

Aroma compounds of flue-cured tobacco in Baoshan geographical distribution and relation to climate and geographical factors

Yang Panpan

E-mail:yangpanpan@reascend.com

Yunnan Reascend Tobacco Technology (Group) Co., Ltd.



云南瑞升烟草技术(集团)有限公司
YUNNAN REASCEND TOBACCO TECHNOLOGY (GROUP) CO.,LTD.

- ◆ Background
- ◆ Objective
- ◆ Materials and Methods
- ◆ Results and Conclusions

Why
aroma compounds
of flue-cured tobacco
are our research topic?

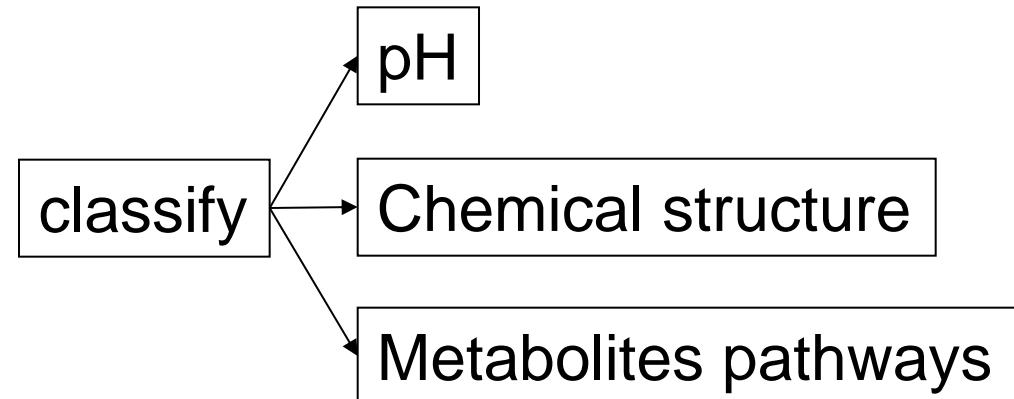
“a very important factor for appraising tobacco quality and commercial value”

“The kinds and content aroma components of flue-cured tobacco”

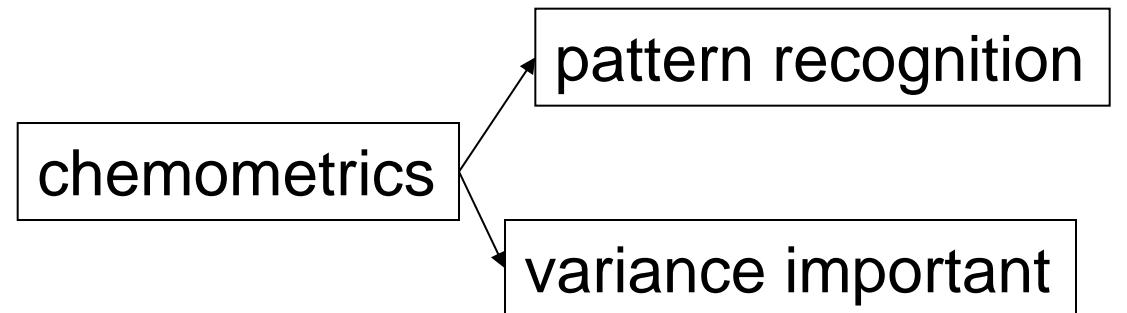
How to test them?

GC;GC-MS etc

D. L. Roberts



FCT leaf contains 58 aroma components

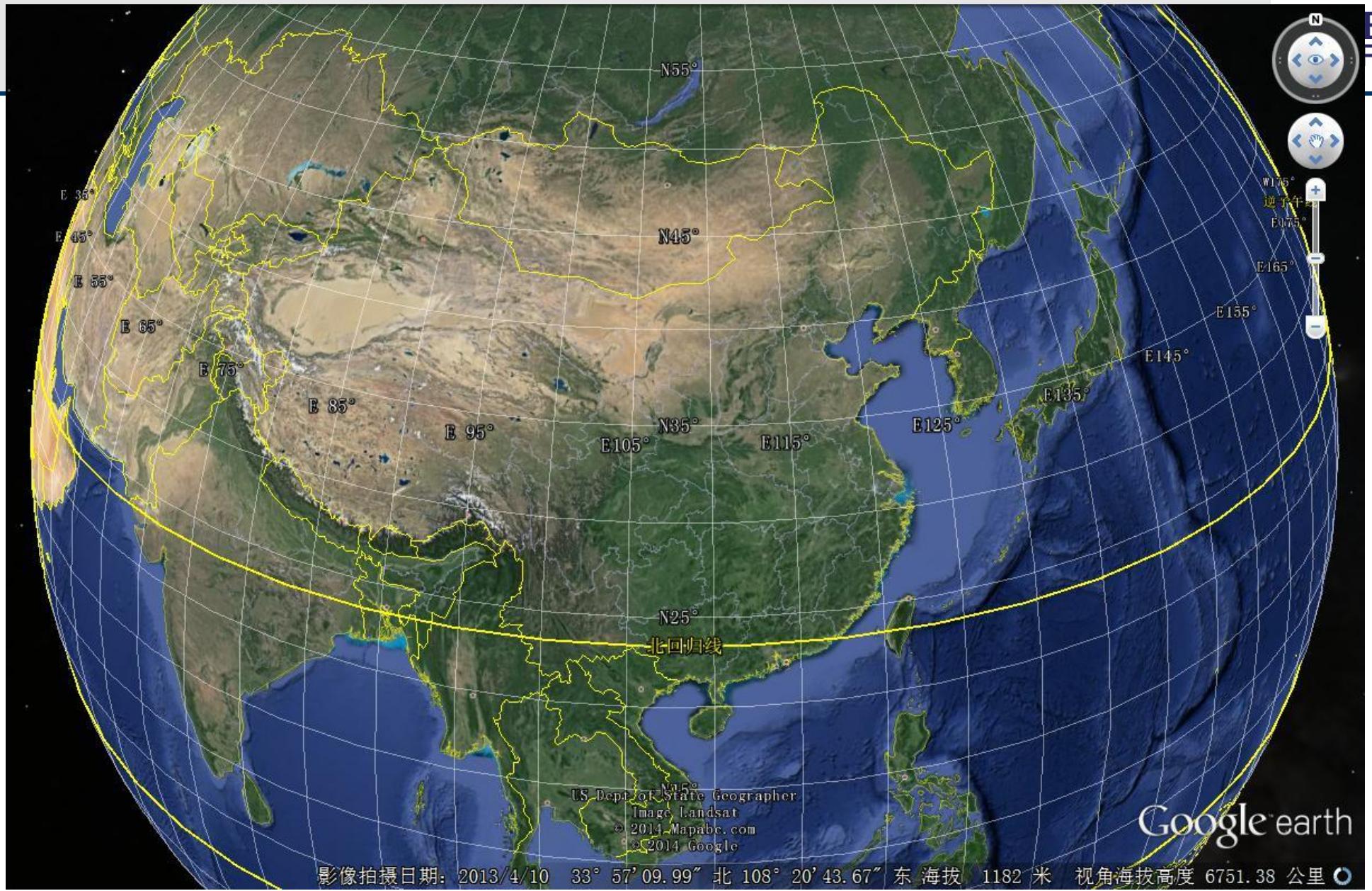


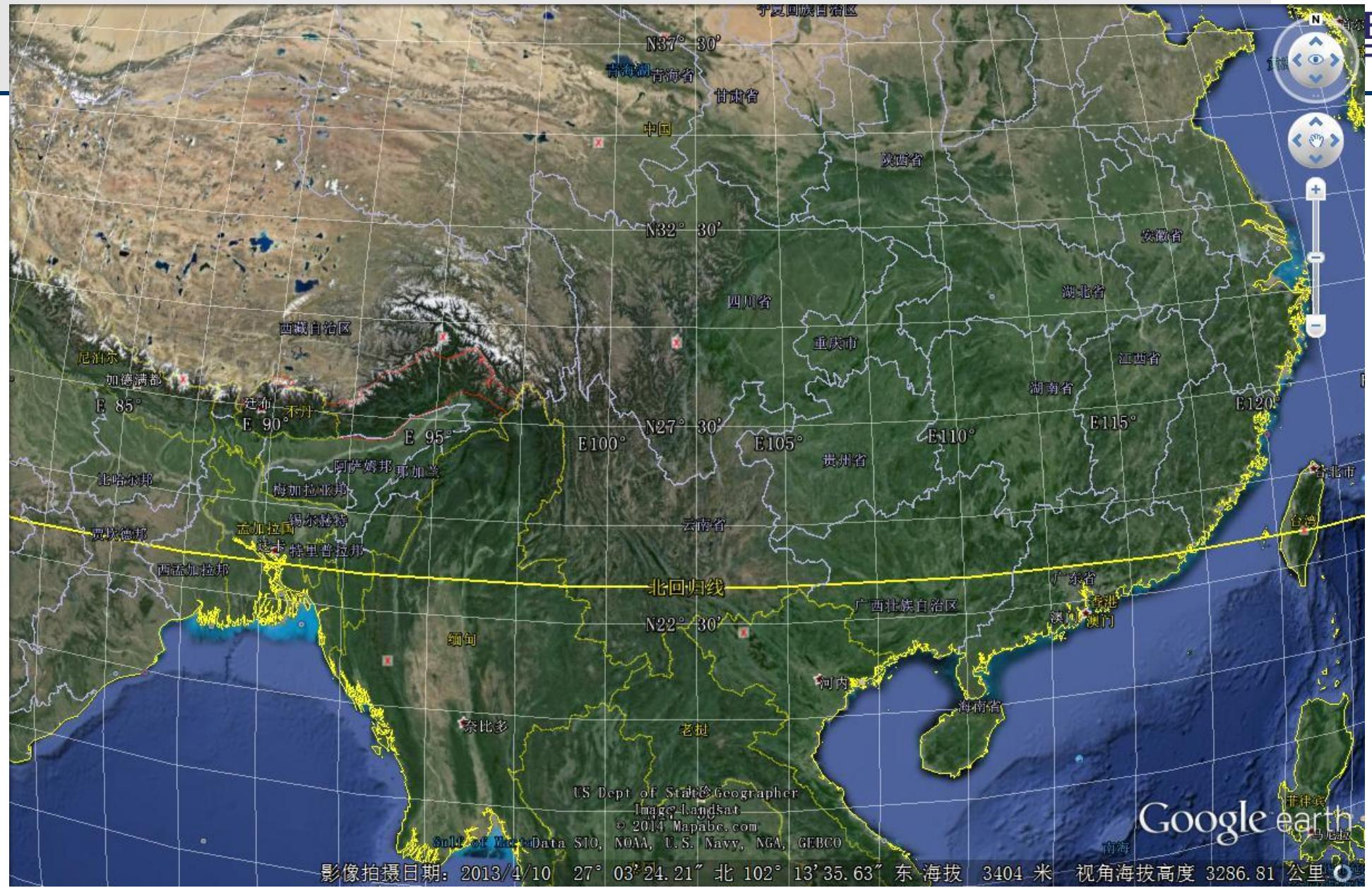
The kinds and content
aroma components of
flue-cured tobacco

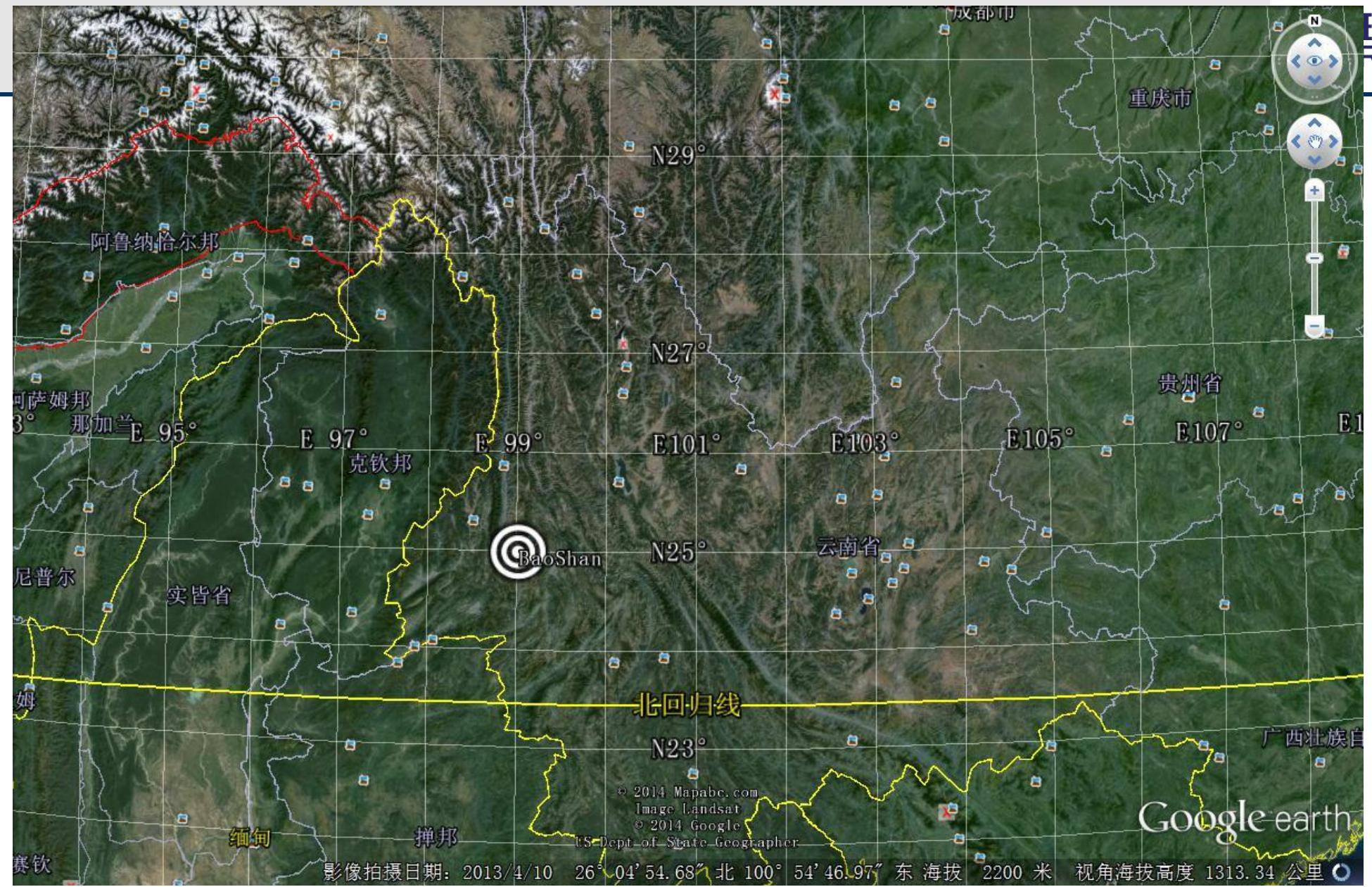
- 1 climatic variables
(mean, minimum and maximum
temperatures, rainfall, relative humidity, and
sunshine hours)
- 2 geography factors
(altitude; soil environments and so on)
- 3 planting and cultivation custom
- 4 variety(DNA)

Where is Baoshan?

Feature of its geographical distribution and climate factors







Background



Altitude: 535m-3780.9m
Air temperature: 8.2 °C -21°C
Total rainfall: 700mm-2100mm
Mountain land: 91.79%

“A mountain at four seasons,
ten miles in different weather”

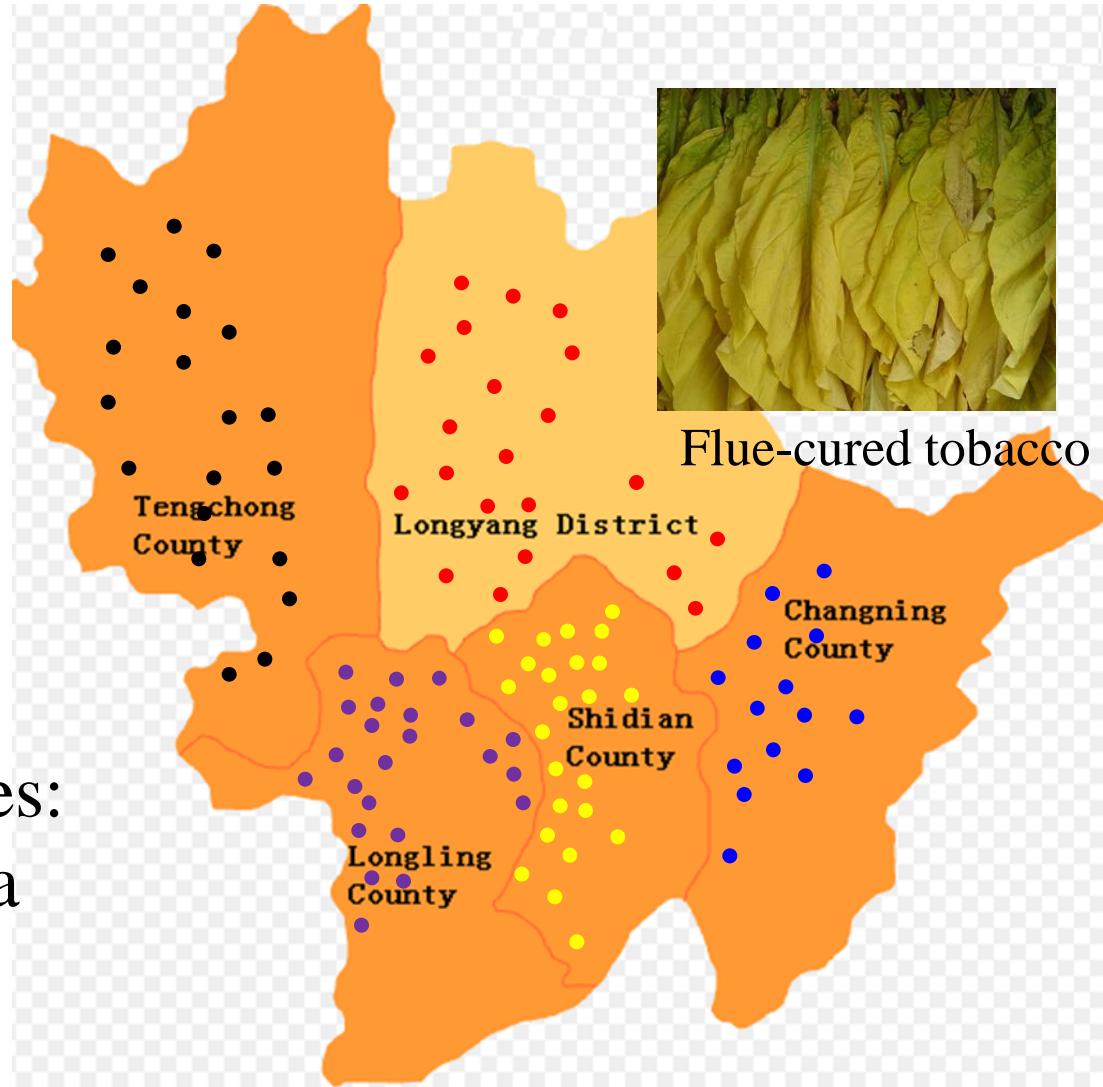
Typical three-dimensional climate

The kingdom of tobacco

What is the relationship between the aroma compounds of flue-cured tobacco and climate and geographical factors?

Materials and Methods

Varieties:
Hongda
Yun87
K326



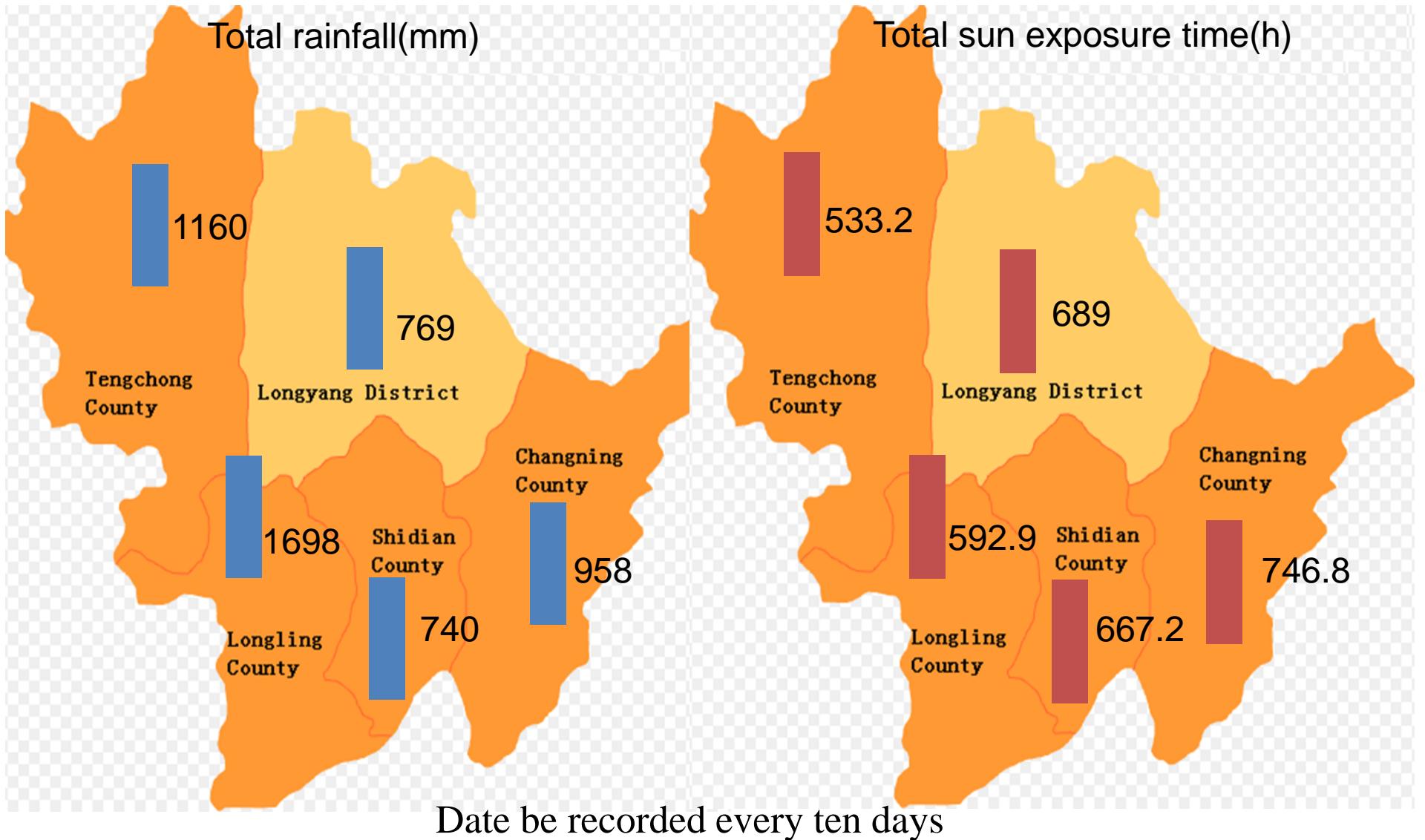
Sample Preparation for GC- MS Analysis



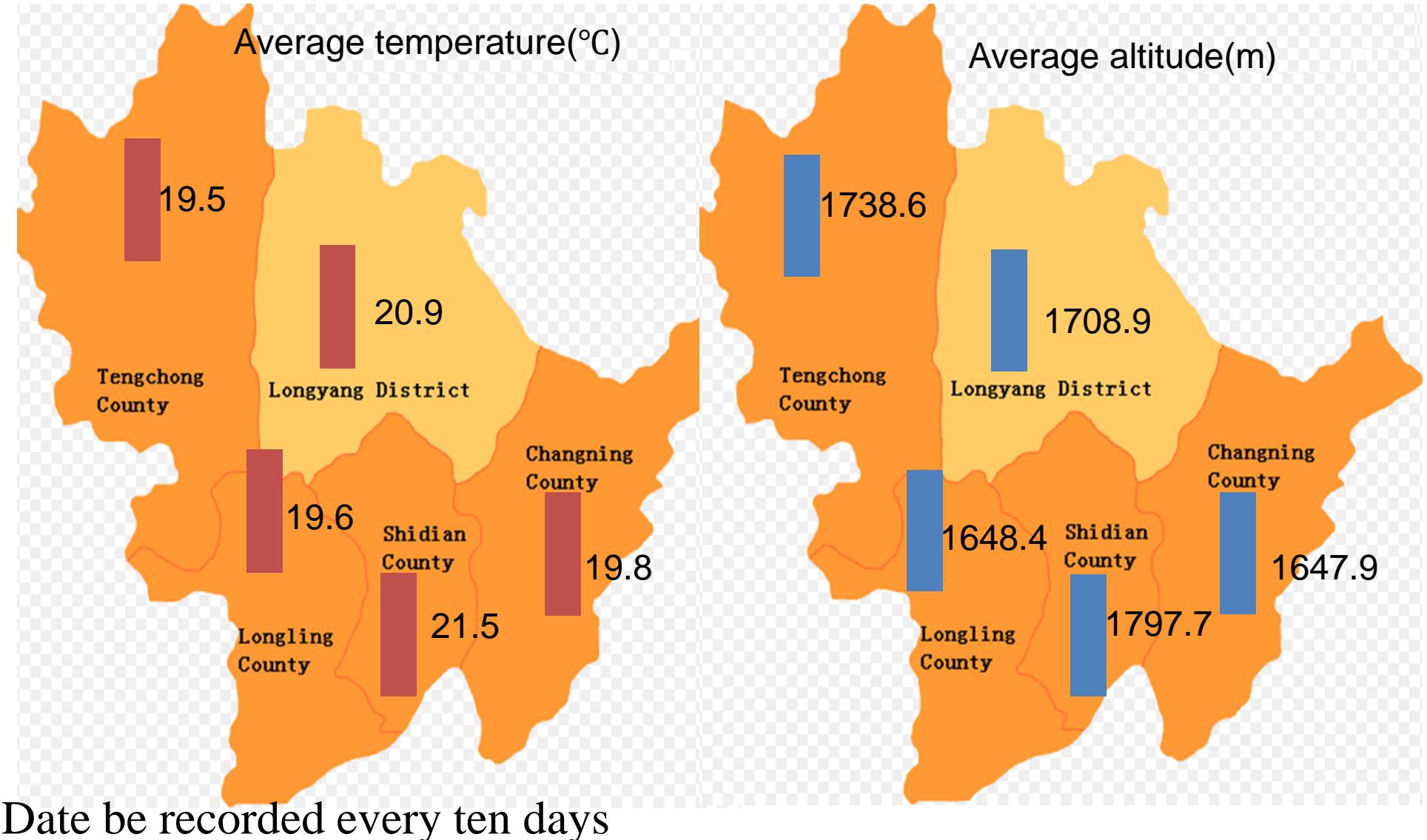
GC-MS Analysis



Materials and Methods

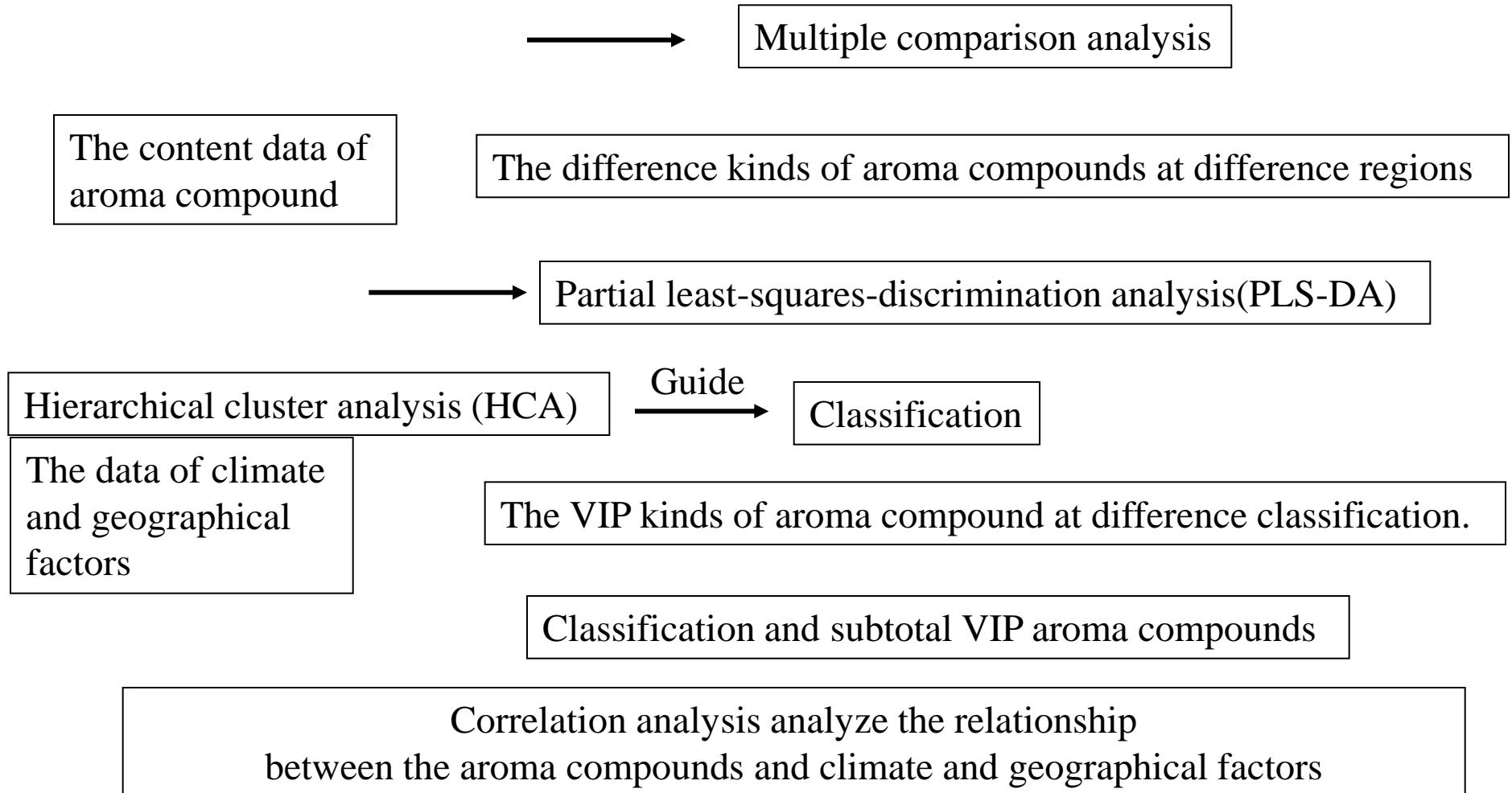


Materials and Methods



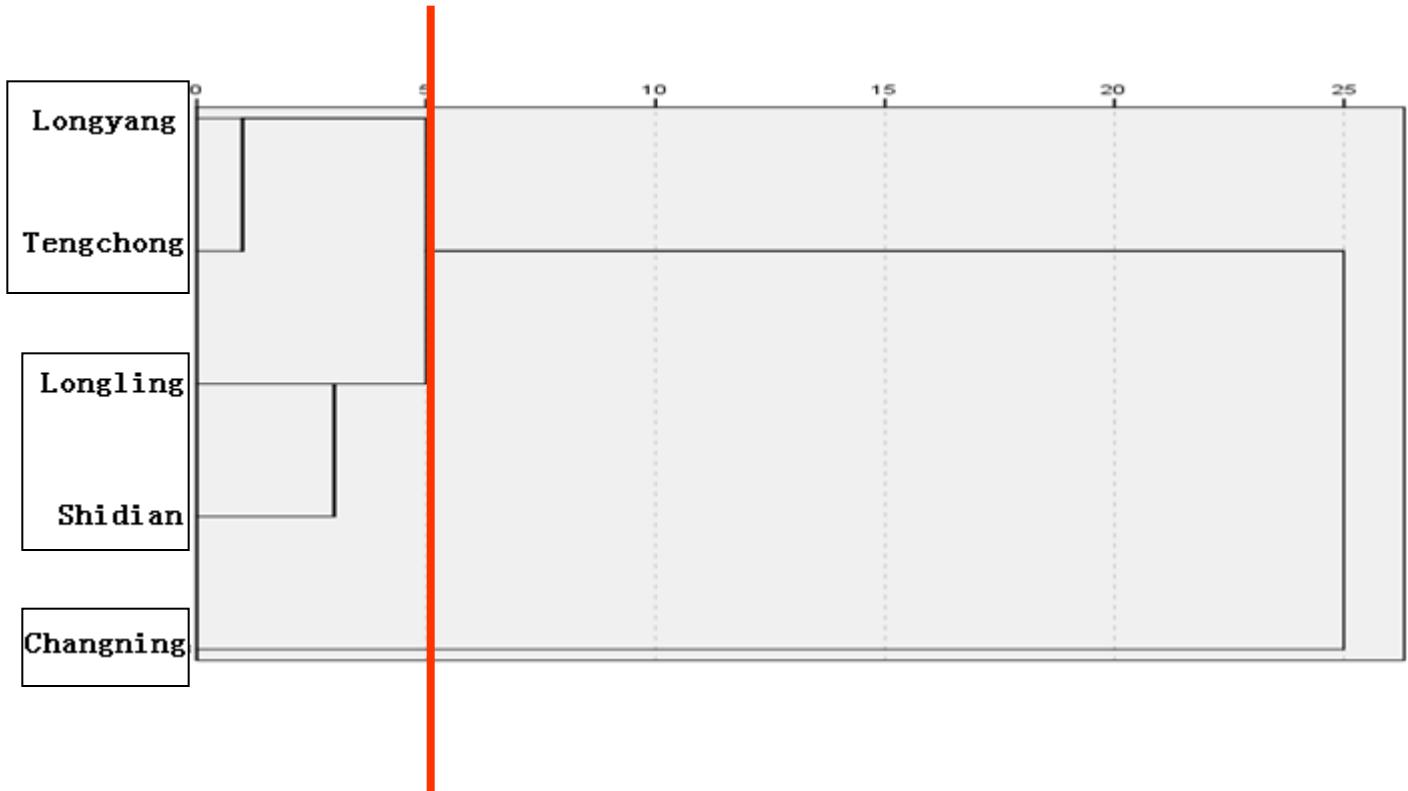
Materials and Methods

Logical map of chemometrics analysis:

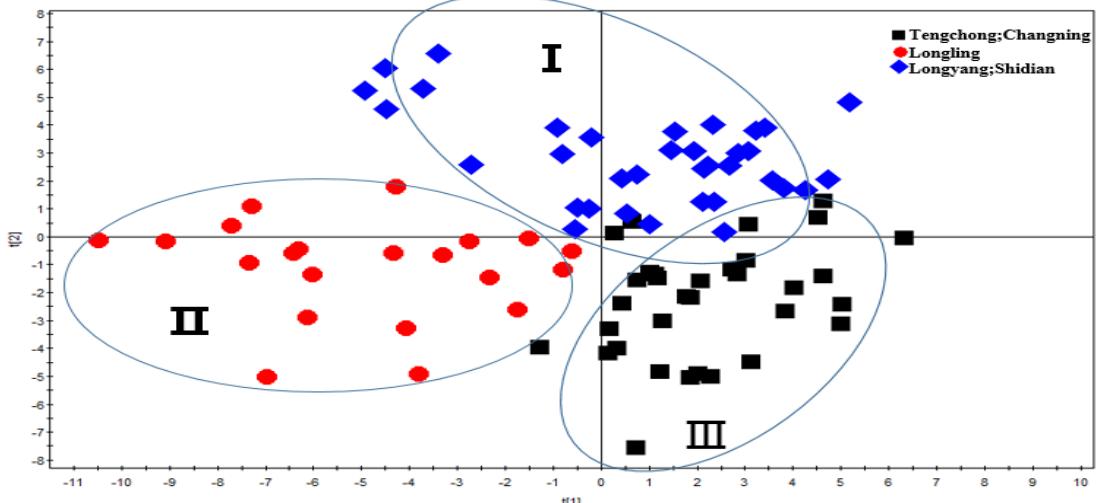


Results and Discussion

Hierarchical cluster analysis (HCA) Climate and geographical factors



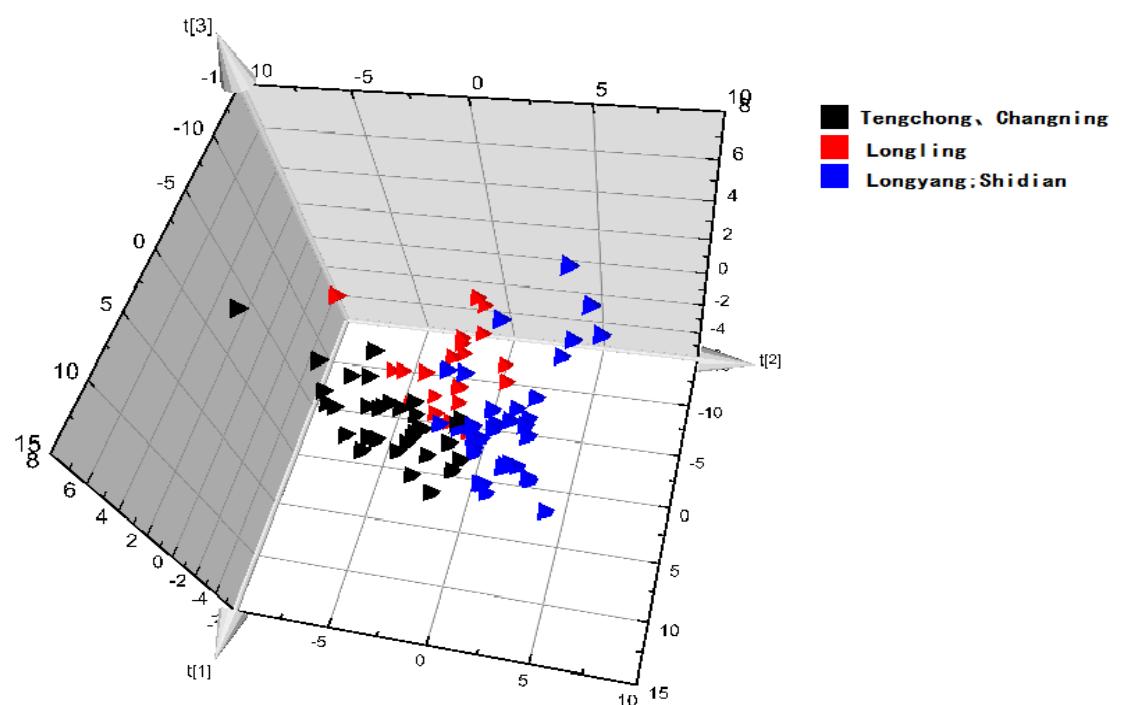
Results and Conclusions



The score of first and second compound of PLS-DA

The result of
Multiple comparison analysis
71 kinds of aroma compounds had
been test from the tobacco

67 kinds of aroma compounds for
PLS-DA
The result of PLS-DA



The score of first, second and third compound of PLS-DA

Results and Conclusions

The extraction factors of VIP used partial least square discriminant analysis (PLS-DA)

Aroma compounds	VIP	Aroma compounds	VIP
furoic acid	2	1-(3-Pyridyl)-ethyl ketone	1.57
β-damascenone	2	megastigmatrienone A	1.49
solanone	1.97	4-Methyl phenol	1.39
megastigmatrienone D	1.8	benzaldehyde	1.29
butylated hydroxytoluene	1.8	1-(1H-pyrrole-2-)-ethyl ketone	1.25
phenethyl alcohol	1.76	benzpyrole	1.24
β-dihydrogen malaysia ketone	1.75	2,3-dihydro coumarone	1.15
megastigmatrienone B	1.74	dihydroactinidiolide	1.15
3-Methyl-2-butene aldehyde	1.73	3-oxygen generation-α-violet alcohol	1.14
2-pyridylaldehyde	1.67	phenylacetaldehyde	1.14
megastigmatrienone C	1.61	pelargonaldehyde	1.13
β-ionone	1.57	geranylacetone	1.11

Results and Conclusions

The string classification and subtotal VIP aroma compounds

the total of lutein degradation products
(β - ionone, β -Dihydrogen malaysia ketone,Dihydroactinidiolide)

the total of β -carotene
(β - Damascenone,3 - Oxygen generation - α - violet alcohol,
Megastigmatrienone A,Megastigmatrienone B,Megastigmatrienone C,Megastigmatrienone D)

the total of isomers Megastigmatrienone
(Megastigmatrienone A,Megastigmatrienone B,Megastigmatrienone C,Megastigmatrienone D)

the total of volatile alcohols
(Phenethyl Alcohol)

the total of volatile aldehydes
(3 - Methyl - 2 – butene aldehyde,2 - pyridylaldehyde,Pelargonialdehyde,Benzaldehyde,Phenylacetaldehyde)

the total of volatile ketones(1-(1H-pyrrole-2-)-ethyl ketone)

the total of self-volatile ketones(Solanone,Geranylacetone)

the total of heterocyclic(Benzpyrole,2, 3 - Dihydro coumarone)

Furoic acid

Butylated Hydroxytoluene

1 - (3 -Pyridyl) - ethyl ketone

4 - Methyl phenol

Results and Conclusions

The total aroma compounds in Changning, Longling Longyang, Shidian and Tengchong(VIP>1) ($\mu\text{g.g}^{-1}$)

content of compounds	Changning	Longling	Longyang	Shidian	Tengchong
the total of lutein degradation products (β - ionone, β -Dihydrogen malaysian ketone,Dihydroactinidiolide)	12.323	18.349	10.996	12.036	12.85
the total of β -carotene (β - Damascenone,3 - Oxygen generation - α - violet alcohol,Megastigmatrienone A,Megastigmatrienone B,Megastigmatrienone C,Megastigmatrienone D)	3.632	5.042	3.359	4.615	3.229
the total of isomers Megastigmatrienone (Megastigmatrienone A,Megastigmatrienone B,Megastigmatrienone C,Megastigmatrienone D)	9.166	13.766	7.493	8.135	9.916
the total of volatile alcohols(Phenethyl Alcohol)	2.317	3.317	2.159	1.949	2.267
the total of volatile aldehydes (3 - Methyl - 2 – butene aldehyde,2 - pyridylaldehyde,Pelargonaldehyde,Benzaldehyde,Phenylacetaldehyde)	2.915	4.26	2.768	2.929	2.856
the total of volatile ketones (1-(1H-pyrrole-2-)ethyl ketone)	0.713	0.843	0.483	0.54	0.518
the total of self-volatile ketones(Solanone,Geranylacetone)	9.996	18.238	9.946	12.452	7.435
the total of heterocyclic(Benzpyrole,2, 3 - Dihydro coumarone)	0.563	0.722	0.512	0.545	0.54
Furoic acid	0.194	0.313	0.17	0.233	0.186
Butylated Hydroxytoluene	0.172	0.373	0.155	0.267	0.141
1 - (3 -Pyridyl) - ethyl ketone	0.12	0.158	0.096	0.149	0.093
4 - Methyl phenol	0.224	0.396	0.247	0.43	0.154

Results and Conclusions

The result of correlation analysis between the content of VIP aroma compounds and the data of total rainfall

	5-1rain	5-3rain	5-4rain	6-1rain	6-2rain	6-3rain	6-4rain	7-1rain	7-2rain	7-3rain	7-4rain	8-1rain	8-2rain	8-3rain	8-4rain
the total of lutein degradation products	0.977**	0.904*	0.917*		0.959**	0.972**	0.945*	0.947*	0.970**	0.927*	0.954*	0.897*	0.981**	0.978**	0.970**
the total of isomers Megastigmatrienone	0.983**	0.940*	0.947*	0.909*	0.980**	0.981**	0.980**	0.986**	0.993**	0.977**	0.991**	0.951*	0.982**	0.998**	0.994**
the total of volatile alcohols	0.901*				0.920*	0.949*	0.923*	0.944*	0.946*	0.937*	0.947*	0.940*	0.983**	0.951*	0.971**
the total of volatile aldehydes	0.925*				0.899*	0.929*		0.888*	0.920*		0.894*		0.961**	0.925*	0.926*
the total of volatile ketones								0.887*				0.907*			
the total of heterocyclic	0.934*				0.899*	0.922*	.884*	0.924*	0.953*	0.882*	0.925*		0.980**	0.939*	0.948*

Results and Conclusions



- 1 Feature of content of tobacco aroma compounds at Baoshan's different places had been summary.
- 2 Built a method to screen the kinds of compound which are sensitive to climate and geographical factors
- 3 71 kinds of aroma compounds had been test from the flue-cured tobacco.

Results and Conclusions

- 4 24 aroma compounds had been screened which are sensitive to climate and geographical factors by the VIP parameter.
- 5 The content of degradation products of lutein and β - carotenoid were increased with total sun exposure time and total rainfall. The kinds of megastigmatrienone and furoic acid are also obey this rule.
- 6 The total of lutein degradation products, isomers Megastigmatrienone, volatile alcohols, volatile aldehydes, volatile ketones and heterocyclic are sensitive to the total of rainfall.



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Thank You !



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