Closure to "Using Thermal Units for Crop Coefficient Estimation and Irrigation Scheduling Improves Yield and Water Productivity of Corn (Zea mays L.)"

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As stated in the paper, the research was focused at the estimation of corn crop evapotranspiration (ETc) in a commercial farm using FAO56 (Allen et al. 1998) and Martínez-Cob (2008) approaches to compute daily crop coefficients (Kc). Therefore ETc was the unique variable in the study and factors as effective precipitation and application efficiency were the same. Thus ETc was the only factor that, in this paper led to different corn crop water requirements (i.e. different irrigation doses) during the crop phenological development.

Ph D. Yildirim raised some questions that will be answered in the following:

1. Among different efficiency and uniformity patterns which criterion/criteria should be first taken into consideration to decide the best performance of a sprinkler irrigation system?

This paper did not deal with the evaluation of the performance of a sprinkler irrigation system. Nevertheless, in a conceptual context, efficiency evaluates the ratio of volume of water beneficially used and total volume of water applied while uniformity deals with amount of water received in all parts of the field (Burt et al. 1997, Playán et al. 2005), thereby high uniformity does not necessarily implies high efficiency (Hsiao et al. 2007). Nevertheless, both concepts play a fundamental role to measure irrigation quality; in fact, uniformity is referred as a component of the efficiency (Howell 2003, Zhang et al. 2013). Under this view, in the particular case of a sprinkler irrigation system, efficiency includes uniformity as well as affects as sprinkler evaporation losses and wind velocity (Martínez-Cob et al. 2008). We also suggest Ph D. Yildirim to read the answer provided by Martínez-Cob et al. (2010) to the exactly same question.

2. Based on the paper statement, the following standpoint could be raised: During the 2009 irrigation season, what could be determined the assumption for the application efficiency, Ea as 70%, since large number of variables relatively affect on the application efficiency?

For a particular year, the same irrigation system was used for both treatments. Therefore, the same application efficiency must be applied for both treatments for a given year. For our purposes (comparing FAO56 against Martínez-Cob 2008 methods of estimating ETc) it is not really important whether the true efficiency

was that assumed in the paper for a given year or it was different as the factors affecting Ea occurred simultaneously for both treatments. In addition, for 2010, experimental values were used for estimating Ea and any factor affecting this variable was the same for both treatments. Therefore, we believe the assumptions for Ea were sound and thus their influence in the results was negligible as the goal was not evaluation of irrigation systems.

3. What is the relative contribution of water losses on sprinkler total water losses through the examination of sprinkler irrigation, during 2010 season?

Our purpose was not evaluating the performance of each irrigation event. It was only to evaluate the water use and the water and economic productivities obtained when two different methods for ETc estimation were used. Therefore, sprinkler water losses were irrelevant for this study but to compute irrigation gross depth we assumed that these losses were the same for each treatment as the same irrigation system was applied for 2010 for both treatments (same operational pressure, quite similar wind velocity, same elevation of sprinklers, and similar hardware).

References

Allen, R. G., Pereira, L. S., Raes, D., and Smith, M. (1998). "Crop evapo-transpiration: Guidelines for computing crop water requirements." Paper 56, Food and Agriculture Organization of the United Nations, Rome.

Burt, C.M., Clemmens, A.J., Strelkoff, T.S.., Solomon, K.H., Bliesner, R.D., Howell,

66 T.A., and Eisenhauer, D.E. (1997). "Irrigation performance measures: Efficiency
67 and uniformity." J. Irrig. Drainage Eng-ASCE, 123(6), 423- 442.

68 Howell, T.A. (2003). "Irrigation Efficiency." Encyclopedia of Water Science, Marcel
69 Dekker, Inc., New York, 467-472.

70 Hsiao, T.C., Steduto, P., Fereres, E. (2007). "A systematic and quantitative approach
71 to improve water use efficiency in agriculture." Irrig. Sci., 25, 209-231.

72 Martínez-Cob, A. (2008). "Use of thermal units to estimate corn crop coefficients
73 under semiarid climatic conditions." Irrig. Sci., 26, 335–345.

74 Martinez-Cob, A., Playán, E., Zapata, N., Cavero, J., Medina, E.T., Puig, M. (2008).
75 "Contribution of Evapotranspiration Reduction during Sprinkler Irrigation to
76 Application Efficiency". J. Irrig. Drainage Eng-ASCE, 134(6), 745-756.

77 Martínez-Cob, A., Playán E., Zapata, N., Cavero, J., Medina, E.T., Puig, M. (2010).
78 Closure to "Contribution of evapotranspiration reduction during sprinkler
79 irrigation to application efficiency". J. Irrig. Drainage Eng-ASCE, 136(9), 671-672.

80 Playán, E., Salvador, R., Faci, J.M., Zapata, N., Martínez-Cob, A., Sánchez, I. (2005).
81 "Day and night wind drift and evaporation losses in sprinkler solid-sets and
82 moving laterals." Agric. Water Mang., 76, 139-159.

83 Zhang, L., Merkley, G.P., Pinthong, K. (2013). "Assessing whole-field sprinkler
84 irrigation application uniformity." Irrig. Sci., 31, 87-105.