SEED GERMINATION AS AFFECTED BY SOIL TYPE AND SOIL MOISTURE

W.A. Wagenvoort
Department of Horticulture
Agricultural University
Wageningen
The Netherlands

Introduction

Optimal soil temperature and soil moisture conditions are necessary for a favourable germination. In the field an ideal combination of soil temperature and soil moisture seldom occurs. The soil moisture tension curve gives an idea of the suitability of water and air (figure 1). For example in a moist zone between pH 0.5 and 2.0 optimal germination can be affected by seed rotting or toxic material rinsed out of the seed. Depending on the soil texture, a too high moisture tension inhibits the imbibition of the seed.

Materials and methods

For three soil types, sandy loam, garden peat and river sand the germination of lettuce, spinach, radish and tomato seeds was studied in a range of five pF values. Results were analysed according to the equation given by Milthorpe and Moorby (1974):

\[ p = A \left( 1 - e^{-k(t-t_i)} \right) \]

in which:
- \( p \) = germination percentage at any time \( t \)
- \( A \) = maximal germination percentage
- \( k \) = \( 1/t \) a value for the time spread in the population
- \( t_i \) = the time in which the first seed germinates

Results

In general for garden peat the best germination was obtained for the 4 species (figure 2). A relation between \( k \) and the maximum germination percentage (A) was found for lettuce and radish (figure 3). With spinach and tomato the time for the first seed to germinate (\( t_i \)) was related with the germination percentage (figure 4).
1. Soil moisture tension curve in relation to the volume percentage $H_2O$ for Sandy Loam (■), Garden Peat (●) and River Sand (▲)
2. Germination percentage ($A$) in relation to moisture tension ($pF$) for Radish (○), Tomato (■), Lettuce (●) and Spinach (△)

- volume percentage $H_2O$
- percentage $O_2$
3. Germination percentage (A) in relation to time spread ($K.10^{-3}$) at different soil moisture tensions (pF)
Germination percentage ($A$) in relation to the time in which the first seed germinates ($t_1$) at different soil moisture tensions (pF)