

# **Effect of waterlogging on the root activity, chlorophyll fluorescence, and leaf water potential of soybean cultivars**

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## **Objectives**

Excessive moisture condition with prolonged waterlogging affects on the soybean growth. The physiological response of soybean to the adverse condition have been examined to know the critical traits and stages in the course of reproductive growth.

## **Materials and Methods**

### *Plant materials*

Soybean cultivars, Taekwangkong (tolerant), Hannamkong (susceptible), and Hwangkeumkong, were transplanted into plastic pot (dia. 20cm) placed on plastic bed on 22 Jul. Waterlogging were imposed with adjusting the depth of water table up to 5cm.

### *Methods*

- Growth analysis - Dry weight of aerial part was measured after drying at 80°C for 48 hrs.
- Root activity - Excised roots were subjected to the root activity determination using  $\alpha$ -naphthylamine oxidation method.
- Chlorophyll fluorescence - Dark-adapted young leaves were used to know the photosynthetic potential.
- Chlorophyll content - Leaf chlorophyll content was determined using portable chlorophyll meter (SPAD 502, Minolta).
- Water potential - Leaf water potential was measured by a pressure chamber.

## **Results**

Growth of aerial part in soybean cultivars was responded differentially to the excessive moisture caused by prolonged waterlogging. Growth of shoot was more highly inhibited in Hannamkong which already known as susceptible as compared to Taekwangkong (tolerant). Root activity showed that the difference between waterlogged and well-watered plant was conspicuous at 49 DAT. However, the difference was reversed at 63 DAT in non-susceptible cultivars. Chlorophyll content (SPAD value) of plant grown in waterlogged soil was lower than that of control plant, however, the decrement was recovered at 63 DAT. Chlorophyll fluorescence, an index of photosynthesis, indicated that light reaction of photosynthesis was slightly inhibited by excessive soil moisture. However, there is no difference in the response of chlorophyll fluorescence between susceptible and tolerant cultivars. Leaf water potential was decreased by the waterlogging treatment in Hannamkong and Hwangkeumkong. On the other hand, tolerant Taekwangkong was not decreased by the treatment. The decreased water potential of leaves was recovered at 63 DAT.

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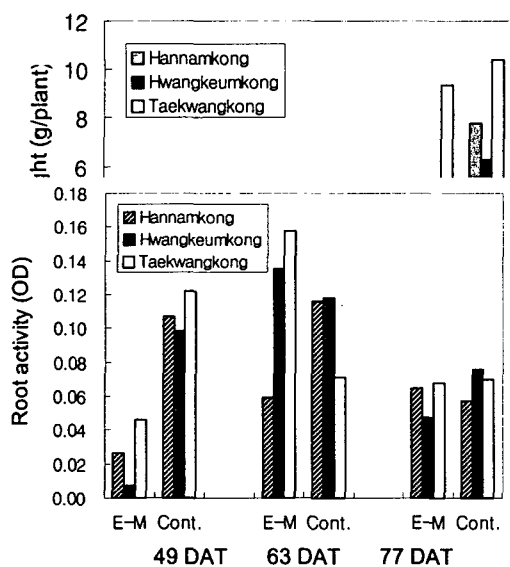


Fig. 1. Differences of the growth of three soybean cultivars treated with prolonged waterlogging. E-M: excessive moisture; Cont.: control (well watered)

Fig. 2. Effect of excessive soil moisture on the root activity of soybean cultivars. Root activity was measured with root segments excised from young roots. E-M: excessive moisture; Cont.: control (well watered)

Table 1. Chlorophyll content of soybean cultivars grown on different soil moisture regimes.

Cultivar	49 DAT		63 DAT		77 DAT	
	Excessive	Control	Excessive	Control	Excessive	Control
----- SPAD value -----						
Hannamkong	37.9	40.8	37.4	38.5	27.8	25.4
Hwangkeumkong	35.2	43.1	39.5	42.1	33.9	39.2
Taekwangkong	30.2	38.5	36.2	39.6	29.7	28.4

Table 2. Chlorophyll fluorescence of soybean leaves from the plants grown different soil moisture conditions.

Cultivar	49 DAT		63 DAT		70 DAT	
	Excessive	Control	Excessive	Control	Excessive	Control
----- Fv/Fm -----						
Hannamkong	0.639	0.643	0.611	0.609	0.596	0.590
Hwangkeumkong	0.646	0.648	0.597	0.623	0.604	0.607
Taekwangkong	0.637	0.644	0.612	0.625	0.563	0.607

Table 3. Comparisons of leaf water potential of three soybean cultivars at different growth stages.

Cultivar	49 DAT		63 DAT		77 DAT	
	Excessive	Control	Excessive	Control	Excessive	Control
----- Water potential (bar) -----						
Hannamkong	-3.80	-4.33	-12.4	-14.9	-16.9	-11.4
Hwangkeumkong	-3.20	-4.50	-12.3	-11.9	-12.6	-12.9
Taekwangkong	-4.07	-4.03	-13.3	-13.8	-14.5	-14.9