

ASSESSMENT OF COTTON PHENOLOGICAL STAGES USING AGROCLIMATIC INDICES: AN INNOVATIVE APPROACH.

STIMA DEGLI STADI FENOLOGICI DEL COTONE MEDIANTE INDICI AGROCLIMATICI: UN APPROCCIO INNOVATIVO

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Abstract

Reliable long time-series of phenological observations are not widely available, since recording requires special expertise. In Greece, phenological stations network exists only in fruits trees and for the past 17 years. Thus, crops' phenological data are rare, whereas the few existing data bases are discontinuous. However, cotton (*Gossypium hirsutum*) is the most dynamic extensive cultivation in Greece and a crop of great importance for the national economy. Hence, there is a necessity for assessing cotton phenological stages using alternate methods. In this paper, an innovative approach for assessing phenological stages in cotton cultivation using agroclimatic indices is presented.

Keywords: *Gossypium hirsutum*, phenology, GDD, Cardinal Temperatures.

Riassunto

*Lunghe serie storiche affidabili di dati fenologici non sono facilmente disponibili, poiché la loro registrazione richiede una particolare perizia. In Grecia esiste solo una rete di stazioni fenologiche per i fruttiferi, istituita da 17 anni. Di conseguenza, i dati fenologici sulle colture sono rari, mentre le poche basi di dati esistenti sono discontinue. In Grecia, il cotone (*Gossypium hirsutum*) è la più dinamica coltivazione estensiva, di grande importanza per l'economia nazionale. Perciò c'è la necessità di stimare con metodi alternativi gli stadi fenologici del cotone. In questo lavoro, viene presentato un approccio innovativo alla stima delle fasi fenologiche nella coltivazione del cotone mediante indici agroclimatici*

Parole chiave: *Gossypium hirsutum*, fenologia, gradi giorno, temperature cardinali

Introduction

Complete and reliable meteorological long-series data-bases are difficult to be found. Data loggers contribute to automatic recording of meteorological data, but still temporal gaps and discontinuities exist due to sensor failures or human errors (delayed upload of data, pure maintenance etc.) Meteorological data come usually from a very sparse meteorological network, sometimes incomplete and/or not always available. Furthermore, phenological growth stages data are even more difficult to be found, since they require the presence of an expert in order to identify the onset and end of the phenophase. Phenological observations in Greece started in 1950 by agricultural research Institutes and the Ministry of Agriculture, focused on research programmes and thus, not on a systematic basis. The recording of observations of phenological stages started in the early 90's. Government organizations named Centers of Plant Protection and Quality Control (CPPQC) started collecting phenological data for fruit trees. For example, CPPQC of Volos has one of the largest phenophases data base for fruit trees, for 17 consecutive years (from 1991 until today). Other CPPQCs, in other Prefectures of Greece have also phenological observations data bases for fruit trees (Tsiros *et al.*, 2008). But the lack of available personnel for the supervision of the phenological-agrometeorological stations (most of the stations operate automatically) in

combination with disastrous extreme weather events has resulted to discontinuous data bases.

Besides the existence of "recent" time-series, the discontinuity and the uneven spatial distribution of phenological stations in Greece, another problem is that only in fruit trees there is a phenological network favouring and receiving data for plant phenology (Tsiros *et al.*, 2008). This is one of the main reasons for the scarcity of crops' phenological stages and the discontinuity in any existing data base. For example, Domenikiotis *et al.* (2003 and 2004) used cotton phenological stages for production estimation and Mygdakos and Gemtos (1998) for relating Growing Degree Days (GDD) with cotton phenophases and final yield. Other than these records, no other information for crops' phenological data is found. Therefore, many researchers and practitioners use the phenological stages for crops provided by F.A.O. (Food and Agriculture Organization) for Mediterranean.

Summarizing, phenological observations have a short history in Greece, whereas no literature is related to phenophases. Thus, there is a need to assess crop phenological stages using alternate methods. This paper presents an innovative approach for assessing phenological stages in cotton cultivation using agroclimatic indices. Specifically, GDD along with temperature range, cardinal temperatures and rainfall anomaly are used for