Effects of Polyhalite application on honey pomelo yield and quality in Fujian province of China

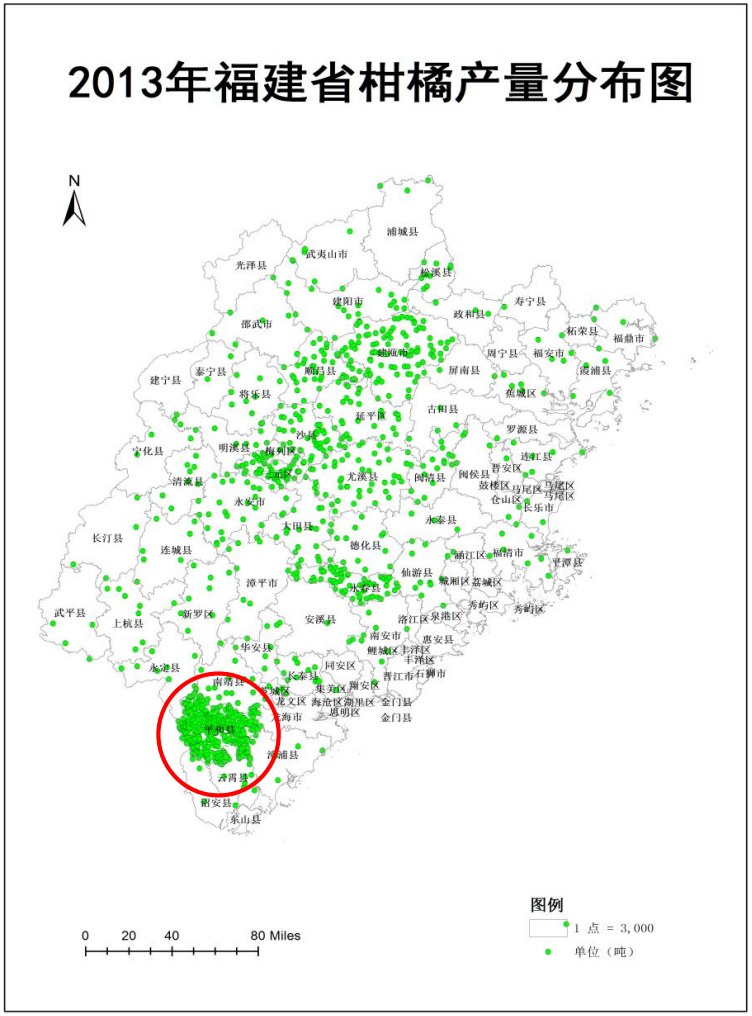
Liangquan Wu , Xiuzhu Xu

International Magnesium Institute

Main Content

- **N, P, K input status**
- **Ca, Mg, S nutrition status**
- **Effects of Polyhalite application**

Orange is the second largest crop in Fujian province



Honey pomelo is an excellent orange variety , accounting for 25% orange planting areas in Fujian province, and its production accounted for 35%, which is mainly distributed in Pinghe County.


Amazing! 80,000 ha!

Unique advantages of honey pomelo

Storable! (3 months)

High quality: juicy, sweety !

Happiness: family reunion!

Welcome by young and old !

Farmer and soil survey in 2016

74 farmers，41 Soil samples，78 drinking water

Fertilizer application status in pomelo producing region

According to agronomist' recommendation， NPK input for pomelo production is very high, which will result in environmental impacts and aggravate micronutrient deficiency.

n=56

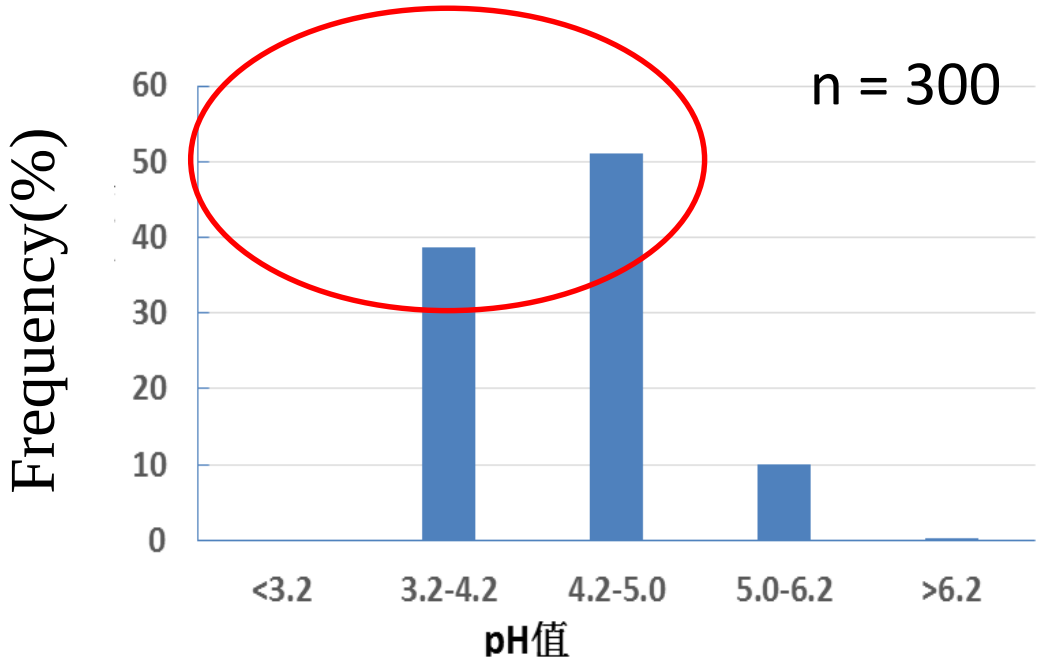
Parameters	Units	Mean	
Yield	t/ha	53.6±23.2	
Times of fertilizer application	time	5	
N rate	N kg/ha	1061±472	600
P rate	P_2O_5 kg/ha	715±379	200
K rate	K_2O kg/ha	859±458	500

Basic Soil property

Soil type	Soil layer	pH	Organic matter	Alkali-hydrolyzable nitrogen	Available P	Available K
	cm		%	mg/kg	mg/kg	mg/kg
Red soil	0-20	4.4	2.7	130	619	185
n=18	20-40	4.0	1.7	83	397	150
	40-60	4.0	1.5	71	188	145
Paddy soil	0-20	4.7	2.3	127	656	175
n=14	20-40	4.4	1.5	74	358	125
Optimum range		5.0-6.5			60-120	100-120

Soil acidification is severe in honey pomelo producing region

90% samples lower than<5.0



Nitrate status of drinking water

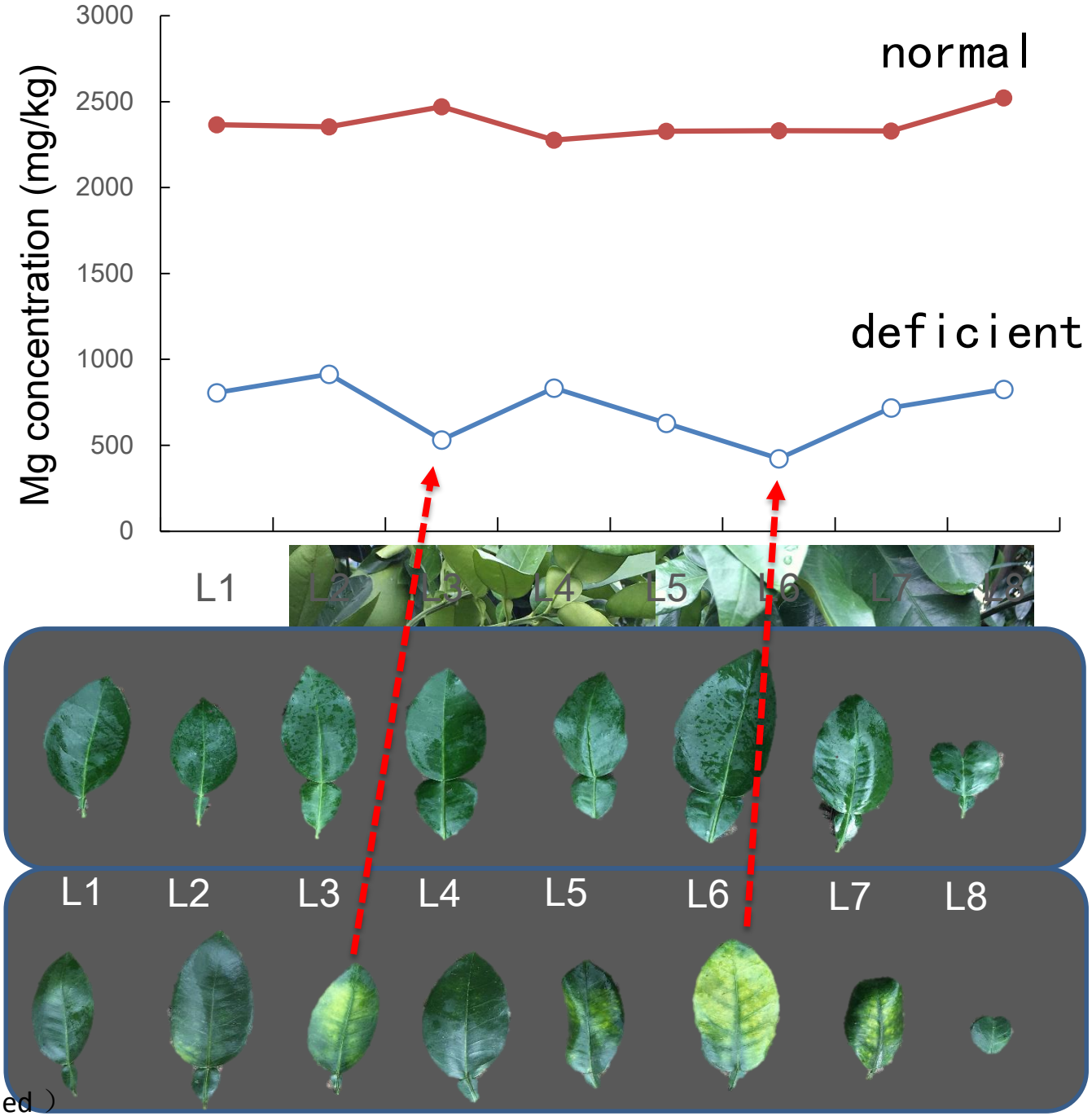
Source of water	Samples	Excess		Average
	No.	No.	%	mg N/L
Tap water	32	13	40.6	8.6±9.1
Well water	9	5	55.6	14.4±13.1
Spring water	37	11	29.7	9.3±9.7

Main Content

- N, P, K input status
- **Ca, Mg, S nutrition status**
- Effects of Polyhalite application

Mg deficiency symptom is common in honey pomelo producing region

Leaf Chlorosis started since early Jun (fruit expansion period); it was especially noticeable post-harvest. Leaf chlorosis were usually happened on leaves of last years' shoot.



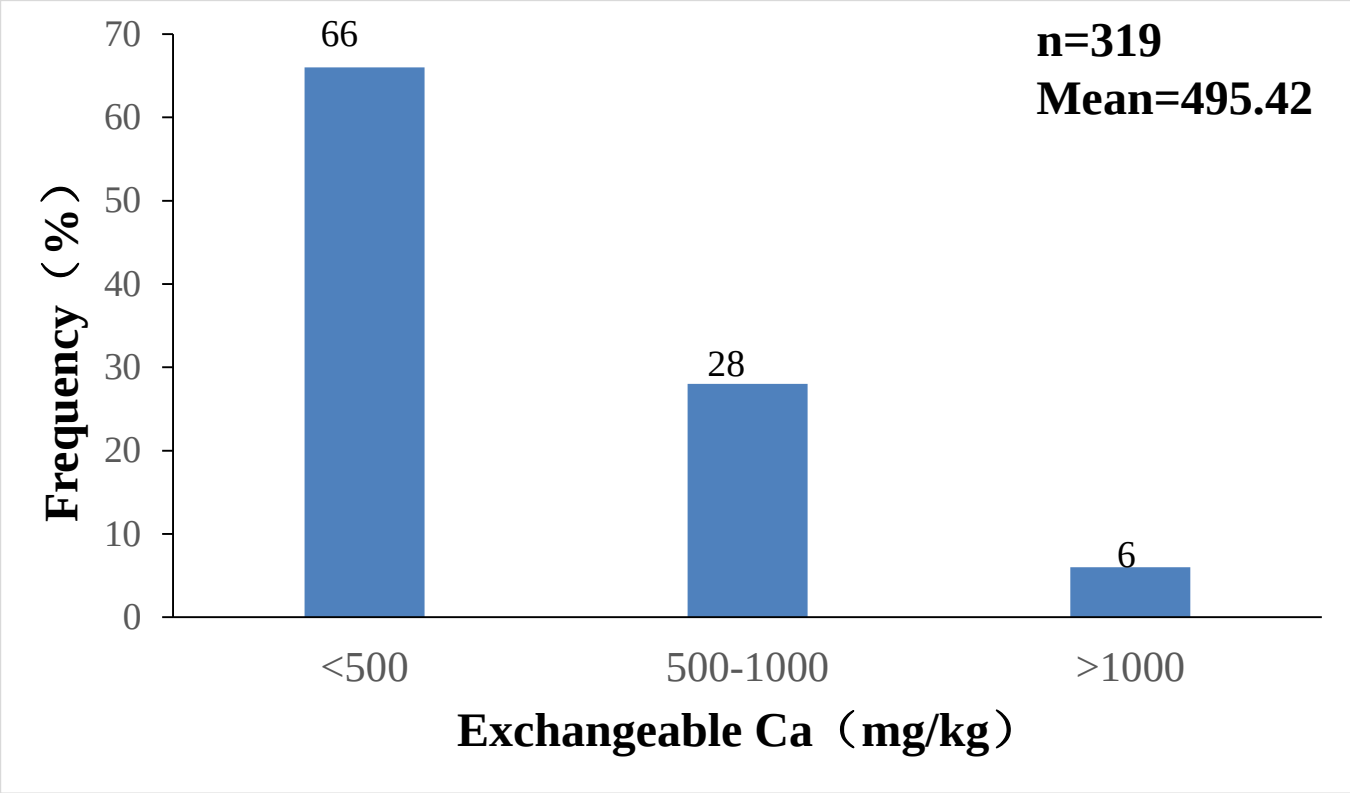
（ Zhichang Chen， 2016， unpublished ）

Ca deficiency symptom is also common in honey pomelo producing region

Fruit cracking is so severe

Soil Ca status in honey pomelo-producing region

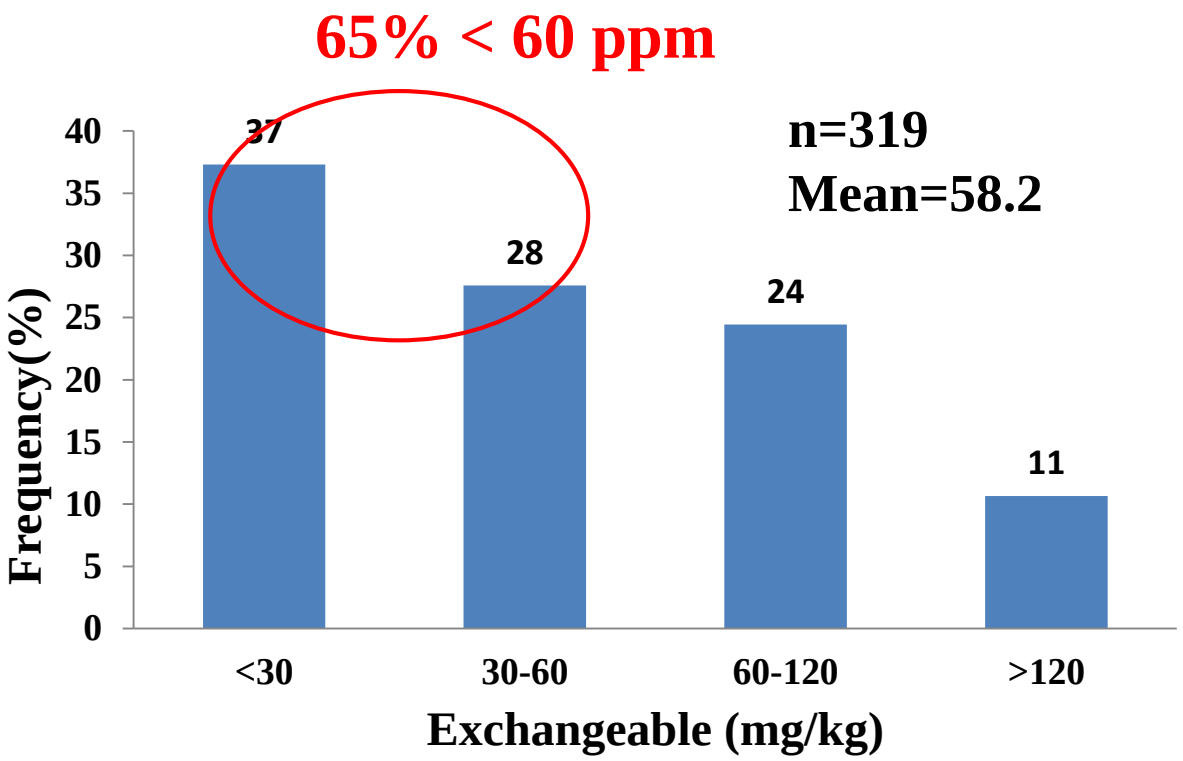
66% < 500 ppm



It is generally considered that the exchangeable Ca in soil lower than 500 mg/kg is in-sufficient for crop growth.

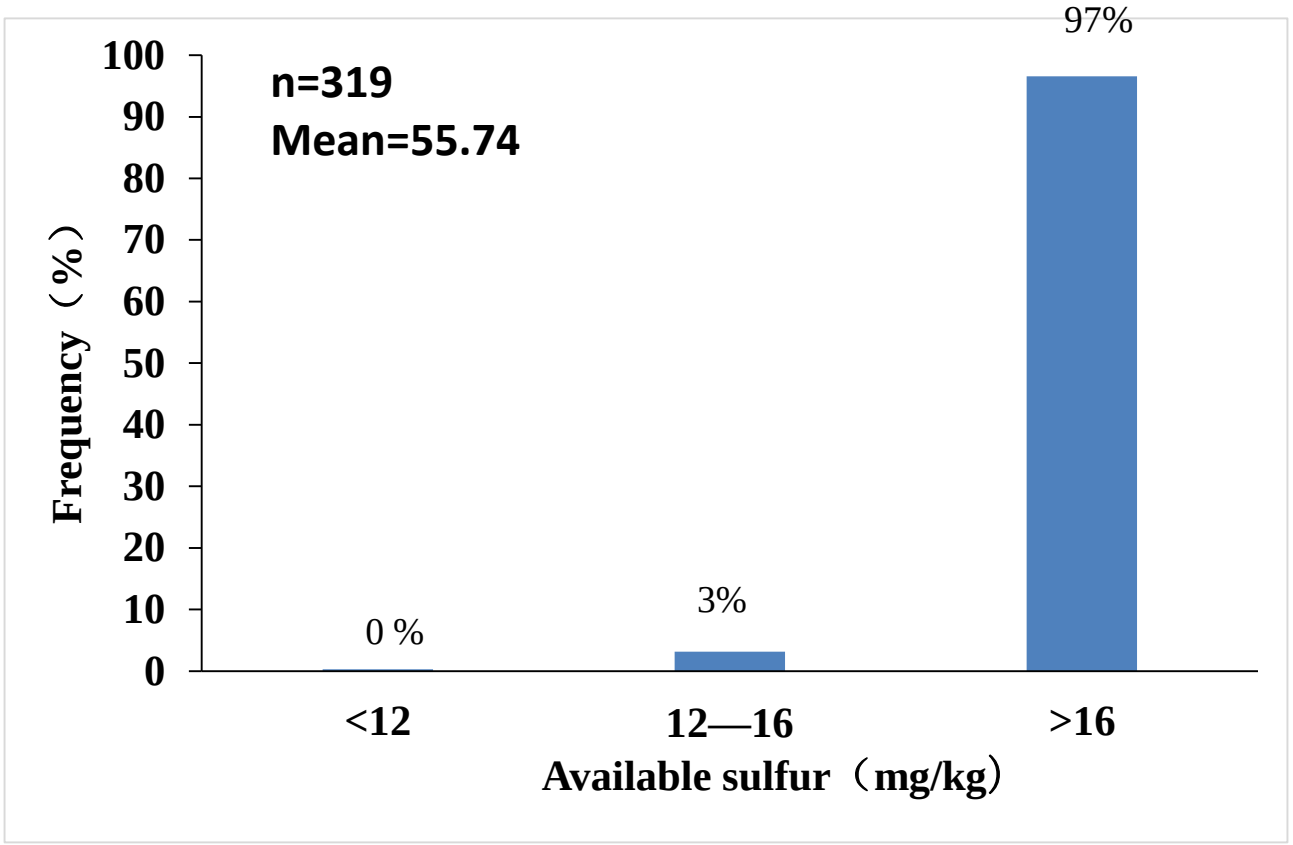
Soil Mg status in honey pummelo-producing region

Mg in most of soils (about 65%) is less than 60mg/kg.



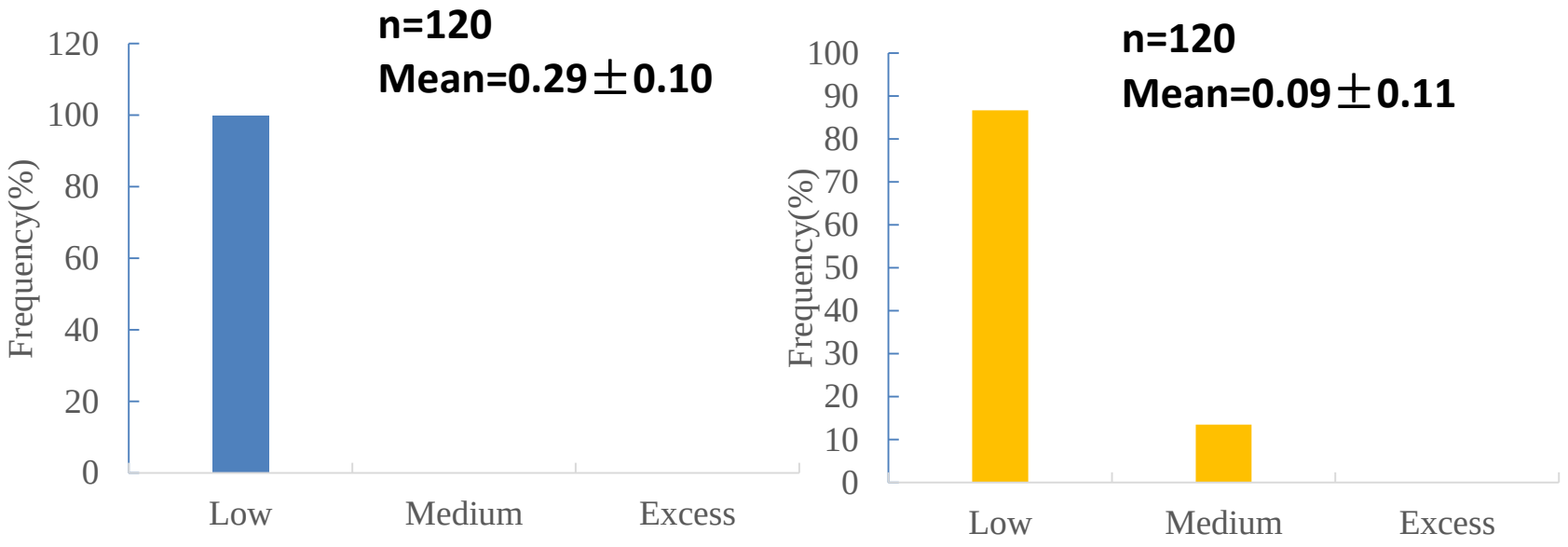
It is generally considered that the exchangeable Mg in soil lower than 60 mg/kg is in-sufficient for crop growth.

Soil S status in honey pummelo-producing region



It is generally considered that the available S in soil larger than 12 mg/kg is sufficient for crop growth.

Ca/Mg Fertilizer application status

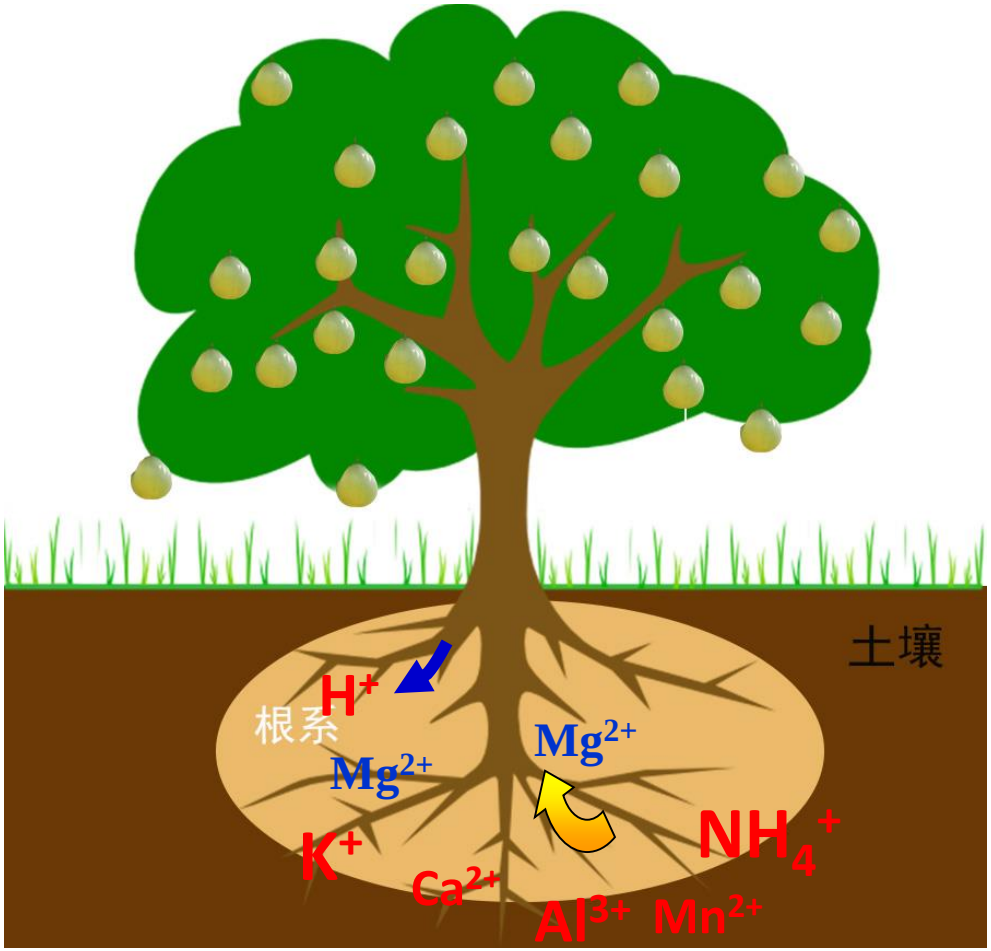


Reference indicator of fertilization for pomelo production(kg/plant.year)

Fertilizer type	Reference indicator		
	EXCESS	medium	Low
CaO	≥1.1	1.0-1.1	≤1.0
MgO	≥0.4	0.2-0.4	≤0.2

（Li et al., 2016）

So, due to low soil Ca/Mg content, cation competition, and high Ca/Mg demand, Ca/Mg deficiency is becoming an important limitation factor in intensive agriculture.



(3) High yield resulted in high demand

(1) Relative low soil Mg supply

(2) Cation competition

Main Content

- N, P, K input status
- Ca, Mg, S nutrition status
- **Effects of Polyhalite application**

Experiment Design

Treatments：

Farmer practice

Optimized NPK

Optimized NPK+2.8kg Polyhalite

12 plants per treatments

Basic soil property：

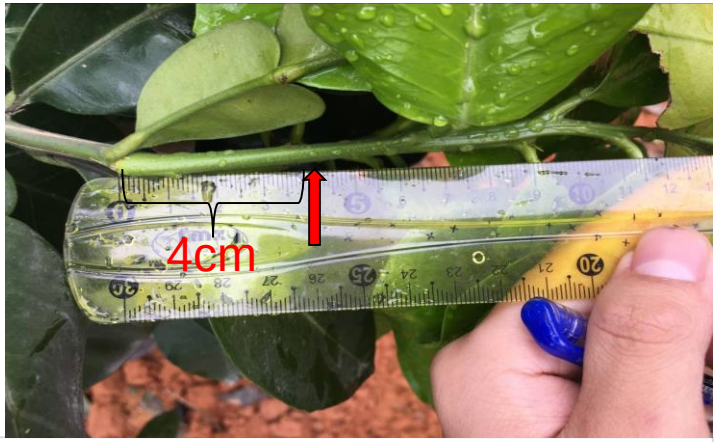
pH=4.08, Organic matter=1.82%，Bray-I P=481, Available K=101, Exchangeable Ca=574, Exchangable Mg=55.

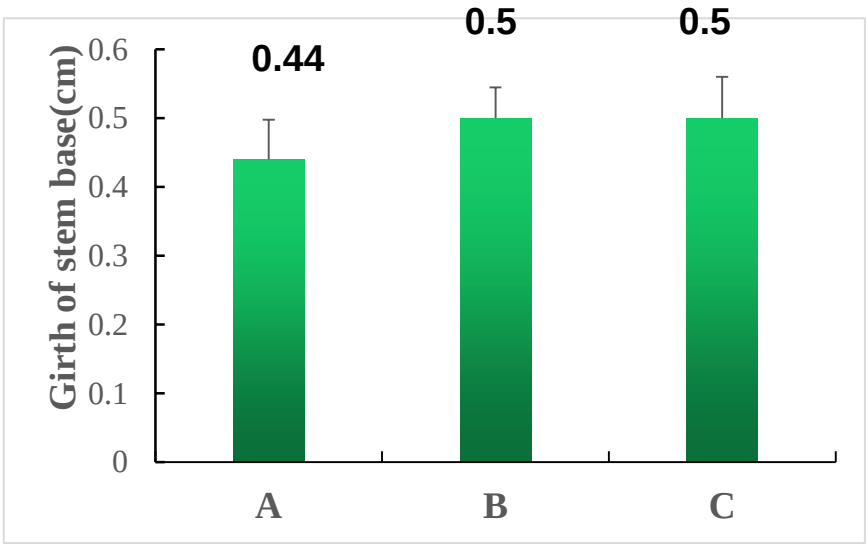
Fertilizing plan

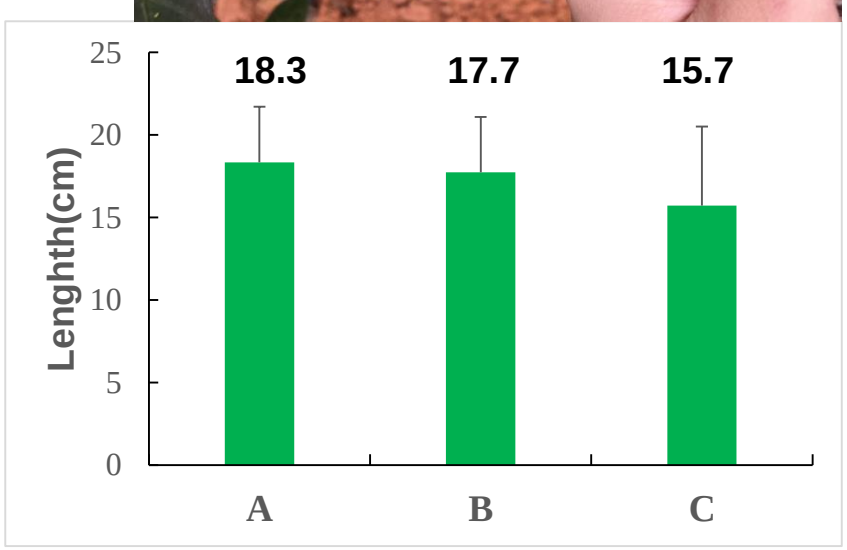
Farmer Practice	Optimized fertilization
Dec 5： 15-15-15（2 kg/plant） +7.5 kg pig manure	**Jan 12：** 15-15-15(1.5 kg/plant) + Organic fertilizer(5 kg/plant)/+2.8kg polyhalite
Feb 4： 26-6-8（2 kg/plant）	
Apr 19： 19-5-21（2kg/plant）	**Apr 19：** 22-11-10（1 kg/plant）
May 20： 17-17-17（2kg/plant）	**Jun 4：** 18-5-22（1.5 kg/plant) +Organic fertilizer(5 kg/plant, contained Ca and Mg)
Jul 7： 17-17-17（2 kg/plant）	**Jul 7：** 15-15-15（1.5 kg/plant）
Total Nutrient Input **（N-P_2O_5-K_2O-CaO-MgO, kg/ha）**	
A: 1528-1016-1246	B：862-631-744-69-49 C：862-631-1038-468-175

Effect of polyhalite application on characteristics of spring shoot

Compared with farmer practice, polyhalite application increase girth of stem base 13.6%, but the length of spring shoot was decreased 14.2%.



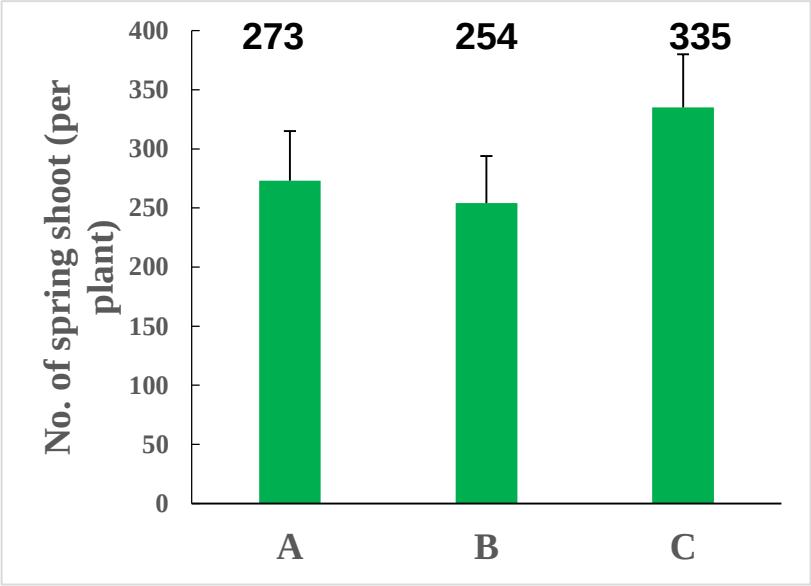


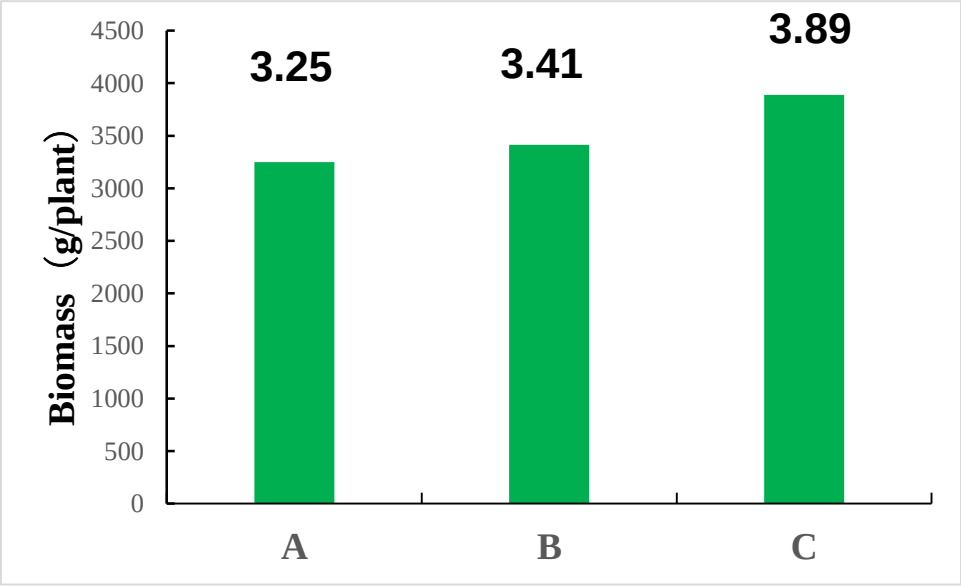


Note：A: Farmer practice; B：Opt. NPK； C： Opt. NPK +2.8 kg Polyhalite

Effect of polyhalite application on characteristics of spring shoot

Compared with farmer practice, polyhalite application increase No. of spring shoot 23% and biomass of spring shoot 19.7%.

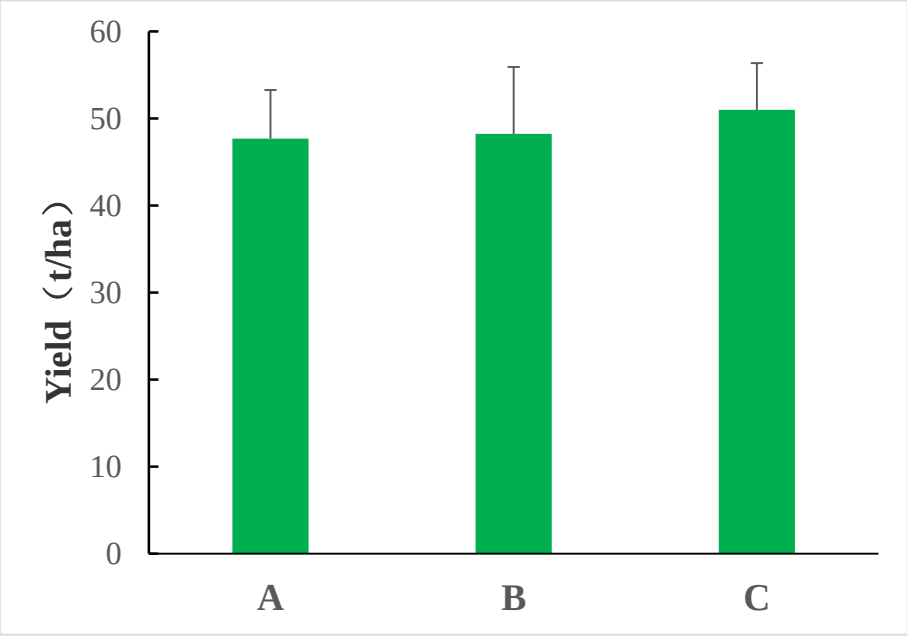




Note：A: Farmer practice; B：Opt. NPK；C： Opt. NPK +2.8 kg Polyhalite

Effect of polyhalite application on yield

Compared with farmer practice, Opt. NPK increase yield 0.55t/ha (1.2%) ; Opt. NPK + 2.8 kg polyhalite increase yield 3.29t/ha (6.9%).



Note：A: Farmer practice; B：Opt. NPK；C： Opt. NPK +2.8 kg Polyhalite

Effect of polyhalite application on characteristics of fruit

Compared with farmer practice, Opt. NPK + 2.8 kg polyhalite increase peel thickness and weigh, transverse and vertical diameter was also increased.

Treatments	Fresh weigh per fruit	Peel weigh	Flesh weigh	Peel thickness	Transverse diameter	Vertical diameter
	g	g	g	mm	cm	cm
Farmer practice	1072±176	321±100	752±172	11.6±2.11	14.5±1.30	14.3±0.63
Optimized NPK	1052±168	333±134	719±98	12.7±2.23	15.0±0.89	14.0±1.00
Optimized NPK + 2.8kg polyhalite	1176±156	416±113	760±163	13.1±2.39	15.5±1.08	15.0±1.03

25 days after harvest

Opt. NPK +2.8 kg Polyhalite

Farmer practice

Effect of polyhalite application on characteristics of fruit

Compared with farmer practice, edible, total soluble solids was decreased in Opt. NPK + 2.8 kg polyhalite treatments; but the ratio of TSS to TA had some increase, due to titratable acidity decreased more.

Treatments	Edible	Total soluble solids	Titratable acidity	TSS/TA	Water ratio of flesh
	%	%	%		%
Farmer practice	69.7±9.9	11.5±0.7	0.67±0.09	17.5±2.8	85.1
Optimized NPK	69.6±9.2	11.4±1.7	0.63±0.09	18.3±3.0	85.1
Optimized NPK + 2.8kg polyhalite	64.4±8.6	10.8±1.2	0.60±0.07	17.9±2.0	86.4

Effect of polyhalite application on income

Compared with farmer practice, Opt. NPK reduced 44% N input, 38% P input, 40 K input; reduced fertilizer cost 12500 RMB/ha；increase income 15000 RMB/ha;
Opt. NPK + 2.8 kg polyhalite reduced 44% N input, 38% P input, 17% K input; reduced fertilizer cost 4100 RMB/ha；increase income 18900 RMB/ha.

Treatments	Nutrient Input（N-P_2O_5-K_2O-MgO-CaO，kg/ha）	Fertilizer Cost（10 000 RMB/ha）	Yield（t/ha）	Gross Income（10000 RMB/ha）	Income Increase（10000 RMB/ha）
Farmer Practice	1528-1016-1246-0-0	3.74	47.71	21.47	-
OPT. NPK	862-631-744-69-49	2.49	48.26	21.72	1.50
OPT. NPK+ 2.8kg polyhalite	862-631-1038-468-175	3.33	51.00	22.95	1.89

Thanks for your attention!