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Standardization of Growing Media for Grapes Nursery Production

Muahmmad Saqib[1], Kashif Razzaq[1*], Sami Ullah[1], Abid Hussain[2], Ishtiaq A. Rajwana[1], Ambreen Naz[3], Gulzar Akhtar[1], Muhammad Amin[4], Hafiz N. Faried[1], Muhammad S. Zafar[5], Muhammad Shafique[6]

[1]Department of Horticulture, MNS-University of Agriculture, Multan 60000, Pakistan.
[2]Department of Soil and Environmental Sciences, MNS-University of Agriculture, Multan 60000, Pakistan.
[3]Department of Food Science and Technology, MNS-University of Agriculture, Multan 60000, Pakistan.
[4]Department of Horticultural Sciences, The Islamia University of Bahawalpur 63100, Pakistan.
[5]Mango Research Station, Shujabad, Multan 60000, Pakistan.
[6]Subcampus Burewala, Vehari, University of Agriculture, Faisalabad, 61010, Pakistan.

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ABSTRACT

Nursery production of grapes in soil-based media causes higher mortality due to soil-borne diseases including root rot, damping off, phytophthora and die back etc. The study was planned to explore the potential of various growing media for the nursery production of grapes cv. Sultana-C through cuttings. Six different growing media including peat moss, silt, sugarcane bagasse, saw dust, coconut fiber and farm yard manure alone and in different combinations (16) were tested. Treatments were arranged under Completely Randomized Design (CRD) and replicated five times. Results indicated that grapes cutting planted in (GM13) media combination of sugarcane bagasse, silt and saw dust (1:1:1) exhibited highest sprouting percentage (100%) and significant results for shoots and roots length (41.4 and 40.4 cm respectively), inter-nodal distance (3.4 cm), leaf area (78.93 cm), no. of leaves (12.3), shoots diameter (10.43 cm) and fresh weight of shoots and roots (17.35 and 19.84 g) as compared to other growing media. Maximum mortality percentage was observed in media (GM6) containing Silt + FYM (1:1) and (GM18) sawdust + FYM + coconut fiber (1:1:1). Conclusively, the combination of sugarcane bagasse, silt and saw dust (1:1:1) has been proved highly significant for survival and growth of grapes nursery.

Corresponding Author: Kashif Razzaq
Email: kashif.razzaq@mnsuam.edu.pk

INTRODUCTION

Grapes (*Vitis vinifera*) are one of the main fruits cultivated in Pakistan belonging to the family Vitaceae. Despite having lot of potential for fresh grapes production, Pakistan imports approximately 43 thousand tons of fresh grapes. Areas of 15.24 thousand hectares produce 77.23 thousand tons of grapes. About 90% of this production comes from Balochistan province followed by Punjab, Khyber Pakhtunkha and Sindh (MNFSR, 2016). Thomson Seedless, Sultana-C, Cardinal, Kings Ruby, White Seedless, Early White and Perlit are the important and most liked grapes. The commercial grapes nursery is usually prepared through hard and soft wood cuttings taken from one-year-old branches of the mother plant. These cuttings were placed in a growing medium, which ultimately produce shoots and roots therefore, making a new plant identical to the mother plant (Khair *et al.*, 2009). In Pakistan, generally, grapes cuttings are planted in soil that results in high mortality, possibly due to soil borne diseases that causes greater economic loss in various crops including grapes (Kambooh *et al.*, 1984).
An alternative approach for healthy and diseased free

nursery production is the use of various growing medias (Riaz *et al.,* 2008). A growing media can be distinct as a material in which roots of plant grow and take nutrients as well as water (Ingram, 1993). Moreover, ideal growing media may have proper water holding capacity with good porosity, aeration and drainage (Ahmad, 2004). The availability of macro and micronutrients in growing media are useful for the plant growth and development. Media comprising of forest soil and sawdust improved U. kirkiana seedling growth when amended with NPK fertilizer (Mhango, 2008). Many suitable growing media are available in the market like peat moss, perlite, vermiculite, vericompost etc but their high cost create difficulties for growers especially from developing countries to afford (Khan et al., 2017). Peat moss when extracted has negative influence on environment (Alexander *et al*., 2008). Two major container media, perlite and peat moss are comparatively high in cost and growers from developing countries could not buy. As for as vermicompost is concerned, its huge cost forced growers to espouse some other mean of low-cost media with high efficiency. (Vadiraj *et al.,* 1992). The paramount option to manage this problem is to utilize economical and locally available resources to get low-cost media with required characters. Sugarcane bagasse is one of the low costs but rich in nutrient media available in bulk quantity from sugarcane industry. Farm yard manure, coconut fiber, saw dust, leaf manure, wheat straw, rice husk etc. are the other options that are available in local markets at low price. (Sahin *et al*., 2002). Physical properties (water holding capacity and aeration) and chemical properties (pH and EC of the media are very much important attributes because they have essential role in plant development (Dewayne *et al.,* 2003).

To the author's knowledge, novelty of work is that no study has been made to determine most appropriate growing media alone or in combination for the production of healthy grapes nursery from indigenous resources. It is hypothesized that using of various media ingredients alone or in various combinations will be helpful for the production of healthy and vigorous nursery grapes plants. Therefore, this research work has planned to search out good media combination(s) for the production of healthy grape plants

MATERIALS AND METHODS

Healthy cutting of Sulthana-C having uniform age and growth were sourced from a commercial nursery located in Royal grapes farm (30º04'45.5"N 71º13'02.1"E) Muzafar Gharh, Punjab-Pakistan during the year of 2018-19. These cutting were transplanted in various growing media including peat moss, silt, farm yard manure (FYM), sugarcane bagasse, sawdust and coconut fiber to evaluate their growth. These six-nursery media were used in 16 combinations (v/v) while peat moss and silt were taken as control. Treatments combinations used were viz., GM1= peat moss, GM2= silt, GM3= silt + sugarcane bagasse (1:1), GM4= silt + sawdust (1:1), GM5= coconut fiber + silt (1:1), GM6= silt + FYM (1:1), GM7= sugarcane bagasse + sawdust (1:1), GM8= sugarcane bagasse + coconut fiber (1:1), GM9= sugarcane bagasse + FYM (1:1), GM10= sawdust + coconut fiber (1:1), GM11= sawdust + FYM (1:1), GM12= coconut fiber + FYM (1:1), GM13= silt + sugarcane bagasse + saw dust (1:1:1), GM14= silt + sawdust + coconut fiber (1:1:1), GM15= coconut fiber + silt+ FYM (1:1:1), GM16= sugarcane bagasse + sawdust + coconut fiber (1:1:1), GM17= sugarcane bagasse + FYM + coconut fiber (1:1:1) and GM18= sawdust + FYM + coconut fiber (1:1:1). The experiment was carried out according to CRD and twenty-five cutting were used as a treatment and replicated five times.

Physico- Chemical analysis for growing media

Analysis for physical and chemical properties like Water holding capacity, pH, EC, organic matter contents and N, P ,K contents are presented in Table 2 and 3. The electrical conductivity (EC) was measured in dS m^{-1} with a conductivity meter and a pH meter (digital ion analyzer) was used to measure the pH of the growing media (Thomas, 1996),

The water holding capacity (g water/ g dry material) was calculated as described by Ahn *et al.,* (2008) and Organic matter contents were determined by using the method outlined by (Moodie *et al.,* 1959). The total nitrogen in the media sample was determined by distillation in Kjeldahl's apparatus and titration was carried out with standard H2SO4. Boric acid and methyl red were used as indicators (Jackson, 1962). Olsen's method was used to determine the available phosphorus in the media (Olsen *et al.,* 1984) and for the estimation of potassium, United States Salinity Laboratory Staff's (1954) method of flame photometer was used.

Sprouting percentage (%)

Sprouting percentage of each treatment was checked on every alternative day up to 10th day of plantation and the sprouting percentage was computed per equation (1) as described by (Wilson *et al.,* 2001).

$$\text{Sprouting (\%)} = \frac{N}{n} \text{x100}$$

N= No. of cutting dead

n= total no. of cuttings planted

Mortality percentage (%)

Mortality percentage from each media was recorded during the entire study process and computed after all observation and expressed as percentage by formula.

$$\text{Mortality (\%)} = \frac{\text{Number of dead cutting}}{\text{Total number of cutting planted}} \times 100$$

Compactness of media (cm)

Initially the plastic bags (6 × 10 inches) were filled with respective nursery media alone or in combination leaving one-inch space at top. At the end of experiment, level of each respective nursery media was measured by using scale and expressed in cm.

Leaf area (cm)

Three multiple sized leaves, randomly selected from each cutting was calculated by digital leaf area meter and expressed as cm.

Root and Shoot length (cm)

Length of basel shoots of each cutting was measured with scale at the end of experiment and root length of each cutting was measured with scale at the end of experiment.

Shoot diameter (cm)

The diameter of the basal shoot per cutting was selected and measured three parts of the shoot (upper, middle and lower) with vernier caliper and expressed in cm.

Shoot fresh and dry weight (gm)

Freshly uprooted cuttings shoot was weighed on analytical balance and shoot of the planting material obtained from each growing media after the completion of experiment were placed in oven (65ºC) till constant weight.

Root fresh and dry weight (gm)

Root of freshly uprooted cuttings was weighed on analytical balance and root of the planting material obtained from each growing media after the completion of experiment were placed in oven (65ºC) till constant weight.

Chlorophyll a, b content (mg)

Chlorophyll pigments were measured according to the method of Makeen et al., 2007).

Inter-nodal distance (cm)

After sprouting of cutting, to quantify the vigor of plants, intermodal distance was measure by scale and expressed in cm.

Statistical Analysis

After three months of planting, data were recorded before and after uprooting of cuttings for shoot and root parameters. The collected data was statistically analyzed and analysis of variance was employed to testify the significance of results, while treatments means were compared by using Least Significant Difference (LSD) test at 5% level of significance (Steel *et al.,* 1997).

RESULTS AND DISCUSSION

Physical and chemical properties of growing media (pH, EC, WHC, OM and N, P and K)

The physical and chemical properties of media components were significantly different (Table 1). As for as physical parameters are concerned, highest value of pH (9.35) and EC (2.41 dS/m) was recorded in FYM and lowest pH and EC was found in sawdust (5.84) and silt (0.68 dS/m) respectively, Sugarcane bagasse exhibited highest WHC (42.78 %) than other growing media and lowest was found in silt (12.23 %). During analysis of different nutrients in media components, it was observed that sugar cane bagasse have highest value of N (2.01 ppm). Whereas, maximum P (0.72 ppm) was found in saw dust while high level of K (8.34 ppm) was observed in peat moss. Minimum values of N, P & K were detected in silt. As far as organic matter was concerned, highest percentage of organic matter (0.44 %) was shown by coconut fiber.

After analyzing the individual media component, treatments combinations were prepared and analysis of these combinations was also performed before planting (Table 2). The value of pH (8.79) and EC (2.97 dS/m) was found maximum in GM6 (silt + FYM). Whereas, GM7 (sugarcane bagasse + sawdust) exhibited Maximum WHC (44.37 %). The value for N (2.01 %), P (0.275 %) and K (8.34 %) were observed highest in (sugarcane baggase + coconut fiber), (sawdust + coconut fiber) and peat moss respectively. Moreover, GM 8 (sugarcane bagasse + coconut fiber) and GM13 (silt + sugarcane bagasse + sawdust) exhibited maximum percentage of organic matter (0.27 %) than other growing media. Growing media combinations were also analyzed after transplanting of cutting (Table 3). Lowest pH and EC recorded in peat moss (5.34) and silt (0.18 dS/m) alone respectively. However, maximum WHC (39.34 %) and organic matter (0.23 %) were obtained in GM7 (sugarcane bagasse + sawdust) and GM8 (sugarcane bagasse + coconut fiber) respectively. Moreover, maximum N (1.57 ppm), P (0.27 ppm) and K (5.24 ppm) were found in (silt + sugarcane bagasse + sawdust), (sawdust + coconut fiber) and (peat moss) respectively.

Table 1. Physical and Chemical properties of the growing media.

Growing media	pH	Electric Conductivity (dS/m)	Water Holding Content (%)	Nitrogen (ppm)	Phosphorus (ppm)	Potassium (ppm)	Organic Matter (%)
Peat moss	5.88±0.11	1.85±0.21	37.87±4.58	1.73±0.10	0.521±0.17	8.34±1.00	0.17±0.06
Silt	6.72±0.14	0.68±0.21	12.23±1.73	0.34±0.11	0.036±0.01	2.78±0.91	0.12±0.04
Sugarcane Bagasse	7.47±0.41	0.77±0.10	42.78±2.66	2.01±0.18	0.434±0.10	6.35±0.16	0.35±0.11
Coconut fiber	6.36±0.21	1.88±0.16	35.87±3.99	1.23±0.17	0.32±0.10	7.83±0.84	0.44±0.05
Sawdust	5.84±0.21	1.99±0.22	19.87±2.06	0.78±0.27	0.72±0.02	5.89±0.49	0.21±0.04
Farm Yard Manure	9.35±0.26	2.41±0.30	23.67±4.59	0.56±0.13	0.041 ±0.03	3.95±0.35	0.08±0.03

Peat moss (n= 3), silt (n= 3), sugarcane bagasse (n= 3), coconut fiber (n= 3), sawdust (n= 3), farm yard manure (n= 3).

Sprouting and mortality percentage

Significant variation of sprouting percentage in different growing media alone or in combinations was observed (Figure 1 and 2). Highest sprouting percentage (100%) obtained in GM1 (peat moss), GM7 (sugarcane bagasse + sawdust), GM8 (Sugarcane bagasse + coconut fiber), GM10 (sawdust + coconut fiber), GM11 (sawdust + FYM), GM12 (coconut fiber + FYM), GM13 (silt + sugarcane bagasse + sawdust), GM14 (silt + saw dust + coconut fiber) and GM17 (sugarcane bagasse + coconut fiber + FYM). On the other hand, GM6 (silt + FYM) and GM18 (sawdust + coconut fiber + FYM) contained the highest pH (8.79, 8.64) and EC (2.97 dS/m, 2.34 dS/m) respectively, that caused 100% mortality. Potted seedlings having good media combination, highest survival rate and sprouting growth was observed by Duryea and Brown (1984). In the present study, same has been observed that reason for highest survival percentage was directly connected to good growing media composition, mainly for good development of a root system as reported by Gulcu *et al.* (2010). Mortality was due to high level of pH and EC as shown in (Table 2). The results are in comparison with Bernstein (1975), who stated that electrical conductivity (EC) of the media combination showed significant results for plant growth and development, while media with high level of EC showed poor growth of plants. Similar results were observed in sprouting percentage (100%) of tomato seedling planted in peat moss (Jailani *et al.,* 2016). The finding of present study was supported with the results of Haq *et al*. (2017) who observed the highest sprouting percentage (94%) in mango seedling was found when planted in media combination containing sugarcane bagasse + coconut fiber + silt (70% + 25% + 5%).

Table 2. Physico- Chemical properties of different growing media alone or in combinations.

Treatments	pH	Electric Conductivity (dS/m)	Water Holding Content (%)	Nitrogen (ppm)	Phosphorus (ppm)	Potassium (ppm)	Organic Matter (%)
GM1	5.88±0.11	1.85±0.05	37.87±7.1	1.73±0.04	0.221±0.03	8.34±0.11	0.17±0.06
GM2	8.70±0.10	0.18±0.07	12.23±5.1	0.34±0.04	0.136±0.02	2.78±0.09	0.12±0.15
GM3	7.48±0.11	0.45±0.06	36.93±6.0	1.92±0.26	0.175±0.03	3.45±0.05	0.14±0.08
GM4	7.23±0.10	1.85±0.39	24.97±3.0	1.23±0.09	0.171±0.04	4.86±0.011	0.24±0.11
GM5	7.64±0.58	2.01±0.20	28.97±4.0	1.09±0.14	0.164±0.01	5.87±0.08	0.14±0.10
GM6	8.79±0.67	2.97±1.00	22.45±4.6	1.02±0.01	0.191±0.02	1.67±0.10	0.15±0.03
GM7	7.35±0.15	1.37±0.11	44.34±4.0	1.95±0.11	0.17±0.05	6.86±0.18	0.19±0.12
GM8	6.32±0.10	1.54±0.46	39.54±4.1	2.01±0.11	0.261±0.01	5.96±0.50	0.27±0.08
GM9	7.69±0.11	2.02±0.87	33.54±3.6	1.65±0.26	0.141±0.00	4.86±0.10	0.23±0.06
GM10	7.67±0.11	2.09±0.26	41.87±1.0	1.45±0.21	0.275±0.03	5.86±0.72	0.12±0.13
GM11	7.96±0.92	2.01±0.60	36.84±3.0	1.21±0.08	0.245±0.01	4.23±0.27	0.22±0.10
GM12	7.87±0.16	1.92±0.05	32.64±0.3	1.32±0.07	0.165±0.06	4.23±0.25	0.1±0.07

GM13	6.78±0.16	1.93±0.11	33.64±3.5	1.87±0.21	0.252±0.01	6.85±0.27	0.27±0.13
GM14	7.82±0.11	1.73±0.52	38.63±1.7	1.67±0.27	0.242±0.00	5.86±0.75	0.21±0.11
GM15	8.56±0.26	1.11±0.03	17.85±3.0	1.47±0.11	0.251±0.06	4.86±0.16	0.11±0.09
GM16	7.23±0.17	1.22±0.22	40.01±1.7	1.94±0.09	0.242±0.00	3.86±0.93	0.18±0.13
GM17	7.23±0.27	1.13±0.11	39.26±2.0	1.65±0.15	0.124±0.01	5.87±0.99	0.11±0.11
GM18	8.64±0.20	2.34±0.51	32.89±1.0	1.09±0.03	0.013±0.01	2.86±1.01	0.11±0.06

Compactness of the growing media

The results regarding the compactness of different growing media alone or in combinations was significantly affected. Maximum compactness (3.70 cm) was observed in GM18 (sawdust + coconut fiber + FYM) and lowest in GM2 (silt) and GM3 (silt + sugarcane bagasse) (Fig. 3). Same results were reported by Trochoulias *et al.* (1990) that compactness of media could be a reason of huge mortality and poor growth of ornamental seedlings.

Leaf area

Leaf area was significantly affected by different growing media alone or in combinations. GM13 (silt + sugarcane bagasse + sawdust) exhibited highest (72.603 cm^2) leaf area followed by GM12 (silt + sawdust + coconut fiber) with leaf area of (60.86 cm^2). However, lowest leaf area (4.13 cm^2) obtained in GM2 (silt) (Table 4). The Significant results were due to high content of nitrogen (N) presented in the above mixtures that showed maximum leaf area.

The findings are same with the results for carnation plant that showed maximum (15.65 cm^2) leaf area in silt + sawdust (1:1) (Cardens *et al.*, 2006). However, contrary to our results, when Amaranths plants were grown in silt + sawdust (1:1) produced lowest (8.67 cm^2) leaf area (Akparobi, 2009).

Table 3. Physico-chemical properties of different growing media alone or in combination after experiment.

Treatments	pH	Electric Conductivity (dS/m)	Water Holding Content (%)	Nitrogen (ppm)	Phosphorus (ppm)	Potassium (ppm)	Organic Matter (%)
GM1	5.34±0.271	1.85±0.18	25.87±1.72	1.23±0.04	0.221±0.10	5.24±1.01	0.11±0.04
GM2	6.71±0.20	0.18±0.03	11.23±1.95	0.24±0.11	0.191±0.09	0.58±1.12	0.12±0.06
GM3	7.11±1.01	0.55±0.16	22.93±1.73	1.52±0.10	0.122±0.02	1.45±0.02	0.12±0.02
GM4	6.34±1.74	1.75±0.30	15.97±0.30	1.13±0.10	0.171±0.10	2.56±0.17	0.14±0.04
GM5	7.02±1.02	2.05±0.99	20.97±2.01	1.05±0.05	0.114±0.00	2.87±0.13	0.1±0.03
GM6	8.75±0.32	2.95±0.18	18.45±2.00	1.02±0.02	0.121±0.01	1.47±0.21	0.05±0.03
GM7	7.34±1.00	1.27±0.65	39.34±0.11	1.55±0.43	0.211±0.13	4.26±1.23	0.15±0.04
GM8	6.63±0.29	1.44±0.15	31.54±0.36	1.5±0.11	0.161±0.02	2.46±0.31	0.23±0.05
GM9	7.55±0.05	2.11±0.30	25.54±0.36	1.15±0.03	0.241±0.10	2.13±0.17	0.15±0.04
GM10	7.63±0.36	2.05±0.86	35.87±0.16	1.25±0.04	0.275±0.10	2.23±0.09	0.11±0.02
GM11	8.86±0.21	2.01±0.87	28.84±0.99	1.11±0.07	0.145±0.03	2.23±0.11	0.09±0.04
GM12	7.85±1.74	1.82±0.17	20.64±2.00	1.05±0.08	0.135±0.06	1.2±0.04	0.08±0.02
GM13	6.68±0.27	1.95±0.45	25.64±1.74	1.57±0.12	0.252±0.01	3.23±1.00	0.17±0.04
GM14	7.52±1.73	1.73±0.10	30.63±0.20	1.37±0.10	0.142±0.01	3.86±0.16	0.11±0.07
GM15	8.02±0.95	1.01±0.30	12.85±0.16	1.13±0.03	0.111±0.00	2.86±1.01	0.05±0.03
GM16	7.55±1.72	1.15±0.15	34.01±1.58	1.54±0.11	0.132±0.03	1.86±0.21	0.18±0.05
GM17	7.05±0.31	1.05±0.11	25.26±0.21	1.25±0.08	0.1±0.01	2.17±1.01	0.05±0.04
GM18	8.55±1.00	2.25±0.10	25.89±0.10	1.09±0.08	0.063±0.05	2.86±0.18	0.12±0.05

Table 4. Effect of different growing media alone or in combinations on plant characteristics of grapes.

Treatments	Leaf area (cm2)	Shoot length (cm)	Root length (cm)	Shoot diameter (cm)	Shoot fresh Weight	Shoot dry weight	Root fresh weight	Root dry weight	Chlorophyll -a content (mg/g)	Chlorophyll -b content (mg/g)	Internodal distance (cm)
GM1	52.50	40.2	35.4	7.79	15.83	7.49	15.13	8.87	25.29	46.77	3.37
GM2	6.33	14.66	3.33	3.58	3.32	1.94	1.95	0.81	8.31	15.78	1.15
GM3	39.89	27.66	31	4.28	9.72	5.24	4.6	1.4	11.05	18.55	1.62
GM4	61.95	19.62	31	6.04	7.12	3.6	5.82	2.90	5.79	12.44	2.43
GM5	16.32	21.87	21	5.94	11.11	5.47	6.09	3.13	18.66	18.87	2.18
GM6	0	0	0	0	0	0	0	0	0	0	0
GM7	41.27	22	26	7.36	6.88	3.45	6.60	3.96	17.03	20.98	2.82
GM8	23.06	21	27.1	6.18	5.50	2.96	6.34	3.46	7.76	27.87	2.84
GM9	32.09	23.25	29.12	5.97	8.39	4.1	7.45	3.43	17.47	29.87	2.50
GM10	58.82	35.3	36.4	8.55	14.84	7.55	9.5	5.71	22.13	25.56	2.92
GM11	29.50	24	21.3	7.75	9.57	5.02	5.93	3.01	12.67	30.87	2.43
GM12	61.36	35.8	41.7	7.76	15.58	8.13	10.12	5.57	8.65	28.87	3.79
GM13	78.93	41.4	40.4	10.43	17.35	8.75	19.84	10.45	17.54	26.76	4.12
GM14	45.23	19.62	23.12	6.17	7.79	4.21	7.69	3.71	19.51	5.91	2.07
GM15	16.91	17.33	8.5	3.75	6.57	4.06	6.33	2.22	10.95	27.98	1.45
GM16	20.28	29.33	19.5	4.11	6.94	3.60	8.08	2.58	15.22	20.87	1.61
GM17	49.88	25.8	29.4	6.55	7.39	4.09	7.02	4.27	9.59	30.44	2.76
GM18	0	0	0	0	0	0	0	0	0	0	0

Shoot and root length

Shoot length was significantly affected by the use of different growing media alone or in combinations. Highest shoot and root length (41. 40 cm and 41. 70 cm) obtained in GM13 (silt + sugarcane bagasse + sawdust) and GM12 (coconut fiber + FYM) respectfully, and minimum shoot and root length (2.20 cm), (8.8000 cm) obtained in GM2 (silt) as mentioned in (Table 4). Results revealed that a mixture of silt with sugarcane bagasse and sawdust to be proved best for shoot length. The maximum shoot and root length might be due to high content of N, P and K. and organic matter of the growing media. Moreover, influence the absorption of nutrients by the plants which eventually produced long shoot (Riaz *et al.*, 2008). Our results are similar with the findings of Shah *et al.* (2006) that highest shoot length (20 cm) in Ficus binnendijkii was found in silt + sugarcane bagasse. Similarly, (Shahid *et al.,* 2017) reported that maximum shoot length (22.85cm) observed in silt + sawdust. However, Hussain *et al.* (2017) reported that minimum shoot length (15.28cm) was showed in silt. Similar result was finding that the combination of FYM and coconut fiber has been initiated long roots and increasing rooting percentage in rough lemon (Qureshi *et al.,* 2014).

Shoot Diameter

Maximum shoot diameter (10.433 cm) obtained in GM13 (silt + sugarcane bagasse + sawdust) followed by GM10 (sawdust + coconut fiber) with shoot diameter of (8.55 cm) as shown in (Table 4) and minimum shoot diameter (3.58 cm) was found in GM2 (silt). Maximum shoot diameter might be due to highest content of nitrogen in growing media resulted to cause highest shoot diameter of grapes cutting because of more buildup of photosynthetic in shoots. Similar results showed with the finding of (Aswath and Padmanabha, 2004) that maximum shoot diameter (3.45 cm) of marigold obtained in silt + sawdust + sugarcane bagasse (1:1:1). Similarlly, Haq *et al.* (2017) reported that combination of bagasse + coconut fiber + silt (70%, 25% and 5%) achieved the highest shoot diameter (1.2 cm) in mango.

Shoot fresh and dry weight

Significant difference obtained in shoots fresh and dry weight in growing media alone or in combination. Highest shoot fresh and dry weight (17.35 g and 8.75 g) obtained from which the cuttings grown in GM13 (silt + sugarcane bagasse + sawdust). And lowest shoot fresh and dry weight (1.99 and 1.166) obtained in GM2 (silt) respectfully (Table 4). Results showed that silt along with sugarcane bagasse and sawdust established best cutting growth with respect to shoot fresh weight of grapes cutting. The presence of macro nutrients in young shoot that the major reason to increase shoots fresh weight. Contrary to our result Dracaena plant grown in silt, sawdust and sugarcane bagasse produced highest shoot fresh weight (71.3 g) (Alidoust *et al.,* 2012). Moreover, Nazari *et al.* (2011) also reported that hyacinth planted in sawdust and silt showed maximum shoot fresh weight. El-Naggar and El-Nasharty, (2009) also reported that (28.20 gm) shoot dry weight of amaryllis plant obtained in nursery media combination consisted of silt + sawdust (1:1).

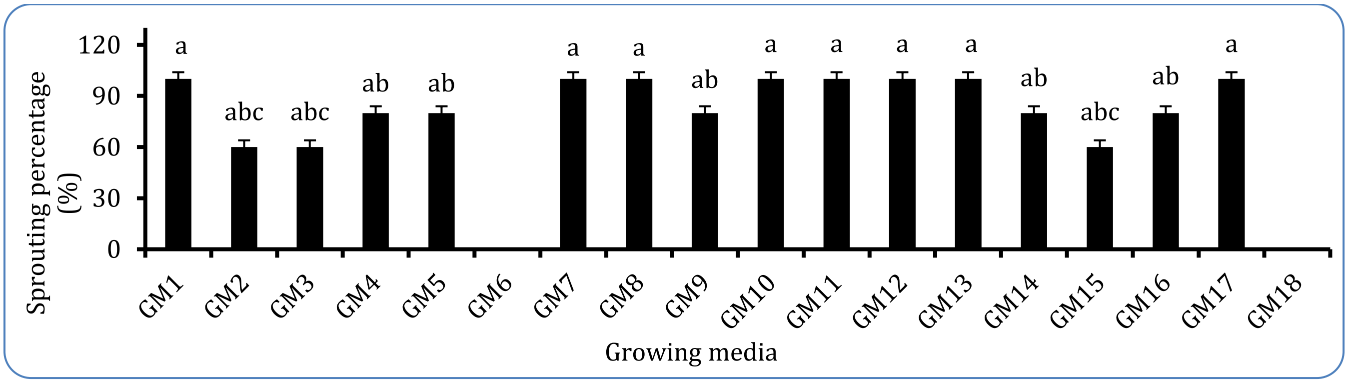

Figure 1. Effect of various growing media on sprouting percentage of grapes cutting alone or in combinations. Vertical bars indicate standard error of means. Letter sharing different letter are significantly different from each other.

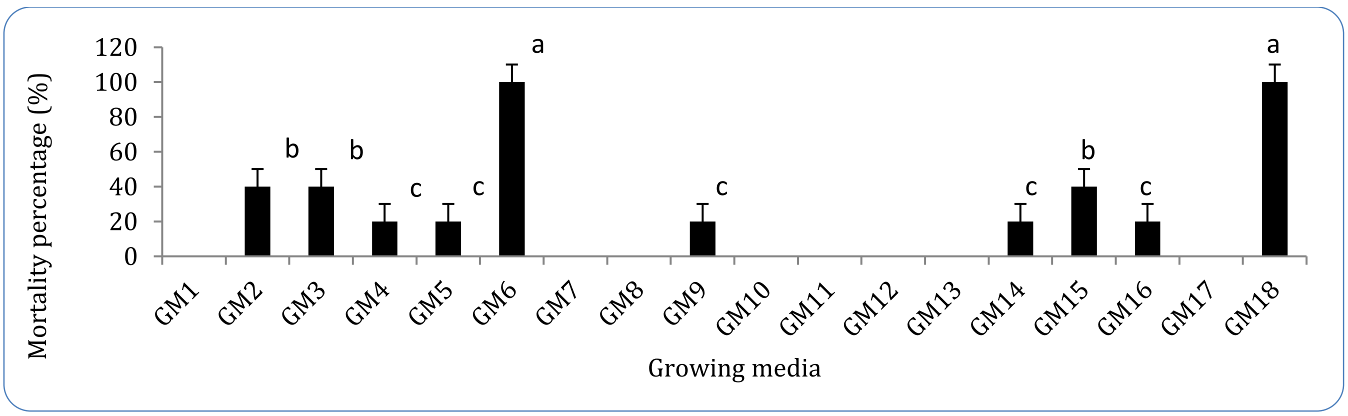

Figure 2. Effect of various growing media on mortality percentage of grapes cutting alone or in combinations. Vertical bars indicate standard error of means. Letter sharing different letter are significantly different from each other.

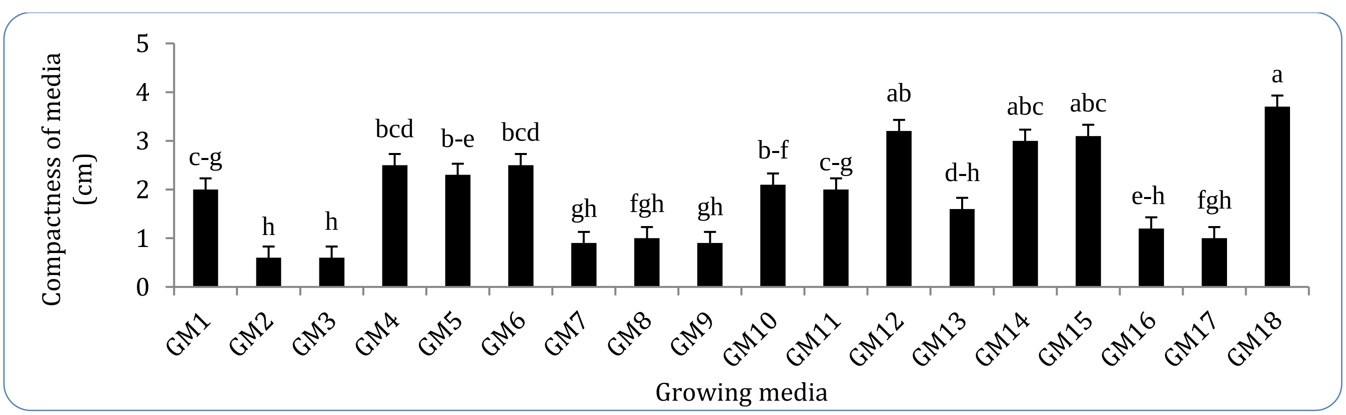

Figure 3. Effect of different growing media on compactness of media alone or in combinations. Vertical bars indicate standard error of means. Letter sharing different letter are significantly different from each other.

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Root fresh and dry weight

The result regarding of root fresh weight in different growing media alone or in combinations was significantly affected. Results depicted in Table 4 showed that highest fresh and dry weight of root (19.84 g) and (10.45g) found in GM13 (silt + sugarcane bagasse + sawdust) followed by GM1 (peat moss) with (15.13g) and (8.87 g) root fresh weight and the lowest fresh and dry weight found in GM2 [(silt) (1.17 g and 0.8120g)] respectively. The major reason of maximum root fresh weight in GM13 is because of proper aeration in media to produce a greater number of roots. Similarly, Gulcu *et al.* (2010) also reported that fresh root weight increases due to presence of organic matter in growing media that gave N and P in root system of plant ultimately results in the increase of nutrients absorption and their utilization.

Alidoust *et al.* (2012) documented that highest root fresh weight (81.3g) of Dracaena plant showed in sugarcane bagasse + silt. Additionally, in hyacinth plant, maximum root fresh weight found in media containing peat moss (Nazari *et al.,* 2011). Similar results were obtained by Worrall, (2011) in which Impatiens walleriana planted in silt + sawdust + that obtained highest roots dry weight (7.87 gm). Contrary to our results Ficus benjamina cuttings grown in bagasse + sawdust (1:1) that obtained the lowest dry root weight (2.918g) (Abouzari *et al*., 2012).

Chlorophyll a, b content of leaves

Leaves chlorophyll-content was significantly influenced by the growing media alone or in combinations. High chlorophyll-a content (25.29 %) in grape leaves obtained in GM1 (peat moss) followed by GM10 (sawdust + coconut fiber) with (22.13 %) of chlorophyll content as mentioned in (Table. 4). However, minimum chlorophyll-a content (5.79 %) was recorded in GM4 (silt + sawdust). Similarly, High chlorophyll-b content (46.77 %) was found in GM1 (peat moss) followed by GM11 (sawdust + FYM) with (30.87 %) and minimum chlorophyll-b content (5.91 %) was recorded in GM14 (silt + sawdust + coconut fiber). Highest chlorophyll contents in leaves might be due to reflection of media properties containing high level of N, K, EC and phosphorous contents (Ahmad *et al.,* 2004). Our results are more similar with the findings of (Khan *et al.,* 2002) that peat moss produced maximum chlorophyll contents (41.32%) in gladiolus leaves. These findings are in similar with previous studies which showed that media comprising of peat-moss with sand increased chlorophyll contents (Abd el Gayed and Attia, 2018)

Internodal distance

Highest distance of internodes (4.1281cm) was shown in GM13 (silt + sugarcane bagasse + sawdust) fallowed by the cutting of grapes planted in GM12 (coconut fiber + FYM). And lowest (1.1500cm) was found in GM2 (silt) as mentioned in (Table 1). The possible reason of long distance of internodes might be due to highest content of nitrogen (N) in young shoots.

CONCLUSION

Cuttings planted in growing media, silt + sugarcane bagasse + saw dust (1:1:1) exhibited highly significant results for growth and development of grapes seedling production. While FYM alone or in combinations resulted either mortality or restricted growth and development of grape nursery.

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