生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	共生使得生物可在充滿鹽分的土壤中生長 (Symbiosis Enables Growth in Salty Soil)
生物系統 LIVING SYSTEM	埃及車軸草/埃及三葉草 (Egyptian clover, *Trifolium alexandrinum*)
功能類別 FUNCTIONS	#獲取、吸收、或過濾化學物質 #不同物種之間合作/競爭 #保護免受化學物危害 #Capture, Absorb, or Filter Chemical Entities #Cooperate/Compete Between Different Species #Protect From Chemicals
作用機制標題	菌根使得埃及車軸草能藉由調控及分配鹽類離子進入植物，使其可生長於鹽分過剩的土壤 (Mycorrhiza allow Egyptian clover to grow in salty soil by regulating the uptake and distribution of salt ions into the plant.)
生物系統/作用機制示意圖 (確認版權、註明出處；畫質)	
作用機制摘要說明 (SUMMARY OF FUNCTIONING MECHANISMS)	

對植物的生長而言，含有過多鹽分的土壤代表極為嚴酷的環境。除了其它挑戰，它還會造成因植物根部無法攝取水分所導致的滲透壓失衡、無法吸收一些必要的營養物質，如氮和磷，也會使植物細胞失去維持鈉-鉀離子平衡的能力。菌根 (mycorrhiza) 是一種真菌網，形成在許多植物根部的內、外部，作為互利共生關係體。

Salty soil represents an extremely harsh environment for plant growth. It causes, among other challenges, an osmotic imbalance that prevents water uptake by roots, prevents the uptake of vital nutrients like nitrogen and phosphorous, and prevents the ability to maintain a proper sodium/potassium balance in the plant cells. Mycorrhiza is the fungal net that forms on and in the roots of many plants as a mutualistic symbiote.

某些菌根可讓其宿主植物生長於平常對它來說含有過多鹽分的土壤。例如，與埃及車軸草 (*Trifolium alexandrinum*) 所形成的真菌網可透過數種生化管道，如於液胞 (細胞內儲存空間) 內儲存過量鹽類離子，有效得的吸收水分、氮，及磷、阻斷宿主植物內鹽類離子的運輸、利用延展真菌網絡得到比只有植物根部本身時更多體積的土壤，以獲取更多養分。

Certain mycorrhiza allow host plants to grow in soil that would normally be too salty for it in its pure state. For example, the fungal net associated with the berseem clover (*Trifolium alexandrinum*) effectively allows the plant to uptake water, nitrogen, phosphorous, and potassium using a number of biochemical means such as storing excess salt ions in vacuoles (internal storage spaces), putting the breaks on the transport of salt ions within the host plant, and tapping the surrounding soil for nutrients by extending the fungal network through a greater volume of soil than would be possible for the plant roots alone.

隨著我們持續地開發土地來種植作物，找尋肥沃的區域來農耕將會十分重要。了解大自然是如何克服挑戰於高鹽環境和其它惡劣的環境讓植物成長，將會幫助我們最有效率地利用土地。這不僅僅是為了農作，或許，為了減緩氣候變遷，我們會利用險惡的地形來謹慎地栽種植物以吸收大氣中的二氧化碳。

As we continue to develop land and clear it to grow crops, finding fertile areas to farm will become increasingly important. Understanding how nature overcomes challenges to grow plants in high-saline soils as well as other inhospitable environments will help us optimize land-usage. And it might not just be for farming. Perhaps we'd use challenging landscapes to grow plants strictly to absorb carbon dioxide from the atmosphere with the goal of mitigating climate change.

文獻引用 (REFERENCES)

"數個調查叢枝菌根真菌 (AMF) 在抵抗鹽分壓力中所扮演的角色之研究指出此類共生會提高養分的攝取量、滲透壓調節劑的累積、提升光合作用速率及提高利用水的效率，也就是說叢枝菌根真菌藉由一系列養分、生物化學及生理學上的影響來降低鹽分壓力。"(Heikham 等人，2009:5)

"Several studies investigating the role of AMF in protection against salt stress have demonstrated that the symbiosis often results in increased nutrient uptake, accumulation of an osmoregulator, an increase in photosynthetic rate and water-use efficiency, suggesting that salt-stress alleviation by AMF results from a combination of nutritional, biochemical and physiological effects." (Heikham et al. 2009:5)

參考文獻清單與連結 (REFERENCE LIST) **Harvard 或 APA 格式**
延伸閱讀: Harvard 或 APA 格式（取自 AskNature 原文；若為翻譯者補充，請註明）
JOURNAL ARTICLE **Arbuscular mycorrhizal symbiosis modulates antioxidant response in salt-stressed Trigonella foenum-graecum plants** *Mycorrhiza* | 11/10/2013 | Evelin Heikham, Kapoor Rupam https://link.springer.com/article/10.1007/s00572-013-0529-4
生物系統延伸資訊連結 (LEARN MORE ABOUT THE LIVING SYSTEM/S)
撰寫/翻譯/編修者與日期
楊金庭翻譯 (2022/4/9)；許秋容編修 (2022/5/14)
AskNature 原文連結
https://asknature.org/strategy/symbiosis-enables-growth-in-salty-soil/