

F0000273

10/11/2003
10/11/2003
10/11/2003

INSTITUT SENEGALAIS DE RECHERCHES AGRICOLES

DIRECTION DES RECHERCHES SUR LES PRODUCTIONS FORESTIERES

CENTRE DE RESSOURCES MICROBIOLOGIQUES (MIRCEN)

SOIL AMELIORATION WITH NITROGEN-FIXING ACACIA SPECIES

First progress report of IAEA contract no.6375/R2/RB

FIRST PROGRESS REPORT

CONTRACT NUMBER

6375/R2/RB

TITLE OF PROJECT

Soil amelioration with nitrogen fixing *Acacia albida* and *Acacia seyal*

INSTITUTE WHERE RESEARCH IS BEING CARRIED OUT

Institut Senegalais de Recherches Agricoles (ISRA)

CHIEF SCIENTIFIC INVESTIGATOR

Mamadou GUEYE

ADDITIONAL SCIENTIFIC STAFF :

Ibrahima NDOYE from Univ. C. A. DIOP, Dakar

Bernard DREYFUS from ORSTOM, Dakar

Simon BADJI from Eaux et Forêts, Dakar

Pascal DANTHU from ISRA/DRPF

TIME PERIOD COVERED : June 1993 ▪ June 1994

FIRST EXPERIMENT : FIELD EXPERIMENT

DESCRIPTION AND CARRYING OUT THE EXPERIMENT

The experiment was carried out in the field on September 1993 and will continue until August 1994 with one provenance of *Faidherbia albida* originated from Kabrousse in the south of Senegal. *Parkia biglobosa* was used as reference tree.

TREATMENTS

1) The *Bradyrhizobium* MAO 232 was used for inoculating the *F. albida* provenance in the nursery before transplanting into the field. Three, 6, 9 and 12 months after transplantation, the fixed nitrogen will be estimated.

2) The *P. biglobosa* served as reference tree.

NUMBER OF REPLICATES : 4

NUMBER OF PLOTS :

2 provenances x 4 harvests x 4 reps = 32 plots (then 32 subplots)

Plot size : 5 m x 3 m = 15 m²

Subplot size : 2 m x 1 m = 2 m²

Spacing : 1 m on the row ; 1 m between rows.

CALCULATING THE NITROGEN REQUIREMENT

Amount of AS with 10.09% ¹⁵N a.e. will be applied at 20 KgN/ha, i.e. 4 gN/subplot.

Total N requirement : 4 g N x 32 = 128 g N

Total AS requirement : 128 x 100/21.2 = 603.773 g AS

Vol. of solution needed : 500 ml/m² x 2 x 32 = 32000 = 32 l

We shall use 40 l because of spillage. Thus, the required amount of AS for 40 l is :

$$603.773 \times 40/32 = 754.71625 \text{ g AS} = 0.75 \text{ Kg AS.}$$

Dilution

$$\begin{aligned} m_1 + m_2 &= 0.75 \text{ Kg AS} \\ M_1 &= 132.3338 \text{ g/mole of AS } 10.09\% \text{ } ^{15}\text{N atom excess} \\ M_2 &= 132 \text{ g/mole of ordinary AS} \\ a' &= 10\% \text{ } ^{15}\text{N a.e. desired in final dilution} \\ a_1 &= 10.09\% \text{ } ^{15}\text{N a.e. of AS to be diluted} \end{aligned}$$

Then,

$$m_1 = \frac{0.75 \times 132.3338 \times 10}{(132.3338 \times 10.09) + (132.3338 - 132) \times 10}$$

$$m_1 = 0.74 \text{ Kg AS,}$$

$$m_2 = 0.01 \text{ Kg AS}$$

Summary

$$\begin{aligned} m_1 &= 0.74 \text{ Kg of As with } 10.09\% \text{ } ^{15}\text{N a.e.} \\ m_2 &= 0.01 \text{ Kg of ordinary AS} \\ \text{Total volume of solution} &: 40 \text{ l} \\ \text{Number of subplots} &: 32 \\ \text{Application rate} &: 1 \text{ l/subplot} \\ \text{Remaining solution} &: 8 \text{ l} \end{aligned}$$

HARVEST

In December, the first samples were harvested. They will be weighed and sent to the agency for analysis.

SECOND EXPERIMENT : GRAFTING EXPERIMENT

DESCRIPTION AND CARRYING **OUT** THE EXPERIMENT

This experiment was planned before, but not **yet** undertaken. The aim of the experiment is to improve the biological **nitrogen** fixation in *Faidherbia albida* with the grafting technique. It will be carried out on February 1994 and will continue until August 1994 with *Faidherbia albida*. Based on the results obtained in the previous contract, the provenances from Merina and Dagalma which fix less **nitrogen** will be grafted on the provenance from Kabrousse which fixes more nitrogen. On the other hand, Merina and Dagalma will be grafted on *Acacia seyal* which has a high **nitrogen** fixing potential.

TREATMENTS

There will be nine treatments :

- T 1 : A. seyal alone inoculated with the strain ORS 1088
- T 2 : Merina alone inoculated with the strain MAO 232
- T 3 : Dagalma alone inoculated with the strain MAO 232
- T 4 : Kabrousse alone inoculated with the strain MAO 232
- T 5 : P. biglobosa alone without inoculation
- T 6 : Merina grafted onto Kabrousse inoculated with MAO 232
- T 7 : Dagalma grafted onto Kabrousse inoculated with MAO 232
- T 8 : Merina grafted onto A. seyal inoculated with ORS 1088
- T 9 : Dagalma grafted onto A. seyal inoculated with ORS 1088

NUMBER OF REPLICATES : 8

NUMBER OF POTS : 9 treatments x 8 reps = 72

CALCULATING THE **NITROGEN REQUIREMENT**

Amount of AS with 10.09% ^{15}N a.e. will be applied at 200 mg N/pots.

Total N requirement : 200 mg N x 72 = 14400 mg N

Total AS requirement : 14400 x 100/21.2 = 67924.5283 mg AS

Volume of solution needed : 50ml/pot x 72 = 3600 ml

We will use 4000 ml because of spillage. Thus, the required amount of AS for 4000 ml is :

$$67924.5283 \times 4000/3600 = 75471.698 \text{ mg AS}$$

Dilution

$$m_1 + m_2 = 75471.698$$

$$M_1 = 132.3338 \text{ g/mole of AS } 10.09\% \text{ } ^{15}\text{N a.e.}$$

$$M_2 = 132 \text{ g/mole of ordinary AS}$$

$$a' = 10\% \text{ } ^{15}\text{N a.e. desired in final dilution}$$

$$a_1 = 10.09\% \text{ } ^{15}\text{N a.e. of AS to be diluted}$$

Then,

$$m_1 = \frac{75471.698 \times 132.3338 \times 10}{(132.3338 \times 10.09) + (132.3338 - 132) \times 10}$$

$$m_1 = 74611.98 \text{ mg AS}$$

$$m_2 = 859.72 \text{ mg AS}$$

Summary

$$m_1 = 74.6 \text{ g of AS with } 10.09\% \text{ } ^{15}\text{N a.e.}$$

$$m_2 = 0.86 \text{ g of ordinary AS}$$

Total volume of solution : 500 ml

Number of pots : 72

Application rate : 50 ml/pot

Remaining solution : 400 ml.

TIME TABLE

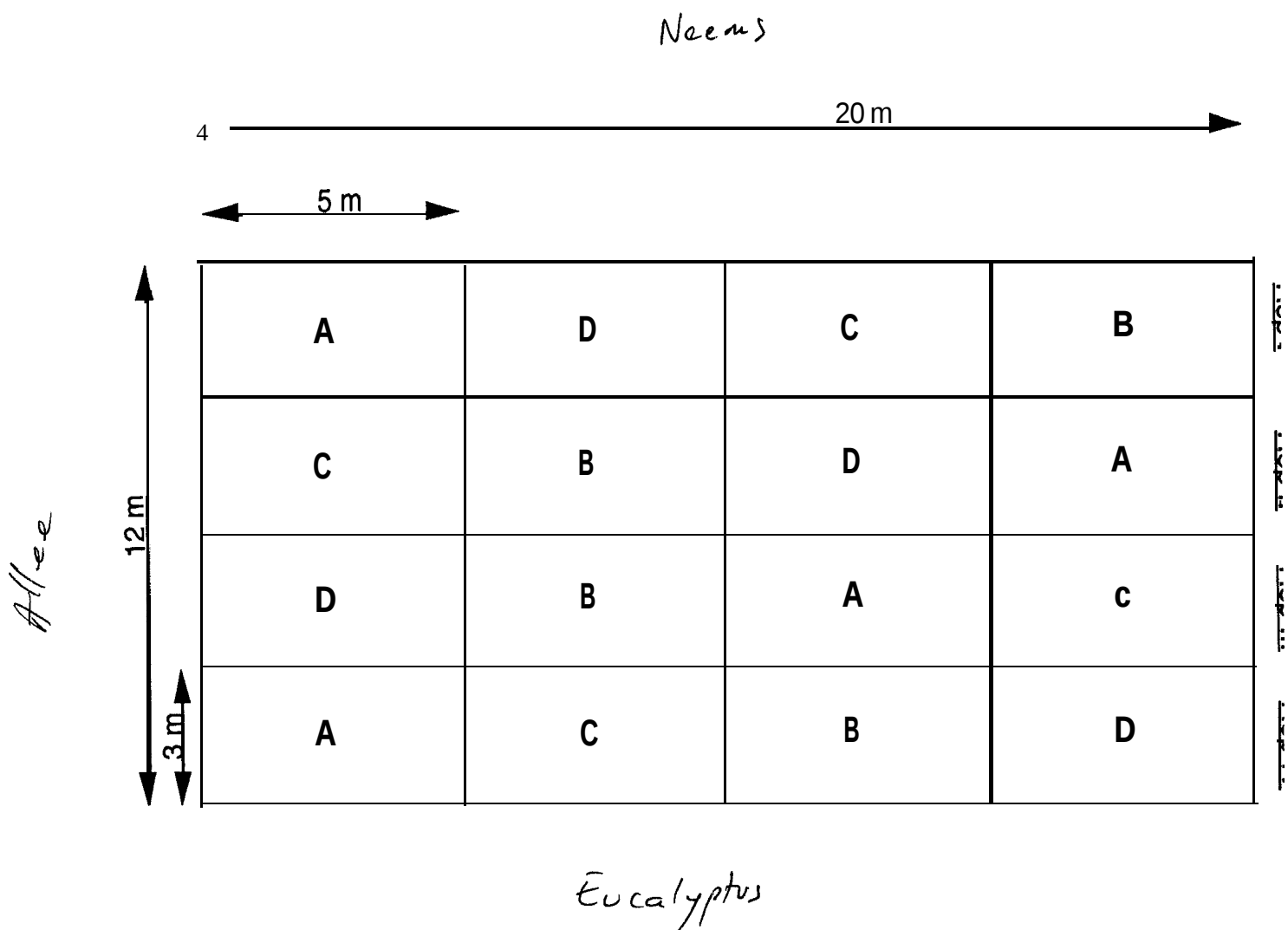
15-28/2 : pregermination of seeds

1/3-30/4 : grafting and culture of plants into tubes

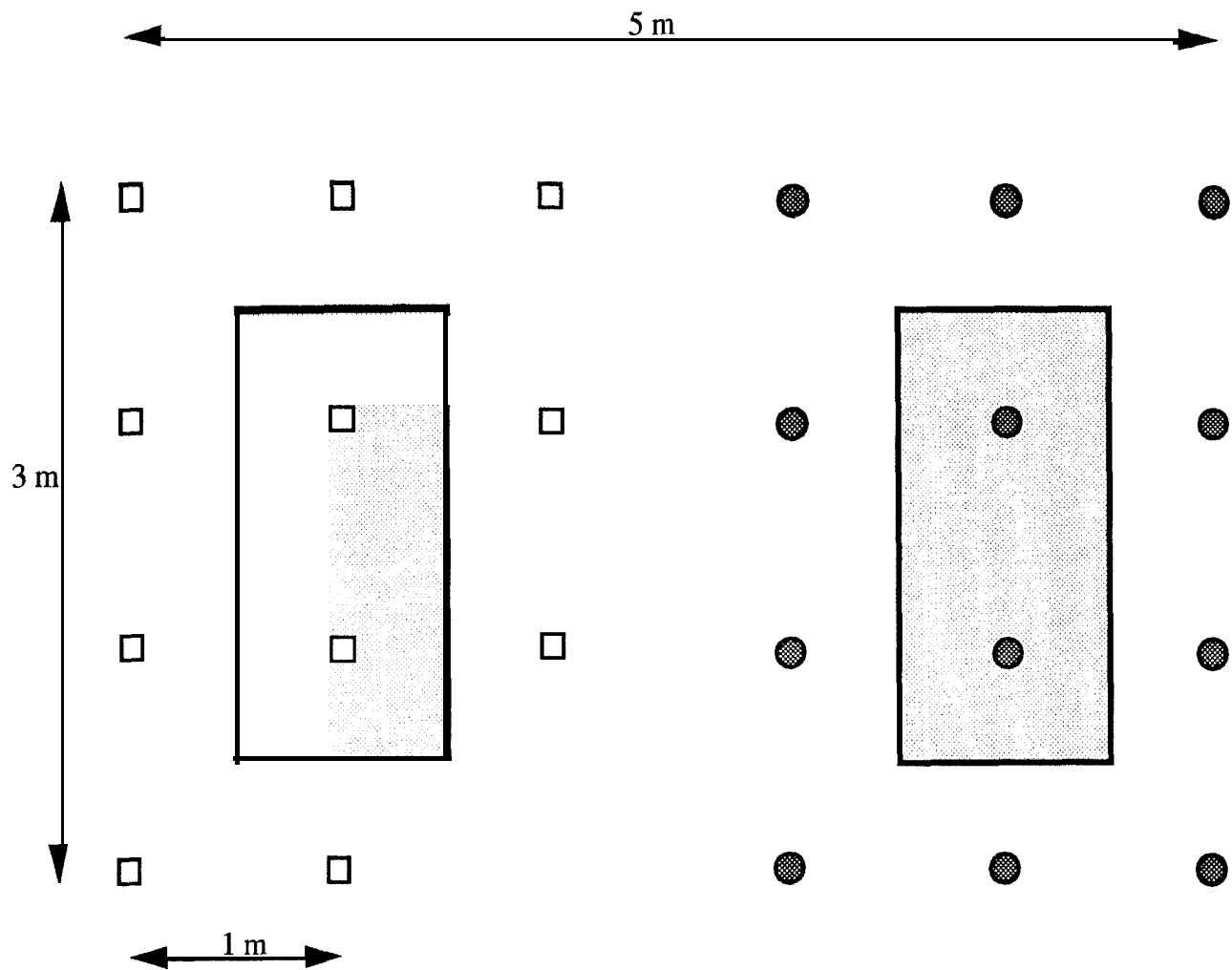
1-15/5 : acclimatization

16-20/5 : transplantation into pots, inoculation and application of fertilizer

20/5-30/8 : transfert of pots in greenhouse ; end of the experiment.



Experimental design. Harvest at 3 months (A), 6 months (B), 9 months (C) and 12 months (D) after transplantation



detailed experimental plot (size : 5m x 2m = 10 m²)

□ *Faidherbia albida*

● *Parkia biglobosa*



labelled subplot with ¹⁵N ammonium sulfate
(2m x 1m = 2m²)