Effect of Different Growing Media on the Growth and Germination of Mango

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Abstract

A trial to study the “Effect of different rowing media on the growth and germination of mango” was conducted at Horticulture Nursery; The University of Agriculture Peshawar Amir Muhammad Khan Campus Mardan during the year 2015. The experiment was laid out in Randomized Complete Block Design with single factors, factorial arrangement having three replications. The mango seeds were planted in sand + Bagas + pine bark (1:1:1), sand + baggas + pine bark (1:2:1), sand + baggas + pine bark (1:1:2), sand + baggas + pine bark (2:1:1). Data was recorded for germination percentage, plant height, number of leaves plant-1, leaf area. Almost all parameters were significantly affected by growing media. Maximum germination percentage (100%), leaf area (69.4cm2) was recorded for seed sown in growing media composed of sand + baggas + pine bark (1:1:1), while maximum number of leaves (7) plant-1, plant height (33.71 cm) was recorded for seed sown growing media composed of sand + baggas + pine bark (1:2:1). Minimum germination percentage (55.55%), plant height (18.54cm), leaf area (27.04cm2) and number of leaves (3.67) plant-1 was recorded for media composed of Sand + baggas+pine bark (1:1:2).

Keywords: Growth media; Germination and mango

Introduction

Mango belongs to the genus Mangifera of the family Anacardiaceae. The genus Mangifera contains several species that bear edible fruit. Most of the fruit trees that are commonly known as mango belong to the species Mangifera indica. The other edible Mangifera species generally have lower quality fruit and are commonly referred to as wild mango. Mango has become naturalized and adapted throughout the tropics and subtropics. Much of the spread and naturalization has occurred in conjunction with the spread of human populations, and as such, the mango plays an important part in the diet and cuisine of many diverse cultures. There are over 1000 named mango varieties throughout the world, which is a testament to their value to humankind. Mango is a common garden tree throughout the tropics. Based on production, mango ranked second after citrus in Pakistan and fourth in the world production Malik [1] Pakistan produces 8.5% of world’s mango. In Pakistan area under mango cultivation is 16.75 thousand hectares with the production of 1,732 thousand tones. Pakistan earns Rs. 4.9 billion from mango exports in 2014. Pakistan has exported 86 thousand tons of mangoes to the different countries of the world in 2014 [2]. Annual estimated world over production of mango is over 25 Million tones.

More than half of mango area (104.9 thousand hectares) lies in Punjab followed by Sindh (50.0 thousand hectare) with minor acreage in Baluchistan (1.4 thousand hectare) and Khyber Pakhtunkhwa (0.3 thousand hectares). But due to favorable conditions, fruits are mature early in Sindh and get its supply catches the Punjab market in early stages and fetches high prices. Besides this also suppresses the prices of local early maturing varieties in Punjab due to suitable conditions in the market [2].

Worldwide, among 1595 varieties of mango known, only few (25-30) are being grown on commercial scale. Important commercial cultivars of Pakistan are Dashehari, Anwar, Ratul, Langra, Chaunsa, Sindhi, Maldha and Fajri. These varieties are consumed at their peaks in summer seasons. However each variety takes over the consumption after it reaches the market. The consumption of Sindri is the highest among all other indigenous varieties (Report on mango from Pakistan) The mango fruit is used and processed in various ways, e.g. mango
juice, mango slices, powdered, candied pulp, jams, paste, jelly, squashes, chutney, preserves, cider, ketchup, and pickles. The ripe fruits are used in cooking. The juice particularly of the fibrous cultivars is squeezed out and dried on plates [3].

Although grown widely, mangoes prefer a warm, frost-free climate with a well-defined winter dry season. Rain and high humidity during flowering and fruit development reduces fruit yields. The tree generally flowers in mid- to late winter, with fruit maturing in the early to mid-summer months. Mango trees are usually between 3 and 10 m (10-33 ft) tall but can reach up to 30 m (100 ft) in some forest situations. The canopy is evergreen with a generally spreading habit. The heavy canopy of the mango is a source of shelter and shade for both animals and humans. Mangos are well adapted to cultivation and have been grown commercially for centuries.

Today, mangos are recognized and eaten throughout the world and are regarded as one of the most popular and esteemed tropical fruits. Mangoes require deep soils with good drainage not necessarily fertile but mangoes can thrive in a wide range of soil types. Mango is mostly propagated by vegetative method. The seedling tree has some major drawbacks. Propagation from seed, though easy and cheap, is unable to perpetuate characters of the parent tree because most commercial varieties in Pakistan are cross pollinated and mono embryonic. Such plants are not uniform in growth, yield and fruit quality and it has long juvenile phase in comparison to vegetatively propagated fruit crops. In case of asexual method, propagation is brought by the plant parts. The asexually or vegetatively propagated fruit plants are true to type and are uniform in growth and fruit quality. Growing media is the important input for the containerized seedling production. It is characterized by light weight, friable, good water holding capacity, drainage, porosity and low bulk density etc. Normally the viability of stone is about 90-100 days. However, it depends on the storage conditions. Stones sown immediately after extraction will exhibit viability up to 60-80 per cent depending on the variety [4].

Methods and Materials

The experiment “Effect of different growing media on the growth and germination of mango” was conducted at Horticulture Nursery, The University of Agriculture Peshawar Amir Muhammad Khan Campus Mardan during the year 2015. The main objective was to determine the best growing media for the better growth rate and germination percentage of mango.

Media Preparation and Bulb Plantation

The media used in this experiment was prepared by thoroughly mixing sand, baggas and pine bark at different ratios. Mango seed were sown in black polythene bag of size 8x12 inches with required media, tree seed per treatment were sown and replicated three times. Thus total 36 seeds were sown for four different types of growing media.

Experimental Design

The experiment was carried out in Randomized Complete Block Design (RCBD) with single factor, Factor arrangement replication three times. There were 4 treatments in each replication. Experiment was based upon following factor: i-e growing media.

Factor A (Growing media)

M1: Sand + Baggas + Pine bark (1:1:1)
M2: Sand + Baggas + Pine bark (1:2:1)
M3: Sand + Baggas + Pine bark (1:1:2)
M4. Sand + Baggas + Pine bark (2:1:1)

The mango seeds were sowed in flat manner in each bag, and the following parameters were studied.

Parameters

The following parameters were checked regularly during the passage of study:

Germination percentage

The germination percentage was calculated with the help of germination formula given below:

Germination percentage = (number of germinated seeds / total seeds) x 100

Plant Height (cm)

The plants to be measured were selected randomly. Plant height was taken from the top of soil to the peak of plant with measuring tape.

Number of leaves plant-1

The plants were randomly selected and the leaves were counted.

Leaf area (cm²)

Leaf area (cm²) was measured with the help of measuring tape by the following formula.

Leaf area (cm²) = L x W

Results and Discussion

Germination Percentage

The data recorded for germination percent is given in (Table 1) and analysis of variance is presented in (Table 1a). The analysis of variance showed that data related to germination percentage were non-significantly different. The mean table showed that maximum germination (100%) was recorded for seeds sown in Sand + Baggas + Pine bark (1:1:1), followed by Sand + Baggas + Pine bark (2:1:1), while minimum germination percentage (55.55%) was noted in seeds sown in Sand + Baggas + Pine bark (1:1:2).
Sand + Baggas + Pine bark (1:1:2). Pine bark increases acidity of the media [5] and high acidity decreases germination capacity [6] as Sand + Baggas + Pine bark (1:1:2) has high proportion of pine bark than sand and baggas that’s why it had minimum germination percentage (Table 1).

Table 1: Germination percentage of mango as affected by different growing media.

| Growing Media | Germination percentage |
|---------------|------------------------|
| Sand + baggas + pine bark (1:1:1) | 100 |
| Sand + baggas + pine bark (1:2:1) | 77.77 |
| Sand + baggas + pine bark (1:1:2) | 55.55 |
| Sand + baggas + pine bark (2:1:1) | 88.89 |

LSD value = 36.817

Table 1a: Analysis of variance for germination percentage of mango as affected by different growing media.

| Treatments | SOV | DF | SS  | MS  | F     | P       |
|------------|-----|----|-----|-----|-------|---------|
| Rep        |     | 2  | 185.15 | 92.57 |       |         |
| Treatments | 3   | 3241.54 | 1080.51 | 3.18 | 0.1059 |         |
| Error      | 6   | 2037.52 | 339.59 |     |       |         |
| Total      | 11  | 5644.20 |         |     |       |         |

The value of probability is 0.1059 which is non-significant.

Plant height (cm):

Table 2: Plant height (cm) of mango as affected by different growing media.

| Media | Plant height(cm) |
|-------|------------------|
| Sand + baggas + pine bark (1:1:1) | 29.14 |
| Sand + baggas + pine bark (1:2:1) | 33.71 |
| Sand + baggas + pine bark (1:1:2) | 18.54 |
| Sand + baggas + pine bark (2:1:1) | 24.14 |

CV 17.34
The value of probability is 0.0269 which is significant. LSD value = 10.906

The data recorded for germination percent is given in (Table 2) and analysis of variance is presented in (Table 2a). The analysis of variance showed that data related to plant height were significantly different. The mean table showed that maximum plant height (33.71cm) was recorded for seeds sown in Sand + Baggas + Pine bark (1:2:1), followed by (29.14cm) in Sand + Baggas + Pine bark (1:2:1), while minimum plant height (18.54cm) was noted in seeds sown in Sand+ Baggas + Pine bark (1:1:2).

Table 2a: Analysis of variance plant height (cm) of mango as affected by different growing media.

| SOV | DF | SS   | MS       | F     | P    |
|-----|----|------|----------|-------|------|
| Rep | 2  | 70.519 | 35.259 | 6.39 | 0.0269 |
| Treatments | 3 | 404.962 | 134.987 |       |       |
| 0.0269 | 6 | 126.777 | 21.130 |       |       |
| Total | 11 | 602.259 |         |       |       |

CV 17.34
The value of probability is 0.0269 which is significant. LSD value = 10.906

The data recorded for leaf area is given in Table 3 and analysis of variance is presented in (Table 3a). The analysis of variance showed that data related to leaf area were significantly different. The mean table showed that maximum leaf area (69.4 cm²) was recorded for seeds sown in Sand + Baggas + Pine bark (1:1:1), followed by (50.01cm²) in Sand + Baggas + Pine bark (2:1:1), while minimum leaf area (27.04cm²) was noted in seeds sown in Sand+ Baggas + Pine bark (1:1:2).

Table 3: Leaf area (cm²) of mango as affected by different growing media.

| Media | Leaf area(cm²) |
|-------|----------------|
| Sand + baggas + pine bark (1:1:1) | 69.4 |
| Sand + baggas + pine bark (1:2:1) | 47.80 |
| Sand + baggas + pine bark (1:1:2) | 27.04 |
| Sand + baggas + pine bark (2:1:1) | 50.01 |

LSD value = 27.499.

Table 3a: Analysis of variance for leaf area (cm²) of mango as affected by different growing media.

| SOV | DF | SS   | MS       | F     | P    |
|-----|----|------|----------|-------|------|
| Rep | 2  | 230.45 | 115.223 | 4.75 | 0.0501 |
| Treatments | 3 | 2699.51 | 899.938 |       |       |
| Error | 6 | 1136.72 | 379.938 |       |       |
| Total | 11 | 4066.98 | 189.453 |       |       |

CV 28.34.
The value of probability is 0.0501 which is significant.

The data recorded for leaf area is given in Table 3 and analysis of variance is presented in (Table 3a). The analysis of variance showed that data related to leaf area were significantly different. The mean table showed that maximum leaf area (69.4 cm²) was recorded for seeds sown in Sand + Baggas + Pine bark (1:1:1), followed by (50.01cm²) in Sand + Baggas + Pine bark (2:1:1), while minimum leaf area (27.04cm²) was noted in seeds sown in Sand+ Baggas + Pine bark (1:1:2). Minimum leaf area (27.04cm²) in Sand + Baggas + Pine bark (1:1:2) might be due to the fact that this media composition decreased the pH of media and low pH (high acidity) has negative impact on plant growth and germination [8] which resulted in producing small leaves with minimum leaf area (Table 3), [9,10].

Number of leaves plant-1

Table 4: Number of leaves plant⁻¹ of mango as affected by different growing media.

| Media | Number of leaves |
|-------|------------------|
| Sand + baggas + pine bark (1:1:1) | 5 |
| Sand + baggas + pine bark (1:2:1) | 7 |
| Sand + baggas + pine bark (1:1:2) | 3.67 |
| Sand + baggas + pine bark (2:1:1) | 4.33 |

Table 4a: Analysis of variance for number of leaves plant⁻¹ of mango as affected by different growing media.

| SOV | DF | SS   | MS       | F     | P    |
|-----|----|------|----------|-------|------|
| Rep | 2  | 1.5000 | 0.75000 | 4.77 | 0.0498 |
| Error | 6 | 7.8333 | 1.30556 |       |       |
| Total | Total | 28.000 |         |       |       |

CV 22.85
The value of probability is 0.0498 which is significant.
The data recorded for number of leaves is given in Table 4 and analysis of variance is presented in Table 4a. The analysis of variance showed that data related to leaf area were significantly different. The mean table showed that maximum number of leaves (7) [11-14] was recorded for seeds sown in sand + baggas + pine bark (1:2:1), followed by (5) in sand + baggas + pine bark (2:1:1), while minimum number of leaves (3.67) was noted in seeds sown in sand + baggas + pine bark (1:1:2). Minimum number of leaves (3.67) in sand + baggas + pine bark (1:1:2) might be due to the fact that this media composition had higher proportion of pine bark than sand and baggas which led to increase in acidity of the medium. High acidity of the medium had a negative effect on green parts of the seedlings [6] and thus produced minimum number of leaves per plant. (Table 4) [19-20].

Conclusion and Recommendation

On the basis of collected data the following conclusion was obtained,

Among all the different growing media sand + baggas + pine bark (1:1:1) was the most effective for maximum germination percentage and leaf area while sand + baggas + pine bark (1:2:1) was recorded as best for maximum plant height and number of leaves plant-1.

Based on the above conclusion, following recommendations are made; For better germination growing media composed of sand + baggas + pine bark (1:1:1) is recommended under the Agro-climatic condition of Mardan.

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