WINTER OILSEED RAPE:

CERTAIN EVENTS CONCERNING FLORAL INITIATION AND THE "BEGINNING OF SPRING"

E.D. TITTONEL
J.P. Chaput F. Letoublon O. Bonnot

E.N.I.T.A. -DIJON - QUETIGNY-
21 boulevard Olivier de Serres
BP 48 21802 QUETIGNY FRANCE

INTRODUCTION

Farmers generally think that winter rape growth stops during the cold season and resumes when the weather gets warmer. At that resumption time, new pale green leaves appear in the heart of the plant whose habit changes: it was stretched out,and it becomes erect.

These two alterations (leaves and habit) are taken by CETIOM 1987 as the definition of the "beginning of Spring" stage. Farmers must pay attention at this stage, for it is the moment when Nitrogen applications are required.

Nevertheless watching plants in the fields gives clear evidence that the above defined "beginning of Spring" stage can occur during Winter independently of mild temperatures.

The work presented here intends to show that this " beginning of Spring" stage actually depends more on Autumn or Winter temperatures than on Spring ones, being a physiological stage correlated with needs in vernalization and with floral initiation.

Overview of floral initiation

From sprouting to anthesis, plant life can fisrt be divided into two parts, i.e. before and after floral initiation: before,this process will be called vegetative s.l., after it will be called reproductive.

Then, the vegetative s.l. stage itself can be divided into two other parts by apex doming.

Doming is the first sign that rape plant is going to have flowers. There is no floral initiation which does not begin by doming.Cultivars needing low temperatures to flower, and not getting them, can continue with their flat apex for months or even for years (Netzer 1986).

Eventually, before apex doming, we will speak of 1st or vegetative stage s.s., after, it will be the 2nd or transition to floral initiation stage, and the third will be called the pre-anthesis one

MATERIAL AND METHODS

Experiment fields are located in the Dijon countryside in a subcontinental area of eastern France.The experiment covers 3 crop years from August 1984 to July 1987.

The six sowing dates in 1984 and the three dates in 1985 took place between mid-August and the end of September. The

variety was Jet Neuf and the density very low, about 10 plants/m2. In 1986, the programme was slightly different: a single sowing date , 27 August 1986, but denser, about 50 plants/m2, and two extra cultivars, Bienvenu and Darmor.

Twice a week from sprouting to anthesis, when the soil is not covered with snow, two kinds of investigations have been carried out on the main axis:

- in the field, on recorded plants, we stress:

. foliar age : it is the number of emerged leaves (present ones plus scars).

. habit: it is only recorded as stretched out, half erect or full erect.

. leaf shape: with or without stipules on the petiole.

. leaf position: on the rosette or on the agronomic stem.

- in the laboratory on dissected plants, in order to relate the outside behaviour with internal events, we record the same four things as above plus:

. total leaf number, taking into account both inside and outside leaves, including scars and primordia.

. apex stages: we use Tittonel and al descriptions, stressing two particular moments: - doming i.e. when the flat apex swells out, and

- floral initiation, when a meristem appears in a primordia leaf axil.

RESULTS AND DISCUSSION

Apex doming date:

In our trials, depending on autumn weather and cultivar, the swelling out of the apex generally begins during the last fortnight of September, for the former sowings and comes to an end around mid-November for the later ones. This is in accordance with Netzer's controlled chamber work (1986):the older the plant,the less it needs chilling.

In any case, it seems that under our best field conditions, a week without maximum temperatures above 20°C is necessary to reach this stage.

The three varieties were chosen for their different requirements in thermoinduction treatment. So, the expected grade was: Bienvenu, Jet Neuf and Darmor. Actually, it turns out to be: Bienvenu, Darmor and Jet Neuf.

Floral Initiation:

As well as doming, floral initiation,is dependent on sowing dates, cultivars and Autumn weather. In our country it usually takes place between early November and mid-January. At that time, the grade is the expected one: Bienvenu, Jet Neuf and Darmor,i.e. the transition to flowering is much longer for Darmor.

So an early initiation date, without any freezing, has put the question of the real function of cold . Do our cultivars need any chilling, or are they only able to stand up to cold without being frozen?

Netzer 1986 checked Jet Neuf and Darmor in a controlled growth chamber: they need exposure to cold but warm temperatures under or equal to 17°C are effective.

Total Leaf Number vs Foliar Age :

Increased rate of initiation of leaf primordia or in other words reduction in plastochron is a conspicuous symptom of the transition from vegetative to reproductive growth (Bernier & al 1984). Nevertheless, Fig 1 shows that it is not so widespread as generally thought. The curve usually found (5th sowing), occurs, in our field conditions , only with high levels of induction factor such as the freezing temperatures of November 1984.

Foliar Age vs Growing Degree Day:

Netzer 1986 pointed out that rape plants are able to obtain a complete cycle from seed to seed at a constant temperature of 5°C. Hodgson 1978 found a base temperature of 0.45 °C. For these reasons we took a 0 base in our growing degree day calculation.

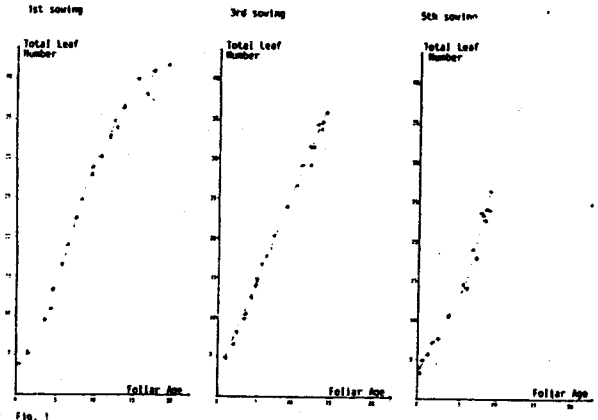

Fig. 1
Total Leaf Number vs Foliar Age -1984-1985. Jet Neuf
Each point is the mean of 10 dissections.

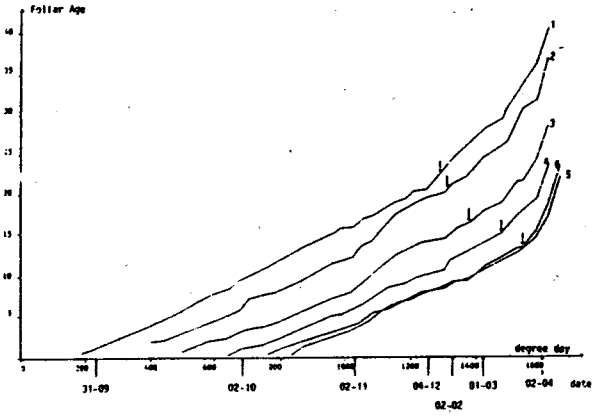

Fig. 2
Average Foliar Age vs growing degree day (0 base)
Each point is the average of 50 observations. The arrow indicates the slope change.
1984-1985- Jet Neuf

particular events	sowing dates in 1986		
	1 20 August	3 5 September	5 21 September
doming	22-23	15	14-15
total leaf number curve particular point	sigmoid inflexion 21-22	straight line -	2 lines intersec 14-15
Foliar Age/ d.D slope change	23	15-16	13-14
1st stipulated leaf	23	16	13
rosette/stem	19-20	12-13	9-10

Table 1: 1984-1985. Cultivar Jet Neuf. Leaf queue number for a particular event.
These data are means; they only point out a zone where the considered event takes place.
d.D= growing degree day.

number of the plant	change in foliar age / degree day				plant habit change			first on the	leave stem
	foliar age	stipules	date	degree-day	foliar age	stipules	date	number	date
1	15-17	Yes	15:12 _ 05:02	1100 _ 1170	16.25	Yes	05:02	15	18:12 - 05:02
2	13-15	No	24:11 _ 26:12	1050_1130	14	No	10:12	16	18:12 _ 05:02
3	17-18	Yes	15:12 _ 26:12	1100_1130	18	Yes	13:12	17	24:11 _ 10:12
4	13-14	Yes	24:11 _ 15:12	1050_1100	16	Yes	05:02	14	25:11 _ 10:12
5	11-13	No	24:11 _ 20:12	1050_1125	14.5	Yes	18:12	15	24:11 _ 10:12
6	13	No	24:11	1050	16.5	Yes	05:02	15	24:11 _ 10:12
7	17-18	Yes	20:12 _ 31:01	1125_1160	16.5	Yes	18:12	16	03:12 _ 10:12
8	13-15	Yes	20:12 _ 07:02	1125_1175	16.5	Yes	13:02	14	10:12 _ 18:12
9	14	Yes	15:12	1100	15	Yes	10:12	14	28:11 _ 10:12
10	13-14	Yes	01:02 _ 05:02	1130_1170	15.5	Yes	25:02	13	18:12
11	15	Yes	20:12	1125	14.25	Yes	10:12	14	18:12 _ 05:02

Table 2: 1986-1987. Cultivar Bienvenu. Individual data for 11 plants.

First, the emerging leaf rate is constant, but at a certain point, it undergoes an increase. Fig 2.

The moment of this increase occuring from mid-December to mid-January according to sowing dates, clearly shows that it is not dependent upon temperature which is the same for all the plants in a single field, but upon internal factors.

General Results

Main data from 1984-1985 experiment are collected in Table 1. Given a particular sowing date, it follows that events recorded late in the cycle, such as the decrease in phyllotherm , leaf shape and stem partition occur in a single leaf group. Furthermore, this leaf group is the one involved in Autumn events, i.e. doming and alteration in plastochron rhythm.

Table 2 confirms previous results in 1986-1987 with Bienvenu and adds that the habit alteration is concerned with the same group of leaves.

CONCLUSION.

From these data it appears that doming is a very important moment in rape life-cycle.

- Before doming, during the vegetative s.s. stage, the apex produces leaves without stipules.They will emerge with a high phyllotherm, the plant habit being stretched out. They will remain on the rosette.

- After doming, during the transition stage,the apex produces changing form leaves: the former are just slightly stipulated, the latter are bracts.They will emerge with a low phyllotherm, the plant habit being straight up. They will be brought up on the elongated part of the stem by bolting.

Consequences

As seen above, Darmor has the longest transition stage; it has got more leaves on the stem: in spite of its shorter internodes, it is the highest.Table 3.

-Table 3 - 1986-1987- Comparison of the agronomic stem of 3 cultivars. (Means within a column followed by the same letter are not significantly different according to Newman & Keuls 5% range test).

cultivar	nb of plants	stem high		nb of internode		average length per internode	
Darmor	12	88.83	a	22	a	4.06	a
Jet Neuf	12	80.67	b	18.67	b	4.35	b
Bienvenu	12	80.25	b	16.33	c	4.95	b

When the plant habit becomes erect, emerging leaf rate usually increases. That is probably the reason why the farmer notices pale green leaves in the heart of the plant.

The transition leaves appear outside, when all the vegetative s.s. ones are already out. That is to say that the moment when the 2nd stage leaves peep out depends on the number and the emerging rate of the first stage ones. The leaf number before doming depends on cool temperatures in September and October. As regards the emerging rate, it is concerned with fine weather in late Autumn and Winter.

For instance in 1986, doming occurred in the last days of September for Bienvenu and Darmor. Then the weather turned out to be unusually fine till mid-December, so that the first leaves of the transition have been found peeping out during this period. As a result from Labadie ,1985, it seems that these second stage leaves have a different composition. This could explain why only some crops were so seriously damaged during the period of heavy frost without snow in the beginning of January 1987. We noticed that the most injured plants were the biggest and the most erect , even witout any stem elongation.

As regards bolting, it occurred, as usual ,during the first days of April, i.e. about three months later. Actually bolting, (and not etiolement due to high density) still begins , both on the main axis and on lateral branches, when ovules can be seen in the gynoecium of the most developped flower of the raceme. Flower development being probably largely under day length effect (King & Kondra 1986), this explains why bolting does not usually changes from year to year.

Acknowledgement: we thank Cetiom ror its financial support and encouragements.

REFERENCES:

- Bernier G. Kinet J.M. Sachs R.M. 1981 The physiology of flowering. Vol II, Transition to reproductive growth. CRC Press 231p.

- Cetiom 1987 La culture du colza d'hiver. Edition juin 1986. 33p

- Hodgson A.S. 1978 Rapeseed adaptation in Northern New South Wales. II Predicting plant development of Brassica campestris L. and Brassica napus L. and its applications for planting time, designed to avoid water deficit and frost. Aust. J. Agric. Res. 1978, 29, 711-26

- King J.R. and Kondra Z.P. 1986 Photoperiod response of spring oilseed rape (Brassica napus L. and B. campestris 1.) Field Crops Research, 13 (1986) 367_373

- Labadie J.M. 1985 Etude du fonctionnement des feuilles de colza d'hiver. D.E.A. Biologie et Physiologie Vegetale. Universite de Clermont II

- Netzer M.H. 1986 Recherche sur le determinisme de la floraison de 3 cvs de Brassica napus L. var. oleifera en conditions controlees. These de 3 eme cycle Universite Pierre et Marie Curie - Paris 6 -

- Tittonel E.D. Desplantes G. Grangeret I. Minochet X. 1982 Modifications morphologiques d'un bourgeon de colza (Brassica napus) au cours de la formation des ebauches florales. Informations techniques CETIOM 78-I-82 p 15-24