

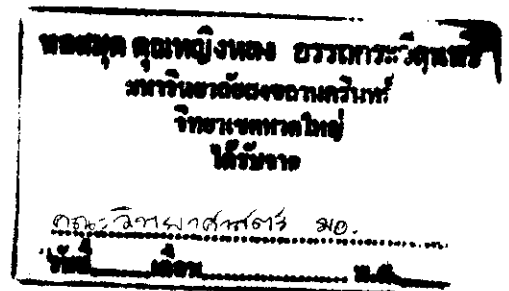
# รายงานการวิจัย

กระแสไฟฟ้าไอออนในรากทานตะวัน (*Helianthus annuus*)  
Ionic Currents in Sunflower (*Helianthus annuus*) Roots

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# Ionic Currents Associated with Primary Root Growth of Sunflower Seedlings and the Effect of External pH

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## Abstract

The current-patterns around 2-d old intact sunflower (*Helianthus annuus* L.) seedling roots were investigated. Ionic currents along the horizontally growing root were measured using a two-dimensional vibrating probe system. Currents entered the root cap and the meristem and left along the remaining part for most of the shorter roots (10-15 mm). For longer roots (15-20 mm) currents entered the root tip, left the main elongation zone and entered the root again in the post elongation and the root hair zones. These currents entered the meristem with a density of about 1 to 9  $\mu\text{A cm}^{-2}$  and left with a density of about 0.4 to 5  $\mu\text{A cm}^{-2}$  in the elongation zone. The inward currents in the post elongation and the root hair zones were generally smaller, *i.e.* about 0.3 to 2  $\mu\text{A cm}^{-2}$ . The results suggested that the current pattern may play a role in root growth while the association between current magnitude and growth rate was not so clear. Ion-substitution and pH experiments suggested that  $H^+$  ions were the major contributors to root currents while other ions did not seem to have any significant effect. Increased root elongation rate at low pH was associated with increased current density and the reversal of the current direction from outward to inward in the main elongation zone. Conversely the reduction of root growth at high pH corresponded to reduced current density but no significant change in current pattern. The finding seems to support the acid growth hypothesis.

**Keywords:** ion currents, intact root, vibrating probe, *Helianthus*, root elongation, acid growth