

# Effect of MOP and Polyhalite on the Productivity and quality of

i) sugarcane; ii) San Tuyet tea, iii) forage  
on some typical soil types  
in Vietnam

IPI - SFRI

Tran Duc Toan

*Soils and fertilizer Research Institute*

# Objective of research

1. To define the effect of MOP; polyhalite fertilizers on the productivity and quality of some crops in Vietnam.
2. Establishing a nutritional balance (N; P; K and S, Ca; Mg ...) base on fertilizing for crops to both improve soil fertility and increase crop yield and quality.
3. To promote widespread use of MOP and polyhalite fertilizers for crop/plant species

# Why MOP and Polyhalite need for crops in Vietnam

## A. Subjective reasons

1. (N) is, generously applied while P and K are generally ignored
2. MOP contains 50-60%  $K_2O$  needs for all soil types in Vietnam
3. Polyhalite ( $K_2Ca_2Mg(SO_4)_4 \cdot 2H_2O$ ) contains elements: sulfur (19.2%); CaO (17%);  $K_2O$  (14%); and MgO (6%), so it is necessary for soil and plants, especially for upland crops, where soil erosion often occurs in rain-fed crop areas.

# Why MOP and Polyhalite need (cont..)

## B. Objective reason: soil is poor in potassium

SOIL TYPE	Soil area (M.ha)	Soil depth (cm)	K <sub>2</sub> O total (%)	K <sub>2</sub> O Available (mg.100g <sup>-1</sup> )
Ferrasols (rhodic)	20	0-20	0.08	16.00
Orthithionic fluvisol	2.0	0-20	1.69	14.60
Acrisol (plintic)	3.0	0-20	0.18	5.65
Fluvisols	3.5	0-20	1.45	7.06
Arenosol	0.350	0-20	0.22	3.76

*Vietnam Soil Reference and information centre (VISRIC)*  
(Soils and Fertilizers Research Institute (SFRI))

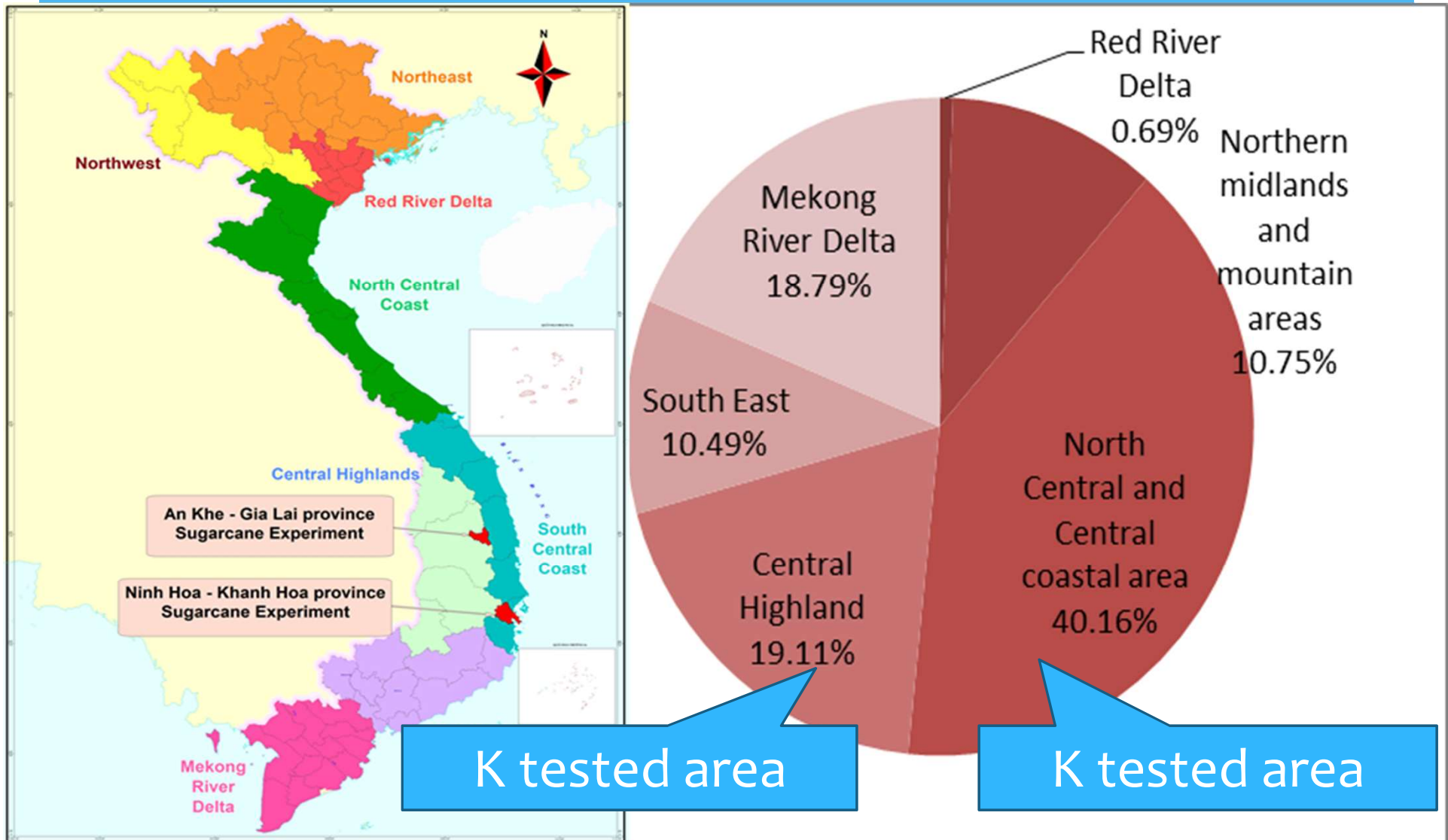
## A. Test Effect of K from **MOP** on yield and quality of sugarcane

1. Sugarcane (*Saccharum* spp.) is an important in Vietnam. Average productivity is **64 Mg ha<sup>-1</sup>**, and CCS content is **10%**, significantly lower than in leading sugarcane producing countries that achieve **75 Mg ha<sup>-1</sup>** and **14-15%** CCS content

**Need a test the effect of K to sugarcane yield and quality of product**

Field experiments were carried out from 2012 to 2015 in two provinces: **Gia Lai** (Central Highlands) and in **Khanh Hoa** (Central Coast).

# Distribution of sugarcane area in Vietnam.



# Soil characteristics in the experimental sites.

Soil properties	Khanh Hoa	Gia Lai
pH <sub>KCl</sub>	4.7	4.6
OC (%)	0.92	0.85
N (%)	0.07	0.074
P <sub>2</sub> O <sub>5</sub> (%)	0.029	0.051
<b>K<sub>2</sub>O (%)</b>	<b>0.33</b>	<b>0.12</b>
P <sub>2</sub> O <sub>5</sub> available (mg/100g)	1.36	3.85
<b>K<sub>2</sub>O available (mg/100g)</b>	<b>8.20</b>	<b>7.73</b>
CEC (meq/100g)	4.13	5.42
Clay (%)	14	14.8
Limon (%)	12	16.6
Sand (%)	74	68.6

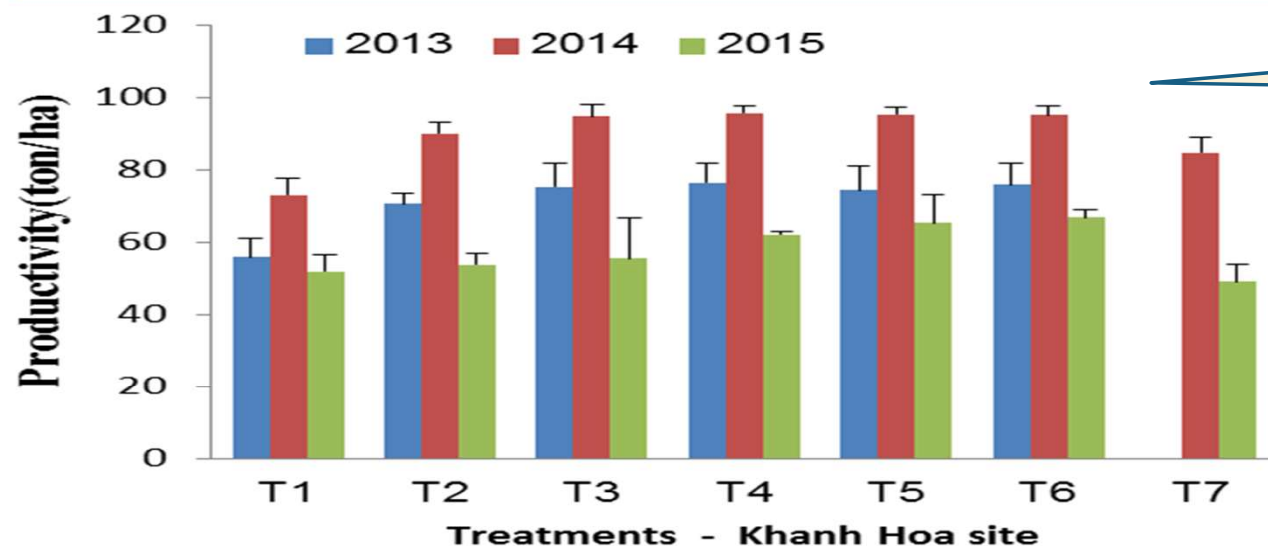
## Treatments of K application dose (kg) in Khanh Hoa and Gia Lai provinces

Fertil.	Treatments (T) RCBD						
	1	2	3	4	5	6	7
N	FP* (cont.)	250	250	250	250	250	250
P <sub>2</sub> O <sub>5</sub>		150	150	150	150	150	150
K <sub>2</sub> O		200	300	350	400	450	0

\* FP in Gai Lai: **N: 190; P<sub>2</sub>O<sub>5</sub>: 110; K<sub>2</sub>O: 90 kg/ha**  
 Khanh Hoa : **N: 160; P<sub>2</sub>O<sub>5</sub>: 120 and K<sub>2</sub>O: 120 kg /ha.**

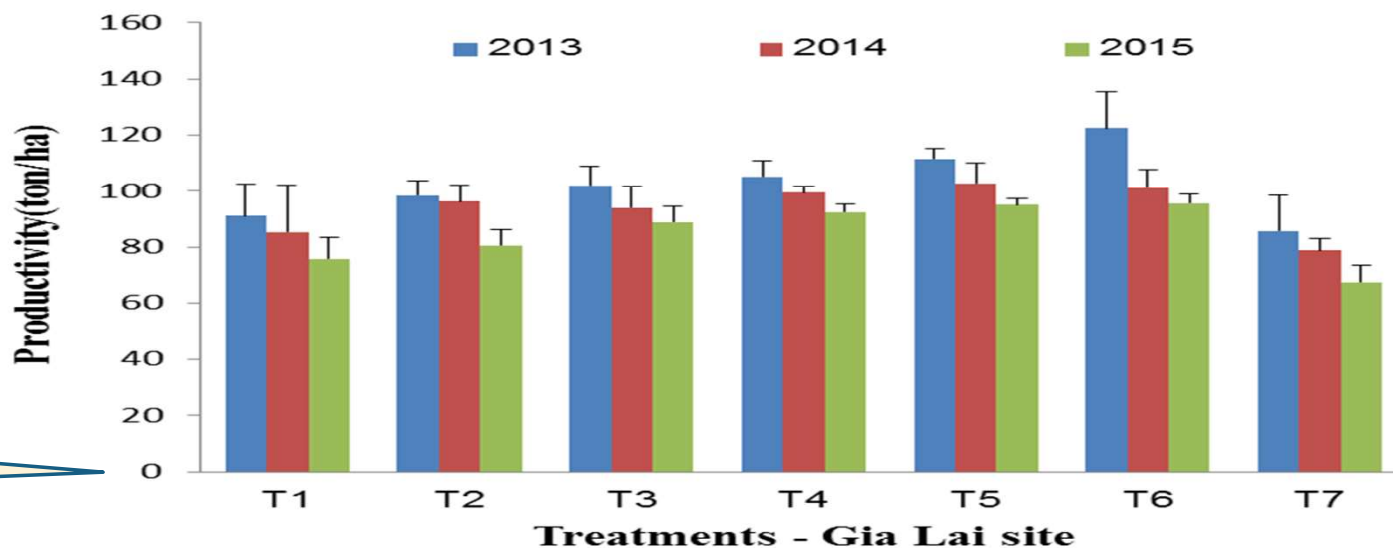


# Effect of K dose on sugarcane yield at Gia Lai and Khanh Hoa experiment sites.



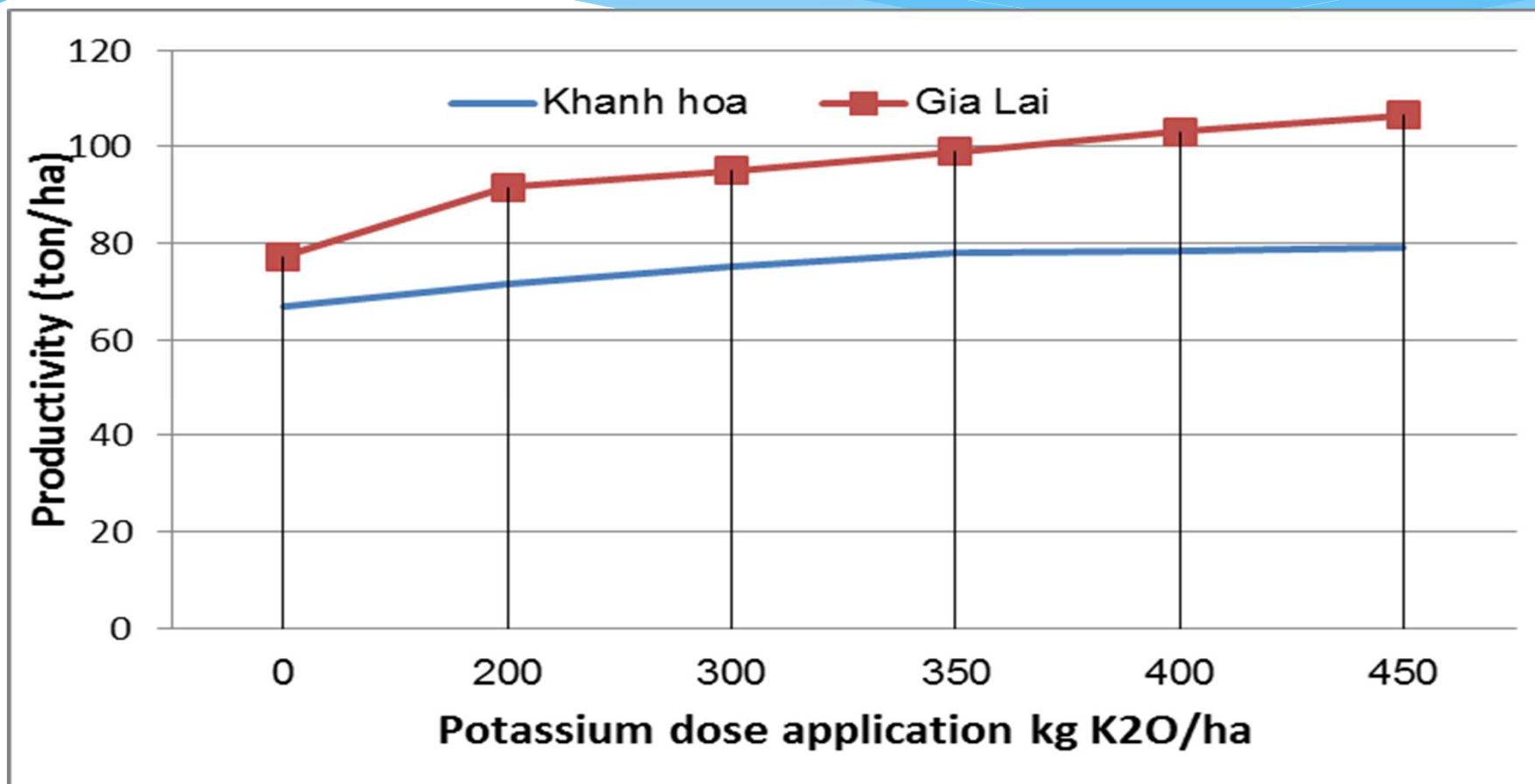
Khanh Hoa

T7 = 0K

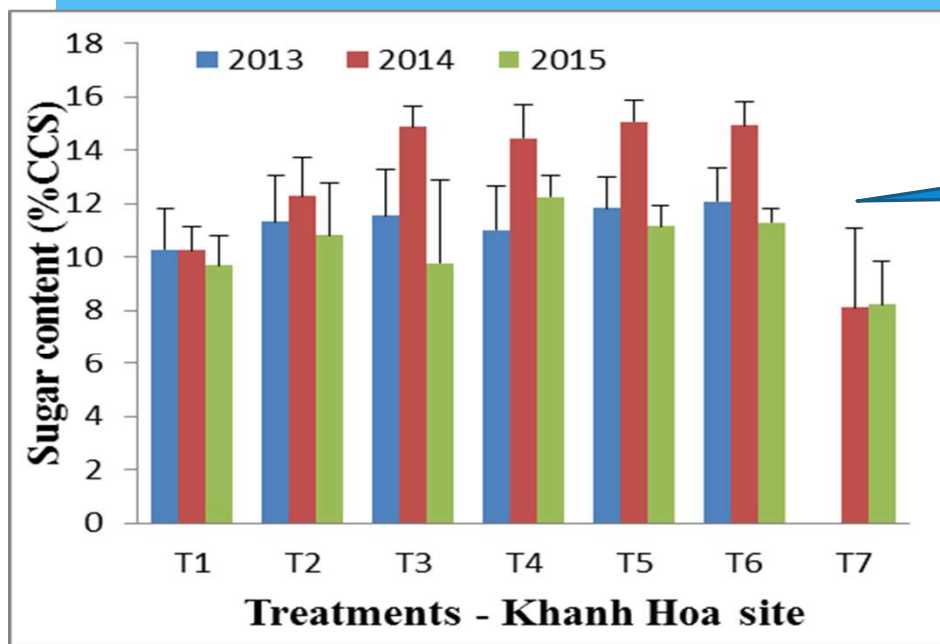


Gia Lai

# K application and sugarcane yield

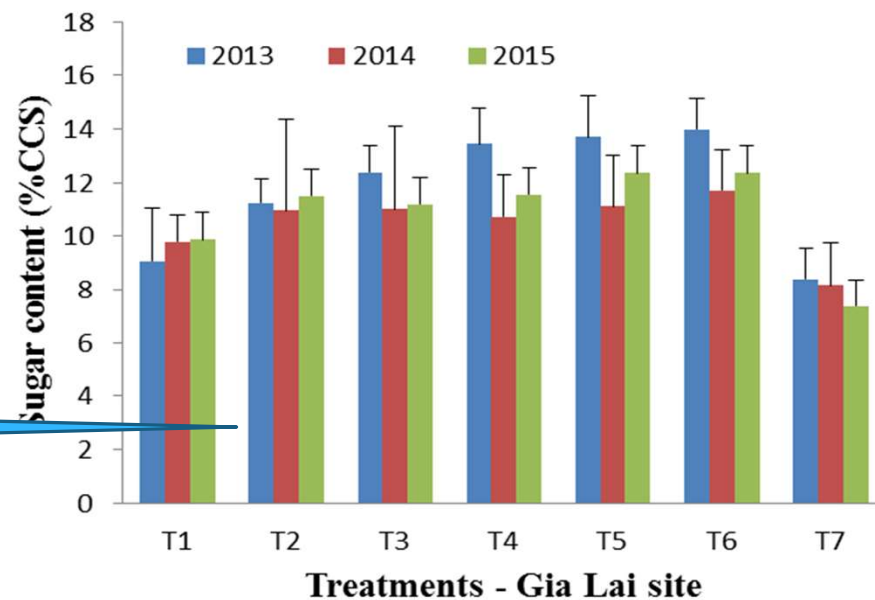


# Effect of K on the CCS in sugarcane

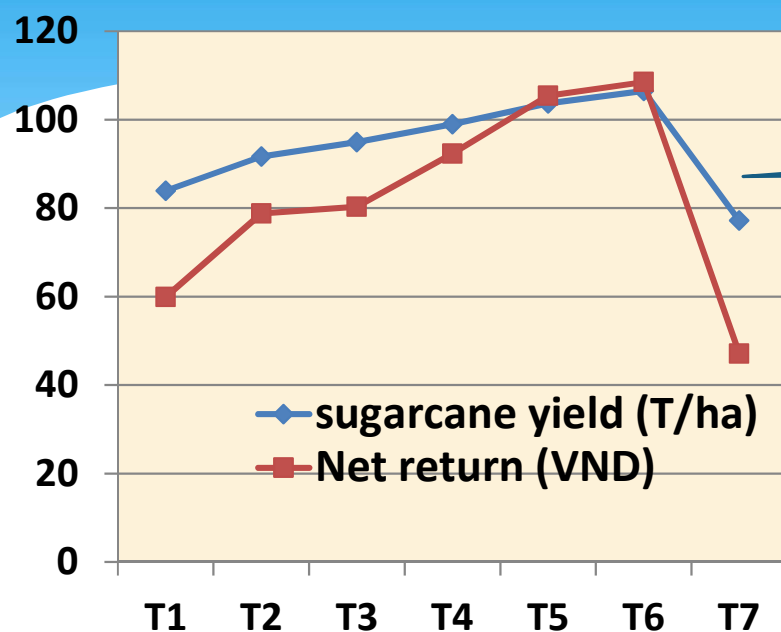


Khanh Hoa

Gia Lai

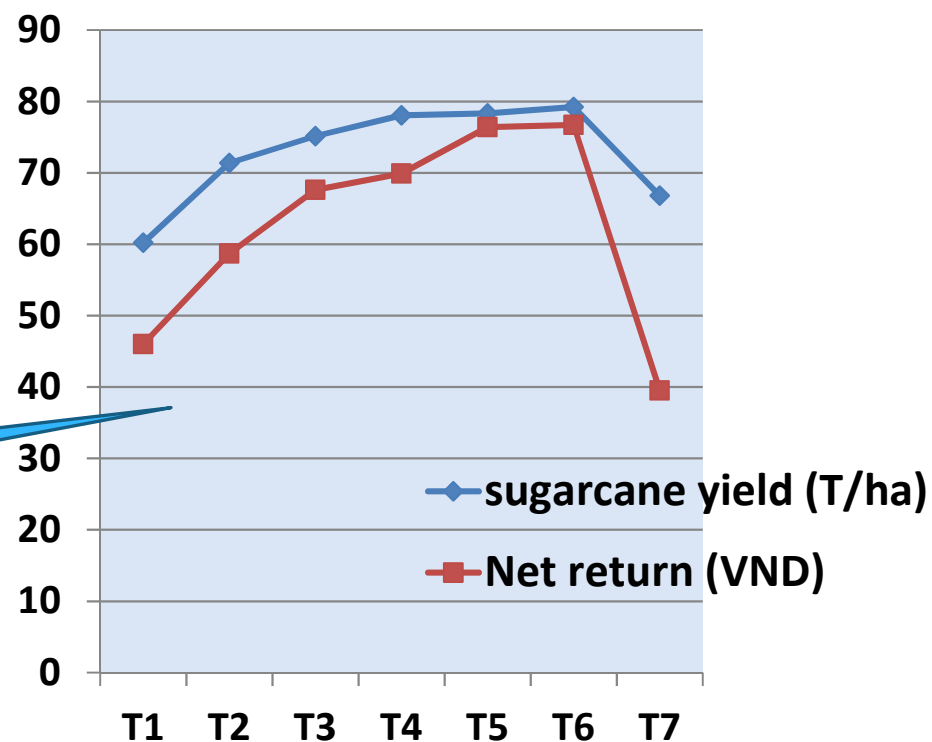


# Economic analysis:



Gia Lai

Khanh Hoa



## **B. Test of Polyhalite for tea in Son La province**



Total about 130,000  
hectares of tea  
plantations (mainly  
in uplands)

The background image shows a vast tea plantation in Son La province, Vietnam. The tea bushes are arranged in neat rows across a hilly landscape. In the foreground, a small blue sign with the white text 'CT6' is visible among the plants. The sky is overcast with grey clouds.

Creating  
jobs for  
more than  
2 million  
people /  
workers

# Experiment of Polyhalite on tea

Experiment was Design by RCBD

Tr.	N1	N2	Total N	P	MOP	Polyhalite (K)	Total K	S	Ca	Mg
	Kg/ha									
T1	425	0	425	80	80	0	80	90	0	0
T2	396.6	28.4	425	80	80	0	80	0	0	0
T3	396.6	28.4	425	80	36.3	43.7	80	60	53	18
T4	396.6	28.4	425	80	14.4	65.6	80	90	80	28
T5	396.6	28.4	425	80	0	80	80	110	97	34
T6	396.6	28.4	425	80	76.3	43.7	120	60	53	18
T7	396.6	28.4	425	80	94.4	65.6	160	90	80	28

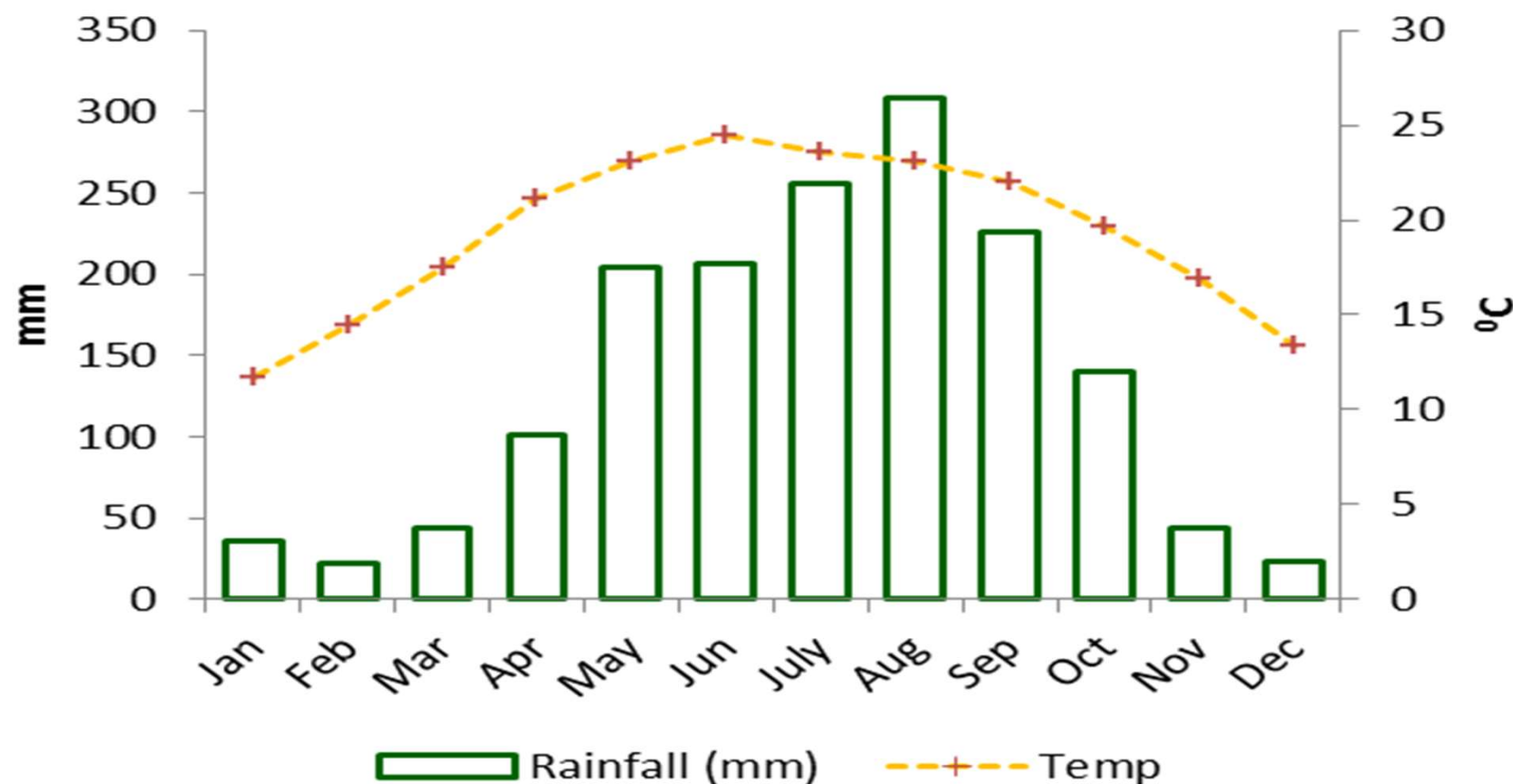
T1: N1 = SA+UREA; P= SSP.

T2-T7: N= UREA; P=DAP;

K=MOP+POLYHALITE



# Precipitation distribution and temperature in Son La/Moc Chau (average 10 years)



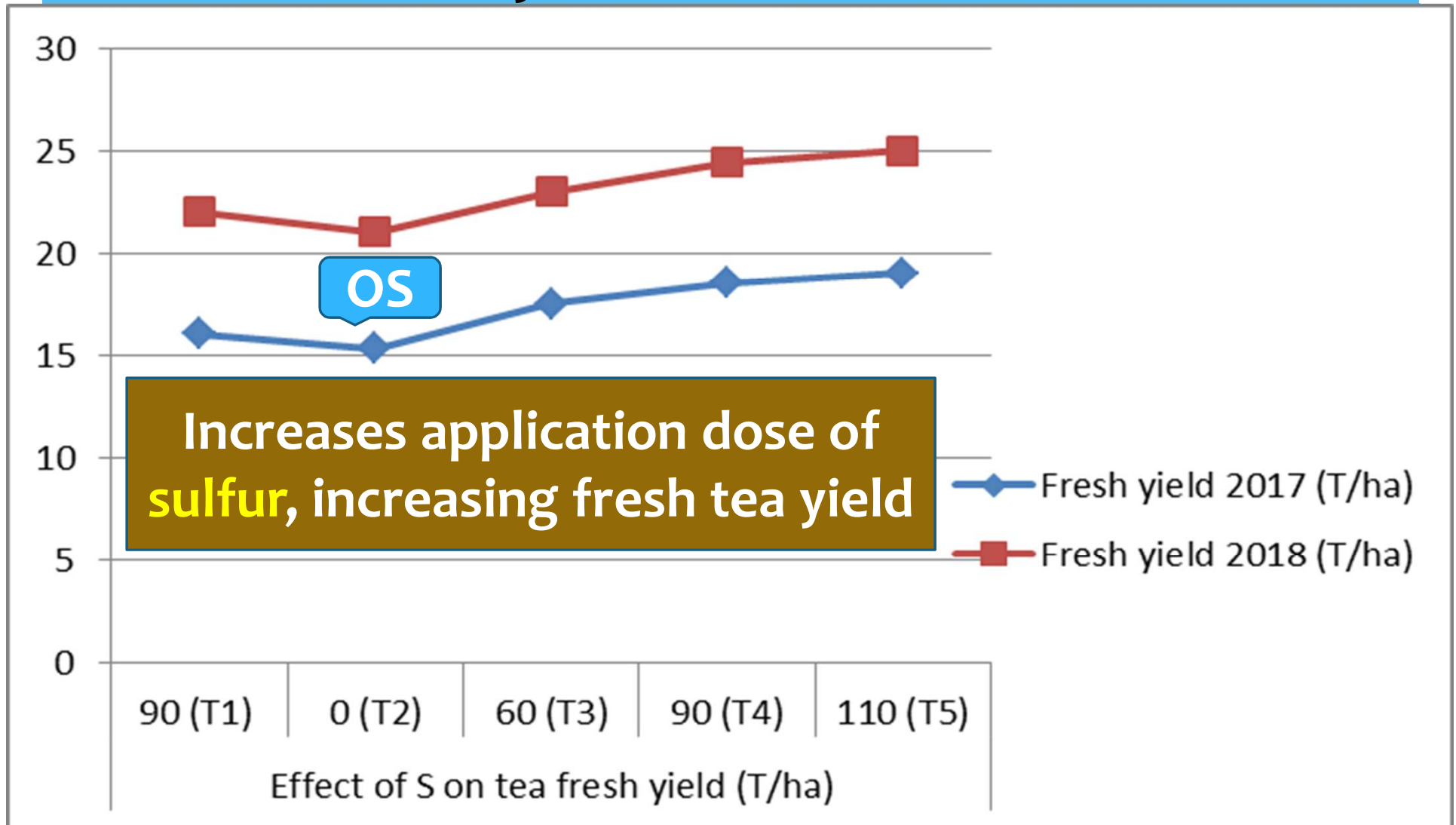
# Soil characteristics at tea tested site

Soil properties	Unit	Soil Depth (cm)	
		0-20	0-20
pH <sub>KCl</sub>		3.81	3.78
OC	%	2.96	1.78
N	%	0.26	0.12
P <sub>2</sub> O <sub>5</sub> total	%	0.12	0.09
<b>K<sub>2</sub>O total</b>	%	0.32	0.16
P <sub>2</sub> O <sub>5</sub> available	mg/100g	10.9	8.24
<b>K<sub>2</sub>O available</b>	mg/100g	6.75	4.26
Ca	%	0.045	0.087
Mg	%	0.007	0.006
<b>S</b>	%	0.028	0.019

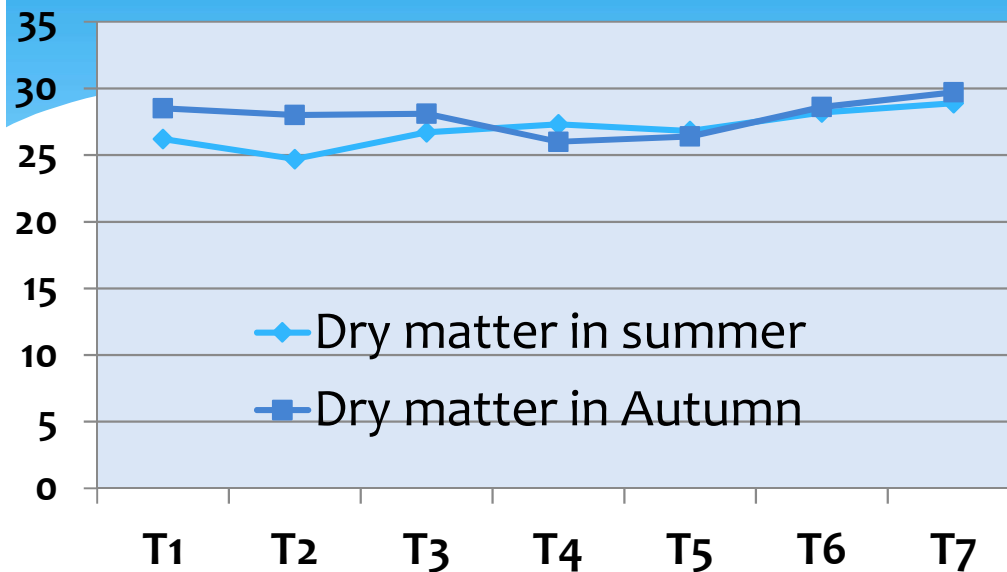


# Effect of Polyhalite on **tea fresh yield**

## Tea's fresh yield 2017 and 2018 Years

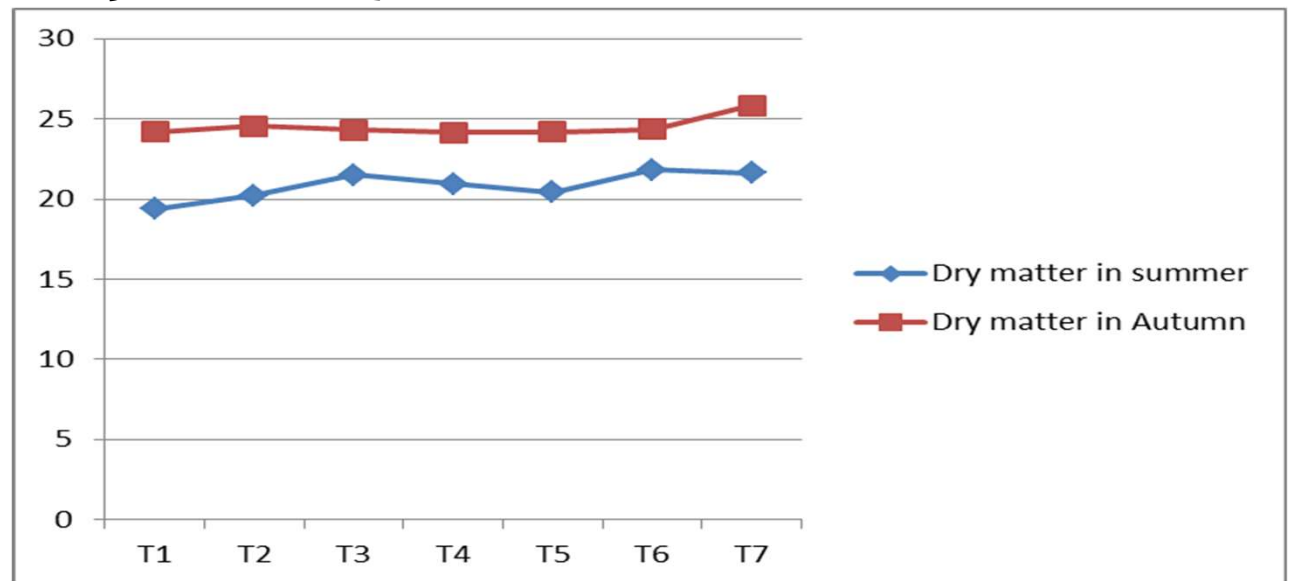


# Effect of Polihalite on tea's dry matter

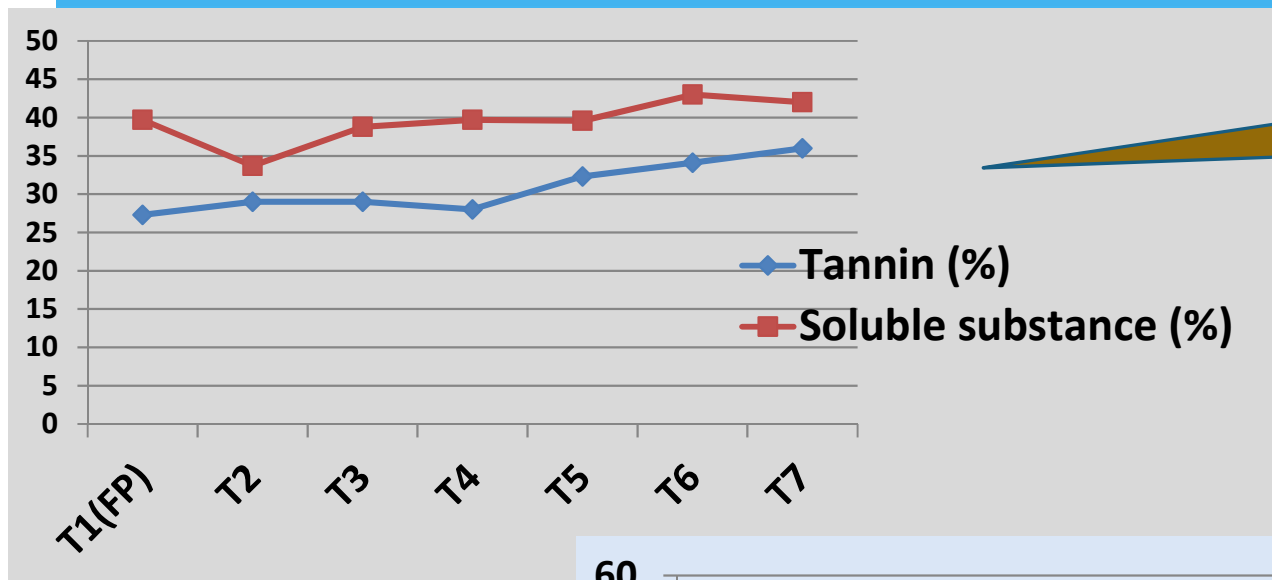


**Summer and  
Autumn 2017  
(in %)**

**Summer and  
Autumn 2018  
(in %)**

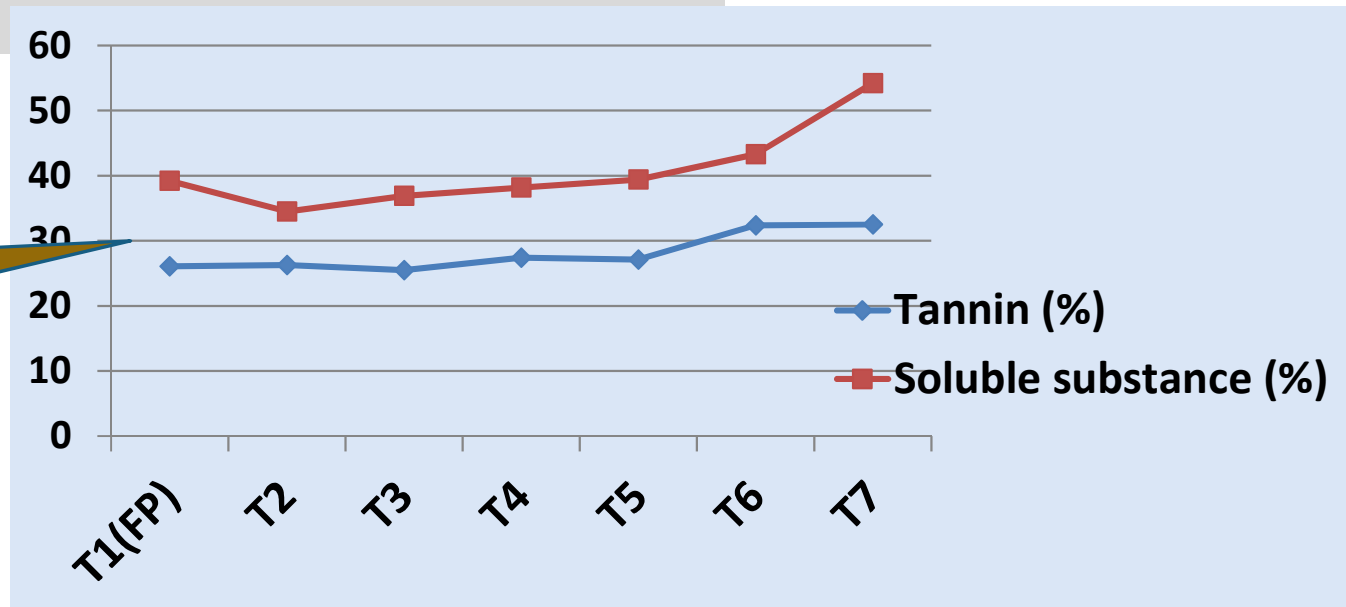


# Tannin and Soluble substance of tea

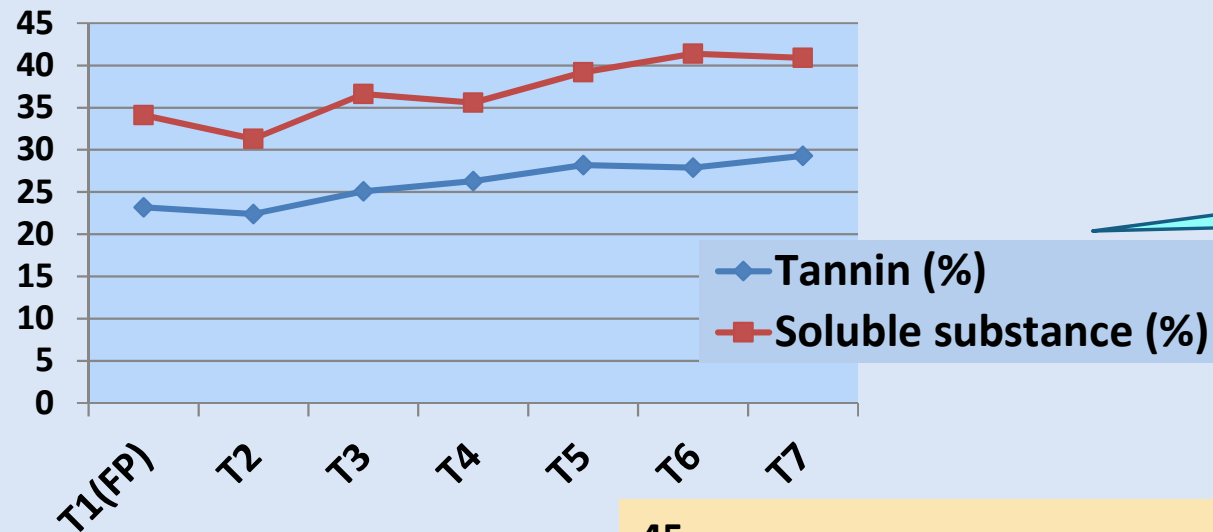


Summer 2017

Autumn 2017

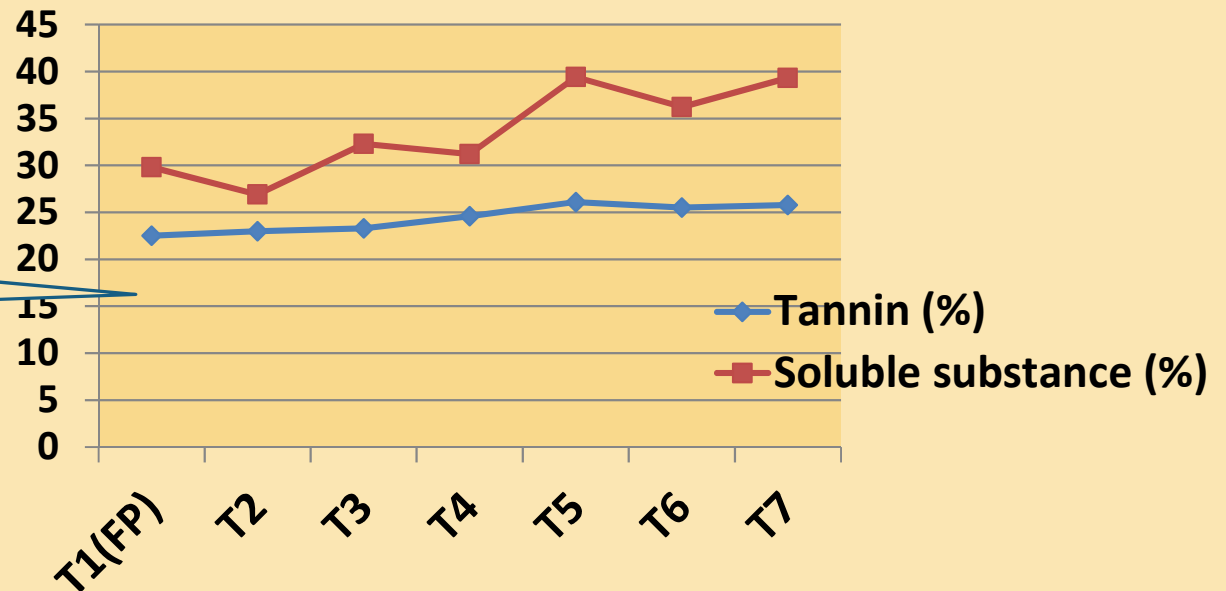


# Tannin and Soluble substance of tea



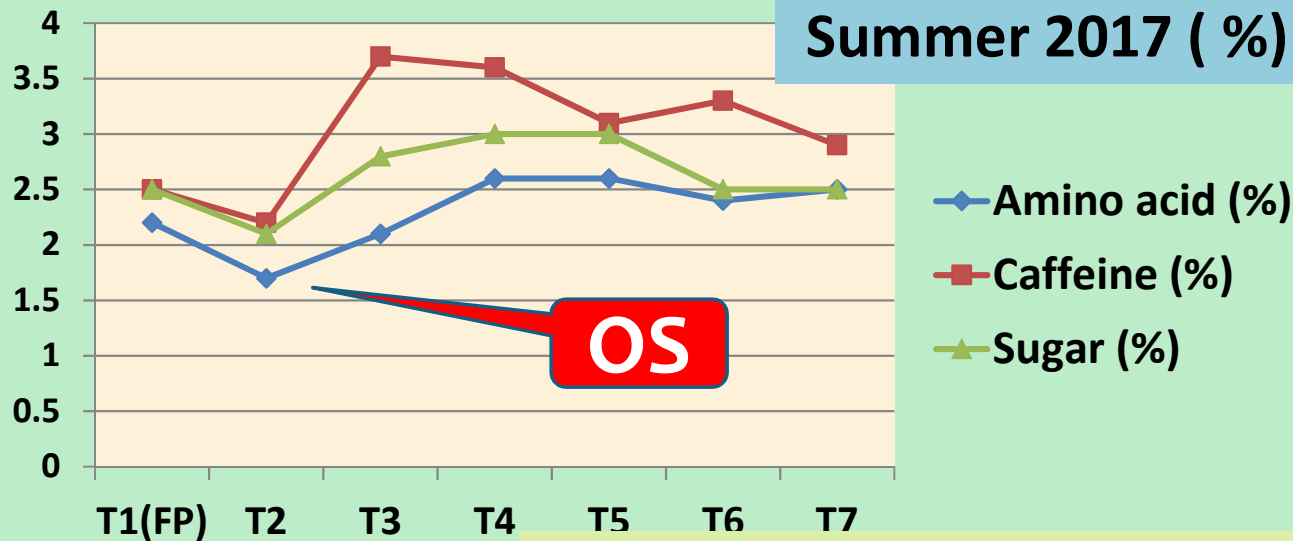
Summer 2018

Autumn 2018

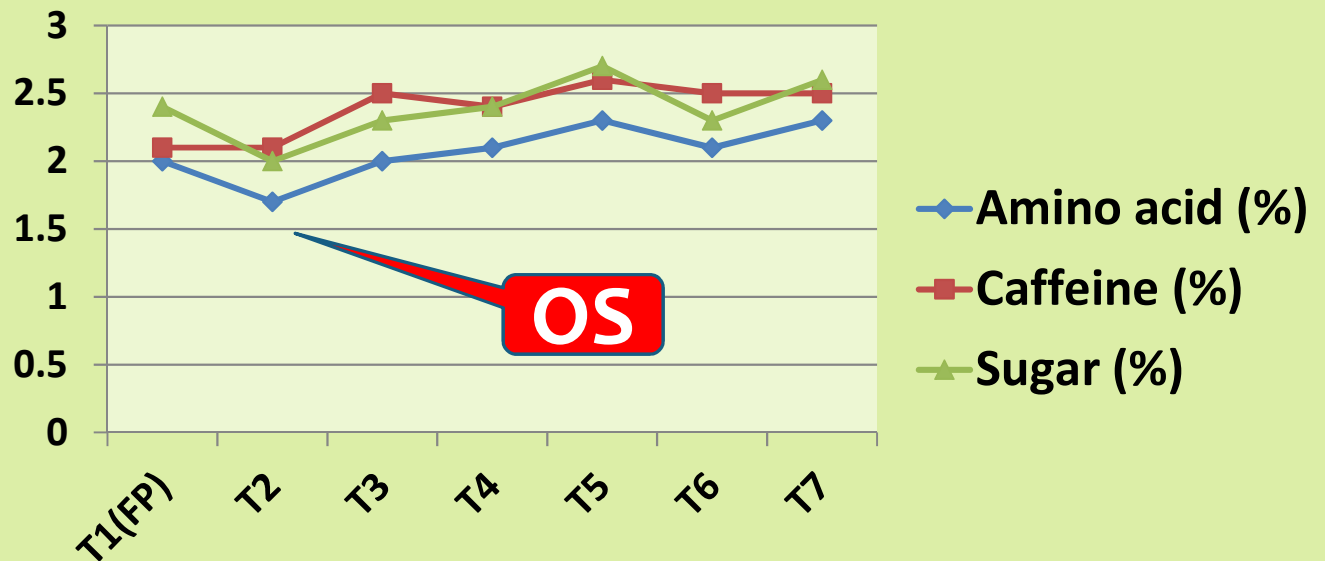


# Amino acid-caffeine-sugar in tea

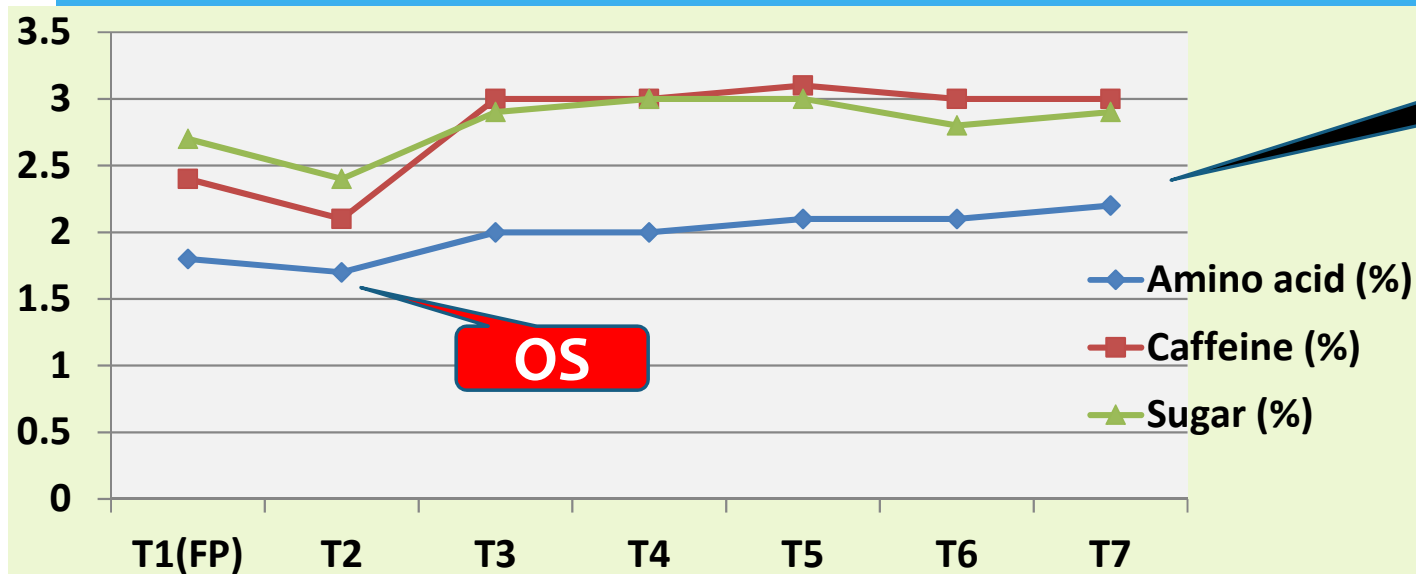
Summer 2017 ( % )



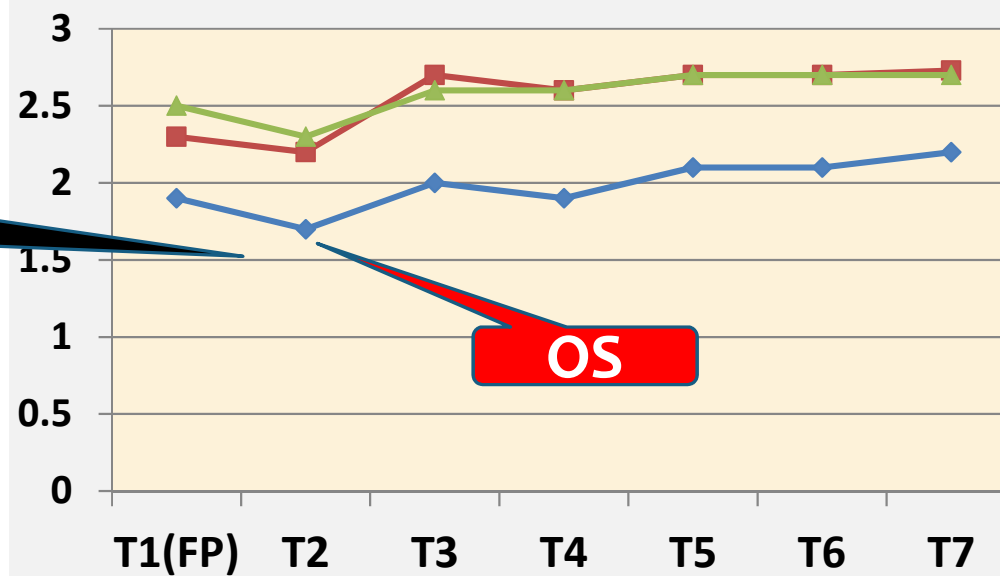
Autumn 2017 ( % )



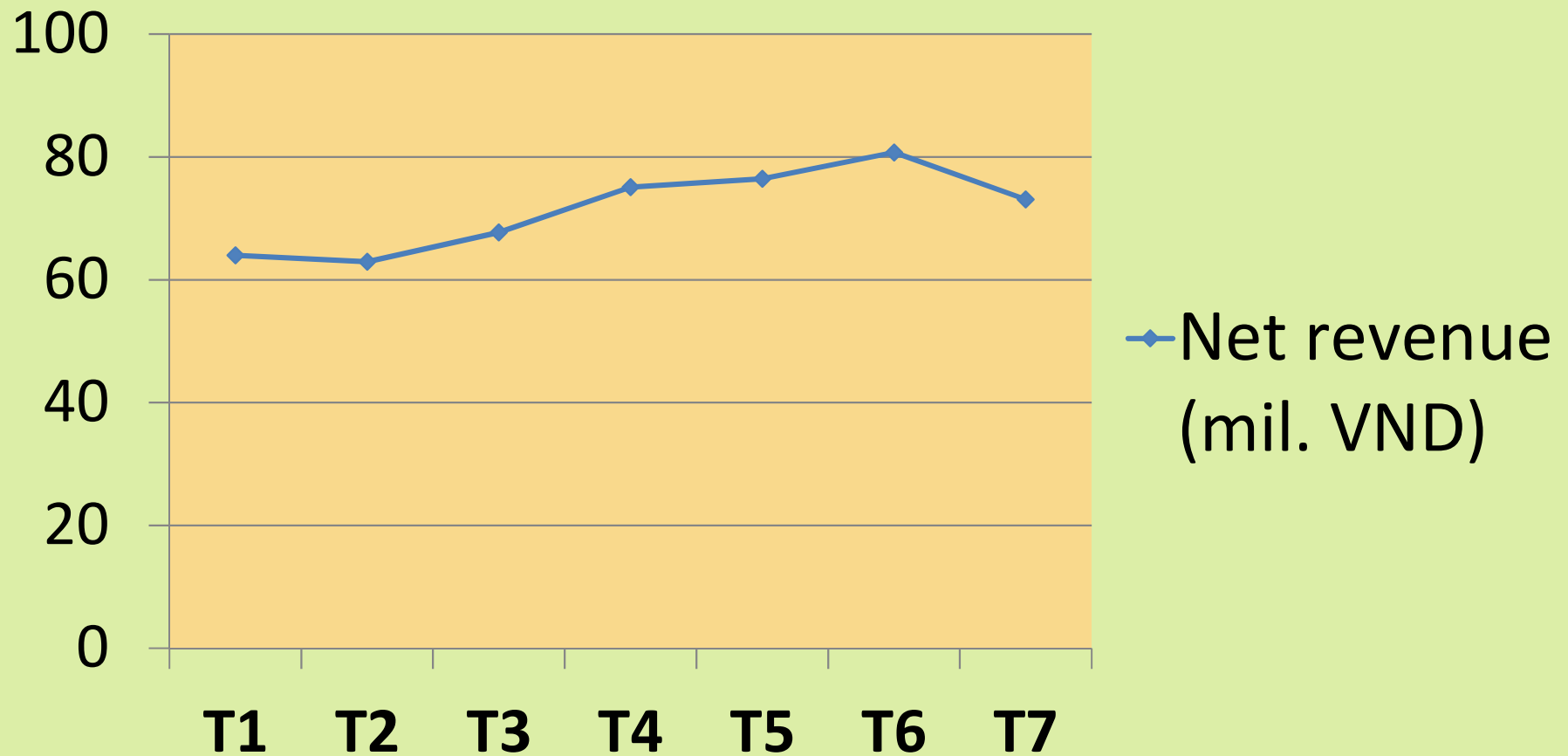
# Amino acid-caffeine-sugar in tea



Autumn 2018



# Economic analysis for tea



## C. Test of polyhalite for forage (VA-06) in Son La province

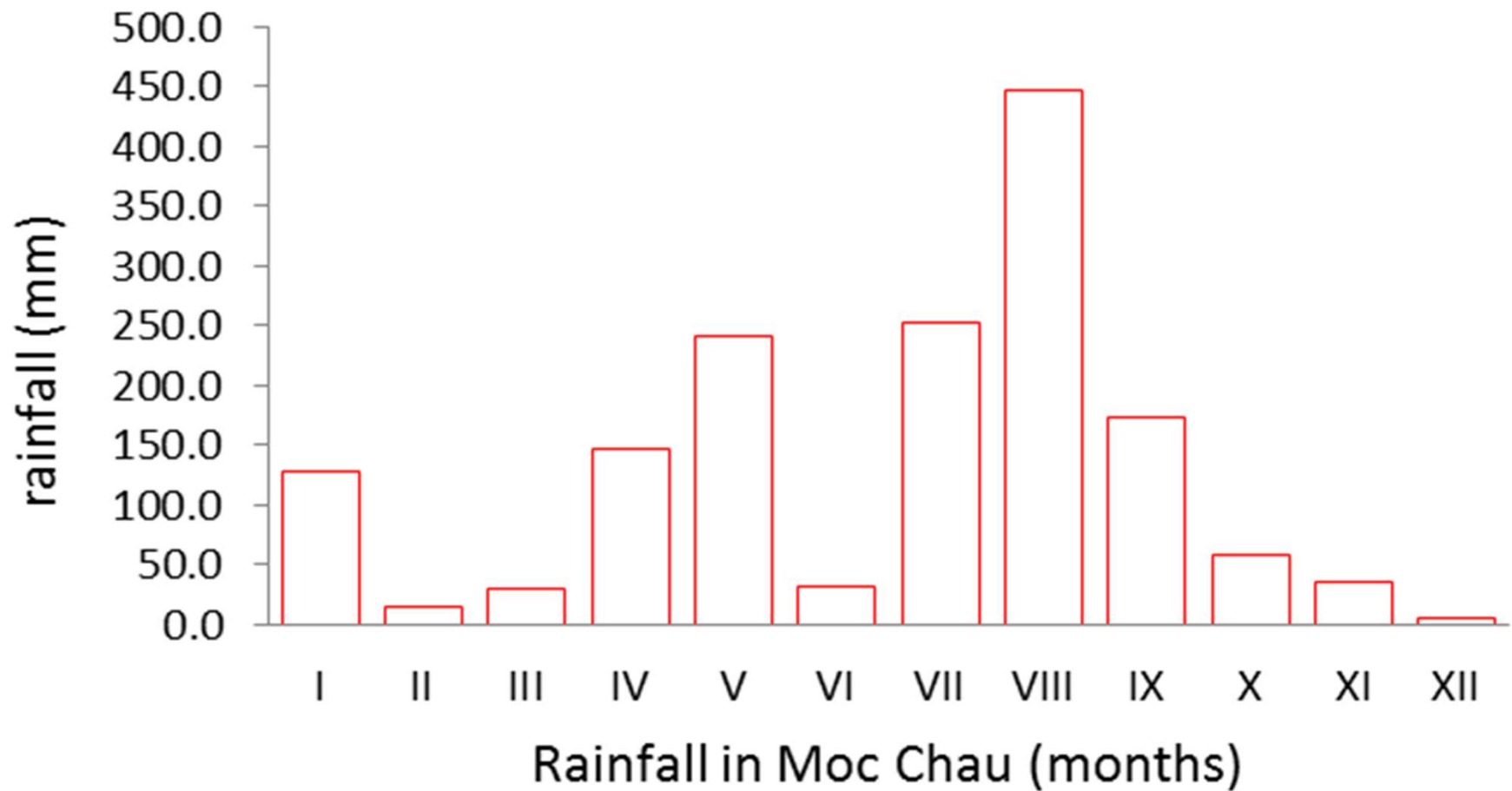
Treat ment	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O kg/ha			S	Ca	Mg
			polyhalite	MOP	Total			
	Kg/ha							
T <sub>0</sub>	250	90	0	0	0	0	0	0
T <sub>1</sub>	250	90	43.8	46.25	90	60	37.5	11.25
T <sub>2</sub>	250	90	58.3	121.6	180	80	50	15
T <sub>3</sub>	250	90	87.5	182.5	270	120	75	22.5
T <sub>4</sub>	250	90	0	180	180	0	0	0



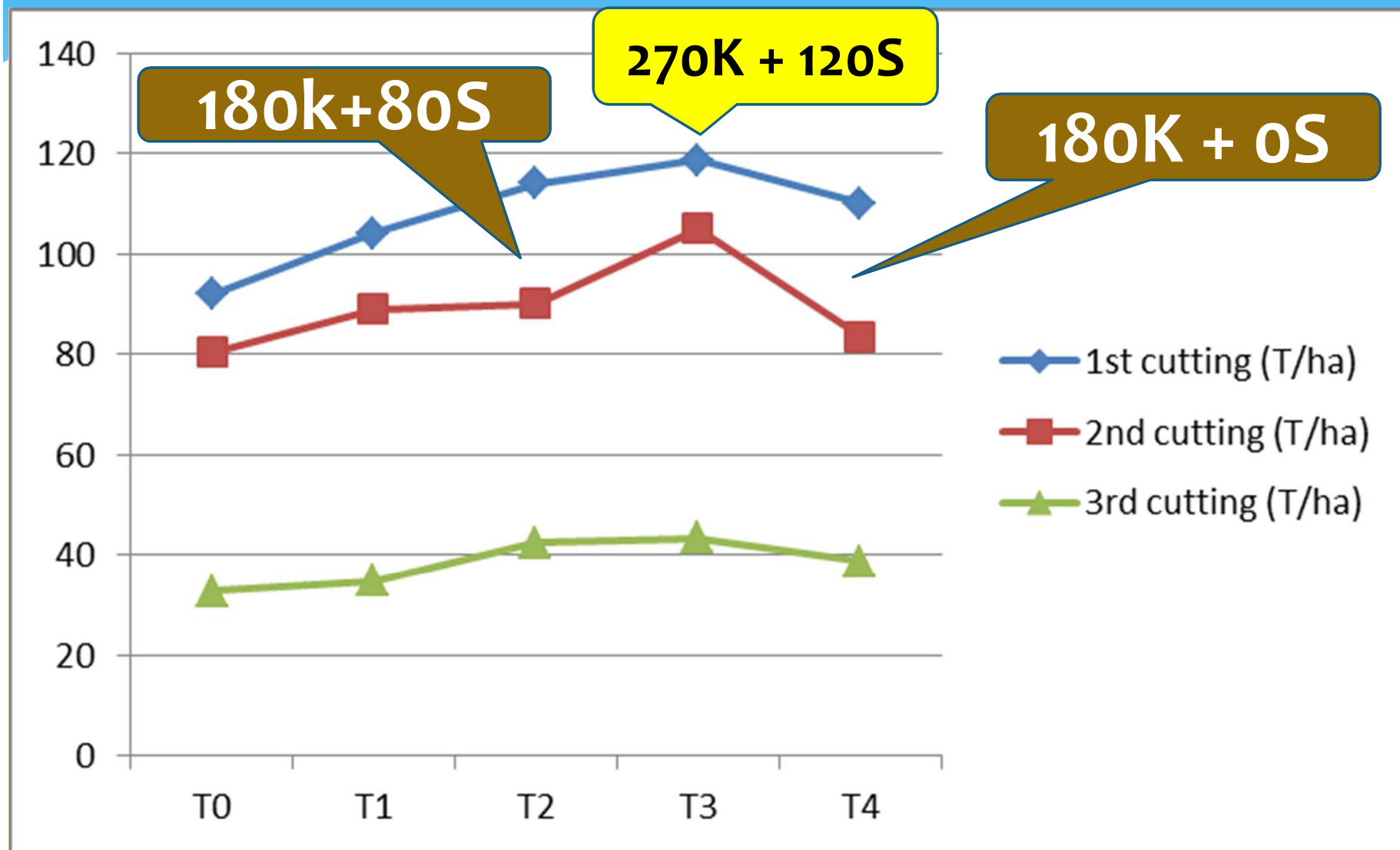
# Soil characteristics in the experimental sites

Soil properties	Unit	Son La
		VA-06
pH <sub>KCl</sub>		5.78
OC	%	2.24
N	%	0.12
P <sub>2</sub> O <sub>5</sub> total	%	0.04
K <sub>2</sub> O total	%	0.16
P <sub>2</sub> O <sub>5</sub> available	mg/100g	10.22
K <sub>2</sub> O available	mg/100g	13.26
Ca	%	0.17
Mg	%	0.03
Ca	meq/100g	8.05
Mg	meq/100g	2.16
SO <sub>4</sub>	%	0.07
S	%	0.02

# Precipitation distribution in Son La sites

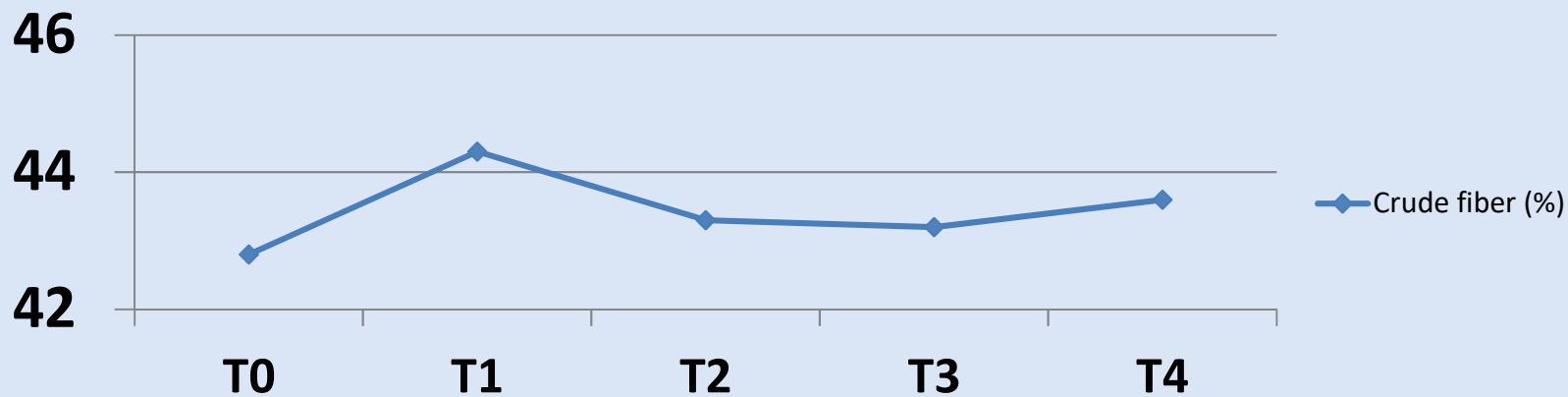


# Effect of polyhalite on VA-06 **yield**

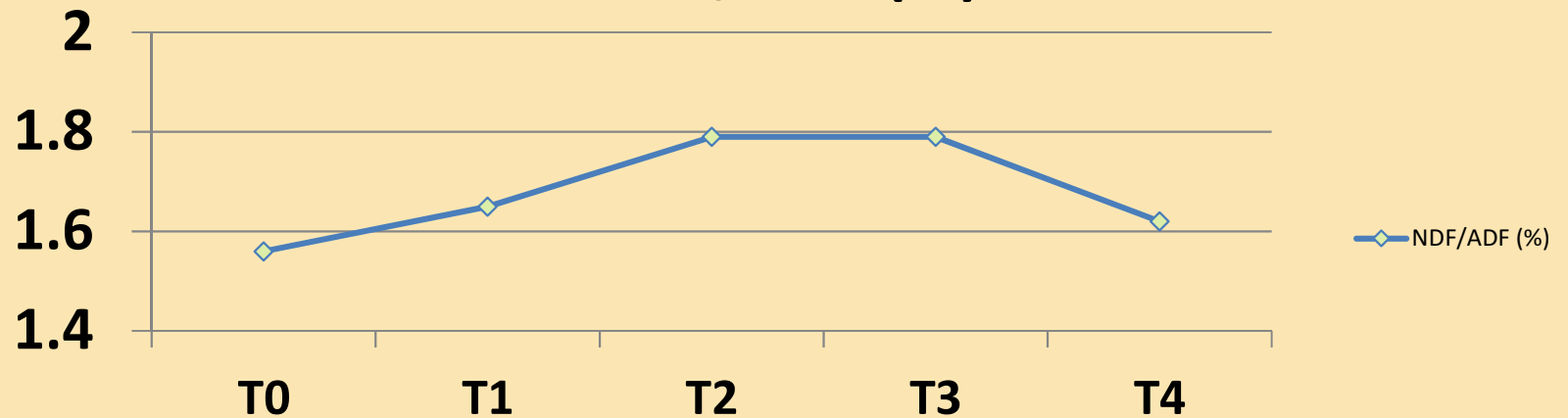


# Effect of polyhalite on **quality of forage** (VA-06) in Son La site

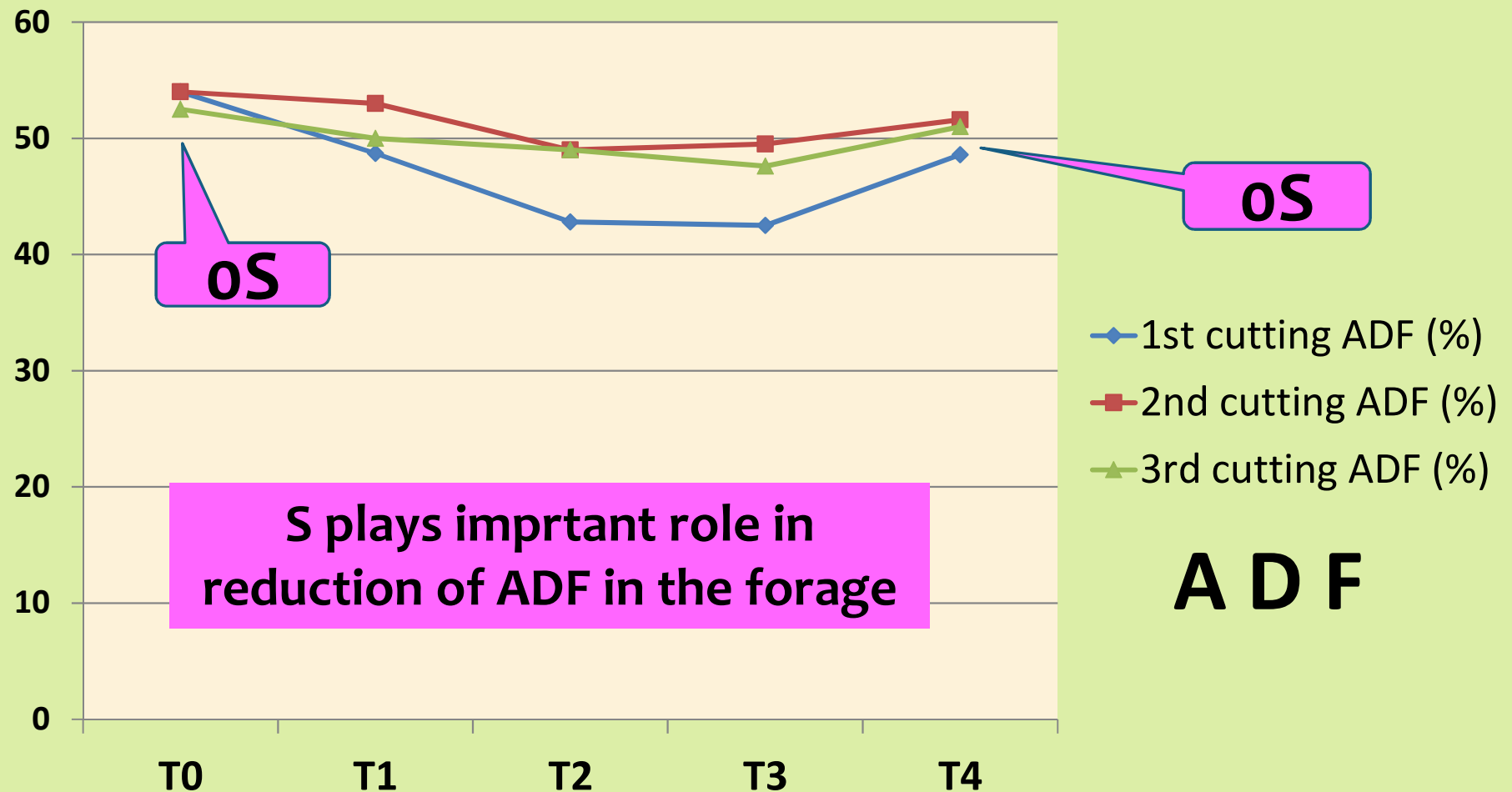
## Crude fiber (%)



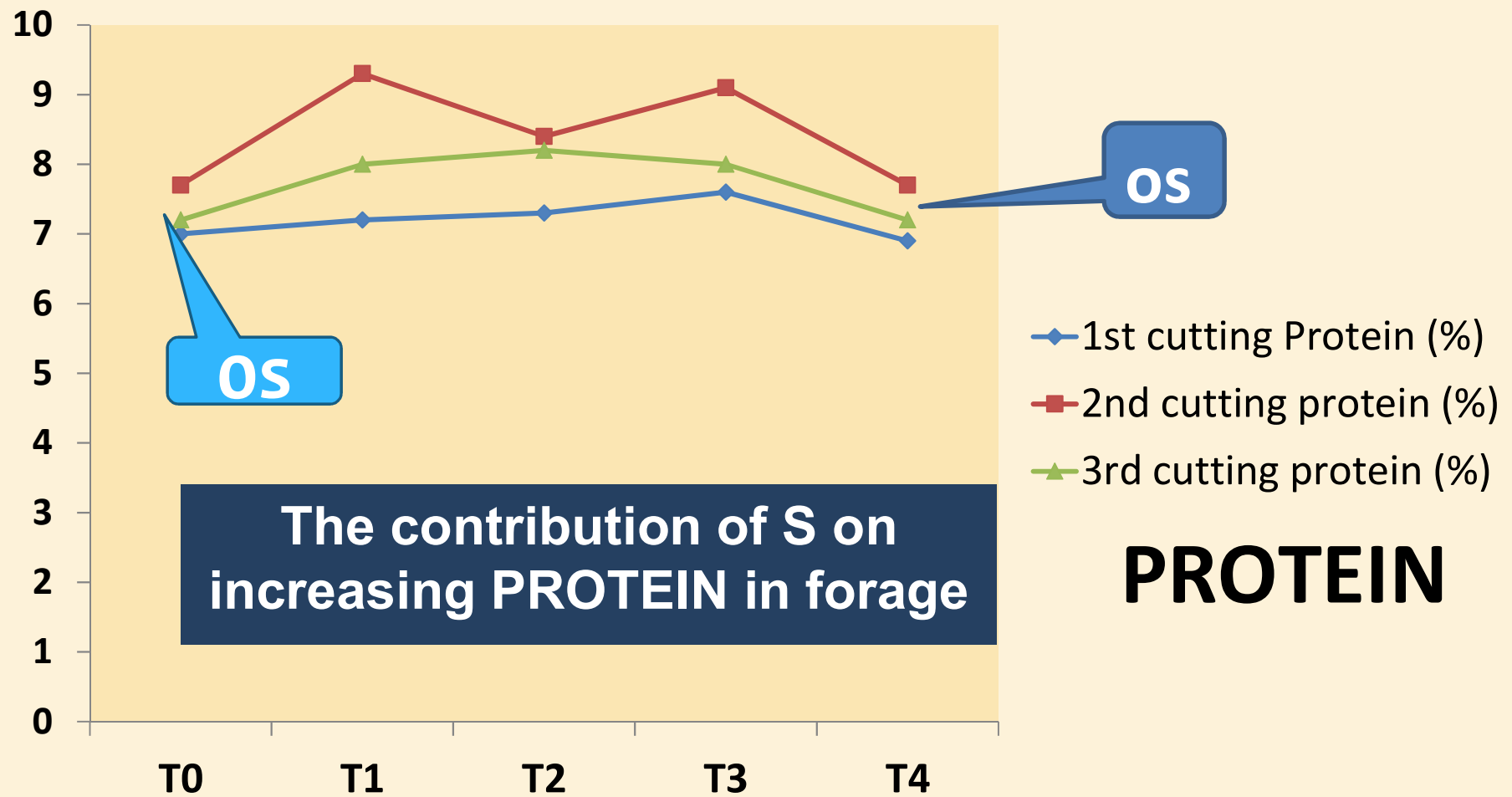
## NDF/ADF (%)



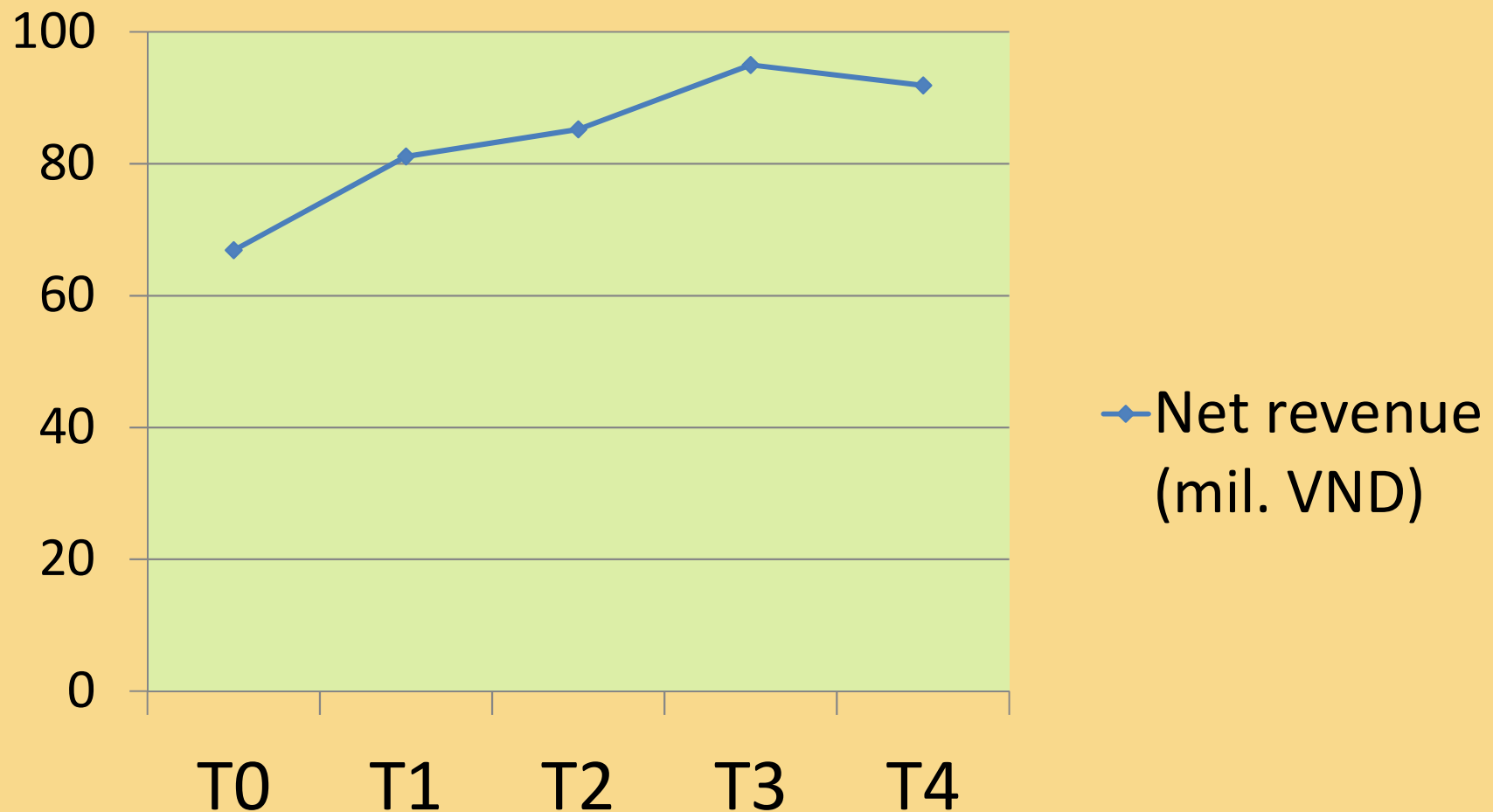
# Effect of polyhalite on quality of forage (VA-06) in Son La site



# Effect of polyhalite on quality of forage (VA-06) in Son La site



# Economic analysis for forage (VA-06)



# Conclusion

- \* **1.** Unchanged doses of N and P fertilizer applied to sugarcane. Increasing amount of K from (MOP) increases productivity of sugarcane (from 70-100 T/ha) and increases quality of the product, such as content of CCS in sugarcane from 10-15%.
- \* **2.** a) Unchanged dosage of N; P; and K used for tea. Increasing the amount of S (from T1 to T5), with contribution of Ca, Mg from polyhalite increases clearly tea yield (from 21T to 24T/ha). Highest tea yield at the T6 (120K + 60S + 53Ca + 18Mg).
- \* b) Fertilization of polyhalite for tea increases tea quality through indicators of tannins, soluble substance, amino acids, sugar. Sulfur also has clearly effect on tea quality through the indicators as amino acid, caffeine and sugar



# Conclusion (cont.)

**3.** a) Unchanged doses of N and P fertilizer applied to forage (VA06). **Increasing dose of polyhalite, increases grass VA06 productivity.** The highest yield at T3 (270K20+120S+75Ca+22.5Mg)

b) **Sulfur** in polyhalite has contributed to **increase productivity forage (VA06), comparing with T2 (with S) and T4 (without S)**

C. Increasing dose of polyhalite **decreases ADF** in forage, and increases protein content. On the contrary, the lack of sulfur will reduce the protein content, and increase ADF.

**4.** Fertilizing MOP and Polyhalite in reasonable doses for sugarcane, tea and forage has not only increased productivity and product quality, but also **increased income for farmers/producers compared to controls.**



**Thank you for your attention**

# Visit to sugarcane field experiments



# Sugarcane at harvesting time





# Polyhalite test for tea





# Polyhalite test for tea





# Forage VA-06

