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RESEARCH ON THE BAMBOO IN KOREA (VIII)

On the Effectiveness of Fertilizers by kind upon the New and Old Bamboos

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韓國產의 竹類에 關한 研究

(第 8 報) 新竹과 舊竹에 있어서 肥料의 種類에 따르는 效率性에 對하여

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ABSTRACT

The writer presented in the report 7th of this series (Chong, 1959, '62 a.b. '64, '65) the result of fertilizer application on *Sasamorpha purpurascens* var. *borealis* with regards to soil conditions, climate, planting position etc. and this report is on the effectiveness of fertilizers by kinds of the new (1-year old) and old (3-to 4 years old) *Phyllostachys reticulata*. The ineffectiveness of fertilizers for old bamboos aged more than 8-years old has been reported previously.

The study site was chosen in a bamboo grove situated at Hyunnae Ri, Okkye Myun, Myungju Gun, Kangwon Do. Each plot was so designed that only one individual remained at the center of a circular area with a diameter of meters by eliminating the clums and severing the rhizomes, of other individuals around it. And, for the fertilizer test, 10 individuals (the new and old: 5 to 5) were observed per kind of fertilizer used; thus making the total number of 160 plots in all.

The second part of this study was conducted for the potted individuals which numbered 48, successfully established ones out of 55 the transplanted to pots. The 48 were divided into 8 treatments: whole fertilization (NPK+compost+human manure); NPK; N; K; Human manure; compost; and the control. Amount of fertilizers applied was 200 grams for the natural plots and 100 grams for pot; it continued for 3 years and applied twice a year (spring and summer) following the theory of Dr. Koichi-ro Ueda (1954, '60 a.b). Measurements were taken in August each year. The results were confirming the fact that the bamboos require a great deal of fertilizers.

The results show the following points:

- 1) Fertilizers were more effective in the 3 to 4 year old bamboos.
- 2) The order of effectiveness of fertilizers by kind was the whole fertilization, NPK, and N treatments for *Phyllostachys reticulata*.
- 3) Organic matter in addition to commercial fertilizers showed better result than the soil application of the latter due to better soil aeration.

INTRODUCTION

The necessity for mass production of bamboos in Korea had already been mentioned in the previous works by the writer. For the mass production, fertilizer application after planting occupies the more important place than planting method, soils, and climate. In view of the rapidly-increasing consumption of the bamboos, an economic production could best be realized through logical fertilizer application. The writer had already presented the result of the preliminary study on the effect of fertilizer on *Sasamorpha purpurascens* var. *borealis*, (Chong, 1965) In this present study, the writer is set about to determine the effectiveness of fertilizer on the new and old bamboos, and what fertilizer is most effective.

STUDY SITE

A *Phyllostachys reticulata* grove which was 2 ha in area and established in 1650, located at Hyonnae Ri, Okky Myun, Myongju Gun, Kangwon Do, was selected for this study. The site is situated on slope of 8 degree approximately; the soil is clayey, pH value 6, and humus with 4,136 as table 1 (Kangwon Do 1957).

Table 1. Analytical results of the soil in the plot 1

Samples soil depth	Gravel and debris (2mm)	pH	Y1	P ₂ O ₅ ppm	Humus
20	80.9%	6.0	59.60	60—90	4,136%

The upper range was a mixed plantation of *Pinus densiflora*, *Alnus japonica*, and *Robinia pseudoacacia*, the lower range of the slope consisted of *Carex siderostica*, *Rubus idaeus* var. *concolor*, *Viola mandshurica* var. *ciliata*, *Petasites saxatilis*, *Atractylis lyrata*, *Sanguisorba officinalis*, *Phus javanica*, and *Smilax niponica*.

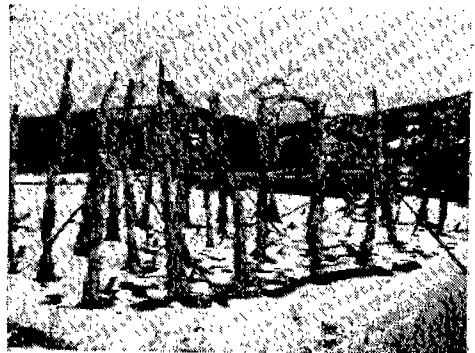
Climatically speaking it is mild: the annual mean temperature for 1963 was 11.4°C with the minimum temperature of -15.7°C in January and the maximum of 33.5°C in July.

MATERIAL AND METHODS

The new bamboos were one-year-old and the old 3 to 4-year-old, and these were grouped into two: one experimental grove and the other pots. The new and old ones were so selected as the table 2 that each was away from others more than 4 meters. The new and the old numbered 120 individuals respectively.

Table 2. Test bamboos

Material	1 year(1960)		2 year(1961)		3 year(1962)	
	Old	New	Old	New	Old	New
Number of experimental culm	40	40	40	40	40	40
Average diameter at eye height of culm(cm)	31	24	33	27	37	28
Number of experimental culm pot	24	24	—	—	—	—
Average diameter at eye height of culm(cm)	20.6	20.4	—	—	—	—



Overwintering *Phyllostachys reticulata* transplanted into pot.

For pot experiment, 55 individuals were transplanted into pots in 1960 April, out of which 48 established ones were used.

The selected bamboos were marked in Autumn of 1960 with numbers; and each was trached around with a depth of 50 cm and in circle with a diameter of 2 meters. Thus the rhizomes were severed and covered with soil. Treatments were initiated from 1961 as the table 3. Plots were designed for each kind of fertilizer. The all-element plot was to

Table 3. Experimental plan of the fertilizing for *Phyllostachys reticulata* old and new bamboos

	N				P				K				H.M.				C.P.			
	1		2		1		2		1		2		1		2		1		2	
	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New
All element	200	200	100	100	200	200	100	100	200	200	100	100	500	500	300	300	500	500	300	300
Three element	200	200	100	100	200	200	100	100	200	200	100	100								
N	200	200	100	100																
P					200	200	100	100												
K									200	200	100	100								
H.M.													500	500	300	300				
C.P.																	500	500	300	300
Control																				

include N+P+K+H.m. and V.m..H.m. stands for human manure; C.P. for compost, and 3 element for N+P+K. Number of materials in plot 1 (under natural condition) was 5 in each plot; the new and the old numbered 40 each; in plot 2 (under pots) the new and the old numbered 3 each for each plot; thus the total numbered 288. In plot 1, the commercial fertilizers were mixed at the rate of 200 grams in 100 grams of water; and applied to ground dug 10 cm below the surface and covered with dirt after the application. And then on top of that, 500 grams of compost or human manure was applied. In plot 2, 100 grams of commercial fertilizer was dissolved in 500 grams of water, and 300 grams of compost and human manure was also applied. The commercial fertilizers were urea, $(\text{NH}_2)_2\text{CO}$, with 46.65 % content, superphosphate of lime with P_2O_5 -content of 46%, and potassium sulphate with K_2O -content of 51%. And the compost and human manure were completely decomposed.

RESULT AND DISCUSSION

Treatments were done from 1961 March to 1963 March, and the measurements were taken in 1963 September.

Table 4. Result of fertilizing test per culm of old and new bamboo shoot and index number

Applied fertilizer	Factor	Newly developed bamboo shoots		Index number		Diameter at eye height		Index number		Culm length		Index number		Color of leaf	
		Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New
						mm	mm			m	m				
All element	9	3	100	44.0	52.5	38	600	72	6.20	5.80	100	94	Deep green	Dark green	
Three element	6	2	66	22.0	42.0	26	80	50	5.10	5.00	82	80	"	gree	
N	4	2	44	22.0	4.0	26	76	50	5.10	5.06	58	52	Green	Light green	
P	1	0	11	0	25.0	24	48	46	3.62	3.20	58	52	Yellowish green	Green	
K	1	0	11	0	35.0	25	67	48	3.80	3.10	61	50	"	"	
H.M.	3	1	33	11	30.0	23	57	44	4.11	3.50	66	56	Green	Green	
C.P.	3	1	33	11	32.0	24	70	46	4.20	3.60	68	58	"	"	
Control	1	0	11	0	25.0	21	48	40	3.05	2.20	49	36	Yellowish green	Yellowish green	

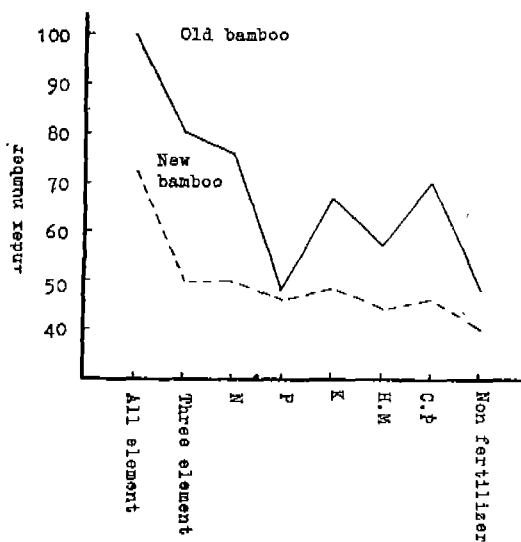
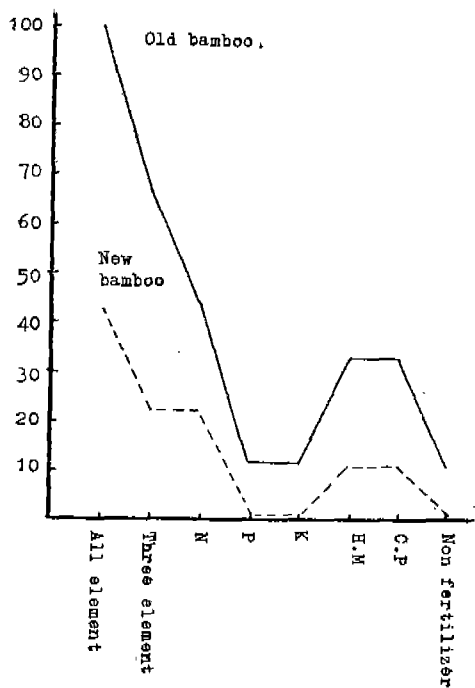


Fig. 1. Indices comparison in the number of bamboo shoots from the new and the old bamboos as affected by the kind of fertilizer.

Fig. 2. Indices comparison in the diameter at eye height of the new and the old bamboos as affected by the kind of fertilizer.

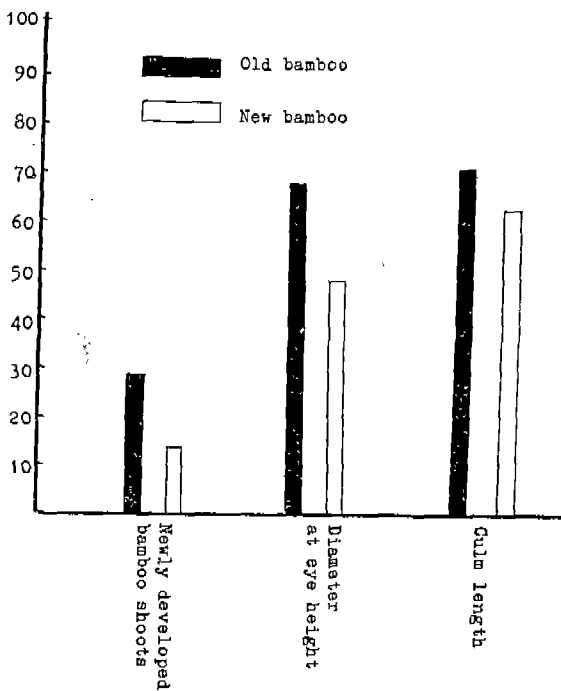
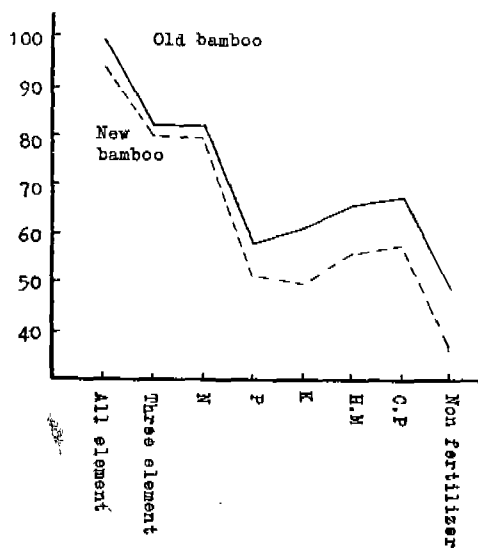


Fig. 3. Indices comparison of the culm length of the new and the old bamboos as affected by the kind of fertilizer.

Fig. 4. Indices differences in growth increment of the new and the old bamboos.

Since the secret of growth and development of new bamboos lies in rhizomes and the buds formed in the previous year, at least two years are needed for observation of results. For observation of the effect of fertilizers, the new buds on rhizomes and then number of new shoots, size of the culm, diameter at eye height, color of leaves must be checked. The results of the observation were as the table 4.

1. On the effect of fertilizer on the new and the old bamboos.

As it has been reported that the old bamboos more than 7 year-old in age were known to have little effect, the old bamboos aged 3-4 years and the new ones aged 1-year were selected. Looking through figures 1-4, the number of bamboo shoots (fig. 1) was shown to be about twice, c.g. 29 to 14 in average index; mean indices for diameter at eye height (fig. 2) were 68 to 500 with the old dominating; and the indices for the culm length (fig. 3) were 71 to 63 with the old superior.

From the above findings, in order for establishment of good bamboo groves in view of long-term, annual application of fertilizer is very desirable; fertilizers must be applied at least 5 years in advance when mass production is projected; and application of fertilizers on the 3-4 year old bamboos rather than all over the grove is more effective when fertilizers are in short.

2. On the growth as affected by the kind of fertilizers

As mentioned above, *Phyllostachys reticulata* also required much nitrogenous element: the number of bamboo shoots produced in the old bamboos were 100:11 in indices comparison between the all-element and the non-fertilized individuals as shown in the fig. 1; for the diameter at eye height (fig. 2) the ratio was 100:48, and in the culm length (fig. 3) it was also 100:48.

From the above, it is known that the bamboos require much fertilizers and the effect is great. There was not much effect on the growth and development of bamboo shoots by P and K, but N was much more effective. In the past study by the writer, the nitrogenous fertilizer was found to produce weaker bamboo shoots when applied more than 1000 grams per culm. But now, it became known that 700 grams brought about good result. In the number of bamboo shoots produced and the culm length, compost and human manure produced better results than P and K.

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