# Chapter 4: Evaluation of the CropSyst model in wheat

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## 4.1 Introduction

CropSyst is the crop growth model chosen as a decision tool for the Tadla Benchmark project. CropSyst is a daily time step simulation model. The model was developed to serve as an analytic tool to study the effect of cropping systems management on productivity and the environment. The model simulates the soil water budget, soil–plant nitrogen budget, crop canopy and root growth, dry matter production, yield, residue production, and decomposition. Management options include cultivar selection, crop rotation, irrigation, nitrogen fertilization, tillage operations, and residue management. Simulation parameter organization is based on separate component input files for location, soil, crop, and management data. The simulation control file is built up by combining these component files. The objective of this study was to evaluate the CropSyst model under the conditions of the Tadla region.

## 4.2 Methodology

An evaluation of the CropSyst model was undertaken using data from the on-farm trials carried out during the 2006/07 cropping season with the Ouled Zmam and Bradia communities. Simulations were made for the effects of planting date, variety and deficit irrigation. Simulated and observed grain yield and evapotranspiration were compared. Other scenarios for planting date and irrigation were also simulated. Details of the conditions and treatments applied in these trials (planting date, variety and deficit irrigation) are described in the previous chapter.

## 4.3 Results

### 4.3.1 Planting date

Sowing is a critical operation in crop production in the Tadla region. An optimal planting date that allows for the early establishment of a good stand can reduce the effect of water stress due to the reduction of soil evaporation and allow the crop to drought escape. However, the choice of sowing date is a difficult decision for the farmer to make under conditions where the risk of drought is high. Consequently, using models like CropSyst as a decision-making tool to forecast sowing will help farmers decide on when to plant.

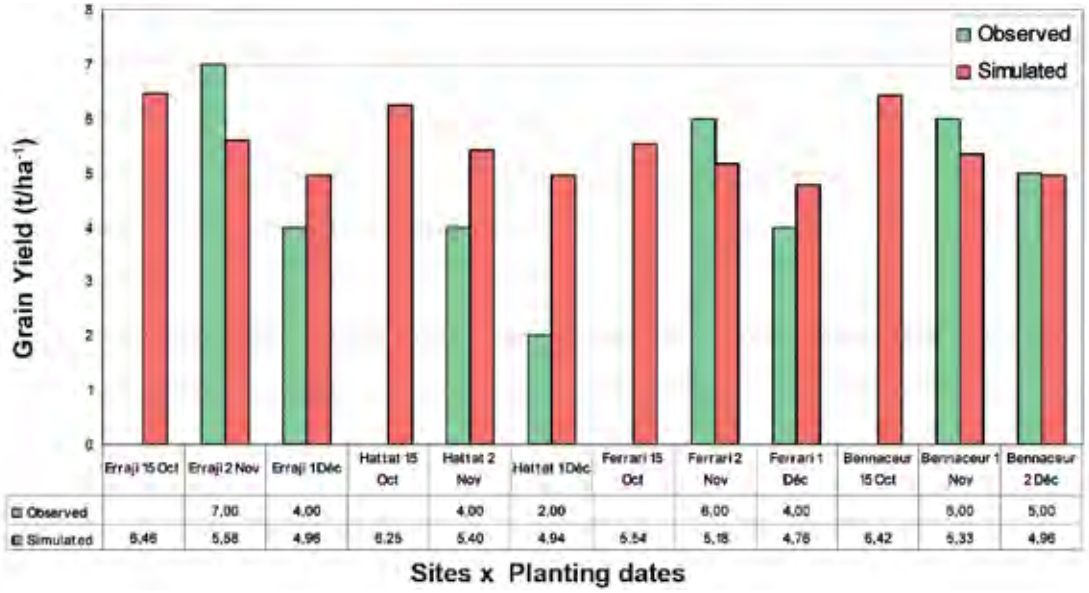
The evaluation of CropSyst for planting dates was made using four on-farm-trials in Ouled Zmam and one in Bradia. Two planting dates were tested early planting in early November, and late planting in early December.

Despite differences between the predicted and observed yield at four sites, the trend is for yield to increase with early planting in both predicted and observed situations (Figure 4.1).

Figures 4.2 and 4.3 show the relationship between observed and predicted grain yield and between evapotranspiration.

### 4.3.2 Variety

Because of the limitations of genetic coefficients, we used only one variety, Achtar. The results show significant differences between observed and




| | Erraji 15 Oct | Erraji 2 Nov | Erraji 1Déc | Hattat 15 Oct | Hattat 2 Nov | Hattat 1Déc | Ferrari 15 Oct | Ferrari 2 Nov | Ferrari 1 Déc | Bennaceur 15 Oct | Bennaceur 1 Nov | Bennaceur 2 Déc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Observed | | 7,00 | 4,00 | | 4,00 | 2,00 | | 6,00 | 4,00 | | 6,00 | 5,00 |
| Simulated | 5,46 | 5,58 | 4,96 | 6,25 | 5,40 | 4,94 | 5,54 | 5,18 | 4,76 | 6,42 | 5,33 | 4,96 |

**Figure 4.1: Simulated and observed wheat yield with different planting dates 2006/2007.**

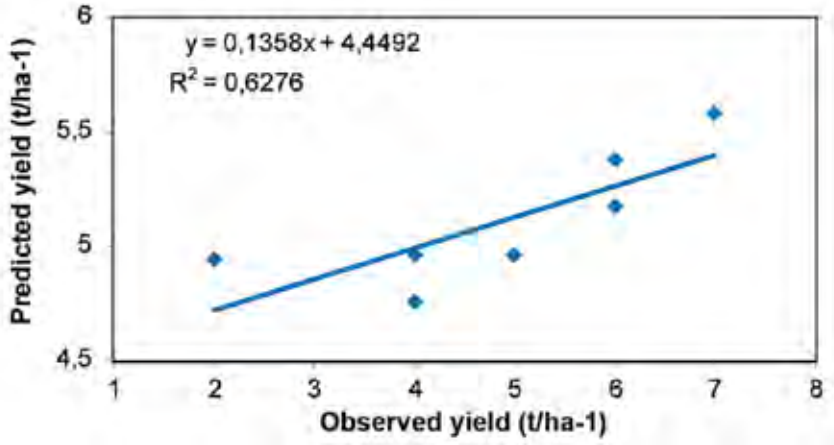



**Figure 4.2: Relationship between observed and predicted grain yield.**

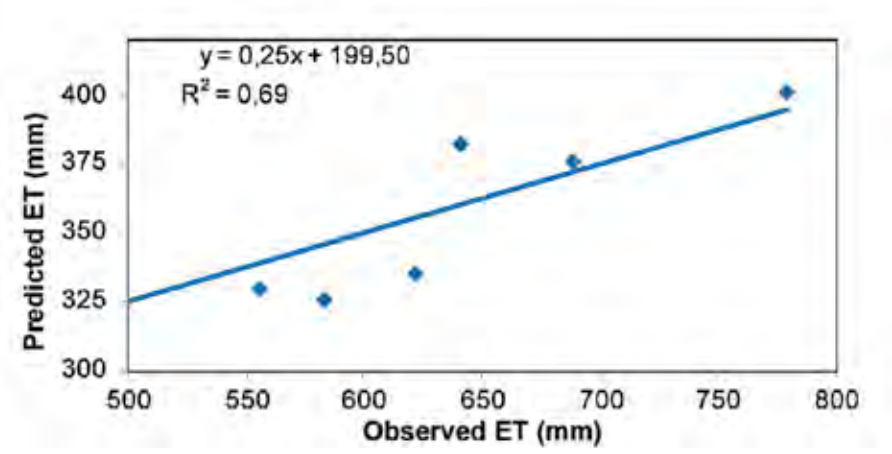



**Figure 4.3: Relationship between observed and predicted evapotranspiration.**

simulated grain yield for this variety on three farms under different management (Figure 4.4), contrasting with the better simulation performance seen in 2005/06 (data not shown). However the positive effect of early planting on crop performances was confirmed (Figure 4.4).

### 4.3.3 Deficit irrigation

The evaluation of CropSyst for deficit irrigation techniques was made with data collected from three on-farm trials in Ouled Zmam and Bradia. The options that were tested were irrigation at 70% of field capacity and irrigation at 100% of field capacity. These two options were compared to the farmers' usual practice.

In contrast to the results obtained in the 2005/06 cropping season (data not shown). CropSyst simulation showed no yield differences between irrigation options under 2006/07 conditions (Figure 4.5). The predicted average yield was about 5 t/ha at the three farms, although the observed yield shows major differences between farmers, varying from 2 to 8 t/ha.

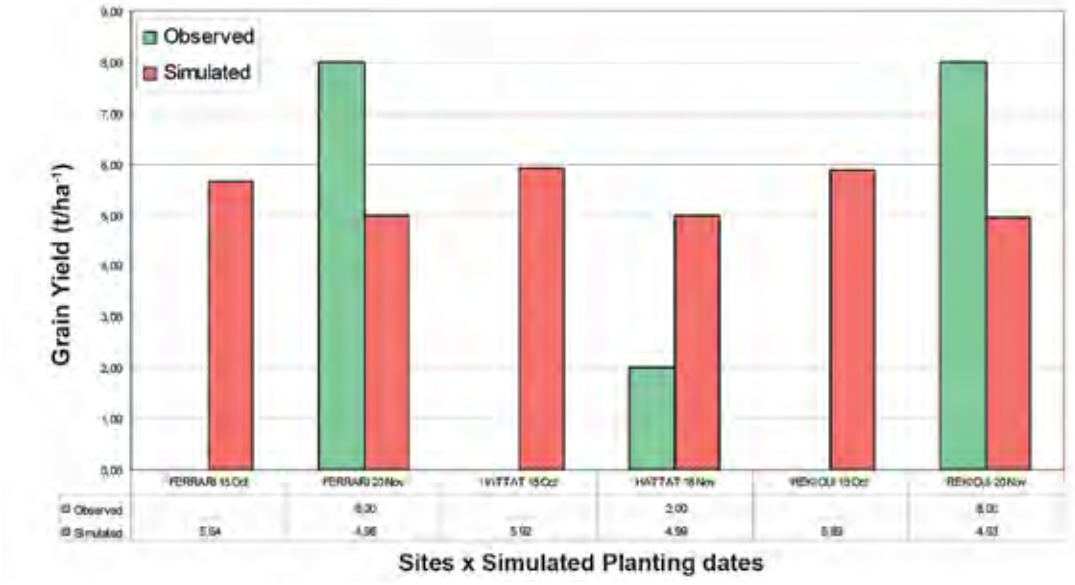



**Figure 4.4: Simulated and observed yield of wheat, Achtar variety 2006/2007.**

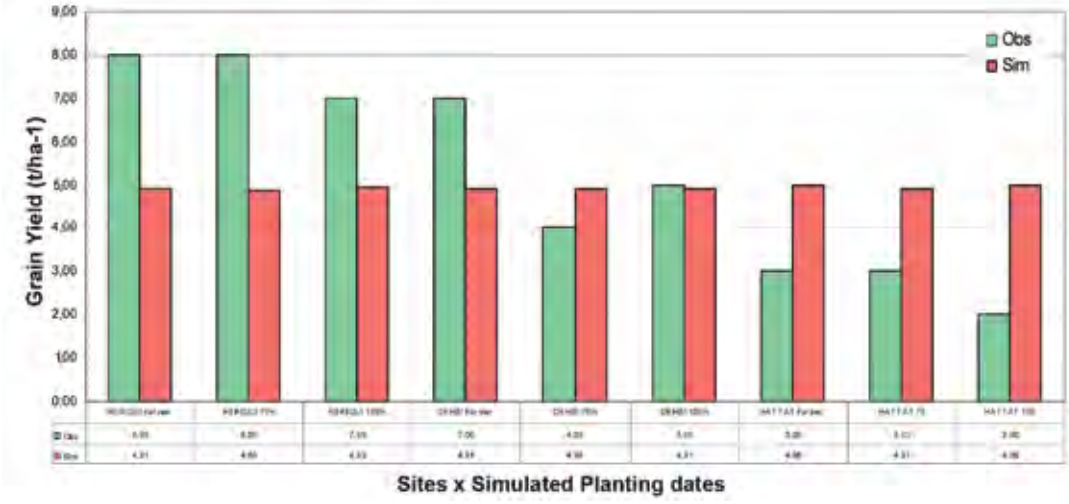



**Figure 4.5: Modeling deficit irrigation in on-farm trials, 2006/2007.**