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Profitable Spin-off from Using Chitosan in Orchid Farming in Thailand

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Abstract

The experiment to investigate the effects of chitosan using in orchid culture has been set up in cooperation with the orchid farmer in the local production farm. The young orchid plants of 8 months old from nursery house were randomly separated into 3 groups of one control and the other two groups of monthly treatment with two different commercial chitosan products. The continuous measurement of the growth and the number of flower shoots have been collected since starting to plant the young orchid stems by comparing the control-plants with the monthly chitosan- treated plants. Every cut-flower from the experiment was weighed and classified into 4 grade levels, i.e. super, long, medium and non-grade which were corresponding to the market-price of 9, 8, 5 and 1 Baht, respectively. The accumulation of the income from the cut-flowers after plantation for one year was collected for evaluation. It was found that most of the chitosan-treated plants showed the positive effect on speeding up of the flower shoots and showed the tendency of more yields on super-grade than the control plants. The income obtained from the chitosan-treated plants is quite higher than the control in the first year of cut-flower production. In addition, the orchid farmer satisfied with the upgrading effect of the cut-flower as well as the good health of the orchid plants treated with chitosan. It was also recommended by the experienced orchid farmer that in order to obtain reliable data of the cut-flower production, all investigations should follow up for more than three years.

Introduction

Thailand is one of the top exporters of the orchid cut-flowers in the world. The annual economic value of the cut-flower export is more than 2000 million Baht. The local orchid farmers are mostly active in development and adaptation in the order to serve the requirement in the world-wide market. Recently, the "Green Evolution" entered into the agriculture, the development of new techniques that can provide the increasing production and safe foods that are affordable to the farmers. Chitosan products are among these new substances, which consistently increases plant yields. Chitin and chitosan are naturally regenerating resources, which are biocompatable with living cells of animals and plants. It was reported that in plants, chitin and chitosan enhance the induction of various biological self-defense substances, the induction of phytoalexins, and protein inhibitors including lignins. (*Ben-Shalom et al., 2000; Hirano, 1997; and Yamada et al., 1993).* The study was focused on long-term investigation for the effects of using chitosan in the orchid cut-flower production and the ecological and economical impacts during the commercial farm production.

Materials and Method

The experiment of orchid culture was set up in November 2002 at Banpong Orchid Farm, where the farm owner, Mr. Suvitchai, has been interested in using the chitosan as plant elicitor for cut-flower production. The orchid used in the experiment is *Dendrobium Sensational Purple* (Dendrobium SP) which is registered for his property right. The process of the procedure was set up as follows:

The young orchid plants were randomly taken out from his nursery after being brought up for about 8 months. The width and the height of the stems of all orchids were measured. The range of the width was average 8.85-10.07 mm. while the height range was between 8.81-10.90 cm. The plants were randomly separated into 3 groups. Each group contained 150 plant population. The

running number tacks from 1 to 150 plants were hung on each plant in different color markers for recognition in each group during the experiment.

All of the orchid plants were cultured in the same technique on the long table with interval space among each group. The program of fertilization and any other conditions were applied in the same manner to each group except two types of chitosan products (CTS-1 and CTS-2) were monthly treated in the dosage of 3-4 ppm on the two experimental groups in order to compare the result with the control. The CTS-1 was specified in the high degree of deacetylation (DD) of 85% while CTS-2 was analysed of the DD in the range of 75 – 80% and the molecular size was between $5x10^3$ - $4 x10^4$ Dalton.

During 4 months after plantation, the measurement of the width and height of the stems were recorded two times. The data of average values of width and height of the orchid plants are shown in Tables 1-2 and Figures 1-2. At the same time, there were also different numbers of the flower shoots appearing among those groups which were recorded as shown in figure 3.

The data of both quality and quantity of the cut-flowers was collected for one year (April 2003-April 2004) and the total weight of the flower production including the sale price were calculated as shown in the result in Table 3.

Result and Discussion

This study was planned for long-term collection of data for at least 3 years which would gradually made observation and evaluation during the interval time period. The identification of any plant growth is the complex process of scientific indications which are concerned with many parameters. The growth indications in this experiment were measured in reference to the width and the height of the growing stems of the orchid plants as shown in the following tables and figures.

Table 1. The data of the average width of the orchid stems measured for 3 times during 4 months after plantation.

Time		Average Width (mm)		
		Control	CTS-1	CTS-2
Nov-02	Average	8.85	9.24	10.07
	Range	0.30-18.37	0.33-14.89	3.81-10.06
Dec-02	Average	11.07	10.16	10.05
	Range	2.90-19.80	1.20-16.44	2.96-18.71
Mar-03	Average	12.00	10.90	10.57
	Range	5.40-17.87	1.15-17.86	5.81-17.9

Table 2. The data of the average height of the orchid stems measured for 3 times during 4 months after plantation

Time		Average Height (cm)		
		Control	CTS-1	CTS-2
Nov-02	Average	8.81	9.50	10.90
	Range	0.22-17.10	0.56-15.60	0.40-20.30
Dec-02	Average	10.13	10.47	10.65
	Range	0.50-22.0	1.00-19.00	0.90-25.90
Mar-03	Average	13.09	11.89	10.79
	Range	6.00-24.00	6.00-20.00	5.00-17.00

Table 3. Data record of quality, quantity, weight and sale price of the cut-flower production for one-year comparing among control, CTS-1 and CTS-2 treated groups

Quality (Grade)	Unit price (Baht/piece)	Number of cut-flowers (pieces)				Number in each group (Baht)		
		Control	CTS-1	CTS-2		Control	CTS-1	CTS-2
Super	9	4	10	12		36	90	108
Long	8	18	7	8		144	56	56
Medium	5	57	59	63		285	295	315
Non-G	1	138	131	159		138	131	159
Total No. (pieces)	-	217	207	242		-	-	-
Total Wt. (g)	-	4327	3680	4231		-	-	-
Total income (Baht)	-	-	-	-		603	578	638

During the orchid culture, the program of fertilizer and the culture conditions were applied in the same technique as the commercial orchid farming system. During the interval time of 4 months after starting of the plantation, it was found that the control plants had kept on growing as normal but the chitosan treated plants were mostly producing the flower shoots instead of keeping on the plant growth as usual. The number of flower shoots gradually coming out from the chitosan treated plants were significantly higher than the control during the period of 4 months after starting the plantation as shown in Figure 3. With this surprising phenomenon, the farmer satisfied with results of the chitosan treated plant which appeared to be boosted for speeding up the flower shoots. At the same time, most of the chitosan treated plants are also appearing in better health conditions which are remarkable observed by the farmers who have long-time experience in orchid culture. Of the most benefit for the orchid farmers was to obtain more super-grade cut flowers, which are highly demanded for both the local and export market. The tendency of using chitosan for inducing more super-grade of cut-flowers was highly possible due to the results obtained from one year collection and evaluation as shown in the data of table 3. However, there are many factors and techniques which effect the orchid culture in the commercial scale of production. Consequently, it was expected that the result from this investigation would be the basical guideline to introduce the local natural material of versatile chitosan products to apply harmoniously resulting in a synergetic effect for ecological or organic farming system.

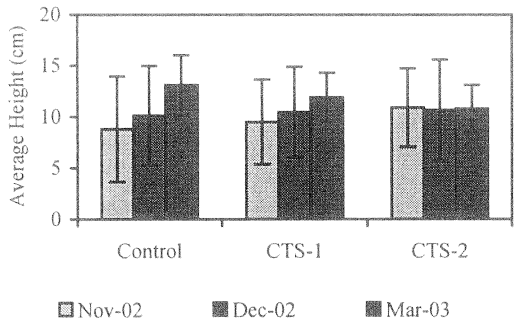

Figure 1. The bar graphs showed the width change of the orchid stems during 4 months after the plantation.

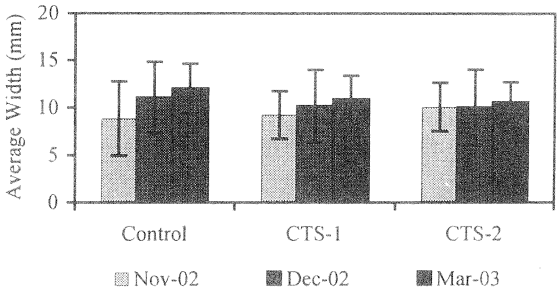

Figure 2. The bar graphs showed the height change of the orchid stems during 4 months after the plantation.

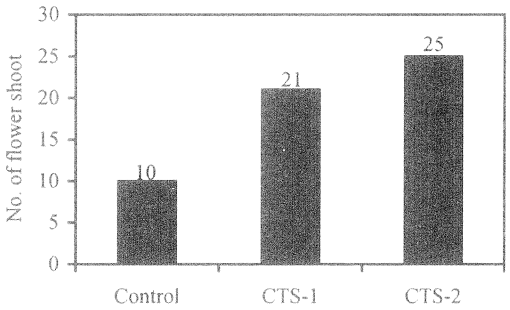

Figure 3. The bar graphs compared the number of flower shoots appearing during 4 months after the plantation.

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