

# Electropotential measurements on germinating seeds of country bean (*Dolichos lablab*)

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Electropotentials (EP) of germinating country bean, *Dolichos lablab* remained steady initially for 3-4 days. As the radicle emerged out, the potential decreased by about 200 mV and remained at this level for 2-3 days. As seedlings turned green the potentials rose gradually by 200-400 mV and remained steady. These changes in electropotentials were marked under hydroponic conditions than in a plant grown on the soil. The fall and rise in EP are attributed to respiration and photosynthesis respectively.

## INTRODUCTION

Redox response electrodes have been applied to the intact plant [1-3] and to the germinating seeds [4,5] to determine their physiological activities. This study was conducted to know the nature of electropotential variation in country bean, *Dolichos lablab* seeds under hydroponic and soil environments and to relate it with the physiological changes in the plant.

## EXPERIMENTAL

Seed coats of dry seeds were pierced to a depth of 2 mm with sterilized stainless steel needle and thin platinum wire electrodes were inserted into them. As seeds absorbed water, they swelled, embedding the sensing electrode tightly. The seed was placed in a PVC container in contact with the Hoagland Nutrient solution (HN) through the cotton bed (C) and cotton wick (CW) as shown in Fig. 1. The set-up was kept inside the laboratory. Fluorescent tube light illumination of 3600 lux was given daily between 9-27 h.

Electropotentials of seeds were measured with respect to SCE kept in a saturated solution of KCl connected by an agar bridge (SB). The electrometer used had a very high impedance ( $> 10^{12}\Omega$ ). The value obtained at 12 noon of each day was taken to draw the Electrophytogram (EPG) of the germinating seeds. In another case, the seeds were placed in moist soil instead of cotton bed.

## RESULTS AND DISCUSSION

Under hydroponic conditions, the seed potential remained at 50 mV for about 3 days. As the radicle emerged, the potential decreased to -150 mV, and remained until the 6th day. As the radicle and cotyledon turned green, the potential rose and attained a maximum of 300 mV on the 13th day, when the plumules became green

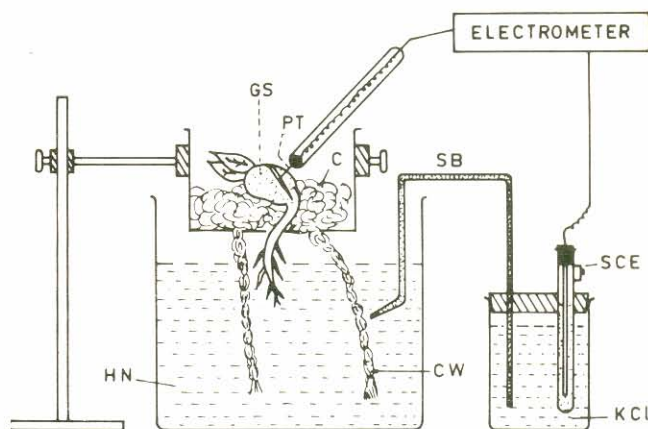


Fig. 1: Experimental setup to measure the electropotentials of a germinating seed under hydroponic condition.

C—Cotton; CW—Cotton wick; GS—Germinating seed; Pt—Platinum electrode; SB—Salt bridge; HN—Hoagland nutrient solution; KCl—Saturated potassium chloride solution; SCE—Saturated calomel electrode

leaves (Fig. 2A). From the 7th day onwards DL—and LD—transitions resulted in increase and decrease of EP respectively. In course of time the magnitude of this rise and fall became more marked. This may be attributed to the formation of more and more chlorophyll.

When grown on soil, the seed EP decreased from 50 mV as radicle emerged and reached a low value of -100 mV. As the seedlings turned green, the potential rose gradually and reached a maximum value of 200 mV on the 16th day when leaves were formed (Fig. 2B).

During the initial days of seed germination available oxygen is consumed; carbon dioxide is given out. The reducing reactions might be responsible for the lowering of EP. As the seedlings turn green, photosynthetic reactions commence. The plant biofluid would be enriched with the oxygen content. The rate of growth of the seedlings

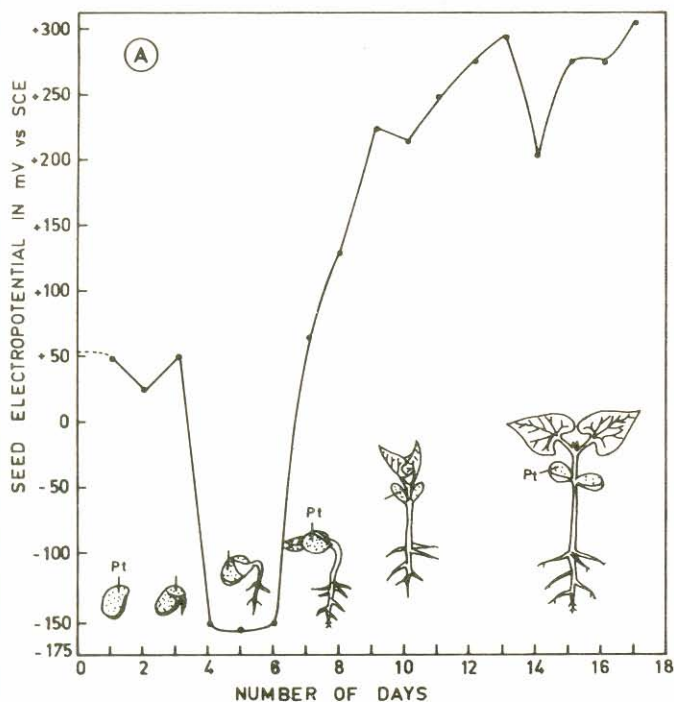


Fig. 2(a): Nature of the electropotential of *Dolichos lablab* seeds during the germination period under hydroponic condition

under hydroponic conditions were faster than on the soil (Fig. 2A & 2B). This is understandable as the Hoagland nutrient solutions have all the plant nutrients whereas the soil would have had its deficiencies.

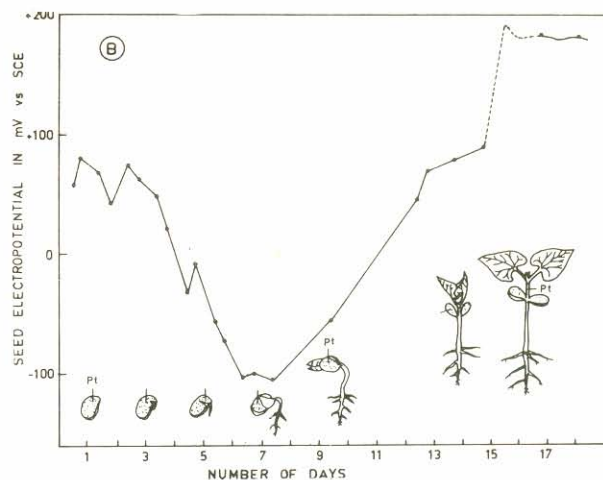


Fig. 2(b): Nature of electropotential of *Dolichos lablab* seeds during germination under soil bed condition

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