Possible effects of climate change on the early development of pea, broad bean, maize and sunflower in Mediterranean areas.

J.A.Andrade[1*], F.G. Abreu[2]

[1]Departamento de Geociências, Universidade de Évora- Colégio Luís António Verney, Rua Romão Ramalho nº59, 7000-671 Évora, Portugal, Tel. nº 266745300, Fax. Nº 266-745397. e-mail: zalex@uevora.pt
[2]Departamento de Ciências do Ambiente, Instituto Superior de Agronomia, Tapada da Ajuda, 1349-017 Lisboa, Portugal. e-mail: fgabreu@isa.utl.pt

ABSTRACT

In Mediterranean-type climates crop yield depends strongly on the early development of individual plants. Extreme variations of soil temperature close to the surface of bare soils and fast changes of soil water content due to irregular rainfall and high evaporative demand reduce the success of germination, emergence and early leaf production, reducing crop productivity. According to *IPCC Fourth Assesment report*, climate change in Southern Europe "is projected to worsen hygrometric and thermal conditions (high temperature and drought) and to reduce water availability" and, consequently, to decrease general crop productivity.

The aim of this study was to evaluate the thermal conditions in the top soil layer under different climate change scenarios, and their effects on the early development of some representative crops of Mediterranean agriculture (pea, broad bean, maize and sunflower). For this purpose, soil temperatures near the surface of a Luvisol and a Vertisol during the usual sowing season of winter (October) and summer crops (April) were compared to those recorded in the air above ground, to forecast future values. The impact of simulations on the speed, size and dispersion of germination, emergence and early leaf production was estimated using values of bioclimatic parameters of the crops (cardinal temperatures and thermal times for different phases of establishment) found in the literature.

In both seasons, monthly mean temperatures at soil top layer were significantly greater (*P<0.05) than those found in the air above ground. However, the relationships between air and top soil temperatures were different in both soils and in both seasons. Summer crops seem to be less affected by an increase in temperature than winter crops. Otherwise, the former seem to be more affected by a decrease in soil water availability than the later. In addition, final emergence, speed of emergence and leaf production of the different species will be more affected by global warming than the dispersion around the most likely thermal times. The magnitude of these effects depends also on the magnitude of warming.