IAA Distribution within Tomato Flower and Fruit

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'Zuisyu' tomato (*Lycopersicon esculentum* Mill.) fruit growth is believed to depend on auxin content, because exogenously applied auxin promotes tomato fruit growth in vivo (Asahira et al., 1968). Iwahori (1967) and Abdel-Rahman (1977) found a rapid increase of auxin in whole tomato fruit after anthesis, and they stressed the importance of auxin in fruit set and development. However, to our knowledge, the IAA distribution within tomato flowers and fruit has not been fully described.

Tomato plants were grown in a greenhouse located at Hiroshima Prefectural Agricultural Expt. Station, Japan. Fruit set was induced by natural pollination [experiments on flower parts sampled 10 days after flowering (DAF)] or by natural pollination combined with 4-chlorophenoxy acetic acid (4-CPA) treatment when four buds had opened in a truss (experiments on fruit parts).

Fruit with mean weights of ≈3.4, 24, 62, 110, and 140 g were sampled. The heaviest fruit were mature green and almost full size. After harvest, fruit were immediately separated into locules (with seeds), pericarps, and calyxes. From the remaining tissues (axes and partitions), only the white and central parts of the axes were excised because fixing the boundary between axes and partitions was impractical. Separated tissues were weighed and then immersed in 80% ethanol. The samples were stored in a freezer at -80°C until analyzed.

Indole-3-acetic acid (IAA) was extracted according to Kojima et al.'s (1993) method and determined with a high-performance liquid chromatograph equipped with a fluorometric detector (Japan Spectroscopic Co., Hachioji, Japan), according to Akiyama et al.'s (1983) method. Endogenous IAA content was calculated from the peak area of IAA :

indolepropionic acid ratio, which was added as an internal standard during extraction.

The IAA distribution pattern in flowers was different from that in buds (Table 1). Stamen IAA concentrations were lowest in the buds 5 days before flower (DBF) and highest in the flower 0 DAF. Iwahori (1965) observed that, within a tomato flower's pollen grain, a macrospore made the first nuclear division between 6 and 3 DBF. The rapid increase of IAA in the stamen may be related to maturation of the pollen within an anther. Pistil IAA concentration tended to decrease from 5 DBF to 10 DAF.

All fruit were pollinated and averaged 107 seeds per fruit, but they were treated with 4-CPA. Thus, there is a possibility that 4-CPA treatment altered the IAA distribution in naturally pollinated fruit. IAA concentrations in the pericarp were low throughout (Table 2). IAA concentrations in a calyx and locule with seeds and axis of a 3.4-g fruit were high, but were much lower in 24-g fruit. The locule's IAA concentration was highest in a 140-g fruit.

The high concentrations of endogenous IAA in the locule and axis of 3.4-g fruit, which almost corresponds to the stage of highest relative growth rate (Monselise et al., 1978), may be related to the onset of fruit growth (Iwahori, 1967). The low IAA concentration in the pericarp tissue throughout development suggests that its expansion is not directly caused by IAA. Varga and Bruinsma (1976) insisted that tomato pericarp tissue expansion was indirectly caused by sink activity produced by developing seeds. In mature-green tomatoes, IAA was mostly confined to the locule and was low in the pericarp, a tendency that confirmed the IAA distribution pattern that Gustafson (1939) and Varga and Bruinsma (1976) reported. IAA in the locule may be confined to the seeds (Varga and Bruinsma, 1976).

Table 1. IAA concentration in parts of tomato flower 5 days before flowering (DBF) and 0 and 10 days after flowering (DAF).

Flower	IAA concn (pmol/g fresh wt) ²		
	5 DBF	0 DAF	10 DAF
Pistil	150 ± 4	67 ± 32	43 ± 2
Stamen	77 ± 8	320 ± 9	---
Petal	380 ± 22	29 ± 5	---
Calyx	190 ± 19	81 ± 3	190 ± 35
Total ³	180	110	57

¹IAA concentrations are means ± SE of three determinations.

²Total values were calculated from partial values.

Among parts of the flower and fruit, changes in IAA concentrations differed conspicuously. The measurement of phytohormones in whole flowers and fruit would mask the changes of hormonal level in their components (Kojima et al., 1993). Thus, hormone analysis using component tissues is desirable in investigations of specific plant hormone roles.

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Table 2. IAA concentration in parts of tomato fruit at five approximate mean weights.

Fruit part	Fruit wt (g fresh wt/fruit) ²				
	3.4	24	62	110	140
Calyx	510 ± 75	57 ± 4	81 ± 14	270 ± 29	260 ± 28
Pericarp	21 ± 12	16 ± 2	38 ± 5	84 ± 6	64 ± 3
Loculus	460 ± 8	110 ± 13	76 ± 21	160 ± 15	690 ± 37
Axis	690 ± 140	32 ± 3	33 ± 9	18 ± 10	22 ± 16

²All values of IAA concentrations are means ± SE of three determinations.

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