PHOSPHORUS UPTAKE AND TRANSFER IN *POSIDONIA OCEANICA* (L.)DELILE

by

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Resumé. Posidonia oceanica *absorbe le phosphate soit par le feuilles soit par les racines comme les autres Phanérogames marines. Le taux d'adsorption est de* $8\mu gl^{-1}d^{-1}$ *pour les racines et de* $7.9.5\mu l^{-1}d^{-1}$. *Le taux journalier dépend de la concentration du phosphore. Indépendemment du site de absorption, le phosphore est distribué dans toute la plante dans 2h d'incubation. Le* ^{32}P *se retrouve dans les epiphytes foliares, mais pas dans l'eau environnante.*

Recent studies on nutrient uptake in marine spermatophytes have shown (Mc ROY & Mc MILLAN,1977; PENHALE & THAYER,1980) that carbon and phosphorus are taken up by the leaves and the roots of these plants.According to some authors (Mc ROY et al., 1973; CAPONE & TAYLOR, 1977; CAPONE et al., 1979), nitrogen uptake occurs directly from the water column and from nitrogen-fixing epiphytes, particularly the Cyanobacteria.

The genus *Posidonia*, and particularly the mediterranean species *Posidonia oceanica* (L.) DELILE, which we are investigating in the framework of the "Progetto Finalizzato Oceanografia" of the Consiglio Nazionale delle Ricerche, Italy, has never been studied with respects to nutrient uptake. Previous anatomical studies on *Posidonia australis* HOOK f. (KUO, 1978;KUO & CAMBRIDGE, 1978) suggest that no significant differences in uptake mechanisms should be expected with regard to other marine angiosperms. However, the structure of the roots of *Posidonia*, with their inconspicuous hairs, seems to discount their role as site of selective ion uptake. According to HOCKING et al. (1980), the sites of uptake in *Posidonia* still remain obscure. For this reasons we decided to carry out a series of experiments on phosphorus uptake in *P. oceanica*. This investigation is a part of a research project designed to determine the role of this seagrass in the biogeochemical cycles of nutrients in Mediterranean coastal ecosystems.
Partitioned chambers of the type described by PENHALE & THAYER (1980) were used. The upper and the lower compartments had volumes of 1.46 and 0.64 liters, respectively. Both were provided with stirring devices in order to reduce phosphorus adsorption, and polarographic O_2 electrodes to monitor plant respiration and photosynthesis. Plants were positioned in a septum with the leaves in the upper compartment and rhizome plus roots in the lower one.The septum was sealed with Terosone rubber. Both compartments were connected to

a multi-channel peristaltic pump sending water samples to a fraction collector for simultaneous monitoring of water radioactivity. These instruments were controlled by a timing circuit allowing the collection of 1ml samples at time intervals varying from 5 minutes to hours.Sulphonamyde was added to water as bacteriostat. Carrier-free ^{32}P, as $NaH^{32}PO_4$ was added to filtered normal sea water, in concentrations varying from 12$\mu gl^{-1}$to 600 μgl^{-1}.A photoperiod of 12h was used in diel experiments which were performed at constant (18°C) temperature and at a light intensity of 2.5 $mWcm^{-2}$. In these experiments the root compartment was not darkened nor kept anoxic. At the end of each experiment, the plants were dissected into leaves, sheaths, roots and and rhizomes for separate activity counts. All radioactivity measurements were made using liquid scintillation techniques. A number of autoradiographs were perfomed on the different parts of the plants, including epiphytes.

The results obtained by these techniques can be summerized as follows: 1) *P.oceanica* took up phosphorus both in the leaves and in the roots.At the concentration of 12 μgl^{-1}, near the ambient concentration, the diel uptake was of ≈8 μgl^{-1}in the leaves+epiphytes, and of 7.1 to 9.5 μgl^{-1}in the roots +rhizomes.These values represent 70 and 67-80%,respectively, of the initial tracer concentration.Uptake rates stabilized after about 10h of incubation. Uptake rates were shown to be dependent on DIP concentration.By increasing DIP concentration up to 600 μgl^{-1}, there was a 30-fold increase in the diel rate. 2)Regardless of the uptake site,the tracer appeared to be distributed to all the plant parts within 2h. Such a distribution of the label demonstrates a very fast transfer of phosphorus from the leaves to the roots and viceversa.The root to leaf transport also took place when leaves were kept dry in a humid atmosphere (2h experiments).^{32}P was found to be accumulated particularly in the vascular system of both roots and leaves,with a maximum localization in the meristematic basal portion of the leaves.3)^{32}P always appeared in the leaf blade epiphytes,including macroalgae,although it was never detected in the water surrounding the leaves.A similar situation occurred in the water surrounding the roots.

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