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FAST MOVING FRONTS - 2010

January 2010 PDF

Elias Fereres talks with *ScienceWatch.com* and answers a few questions about this month's Fast Moving Fronts paper in the field of Plant & Animal Science. The author has also sent along an image of his work.

Article: Deficit irrigation for reducing agricultural water use
Authors: **Fereres, E**;Soriano, MA
Journal: J EXP BOT, 58 (2): 147-159 JAN 2007
Addresses: CSIC, Inst Agr Sostenible, Alameda Obispo S-N, E-14004 Cordoba, Spain.
CSIC, Inst Agr Sostenible, E-14004 Cordoba, Spain.
Univ Cordoba, Dept Agron, E-14014 Cordoba, Spain.

SW: Why do you think your paper is highly cited?

I believe that there are two primary reasons. First, the paper provides a background for a variety of research topics aimed at conserving water in the domain of agricultural water use. The second reason is that it is a timely work on an issue—deficit irrigation—which recently has become quite important in the efforts to reduce agricultural water use. Also, the content of the paper supports renewed research efforts in advancing scientific knowledge on the crop responses to water deficits, and on more applied research on irrigation management as well.

SW: Does it describe a new discovery, methodology, or synthesis of knowledge?

The paper provides a synthesis of knowledge, a comprehensive review of the subject, and new research findings which prove that deficit irrigation is a viable option to reduce the consumption of water by crops.

SW: Would you summarize the significance of your paper in layman's terms?

Globally, irrigation uses more than two-thirds of all diverted water. After decades of improving the efficiency of irrigation systems, the time has come to reduce the consumption of water by crops. Crops evaporate large amounts of water; to produce a kg of wheat, more than 500 kg of water are evaporated. To achieve that goal, deficit irrigation aims at reducing water application to crops while managing

stress levels. The paper provides key information to advance the design of deficit irrigation strategies, leading to the reduction of irrigation water requirements.

[+]enlarge

Elias Fereres (left) and Mario Salinas inspect dataloggers and associated equipment that were used to record daily trunk growth.

SW: How did you become involved in this research and were any particular problems encountered along the way?

Relevant agricultural research under field conditions is usually long-term. I started conducting irrigation research in 1977 and have included deficit irrigation experiments in my work since then. There are two major problems associated with this type of research; one is the inherent variability of field research that require medium- to long-term efforts (several years at least) to obtain conclusive results. The other is the usual short-term funding schemes for research—three years—that prevent the establishment and successful conclusion of long-term experiments on this subject.

SW: Where do you see your research leading in the future?

I have been concentrating my efforts recently on the deficit irrigation of tree crops and vines. This is because they are more amenable to this approach than many annual crops, and because they are high-value crops with higher water productivity than annual crops. Also, the information on deficit irrigation is critical in preventing major losses in perennial crops in situations of water scarcity.

SW: Do you foresee any social or political implications for your research?

Yes, deficit irrigation is one approach to reduce agricultural water consumption, thus releasing water for other uses, including additional irrigation for increasing future food production, which will be needed to cope with the anticipated growth in world population. As knowledge progresses, adoption of these practices will increase the efficiency of water use in agriculture.

As an example of deficit irrigation, Table 1 of the paper (shown below) reports the different stress levels experienced by peach trees under three treatments: full irrigation (FI), and two deficit irrigation treatments that used 2/3 of the water applied in FI. One was regulated deficit irrigation (RDI), a treatment that reduces irrigation in certain developmental stages, and sustained deficit irrigation (SDI), where the irrigation reduction is constant throughout the season.

The lowest water stress level was experienced by FI, as indicated by the integrated stem water potential value over the season (-86.7). The SDI treatment experienced more stress than FI and had lower yields and smaller fruits (see Table 1). However, the RDI treatment, despite having experienced more stress than both SDI and FI, had the same yield and fruit size than FI, and more than the SDI (Table 1).

The explanation is that, in the RDI, water stress was managed in such a way, by the manipulation of irrigation timing and amounts, as to avoid the sensitive developmental stages. Thus, fruit growth was not affected, while vegetative growth was reduced by the water deficits.

The RDI treatment exemplifies how physiological knowledge may be combined with irrigation management to reduce water use while maintaining yield via deficit irrigation. This particular experiment was conducted in Córdoba for six years by Mariá Auxiliadora Soriano, Carmen Ruz, and Elias Fereres.

Elias Fereres, Ph.D.

Professor of Agronomy

University of Córdoba

Córdoba, Spain

Researcher at the Institute of Sustainable Agriculture

CSIC

Córdoba, Spain

Table 1 (Fereres and Soriano, 2007):

Means followed by a different letter (within a column) are significantly different at the 0.05 probability level according to LSD.

Treatment	Stem water potential (MPa) integrated over		Yield (t ha^{-1})	Fruit volume (cm^3)
	Season[a]	RDI irrigation period		
RDI	−125.6	−34.7	48.1 a	178 a
SDI	−108.1	−39.2	43.8 b	155 b
FI	−86.7	−31.2	49.2 a	171 a

[a] Irrigation season (1 May to mid-September).

[return]

KEYWORDS: CONTROL VEGETATIVE GROWTH; PEACH-TREE GROWTH; SUPPLEMENTAL IRRIGATION; USE EFFICIENCY; MEDITERRANEAN ENVIRONMENT; YIELD RELATIONSHIPS; ALFALFA YIELD; FRUIT-QUALITY; DRYLAND WHEAT; OLIVE ORCHARD.

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