

## Table of content

<b>Acknowledgement</b>	iii
บทกัศดยอ	iv
<b>Abstract</b>	v
<b>Table of content</b>	vi
<b>List of table</b>	viii
<b>List of illustration</b>	ix
<b>Chapter 1</b> Introduction	1
<b>Chapter 2</b> Review of Literature	4
1. General	4
2. The lychee cultivars in Thailand	5
1. Lowland or tropical cultivars	5
2. Subtropical cultivars	5
3. Functions of essential elements and deficiency symptom	6
4. The nutrient study in lychee	10
<b>Chapter 3</b> Materials and Methods	13
1. Materials and equipments	13
2. Methods	14
1. Nutrients concentration in soil of lychee orchards at different representative sites	14
2. Nutrients concentration in lychee leaf	16
3. Comparison of the nutrient concentration in leaves and fruits of lychee at four cardinal points	19
4. Comparison of the quality of lychee fruit at four cardinal points	21
5. The relationship of nutrient concentration in soil, leaves and fruits of lychee	22
<b>Chapter 4</b> Results	23
1. Nutrients concentration in soil of lychee orchards at different representative sites and soil parent material	23

2. Nutrients concentration in lychee leaf	32
3. Comparison of the nutrients concentration in leaf and fruit of lychee at four cardinal points	33
4. Analysis of fruit quality at different four cardinal points	40
5. The relationship of nutrient concentration in soil, leafs and fruits of lychee	53
<b>Chapter 5 Discussion</b>	<b>58</b>
1. Nutrient concentration in soil of lychee orchards at different representative sites of soil parent material	58
2. Nutrient concentration in lychee leaf	60
3. Nutrient concentration in fruit of lychee	62
4. Comparison of the nutrient concentration in leaves at four cardinal points and at different development stage	62
5. The relationship of nutrient concentration in soil, leaf and fruit of lychee	64
6. Field application possibility	65
<b>Chapter 6 Conclusions</b>	<b>68</b>
<b>Reference</b>	<b>69</b>
<b>Appendix</b>	<b>71</b>
<b>Curriculum vitae</b>	<b>74</b>

**List of Table**

<b>Table</b>	<b>Page</b>
2.1 Standard nutrient availability for tree, nut, vine and fruit crops	11
2.2 Leaf standards developed for lychee in South Africa, Israel and Australia	12
4.1 Fruit proportion and ratio of fresh per dry weight of lychee at four cardinal points	42
5.1 Nutritional status of soil at three representatives sits	59
5.2 Leaf nutrient level in the current study compared with leaf standard developed for lychee in South Africa, Israel, Australia and studied in Thailand	61
5.3 Nutrients concentration in fruit of lychee	62
5.4 The $R^2$ value of correlation between soil-leaf nutrient, soil –fruit and leaf-fruit nutrient	65

### List of Illustration

<b>Figure</b>	<b>Page</b>	
3.1	Locations where samples were collected in Chiang Mai, Thailand	15
3.2	Locations where leaves and fruits were sampling at four cardinal points	20
3.3	L* a* and b* color system	21
4.1	Soil pH at different soil depth of three representative lychee orchards	23
4.2	Nitrogen concentration at different soil depth of three different soil types	24
4.3	Phosphorus concentration at different soil depth of three different soil types	25
4.4	Potassium concentration at different soil depth of three different soil types	25
4.5	Calcium concentration at different soil depth of three different soil types	26
4.6	Magnesium concentration at different soil depth of three different soil types	27
4.7	Manganese concentration at different soil depth of three different soil types	28
4.8	Iron concentration at different soil depth of three different soil types	28
4.9	Zinc concentration at different soil depth of three different soil types	29
4.10	Boron concentration at different soil depth of three different soil types	30
4.11	Macro- and micro-element concentration in lychee leaves at three different soil types	31
4.12	Trace elements, Mn, Fe, Zn and B concentration in lychee leaves at three different soil types	32
4.13	Nitrogen concentration of lychee leaf at different four cardinal points and sampling periods	33
4.14	Phosphorus concentration of lychee leaf at different four cardinal points and sampling periods	34
4.15	Potassium concentration of lychee leaf at different four cardinal points and sampling periods	35
4.16	Calcium concentration of lychee leaf at different four cardinal points and sampling periods	35
4.17	Magnesium concentration of lychee leaf at different four cardinal points and sampling periods	36

4.18	Sulfur concentration of lychee leaf at different four cardinal points and sampling periods	36
4.19	Manganese concentration of lychee leaf at different four cardinal points and sampling periods	37
4.20	Iron concentration of lychee leaf at different four cardinal points and sampling periods	37
4.21	Zinc concentration of lychee leaf at different four cardinal points and sampling periods	38
4.22	Boron concentration of lychee leaf at different four cardinal points and sampling periods	39
4.23	The color of lychee fruit at four cardinal points	40
4.24	Fruit size and weight per fruit of lychee at four cardinal points	41
4.25	Total soluble solid and titratable acid of lychee fruit at different four cardinal points	43
4.26	Nitrogen concentration in seed, peel and aril of lychee fruit at different sampling points (North, South, East and West)	44
4.27	Phosphorus concentration in seed, peel and aril of lychee fruit at different sampling points (North, South, East and West)	45
4.28	Potassium concentration in seed, peel and aril of lychee fruit at different sampling points (North, South, East and West)	46
4.29	Calcium concentration in seed, peel and aril of lychee fruit at different sampling points (North, South, East and West)	47
4.30	Magnesium concentration in seed, peel and aril of lychee fruit at different sampling points (North, South, East and West)	48
4.31	Sulfur concentration in seed, peel and aril of lychee fruit at different sampling points (North, South, East and West)	49
4.32	Manganese concentration in seed, peel and aril of lychee fruit at different sampling points (North, South, East and West)	50
4.33	Iron concentration in seed, peel and aril of lychee fruit at different sampling points (North, South, East and West)	51

---

4.34	Zinc concentration in seed, peel and aril of lychee fruit at different sampling points (North, South, East and West)	52
4.35	Boron concentration in seed, peel and aril of lychee fruit at different sampling points (North, South, East and West)	52
4.36	The relationship between the concentration of nutrients in soil, leaf and fruit of lychee	54
5.1	Sunburn symptom of lychee leaves in granite and sandstone orchards	61