

REGIONAL OBSERVATORIES FOR THE DIAGNOSIS OF SUNFLOWER CROP MANAGEMENT

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Abstract

In 2003, CETIOM launched the observatories of the limiting factors of oilseed crops, whose objective is to increase the performance and the competitiveness of these crops by improving the adaptation of the crop management to the local context of production. This step consisted of following a network of a small number of fields (40 in 2003) distributed over three areas, to estimate the potentialities of these fields in the climatic context of the year using models, then to identify and establish a hierarchy of the limiting factors of production. The results indicate potential yields of 3.5 tons per ha for a water deficit that appeared after flowering, and about 2.0 tons per ha for water deficits that appeared before flowering. In fact, the real results of yields in the network are 20% lower on average than these potentialities. Which are the limiting factors of crop management that make it possible to explain these variations, in a context where sunflower is not irrigated? Three principal limiting factors emerged in this network in 2003: deficient rooting systems because of poor soil structure; poor distribution of plants in the field; and nitrogen deficiencies, due mainly to the water deficit. If the importance of these limiting factors is confirmed in the future, that shows a need to improve the rooting in sunflower, and

regularity and homogeneity of plant distribution by the farmers for the performance of production and the competitiveness of sunflower.

Introduction

The setup in 2003 of the regional observatories for the diagnosis of sunflower crop management answers a request for improvement of performance and in particular of competitiveness of the oilseed crops. The principle of the method consists of carrying out a systemic diagnosis of the limiting factors of sunflower crop management in agricultural fields, explaining the variations noted between the results measured and the potential permitted by the climate and the soil, and identifying the main points to be improved in the crop management.

The diagnosis of the crop management on which the regional observatories are based comes to supplement existing tools: questionnaires to determine on a national scale the diversity and evolution of farmers' sunflower cultural practices and assessments of the agricultural campaign carried out each year to analyze the year from the climatic and epidemiologic point of view. It is a question of initially determining which among all of the limiting factors of production identified are those that are related to the practises of the farmers in the situations studied, then to propose adaptations of crop management in the local context to overcome these limiting factors.

Materials and Methods

During 2003, 40 farmers' fields were the subject of regular measurements, distributed in three areas of France: Poitou-Charentes (20 fields), Lauragais (10 fields) and Agen (10 fields). In Poitou-Charentes, the 20 fields were distributed on the one hand on groies soils and on the other hand on limons, "aubues" and marsh, two types of soil where diseases are expressed differently. In the same way in the southwestern area the soils of hillsides and valleys were equally represented in the field networks. Parallel to these field measurements, the potentialities of these same fields in the climatic context of the year were estimated using models. The variations highlighted between the real results (yield, quality) and the potential results were then analyzed from the observations carried out during the year. This information, organized in a coherent and systemic way with DIASOL (see below), allowed identification and establishment of a hierarchy of the limiting factors of production.

DIASOL is a tool for agronomic diagnosis in farmers' sunflower fields and crop management improvement composed of three tools: a notebook for field observations which guides the experimenter in his field notations; a book of indicators information on the mode of calculation and the use of indicators obtained by observations; and a data-processing spreadsheet that allows data acquisition, carries out an automatic calculation of the indicators and gathers them in an organized synthetic synoptic table. The method used to make the agronomic diagnosis is a systemic approach based on oilseed rape yield; first of all linking yield and growth indicators to environmental indicators, and then linking them to management indicators. The agronomic diagnosis ends with the identification of the crop management and environmental aspects responsible for problems in the field, and with the discussion about crop management adaptation to climates, soils and cropping systems. This method of systemic analysis allows a global analysis of the cultivated field and the hierarchy of the limiting factors related to crop management, without limiting itself to an analysis of the conformity of the practices to the recommendations.

Results and Discussion

Water deficit was the determining element of yield in 2003. The study of the fields with no limiting factor other than the water deficit enables us to estimate the potential yields for the years with similar situations of soil and climate. The results showed potential yields of 3.5 tons per hectare for water deficits appearing after flowering, and about 2.0 tons per hectare for deficits appearing before flowering. Confrontation between these potential yields and the measured yields reveals a variation of approximately 20%, but how to explain this gap in the performance of sunflower is the question.

The place of diseases in this yield variation appeared negligible here taking into account the quasi total absence of diseases symptoms in 2003. The analysis of the synoptic tables makes it possible to highlight limiting factors of crop management at the origin of the measured yield variations. Three principal factors emerge: deficient rooting systems, generally due to poor soil structure, disturbed the water and nitrogen recovery; poor distribution of plants in the field due to heterogeneous emergence over time and/or irregular spacing led to weak biomasses and did not allow levels of potential yields to be reached; nitrogen deficiencies, generally induced by water deficit or caused by limited rooting, but more rarely directly due to a nitrogen underfertilization.

Conclusions

The atypical climatic context of the year 2003 highlights limiting factors of rooting, irregular distribution of the plants in the field, crop management of sunflower, soil tillage and sowing. These limiting factors are rarely mentioned in the assessment of the agricultural campaigns of CETIOM, which retains primarily climatic and epidemiologic causes to explain the measured yields. These limiting factors of crop management, if they appear again in another climatic context, will cause us to orientate our work of development towards these topics to improve the competitiveness of sunflower.

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