

## The relationship between phenolics and flavonoids production with total non structural carbohydrate and photosynthetic rate in labisia pumila benth. under high CO<sub>2</sub> and nitrogen fertilization.

### ABSTRACT

A factorial split plot  $4 \times 3$  experiment was designed to examine and characterize the relationship among production of secondary metabolites (total phenolics, TP; total flavonoids, TF), carbohydrate content and photosynthesis of three varieties of the Malaysian medicinal herb *Labisia pumila* Benth. namely the varieties *alata*, *pumila* and *lanceolata* under CO<sub>2</sub> enrichment (1,200  $\mu\text{mol mol}^{-1}$ ) combined with four levels of nitrogen fertilization (0, 90, 180 and 270 kg N ha<sup>-1</sup>). No varietal differences were observed, however, as the levels of nitrogen increased from 0 to 270 kg N ha<sup>-1</sup>, the production of TP and TF decreased in the order leaves>roots>stems. The production of TP and TF was related to increased total non structural carbohydrate (TNC), where the increase in starch content was larger than that in sugar concentration. Nevertheless, the regression analysis exhibited a higher influence of soluble sugar concentration ( $r^2 = 0.88$ ) than starch on TP and TF biosynthesis. Photosynthesis, on the other hand, displayed a significant negative relationship with TP and TF production ( $r^2 = -0.87$ ). A decrease in photosynthetic rate with increasing secondary metabolites might be due to an increase in the shikimic acid pathway that results in enhanced production of TP and TF. Chlorophyll content exhibited very significant negative relationships with total soluble sugar, starch and total non structural carbohydrate.

**Keyword:** Carbon; Nitrogen ratio; CO<sub>2</sub> enrichment; Medicinal herb; Photosynthesis nitrogen use efficiency; Total phenolics and flavonoids; Total soluble sugar and starch profiling.