Effects of $KClO_3$ and Water Deficit on Flowering and Growth Characteristics of Longan

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Problem statement

Longan is one of the most important subtropical fruit crops in Thailand, both in terms of crop yield and export volume. In 1998, Thai longan farmers began to apply potassium chlorate ($KClO_3$) to induce off-season flowering and soil drench is most effective application method. Nowadays fresh longan fruits are available in domestic markets almost all year round. However, irrigation management is critical for off-season longan production when it falls into the rainy season. Due to high relative humidity, high soil moisture and also low light intensity the percentage of flowering is greatly reduced as compared to production during dry-season. However, water deficit reduces leaf photosynthesis, vegetative growth and fruit development.

Working hypothesis

This research is aimed at studying the effect of $KClO_3$ and water deficit on chlorophyll fluorescence, leaf photosynthesis and flower induction in longan.

Material and methods

Material & Experimental design

- For the experiment 64 two-year-old longan trees cv. Daw were grown in concrete lysimeters with a capacity 150 L, filled with sand and connected through a tube to a 30 L plastic container with nutrient solution.
- The experiment was structured as CRD, consisting of 4 treatments: 1) Well-watered with $KClO_3$, 2) Well-watered without $KClO_3$,3) Water deficit with $KClO_3$ and 4) Water deficit without $KClO_3$. In November 2007, twenty four longan trees at fully mature leaf stage were treated with 10 g $KClO_3$ per pot.

Methods & Measurements

1. Percentage of flowering and time of flowering.
2. The efficiency of photosystem II (Hansatech Instrument Ltd).
3. Leaf photosynthesis analysis system equipped with a PLC-4 leaf chamber (ADC; Analytical Development Company Ltd.).
4. Chlorophyll content (SPAD-502, Minolta).

Results and discussion

1. Percentage of flowering and time of flowering. $KClO_3$-treated longan trees were flowering under well-watered and water deficit condition while the well-watered and water deficit without $KClO_3$ were not flowering. Both $KClO_3$ treatments began to flower between 25 and 27 days after $KClO_3$ application (Tab. 1).

Table 1 Time of flowering and percentage of flowering after $KClO_3$ application.

Treatments	Time of flowering (days)	Flowering (%)
1. Well-watered with $KClO_3$	NF	0 b
2. Well-watered	27	84.50 a
3. Water deficit with $KClO_3$	NF	0 b
4. Water deficit	25	94.18 a
F-test	NS	*

* Means within column with different letters differ significantly at P<0.05
NF=Non flowering

2. Chlorophyll fluorescence. After 7 days the efficiency of photosystem II (Fv/Fm) of leaves from the $KClO_3$- and water deficit treatment was significantly reduced as compared to well-watered conditions (Fig. 1). The reduction lasted longer and was most expressed in the combined treatment.

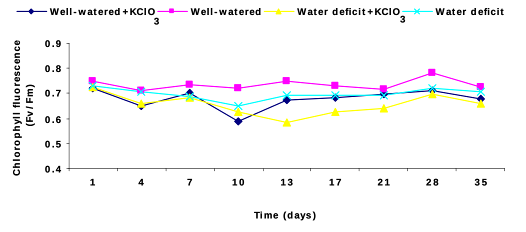

Figure 1. Change of chlorophyll fluorescence after $KClO_3$ and water deficit application.

3. Leaf photosynthesis and chlorophyll content. Net CO_2 exchange rate, transpiration rate and stomata conductance were reduced from day 7-13 and 35 days under well-watered conditions with $KClO_3$, water deficit and water deficit in combination with $KClO_3$ (Fig 2,3 and 4). However, chlorophyll content was not significantly different (Fig 5).

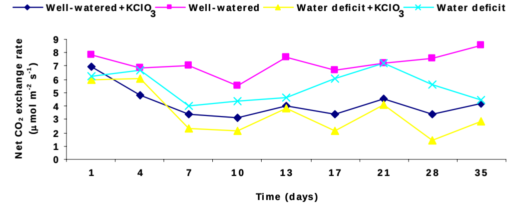

Figure 2. Net CO_2 exchange rate after $KClO_3$ and water deficit application.

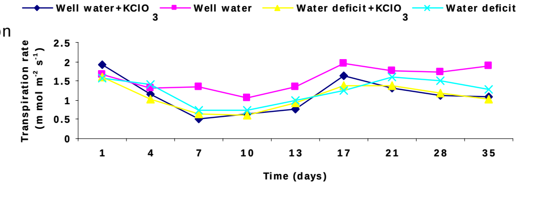

Figure 3. Transpiration after $KClO_3$ and water deficit application.

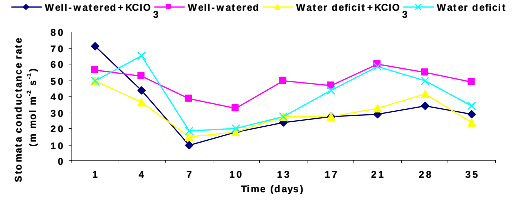

Figure 4. Stomata conductance after $KClO_3$ and water deficit application.

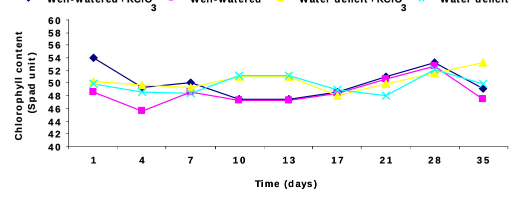

Figure 5. Chlorophyll content after $KClO_3$ and water deficit application.

Conclusions

Although water deficit impacted on the efficiency of photosystem II (Fv/Fm), leaf net CO_2 assimilation rate, transpiration rate and stomata conductance it did not negatively affect off–season flower induction by $KClO_3$. Therefore off-season production during dry season or under controlled deficit irrigation seems to be feasible at least in terms of effectivity of $KClO_3$ as a flower inducing agent. Irrigation management during further fruit development still affords detailed investigation in order to optimize yield and quality of off-season longan fruit.

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