

## 源助ダイコンの空洞発生におよぼすオーキシン処理の影響

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## Effect of Auxin Treatment on the Occurrence of “Hollow Root” of ‘Gensuke’

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### Introduction

A cultivar of Japanese radish, ‘Gensuke’ is cultivated mainly in the sand dune regions in Ishikawa Prefecture. This radish is marketed at a high price in the central wholesale

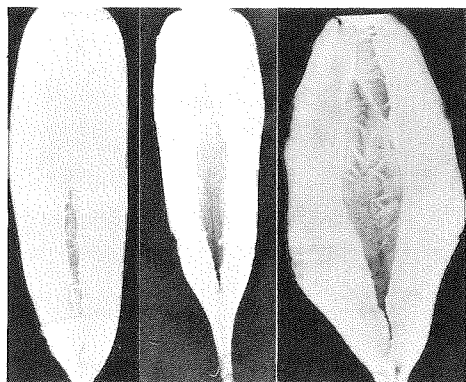


Fig. 1. Most often observed hollowness in the root of ‘Gensuke’.

market in Kanazawa City during the period from the end of September to the middle of October. Therefore, the radish is sown from August 10 onwards, and furthermore, sowing during July is much needed among the growers in these districts. In this case, however, “hollow root” (Fig. 1) which has lengthwise hollownesses in the central part of the root induced by a physiological disorder (s) has been frequently observed.<sup>1)</sup> This gives much trouble to the growers in these districts. By the way, Takano<sup>2)</sup> observed the increases of meristematic tissues and rays of conducting tissues in radish roots by naphthalene acetic acid (NAA). Therefore, for the purpose of the prevention of occurrence of hollow root, this

research was carried out to investigate the influences of NAA on the growth and the occurrence of hollow root of ‘Gensuke’.

### Materials and Methods

Experiments were carried out on the field of Ishikawa Agricultural College. ‘Gensuke’ seeds were sown on July 16 and July 22. Amounts of 2 kg/m<sup>2</sup> of farmyard manure and 0.1kg/m<sup>2</sup> of dolomite were applied in the middle of June. Amounts of 100g/m<sup>2</sup> of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O, using a slow-acting fertilizer, and an amount of 4g/m<sup>2</sup> of FTE (Fritted Trace Elements) were applied as a basal fertilizer, and an amount of 4.6g/m<sup>2</sup> of N 14 days after sowing and amounts of 4.8g/m<sup>2</sup> of N and K<sub>2</sub>O were applied 25 and 40 days after sowing as top dressing. Plants were selected for uniformity and reduced to one at each position after 14 days after

\* Part of this study was presented at the Annual Meeting of the Hokuriku branch of the Japanese Society for Horticultural Science, Kanazawa, October, 1986.

sowing. There were 8 plants per squaremeter. The whole leaves of plants were treated once a day with the solution of 50mg/l and 100mg/l of NAA, and with water as the control 14, 15 and 16 days after sowing. Wetting agent, 0.5% Tween 20 was added in all treatments. Ten plants in all treatments were sampled 60 days after sowing. Leaf weight and root length, diameter and weight, and hollowness in root were investigated. Root length was measured from the top of the root to the portion where the root diameter was 5mm. Root diameter was measured at the largest portion of the root. Upon observation of hollowness, root was cut lengthwise at the central axis, and the maximum horizontal and longitudinal length of hollowness were measured. The root in which the product of the horizontal and longitudinal length reached above 200mm<sup>2</sup> was regarded as a hollow root.

### Results

Leaf weight of the control plants sown on July 16 and 22 was about 490 g; however, the weight of the NAA treated plants decreased (Table 1). Especially, the leaf weight of plants treated with the 100mg/l NAA solution was nearly 150g smaller than that of the control plants. Seven days after the NAA treatment, the leaf growth was severely suppressed due to the 100mg/l of NAA treatment, in comparison with the control (Figs. 2 and 3).

Table 1. Effect of NAA treatment on leaf weight (g, mean of 10 plants±S.E.) of 'Gensuke'

Sowing date	Concentration of NAA (mg/l)		
	0	50	100
July 16	489±37	461±19	332±21
July 22	486±50	350±28	313±21

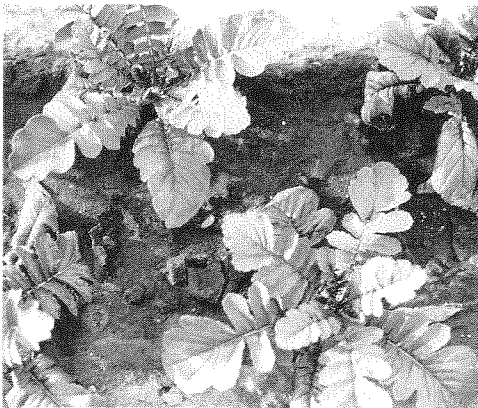


Fig. 2. Leaf growth in control plants of 'Gensuke' sown on July 16. Photograph was taken 20 days after sowing.



Fig. 3. Leaf growth in plants of 'Gensuke' sown on July 16, treated with the 100mg/l NAA solution. Photograph was taken 20 days after sowing.

Root lengths of all plants treated were the same, being about 25cm, but root lengths of the control plants sown on July 16 and 22 were 29cm and 27cm, respectively (Table 2). A root diameter of 76mm was the greatest obtained regarding the control plants sown on July 16. The diameter of the control plants sown on July 22 was 69mm (Table 3). The diameter decreased to about 60mm due to the NAA treatments. The smallest one was 57mm for the plants sown on July 16, treated with the 50mg/l NAA solution. Root weight of the control

Table 2. Effect of NAA treatment on root length (cm, means of 10 plants  $\pm$  S.E.) of 'Gensuke'.

Sowing date	Concentration of NAA (mg/l)		
	0	50	100
July 16	29 $\pm$ 1	24 $\pm$ 1	25 $\pm$ 1
July 22	27 $\pm$ 1	25 $\pm$ 1	26 $\pm$ 1

Table 3. Effect of NAA treatment on root diameter (mm, means of 10 plants  $\pm$  S.E.) of 'Gensuke'.

Sowing date	Concentration of NAA (mg/l)		
	0	50	100
July 16	76 $\pm$ 3	57 $\pm$ 2	59 $\pm$ 3
July 22	69 $\pm$ 3	61 $\pm$ 2	59 $\pm$ 2

plants sown on July 16 was 670g, but the weight decreased to 317g and below due to the NAA treatments (Table 4). A root weight of 473g for the control plants sown on July 22 decreased by every about 100g as the NAA concentration became higher.

The occurrence of hollow root was high, being 40% and 50% for the control plants sown on July 16 and 22, respectively (Table 5). On the other hand, the occurrence decreased distinctly as a result of the NAA treatments. Especially, no hollow roots were observed in any of the plants sown on July 16, treated with the 100mg/l NAA solution.

Table 4. Effect of NAA treatment on root weight (g, means of 10 plants  $\pm$  S.E.) of 'Gensuke'.

Sowing date	Concentration of NAA (mg/l)		
	0	50	100
July 16	670 $\pm$ 79	288 $\pm$ 17	317 $\pm$ 28
July 22	473 $\pm$ 62	381 $\pm$ 28	273 $\pm$ 34

Table 5. Effect of NAA treatment on the occurrence (%) of hollow roots of 'Gensuke'.

Sowing date	Concentration of NAA (mg/l)		
	0	50	100
July 16	40	10	0
July 22	50	40	10

## Discussion

In this experiment, by NAA treatment, leaf and root weight of 'Gensuke' were extremely suppressed and the occurrence of hollow roots was small, compared to the control. It is clear that root weight is small due to poor growth of root diameter, which results from severe suppression of leaf growth by NAA treatment. Toyotomi and Imaizumi<sup>3)</sup> stated that hollowness in a Japanese radish originated from the cracks which developed from the intercellular space of parenchymatous tissues. Yoshikawa and Ishizaki<sup>4)</sup> reported that hollow roots were observed more frequently in larger roots, and pointed out that rapid growth of larger roots was a major cause for the higher occurrence of hollow roots. These results may indicate that cracks come out by mechanical strains as a result of rapid growth of larger roots, but no cracks are induced due to the absence of the strain associated with poor growth of smaller roots.

On the other hand, Takano<sup>2)</sup> declared for a radish that by NAA treatment total pectic substances were high in content in the cell walls. Then it is suggested in this experiment that by NAA treatment total pectic substances which stick cells together kept in large quantities.

Consequently, it is reasonable to consider that by NAA treatment to 'Gensuke' the occurrence of hollow roots becomes less frequent because of no strains between the cells of smaller roots, and because of firm stickiness of the cells due to a large amount of total pectic substances in the cell walls.

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## 源助ダイコンの空洞発生におよぼす オーキシンの影響

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### 摘 要

石川県では源助ダイコンの早まき栽培が行われるようになったが、根部の中央部が縦に空洞になる空洞症が多発するようになり、問題となった。本報では植物生長調節物質の1種であるオーキシンが生育ならびに空洞発生に及ぼす影響について検討した。

葉重はNAA処理により小さくなった。また、NAA処理により根長はあまり影響は受けなかったが、根径

が小さくなったため、根重は著しく小さくなった。空洞発生率は、NAAの100 mg/l 処理区で著しく小さくなった。

NAA処理により源助ダイコンの空洞発生率が小さくなる理由について、NAAの直接的な影響と間接的な影響をあげて論じた。