Effect of Activated Charcoal on Growth of Zingiber mioga ROSC

Seong-Kyu Choi*, Kyeong-Won Yun, Sang-Uk Chon[1], Young-Nam Seo[2], Kyoung- sun Seo, and Byung-Sun Kwon[3]
Department of Oriental Medicine Resources, College of Nature Science,
Sunchon National University, Suncheon 540-742, Korea
[1]Biotechnology Industrialization Center, Dongshin University, Naju 520-811, Korea
[2]Department of Food and Nutrition, Graduate School of Chosun University
[3]College of Agriculture and Life Science, Sunchon National University

ABSTRACT

Activate charcoal (AC) can be utilized as a soil conditioner in agricultural crop areas. This study was conducted to investigate the effect of AC on growth and yield of *Zingiber mioga* ROSC as affected by different amounts of AC. The results obtained are summarized as follows. Growth characteristics including plant height and leaf length were the highest when activated charcoal added with 10~30%, suggesting that optimum amount of activated charcoal was ranged from 10 to 30%. Growth and enlargement of the root were improved by 10% AC with higher rhizome length and weight.

Key words : Activated charcoal, *Zingiber mioga* ROSC, growth, quality, yield

INTRODUCTION

'Yangha' (*Zingiber mioga* Roscoe), a perennial herbaceous plant of Zingiberaceae, is native to Korea and Japan. Leaves are big, 20-35 cm long, 3-6 cm wide, with sharp leaf tip, triangled leaf base, and green in the upper side. *Z. mioga* belongs to *Zingiber* genus as like *Zingiber* officinalis Rosc. and has rhizomes with scents and yellow color in periderm (An et al., 2000). The rhizome of *Z. mioga* is thinner than ginger (*Zingiber officinalis* Rosc.). The rhizome is being utilized as a medicinal material, and its major compositions are known to be zingiberene, zingirone, shogaol and had excellent pharmaceutical effects (Choi et al., 1993).

Many studies on the soil conditioner have conducted to enhance yield and quality of agricultural crops, especially in Japan. In Korea, researches on the soil modifier for improving productivity in crops are a increasing field in organic agriculture and soil science (Park, 1996).

The utility of activated charcoal varies for multi-purposes in environmental and agricultural areas. Especially, it will be utilized as a multi-pore carbon absorbant for protecting environmental contamination and as a soil modifying material for improving soil physical property and sustainable nutrient sources, through mixing with it into soil (Park, 1996).

Recently, in Korea, 45,000 tons of activate charcoal a year is required for protecting environmental contamination and cleaning up water and air. However,

*Corresponding author : **Seong-Kyu Choi,** E-mail : skchoi@sunchon.ac.kr

the waste of activated charcoal as a industrial abandon after using is increased every year (Park, 1996).

Therefore, this study was conducted to develop recycling methods of the wasteful activated charcoal for agricultural cropping system and industrial areas. It would be very useful as a soil-modifyng material for enhancing crop productivity.

MATERIALS AND METHODS

Rhizomes with two-three sprouts (5-10cm long, 15g weigh) of *Zingiber mioga* Roscoe were transplanted at a pot (45cm x 45cm x 60cm) on April 20, 2002. At 2 weeks before transplanting, activated charcoal at 0, 10, 30, 50 and 70% were mixed with clay loam soil that sterilized with heat. All treatments were replicated five times using a randomized complete block design. All cultural management for *Zingiber mioga* Roscoe were followed standard methods for ginger from Rural Development Adminstration (RDA), Korea. During plant growth, the growing conditions were maintained near field capacity by sub-irrigation. Growth of all plants were determined 120 days after transplanting (August 20, 2002), and harvest for rhizome was made at 230 days after transplanting (December 10, 2002).

Emergence rate was determined 3-5 weeks after transplanting, plant height, leaf length, and leaf width were measured on September 25, and the rhizome was harvested on December 10, 2002. All measurements for plant growth and yield were referred to standard measurement of RDA, Korea (RDA, 1983).

RESULTS AND DISCUSSION

Effect of Activated Charcoal on Top growth of *Zingiber mioga*

When the charcoal was added into pot, effect of activated charcoal on top growth of *Zingiber mioga* Roscoe as affected by different amounts was determined. The results on responses of emergence rate, plant height, leaf length and leaf width were shown Table 1.

Emergence of *Zingiber mioga* Roscoe was made on May 20 (30 days after transplanting), showing 93~98% in emergence rate. It is generally accepted that *Zingiber mioga* Roscoe ave higher emergence rate and short emergence period when faced with high soil temperature (Ahn, 1987).

Treatment of activated charcoal at 10% showed the highest plant height (80 cm) compared with control (72 cm) and followed by 30% AC (78 cm) treatment, 50% AC (75 cm) and 70% AC (71cm). The result suggests that optimum amount of activated charcoal was ranged from 10 to 30% for enhancing growth of *Zingiber mioga* Roscoe due to increasing of water and nutrient holding capacities as well as improving soil physical property. Leaf length and width at 10% AC treatment were 23.2 and 5.6 cm while those at control were 22.3

Table 1. Effect of activated charcoal on the growth of Zingiber mioga

Treatment	Emergence		Height	Leave	Leave
	Date	Ratio(%)	of plant(cm)	length(cm)	width (cm)
Control	May 19	93	72b[z]	22.3a	5.4a
Activated Charcoal 10%	May 20	95	80a	23.2a	5.6a
Activated Charcoal 30%	May 21	97	78a	23.4a	5.7a
Activated Charcoal 50%	May 21	98	75ab	22.0a	5.1a
Activated Charcoal 70%	May 20	96	71b	22.2a	5.2a

[z]:Same alphabetical letters indicate no significant difference at 5% level of DMRT.

Table 2. Effect of activated charcoal on the growth characteristic of rhizome in *Zingiber mioga*

Treatment	Rhizome Diameter(mm)	Rhizome wt.(mg)	Rhizome color
Control	10.6b[z]	33b	Olive brown
Activated Charcoal 10%	12.9a	40a	Yellowish brown
Activated Charcoal 30%	12.5a	39a	Yellowish brown
Activated Charcoal 50%	11.6b	35ab	Yellowish brown
Activated Charcoal 70%	10.3b	31b	Olive brown

[z] : Mean separation within column by Duncan's multiple range test, 5% level of significance.

and 5.4 cm, respectively, showing a similar tendency to the top-growth. However, no significant difference among treatments were observed.

Taking together, the results are supported by the report of Park (1996) who reported that optimized amount of AC stimulate crop growth by improving soil physical characteristics. Choi et al(2002), in another study, reported that treatment of AC around 20% improved the growth of medicinal plants, and exhibited differently depending on crop species.

Effect of Activated Charcoal on Rhizome Growth of *Zingiber mioga* Roscoe

To determine the effect of AC on rhizome growth of *Zingiber mioga* Roscoe, length and weight of rhizomes were measured on a plant (Table. 2)

In pot test, Diameter of rhizome was ranged from 10.3m to 12.9m, and rhizome weight a plant from 31 to 40 mg when treated with AC. Rhizome Diameter was significantly increased to 12.9~12.5 mm comapred with control when treated with 10~30% AC. AC at 10% increased rhizome weight by 40 mg while control was 33mg. However, no significant difference in weight was observed when treated with above 50% AC. As the results, it was thought that optimum amount of AC was ranged with 10%~30% and improved rhizome length and weight due to increasing water and nutrient holding capacities as well as physical properties of cultivated soil. This result supports the report that AC treated with optimum amount significantly can stimulate crop growth (Park, 1996).

On the other hand, color of rhizome coat was light to dark brown and not differ among treatment amounts. These results require further more detail studies on effects of treatment methods on growth responses of *Zingiber* as affected by different growing stages.

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