Biological Forum – An International Journal **14(2): 1286-1289(2022)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Effects of Humic Acid, Vermiwash and Biofertilizer on Grafting Success of Soursop (*Annona muricata* L)

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(Received 10 April 2022, Accepted 07 June, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: An experiment was undertaken on effects of humic acid, vermiwash, and biofertilizer on soursop grafts. Soursop (local) as root stock and scion (local) was used for study at the department of Fruit Science, College of Horticulture, Bengaluru during the period 2020-21. The scion of local plant was used for softwood grafting in six month old seedlings which were planted in media containing mixtures of soil and FYM (1:1) treated with humic acid, vermiwash and biofertilizers per treatment and these bags were kept under open condition. A total of 12 treatments were tested in three replications. The results at the end of 90 days showed that the inoculation of consortium of T_{11} Vermiwash (1%) + *Azospirillum* spp (2g/ seedling) + *Pseudomonas fluorescence* (2g / seedling) + AM fungi (2g / seedling) had taken less number of days for sprouting (23 days), more successful grafting (70.33 %), produced the highest length of sprout (18.83 cm) and number of leaves (29.00). The inoculation of consortia of humic acid, vermiwash and biofertilizer showed better nutrient uptake and growth at the end of 90 days in open condition.

Keywords: Soursop, humic acid and vermiwash.

INTRODUCTION

Soursop/ Laxman phal (*Annona muricata* L.; 2n= 14) is a small erect evergreen tropical plant belonging to the family Annonaceae, growing 5-6 meters in height and bears the largest fruit among the Annonas (Uchegbu *et al*., 2017). It is a native of Central America, mostly distributed in tropical and subtropical regions of the world. In recent years, soursop production has increased, now widely dispersed across the planet's equatorial belt, with considerable economic importance in nations like as Venezuela, Puerto Rico, Mexico, Jamaica, Cuba, Spain, India, Suriname, Brazil, and Senegal, among others. Soursop was first introduced to India many years ago, but it is presently only grown in plantations on a modest scale. In India, on an average plants produce about 25-40 kg fruits/plant. Soursop is only grown in tiny amounts in Tamil Nadu, Karnataka, Andhra Pradesh, and Kerala in southern India. It has a high economic value and is commonly grown and eaten as a meal. The fruit pulp has an elongated receptacle surrounded by white fibrous juicy segments and used to prepare post-harvest products like purees, juices, jams, jellies, powdered fruit bars, and flakes. Nectar can be made from the pulp (Peters *et al*., 2001). Antibacterial, antiviral, and antifungal activities are found in soursop. As a result, this is an excellent source of medicine. A diuretic is supposed to be the juice of ripe fruit, whereas a decoction of powdered immature fruits is used to treat dysentery.

Humic acid is a natural combination of organic macromolecular units found in all soils. It's a bio-stimulant with an organic charge that increases crop yield by influencing plant growth and development. It has been carefully investigated due to their specific physiological properties (Quaggiotti *et al*., 2004). Vermiwash is a rich source of vitamins, hormones, enzymes, macronutrients and micronutrients when applied to plants help in efficient growth (Nath *et al.*, 2009). Bio-fertilizers are microbial preparations contain living cells of various microorganisms that do have the potential to mobilize plant nutrients in soil from inert to useable form through a biological process, are environmentally friendly, and play an important role in crop

development. *Azospirillum* is a non-symbiotic micro aerophilic bacteria that is typically discovered in horticulture crop roots. *Pseudomonas fluorescens* is a common bacterium that aids in soil health management and has a wide metabolic and functional range.

MATERIAL AND METHODS

The present investigation entitled "Studies on the effect of humic acid, vermiwash and biofertilizers on growth of soursop (*Anonna muricata* L.)". was undertaken at the Department of Fruit Science, College of Horticulture, GKVK Campus, Bengaluru-560 065, during the year 2020 – 21. The experimental field is located at an altitude of 930 AMSL, 12° 58′N latitude and 77° 35′S longitude. The grafting operation was performed on selected rootstock seedlings of soursop consisting of 360 seedlings in each treatment using the scion shoots of 10-15 cm long with thickness equal to that of rootstocks to match with the girth of rootstock. The softwood of rootstock was split vertically in the form of cleft to a length of about 3-4.5 cm downward into cut stem with sharp knife. The cleft looks like a fork or letter "V". A wedge-shaped cut of about 5 cm by removing the bark and little wood on both sides is made on lower portion of scion stick. Some portion of bark remaining on two sides of scion was retained. The wedge-shaped scion was prepared and inserted into the "V" shaped split of rootstock. The graft was secured firmly using 1.5 cm wide, 200-gauge polythene strip. The scions were covered with polythene caps to avoid desiccation of scion by creating humidity near and above the union region.

RESULT AND DISCUSSION

The result in Table 1, (Fig. 1) showed a beneficial impact on maximum percentage of sprouting (70.33%) , less day taken for sprouting (23.00 days), highest number of leaves (29.00), highest length of sprout (18.83 cm) at 90 was recorded in treatment T_{11} with Vermiwash (1%) + *Azospirillum* spp (2g / seedlingdays) + *Pseudomonas fluorescence* (2g / seedling) + *AM* Fungi (2g/ seedling) and minimum percentage of sprouting (50.00%), more days taken for sprout (28.00 days), lowest number of leaves (22.00) and minimum sprout length (11.50 cm) was recorded at 90 days in control treatment (T_1).

The evaluation of biofertilizers on grafting of soursop revealed or showed that the biofertilizers, phosphate solubilizer, biocontrol agent and phosphorous mobilize in the form of *Azospirillum* spp., *Pseudomonas fluorescens* and *AM* Fungi respectively had enhanced the growth and nutrient uptake. The growth, establishment and nutrient uptake was significantly superior over un-inoculated control. All the biofertilizers with combination of vermiwash increased the growth and provided congineal condition for growth and sprout of plant in short time. Similar findings were reported by Shankarappa, *et al.* (2018). Various reports in horticultural crops indicated that humic acid, vermiwash and biofertilizer either individually or in combination had synergistic effect on plant growth. The dual inoculation of *Azospirillum*, *Pseudomonas* had more positive response in peach seedlings as compared to single inoculation or control (Awasthi *et al.*, 1996). Sharma *et al.* (2002) reported that *AM* fungi enhanced nutrient uptake and level of plant growth substances in apple seedlings. Subbiah (1990) also reported that when adequate amount of farmyard manure added to the soil with biofertilizers, it improved biofertilizer efficiency and ultimately nutrient status of the soil. Similar increase in growth of fruit plants with biofertilizers has also been reported by Sharma and Bhutani (1998).

Table 1: Effect of humic acid, vermiwash and biofertilzer on grafting success of soursop.

Treatments	Days taken for sprouting	Grafting success percentage	Number of leaves/graft at 90 (DAG)	Length of sprouts (cm) at 90 (DAG)
T_1: Water sprays (Control).	28.00	50.00	22.00	11.50
T_2: GA_3 (250 ppm)	24.00	55.66	24.66	15.83
T_3: Humic Acid (3%) + *Azospirillum* spp (2g/ seedling)	27.00	50.66	24.66	14.66
T_4: Humic Acid (3%) + *Pseudomonas fluorescence* (2g/ seedling)	24.00	59.00	25.33	16.50
T_5 : Humic Acid (3%) + *AM* Fungi (2g/ seedling)	24.00	53.66	25.00	15.16
T_6: Humic Acid (3%) + *Azospirillum*s spp (2g/ seedling) + *Pseudomonas fluorescence* (2g/ seedling)	27.00	56.33	25.66	15.66
T_7: Humic Acid (3%) + *Azospirillum*s spp (2g/ seedling)+ *AM* Fungi (2g/ seedling)+ *Pseudomonas fluorescence* (2g/ seedling)	25.00	59.00	25.66	16.00
T_8: Vermiwash (1%) + *Azospirillum* spp (2g/ seedling)	24.00	61.33	25.00	16.00
T_9: Vermiwash (1%) + *Pseudomonas fluorescence* (2g/ seedling)	24.00	60.00	26.00	15.33
T_{10} : Vermiwash (1%) + *AM* Fungi (2g/ seedling)	24.00	67.00	26.33	16.83
T_{11}: Vermiwash (1%) + *Azospirillum* spp (2g/ seedling) + *Pseudomonas fluorescence* (2g/ seedling) + *AM* Fungi (2g/ seedling)	23.00	70.33	29.00	18.83
T_{12}: Humic Acid (3%) + Vermiwash (1%) + *Azospirillum* spp (2g/seedling) + *Pseudomonas fluorescence* (2g/seedling) + *AM* Fungi (2g/ seedling).	23.00	69.66	28.00	18.53
S.Em±	0.58	1.64	0.85	0.61
CD at 5%	1.69	4.80	2.48	1.78

Increase in the growth of pecan seedlings could be attributed to the combined effect of biofertilizers on nutrient uptake and plant growth, *AM* fungi enhanced the growth parameters like root length, height of plant, number of leaves, dry weight of shoot and root, on pecan seedling Joolka, *et al* (2004) Vermiwash, *Azospirillum* spp, *Pseudomonas fluorescens* and *AM* respectively had increased the growth and nutrient uptake. The growth, establishment and nutrient uptake was significantly superior over un-inoculated control. All the biofertilizers irrespective of their application as single, dual, triple or four organisms in a consortium produced better establishment. Similar report on the establishment of grafts, increased graft height, girth and number of leaves due to biofertilizer inoculation was reported by Shankarappa *et al.* (2017).

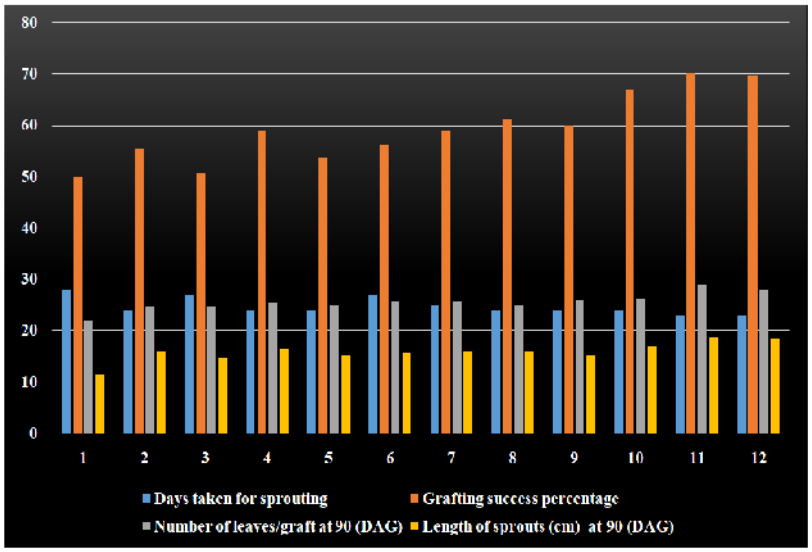

Fig. 1. Effect of humic acid, vermiwash and biofertilzer on grafting success of soursop.

CONCLUSION

The research aimed at developing grafting technology in the most challenging Annonaceae family. The scion of local plant was used for softwood grafting in six month old seedlings which were planted in media containing mixtures of soil and FYM (1:1) treated with humic acid, vermiwash and biofertilizers per treatment and these bags were kept under open condition. A total of 12 treatments were tested in three replications. The results at the end of 90 days showed that the inoculation of consortium of T_{11} Vermiwash (1%) + *Azospirillum* spp (2g/ seedling) + *Pseudomonas fluorescence* (2g / seedling) + AM fungi (2g / seedling) had taken less number of days for sprouting (23 days), more successful grafting (70.33 %), produced the highest length of sprout (18.83 cm) and number of leaves (29.00). The inoculation of consortia of humic acid, vermiwash and biofertilizer showed better nutrient uptake and growth at the end of 90 days in open condition. The experiment may be helpful in producing successful grafting technology using various growth stimulating substances such as humic acid, vermiwash, and biofertilizer on soursop grafts.

Acknowledgement. The first author gratefully acknowledge student scholarship support of Indian Council for Cultural Relations, Govt. of India and to his employing organization Technical & Vocational Education and Training Authority of Islamic Republic of Afghanistan. Authors also express their sincere thanks to the Dept. of SS&AC-UAS Bangalore, UHS Bagalkot and College of Horticulture for all the facilities in conducting the research.
Conflict of Interest. None.

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How to cite this article: Fetrat A. Noory, S.V. Patil, Venkat Rao, Manjunath Ramanna, Gundappa G. Kadalli and Swetha B.S. (2022). Effects of Humic Acid, Vermiwash and Biofertilizer on Grafting Success of Soursop (*Annona muricata* L). *Biological Forum – An International Journal*, *14*(2): 1286-1289.