MIYOBI: A New Fertilizer Containing Abscisic Acid©

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INTRODUCTION

MIYOBI is the commercial name of new fertilizer that contains the natural type of abscisic acid [SABA (S)-(+)-ABA 5-[(1S)-1-hydroxy-2,6,6-trimethyl-4-oxo-2-cyclohexen-1-yl]-3-methyl-2,4-pentadienoic acid], and that was registered in Japan in Dec. 2003 (Table 1).

Table 1. Formulation of MIYOBI.

Percent a.i. (w/w) in MIYOBI	
Agents as fertilizer	
Water soluble K:	8.0
Water soluble P:	5.0
Water soluble Mg:	0.90
Water soluble Bo:	0.50
Water soluble Mn:	0.30
Activator of fertilizer	
SABA:	10.0

The natural type of abscisic acid is found ubiquitously in the plant kingdom, and it is well known that SABA inhibits the K-ion pump (Walton, 1980). In addition, it is also generally known that K-ion shows growth-promoting effects such as tissue differentiation, improvement in photosynthesis, biosynthesis of proteins and pigments, flower bud differentiation, and fruit maturation.

Natural type abscisic acid shows totally different physiological effects when compared with racemic ABA, which is chemically synthesized. For exmple, SABA promotes plant growth at a low dosage and inhibits growth at a high dosage (Kamuro, 1994; Kamuro et al., 1992). It is also very interesting that the combination of SABA and GA_3 showed synergistic promotive effects on photosynthesis, vegetative growth, flowering of long-day plants, fruit-set, and fruit-thickening growth (Kamuro et al., 1997; Kamuro et al., 2001; Nozawa-Gloria et al., 2003). The objective of this research was to study the effects of SABA and GA_3 treatments, alone and in combination, on photosynthetic rate and vegetative growth.

MATERIALS AND METHODS

Two-year-old camphora trees (*Cinnamomum camphora* L.) were used as test plants. Each plant was grown in a pot 7 cm in diameter. Individual plants were 15 cm in height and had 10 leaves. This research was carried out in September. Four test plots were set up as shown in Table 2. Five plants in each plot were sprayed with SABA 10 ppm, GA_3 50 ppm, SABA 10 ppm + GA_3 50 ppm, or water only (control). Photosynthetic rate was investigated under the conditions of 23–24 °C and 1050 $\mu mol \cdot m^{-2} \cdot s^{-1}$ at 7 days and 30 days after spray treatment. Growth increment at 34 days after treatment was recorded.

Table 2. Effect of SABA and GA_3 treatments on photosynthetic rate and vegetative growth in young plants of camphora tree (Kamuro et al., 1992)

	Photosynthetic rate (%)		Growth increment/plant (%) at 34 D.A.T.		
Spray treatment	7 D.A.T.	30 D.A.T.	Plant height	Leaves D.W.	Root D.W.
Control	144.5*	124.2*	2.7cm	0.84g	0.68g
	(100%)	(100%)	(100%)	(100%)	(100%)
SABA 10 ppm	106.3	94.7	92.6	98.8	141.2
GA_3 50 ppm	103.0	122.0	800.0	120.2	94.1
SABA 10 ppm + GA 50 ppm	121.9	136.0	740.7	133.3	126.5

*nmol CO_2·s/plant, D.A.T. = days after treatment, D.W. = dry weight.

Table 3. How to use "MIYOBI" on crops.

Effects	Crop	Treatment and Dosage (MIYOBI: g per L^{-1} water)
Establishment increase (%) and vigorous growth	Seed	Quick dipping (1 g per 5 L), or Soaking for one night (1 g per 500 L)
	Bulb	Mix treatment with GA_3 1-5 ppm is recommended in some cases.
Increasing rooting (%) and prevent wilting	Cutting Seedling	Spray on cutting, seedling, or nursery stock 1–2 days before transplanting (1 g per 5 L)
Growth promotion and yield increase	Vegetable Root crop	Spray at the 2–5 true leaves stage 1 or 2 times at intervals of 20 days (1 g per 5 L)
	Nursery stock	Mix treatment with GA_3 5–20 ppm is recommended in some cases.
Growth promotion and early flowering	Long-day ornamental plant	Spray at the 2–5 true leaves stage 1 or 2 times at intervals of 20 days (1 g per 5 L + GA_3 10-20 ppm)
Fructification increase (%) and under unfavorable weather conditions.	Fruit tree	Spray at the beginning stage of flowering.
	Vegetative fruit and leguminous crops	1 or 2 times at intervals of 20 days. (1 g per 5 L)
Preventing of early fruit drop and fruit thickening	Fruit tree	Spray at the early stage of fruit growth.
	Vegetative fruit	1 or 2 times at intervals of 20 days (1 g per 5 L + GA_3 5–20 ppm)
Dwarfing	All kinds of plant	Spray at the early stage of stem elongation. (1 g per 2 L + Ethephon 100–200 ppm)

RESULT AND DISCUSSION

The test results are shown in Table 2. The combined treatment of SABA and GA_3 showed increased effects on photosynthetic rate and dry weight per plant. It is very interesting to note that the combined treatment was more effective on dry weight increase of both top and root growth. These effects might result from the combined treatment promoting an increased photosynthetic rate, however, the mode of action is not yet cleared.

It is generally understood that abscisic acid counteracts the physiological action of gibberellins. A racemic ABA mixture has been used generally for research in plant physiology and showed only weak effects on growth promotion. We have previously reported that SABA showed totally different effects on plant growth when compared with racemic ABA and that mixed applications of SABA and GA enhanced the physiological actions of GA as mentioned above.

We also reported that mixed treatments of K-ion and SABA were effective in promoting these growth phenomenon mentioned above. So, SABA was added as an activator in fertilizer. A useful fungus that is available for wine brewing since old times produces SABA, which is added in MIYOBI. Racemic ABA, which is chemically synthesized, does not work for this purpose.

MIYOBI is valuable only as a foliar spray and not effective as a soil treatment because SABA is easily inactivated in soil.

Currently SABA is registered as a fertilizer activator and MIYOBI is available for agricultural production in Japan, Korea, and Taiwan. The use of MIYOBI on various crops is shown in Table 3.

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