# STUDY ON POSSIBLE RELATIONSHIP BETWEEN NUTRIENT SUBDEFICIENCY AND GRAIN ABORTING, DETECTED IN THE IRRIGATED FIELDS OF VALLE MEDIO OF THE EBRO RIVER.

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Summary

Rape-seed implantation in the irrigated fields of Valle Medio of the Ebro river, has up until present time met with the basic problem of a low yield, which when compared with more traditional crops such as wheat and maize, make it very little competitive. Low yield seems to be related with grain aborting during the young phases, although the fruit develop normally.

The possibility is studied of this problem being connected with nutrient-subdeficiency, by means of foliar analysis of macro(N,P,K, ca,Mg) and micro-elements(Fe,Mn,Cu,Zn,Bo). Although an abnormally low content of K(1,20%) was detected during the 1980/81 season on leaves from four cultivars(Quinta,Si-7440/76,R-51,Libelle), the following season 1981/82 revealed that this low content was related with the soil. It does not therefore appear that the grain aborting is connected with any problem of nutrient-subdeficiency. The curren work hypothesis consists of relating the high aborting rate with incidence of tardy micro-frosts which are capable of damaging the ovules and/or young embrions, but not the carpellary walls or those of the young fruit.

It is concluded that there are no nutritive factors in the soil of the irrigated fields of Valle Medio of the Ebro river that have a restrictive action on the rape-seed crop. Development is possibly related with sowing the crop at an optimun date and using adequate cycle cultivars with a better physiological resistance against tardy frost.

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## Introduction

The introduction of rape-seed in irrigated land of the mid-valley of the Ebro river, has met with serious difficulties as a result of low yields obtained up until now. In extensive farming, with irrigation, between 2,000 and 2,500 Kg./Ha. have been obtained, which are levels that should compete with yields of 7,000Kg./Ha. in wheat and 11,000 Kg/Ha in maize. In cultivar tests, in random blocks in small plots, during 4 seasons a mean yield of 2,500 Kgs./Ha. has been obtained, whereas in twin tests, on dryland, carried out during the same years in localities of the North Meseta, a mean yield of 3,800 Kgs./Ha. was obtained. This difference, logically, should be the opposite, since in most parts of Spain, crop yields are greatly conditioned by just how much water is available for the plants, because rainfall is scarce and with an irregular distribution.

The low production of rape-seed on such irrigated land, leads us to think that one or more than one limiting factors are present, and characteristic of this area, that have a negative influence on the rape-seed development.

In a first phase, the study was directed towards looking for cryptogamic deseases, but only quite general attacks although benign attacks were detected of Phoma limgan(Toole) Desm. and the isolated presence of Botrytis cinerea Pers. and Albugo candida(Pers. Kuntze.

Parallel to this, it was found that the low yield was produced by a high percentage of aborted grains, although no damage or malformation was adverted in the siliquas, and in addition, the presence of bees and other pollenizer insects was really important. On these grounds, the study was directed in search of nutritive subdeficiencies, which could influence the aborting of grains, using foliar analysis techniques of macro and micro-elements.

## Material and Methods

The experiments were made during two consecutive seasons(1980/81 and 1981/82) on the same farm in El Bayo(Zaragoza).

- Season 1980/81

The plant material was obtained from a cultivar test, using the following cultivars: Quinta,Si7440/76,R-51,Libelle.

The test was made on irrigated land(4 irrigations to saturation) on a loose texture soil, with the fertility characteristics shown in Table 1.

The fertilization was made with 125 Kg./Ha. of N, 100 Kg./Ha. of $P_2O_5$ and 100 Kg./Ha. of $K_2O$.

The adult leaves were picked from each of the 4 replications of the test, in the same vegetative moment(full bloom) in the -- four mentioned cultivars.

TABLE 1.- Analysis of the soil where the test of rape-seed crops was made in random blocks in 1980/81.

| | | |
|---|---|---|
| pH ($H_2O$) | | 8.18 |
| Total carbonates % | | 42.84 |
| Organic matter % | | 1.273 |
| Total nitrogen % | | 0.107 |
| Assimilable phosphorus mg. $P_2O_5$/100 g | | 5.20 |
| Assimilable potash mg. $K_2O$/100 g | | 8.04 |
| Assimilable calcium (ppm) | | 2.500 |
| Assimilable magnesium (ppm) | | 200 |
| Extract conductivity 1/5 mmhos/cm | | 0.775 |
| Fe (ppm) | Total | 17,650.0 |
| | Assimilable(DTPA) | 4.20 |
| Mn (ppm) | Total | 423.0 |
| | Assimilable(DTPA) | 5.10 |
| Cu (ppm) | Total | 16.0 |
| | Assimilable(DTPA) | 0.4 |
| Zn (ppm) | Total | 47.0 |
| | Assimilable(DTPA) | 0.5 |
| Co (ppm) | Total | 17.0 |
| | Assimilable(DTPA) | 0.1 |
| Ni (ppm) | Total | 30.0 |
| | Assimilable(DTPA) | 0.3 |

- Season 1981/82.-

A test of differential fertilizing of potassium was made, on irrigated land, with all the remaining conditions fixed, using random blocks, 4 replications and elementary plot of 6 rows. The Quinta - cultivar was used. The dose of $K_2O$ was 0,50,100,150,200 and 300 -- Kg./Ha. The other fertilizing was identical for all the plots: 150 Kg/Ha. of N and 100 Kgs./Ha. of $P_2O_5$. The soil texture was loose-- clay and the analysis is shown in Table 2. Samples of soil were taken in al the plots of the first two replications, and also samples of adult leaves. In addition, the yield was controlled for the four central rows of each elementary plot.

TABLE 2.- Analysis of the soil where the differential testing of potassium fertilizing was made, in 1981/82

| | |
|---|---|
| pH | 8.33 |
| Total carbonates % | 34.44 |
| Organic matter % | 1.092 |
| Total nitrogen % | 0.092 |
| Assimilable phosphorus mg. $P_2O_5$/100 g. | 11.0 |
| Assimilable potash mg. $K_2O$/100 g. | 86.40 |
| Conductivity extract 1/5 mmhos/cm. | 0.93 |
| Assimilable calcium (ppm) | 3.500 |
| Assimilable magnesium (ppm) | 400 |

## Analythic Techniques

The leaves collected were washed with water at the laboratory - and after being dried in forced air heater were ground up. In the - analytical techniques, MONTAÑES et. col.(1972) was followed.

## Results and Discussion

In the results obtained in the foliar analysis carried aut in - 1980/81, that are shown on Table 3, a similar content of macro and micro-nutrients was detected among the 4 cultivars used. Comparing the levels of the different nutrients with the control figures taken from SOBRINO and SANZ(1983), it is observed that they can all be considered normal, with the exception of the potassium content, which - is low, 1.20% compared with 2.05%.

Based on this difference in the foliar content of K, it was considered this could be a sub-deficiency, related with the problem of aborting of grain as explained. To clarify this hypothesis, a differential test of potassium fertilizing was designed in the following season, as described under the chapter on material and methods.

The averages of chemical analysis of the soil in the various -- treatments are shown in Table 4 together the average results of the foliar analysis and yield obtained. It establishs the following regression lineal $y = 78,31 + 0,14\ x$ ($r^2 = 0,83$) between the amount of $K_2O$ in soil in the different treatments and the amount of $K_2O$ per - Ha. added, but in the foliar contents of K, a lower level in only - observed for the control plot, that has no potassium fertilizer, -- although this did not affect the yield, which was clearly similar - in all the treatments used. The highest value of K in leaf correspon



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TABLE 3.- Mean contents(4 replications) of various macro and micro nutrients in adult leaf, of four cultivars of rape-seed, in the test of 1980/81

| CULTIVAR | N% | P% | K% | Ca% | Mg% | Fe ppm | Mn ppm | Cu ppm | Zn ppm | Bo ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| Quinta | 2,61 | 0,258 | 1,16 | 5,29 | 0,61 | 120 | 124 | 5 | 28 | 29 |
| Si-7440/76 | 3,10 | 0,300 | 1,18 | 4,85 | 0,61 | 126 | 135 | 5 | 29 | 29 |
| R-51 | 3,10 | 0,311 | 1,36 | 4,63 | 0,63 | 124 | 145 | 6 | 30 | 31 |
| Libelle | 2,9 | 0,271 | 1,11 | 5,32 | 0,65 | 123 | 130 | 5 | 26 | 29 |
| $\bar{X}$ | 2,95 | 0,285 | 1,20 | 5,02 | 0,63 | 123 | 134 | 5 | 28 | 30 |

TABLE 4.- Mean contents(2 replications) of nutrients in adult leaf of rape-seed, in the differential testing of potash fertilizer together to yield and assimilable potash in soil. (1981/82).

| Treatment Kg.$K_2O$/Ha. | Assimilable mg.$K_2O$/ 100 g. soil | N% | P% | K% | Ca% | Mg% | Fe ppm | Mn ppm | Cu ppm | Zn ppm | Yiel Kg/Ha |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 73,80 | 3,430 | 0,190 | 1,752 | 4,27 | 0,61 | 142 | 51 | 5,0 | 17,1 | 4.12( |
| 50 | 81,75 | 3,262 | 0,258 | 2,851 | 4,24 | 0,54 | 164 | 46 | 5,3 | 2,05 | 4.01 |
| 100 | 106,50 | 3,024 | 0,218 | 2,607 | 4,69 | 0,54 | 168 | 38 | 4,9 | 18,3 | 4.24 |
| 150 | 99,00 | 3,654 | 0,239 | 2,419 | 4,39 | 0,58 | 131 | 45 | 5,3 | 20,2 | 4.21 |
| 200 | 99,90 | 3,682 | 0,233 | 2,419 | 4,69 | 0,63 | 156 | 43 | 5,8 | 16,4 | 4.04 |
| 250 | 112,80 | 3,038 | 0,240 | 2,148 | 4,44 | 0,56 | 165 | 43 | 5,8 | 19,0 | 4.11 |
| 300 | 120,00 | 3,710 | 0,232 | 2,335 | 4,68 | 0,60 | 146 | 45 | 5,5 | 20,1 | 4.14 |

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ded to the treatment of 50 Kg./Ha. of $K_2O$, followed by that of - 100 Kg./Ha. of $K_2O$, and a lowering of assimilation was observed for the following treatments since the foliar contents of K drop. The K contents reached are of the same level as those taken as control(SOBRINO and SANZ, 1983), and it is therefore shown that the - low yields due to aborting of grain are not related with a sub-deficiency of potassium, and that the low level of this macro-element, detected in 1980/81, was related with the soil.

As a result of the lack of response of the rape-seed in this -- type of soil, to the increase in potassium fertilizing, it would -- seem recommendable not to exceed the figures of 50 to 100 Kg./Ha. - of $K_2O$ in order to obtain a fertilizing with the maximum profitability.

It is concluded that the aborting of grain, which is the cause of the low yields obtained in the rape-seed crop in the irrigated -- lands of the mid-Valley of the Ebro river, is not related with any - problem of sub-nutrition. And no nutrient factors have been detected in these soils that could restrict the rape-seed crop.

The present work hypothesis relates the high percentage of aborted grains to the presence of tardy micro-frosts that are capable -- of damaging the ovules and/or the young embrions, but not the carpellary walls or those of the young fruit.

The limitation for the rape-seed crop in this area, in the event of this hypothesis being confirmed, could be resolved by making the sowing at a timely date, and by using cultivars with a more suitable cycle.

## References


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