The control effect and mechanism of green manure on the soil-borne diseases of tobacco (AP 14)

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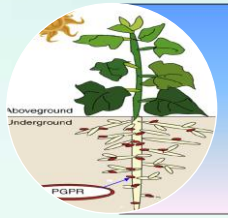
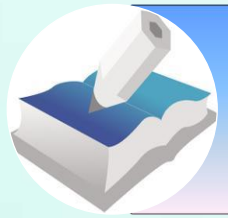
Outline



Background and Objective

Materials and Methods

Main Results



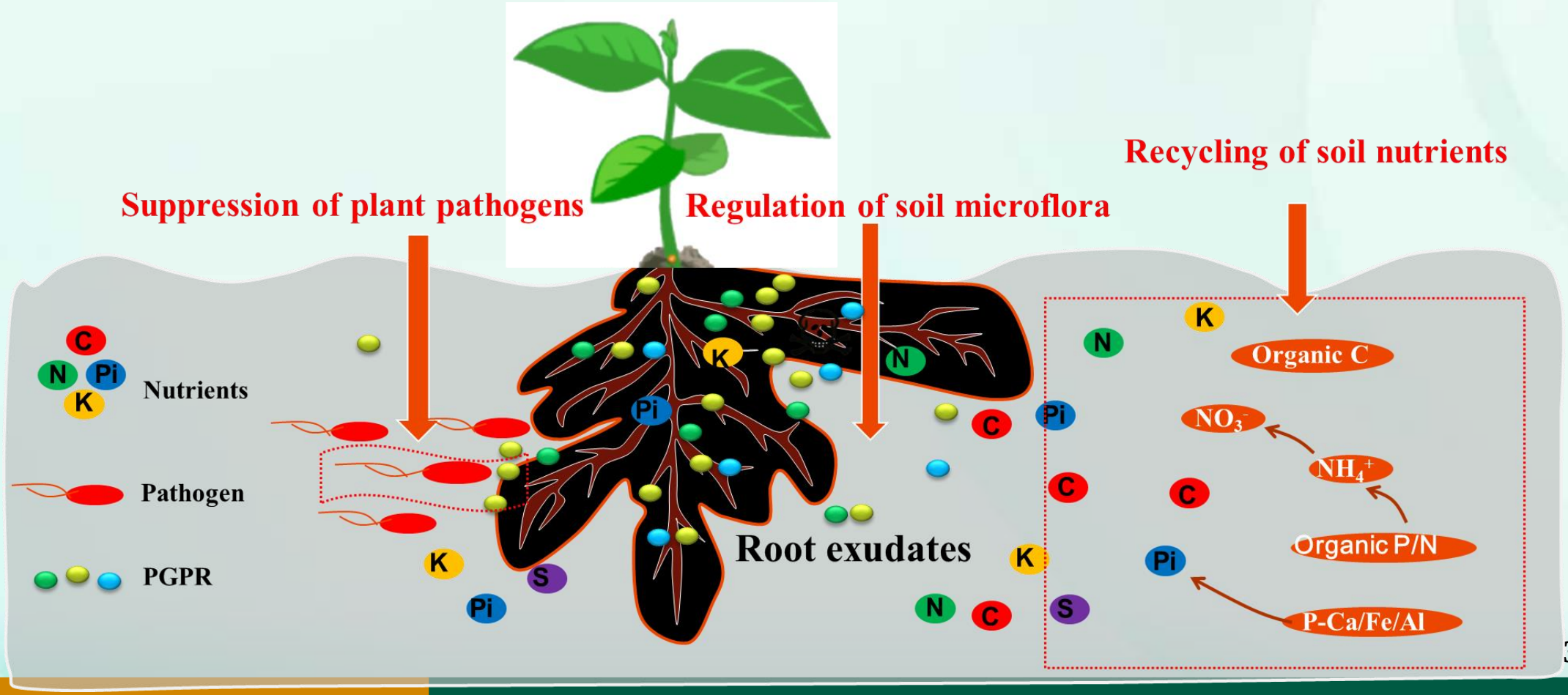
Summary and Conclusion

1. Background and Objective

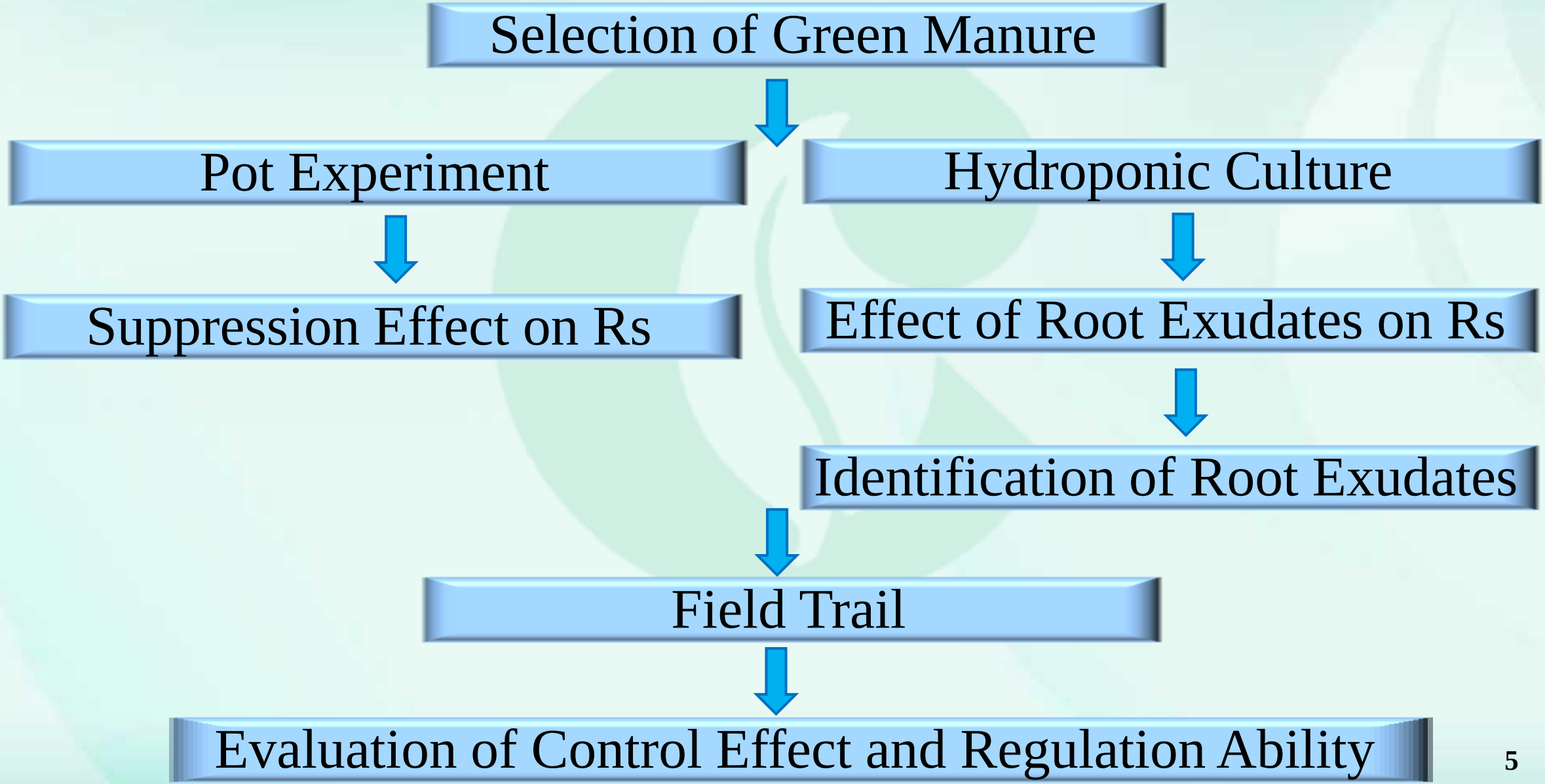
- Green manure has become more and more popular in Guizhou Province recently, due to its low cost and obvious carbon increase in soil.
- It was found that tobacco bacterial wilt (Ralstonia solanacearum = Rs) was suppressed in some green manure growing areas compared to other green manure areas.
- The geographical distribution of green manure can effectively prevent and control tobacco bacterial wilt.

1. Background and Objective

The rhizosphere is a critical area for regulating soil microflora.
Non-host root exudates have obvious suppression effect on soil-borne diseases.
Root exudates from green manures can regulate soil microorganisms.



2. Materials and Methods



3. Main Results

——Selection of green manure and its effect on Rs

15 green manures suitable for planting in southwest tobacco areas were provided.

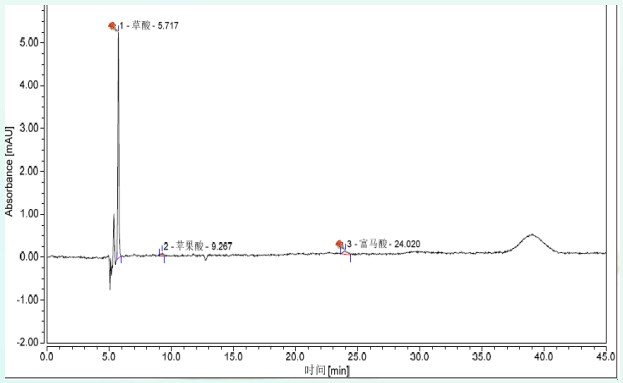
The population of Rs in the mung bean planted soil was only 31.26 % of that in control treatment 80 days after planting. Mung bean, Hairy vetch, Rape and February orchid with good control effect to Rs were selected for following evaluation.

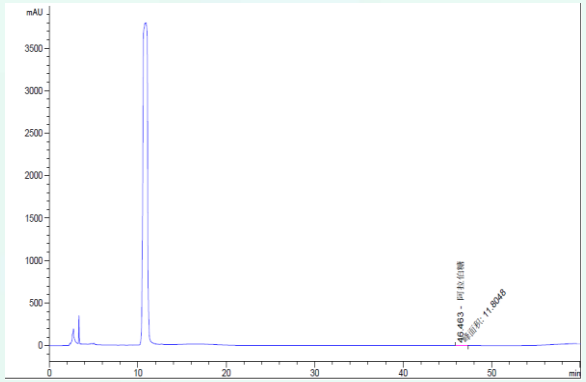
Green Manure		20d	40d	60d	80d
Family	Type	Population log(CFU/g soil)			
Composite	Rudbeckia	4.08±0.01a	3.87±0.02b	3.31±0.04b	2.89±0.04c
Gramineae	Ryegrass	3.40±0.06b	3.69±0.03b	3.51±0.02b	2.43±0.03c
Cruciferae	Rape	2.65±0.03c	2.75±0.02c	2.41±0.04c	1.77±0.04d
	February orchid	3.88±0.02b	2.35±0.02c	2.94±0.02c	2.04±0.03c
Leguminosae	Green pea	3.29±0.02b	3.14±0.04b	2.54±0.04c	1.79±0.02d
	Chinese milk vetch	3.23±0.02b	2.31±0.04c	2.51±0.05c	1.84±0.03d
	Smooth vetch	2.82±0.02c	2.75±0.02c	2.27±0.02c	2.00±0.04cd
	Mung bean	2.91±0.02c	2.33±0.02c	1.89±0.02d	1.31±0.04d
	Bamboo bean	3.50±0.02b	3.83±0.02b	3.08±0.03b	2.04±0.02c
	Soybean	3.30±0.05b	3.17±0.05b	3.37±0.03b	2.42±0.03c
	Hairy vetch	2.96±0.03bc	3.18±0.03b	2.23±0.03c	2.18±0.03c
	Trifolium repens	3.65±0.03b	3.45±0.04b	3.35±0.03b	3.79±0.03b
	Cowpea	4.11±0.04a	2.84±0.02c	3.04±0.05b	1.63±0.04d
	Vicia sativa	3.62±0.02b	4.51±0.04a	3.04±0.04b	3.54±0.04b
	Horsebean	2.92±0.03c	2.16±0.03c	2.20±0.03c	2.30±0.05c
CK		4.67±0.01a	4.42±0.03a	4.33±0.03a	4.19±0.03a

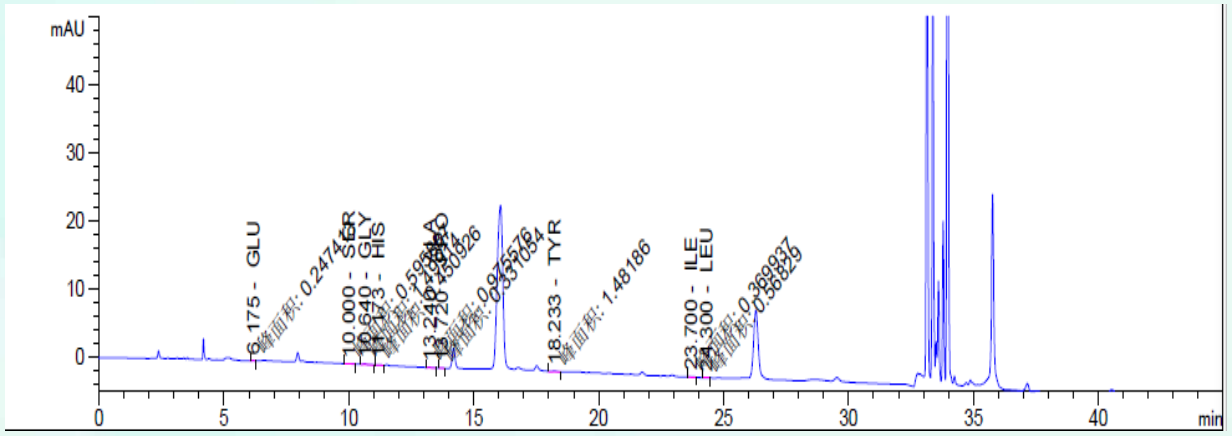
3. Main Results

——Identification of root exudates and its effect on Rs

Nine substances belonging to amino acids, organic acids and carbohydrate were identified.







The content of amino acids in the root exudates of February orchid was higher than any other green manures, while amino acid in rape was the least. Three substances with significant differences in content, glutamic acid, oxalic acid and arabinose, were selected to study their effects on the growth of Rs.

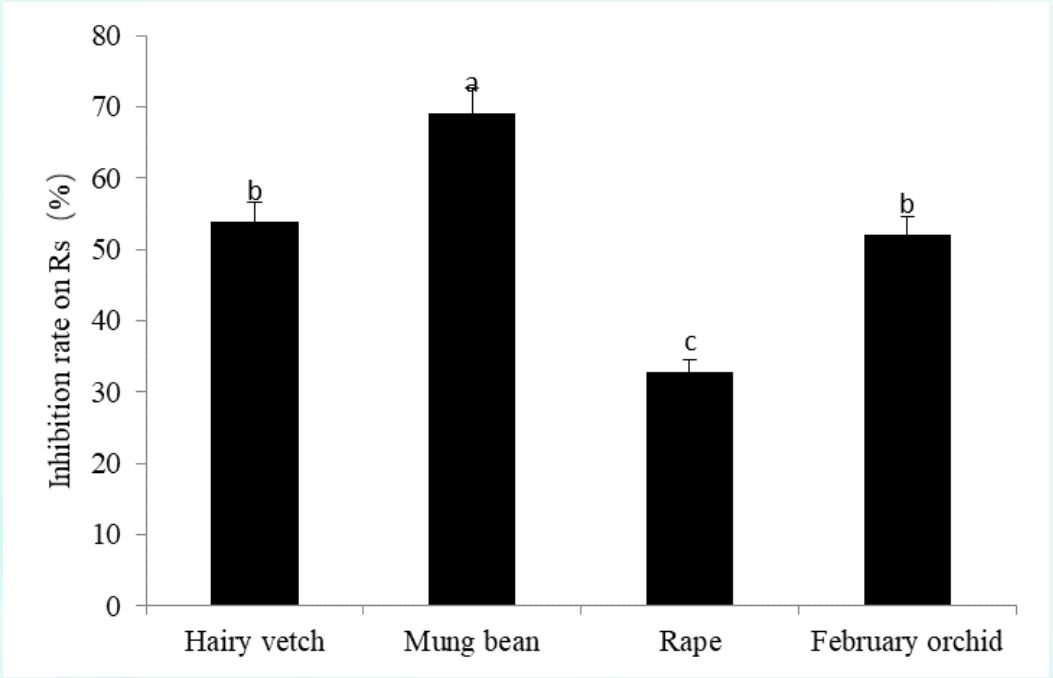
Types of substances		Mung bean	Villose vetch	Rape	Orchid
Amino acids (mg/kg)	Glutamic acid	10.51±0.04d	12.46±0.06b	11.73±0.03 c	13.44±0.02a
	Serine	40.97±0.02d	54.57±0.06a	41.89±0.03 c	48.68±0.03 b
	Glycine	5.06±0.06c	5.23±0.03b	5.45±0.04a	5.48±0.02a
	Histidine	41.13±0.07c	44.84±0.05b	44.77±0.07 b	48.92±0.06a
	Alanine	20.26±0.04b	17.67±0.04d	18.37±0.04 c	21.56±0.03a
	Tyrosine	24.79±0.06a	19.70±0.04c	16.02±0.03 d	22.85±0.04 b
Organic acids (mg/kg)	Oxalic acid	1.90±0.05d	2.95±0.01b	2.73±0.04c	5.88±0.04a
	Palmitic acid	8.03±0.04a	8.02±0.06a	5.00±0.03b	5.00±0.00b
Carbohydrate (mg/L)	Arabinose	2.22±0.06c	2.28±0.05bc	2.32±0.04b	2.46±0.03a

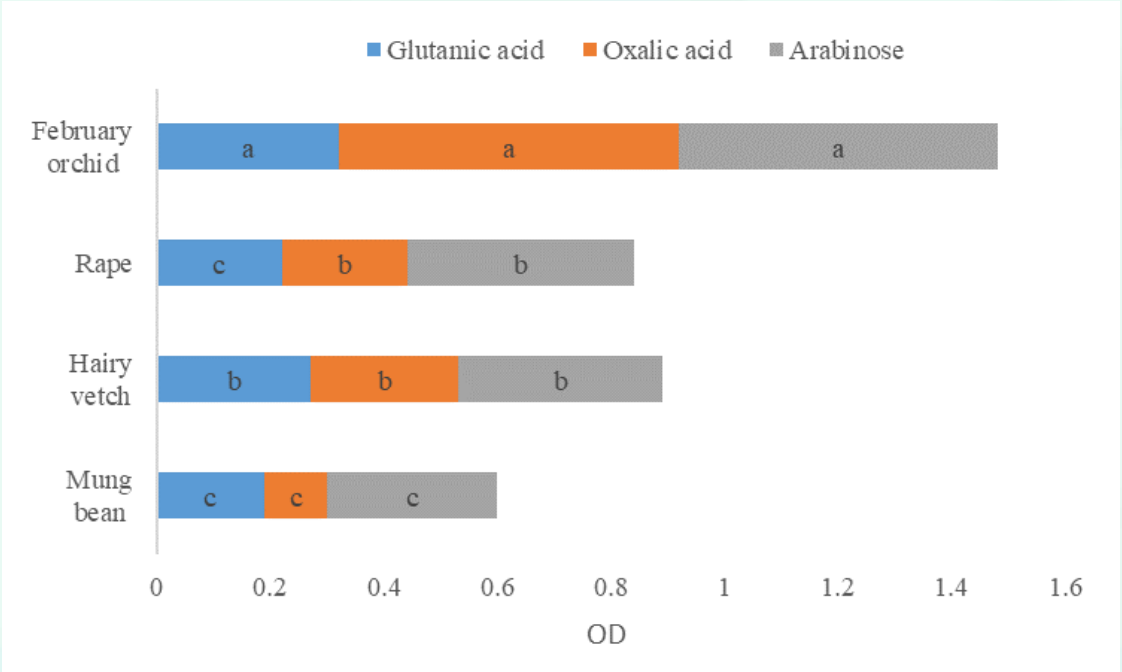
3. Main Results

——Identification of root exudates and its effect on Rs

The root exudates of mung bean had the most obvious inhibitory effect on Rs, with an inhibitory rate of 69.05 %, followed by Hairy vetch and February orchid.

The promoting effect of glutamic acid, oxalic acid and arabinose on the growth of Rs was February orchid > Hairy vetch ≥ Rape ≥ Mung bean. The difference in the effect of root exudates and substances on Rs was mainly due to the different content and proportion of substances in the root exudates.



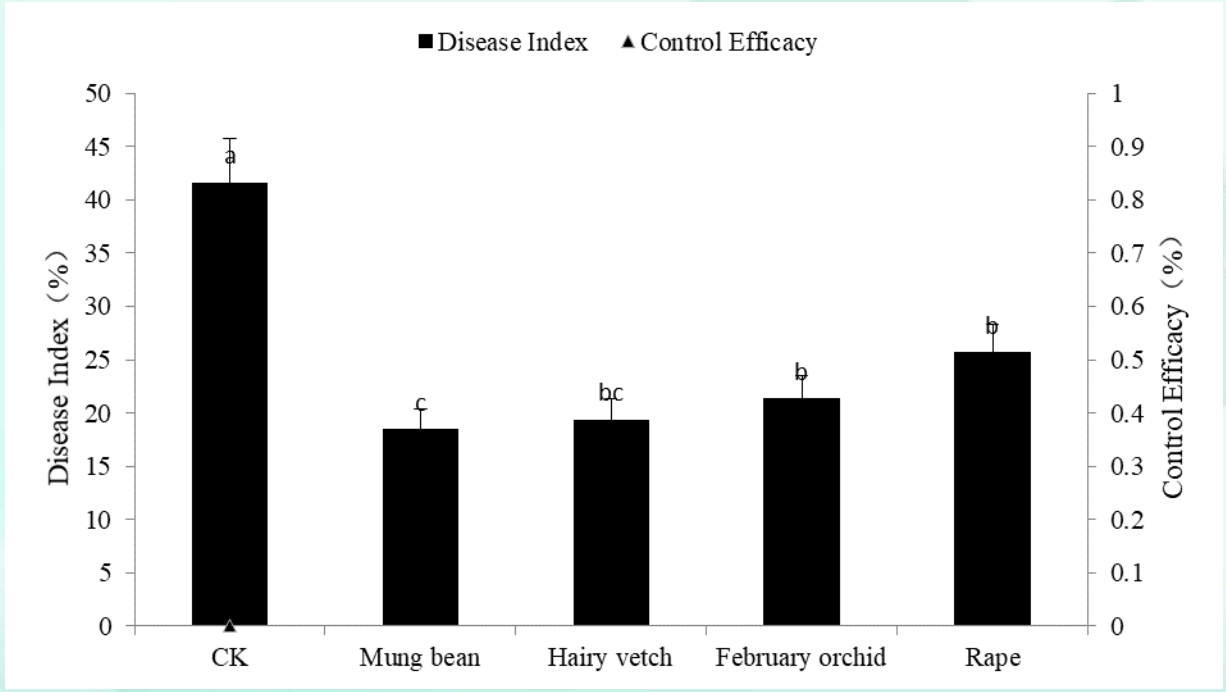


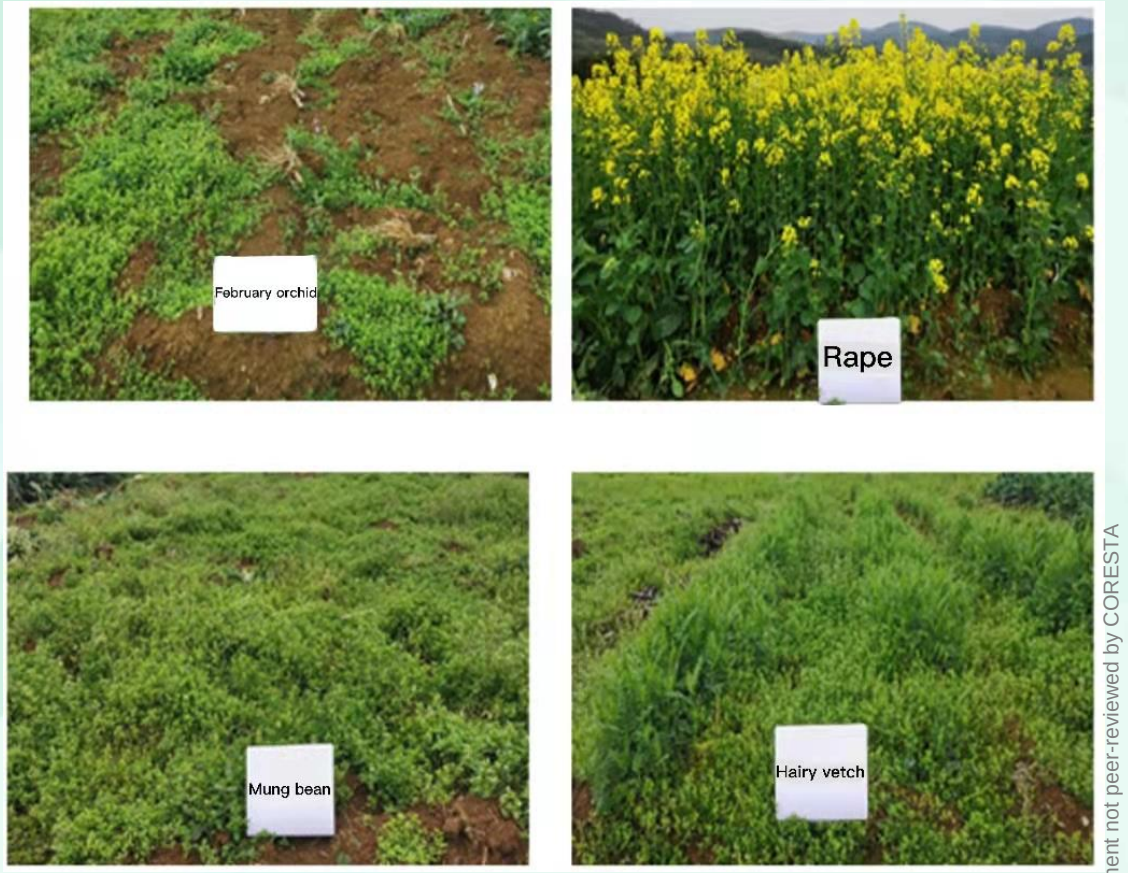
3. Main Results

——Field trial to evaluate control effect and regulation ability

There was no significant difference between the disease index of mung bean and vetch treatments, but it was 86.55 % and 71.90 % of February orchid and rape, respectively.

The control efficacy of bacterial wilt in mung bean treatment was the highest as 55.61 %.

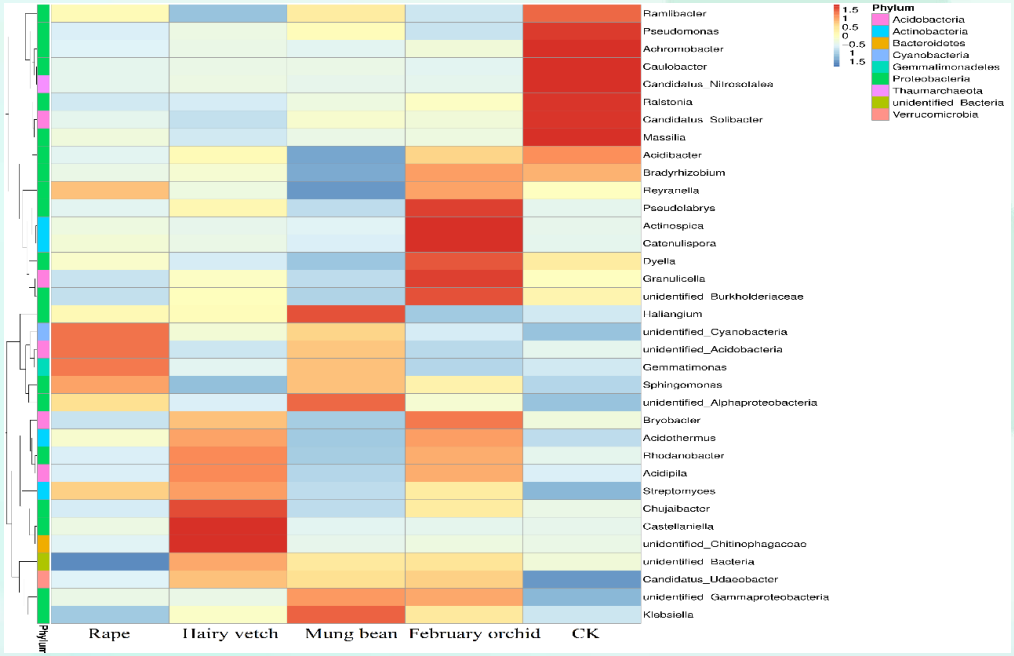


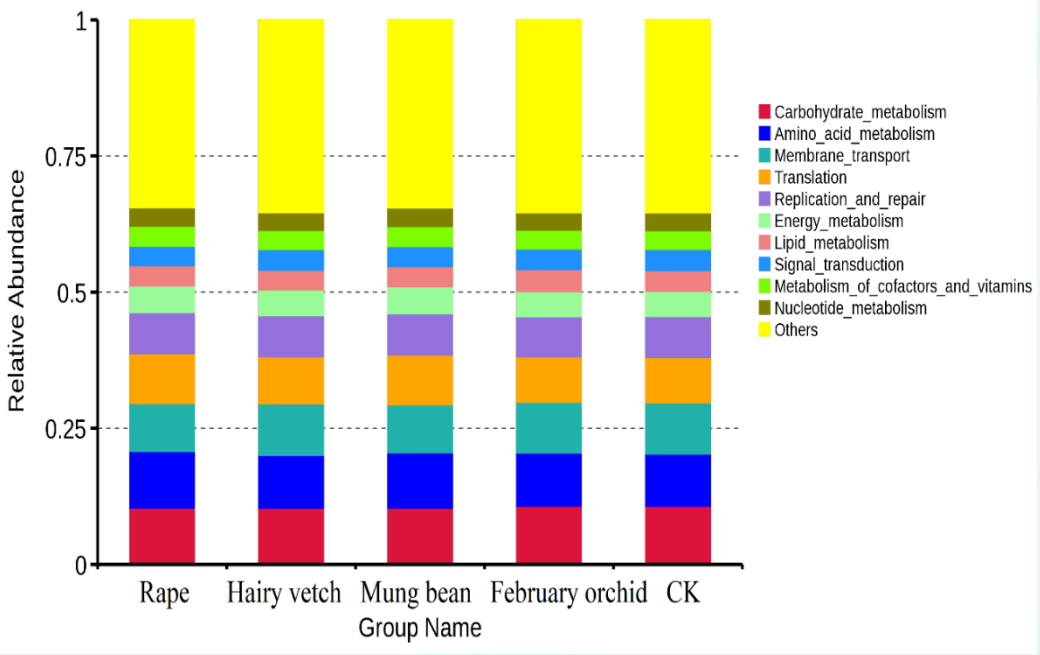


3. Main Results

——Field trial to evaluate control effect and regulation ability

- The abundance of Rs in the control rhizosphere soil was significantly higher than that in green manure-planted soil, which were 4.35, 4.14, 2.90 and 2.29 times of that with rape, hairy vetch, mung bean and February orchid, respectively.
- The abundance of α-*Proteobacteria*, *Haliangium* and *Klebsiella* were higher in mung bean treatment than other treatments.
- The soil functions, such as amino acid metabolism, transcription, replication and repair, were enhanced after treated with green manures.





4. Summary and Conclusion

Reduce soil-borne disease

Root exudates of green manure effectively suppress the population of Rs in soil.

Regulation soil microflora

After the application of green manure, the structure and function of soil bacterial communities have changed.

Suitable green manure

Mung bean is the most suitable manure for biological control tobacco bacterial wilt in southwest China.

Significance

This research will explore a new approach for green prevention and control of tobacco bacterial wilt.

Acknowledgements

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附件 2

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科技项目合同

CNTC

Dr. Liu Yanxia

Welcome to Colorful Guizhou!

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