

Effects of Topping Methods on Root Yield and Major Agronomic Characteristics in *Alisma plantago*

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ABSTRACT

The effects of topping method on the yield and major agronomic traits of two varieties, Sunwol and Youngjun of *Alisma plantago*, were investigated in the Southern region. Plant height, yield of fresh root, yield of dry root and weights of total roots were the highest in the variety of Sunwol, and at the plots with topping of four times cutting in flowering in main culm (Treatment No. 1). Considering from our results, optimum topping method is most likely be topping of four times cutting in flowering in main culm in the Sunwol variety.

Key word : Medicinal plant, Topping, Root yield.

INTRODUCTION

Alisma plantago is perennial herb grown in pond or water as medicinal crop used for diuresis, vomit and dizziness. It's rootstock is short, fibrous root grows dense and petiole is long and oval. In Korea 100 ha *Alisma plantago* of is cultivated in Sunchon and it occupies 76% of the national cultivation area 130 ha. *Alisma plantago* is double cropping after early cultivation of rice and when it is transplanted to the main rice field in the 30th of August, it blooms in the 20th of September and then farmhouse eliminates the rachis, the nutrients required for seeding are delivered to root and the growth of root is fostered.

There were many researches of the increase of *Alisma plantago* productivity and the prevention of damages from diseases and insect pests(Kwon et al., 2000, 2001a, 2001b, 2001c, 2001d, 2002 ; Kim et al., 2000 ; Shin et al., 2000, 2001 ; Park et al., 2000).

There was research of effects of topping methods on yield and major agronomic characteristics in *Hibiscus manihot* by Kim et al., (1993), but no research of the effects of topping methods on yield and major agronomic characteristics in *Alisma plantago*, has been done. Therefore, this experiment is to investigate the optimal topping methods of *Alisma plantago*.

MATERIALS AND METHODS

This experiment was conducted at farmhouse field, Haeceyong-myeon, Suncheon-city, Chonnam from July to December 2004, Physicochemical composition of arable soil layer has pH 5.2 and rich contents of organic matters and phosphate, but its contents of K, Ca and Mg are low as shown in Table 1.

Test varieties were Sunwol and Yongjun, the placement of experimental plot is made on the basis of seeding period (transplanting period) and seeding is

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Table 1. Soil properties of the experimental plot at the beginning of experiment.

PH(H ₂ O)	EC (ds/m)	OM (g/kg)	T-N (mg/kg)	Av.P ₂ O ₅	Ex. cation (molt/kg)			Sio ₂
					K	Ca	Mg	
5.2	0.093	20.7	0.34	952	0.66	3.74	0.98	40

Table 2. Topping treatment method of the experiment.

Treatment	Topping treatment method
1	Four tims cutting in flowering
2	Once cutting in beginning of flowering
3	No treatment (control)

carried out in July 20 and transplanting is Aug. 30.

Seedbeds apply 25 kg of complex fertilizer (21-17-17) and 200 kg of compost at the area of 66 m² and after making seedbed of 120 cm wide, the mixture of 1 l of seed and 10 l of sand are sown equally on the whole surface of seedbed of 120cm wide, the mixture of seedbed.

Water is provided only for furrow before it sprouts after seeding and the vinyl tunnel is installed for preventing the loss of seeds by showers. When it sprouts completely after 10 days of seeding, water is provided to top by night and is provided only for furrow by day.

As seed grows, water is provided more and it is managed by the depth of 3 cm. Amount of application to the main rice field is 100 kg of complex fertilizer (21-17-17) per 10a and 2,000 kg of compost and 50 kg of urea is applied as the first addition in 30 days of transplantation.

For the prevention of damages by blight and harmful insects, Chlorothalonil - Wp. 75% is applied for preventing Brown leaf blight, Imidacloprid-Wp. 10% for applied and Tebufenozide-Wp. 8% for *Spodoptera exigua* by three times at intervals of 10 days after 10days of transplantation.

Other controls conform to the cultivation of second cropping *Alisma plantago* of early cultivated rice at farmhouse, Haeryong-myeon, Suncheon-city and when

flower stalk buds in the flowering time, the lower part of the root is cut before hardening as shown in table 2. For the investigation of growth and characteristic, 20 samples showing uniform growth are selected and the examination method is based on the standard of medicinal crops of Rural Development Administration.

RESULTS AND DISCUSSION

Examination of nursery characters

Nursery characters in varieties are shown in table 3. In the growth condition of nursery at seedbed, the plant height of nursery is 30 cm in Sunwol variety, 29 cm in Yongjun variety, and the leaf width of nursery is 3.4 cm in Sunwol variety, 2.7 cm in Yongjun variety, the leaf length of nursery is 4.5 cm Sunwol variety, 3.2 cm in Yongjun variety, and the plant height, leaf width and leaf length of Sunwol variety were higher than that Yongjun variety.

Agronomic traits before topping

Agronomic characterisits in main field before topping in different treatment in varieties are shown in table 4. Number of floral axis and plant height are important factors for determing yield level of *Alisma plantago* because they themselves are yield components. Varieties used in this trial were Sunwol and Yongjun which were selected from the nine domestic varieties of *Alisma plantago* with high yield (Kwon et al., 2001a). Date of floral axis formation of Sunwol variety was Sep. 15 which was about five days earlier than that of Yongjun variety, Sep. 20, and average number of floral axis were 5 (Sunwol var.) and 4 (Yongjun var.), respectively.

Table 3. Agronomic traits in nursery before topping in different variety.

Nursery condition		Plant height	Leaf width	Leaf length
Variety	Nursery period (days)	(cm)	(cm)	(cm)
Sunwol	30	21.7	3.4	4.5
Yongjun	30	18.9	2.7	3.2

Table 4. Agronomic traits in main field before topping in different treatment and variety.

Variety	No. of treatment	Date of floral axis formation	No. of floral axis	Plant height	No. of leaves
Sunwol	1	Sep. 15	5	68	18
	2	Sep. 15	5	65	18
	3	Sep. 15	5	51	18
	Mean \pm SD	Sep. 15 \pm 0.00	5 \pm 0.00	61 \pm 2.71	18 \pm 0.54
Yongjun	1	Sep. 20	4	63	16
	2	Sep. 20	4	62	16
	3	Sep. 20	4	50	17
	Mean \pm SD	Sep. 20 \pm 0.00	4 \pm 0.00	58 \pm 1.25	16 \pm 0.34

Table 5. Fresh and dry weight in different treatment and variety.

Variety	No. of treatment	Fresh wt. (MT/ha)			Dry wt. (MT/ha)		
		Root	Leaf	Total	Root	Leaf	Total
Sunwol	1	8.73	6.37	15.10	3.52	2.62	6.14
	2	8.22	3.96	15.18	3.25	2.97	6.22
	3	6.15	8.84	14.99	2.43	3.64	6.07
	Mean \pm SD	7.93 \pm 2.52	7.39 \pm 2.74	15.09 \pm 0.79	3.06 \pm 0.84	3.07 \pm 0.95	6.14 \pm 0.77
Yongjun	1	8.42	5.97	14.39	3.25	2.42	5.67
	2	7.86	6.83	14.69	3.17	2.78	5.95
	3	5.87	8.84	14.71	2.31	3.35	5.66
	Mean \pm SD	7.38 \pm 2.63	7.21 \pm 2.81	14.59 \pm 0.84	2.91 \pm 0.86	2.85 \pm 0.94	5.76 \pm 0.79

Treatment No. 1 (four times cutting in flowering) was the longest one in plant length with 68cm (Sunwol variety) and with 63cm (Yongjun variety) in this trial. It were more than longer with 3-17cm in Sunwol variety and 2-13 cm in Yongjun variety. Number of leaves for treatment No. 1 (four times cutting in flowering) were 18 (Sunwol var.) and 16 (Yongjun var.), respectively,

and resulting in Sunwol var. had about 2 more leaves than Yongjun variety.

Fresh weight and dry weight

The results on fresh weight and dry weight in different treatment and variety are shown in table 5. Plant fresh weight was calculated by summing fresh

Table 6. Variations of fresh weight ratio on parts of plant body under different treatment and variety.

Variety	Treatment no.	ac* (%)	b/c* (%)
Sunwol	1	42.7	57.3
	2	40.2	59.8
	3	31.2	68.8
	Mean ± SD	38.0 ± 1.26	61.9 ± 3.14
Yongjun	1	35.6	54.4
	2	34.4	65.6
	3	29.7	70.3
	Mean ± SD	33.2 ± 1.17	63.4 ± 9.85

* a : Weight of fresh root,
 b : Weight of fresh leaf,
 c : Weight of fresh whole plant.

Table 7. Variations of dry matter ratio on parts of plant body under different treatment and variety.

Variety	No. of treatment	Root (%)	Leaf (%)	Whole Plant (%)
Sunwol	1	41.4	38.9	42.5
	2	40.3	40.3	41.4
	3	36.6	43.5	37.7
	Mean ± SD	39.4 ± 1.74	4.09 ± 1.13	40.5 ± 1.22
Yongjun	1	40.0	37.3	40.2
	2	38.4	37.5	38.9
	3	36.5	41.7	37.0
	Mean ± SD	38.3 ± 1.66	38.8 ± 1.43	38.7 ± 1.57

weight of root and leaf. Treatment No. 1 (four times cutting in flowering) showed longer values in root(8.73 MT/ha in Sunwol var., 5.97 MT/ha in Yongjun var.), respectively than any other treatments. Plant dry matter weight was also calculated by summing dry matter weight of root and leaf. Treatment No. 1 showed larger values in root (3.52 MT/ha in Sunwol var., 3.25 MT/ha in Yongjun var.) and smaller values in leaf (2.62 MT/ha in Sunwol var., 2.42 MT/ha in Yongjun var.) respectively than any other treatments.

Ratio of fresh weight and dry weight

Fresh weight ratio expressing of fresh weight were

presented in table 6. Fresh weight ratio of treatment No. 1 were 42.7% in Sunwol var., 35.6% in Yongjun var. in root for fresh whole plant and(57.3 in Sunwol var., 54.4 in Yongjun var.) percent in leaf for fresh whole plant, respectively. Those results were more heavier weight ratio than that the other treatments. Dry weight ratio of fresh weight were presented in table 7. Dry weight ratio of treatment No. 1 were (41.4 in Sunwol var, 40.0 in Yongjun var.) percent and (38.9 in Sunwol var., 37.3 in Yongjun var.) percent, respectively.

These results were more heavier weight ratio than that the other treatments.

REFERENCES

- Kwon B. S. and K. H. Hyun. 2001a. The selection of *Alisma plantago* varieties suitable for the southern part of Korea. Korean J. Plant Res. 14(3) : 183-187.
- Kim S. G., B. S. Kwon, B. G. Jung, H. J. Kim. 2000. Influence of sowing dates and nursery period on growth and yield of *Alisma plantago* in mono - cropping. Suncheon Nat'l Univ. Bulletin. 19(1) : 1-7.
- Shin J. S., B. S. Kwon and S. R. Lee. 2000. Insect pest control of aphides for *Alisma plantago* cultivated after early maturing rice cropping. Korean J. plant Res. 13(3) : 255- 259.
- Kwon B. S., H. J. Park, J. S. Shin and S. R. Lee. 2000. Effect of transplanting dates and density on dry root yield in *Alisma plantago* cultivated after after early maturing rice cropping. plant Res. 3(3) : 194-199.
- Park H. J., B. S. Kwon, J. S. Shin and S. R. Lee. 2000. Response of *Alisma plantago* varieties cultivated after early maturing rice cropping to fertilizer levles. Korean J. plant Res. 3(3) : 200-205.
- Kwon B. S. J. S. Shin, H. J. Park and S. R. Lee. 2001. Effects of nursery period on growth and yield in *Alisma Plantago*. Koran J. plant Res. 14(2) : 124-128.
- Kwon B. S. J. S. Shin and H. J. Park. 2001b. Screening of insecticides for control of *spodoptera exigua* in double cropping after early rice *Alisma plantago*. Korean J. Crop Sci. 40(5) : 345-347.
- Shin J. S., B. S. Kwon and H. J. Park. 2001c. Chemical control of brown leaf in *Alisma plantago* double cropping after early rice. Korean J. Crop Sci. 46(5) : 348-351.
- Kwon B. S., J. T. Lim, Y. T. Lim and K. H. Hyun. 2001. Selection of useful chemicals reducing *Alisma plantago* disease and insect pest. Suncheon Nat' l Univ. Bulletin. 20:1 35-45.
- Kwon B. S., J. S. Shin and S. K. Choi. 2002. Selection of Early Maturing Rice for double cropping before growing of *Alisma plantago*. Korean J, Plant Res.5(2):104-108.
- Kim S. G., Kim C. W., D. H. Chung and B. S. Kwon. 1993. Effects of topping methods on yield and major agronomic characteristics in *Hibiscus manihot*. Korean J. Crop Sci 39(3) : 256-261.

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