SOFTWARE APPLICATIONS - MICROCAL ORIGIN FOR POLYNOMIAL INTERPOLATION IN RHYTHM OF ACCUMULATION A DRY MATTER OF VINE

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Abstract: *The dedicated software having in background a powerful matematichal apparatus (specially numerical methods with informathical saucer) was revolution experimental research, having the posibility important anticipation, completing the colection rare data which obtain occasionally with difficulty. Using numerical simulation can find formulas for calculating (based on a collection of experimental data) using the media as a powerful Matlab programming, LabVIEW, Microcal Origin eliminating many experimental calculations difficult to get. If we compare the results between the two modes of working (and experimental data) shows that the interpolation methods used: spline, cubic, linear, polynomial (on different degrees until 10 degree) have very small errors, the degree pof fidelity is almost 100% (95% and 98%). By getting expression of mathematical functions and values with average temperatures during certain periods of time (for example, the average for the past 60 years) we can predict the development of biorithm by predictions of the accumulation of dry matter without further recourse to dense experimental calculations. "Microcal Origin" is a programming language likewise a developing system which integrates the calculation, the visualisation and the programming in an easy way. The problems and their solution are concurred in an available mathematical language. Starting from the experimental data, the accumulation of the dry substance like a function of active temperature (∑°C) and time (t), the software gets a function which brings the increase of vine SU(∑°C, t), through interpolations with a very little step; so, this evolution can be determined empiric. For mathematical thoroughness in the approximation of function - accumulation of dry matter (SU) depending on the temperature have used a variety of functions: exponential, logarithmic, polynomial depending on the type curve nonlinear sometimes fragmenting the diagram on parts. Simultaneous we can choose the function that proximate the best the experimental data by using dedicated software and we can get the values y=f(x) by interpolation $y_i=f(x_i)$, the interpolation step being very small, 10^{-6}. We can make such calculations of the value of dry matter (SU) not by experimental way, but by using the applied sciences on computer. Where experimental data collection are a disparate values we can complete, however small it would be intervening Variation Δx , can learn at any time variant ΔSU.*

Key words: *numerical methods, anticipation, colection data, approximation, interpolation, simulation, process phases.*

INTRODUCTION

By numerical simulation we can find calculating formulas (on abide by a collection of experimental data) by using strong programming surroundings like Matlab, LabView, Microcal Origin and by elimination of many determinations difficultly to get.

If we compare the results of both way of work (exprimental and by computer)

METHOD. ANALYTIC STUDY

All entry data should be identified and later synoptically presented in a table, all graphics should be made and the formulae should be identified by employing various numerical methods. Interpolations shall be made for x_i data, which are necesary to anticipation and they shall be compared to the experimental ones. Specialized software shall be used, like Matlab, LabView, Origin, Excel, Mathematica, while the results shall be compared and formulae which best approximate reality shall be found.

Table 1

Evolution of dry substance accumulation depending on the active temperature:

Month	1	2		3	4			5	6	7	8	9	10	11	12
	Jan	Feb		Mar	Apr			May	June	July	Aug	Sept	Oct	Nov	Dec
Date	-	12	20	-	6	10	20	-	5	-	5	21	23	-	-
No of day	-	-	-	-	6	10	20	-	65	-	126	172	205	-	-
Phase	RR	SF	Vl	-	B	U	DI	-	BI	-	R	M	LF	RR	RR
Active ∑°C	-	21	42	-	183	250	346	-	1060	-	2430	3320	3740	-	-
Dry Subst(g)	-	-	-	-	1	6	250		875	-	1600	2380	2685	-	-
-	-	-	-	-	Active period									-	-

Where:

- RR – relative repose
- SF – physiologic start
- Vl – vine lachrymal or vine tear
- B - buddind
- U – unfolding
- DI – devolpment of inflorescence
- Bl – blossoming
- R – ripe
- M- complete maturation
- LF – leaf fall

The active degrees accumulated in time are as follows:

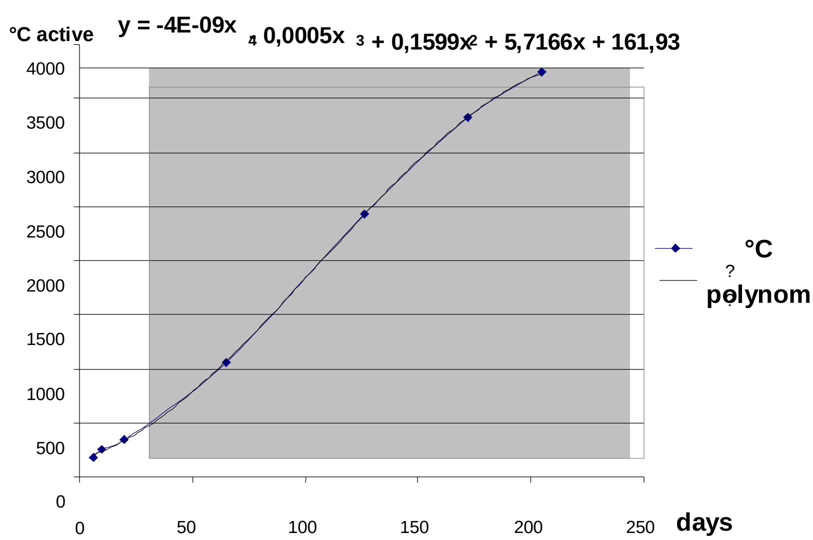

Figure 1: The evolution of ∑°C(active)

The function that best reflects the evolution of temperature was determined by polynomial approximation, obtaining a IVth degree polynom that is employed to determine the accumulation of daily active degrees.

$$Y(X)=-4*10^{-9} X^{4}-0,0005 X^{-3}+0,1599 X^{-2}+5,7166 X+161,93$$

RESULTS AND DISCISSIONS

APPROXIMATION TYPES (SOFTWARE MICROCAL ORIGIN) FOR ACCUMULATION OF DRY SUBSTANCE DEPENDING ON TEMPERATURE

The software allows the graphic to be achieved by points depending on x_i, y_i pairs which were experimentally determined. Only then the polynomial approximation is performed (95%-98% approximation degree, various degree polynomials).

The approximation shall result in determining a function, namely a polynomial of Vth order, which shall be compared to the one determined through differents means. Afterwards the interpolation is performed in order to quantify the Dry Substance (g) values that were not determined with an experimental method.

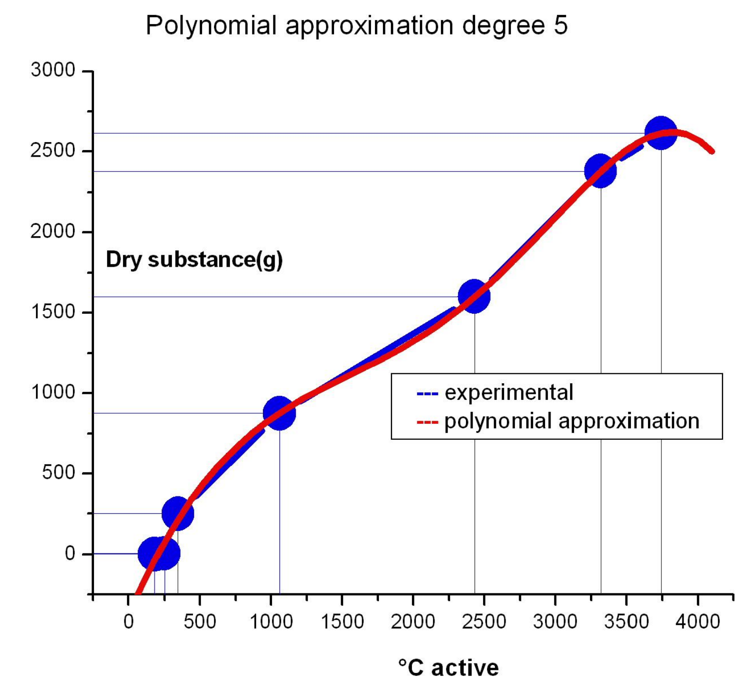

Figure 2: Popynomial approximation degree 5

Y = A + B1*X + B2*X^2 + B3*X^3 + B4*X^4 + B5*X^5

$$Y = A + B1*X + B2*X^{2} + B3*X^{3} + B4*X^{4} + B5*X^{5}$$

The function is expressed as:

$$Y = -367,893 + 1,99773*X + -9,53*10^{-4}*X^{2} + 1,14*10^{-7}*X^{3} + 6,34*10^{-11}*X^{4} – 1,3*10^{-14}*X^{5}$$

Table 2

Approximation 95%

Polynomial Regression for Data1_B:				
Y = A + B1*X + B2*X^2 + B3*X^3 + B4*X^4 + B5*X^5				
Parameter	Value	Error	t-Value	Prob>|t|
A	-367,893	328,9294	-1,11846	0,46444
B1	1,99773	1,95999	1,01926	0,49393
B2	-9,53E-04	0,00305	-0,3129	0,80694
B3	1,14E-07	1,86E-06	0,06105	0,96118
B4	6,34E-11	4,91E-10	0,12901	0,91832
B5	-1,30E-14	4,71E-14	-0,27562	0,82878
R-Square(COD)	Adj. R-Square	Root-MSE(SD)	N	
0,99904	0,99425	83,98796	7	
ANOVA Table:				
	Degrees of	Sum of	Mean	
Item	Freedom	Squares	Square	F Statistic
Model	5	7,35E+06	1,47E+06	208,513
Error	1	7053,977	7053,977	
Total	6	7,36E+06		

Y = A + B1*X + B2*X^2 + B3*X^3 + B4*X^4 + B5*X^5

$Y = -367{,}893 + 1{,}997 * X - 9{,}53 * 10^{-4} * X^2 + 1{,}14 * 10^{-7} * X^3 + 6{,}34 * 10^{-11} * X^4 - 1{,}3 * 10^{-14} * X^5$

Table 3

Approximation 98%

Y = A + B1*X + B2*X^2 + B3*X^3 + B4*X^4 + B5*X^5				
Parameter	Value	Error	t-Value	Prob>|t|
A	-367,893	1,54E-12	-2,38E+14	<0.0001
B1	1,99773	7,90E-15	2,53E+14	<0.0001
B2	-9,53E-04	1,46E-17	-6,55E+13	<0.0001
B3	1,14E-07	1,01E-20	1,13E+13	<0.0001
B4	6,34E-11	1,00E-20	6,34E+09	<0.0001
B5	-1,30E-14	1,00E-20	-1,30E+06	<0.0001
R-Square(COD)	Adj. R-Square	Root-MSE(SD)	N	
1	1	3,85E-12	50	
ANOVA Table:				
	Degrees of	Sum of	Mean	
Item	Freedom	Squares	Square	F Statistic
Model	5	4,15E+07	8,30E+06	8,30E+26
Error	44	6,51E-22	1,00E-20	
Total	49	4,15E+07		

The interpolated values are presented in the following table.

The experimentally determined values are compared to the ones resulted through interpolation, thus pointing out to the fact that a large number of iterations is possible, in this case 50:

Table 4

Approximation 95%

Item	T Measured	Dry Subst. experimental	T Iterated	Interpolated Dry Subst.
1	346	250	349,9612	220,2829
2	1060	875	1046,843	869,2726
3	2430	1600	2440,606	1607,505
4	3320	2380	3311,708	2373,559
5	3740	2685	3747,259	2616,215

Table 5

Approximation 98%

Item	T Measured	Dry Subst. experimental	Dry Subst. Interated	Dry Subst. Value
1	346	250	214,7944	35,20558
2	1060	875	876,966	-1,96595
3	2430	1600	1599,493	0,50743
4	3320	2380	2380,342	-0,34196
5	3740	2615	2614,867	0,13318

The correspondence between the values of the Dry Substance and values of the temperature is obvious and comparable in the two situations (experimental and by interpolation).

CONCLUSIONS

Numerical simulation may help in finding calculus formulae (the richer the experimental data set is, the better the numerical determinations shall reflect reality) by employing powerful programming media, like Matlab, LabView, Microcal Origin, which may be used thus eliminating many experimental.

The comparison between the two work methods (informatical and experimental) points out to the fact that the employed interpolation methods, cubic, linear, polynomial, (in various degrees up to the X^{th} degree) have very small errors, the approximation degree being of almost 100 % (95% şi 98%).

After mathematically expressing the functions with the average temperature values during certain periods of time (for example the average for the past 60 years), the evolution of the biorhytm may be anticipated by predicting the dry substance accumulations without employing experimental determinations.

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