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PROPAGATION AND FERTILIZER FOR *Morinda officinalis* How. CULTIVATED IN BAC GIANG PROVINCE, VIETNAM

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Abstract — *Morinda officinalis* How. is widely used as traditional medicinal plant with high pharmacological value. A big gap in the market for medicinal herbs in Vietnam emerged due to overexploitation and high demand for medicinal herbs. Covid-19 further boosted demand to develop medicinal plants to meet the domestic demand. There were limitations on applying fertilizers for medicinal plants in cultivation. In this study, the impact of propagation and different fertilizer applications for *M. officinalis* cultivation in Bac Giang Province were investigated. Data on ground diameter, height, root weight, and yield were collected after 18 and 54 months. The results showed that propagation could provide high yield and maintain good chracteristics of mother trees. *M. officinalis* grew well and provided high yield when it was applied with manure, mixture fertilizers and microbial fertilizers. The results of the study can be used for cultivating *M. officinalis* in large scale in support of the pharmaceutical industry having enough materials as well as improving livelihood of local people.

Keywords — **Bac Giang Province, Vietnam, fertilizer, *Morinda officinalis*, propagation**

INTRODUCTION

Morinda officinalis How. (Family: Rubuiaceae) is considered as a medicinal plant as its roots have been used for various purposes (Huong et al., 2020, Zhai et al., 2020). The root extract of *M. officinalis* was used to enhance immune function in the treatment of impotence, menstrual disorders, diabetes and dermatitis (Zhang et al., 2018). In Viet Nam, *M. officinalis* is also listed as an endangered species (Nguyen Tap and Nguyen Chieu, 2007).

Due to past unsustainable practice, the resource of medical plants in Vietnam has been depleted and some plants are endangered or have become extinct. The big gap in the market for medicinal herbs in Vietnam emerged due to exploitation and high demand for medicinal herbs. COVID-19 further boosted demand to develop medicinal plants to meet the domestic demand (Caspani, 2020).

Cultivation of medicinal plants has been limited and there was blind application of fertilizers to *M. officinalis* to provide theoretical support in cultivation. Zhu et al. (2020) studied the effects of fertilizers on yield and quality of *Panax notoginseng* in Yunnan Province, China and found that supplementation of organic and medium and trace element fertilizers would help to increase root weight per plants.

To date there has been no formalized studies examining propagation techniques and fertilizer application rates for *M. officinalis*. Therefore, this study was conducted to investigate the impact of propagation and different fertilizer applications on *M. officinalis* in Bac Giang Province.

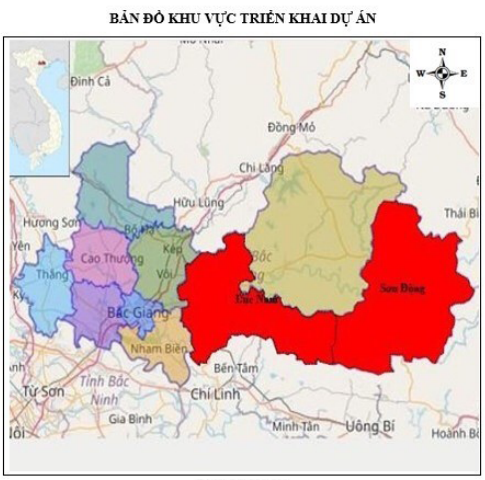

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Fig.1. Location of cultivation *Morinda officinalis* How. in Bac Giang Province.

MATERIALS AND METHODS

Impact of Propagation on the Growth and Yields of *M. officinalis*

The experiment had 2 treatments including CT1: used seeds of *M. officinalis* and CT2: used stem cutting for propagation. In CT1, seeds were collected from the mature trees, over 3 years old with ripened fruits in red color. In CT2, stem cutting plants were collected from the mother trees, 2-3 years old. Stem cutting materials were soaked with Indol Butylic Acid (IBA) in concentration of 1500ppm (Quang et al., 2020). Experiments were conducted using the completely randomized design with 3 replicates, each measured 62.5 m² with 50 plants/replication/treatment. Materials in both treatments used the same variety (BK8). Experiments was conducted from April 2014 to October 2018.

Experiments were done in the land after harvesting hybrid Acaciar in the Nghia Phuong commune, Luc Nam district, Bac Giang Province, Vietnam (Figure 1). Soil was dug and turned 50cm deep by machine. The hole size was 40 x 40 x 30cm, distance 1 m x 1.25m (8.000 plants/ha). Basal fertilizer for each hole included 0.1 kg NPK (5:10:3). Fertilizer application, land preparation and hole cover were completed before planting in 20 days. In the CT1, plants for cultivation had height 20-25 cm, 4-5 leaves, 5-10cm root length, healthy, not curved or cut shoot. In the CT2, plants for cultivation had height 15-20 cm, 4-5 leaves, 5-10 cm root length, healthy, not curved or cut shoot (after 4 months).

Impact of Fertilizers on the Growth and Yields of *M. officinalis* root

The experiments had four (4) treatments namely:

CT1: Basal fertilizers inluded 0.1kg NPK (5:10:3)/plant with additional fertilizer application in the 2nd, 3rd year, two times per year, each 1kg NPK (5:10:3)/plant.

CT2: Basal fertilizers included 1kg manure + 0.1kg NPK (5:10:3)/plant, additional fertilizer were applied in the 1st year once at 0.1kg NPK (5 :10 :3)/ plant; applying additional fertilizers were applied in the 2nd year, twice each time at 0.5kg manure + 0.1kg NPK (5:10:3)/plant; additional fertilizer were applied in the 3rd year, twice each time at 0.1 kg NPK (5:10:3)/ plant each time.

CT3: Basal fertilizers included 1kg manure + 0.05kg mixture of fertilizer/plant, additional fertilizers were applied the 1st year, once at 0.05kg mixture of fertilizer/ plant additional fertilizers were applied in the 2nd year, twice each time at 0.5kg manure + 0.05kg mixture of fertilizer/plant each time; additional fertilizer in the 3rd year was applied twice, each time at 0.05kg mixture fertilizers/plant each time. Mixed fertilizers included 288 kg NPK (5:10:3) + 80 kg $P_2 0_5$ + 32 kg $K_2 0$. Buffalo manure was collected one year prior to application.

CT4: Basal fertilizers included (1kg manure + 0.05kg mixture fertilizers + 0.1kg microbial fertilizers/plant; additional fertilizers were applied in the 1st year, once at (0.05kg mixture fertilizers + 0.1 kg microbial fertilizers)/plant; additional fertilizers were applied in the 2nd year, twice, each time at (0.5kg manure + 0.05 kg mixture fertilizers + 0.1kg microbial fertilizers)/plant each time; additional fertilizers was applied in the 3rd year, twice, each time at (0.05 kg mixture fertilizers + 0.1kg microbial fertilizers)/plant each time.

Location and design of experiments were similar with the propagation study. In both experiments, data were collected on the survival ratio (sr = alive plants/ total plants x 100%), ground diameter, height, the numbers of leaf pair and the numbers of the third brands, root weight and root yields [ry = average root weight (kg)/plot area x ($10000m^2$)].

Data were analyzed by using SPSS Version 12.0.

RESULTS AND DISCUSSION

Comparing propagation to seedling after 18 months, the following we observed:

In the propagation by stem cutting experiment had a survival ratio was 88.5%, ground diameter was 6.2mm, there were 68.1 pairs/plant and 42.7 third branches/ plant. By contrast, in the seeding experiment, survival ratio was 82.5%, ground diameter was 4.6mm, the numbers of leaf pair was 48.5 pairs/plant and the numbers of the third branches was 25.5/plant. After 54 months, root yields of *M. officinalis* in the propagation experiment reached 4.8 tons ha^{-1} whereas seedling yielded 3.7 tons ha^{-1} (Table 1).

Table 1. Growth of *M. officinalis* plants by cultivating seeds and propagation after 18 months.

Treatment	Survival rate (%)	Ground diameter (mm)	Height (cm)	Numbers of pair of Leaves (a pair)	The third branch numbers (branches)
By propagation	88,5	6,2	255,1	68,1	42,7
By seeds	82,5	4,6	270,2	48,5	25,5
Fpr	*0,024*	*0,003*	*0,081*	*0,004*	*0,000*
Lsd 0.05	*4,3*	*0,14*	*22,4*	*11,6*	*0,99*

Comparing propagation and seed experiments, it can be concluded that using propagation of *M. officinalis* can lead to faster growth in physiological indicators of the mother trees than using seeds. More importantly, propagation leads to statistically higher root yields. After 18 months, survival ratio of *M. officinalis* in the 4 treaments using fertilizers ranged from 84.7% – 94.6%, highest number in CT4 (94.6%) and lowest number in CT1 (84.7%) (Table 2).

Table 2. Impact of fertilizers to the growth of *M. officinalis.*

Treatment	Survival rate (%)	Measurement factors after 18 months		
		Ground diameter (mm)	Numbers of pair leaves (a pair)	Numbers of the third branches (branches)
CT1	84.7	5.2	57.6	24.0
CT2	92.4	5.8	77.3	27.3
CT3	94.1	6.8	83.1	30.3
CT4	94.6	8.5	109.7	41.2
Fpr	*0.000*	*0.000*	*0.000*	*0.002*
LSD0.05	*2.68*	*0.29*	*8.79*	*5.6*

Similarly, measurement factors in CT4 were higher significantly than in other experiments such as ground diameters (8.5mm), the numbers of pairs leaves (109.7 pairs/plant), the numbers of the third branches (41.2 branches/plant) whereas in the other experiments, ground diameter ranged from 5.2 – 6.8mm, the numbers of pair leaves 57.6-83.1 pairs/plant and the numbers of the third branches 24.0/plant (Table 3).

Table 3. Yield of *M. officinalis* roots by cultivating seeds and propagation after 54 months.

Treatment	Root weight (g/plant)	Root yield (ton/ha)
By propagation	680,5	4,8
By seeds	567,1	3,7
Fpr	*0,002*	*0,001*
Lsd 0.05	*4,1*	*0,24*

After 54 months, highest root yield of *M. officinalis* gained 5.2 tons/ha in CT4 and lowest yield was in CT1 (3.5 tons/ha) (Table 4).

Table 4. Yields of *M. officinalis* How roots after 54 months applying fertilizers.

Treatment	Root weight (g/plant)	Root yield (ton/ha)
CT1	776.5	3.5
CT2	927.3	4.3
CT3	1.01.7	4.8
CT4	1.169.0	5.2
Fpr	*0.003*	*0.000*
LSD0.05	*137.78*	*0.24*

M. officinalis would grew well after applying manure, mixture fertilizers (NPK + phosphate + potassium + microbial fertilizers) as supported by Quang et al. (2020) in their propagation technique of *M. officinalis.*

M. officinalis is a species develops and produces roots so it needs high noncohesive and highly fertile soils. In the growing stage and rooty development stage, potassium fertilizers should be added. Zhu et al. (2020) obtained similar results where organic and trace element were added on P. notoginseng.

A limitation of study was to assume that *M. officinalis* grew well without pest and disease and trialed in Bac Giang Province, the native area of this species.

CONCLUSIONS

Cutting stem propagation of *M. officinalis* would provide statistically higher growth and yield.

Supplementation of manure, mixture fertilizers and microbial fertilizers for *M. officinalis* How in the basal application and later stages would enhance h yield.

This study indirectly inferred that *M. officinalis* required noncohesive and fertile soils. Fertilizers should be added in the developing stages of *M. officinalis*.

M. officinalis plantation should be expanded to help improve the livelihood of local residents.

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REFERENCES

Huong, T.T., Mong, N.T.K., Loc, L.T., Co, N.T.Q., Tuan, T.T. 2020. Study of adventitious root formation derived from node of *Morinda officinalis* How cultured in vitro. J. Sci. Tech. and Food , 20(2): 72-79 https://123docz.net/document/7012471-study-of-adventitious-root-formation-derived-from-node-of-morinda-officinalis-how-cultured-in-vitro.htm

Nguyen Tap, Nguyen Chieu. 2007. *Morinda officinalis* How. Labor Public House. Ha Noi. (Vietnamese).

Quang, K.N., Thom, N.M., Hai, V.D. 2020. Study on propagation techniques of *Morinda officinal* How in Bac Giang, Vietnam Journal of Forest Science. 4: 3-13. http://vafs.gov.vn/en/2020/11/vietnam-journal-of-forest-science-number-4-2020/

Zhai, H.J., Ye, G.H., Xue, J.J., Yu, J.H., Zhang, Y.Y., Zhang H. 2020. Two new naphthoate derivatives from *Morinda officinalis* How. Journal Asian Natural Products Research. 22 (11), 1018-1023. https://doi.org/10.1080/10286020.2019.1670648

Zhang, J.H., Xin, H.L., Xu, Y.M., Shen, Y., He, Y.Q., Yeh, H., Lin, B., Song, H.T., Yang, H.Y., Qin L.P., Zhang, Q.Y., Du, J. 2018. *Morinda officinalis* How. – A comprehensive review of traditional uses, phytochemistry and pharmacology. Journal of Ethnopharmacology 213: 230- 255. DOI: 10.1016/j.jep.2017.10.028

Zhu, Y., Chen, J., Long, G., Zhu, T., Zhu, S. 2020. Effect of organic and medium and trace element fertilizers on yield and quality of *Panax notoginseng*. Medicinal Plants 11(3): 55-59.