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► **To cite this version:**

Laure Hossard, Hiba Merzouki, Hatem Belhouchette. Effect of preceding crop on nitrogen efficiency for soft winter wheat in Sais region, Morocco. 16th ESA Congress, European Society of Agronomy, Sep 2020, Sevilla, Spain. hal-02929305

HAL Id: hal-02929305

<https://hal.inrae.fr/hal-02929305>

Submitted on 3 Sep 2020

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EFFECT OF PRECEDING CROP ON NITROGEN EFFICIENCY FOR SOFT WINTER WHEAT IN SAIS REGION, MOROCCO

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Keywords: *Triticum aestivum L.*, legumes, Cropsyst, Eco-efficiency

Efficiency in use of non-renewable resources is becoming critical to favor sustainability and resilience goals of agricultural systems. In Southern Mediterranean countries, agricultural development leads to environmental concerns such as water-table decrease due to over-irrigation, and water pollution, together with issues related to the unequal access to the necessary inputs needed by farmers. Wheat is an important crop in these countries, however still with higher consumption than production. In this context, our study explores the nitrogen efficiency in wheat taking into consideration the role of cultivated previous crops (legumes, cereals, irrigated market gardening, or fallow). Using a large database of cropping practices of 205 farmers surveyed in 2011-2012 in the Saïs region (Morocco), we followed a three stages approach. First, we determined the farms displaying wheat yields as close as their potential (defined by N) by applying a Stochastic Frontier Analysis to the 205 farmers' dataset. This was performed according to the type of variety, local (150 farms) and improved (56 farms). Second, we used these farms to calibrate Cropsyst, derived the values of all parameters, and used it to simulate the performances of the other farms. Third, we calculated nitrogen efficiency of all farms, and built eco-efficiency frontiers between (observed) yields, (observed) N inputs and (calculated) N absorbed. The 1st step led us to use 17 and 16 farms to calibrate/validate Cropsyst for local and improved varieties, respectively. Performances showed a RMSE of 14.5% and 10.2% for local and improved varieties, respectively. Running simulations with CropSyst for the remaining farms, according to the optimized model parameters, lead to RMSE of 38.9% and 21.4% for local and improved varieties, respectively. For the third step, we observed the same trends while looking at observed yield vs. N input, and yield vs. N absorbed. For both, eco-efficiency trends distinguished two groups of preceding crops: legumes and irrigated market gardening showed better eco-efficiency as compared to cereals and fallow. Main differences between legumes and irrigated market gardening concern the workload, the N inputs, and the associated revenue, all being lower for legumes. In addition, the relationship between N input and N absorbed was closely determined by soil type, with three different types available in our database. These results confirm that, from a pure N efficiency point of view, legumes are “the best” preceding crops. It would be then necessary to compare these results with 2 years results regarding especially workload and raw margin.