# 30.

**Mineral uptake and components in flesh disordered mangosteen fruit in east Thailand**

*S. Fukumoto[1]・N. Kozai[2]・T. Kondo[1]・H. Higuchi[1]・
T. Chutinanthakun[3]・S. Tongtaw[3]・T. Ogata[2]・Y. Yonemoto[4]
([1]Grad. Sch. Agric. Kyoto Univ., [2]JIRCAS, [3]Chanthaburi Hort. Res. Cen., [4]Jinnai Tropical Fruit Tree Laboratory)

The mechanism of the mangosteen translucent flesh disorder development is still unknown. Our previous report revealed that soil in east Thailand contained excessive Al, and that fine root elongation was inhibited by low pH. It is well known that excessive Al inhibits plant nutrient uptake such as Ca and Mg. Ca deficiency is reported to cause water core symptom of apple and flesh breakdown symptom of mango. This study is to testify the hypothesis that Ca deficiency causes mangosteen flesh disorder by excessive Al.

**Material and Method**

**Experiment 1**: Fruit, leaves, and soils were collected from 23 orchards in east Thailand from May to June in 2009-2010. Leaf Ca and Al contents, flesh Ca content in normal and disordered fruits, and disorder incidence in each orchard were determined. Soil pH and exchangeable cation contents were measured to obtain Al saturation. **Experiment 2**: To observe soil pH effects on nutrient uptake and on the vegetative growth, fifty trees aged 3 years old and fifty seedlings just germinated that were grown in 20L clay pots under a rain-protected greenhouse were subjected to 5 different soil pH (3.60-6.74) conditions regulated by adding lime or sulfuric acid into control soil (Table 1). Treatment was started on May 16 and ended on Oct. 18, 2010, in Chanthaburi Horticultural Research Center. Soil pH, exchangeable cations, and Al saturation were measured. Plant dry matters were weighed. Ca, Mg, Al, Mn contents of newly expanded leaves were measured.

**Results and Discussion**

The incidence of translucent disorder was low in orchards where leaf Ca content was high (Fig. 1). At high Al saturation orchards, leaf Ca content was low (Fig.2) and Al was high (Fig. 3). Such tendency might be ascribed by Ca uptake inhibition caused by excessive soil Al. Soil pH at control was less than 5.0 and Al saturation was more than 60%, which was extremely higher than lime added soils. In the treatments soil pH was less than 5, leaf Ca content was significantly low (Table 1). In control and sulfuric acid treatments, leaf Al and Mn contents were higher and Ca and Mg contents were lower than the lime treatments. The dry weights of seedlings were depressed not only at sulfuric acid treatments but also at control treatment. The vegetative growth was seemed to be inhibited by excessive Al and was improved by lime. These results indicate mangosteen was not tolerant to Al toxicity. The cultivation under the soil conditions of pH<5 or Al saturation > 60% is not recommendable for mangosteen, although 70 % of the surveyed orchards were out of this range. Ca content of translucent flesh was significantly higher than normal flesh in almost all orchards (Fig. 4), although some reports noted that Ca was low in disordered flesh. Thus, mechanism of mangosteen fruit flesh disorder development seemed to be different from that of apple or mango.



Table 1 Effects of soil pH and Al saturation on leaf Ca, Mg, Al, Mn concentration of young tree and dry weight of seedling.

| | Soil pH ($H_2O$) | | | Leaf nutrients of young trees | | | | Dry weight of seedlings | |
|---|---|---|---|---|---|---|---|---|---|
| Treatment[z] | Initial | Terminal | Al Sat. (%) | Ca (%) | Mg (%) | Al (ppm) | Mn (ppm) | Root (g) | Above ground (g) |
| S1 | 3.60 | 4.01 | 83.0 | 0.34 c | 0.15 b | 74.4 a | 777.7 a | 0.27 ab | 0.53 ab |
| S2 | 3.68 | 4.18 | 71.6 | 0.35 c | 0.16 ab | 56.2 a | 705.4 a | 0.26 ab | 0.57 ab |
| Control | 4.63 | 4.96 | 60.6 | 0.34 c | 0.15 b | 51.8 a | 512.1 b | 0.25 b | 0.43 b |
| L1 | 5.52 | 5.89 | 7.8 | 0.67 b | 0.19 a | 22.2 b | 274.4 c | 0.39 a | 0.66 a |
| L2 | 6.74 | 7.18 | 0.6 | 0.92 a | 0.20 a | 20.2 b | 187.3 c | 0.28 ab | 0.52 ab |

[z]: Ten and 15ml of 5% sulfuric acid were added per 20L soil for S1 and S2 treatments, respectively. Four and 10g of lime were added for L1 and L2 treatments, respectively.

Different letters within column indicate statistical singnificance by Tukey's test at $p$ <0.05

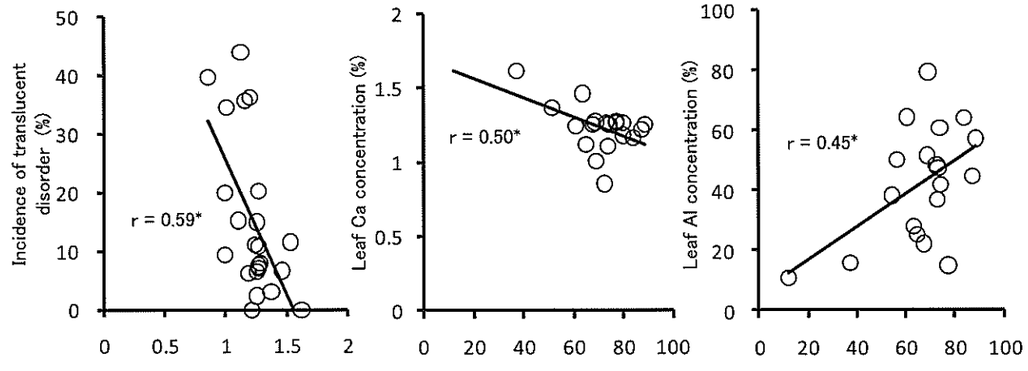


Fig. 1. Relationship between leaf Ca concentration and incidence of translucent disorder of mangosteen in each orchards. *: Significant at P < 0.05.

Fig. 2. Relationship between Al saturation of soil in mangosteen orchards and leaf Ca concentration.

Fig. 3. Relationship between Al saturation of soil in mangosteen orchards and leaf Al concentration.

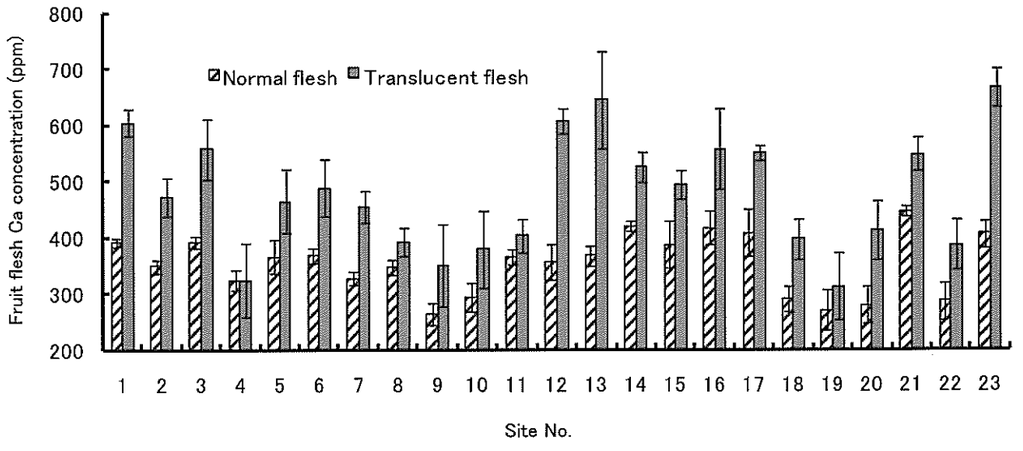


Fig. 4. Ca concentration in normal and translucent disorder flesh of mangosteen fruit.