



An Allometric Growth Estimation of Grapes (*Vitis vinifera* L) from High Mountainous Region of Gilgit-Baltistan, Pakistan

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Abstract: Grapes (*Vitis vinifera*), besides their medicinal and health importance, plays an important role in livelihood of poor populations living across mighty mountain ranges of Himalaya, Karakoram and Hindukush. Allometric study is necessary to understand quantitative correlations of tree growth. Hundred plant samples (n=100) from ten populations (N=10) were studied at an elevation of 1854 meters asl. Ten (N=10) different population studied revealed that mean leaf length is 10.9 cm (max. 13.4, min. 9.1 cm) followed by mean leaf width 8.4 cm (max. 9.3, min. 7.1 cm). total mean leaf area was 92.2 cm² (max. 122.6, min. 70.9 cm²). Mean stem length recorded was 26.8 feet (max. 35, min. 16 feet) followed by mean stem width 8.44 cm (max. 12.8, min. 3.1 cm). one thousand seeds were measured and mean seed weight recorded was 0.043 mg (max. 0.047, min. 0.039). similarly mean weight of hundred (n=100) seeds recorded was 4.29 g. research was summarized with the fact that stem length grows 98.97% faster than its width increase. Which means 1 cm with increase corresponds almost 100 cm increase in length. Similarly, leaf length increase is 23% higher to its growth in width. Ignorance towards a rich varietal base is on erosion.

Keywords: Livelihood, Climate Change, Medicinal, Growth Estimation, Karakoram, Himalaya, Hindukush

1. Introduction

Vitis vinifera L. (wine grape) belongs to family Vitaceae. Genus *Vitis* contains more than 70 species grown worldwide [1, 2]. In Pakistan it is grown in Gilgit-Baltistan, some parts of Khyber Pakhtunkhwa and Baluchistan provinces. A great varietal base is found in Gilgit-Baltistan which go more than 50. Market oriented preferences, climate change and poor management have squeezed rich varietal base and germ plasm diversity. More than 80% of populations differentially rely on income generated from its fresh, processed and value added products [3].

Grapes are famously known as ‘The Queen of Fruits’ [4]. Grapes are considered to contain antioxidants (polyphenols) [5, 6] which reduce the risk of different cancers including esophageal, lung, mouth, pharynx, endometrial, pancreatic, prostate and colon [7]. Similarly, resveratrol found in skin is considered beneficial for heart health [8]. It also has proved effective for constipation, diabetes, indigestion, fatigue,

kidney disorders, macular degeneration and the prevention of cataracts [9]. It is considered a rich source of vitamin A, C, B6 and folate in addition to essential minerals like K, Ca, Fe, P, Mg and selenium [10, 11]. The grape is composed of many macro nutrients and micro nutrients e.g. water 82%, proteins 0.5-0.6% carbohydrates 12–18%, and fats 0.3–0.4%. In addition to it, the grape contains significant amounts of potassium 0.1–0.2%, vitamin C 0.01–0.02%, and vitamin A 0.001–0.0015% [12]. Dried grapes are very fruitful in thirst on fevers, cough, inflammation of the mucous membranes of the nose and throat, jaundice, and in sub-acute cases of enlarged liver and spleen [13].

According to FAO statistics [18], there are ninety-four (94) countries in the world which produce grape. Among the top ten countries producing grapes are China, USA, Italy, Spain, France, Turkey, Argentina, India and Iran. Pakistan ranks 57 in the list of grape producing countries with an annual production of 66036 tonnes. Figure 1 shows the total production of grape in 2014 with highest figure against China with a total production of 12.63 million tonnes.

Grape is considered one of the most remunerative summer fruit crops, native to warm, temperate zone between 34°N and 49°S latitude. In Pakistan, grapes are grown over an area of 13,000 ha (FAO 42992 ha) with annual production of 49.0 thousand (FAO 0.066 million) tones. Differential climatic conditions are suitable for grape farming. Its crop requires long, warm, dry summers and cool winters for best development. Mountainous and sub-mountainous areas up to 2000m altitude or more are suitable for its cultivation [19].

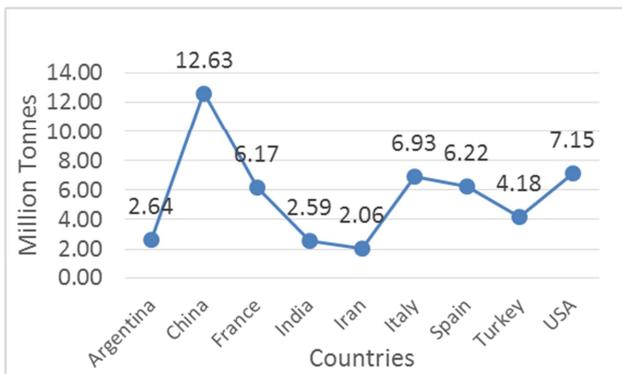


Figure 1. Countries with highest production of grape 2014.

With introduction of new grape varieties, grapes cultivation and farming is taking roots in new areas of Pakistan. New varieties introduced are even suitable for farming in Punjab province. This provides an opportunity for thousands of farmer communities to shift their agricultural products and produce towards new ways of earning cash through grape farming. According to Agribusiness of Pakistan [19], these provided grape varieties can generate earning around Rs. 1.6 – 2.0 million (USD 0.019 – 0.02 million) per [20].

According to Pakistan Agriculture Research Council [20] following ten seedless grape varieties are commonly grown in;

- i. Thompson (Seedless)
- ii. Perlette (Seedless)
- iii. Red Globe (Seeded)
- iv. Cardinal (Seeded)
- v. Kings ruby (Seedless)
- vi. Narc black (Seeded)
- vii. Crimson (Seedless)
- viii. Flame (Seedless)
- ix. Sultana (Seedless)
- x. Muscatil (Seeded)

[20]

Grapes are known to originate in Armenia, Russia or Georgia and in Turkey around 8000 years ago [14]. It was introduced to India and Pakistan as early as 1300 AD by Mughal assailant from Iran and Afghanistan [15, 16]. The *Vitis vinifera* has flaky bark, it has weak stem and branches have long shoots, the secondary shoots develop from the primary long shoots and tendrils assist it to hold on to other structure. The height of plant is about 35m and leaves are alternate and palmate in shape, lobed and broad. The length

of leaves ranged from 5 to 20cm, the fruit is fleshy berry, known as a grape [17].

Study was carried out to characterize allometric growth which is important aspect of its cultivation, produce and productivity. There is a rich base of land races and cultivars in the area but undesired forces are forcing grapes to decline in its varietal richness. Study is unique in its nature and documents in the history of the area. More enriched and at greater scale studies are important to save and promote diversity among the germplasm variations in the area.

2. Material and Method

2.1. Geography

Research was carried out during March-October, 2016 in Hasis and adjacent villages in Puniyal region of district Ghizer, Gilgit-Baltistan, Pakistan. Puniyal region is well known for grape cultivation and production. Thousands of poor families rely on income generated from sale of fresh grapes and its byproducts like 'Kilaw'.

2.2. Sample Frame

The samples were randomly selected from Hasis Valley, Puniyal, district Ghizer.

2.3. Sample Size

Hundred plants (N=100) of *Vitis vinifera* were measured from ten different sites, ten from each site (population), hundred (n=100) leaves, hundred seeds (n=100) were collected from each site making a composite of n=1000 leaves and 1000 seeds.

2.4. Parameters Studied

The parameters studied include length of shoot (ft.), leaves length (cm), leaves width (cm), leaves area (cm²), stem diameter (cm) and seed weight (mg/g).

2.5. Data Analysis

Data gathered was processed using MS-Excel. Mean of each population was calculated like mean of population 1 (MP1) and so on mean population 10 (MP10). Mean of leaf length was indicated as LL(cm), width (LW-cm) and leaf area (LA-cm). similarly, mean stem/shoot length was expressed as SL (cm) and diameter as SD (cm²).

3. Result and Discussion

3.1. Leaf

Ten (N=10) different population studied revealed that mean leaf length is 10.9 cm (max. 13.4, min. 9.1 cm) followed by mean leaf width 8.4 cm (max. 9.3, min. 7.1 cm). total mean leaf area was 92.2 cm² (max. 122.6, min. 70.9 cm²). See figure 2 for further details.

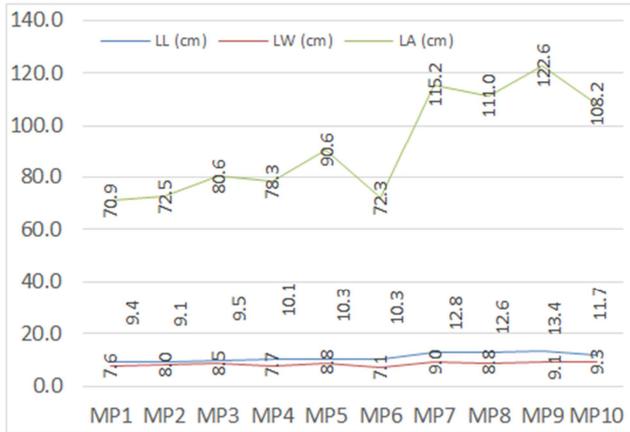


Figure 2. Leaf (leaf length, width and area (cm).

3.2. Shoot/Stem

Mean stem length recorded was 26.8 feet (max. 35, min. 16 feet) followed by mean stem width 8.44 cm (max. 12.8, min. 3.1 cm). see figure 3.

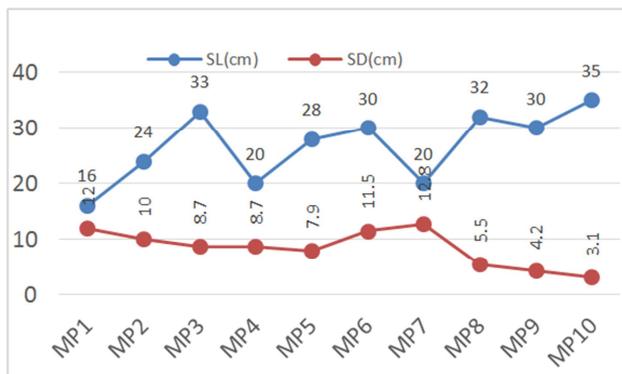


Figure 3. Mean stem length and width (cm).

3.3. Seed

One thousand seeds were measured and mean seed weight recorded was 0.043 mg (max. 0.047, min. 0.039). similarly mean weight of hundred (n=100) seeds recorded was 4.29 g. see figure 4.

3.4. Discussion

Research area is experiencing a rapid climate change which has a profound impact on the grape cultivation and production. Most of the poor families depend on the grape production and its sale annually. Grapes are not only a source of income generation but make most of food composition through its fresh and processing for making of byproducts contribute towards food security as well. Ruthless climate change, insufficient management practices and market dictations can create some financial, livelihood and food security issues in the next 10-20 years. Therefore, it is recommended that further investigation is required to document on scientific basis including their land races which have never been explored from the area. Area holds rich

germ plasm but continued ignorance from government departments and other several non-governmental organization besides farmers themselves can lead to depletion of precious germ plasm as well.

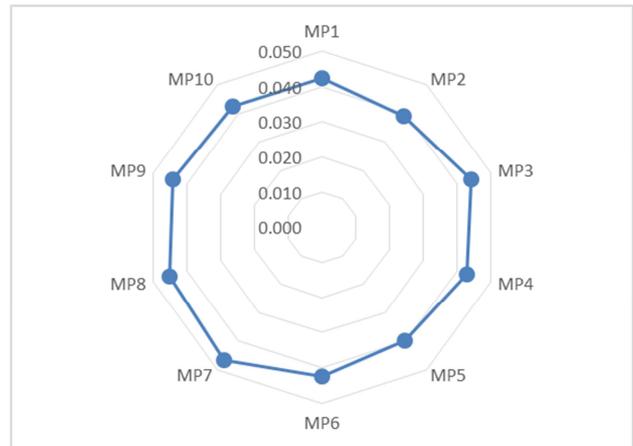


Figure 4. Seed weight (mg) mean of means.

4. Conclusion

Keeping its importance from scientific, socio-economic and livelihood perspectives, it is important to educate and train poor farmers to improve their management practices which are a great hindrance toward getting good production. Moreover, government needs to introduce new seedless varieties besides promoting research and conservation of land races in the area.

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