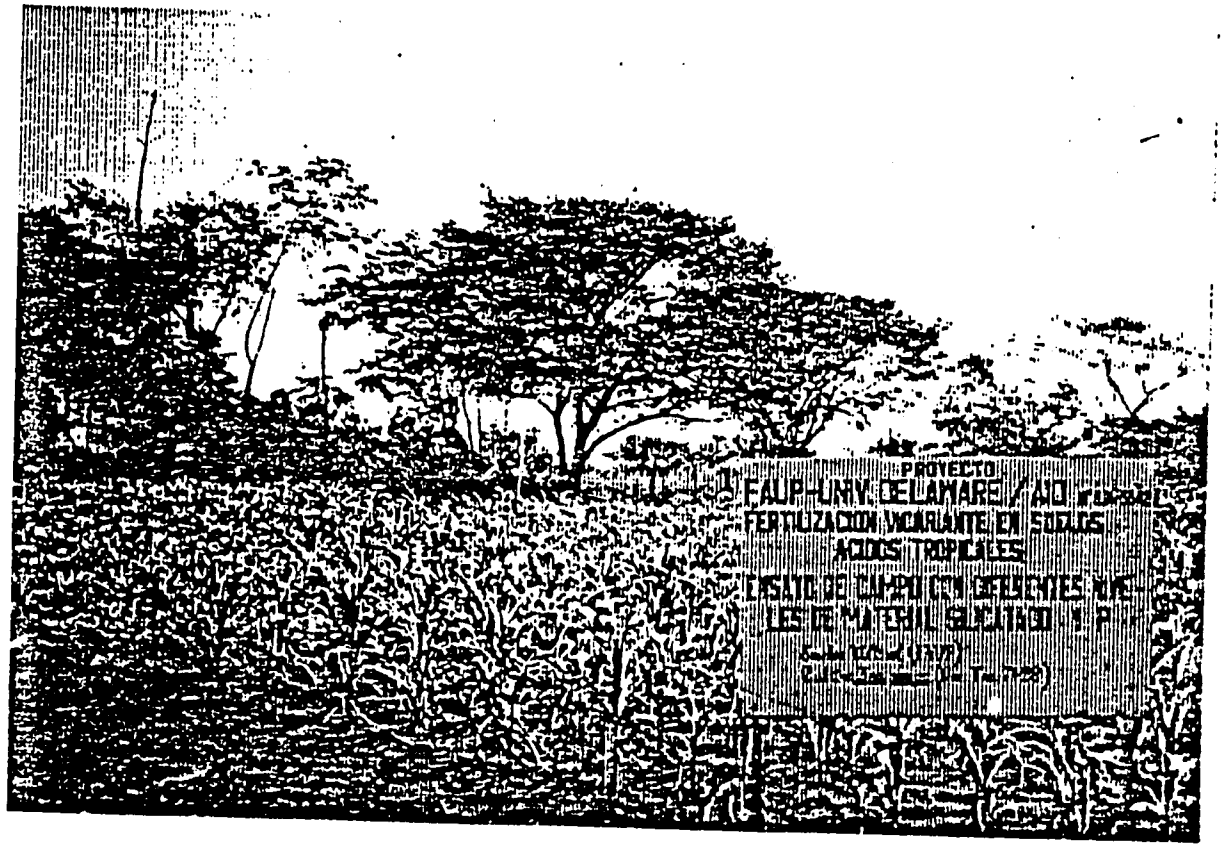
8. <u>FUTURE AIMS</u> : a. Greenhouse pot tests and field experiments, continuing with maize.for Oxisols and Andepts.

b. Synthesis of silicates and study of their physicochemical properties.

c. Further Physico-chemical investigations are necessary for soils, especially with respec to the retention properties of silicates an phosphates and their interactions with the different soil surfaces.

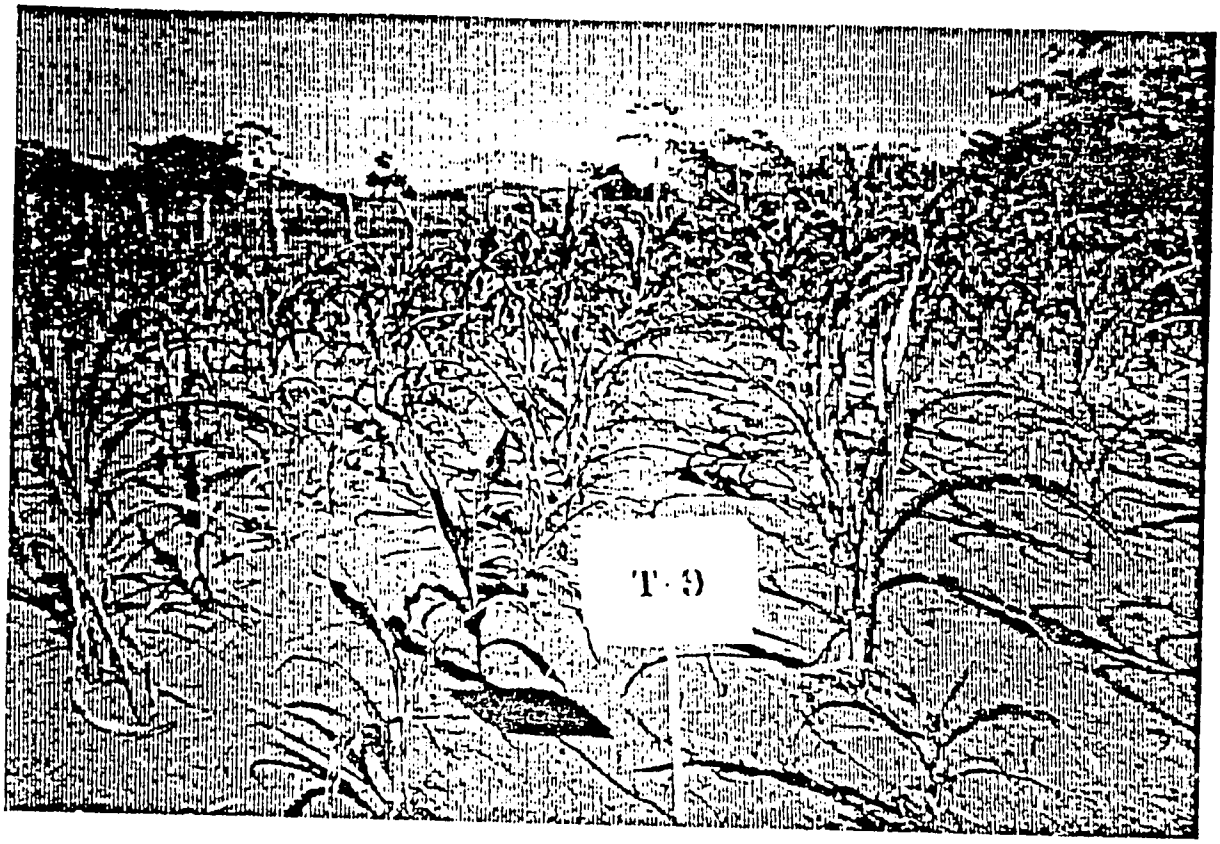
To examine soil and soil material surfaces by modern spectroscopic techniques.

An overview of the field test. The growth of maize was tested in an Ultisol for several levels of phosphorous (P) and Silicated materials (vicariant fertilizers).



In this field experiment we may compare the growth of maize in Plot 9 vs Plot 10. In Plot 9 rice hull-ashes were applied as vicariant fertilizers. The growth of maize is similar for both plots, but in plot 9 only one third of the P placed in plot 10 was applied. In other words a considerable amount of P fertilizer was saved by replacing P- phosphate by a much less expensive silicated material.

Plots 5 and 6 underwent the same treatments with respect to the levels of P and silicate, but silicate was applied in Plot 5 as untreated rice-hulls.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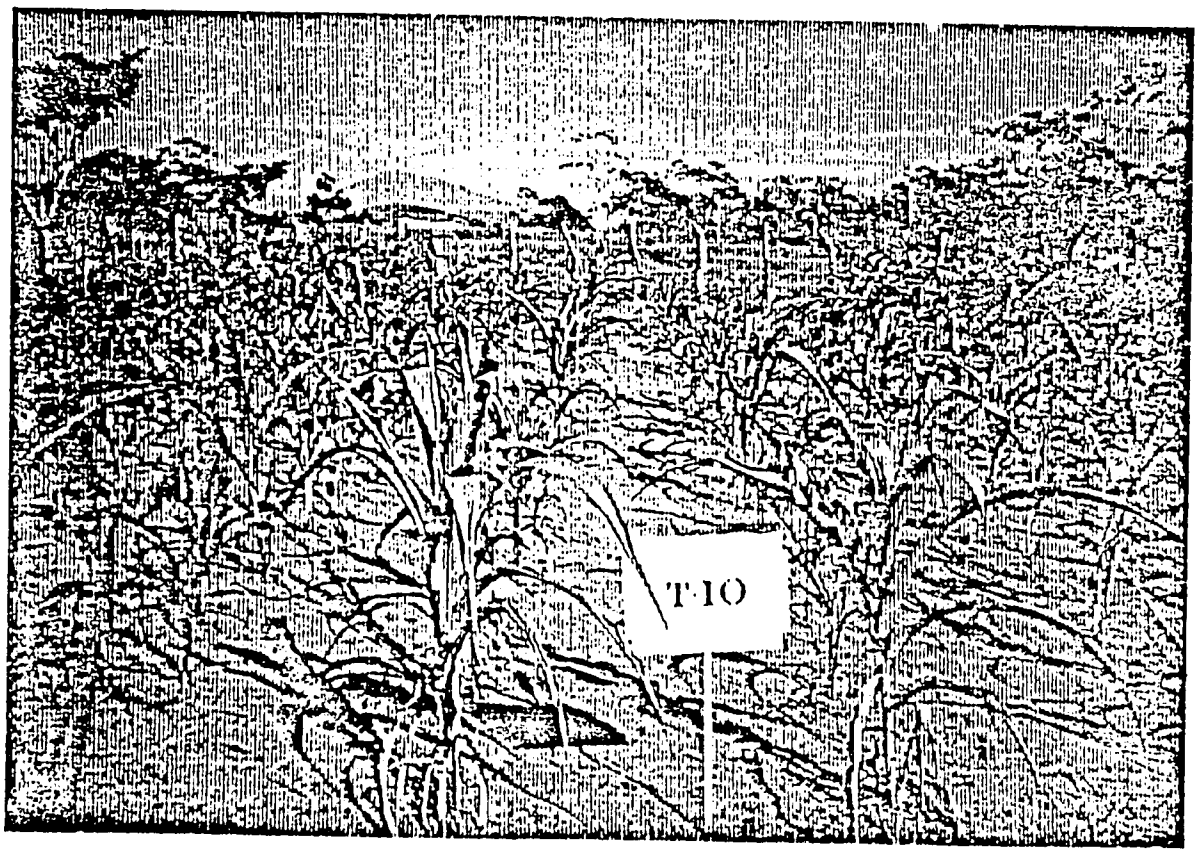
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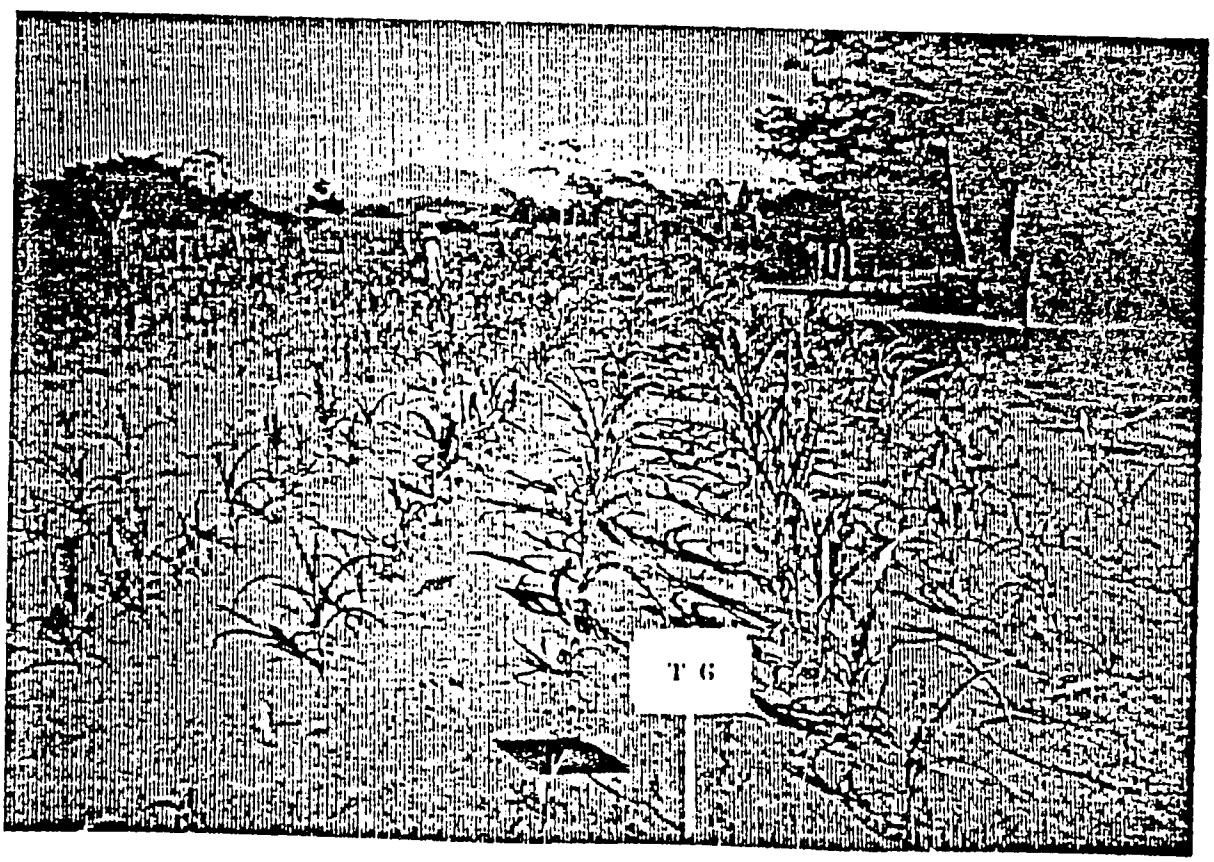
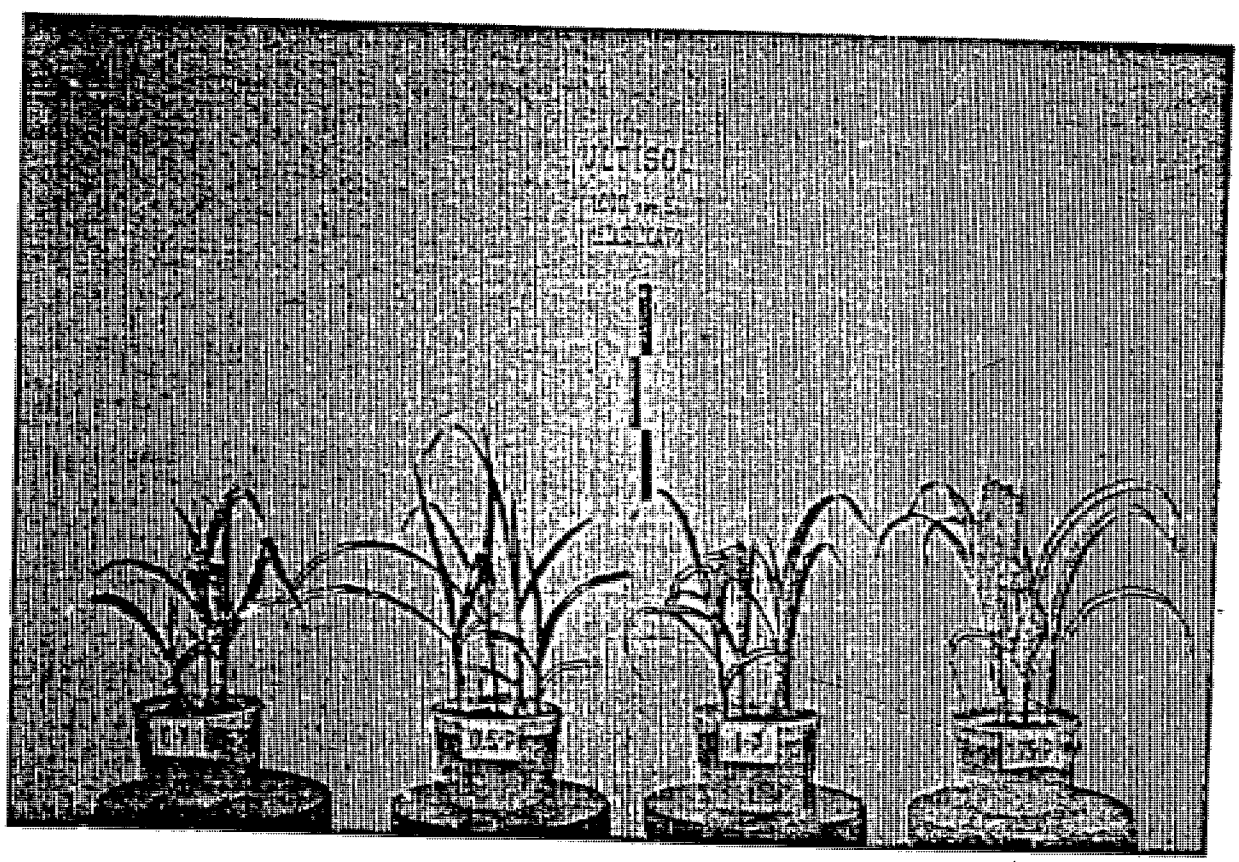
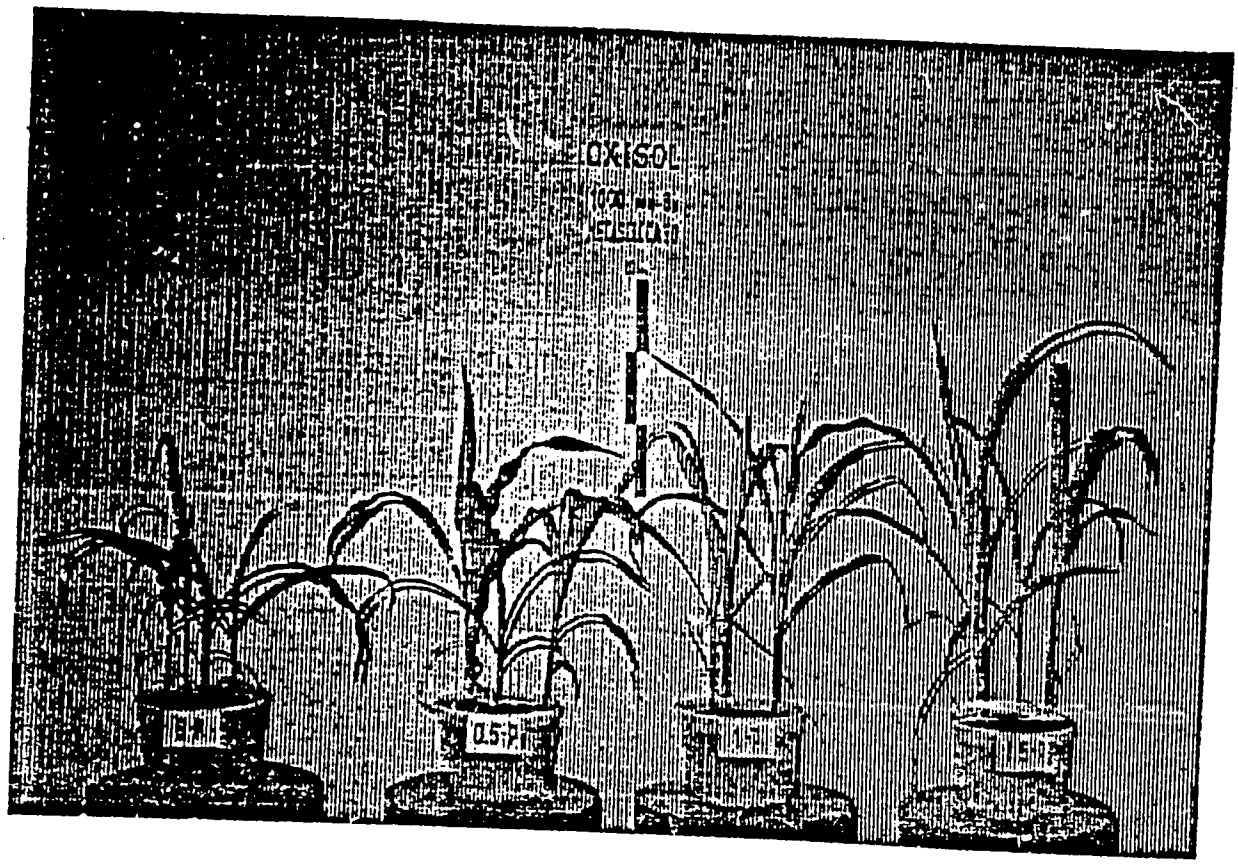
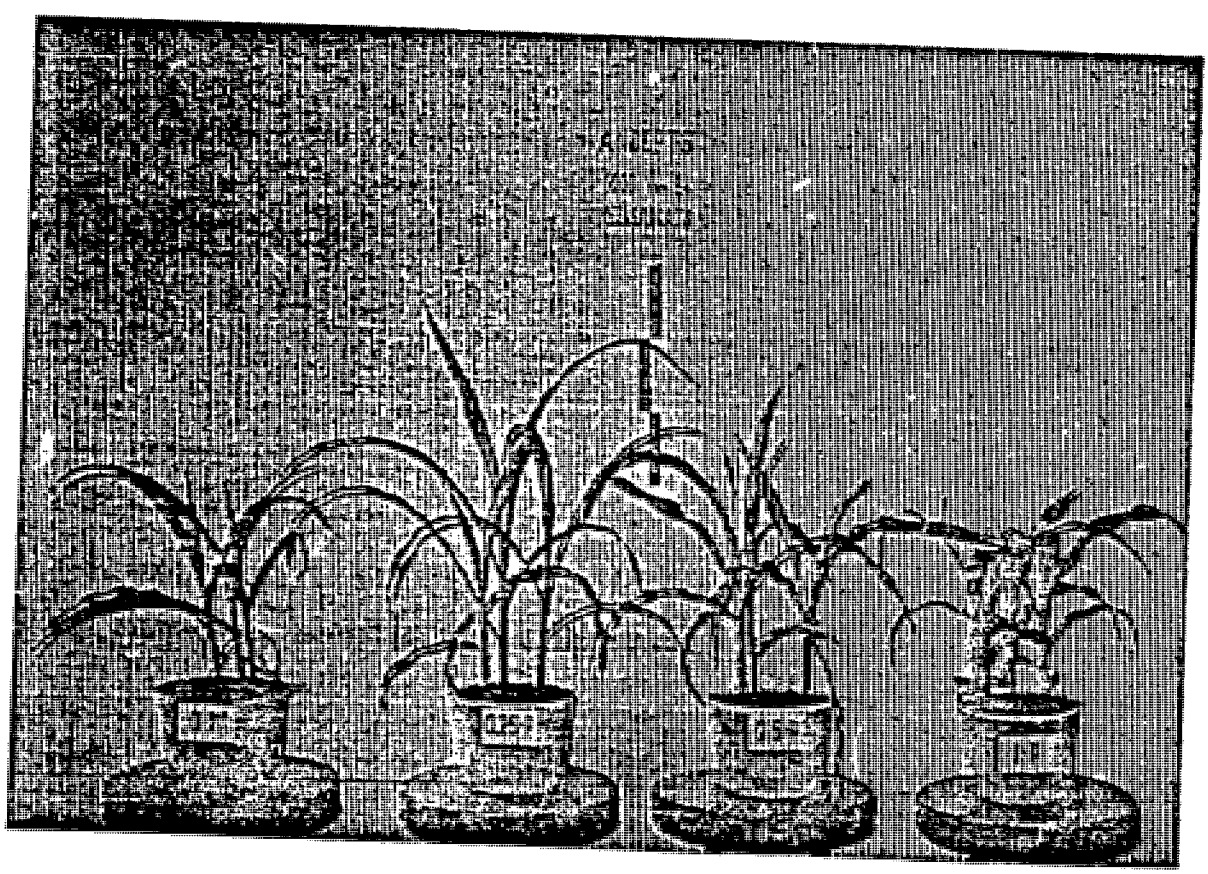
T 5


T 6

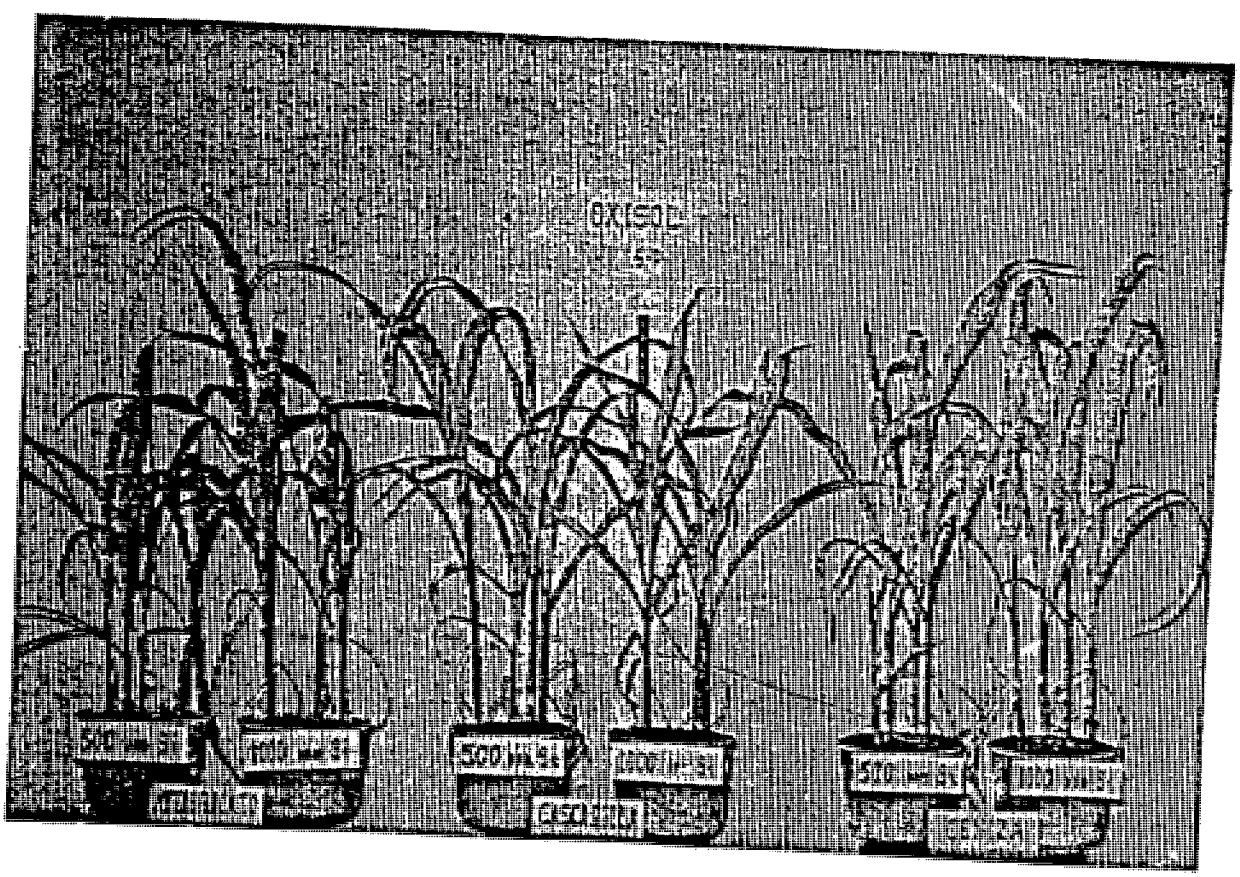
For the same levels of sodium silicate applied to the acidic soils as vicariant fertilizer, the growth response of maize was the same for the Ultisol and the Andept.. For the Oxisol the limits of growth increase proportionally to the amounts of P levels, without any appreciable toxicity limit.

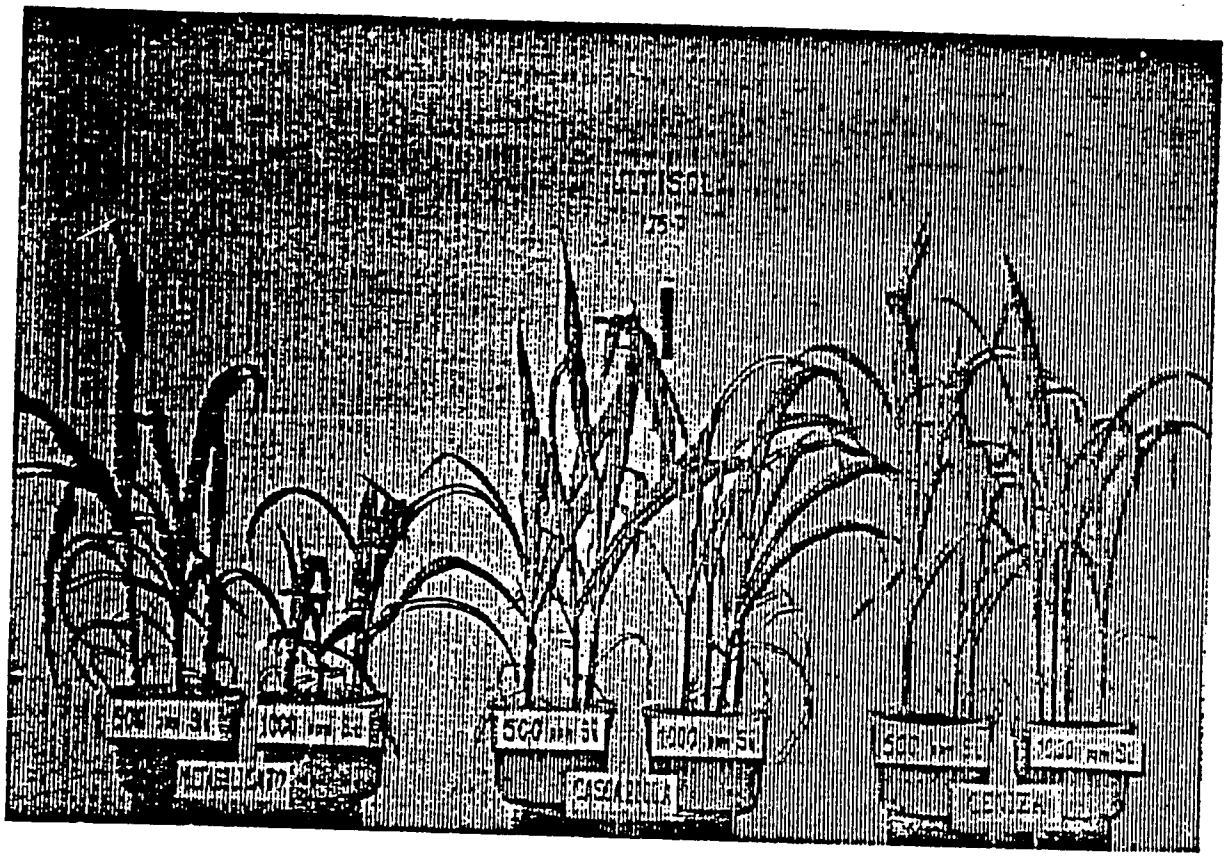



OXISOL
0.5 P
1.5 P



A greenhouse experiment in which synthetic (sodium silicate) or natural (rice hulls or rice hull-ashes) silicated materials were applied as vicariant fertilizers to tropical acidic soils. At the same silicate-silicon levels the growth of corn was similar for the three soils, Andept, Ultisol and Oxisol, no matter what the origen of the silicated material was.




500 ppm Si
1000 ppm Si
500 ppm Si
1000 ppm Si
500 ppm Si
1000 ppm Si
CASCARILLA
CENIZA

ANDEPTS
500 ppm Si
1000 ppm Si
500 ppm Si
1000 ppm Si
500 ppm Si
1000 ppm Si
CASCARILLA
CENIZA

9. CONCLUSIONS:

The research. Findings for natural silicated materials such as rice hulls and rice hull ashes tested in greenhouse and field experiments have shown that:

I. Si from those msterials favors P- availability to maize plants in all soils.

II. The source of Si does not appear to produce significant differences in the growth of maize, in relation to P-availability Greenhouse trials also demonstrate comparable results among Sodium Silicate and all natural silicated materials.

III. In field trials with the Ultisol, the addition of natural silicated materials produced the same yields of maize with only one third of the Phosphate fertilizer applied.

Significance:

The vicariant effect of Silicates to alleviate P-fixation in tropical acidic soils has been practically shown for Ultisols in the field. and Andepts and Oxisols in laboratory and greenhouse.

IV. DISSEMINATION OF INFORMATION:

At least five papers have been presented in national and international scientific meetings. One is published in Nature, and the rest are underway to be published in journals.