Published with Open Access at Journal BiNET
Vol. 25, Issue 01: 2069-2074
Journal of Bioscience and Agriculture Research
Journal Home: www.journalbinet.com/jbar-journal.html

Impact of natural substances and synthetic hormone on grapevine cutting

AFM Jamal Uddin, M. Rakibuzzaman, I. Raisa, M. Maliha and M. A. Husna

Department of Horticulture, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh

✉ For any information: jamal4@yahoo.com (Jamal Uddin, AFM)
Article received: 14.07.2020; Revised: 25.07.2020; First published online: 01 August 2020.

ABSTRACT

Application of synthetic rooting hormone has been recognized successful but expensive, so need to improve the knowledge of vegetative propagation with using natural substances. This experiment was conducted to study the effect of natural substances and synthetic hormone on rooting and vegetative growth of grapevine cutting. The study comprised of six treatments: (i) no hormone application (control), (ii) Aloe vera gel, (iii) Cinnamon powder, (iv) Undiluted honey, (v) Indole-3-Butyric acid (IBA) and (vi) Indole Acetic acid (IAA). Data on survival ability; vegetative growth and rooting were taken. The results showed that the highest survival percentages and root number observed for synthetic hormone (IBA) which was close to natural substance (Aloe vera gel) treatment. On the other, Aloe vera gel treatment significantly higher than other treatments in terms of vine length, vine diameter, root length and SPAD value. Therefore, natural substances like aloe vera gel treatment could be the effective root hormone for rooting of grapevine cutting.

Key Words*: Phytohormone, IAA, IBA, Aloe vera gel, Cinnamon and Honey.*

Cite Article: Jamal Uddin, A. F. M., Rakibuzzaman, M., Raisa, I., Maliha, M. and Husna, M. A. (2020). Impact of natural substances and synthetic hormone on grapevine cutting. Journal of Bioscience and Agriculture Research, 25(01), 2069-2074.
Crossref: https://doi.org/10.18801/jbar.250120.253

I. Introduction

Grape is one of the most valuable and economical crops as the source of grapes, both for direct and indirect consumption in the world. The main propagation technique of grape is vegetative propagation and stem cutting is recognized as the easiest and cheapest technique to large propagation and production of plants more unique and genetically similar to the genitors (Hartman et al., 2011). Stem cutting for propagation process involves the initiation of several new meristematic areas in different tissues of shoot cuttings (Kaur et al., 2002). Cuttings without application of root hormones are difficult and usually take a long time. Hormones are involved in either cell division or interact with other hormone's effects on plants. Plants produce natural auxin in young shoots and leaves, but the synthetic auxin should be used for successful rooting to prevent cuttings death (Kasim and Rayya, 2009).

Hormones are chemicals produced by plants that regulate the growth processes (stimulates root development, control plant height) and manipulates plant for specific purposes. Natural substance

Published with open access at journalbinet.com
EISSN: 2312-7945, ©2020 The Authors, Research paper

possesses the rooting ability of cuttings, they may perfect substitute to the synthetic hormones such as auxins, cytokinins, gibberellins and alternative hormones may be used as honey, coconut water, willow tea, aspirin, moringa extract and saliva (Dunsin et al., 2016). Natural plant extracts like Aloe Vera are rich in plant hormones, can be used to improve and stimulate growth of other plant species (Hamouda et al., 2012), Cinnamon powder is considered to have high potential as a biological control agent and act as a rooting agent which is useful to stimulate root growth in almost every plant variety (Xing et al., 2010). Honey as an organic substitute for rooting hormone powder which is anti-fungal, anti-bacterial and fights infections, helping plants to root (Gangwar, 2016). This paper describes the experiment which aims at the goal to study the effect of natural and commercial synthetic rooting products, to compare the natural and synthetic hormone to evaluate rooting stimulants work best with cuttings of grapevine.

II. Materials and Methods

Description of the experiment site

The experiment was conducted at the Horticulture research field of Sher-e-Bangla Agricultural University, Dhaka, during the period from August 2019 to October 2019. The location of the site is $23^{0}74'$ N latitude and $90^{0}35'$ E longitudes with an elevation of 8.2 meters from sea level in Agro-Ecological Zone of Madhupur Tract (AEZ No. 28).

Experiment design and treatment

The pot experiment was conducted in Completely Randomized Design (CRD) following three replications. The experiment comprised six treatment viz., Control (T_0), Aloe Vera gel (T_1), Cinnamon powder (T_2), Honey (T_3), Indole-3-Butyric acid (T_4) and Indole Acetic acid (T_5).

Potting media preparation, experiment materials collections and applications

Growing media prepared with Soil, vermi-compost, sand and Trichoderma (2:2:1:1) following (Rakibuzzaman et al., 2019). Seedless grapevine cuttings and natural substances like aloe vera, honey were collected from Horticulture Innovation Lab. of Sher-e-Bangla Agricultural University, Cinnamon from local vendors and synthetic hormone (IBA and IAA) from India. Grapevines were cut into 12 cm with a minimum of 2-3 nodes and the cut ends of the cuttings were dipped into tap water for 5 minutes. Then, end cut of the cuttings (60 cuttings for individuals treatment and each replication was 20 cuttings) were dipped into aloe Vera gel, undiluted honey, cinnamon powder, IBA and IAA, and to create a thin layer dipped cuttings were rolled and then cuttings were store for 20 minutes. After, completing this process cuttings were planted into potting media which were al watered to maintain moist condition.

Rooting, vegetative measurement and SPAD value determination

Three months after planting, data from five randomly chosen cuttings were collected from each treatment. We counted the number of sprouting shoot and survive percentages calculated thus:

$$\text{Survive percentages} = \frac{\text{Number of cuttings survived}}{\text{Number of cuttings planted}} \times 100$$

Vine length (cm), diameter (mm) and number of leaves were measured for all treatment. The apical leaflets were taken for SPAD reading. The leaf chlorophyll content was determined using an automatic SPAD meter (Minolta SPAD-502 meter). Root samples were washed with water to measure fresh determination i.e. No. of roots/ cutting, average root length (cm) (Plate 01).

Statistical analysis

The data recorded for different parameters were statistically analyzed using MSTAT-C computer software to find out the significance of variation among the treatments and treatment means were compared by Duncan's Multiple Range Test (DMRT) at 5% level of probability.

Published with open access at journalbinet.com
EISSN: 2312-7945, © 2020 The Authors, Research paper

III. Results and Discussion

Survive percentages

Survival rate was varied significantly with natural substance and synthetic hormone application treatment. The highest survival was found to be 94.7% in IBA treatment which was followed by cinnamon treatment (92.3%) and the lowest survival of 73.3% was found in control (Figure 01).IBA derived auxin which play a crucial role in root and shoots development. Rakibuzzaman et al. (2018) observed that stevia cutting survival rate was triggered due to IBA. Cinnamon has an antifungal activity (Ojaghian et al., 2014) also encourages plant stem to produce more stem for plant growth.

Number of leaves per cutting

Significant variation was found in number of leaves per cutting under different natural and synthetic hormone treatments. A maximum number of leaves (9.3) observed in Aloe vera gel treatment which followed by cinnamon powder (8.7) while the lowest number of leaves found in the control treatment. Here, natural substances showed better result compare to synthetic hormone where IBA (6.3) and IAA (5.3) (Figure 02). Aloe vera gel contains essential amino acids, macronutrients, micronutrients, vitamins, gibberellins and salicylic acid (Hamouda et al., 2012) and had stimulating effect on plant growth and development (Mady, 2008). Carmello and Cardoso (2018) reported that, application of cinnamon have stimulating effect to increase fresh mass of aerial part of a plant and number of leaves, it may be due to cinnamon contain bioactive compound like cinnamaldehyde, eugenol oil which having allopathic impact that promotes vegetative growth.

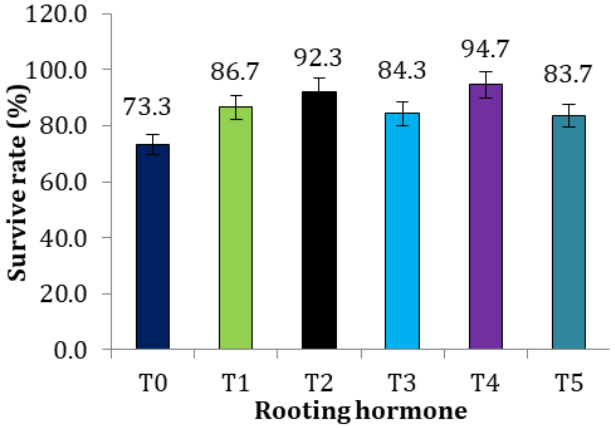

Figure 01. Effect of natural and synthetic hormone on survive rate of grapevine cutting

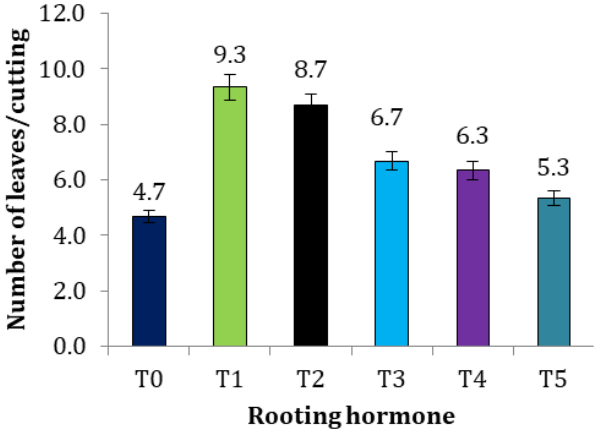

Figure 02. Effect of natural and synthetic hormone on number of leaves per cutting

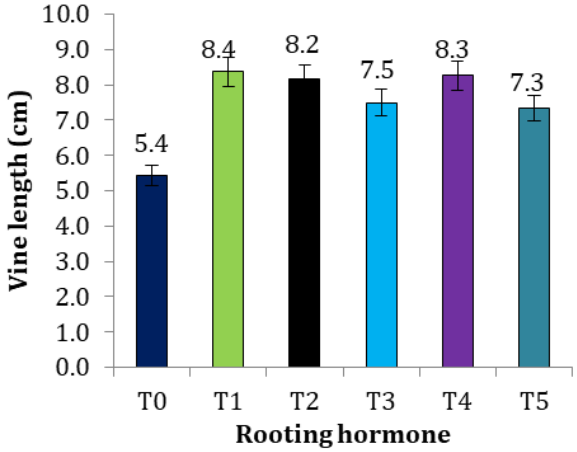

Figure 03. Effect of natural and synthetic hormone on length of vine of grapevine cutting

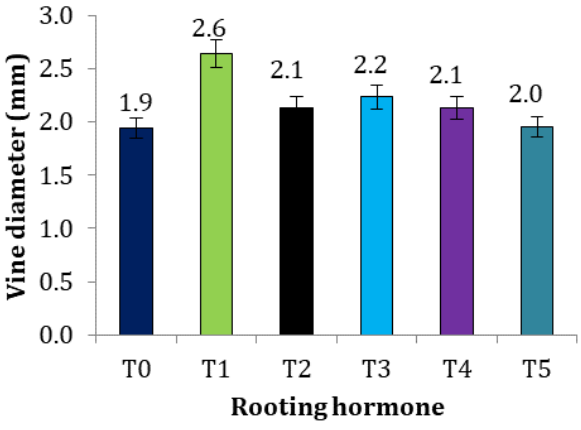

Figure 04. Effect of natural and synthetic hormone on stem diameter of vine cutting

Here, Control (T_0), Aloe Vera gel (T_1), Cinnamon powder (T_2), Honey (T_3), Indole-3-Butyric acid (T_4) and Indole Acetic acid (T_5).

Published with open access at journalbinet.com
EISSN: 2312-7945, ©2020 The Authors, Research paper

Vine length

Different treatments had a prominent performance on vine length of grapevine cutting. Figure 03 revealed that, the longest length (8.4 cm) recorded in aloe vera gel treatment. In addition, the rest of natural substance (cinnamon, 8.2 cm and honey, 7.5 cm) whereas (8.3 cm in IBA and 7.3 cm in IAA). The shortest vine length (5.4 cm) found in the control treatment. Aloe vera rich in growth hormones like gibberellin and salicylic acid (Sahu et al., 2013) promotes vegetative growth, cinnamon contains phenolic compounds that impact plant growth and development (Hiraddate et al., 2005). IBA derived auxin that affects hypocotyls and shoots branching (Starder et al., 2011).

Vine Diameter

Stem girth of grapevine cutting varied with different natural substances and synthetic hormones. Among natural substances the highest stem girth (2.6 mm) recorded in T_2 while the lowest (2.1 mm). In case of synthetic hormone maximum results (2.1 mm) found in T_4 and the minimum (2.0 mm) in T_5. However, the overall lowest stem diameter observed in T_0 treatment (Figure 04). GA_3 found in aloe vera gel which stimulates plant growth by increasing cell membrane permeability, photosynthesis, nitrogen uptake (Padmaja et al., 2007). Natural substances are prominent than the synthetic hormone for grapevine cuttings and the result was similar to El-Botaty and Saleh (2018).

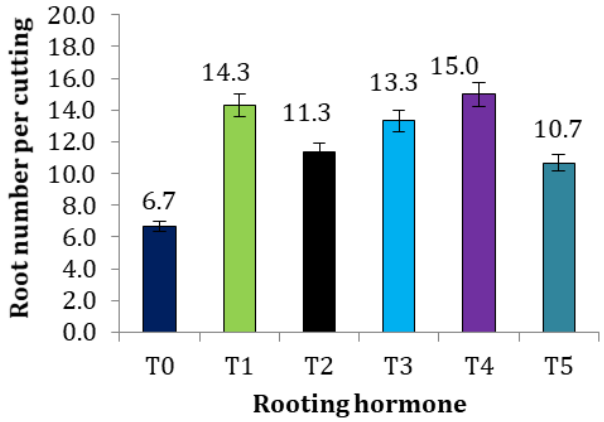

Figure 05. Effect of natural and synthetic hormone on number of root per cutting

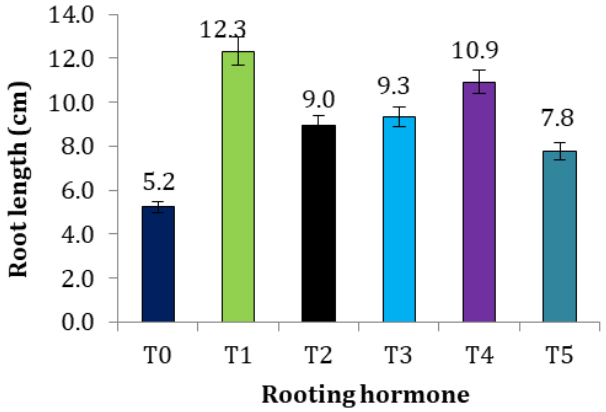

Figure 06. Effect of natural and synthetic hormone on length of root of vine cutting

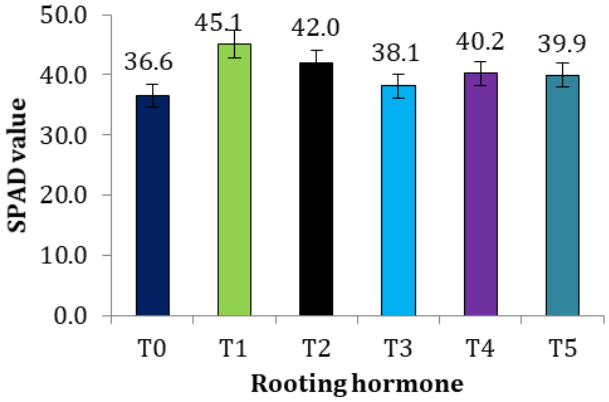

Figure 07. Effect of natural and synthetic hormone on length of root of vine cutting

Plate 01. Effect of hormone on rooting and vegetative growth of grapevine cutting

Here, Control (T_0), Aloe Vera gel (T_1), Cinnamon powder (T_2), Honey (T_3), Indole-3-Butyric acid (T_4) and Indole Acetic acid

Root number per cutting

Significant variation was observed in case of number of roots under different hormone treatments. The maximum number of root (15.0) recorded in Synthetic rooting hormone (IBA treatment) which was statistically similar to natural substances (Aloe vera gel) and the observed root number was (14.3) and even, honey showed the prominent findings in number of root per cuttings. On the other, control treatment gave the minimum results (Figure 05). Ahmad et al. (2016) found maximum root

Published with open access at journalbinet.com
EISSN: 2312-7945, © 2020 The Authors, Research paper

number in dragon fruit with the application of IBA. Dunsin et al. (2016) reported that, alternative rooting hormones like natural substance had a great impact compare to synthetic rooting hormone due to easy maintain, low cost and have stimulating effect on rooting.

Root length

There was a significant effect of different rooting hormone on root length. Aloe vera gel treatment showed the longest root length (12.9 cm) which was followed by IBA (10.9 cm) whereas the smallest root length (5.2 cm) was measured in the control treatment (Figure 06). El-Sherif, (2017) observed that root length increased due to application of aloe vera gel. He reported that aloe vera gel contains IAA which could be the alternative root hormone.

SPAD value

SPAD reading showed significant variation among the different hormone treatments, the highest SPAD reading was measured from aloe vera gel treatment (T_2) (45.1) whereas the lowest (36.6) was recorded in control (T_0). Natural substances aloe vera, cinnamon gave maximum value than synthetic hormone IBA, IAA treatment (Figure 07). Lin et al. (2003) reported that, aloe vera extracts have stimulating impact on seedling vegetative growth and suggested that aloe vera as an important plant growth promoter.

IV. Conclusion

The results of the study revealed that synthetic hormone Indole-3-Butyric acid had impact on rooting number and survival in cuttings which followed by Aloe vera gel treatment. Aloe vera gel treatment had a prominent influence on survival of grapevine cutting, vine length, vine diameter, root number, root length and leaf chlorophyll content. So, it can be said that natural substances like aloe vera gel could be the potential root hormone substitute to synthetic root hormone for grapevine cutting.

V. References

[1]. Ahmad, H., Mirana, A. S., Mahbuba, S., Tareq, M. S. and Jamal Uddin, A. F. M. (2016). Performance of IBA Concentrations for Rooting of Dragon Fruit (*Hylocereus undatus*) Stem Cuttings. International Journal of Business, Social and Scientific Research, 4(4), 231-234.

[2]. Carmello, C. R. and Cardoso, J. C. (2018). Effects of plant extracts and sodium hypochlorite on lettuce germination and inhibition of *Cercospora longissima* in vitro. Scintia Horticulturae, 234, 245-249. https://doi.org/10.1016/j.scienta.2018.02.056

[3]. Dunsin, O., Ajiboye, G. and Adeyemo, T. (2016). Effect of alternative hormones on the rootability of parkia biglobosa. Scientia Agriculturae, 13(2), 113-118. https://doi.org/10.15192/PSCP.SA.2016.13.2.113118

[4]. El Botaty, M. S. and Saleh M. M. S. (2018).Effect of Some Natural Substances on Grape Cuttings Rooting. Middle East Journal of Agriculture Research, 07(04), 1702-1719.

[5]. El Sherif, F. (2017). Aloe vera Leaf Extract as a Potential Growth Enhancer for Populus Trees Grown Under in vitro Conditions. American Journal of Plant Biology, 2(4), 101-105.

[6]. Gangwar, S. K. (2016). Honey physio-chemical parameters and its application with reference to Ethiopia. International Journal of Science and Nature, 7(1), 16-24.

[7]. Hamouda, A. M. A., Hendi, D. M. G. and Abu-El-Leel, O. F. A. (2012). Improving basil growth, yield and oil production by Aloe vera extract and active dry yeast. Egypt Journal Horticulture, 39. 45-71.

[8]. Hartman, H. T., Kester, D. E., Davies, J. F. T. and Geneve, R. L. (2011). Plant Propagation: principles and practices, 8th Ed. Boston: Prentice-Hall, 915 p.

[9]. Hiraddate, S., Morita, S., Furubayashi, A., Fujii, Y. and Harada, J. (2005). Plant growth inhibition by cis-cinnamoyl glucosides and ciscinnamic acid. Journal of Chemical Ecology, 31, 591-601. https://doi.org/10.1007/s10886-005-2047-0

[10]. Kasim, N. E. and Rayya, A. (2009). Effect of different collection times and some treatments on rooting and chemical interminal constituents of bitter almond hardwood cutting. Journal of Agriculture and Biological Science, 5(2), 116-122.

[11]. Kaur, S., Cheema, S. S., Chhabra, B. R. and Talwar, K. K. (2002). Chemical induction of physiological changes during adventitious root formation and bud break in grapevine

Published with open access at journalbinet.com
EISSN: 2312-7945, ©2020 The Authors, Research paper

cuttings. Plant Growth Regulation, 37(1), 63-68. https://doi.org/10.1023/A:1020310008830 https://doi.org/10.1023/A:1020355505105

[12]. Lin, D. Z., Tsuzuki, E., Sugimoto, Y., Dong, Y. and Matsuo, M. (2003). Allelopathic effects of aqueous Aloe vera leaf extracts on selected crops. Allelopathy Journal, 13(1), 67-74.

[13]. Mady, A. (2008). Effect of certain medicinal plant extracts on growth, yield and metabolism of some medicinal and aromatic plants. (M.Sc. Thesis) Faculty of Science Al-Azher University.

[14]. Ojaghian, M. R., Chen, Y., Chen, S., Cui, Z.Q., Xie, G. L. and Zhang, J. (2014). Antifungal and enzymatic evaluation of plant crude extracts derived from cinnamon and rosemary against Sclerotinia carrot rot. Annals of Applied Biology, 164(3), 415-429. https://doi.org/10.1111/aab.12111

[15]. Padmaja, C. K., Kowsalya, B. and Seethalakshmi, C. (2007). Efficacy of Aloe vera leaf powder as biostimulant in enhancing the growth and yield of Lady's Finger (*Abelmoschus esculentus* L.). Research on Crops, 8, 395-397.

[16]. Rakibuzzaman, M., Maliha, M., Dina, A., Raisa, I. and Jamal Uddin, A. F. M. (2019). Evaluation of growing media for seedling emergence and seedling growth of Red lady papaya. International Journal of Business, Social and Scientific Research, 7(4), 27-30.

[17]. Rakibuzzaman, M., Shimasaki, K. and Jamal Uddin, A. F. M. (2018). Influence of Cutting Position and Rooting Hormones on Rooting of Stevia (*Stevia rebaudiana*) Stem Cutting. International Journal of Business, Social and Scientific Research, 6(4), 122-121.

[18]. Sahu, K. P., Giri, D. D., Singh, R., Pandey, P., Gupta, S., Shrivastava, A. K., Kumar, A. and Pandey, D. K. (2013). Effect of Aloe vera on some annual plants. Scientific Research of Pharmacology and Pharmacy, 4, 599-610. https://doi.org/10.4236/pp.2013.48086

[19]. Starder, L. C., Wheeler, D. L., Christensen, S. E., Berens, J. C., Cohen, J. D., Rampey, R. A. and Bartel, B. (2011). Multiple facets of Arabidopsis seedling development require indole-3-butyric acid-derived auxin. The Plant Cell, 23, 984-999. https://doi.org/10.1105/tpc.111.083071

[20]. Xing, Y., Li, X., Xu, Q., Yun, J., and Lu, Y. (2010). Antifungal activities of cinnamon oil against Rhizopus nigricans, Aspergillus flavus and Penicillium expansum in vitro and in vivo fruit test. International Journal of Food Science and Technology, 45(9), 1837-1842. https://doi.org/10.1111/j.1365-2621.2010.02342.x

HOW TO CITE THIS ARTICLE?

Crossref: https://doi.org/10.18801/jbar.250120.253

MLA
Jamal Uddin, A. F. M. et al. "Impact of natural substances and synthetic hormone on grapevine cutting". Journal of Bioscience and Agriculture Research, 25(01), (2020): 2069-2074.

APA
Jamal Uddin, A. F. M., Rakibuzzaman, M., Raisa, I., Maliha, M. and Husna, M. A. (2020). Impact of natural substances and synthetic hormone on grapevine cutting. *Journal of Bioscience and Agriculture Research*, 25(01), 2069-2074.

Chicago
Jamal Uddin, A. F. M., Rakibuzzaman, M., Raisa, I., Maliha, M. and Husna, M. A. "Impact of natural substances and synthetic hormone on grapevine cutting". Journal of Bioscience and Agriculture Research, 25(01), (2020): 2069-2074.

Harvard
Jamal Uddin, A. F. M., Rakibuzzaman, M., Raisa, I., Maliha, M. and Husna, M. A. 2020. Impact of natural substances and synthetic hormone on grapevine cutting. Journal of Bioscience and Agriculture Research, 25(01), pp. 2069-2074.

Vancouver
Jamal Uddin, AFM, Rakibuzzaman, M, Raisa, I, Maliha, M and Husna, MA. Impact of natural substances and synthetic hormone on grapevine cutting. Journal of Bioscience and Agriculture Research, 2020 August 25(01): 2069-2074.

Published with open access at journalbinet.com
EISSN: 2312-7945, © 2020 The Authors, Research paper