

Artemisia annua L.

Drying and Storage

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Aims:

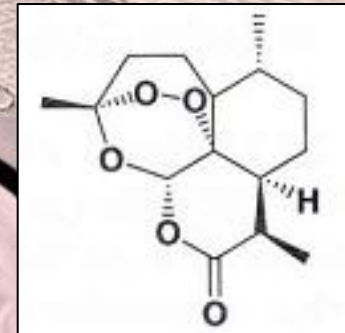
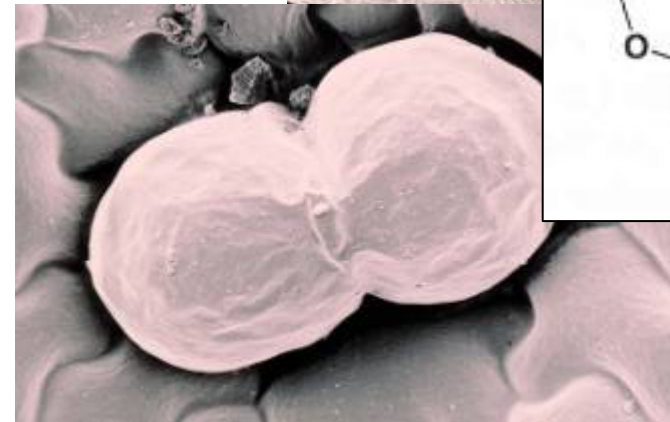
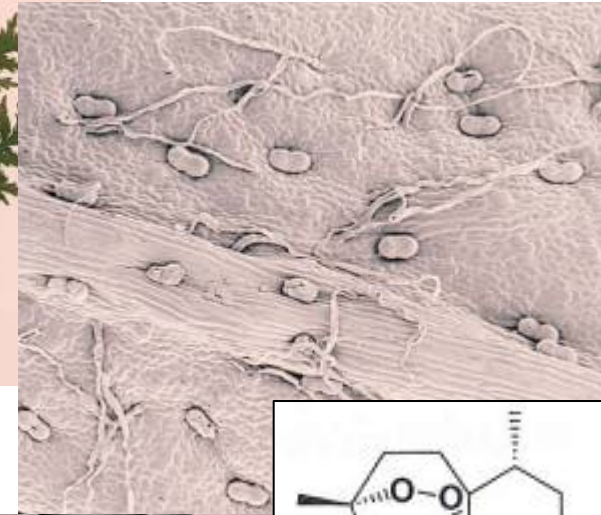
1-Effect of drying temperatures on the artemisinin content

2-Effect of temperatures during the storage on the artemisinin content



Recommendations for *Artemisia annua* GACP

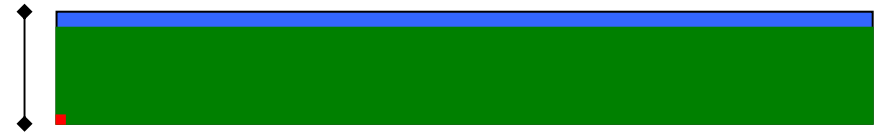
Basic information for the farm trials



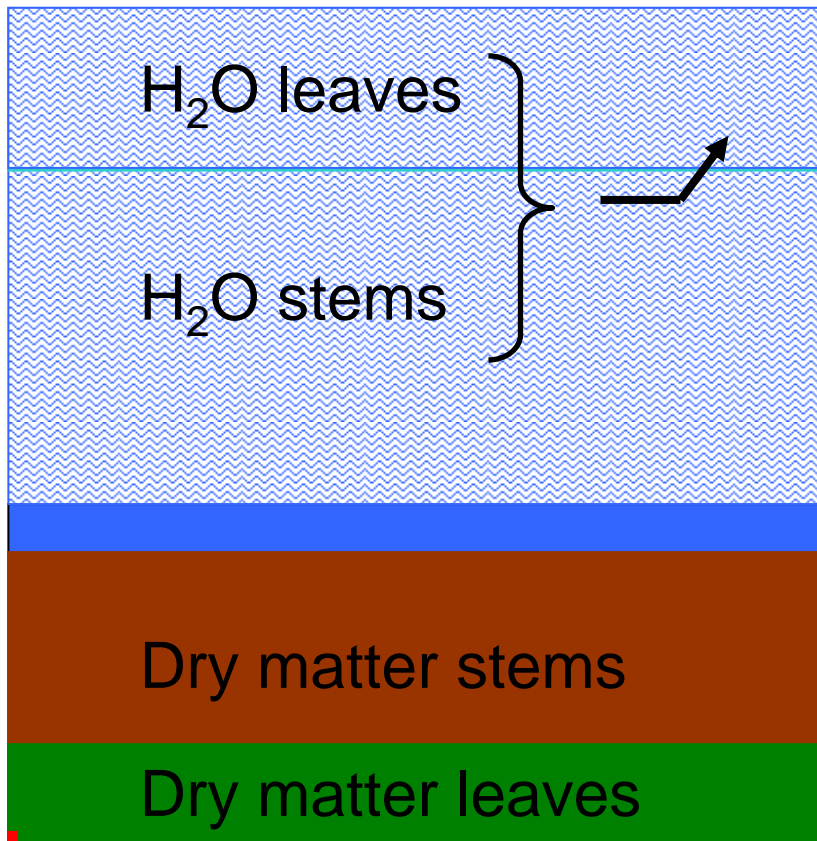
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Dried leaves stored

~2.5 t



Fresh plant in the field



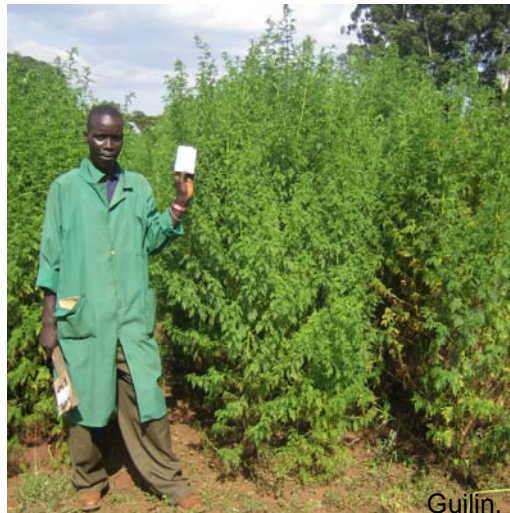
~22%

~37%

~5%

~27%

~9%



artemisinin

Guilin, November 2008

1-Effect of drying temperatures on the artemisinin content

11-Leaves, constant temperatures 20, 30, 40, 50, 70 or 90°C

12-Leaves, drying 1h30 at 40, 50, 70, or 90°C then end of the drying at 30°C

13-Leaves, drying at 30°C (78, 72, 64, 45% moist. content) then drying at 40, 50, 70 or 90°C

14-Stems+leaves (4 cm or «crushed»), drying at 30, 40 or 50°C

15- Stems+leaves (4 cm or «crushed»), storage 4h at 30°C then drying at 30, 40 or 50°C

- Artemis F1 110 days old imported from Kenya**
- ovens with air ventilation**

- Moisture content analysis (oven at 105°C)**
- Artemisinin content analysis (TLC + densitometer)**
- 3 replications per treatment**



Leaves

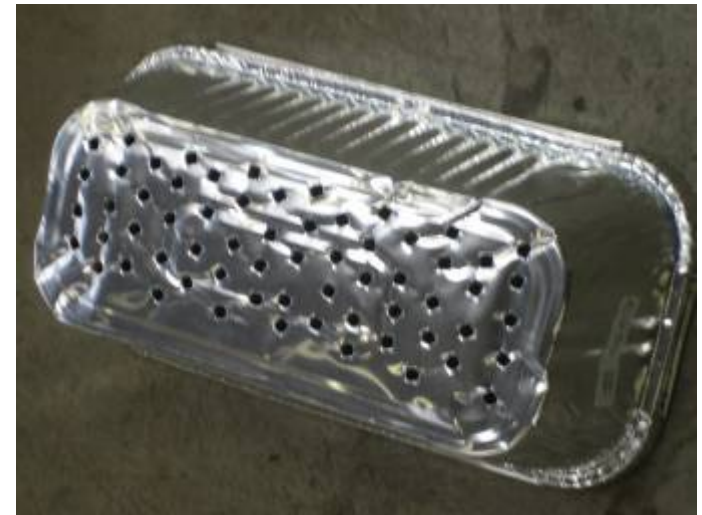


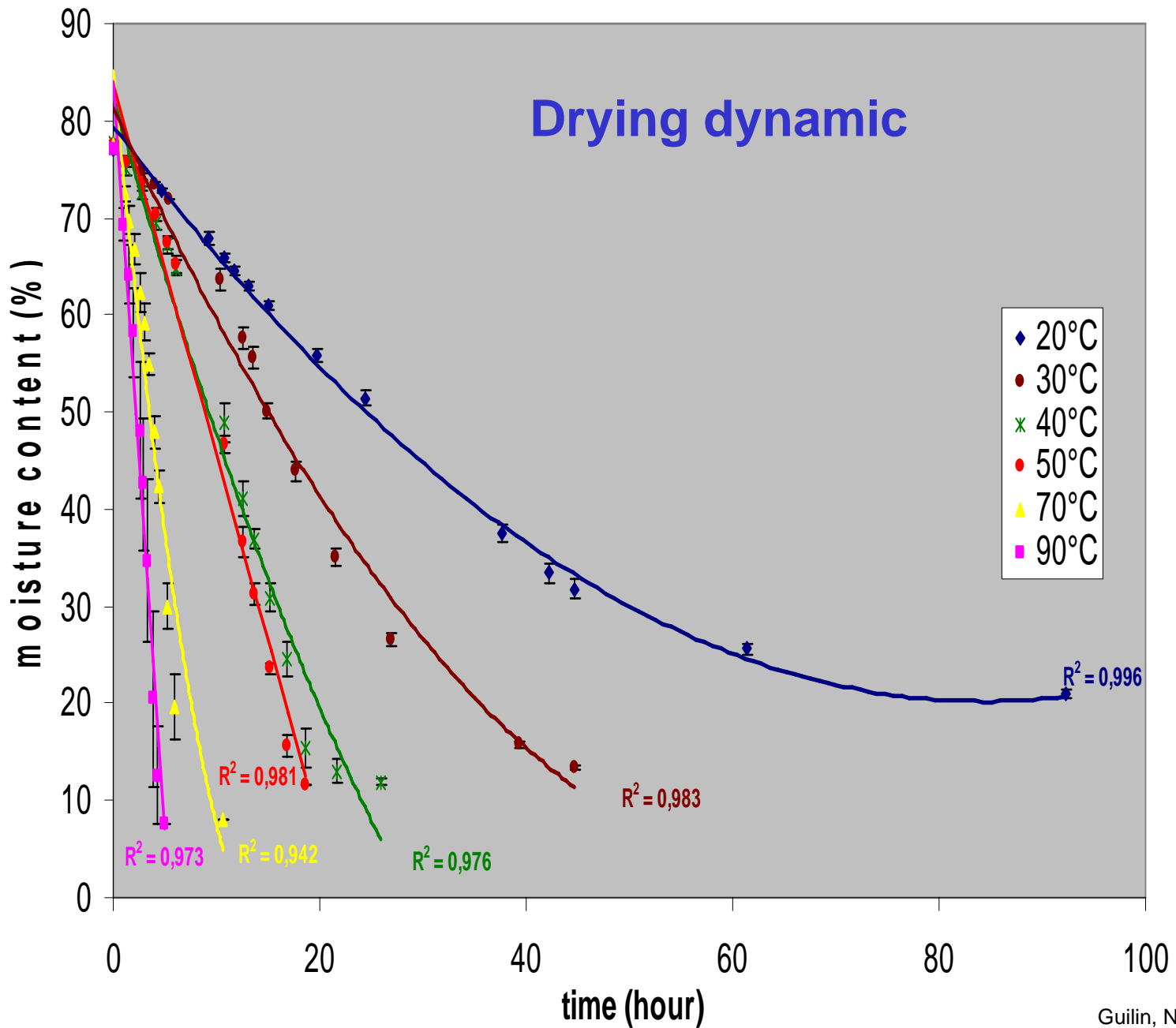
Stems+leaves

«crushed»

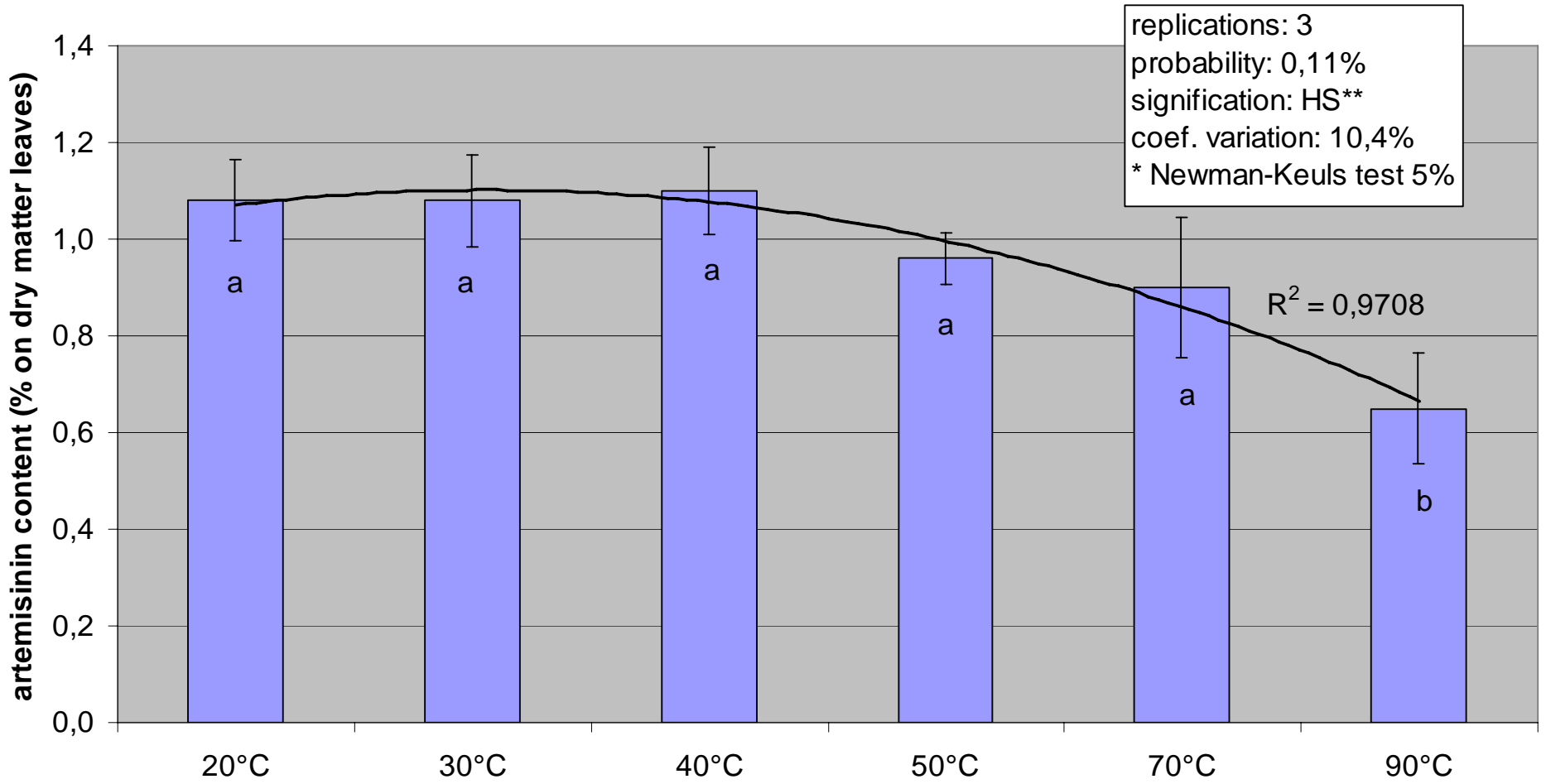
Stems+leaves

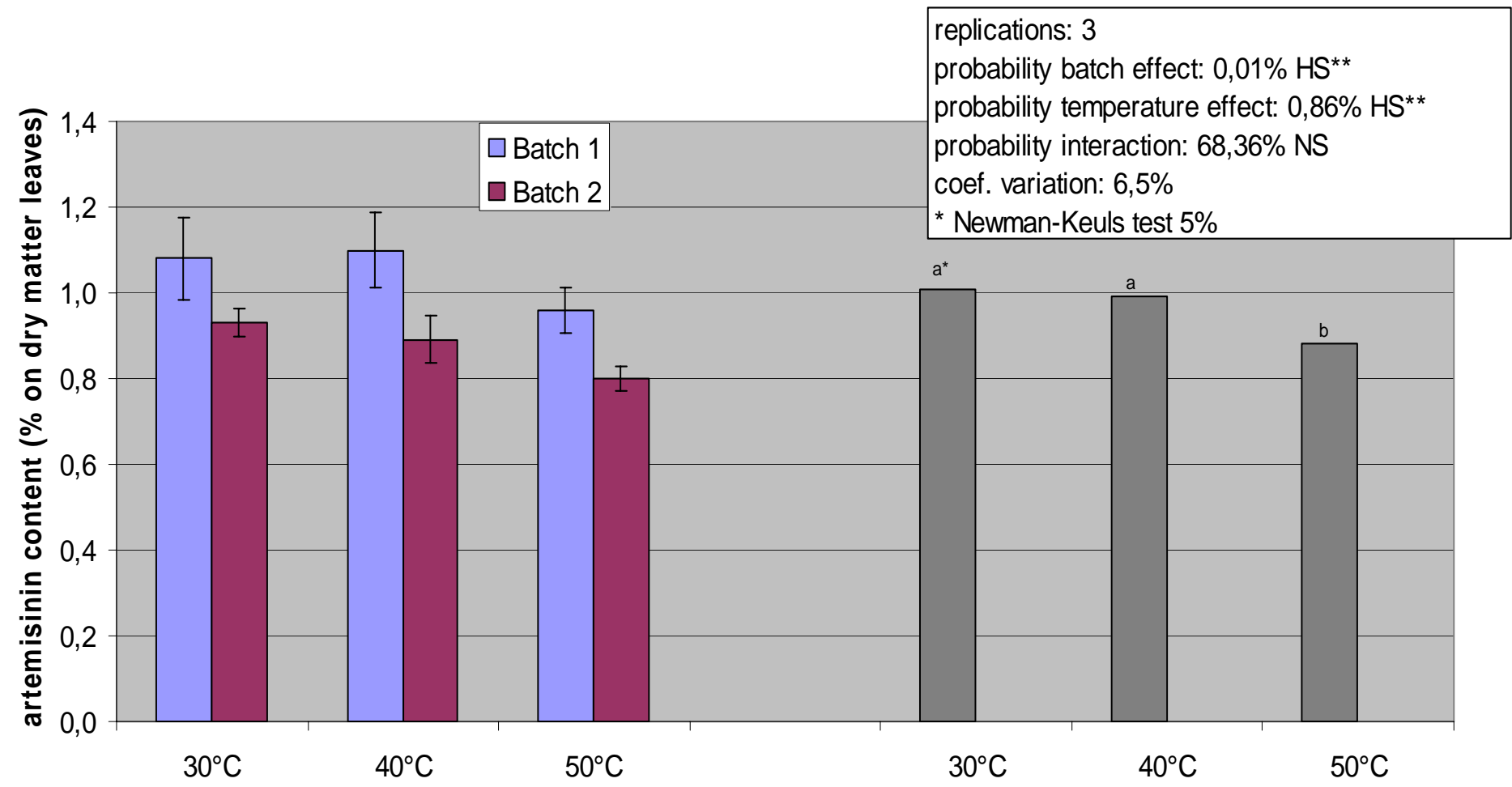
cut ~4 cm



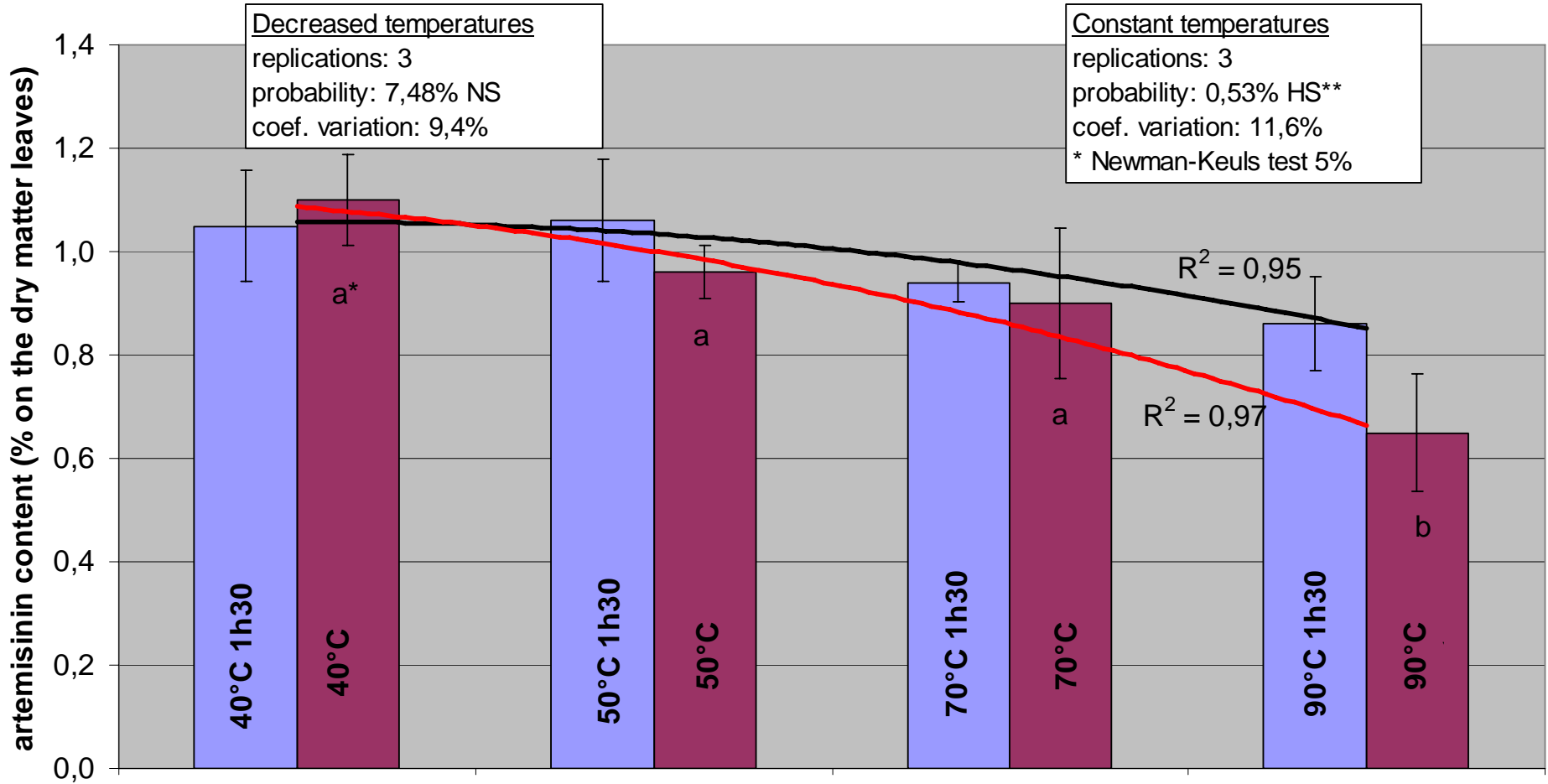


Leaves - drying at constant temperatures





Leaves - 1h30 at high temperatures then 30°C

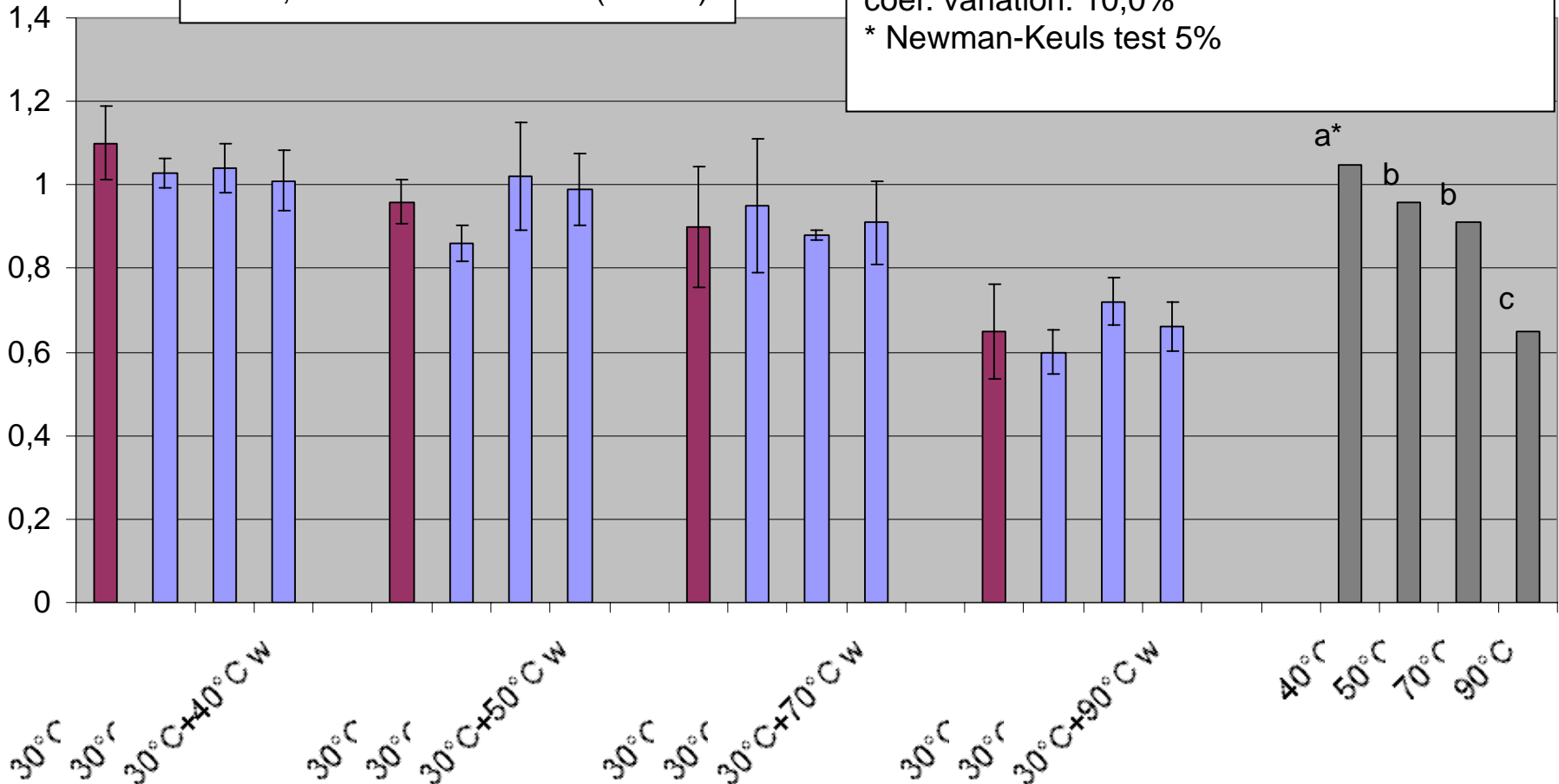


Leaves - different moisture content * different temperatures

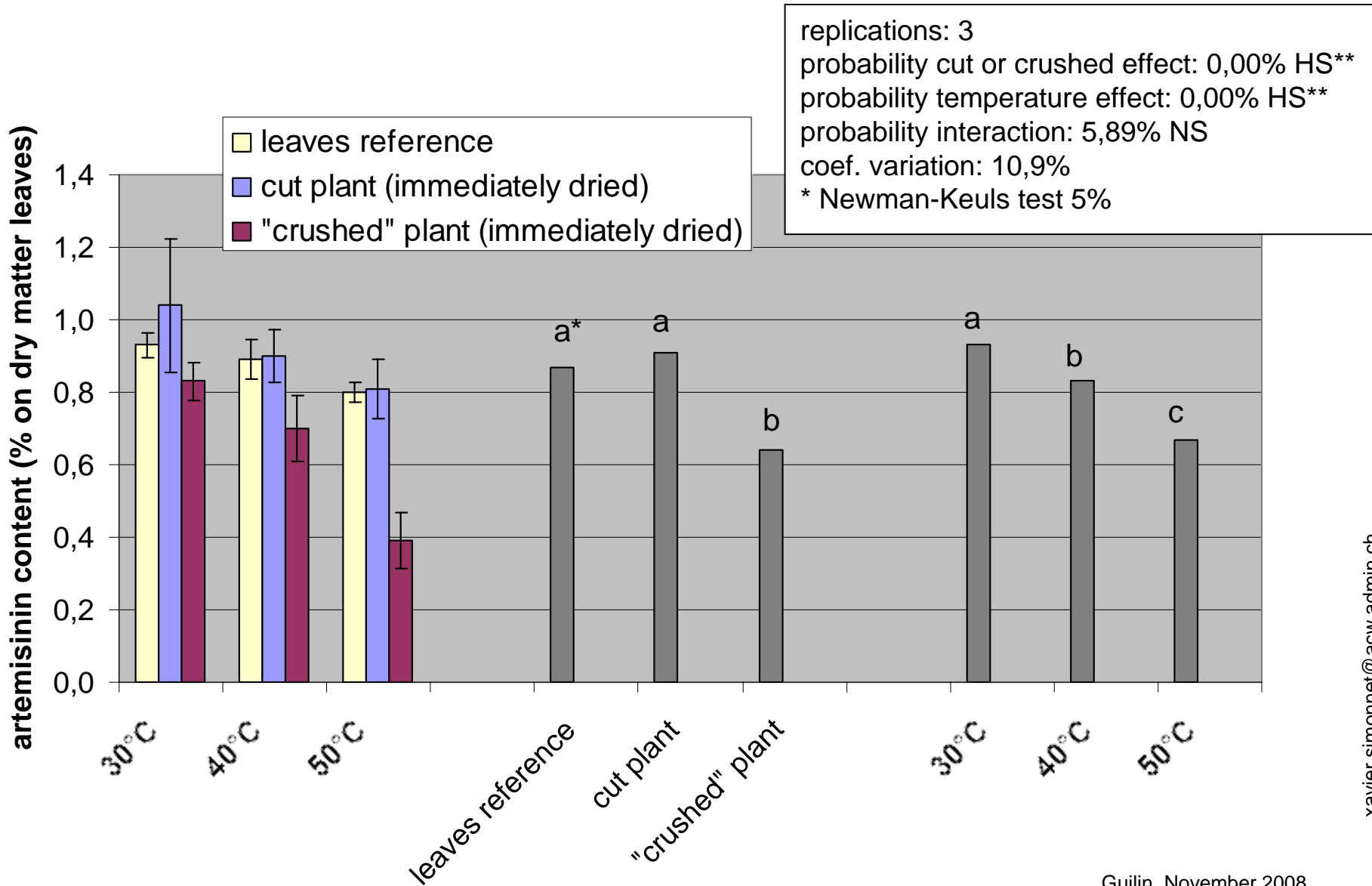
X: 78,2% moisture content (leaves)
 Y: 71,7% moisture content (leaves)
 Z: 63,7% moisture content (leaves)
 W: 45,4% moisture content (leaves)

replications: 3
 probability temperature effect: 0,00% HS**
 probability moisture content effect: 48,49% NS
 probability interaction: 48,54% NS
 coef. variation: 10,0%
 * Newman-Keuls test 5%

artemisinin content (% on dry matter leaves)

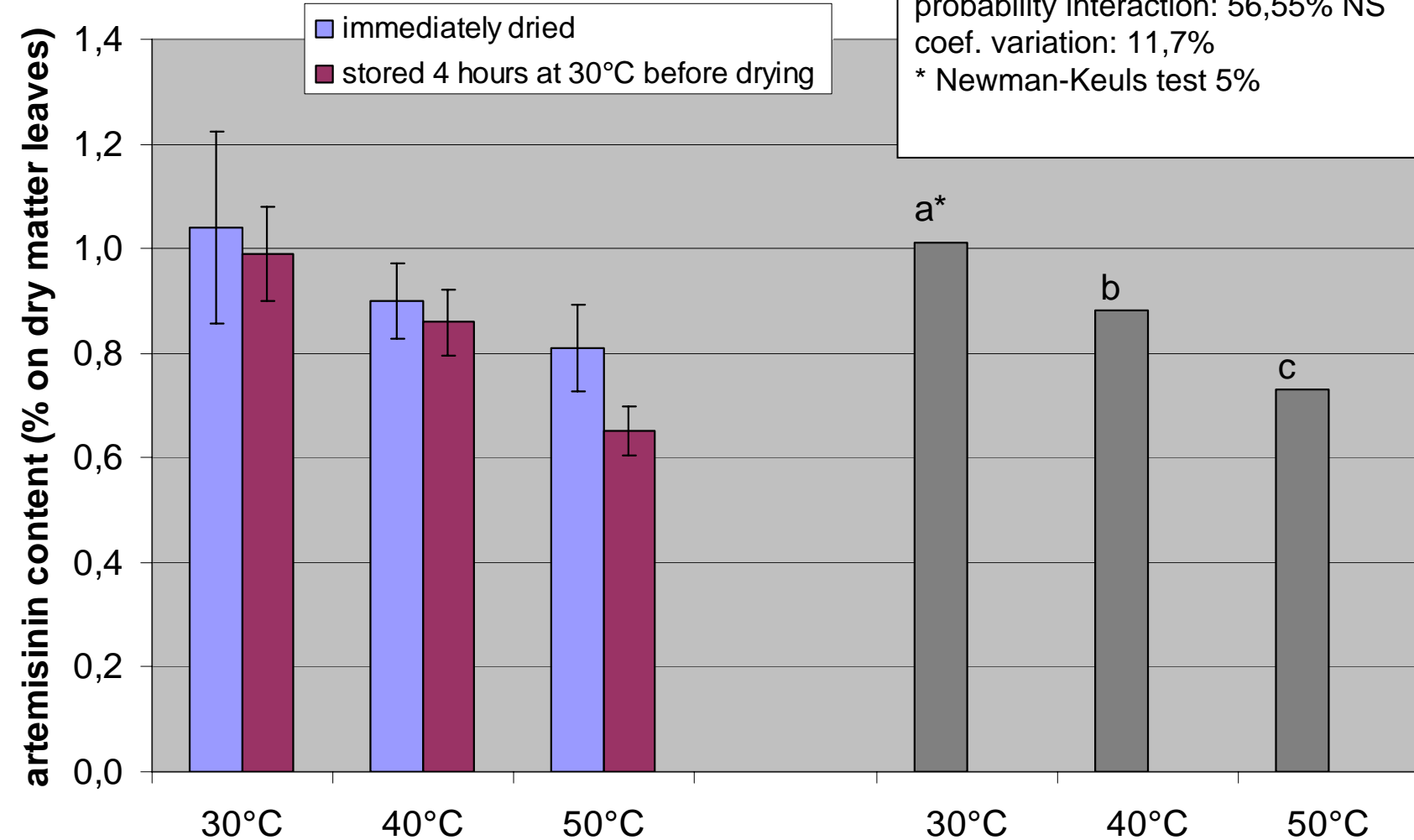


Entire plant - cut or «crushed» * different temperatures

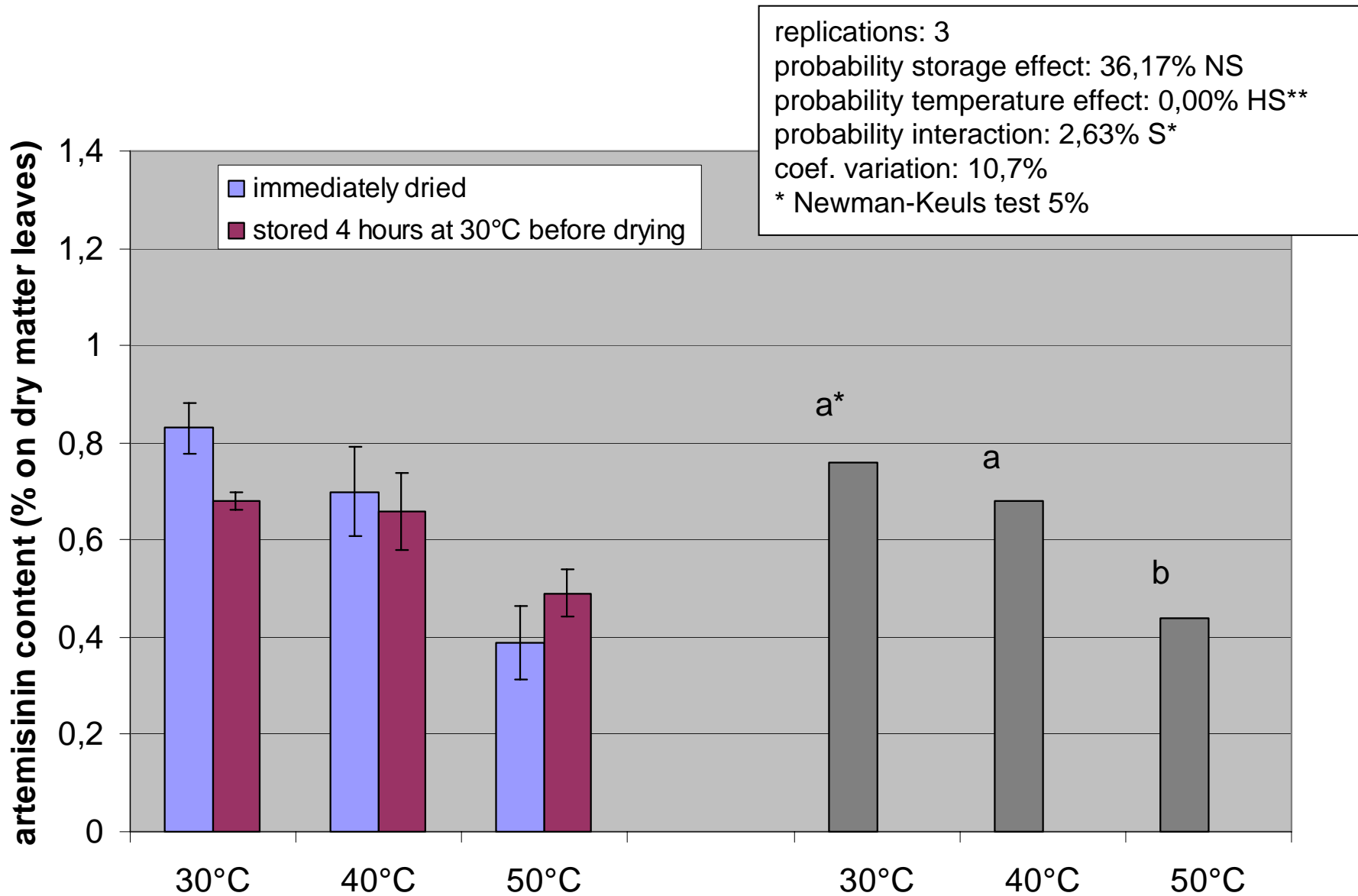


Entire cut plant - storage or not * different temperatures

replications: 3
 probability storage effect: 11,07% NS
 probability temperature effect: 0,19% HS**
 probability interaction: 56,55% NS
 coef. variation: 11,7%
 * Newman-Keuls test 5%



Entire «crushed» plant - storage or not * different temperatures



2-Effect of temperatures during the storage on the artemisinin content

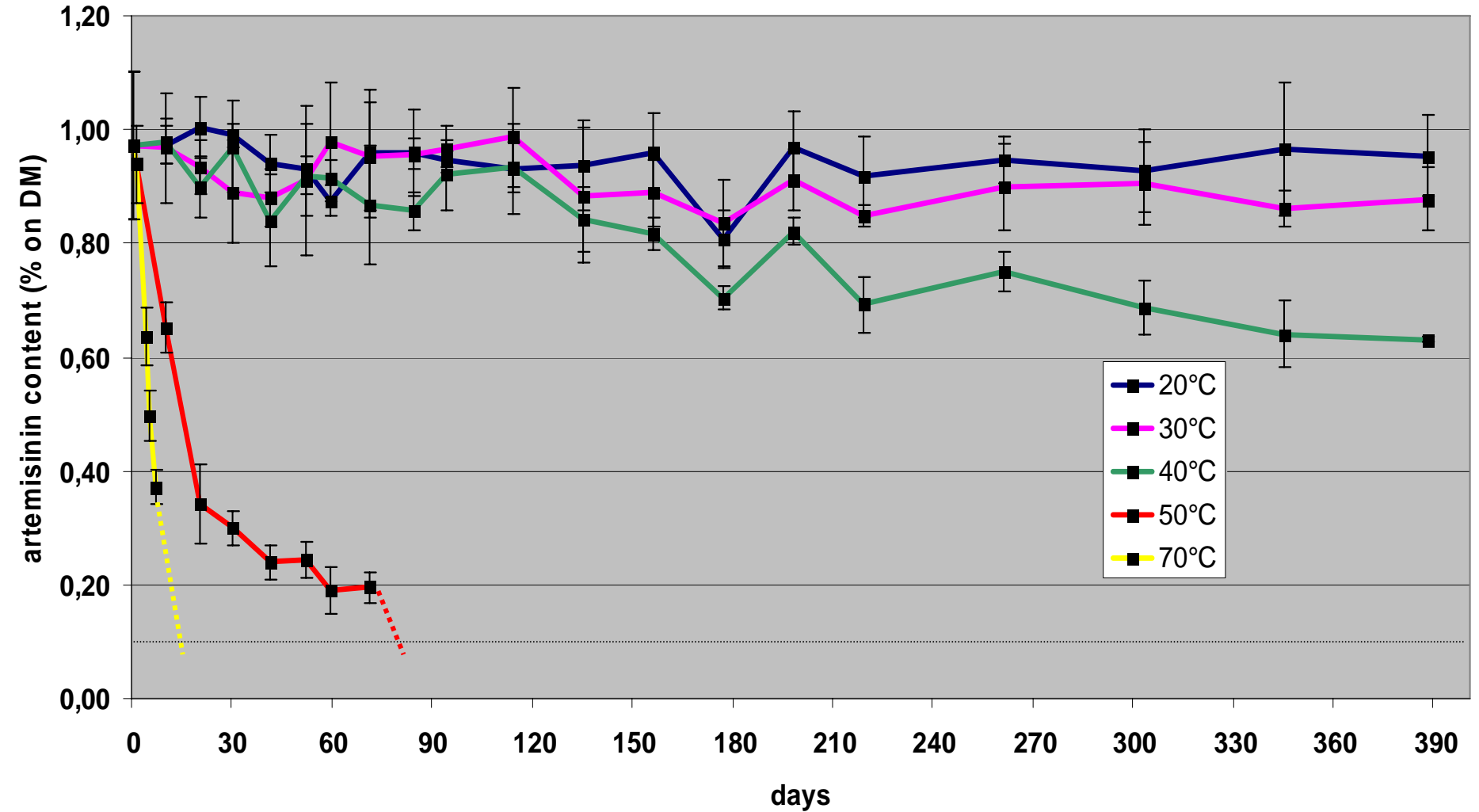
21- Leaves, storage at constant temperatures 20, 30, 40, 50 or 70°C

22- Powder (<0,5 mm), storage at constant temperatures 20, 30, 40, 50 or 70°C

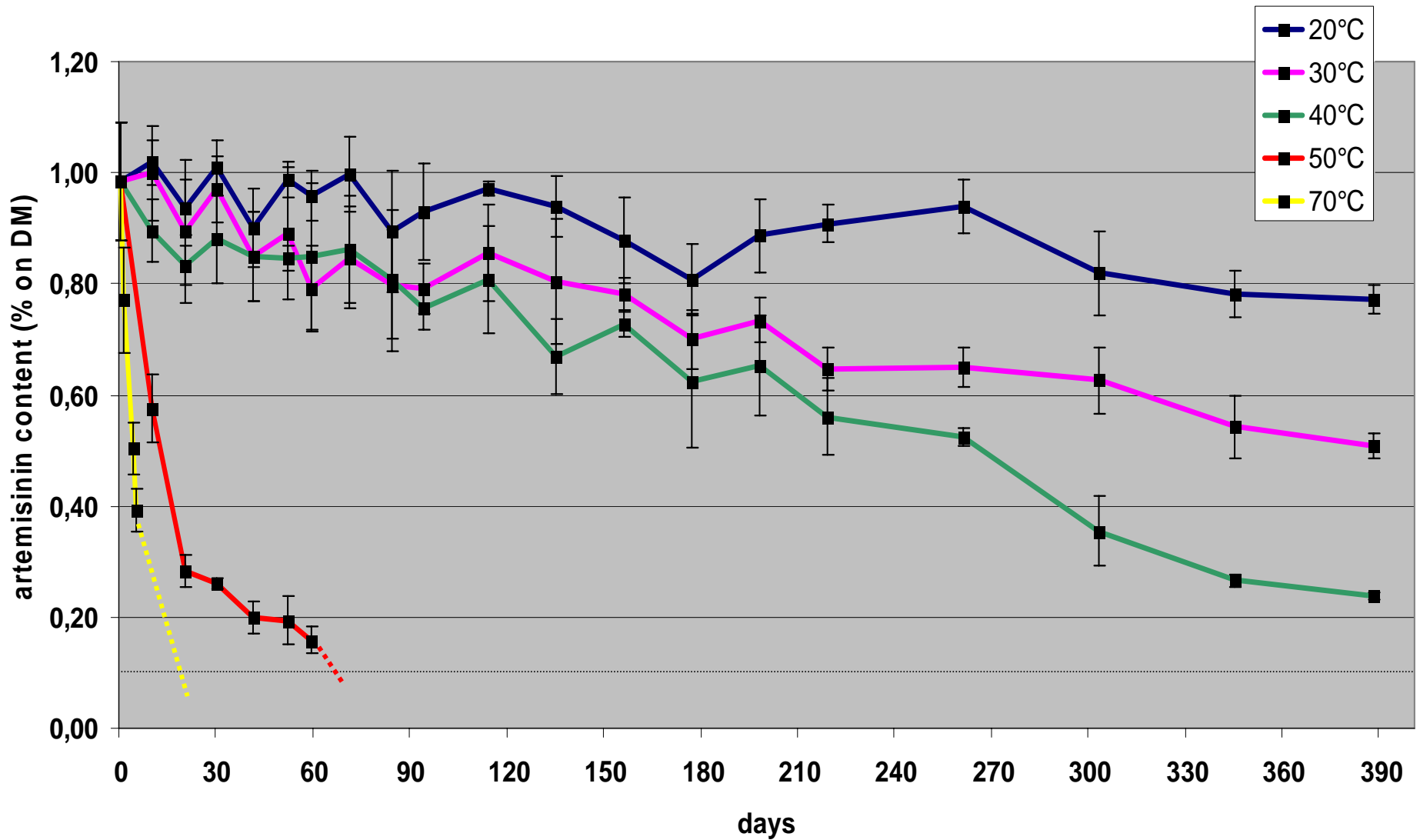
- *Artemisia annua* produced by Médiplant
- Storage in incubators (RH=30% maxi)
- Sampling every 10, 20, 40 days (1 year)
- Moisture content analysis (oven 105°C)
- Artemisinin content analysis (TLC + densitometer)
- 4 replications



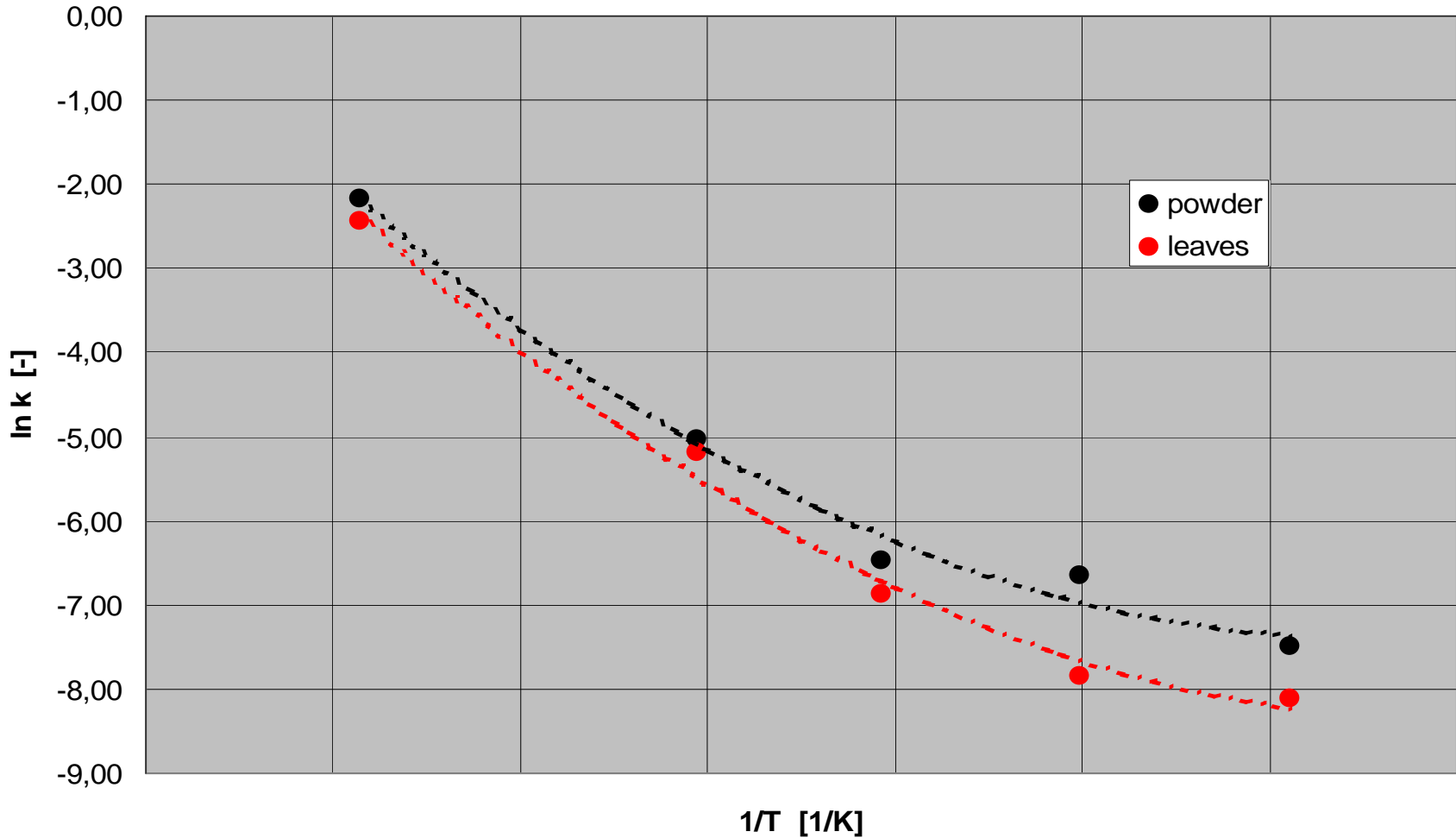
Dry leaves - storage at constant temperature



Dry powder - storage at constant temperature



Estimation of the activation energy



The activation energy changes with the temperature and there off involves a diffusion depending transformation

Conclusions:

- 1- Don't use temperatures higher than 30-40°C (leaves or entire plants);**
- 2- No interaction between leaves moisture content and drying temperatures;**
- 3- Avoid to damage leaf structure before the drying;**
- 4- A low drying process (open field, 20°C, ...) is not a problem; in some case it could increase the artemisinin content;**

5- Too high temperatures during the transport and storage could affect quickly the artemisinin content;

6- Stored dry leaves at temperatures below 40°C (maxi 30°C for a long period)

7- Leaves powder are very sensitive even to low temperatures

Coming ...

1- Leaves and powder storage at RH=85%

2- Light effect during the drying

3- On farm trials