Effects of rational K application on vegetable yield and quality

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Outline

1 Significance of rational K application on vegetable

◆ At the same time of resolving the food gross, the quality of important food like vegetable arouses more and more social attention.

◆ Although K is not the composing element of plants ,K takes part in many metabolize in plants. K plays the role of activation in the forming progresses of protein and nucleic acid.

◆ K plays many important roles such as improving crop yield, quality and resistance, and so on.

◆ K is named "quality element" .

Research background

◆ Purpose：to make regulations of fertilization technique about no social effects of pollution vegetable

◆ Test time：2002--2005

◆ Test magnitude：more than 10 field tests

◆ Test content：relationship of vegetable yield and quality and K rate and varieties.

◆ To research effects of rational K application on vegetable yield and quality on the basis of using N and P.

2 Effects of rational K application on vegetable yield

- **Effects of K application with N and P on**
  - ◆ Cabbage yield
  - ◆ K application and balsam pear yield
  - ◆ K application and bean yield
  - ◆ K application and eggplant yield
  - ◆ K application and winter potato yield

2.1 K application rate and cabbage yield
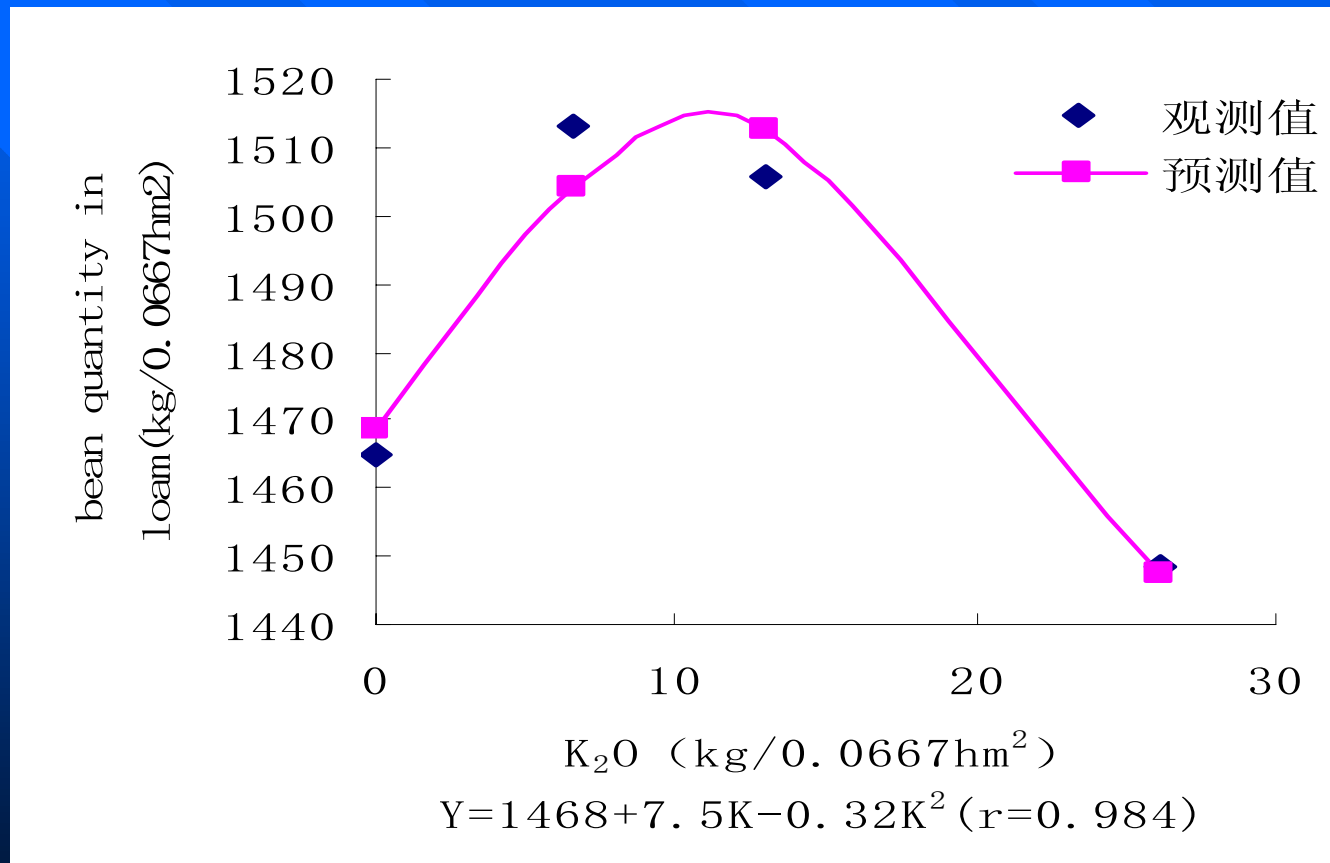

K2O(kg/0.067hm2)

Y=993+147X−7.4K2(r=0.950)
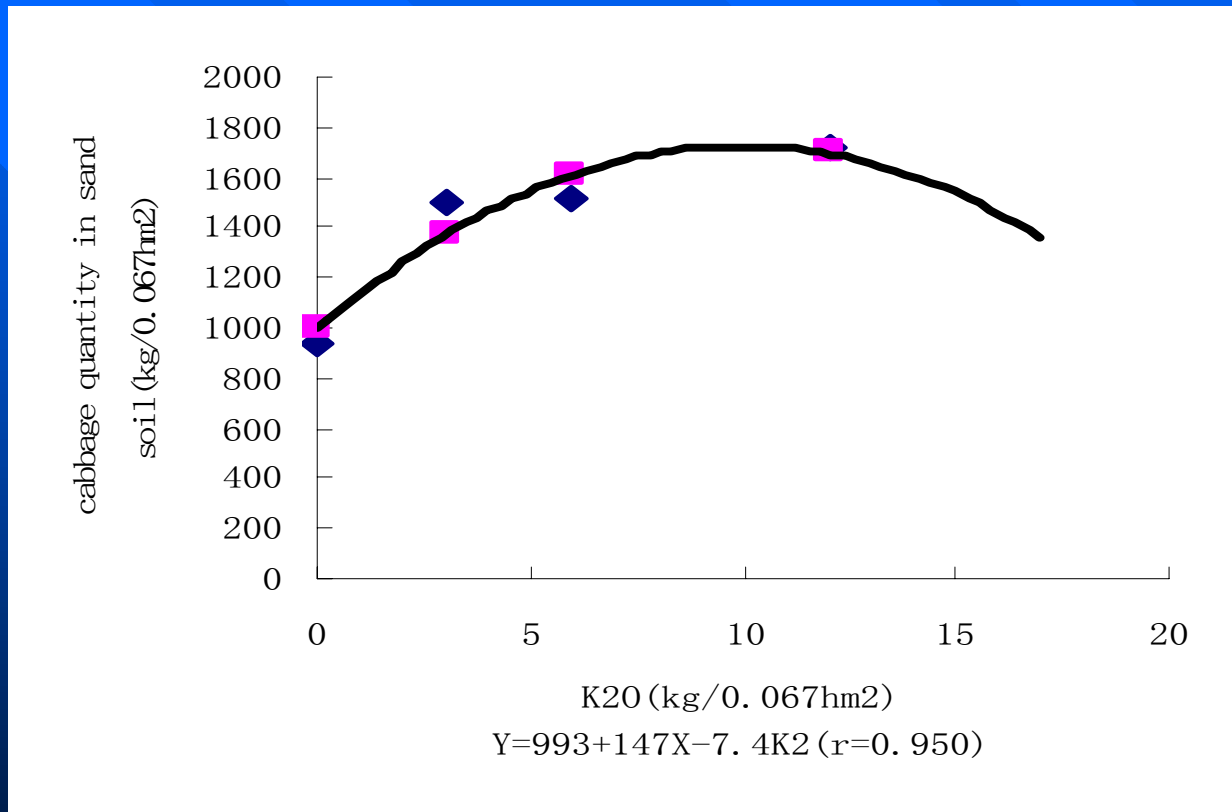
The quadratic regression relationship of K rate and cabbage yield indicates that more than appropriate K application will reduce vegetable yield.

2.2 K application rate and balsam pear yield
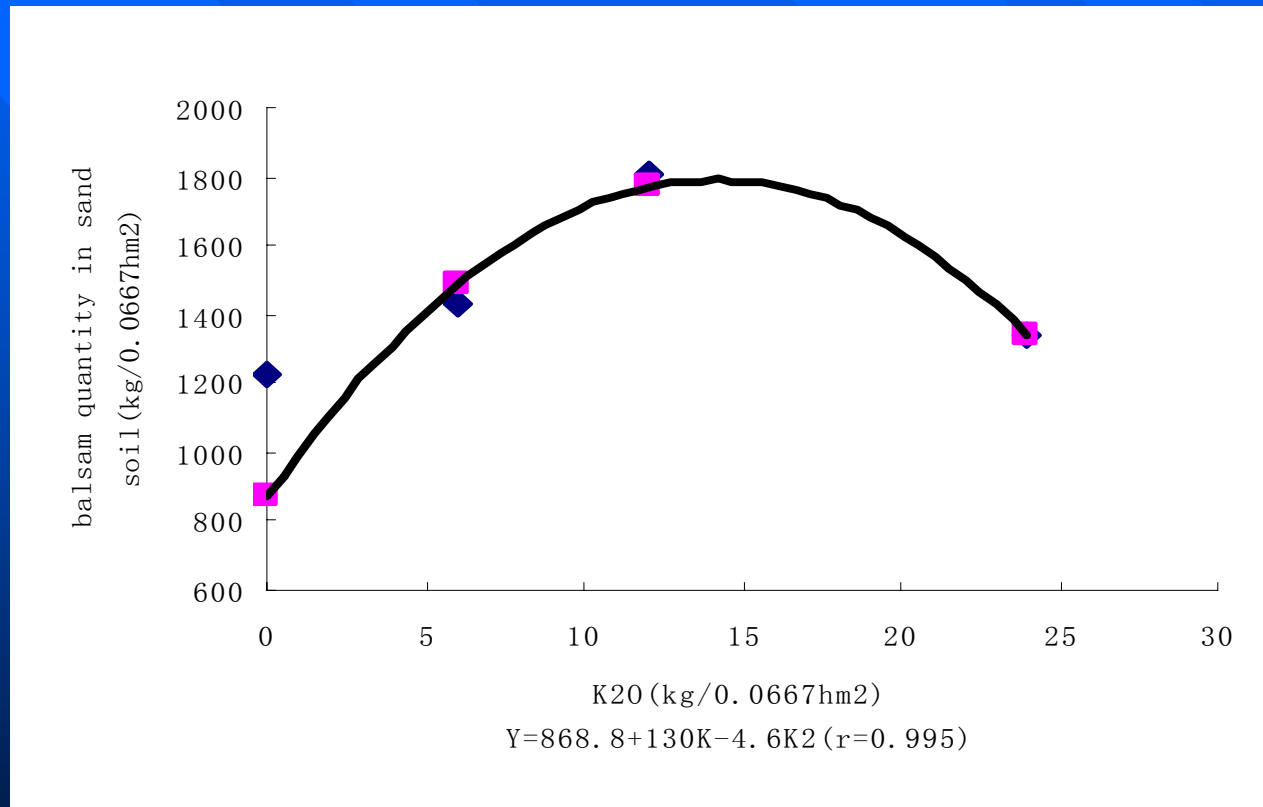
■ The same effects with cabbage

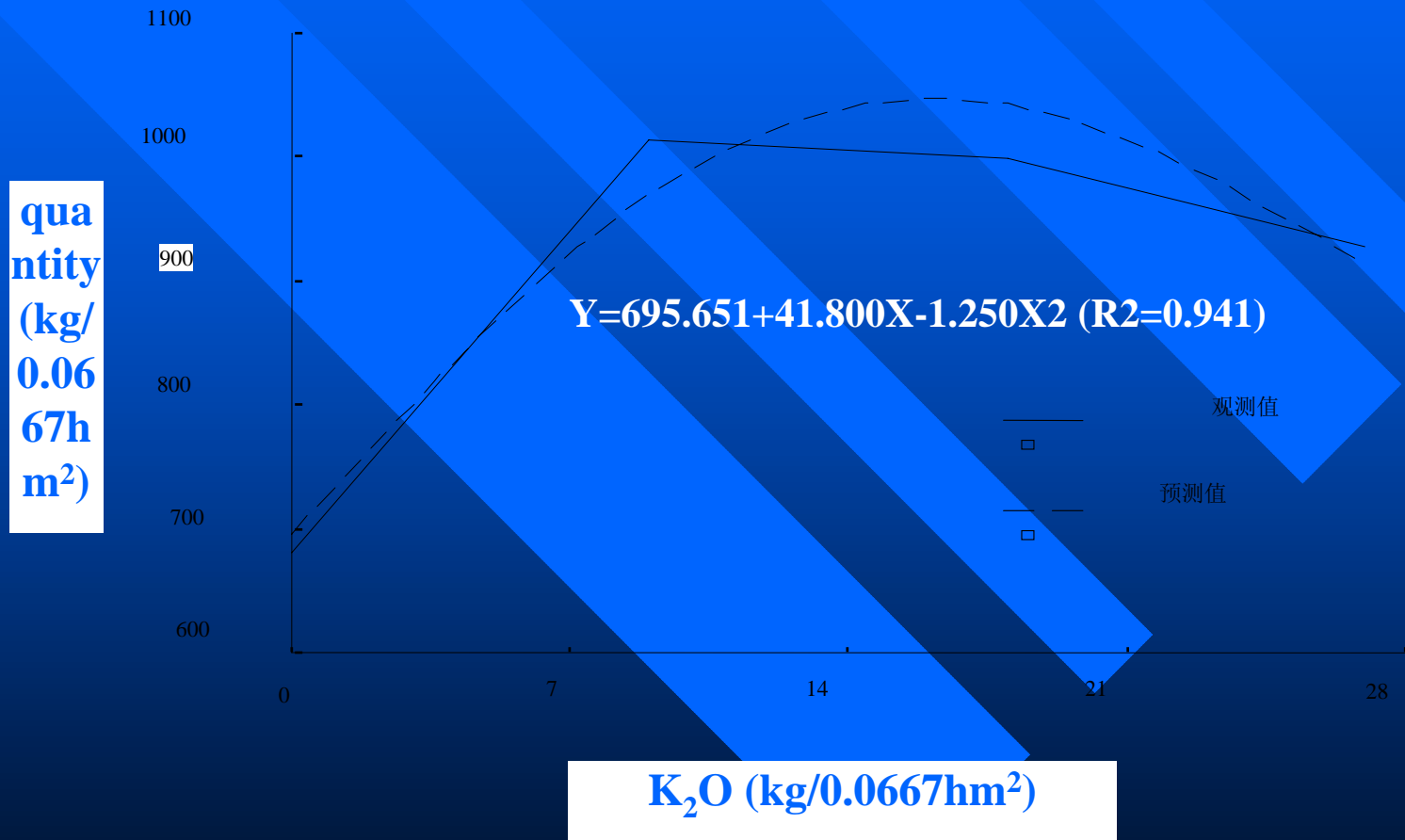# 2.3 K application rate and bean yield

The same effects with cabbage

2.4 K application rate and eggplant yield

$Y=695.651+41.800X-1.250X2 \ (R2=0.941)$

观测值

预测值

quantity (kg/0.0667hm²)

K₂O (kg/0.0667hm²)

■ **The same effects with cabbage**

2.5 K application rate and winter potato yield

$$Y=527.886+54.4183X-1.4223\ X2\ (R2=0.857)$$

quantity (kg/0.0667hm²)

观测值

预测值

K_2O (kg/0.0667hm²)
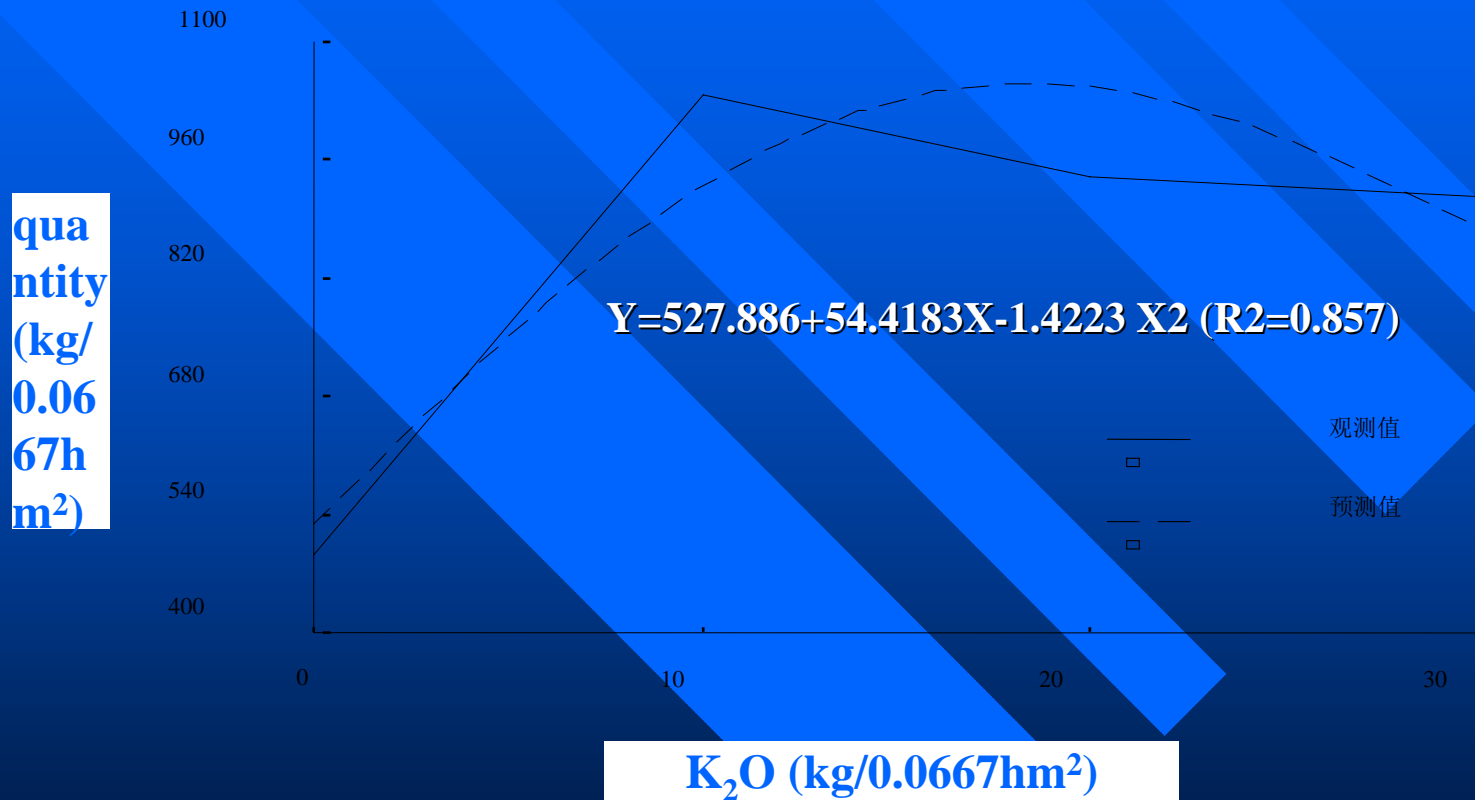
- **The same effects with cabbage**

3 Effects of rational K application rate on Vc content in vegetable

- **Effects of K application with N and P on**
  - ◆ K application rate and Vc content in cabbage
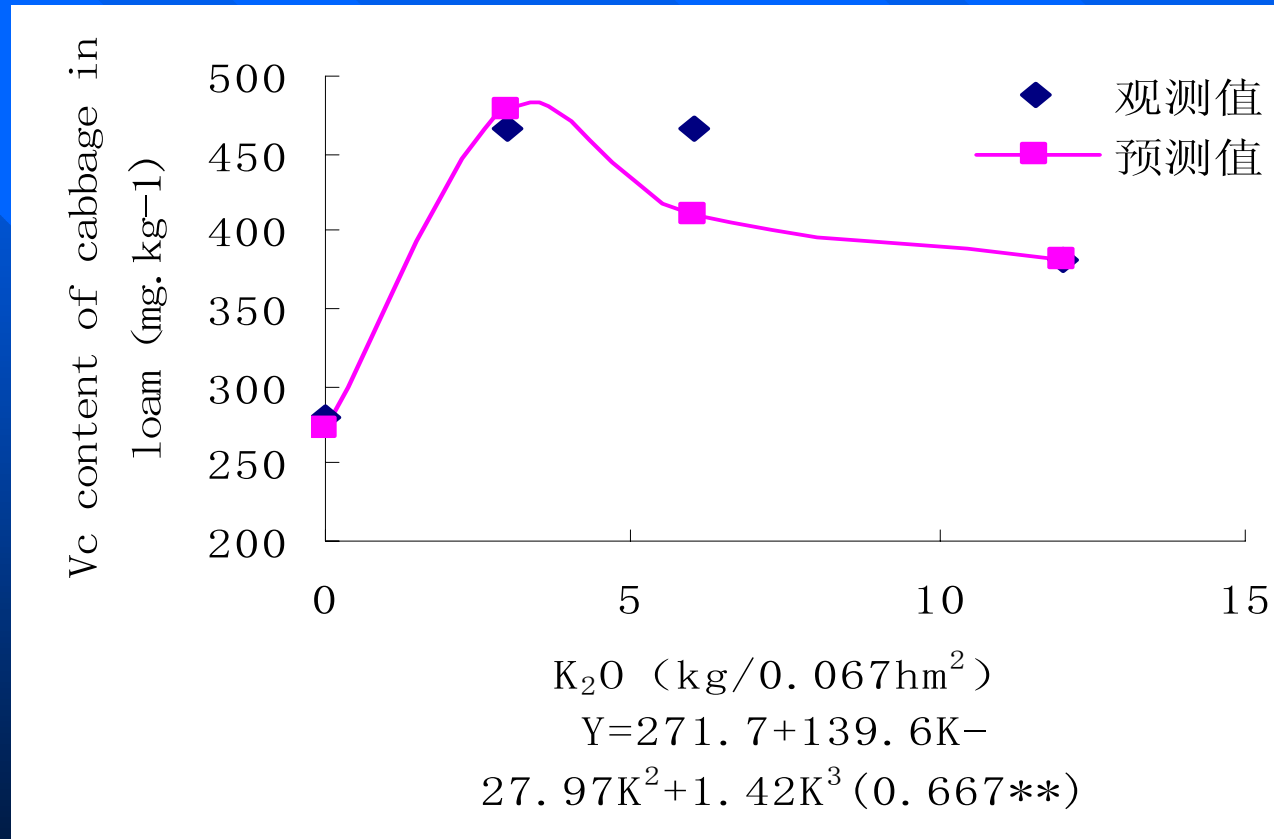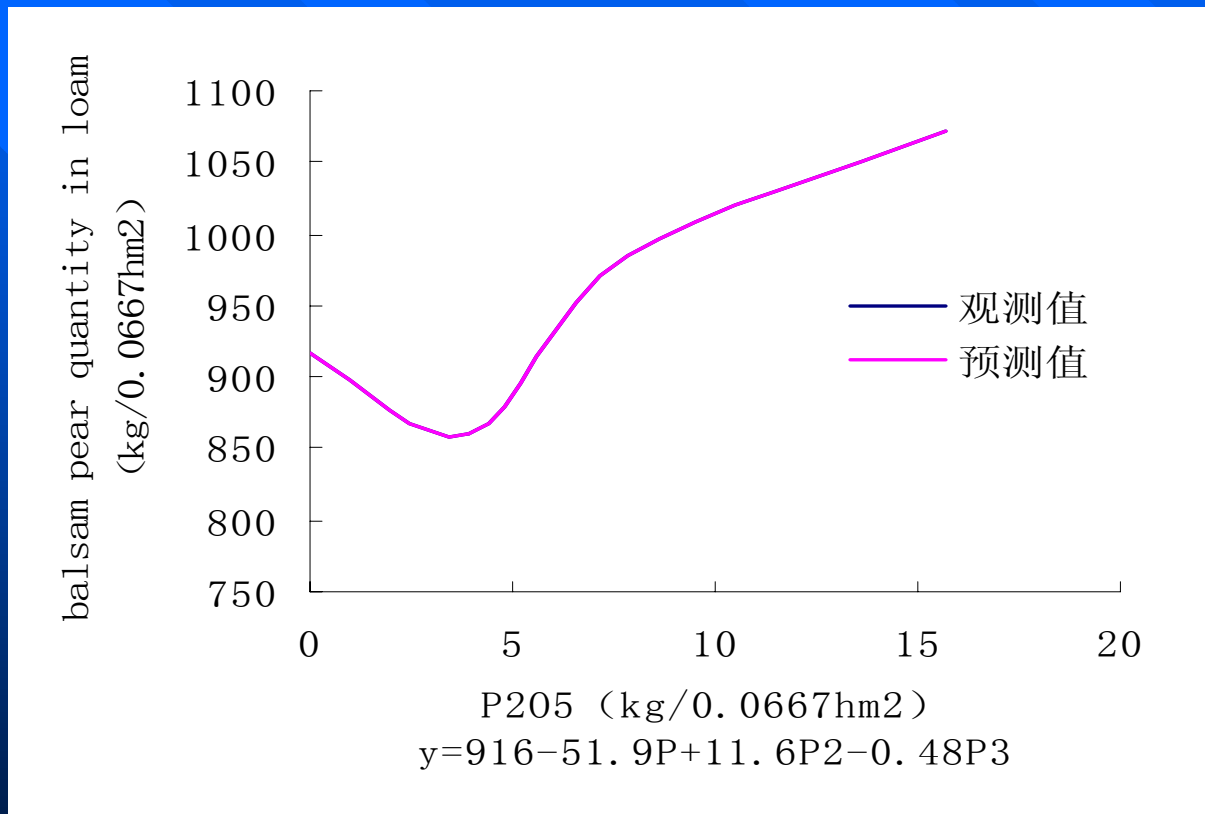 - ◆ K application rate and Vc content in balsam pear
  - ◆ K application rate and Vc content in bean
  - ◆ K application rate and Vc content in eggplant
  - ◆ K application rate and Vc content in winter potato

3.1 K application rate and Vc content in cabbage

Y-axis: Vc content of cabbage in loam (mg.kg-1)

X-axis: K_2O (kg/0.067hm^2)

Legend: 观测值 (◆), 预测值 (■)

$$Y=271.7+139.6K-27.97K^2+1.42K^3 (0.667**)$$

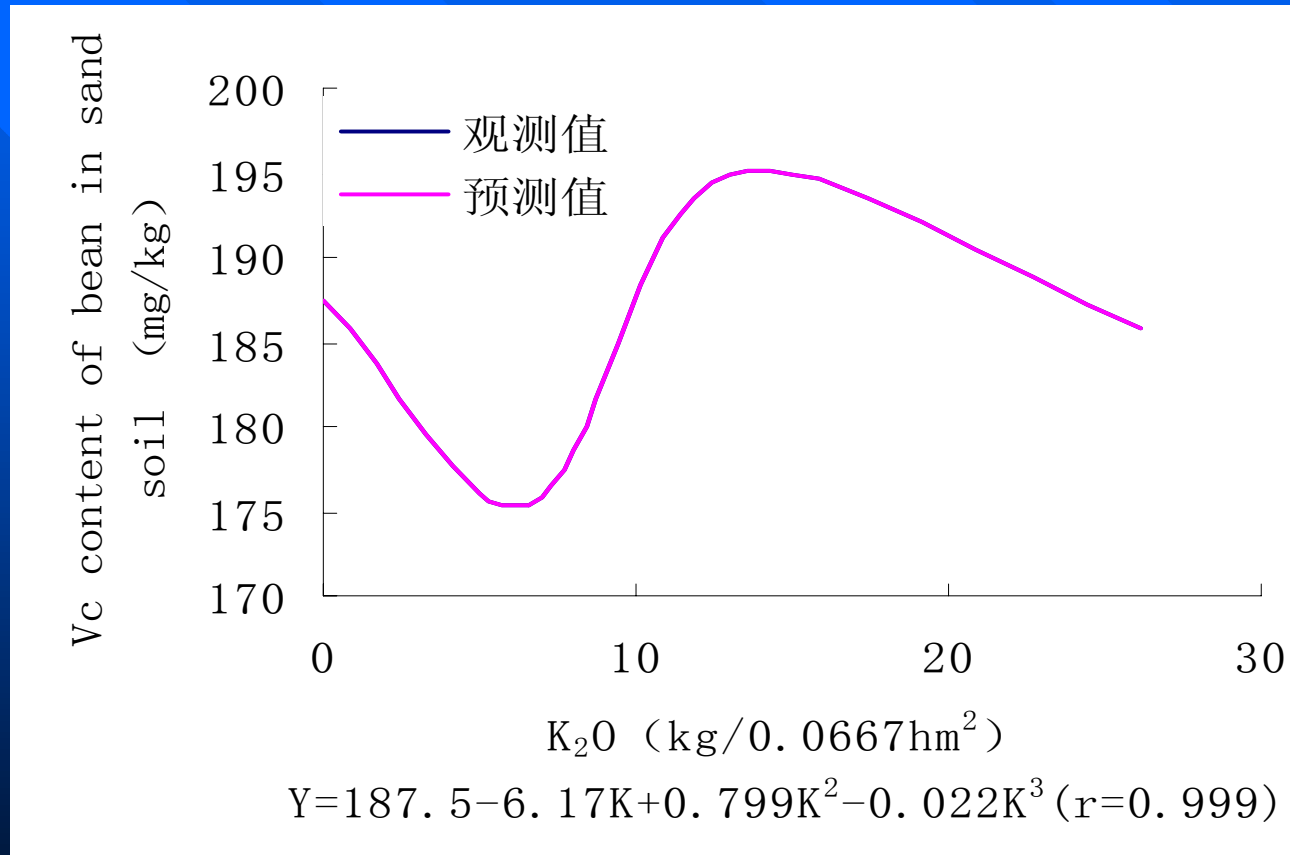- **To apply appropriate K fertilizer can get the highest Vc content in vegetable on the basis of using N and P.**

3.2 K application rate and Vc content in balsam pear

- **There is a appropriate K rate for the Vc content in balsam pear.**

3.3 K application rate and Vc content in bean

Y=187.5−6.17K+0.799K^2−0.022K^3(r=0.999)

■ **Bean has the same effects with balsam pear.**

3.4 K application rate and Vc content in eggplant

Vc (mg/kg)

40
34
28
22
16
10

$Y=12.3017+2.6030X-0.0736X^2 (R^2=0.928)$

观测值

预测值

0   7   14   21   28

K$_2$O (kg/0.0667hm^2)
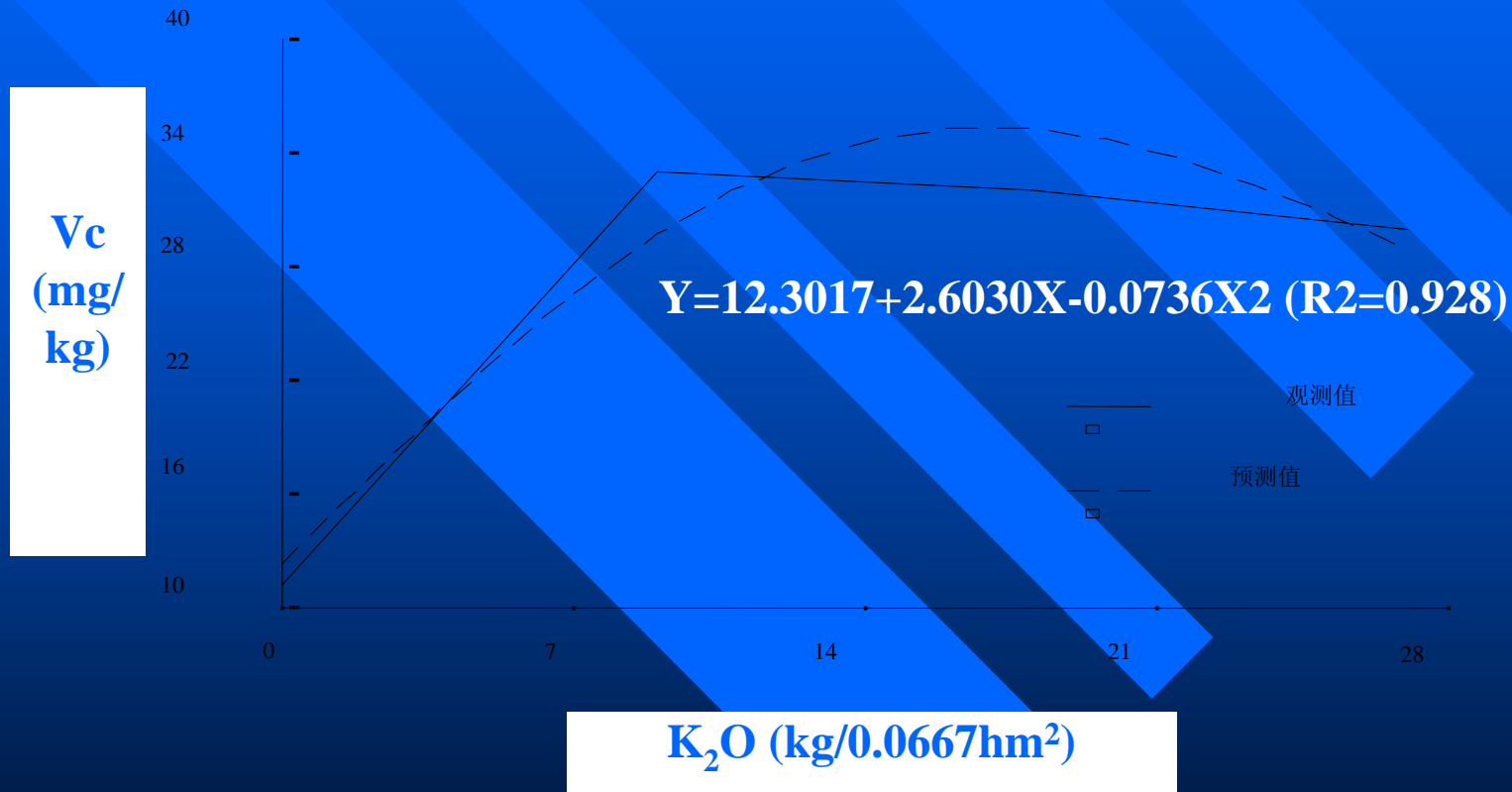
- **Eggplant has the same effects with balsam pear.**

3.5　K application rate and Vc content in potato

$$Y=104.427+12.6082X-0.3382X2 \quad (R2=0.930)$$

Vc (mg/kg)

观测值

预测值

$K_2O(kg/0.0667hm^2)$
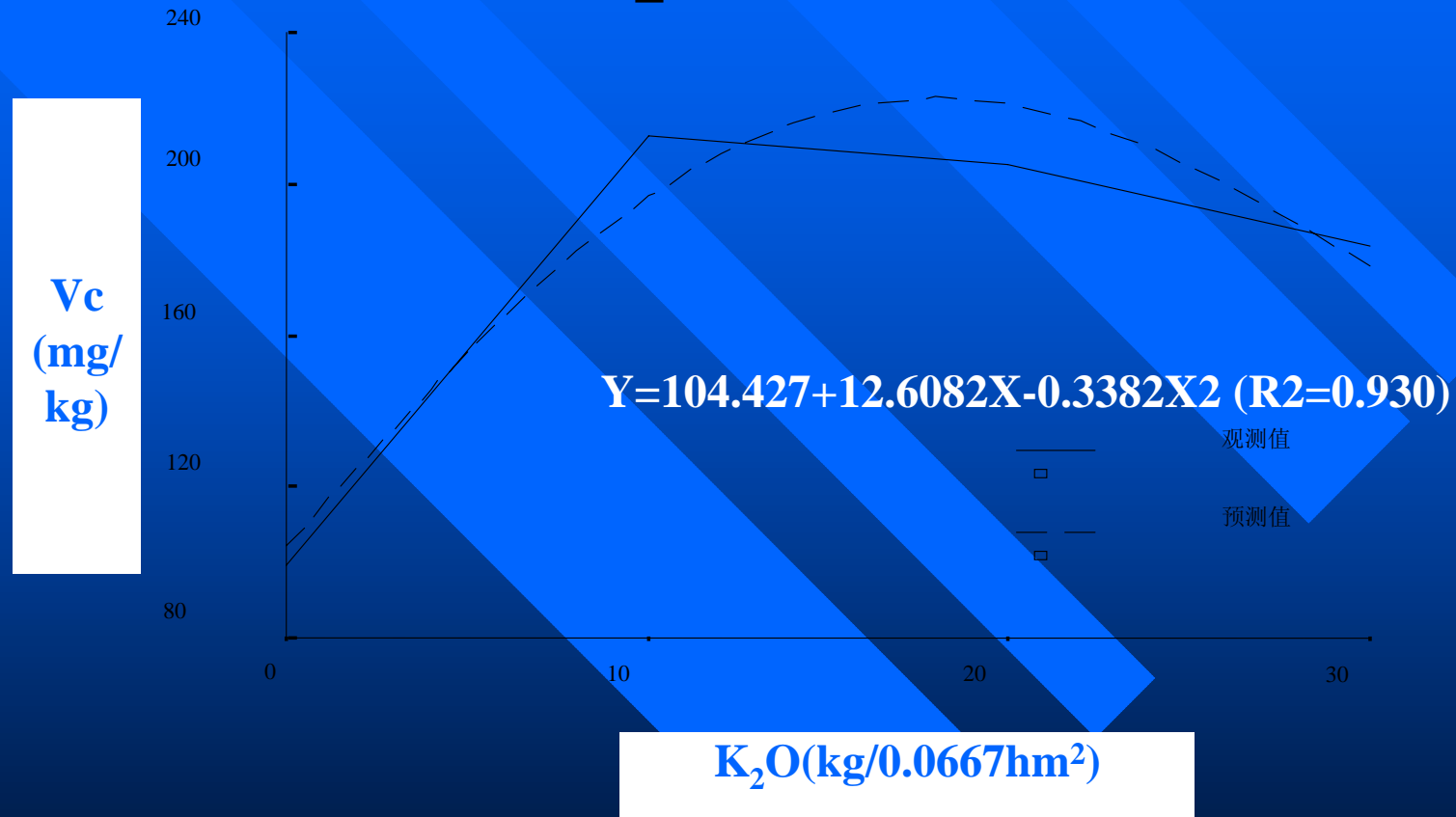
■ **Potato　has the same effects with balsam pear.**

# 4 Effects of rational K application on sugar content in vegetable

- **Effects of K application with N and P on**
  - ◆ **K application and sugar content in cabbage**
  - ◆ **K application and sugar content in balsam pear**
  - ◆ **K f application and sugar content in bean**
  - ◆ **K application and sugar content in eggplant**
  - ◆ **K application and sugar content in winter potato**

4.1 K application rate and sugar content in cabbage

sugar content of cabbage in loam (g.kg-1)

170
160
150
140
130
120
110
100

0   5   10   15

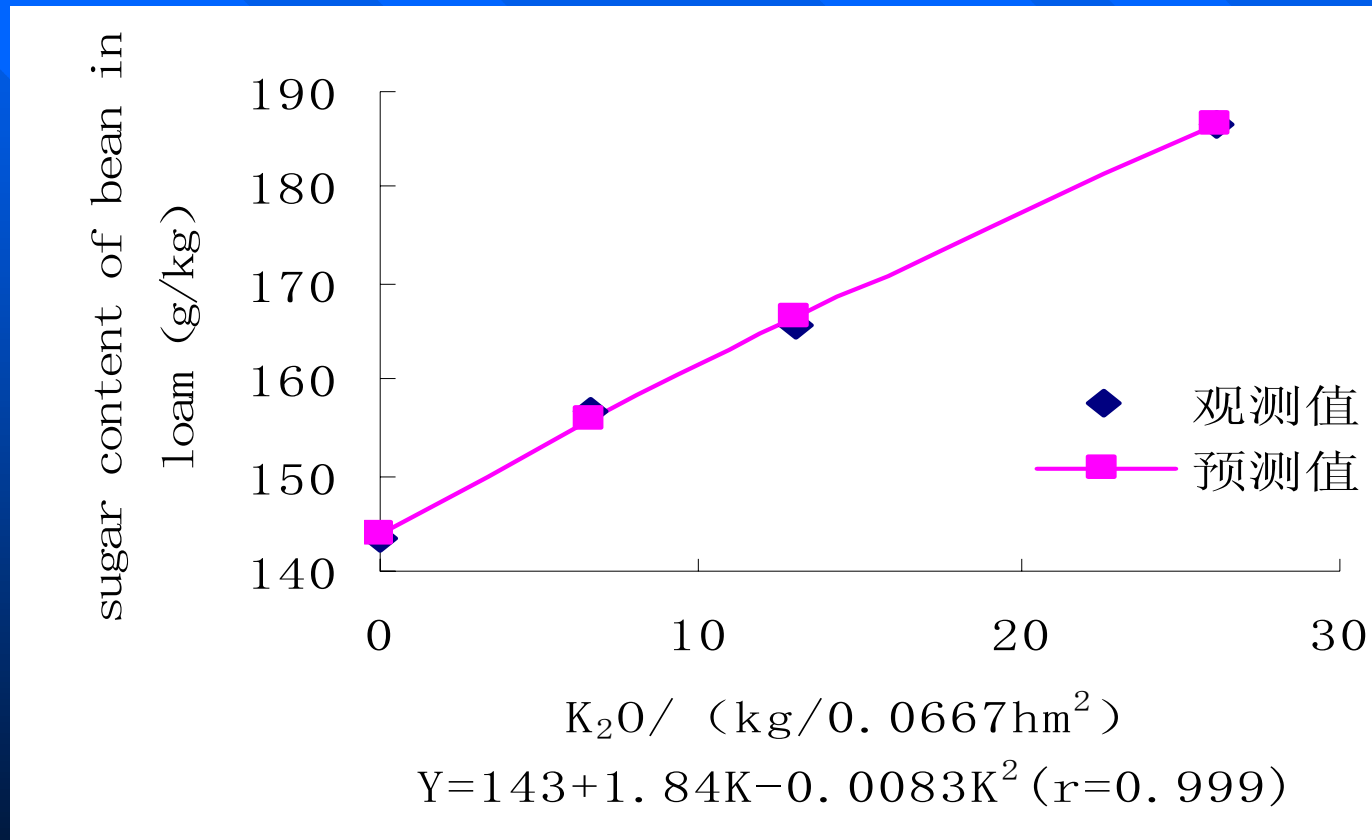K_2O （kg/0.067hm2）

观测值
预测值

$Y=124.4+8.34K-0.47K^2(0.998**)$
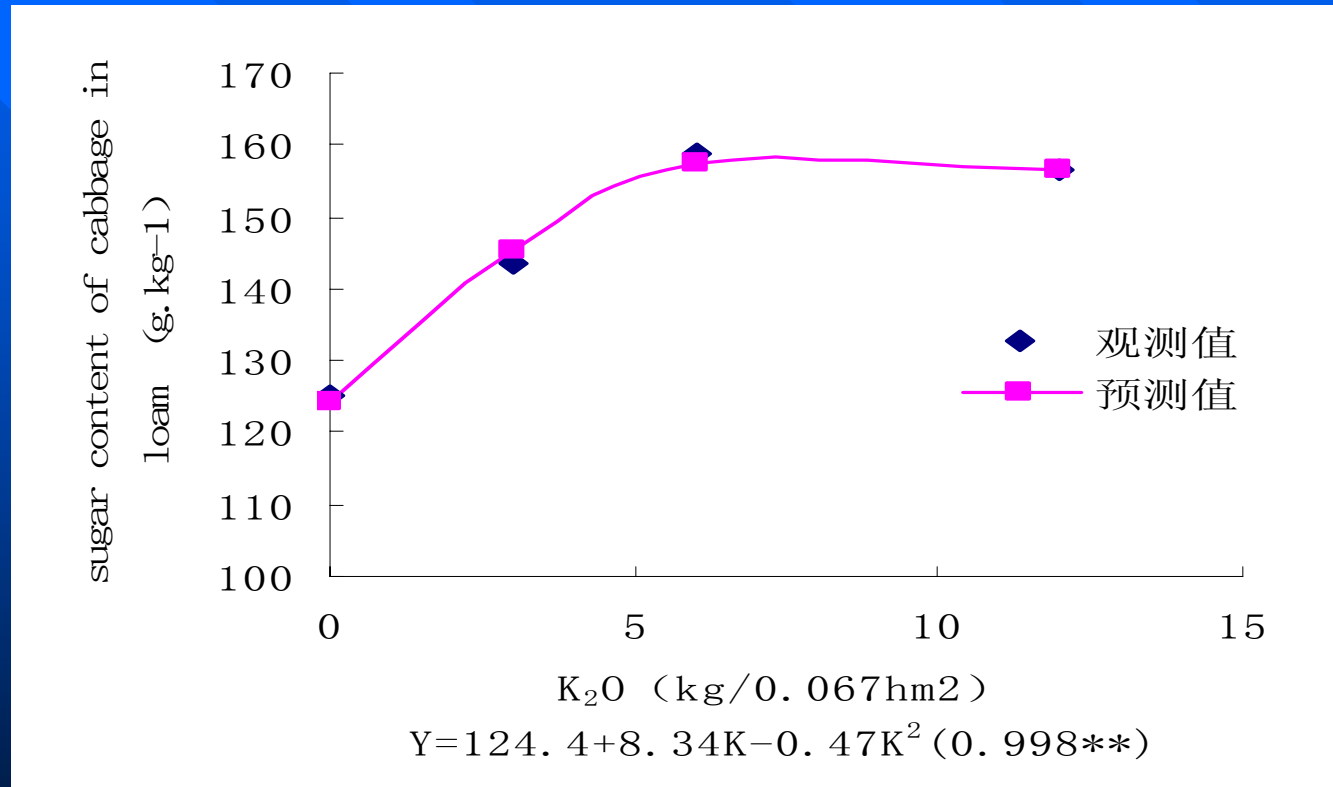
- **Appropriate K rate can get the highest sugar content in cabbage at the same time using N and P, but over K rate reduce the sugar in cabbage.**

4.2 K application rate and sugar content in balsam pear
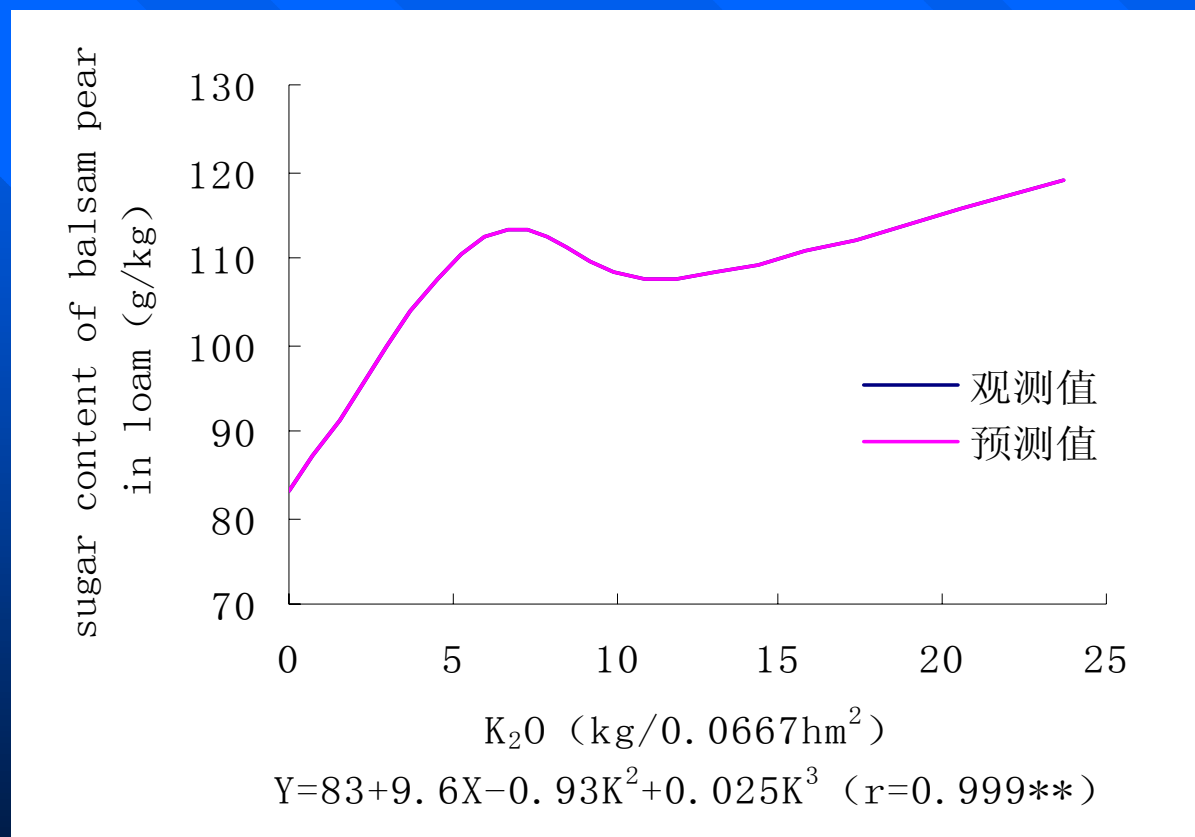
- **Appropriate K application can adjust the sugar content in balsam pear .**

4.3 K application rate and sugar content in bean

sugar content of bean in loam (g/kg)

190
180
170
160
150
140

0   10   20   30

$K_2O/$（$kg/0.0667hm^2$）

$Y=143+1.84K-0.0083K^2$（$r=0.999$）

◆ 观测值
■ 预测值

■ **More sugar in bean need more than 13kg/mu K.**

4.4 K application rate and sugar content in eggplant

$Y=30.1597+0.1581X-0.0036X2 \ (R2=0.250)$

Sugar (g/kg)

观测值

预测值

$K_2O(kg/0.0667hm^2)$
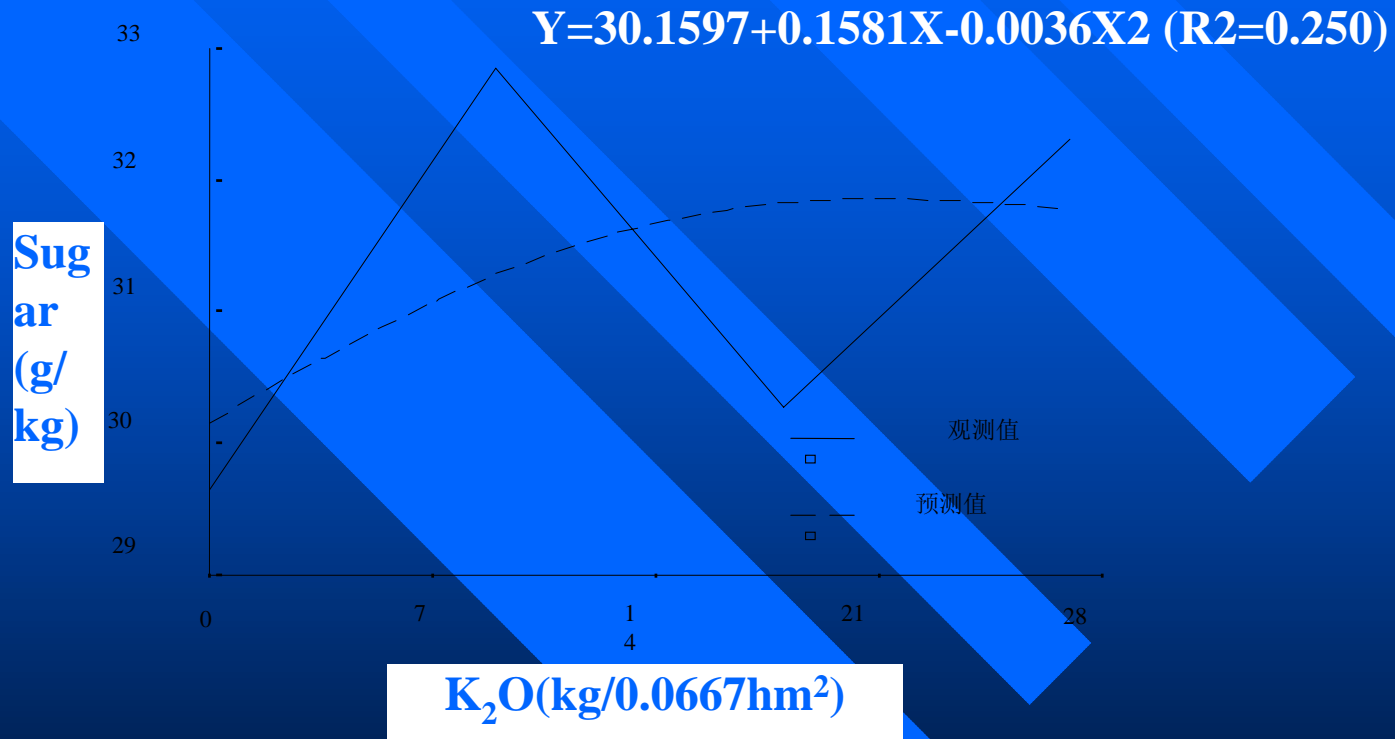
- **There may be an appropriate point between K application and sugar content in eggplant.**

4.5 K application rate and sugar content in potato

$$Y=1.8682-0.046X+0.0015X2 \ (R2=0.888)$$
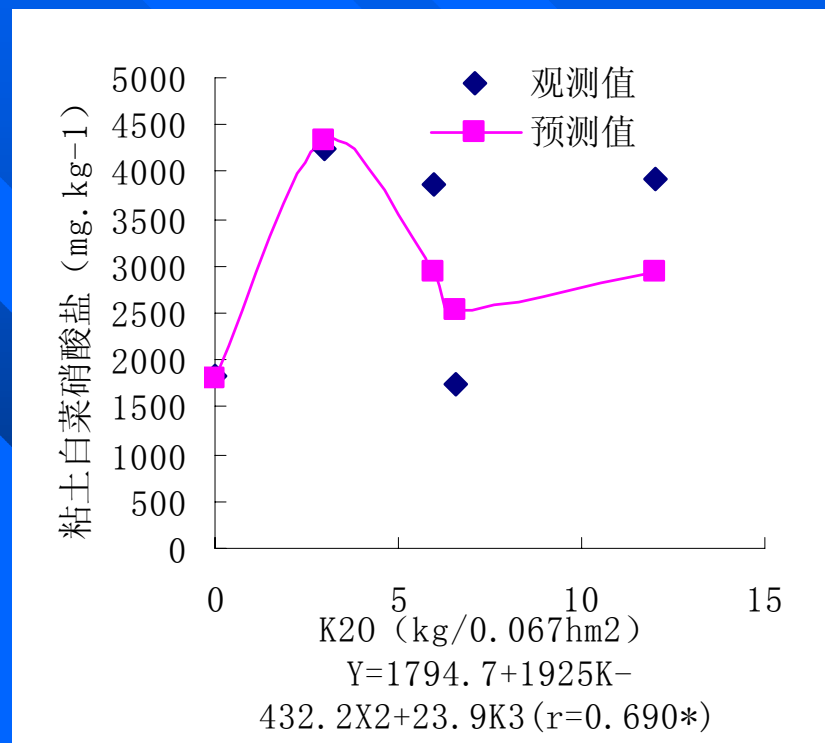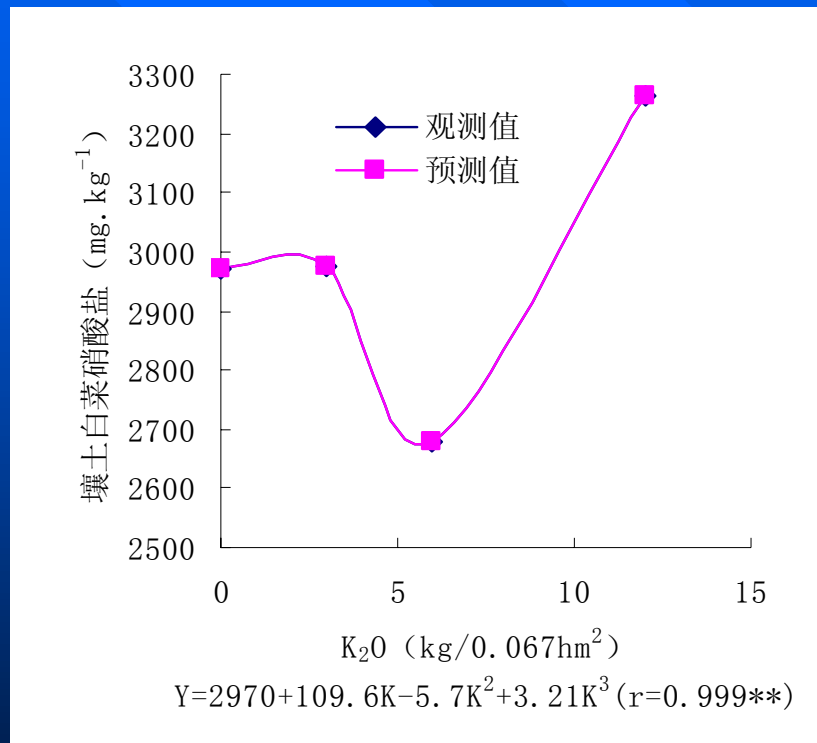
sugar (g/kg)

观测值

预测值

$K_2O(kg/0.0667hm^2)$
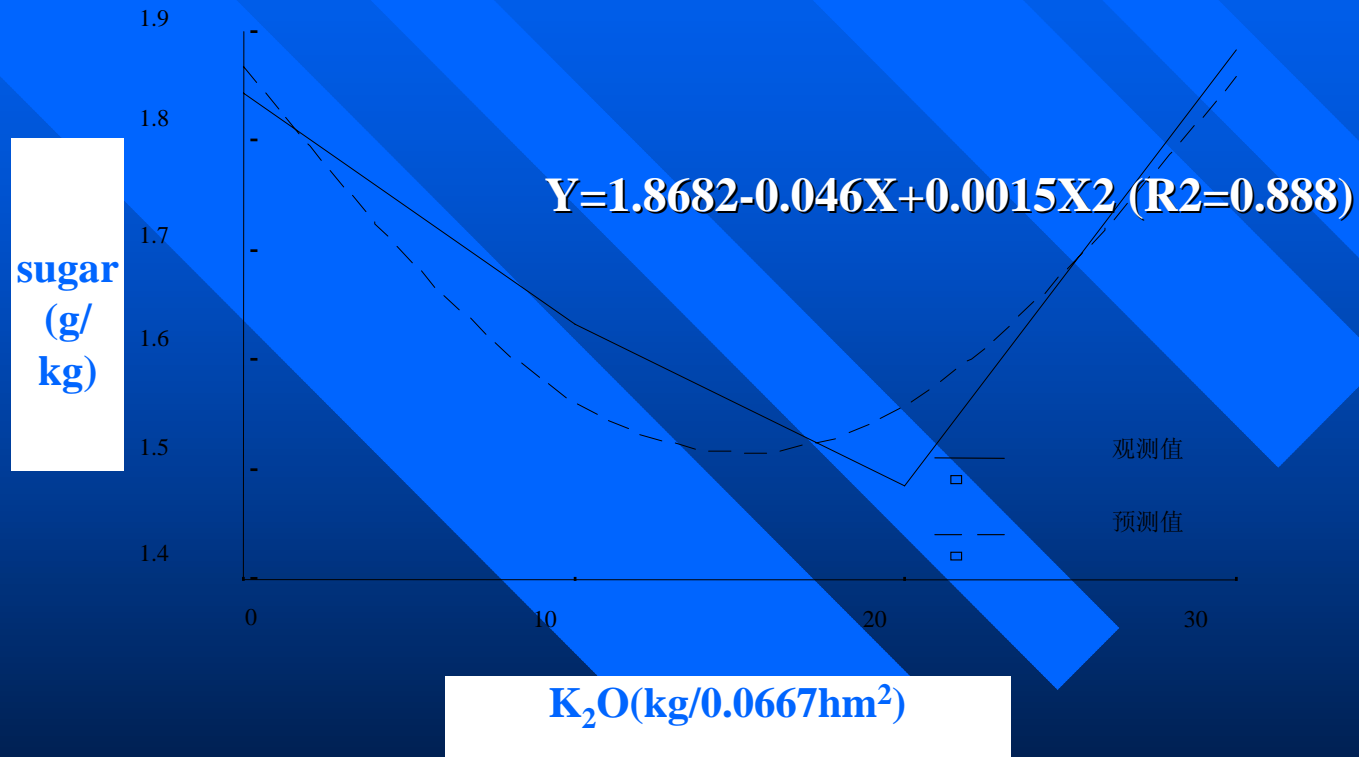
- **Appropriate proportional NPK can control deoxidize sugar content in potato, and so can some K range.**

5 Effects of different kind K fertilizer to winter potato yield and quality

K	Yield (kg/mu)	Dried matter(%)	Vc (mg/kg)	Sugar (g/kg)	Starch (g/kg)	protein (%)
No K	817.5b	19.65a	102.8bc	1.88a	149.8a	10.22a
KCl	976.4a	19.11a	170.1ab	1.50a	153.6a	9.71a
K_2SO_4	970.5a	18.23a	225.2a	1.51a	149.8a	9.38a
KCl + K_2SO_4	861.6ab	19.71a	208.4a	1.18a	162.3a	9.92a

- **Differences of potato yield, dried matter, Vc, deoxidize sugar and starch between different kind K fertilizer are not significant .**

6   Effects of K application on control of nitrate content in leaf vegetable

壤土白菜硝酸盐 (mg. kg^{-1})

观测值
预测值

K_2O (kg/0.067hm^2)

$Y=2970+109.6K-5.7K^2+3.21K^3 (r=0.999**)$

粘土白菜硝酸盐 (mg. kg^{-1})

观测值
预测值

K2O (kg/0.067hm2)

$Y=1794.7+1925K-432.2X^2+23.9K^3 (r=0.690*)$

- **K application in some range with N and P can control nitrate content in cabbage .**

7 Conclusions

- **7.1 Vegetable yield and quality and K fertilizer rate**

- **7.2 Rational K application on cabbage**

- **7.3 Rational K application on balsam pear**

- **7.4 Rational K application on bean**

- **7.5 Rational K application on eggplant**

- **7.6 Rational K application on potato**

Vegetable yield and quality and K rate

◆ **Application of K with N and P can improve vegetable yield and quality .**

◆ **There is a quadratic regression relationship between K amount and vegetable yield , the appropriate K fertilizer application can get the highest quantity.**

◆ **More Vc and sugar content in vegetable need more K_2O amount .**

Vegetable yield and quality and K rate

◆ **Nitrate content in leaf vegetable and K rate have relationship of cubic regression, and there is the most appropriate K rate for the least nitrate content.**

◆ **Sugar content in potato and K rate have relationship of inverted quadratic regression , and there is the most appropriate K rate for the least sugar content.**

Rational rate of K on cabbage

- **Cabbage yield**   2000kg/0.0667hm²
- **Organic Matter**   200-300kg/0.0667hm²
- **N**   5-10 kg/0.0667hm²
- **P₂O₅**   2.4 kg/0.0667hm²
- **Appropriate K₂O rate**

         6-8kg/0.0667hm²

Rational rate of K on balsam pear

◆ **Balsam pear yield at following fertilizer 1200-1500 kg/0.0667hm^2**

◆ **Organic Matter   300 kg/0.0667hm^2**

◆ **N   5-8kg/0.0667hm^2**

◆ **P_2O_5 3kg/0.0667hm^2**

◆ **Appropriate K_2O rate   3-5kg/0.0667hm^2**

◆ **N:P:K   1：0.44：0.91**

Rational rate of K on bean

◆ **Bean yield at following fertilizer**

  1000-1500 kg/0.0667hm^2

◆ **Organic Matter   200-300 kg/0.0667hm^2**

◆ **N   5-8kg/0.0667hm^2**

◆ **P$_2$O$_5$ 2-3kg/0.0667hm^2**

◆ **Appropriate K$_2$O rate   5-6.5kg/0.0667hm^2**

◆ **N:P:K   1：0.70：1.20**

Rational rate of K on eggplant

◆ **Eggplant yield at following fertilizer 2000kg/0.0667hm^2**

◆ **Organic Matter   800 kg/0.0667hm^2**

◆ **N   22 kg/0.0667hm^2**

◆ **P$_2$O$_5$ 10 kg/0.0667hm^2**

◆ **Appropriate K$_2$O rate   18 kg/0.0667hm^2**

Rational rate of K on winter potato

- ◆ **Winter potato yield at following fertilizer 1100kg/0.0667hm^2**

- ◆ **Organic Matter   400-550 kg/0.0667hm^2**

- ◆ **N   12-16 kg/0.0667hm^2**

- ◆ **P$_2$O$_5$ 3.5-5.2 kg/0.0667hm^2**

- ◆ **Appropriate K$_2$O rate   10-15kg/0.0667hm^2**