

A MODELLING APPROACH OF ACETYLENE REDUCING ACTIVITY OF
PLANT-RHIZOSPHERE DIAZOTROPH SYSTEMS

J.P. BALANDREAU¹, C.R. MILLIER², PIERETTE WEINHARD¹,
P. DUCERF¹ and Y.R. DOMMERGUES¹

INTRODUCTION

Acetylene reducing activity (ARA) of plant-diazotroph systems whether obligatory or associative is known to be affected by environmental factors, by plant factors and by specific characteristics of associated diazotrophs. Marked and rapid variation in ARA occur due to the number of fluctuating environmental factors acting to limit ARA.

Diurnal ARA variations were reported in the case of symbiotic systems such as legume-*Rhizobium* (Hardy *et al.*, 1968; Mague and Burris, 1972) and non-legume-actinomycetes like organisms (Wheeler, 1971; Bond *et al.*, 1975). In the case of grass-rhizosphere diazotroph systems (Balandreau *et al.*, 1974), variation in the ARA was related to variation in the photosynthetic activity of the plant, rate of translocation of photosynthates to the roots and rate of exudation of compounds from the roots. These processes were all sensitive to light intensity, temperature and other environmental parameters. Variations in ARA from day to day are also known to occur, which result from daily variations in environmental parameters. (e.g. Balandreau, 1975). Moreover variation in ARA throughout the plant growth cycle can also be expected (e.g. Hardy *et al.*, 1973; Balandreau and Dommergues, 1973).

Variation in ARA may obscure the interpretation of field experiments where estimations of N₂ fixation are made by extrapolating over long periods of time. Precise estimation of N₂ fixation would necessitate a large number of ARA measurements - at least 8 per day with 5 replicates (Balandreau *et al.*, 1974) for the duration of the experiment.

22 OCT. 1979

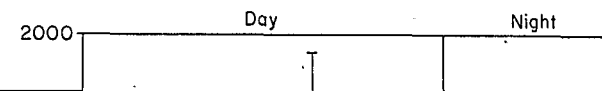
¹ Centre de Pedologie du C.N.R.S., B.P. 5, 54500 VANDOEUVRE-LES-NANCY, France.

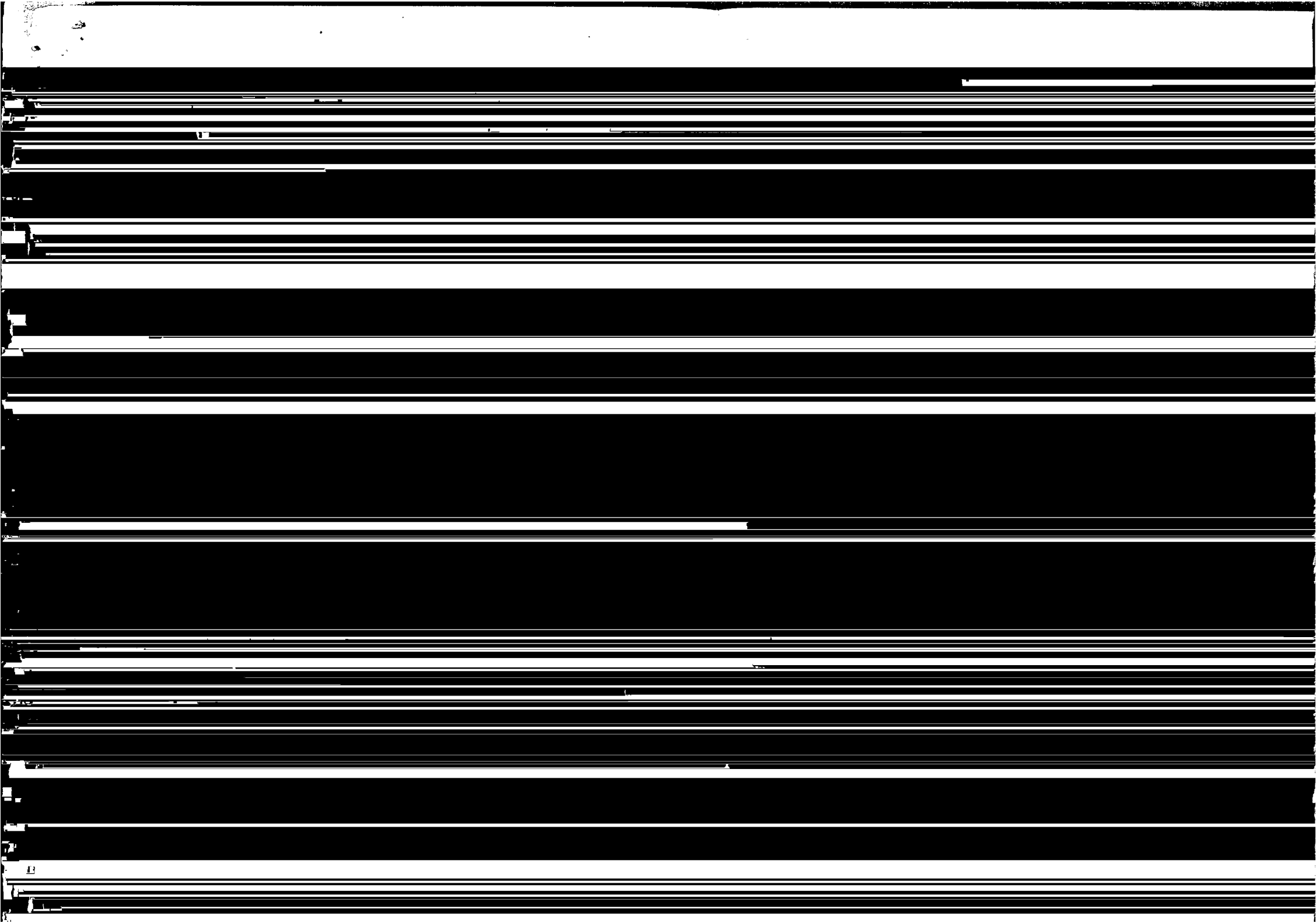
² Centre National de Recherches Forestieres, Champenoux, 54280 SEICHAMPS, France.

O. R. S. T. O. M.

Collection de Référence

The object of the present investigation is to attempt to correlate observed ARA with soil and climatic factors and with plant growth in order to build a preliminary model (1) allowing the interrelation of a limited number of ARA determinations over





DISCUSSION

ARA of the maize-rhizosphere diazotroph system was shown to depend primarily upon the stage of growth of the plant. Mid-day ARA (MDARA) was proportional to the leaf weight (LW), in the absence of limitations imposed by other environmental factors.

The influence of environmental parameters on ARA was also significant, but more difficult to elucidate because of interactions. Light energy (LE) was a major factor which was responsible for rapid ARA variations together with air tempera-

- Balandreau, J.P., Millier, C.R. and Dommergues, Y.R. (1976). *Appl. Microbiol.*, 27(4): 662-665.
- Bond, G., and Mackintosh, A. (1975). *Proc.R.Soc.Lond., B*, 192: 1-12.
- Bowen, G.D. and Rovira, A.D. (1973). *Bull.Ecol.Res.Comm.(Stockholm)*, 17: 443-450.
- Bülow, J.F.W. Von and Döbereiner, J. (1975). *Proc.Nat.Acad.Sci.(U.S.A.)*, 72: 2389-2393.
- Döbereiner, J. and Day, J.M. (1974). *In: Proceedings of the Int. Symposium on Nitrogen Fixation. Pullman, in press.*