Research Article

Effect of humic acid and seed size on germination of mango (*Mangifera indica* L.) seed

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Abstract

Seed emergence is influenced by many environmental factors including growth media as well as seed sizes. Keeping in view the importance of growth media and seed sizes on the emergence of plant seed and growth the present experiment was designed to evaluate the effect of humic acid and seed sizes on germination of mango (*Mangifera indica* L.) seed in 2015 at Jabban Agriculture Extension Department Dargai Malakand. The experiment was triplicated at Randomized Complete Block Design (RCBD) with two factors i.e. Humic acid: H₁ (0g), H₂ (3g), and H₃ (6g) and seed size: S₁ (Small)= 33.48 cm³, S₂ (Medium)= 36.00 cm³ and S₃(Large)= 39.20 cm³). The result showed that all parameters were significantly affected by humic acid levels and seed size. Maximum germination (90 %), shoot length (28.09 cm), stem diameter (1.10cm), number of leaves plant⁻¹ (7.98) was recorded for seed sown at 6g humic acid, while minimum germination (66.75 %), shoot length (21.23cm) was recorded for seeds sown at 0 g humic acid. On the other hand minimum stem diameter (0.97cm) and number of leaves (6.37) plant⁻¹ was recorded for seed sown at 3gm humic acid. In case of seed size all parameters were significantly affected. Maximum germination (86 %), shoot length (26.69cm), stem diameter (1.10cm), number of leaves plant⁻¹, (7.72) were recorded for larger size seeds, while minimum germination (66.75 %), stem diameter (0.49mm) and number of leaves (6.37) plant⁻¹ was recorded for small size seeds. On the other hand minimum shoot length (23.07cm) was recorded for medium size seeds. In response to humic acid most of the parameters performed well at 6 g humic acid as compared to the other two levels and in case of seed size large seed was best for most of the parameters as compared to medium and small size seeds.

Keywords: Humic acid; *Mangifera indica* L.; Seed emergence; Seed size

Introduction

Mango (*Mangifera indica* L.) belongs to family Anacardiaceae is one of the most important fruit of the tropical and sub-tropical areas, such as Australia, Egypt, America, Malaya, Pakistan, Philippine and West Indies. Mango has been a favorable

fruit in the sub-continent throughout the recorded history. Mango is considered as a highly esteemed fruit the “King of Fruits” in the region due to its delicious taste, excellent, flavor and high vitamin contents [1]. Based on production, mango ranked second after citrus in Pakistan and fourth in

the world production. Pakistan produces 8.5% of world's mango. In Pakistan area under mango cultivation is 175 thousand hectares with the production of 1,784 thousand tones. Pakistan earns Rs\$46 million in from mango exports in 2015. 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). 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, ketch up and pickles. The ripe fruits are used in cooking. The juice particularly of the fibrous cultivars is squeezed out and dried on plates [3]. 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, Sindhri, Maldha and Fajri. These varieties are consumed at their peaks in summer seasons. Mangoes can be grown on a wide range of soil types, but deep, well-drained, sandy loam soils give the best. Mangoes are grown on soils with pH ranging from 5.5-8.7. FYM at 100 kg to a bearing tree or 2 kg of N tree⁻¹ is recommended. For young trees both in Punjab and Sindh 5-10 kg FYM tree⁻¹ is recommended for quality fruit production. Mango is propagated through seed or grafting, the best propagation methods will depend on cultivars required and the growing condition, most cultivars of mango do not produce seedling true-to-type, therefore grafting is necessary to overcome this problem. Seed germination is influenced by many factors such as the type of substrate used, environmental factors such as oxygen, water, temperature and for

some plant species, light [4]. Generally, growth medium has been judged to be the most critical factor determining seedling quality in the nursery [5] acting as a reservoir for nutrients and moisture [6]. Apart from medium, physical properties can also have a profound effect on the supply of water and air to growing plant [5]. The sizes of the seeds also play a major role on the emergence of the seedlings and growth. Large seeds produce larger seedlings than small ones, hence are able to emerge from greater soil depths [7].

Materials and methods

The experiment was conducted at Jabban Agriculture Extension Department Dargai Malakand during the year 2015. The experiment was triplicated in a Randomized Complete Block Design (RCBD) with two factors.

Five seeds per treatment were sown and replicated three times thus one hundred and eighty five seeds were sown for three different levels of humic acid H₁ (0g), H₂(3g), and H₃ (6g), and seed size S₁(Small)= 33.48 cm³, S₂(Medium)= 36.00 cm³ and S₃ (Large)= 39.20 cm³). Seeds (Small, Medium and Large) were sown manually. Other cultural practices were performed accordingly. The following growth parameters were studied during the experiment Shoot length (cm), Stem diameter (mm), Number of leaves plant⁻¹, Germination percentage.

$$\text{Germination \%age} = \frac{\text{No. of Germinated Seed} \times 100}{\text{Total Seed}}$$

Statistical procedure

Least Significant Difference (LSD) test was used for mean differences where the results were significant. Data were analyzed by using statistical software "MSTATC" for ANOVA and LSD

Results and discussion

The results and discussion of the recorded data regarding the effect of humic acid and seed size on germination of mango seed are briefly described as in (Table 1).

Table 1. Effect of humic acid and seed size on germination of mango seed.

Seed Size	Germination (%)	Shoot length (cm)	Diameter of stem (mm)	Number of Leaves plant ⁻¹
Small	66.75 c	23.13 b	0.99 c	6.37 c
Medium	72.25 b	23.07 c	1.01 b	6.70 b
Large	86 a	26.69 a	1.10 a	7.72 a
LSD	0.600524	3.098894	0.084987	0.956117
Humic acid levels				
0gm	66.75 c	21.23 c	1.02 b	6.44b
3gm	69.5 b	23.56 b	0.97 c	6.37 c
6gm	89 a	28.09 a	1.10 a	7.98 a
LSD	0.600524	3.098894	0.084987	0.956117
N×C	NS	5.367442	0.147203	NS

Germination percentage

The analysis of variance showed a significance effect of humic acid and seed size on seed germination while the interaction between humic acid and seed size was found non-significant. Comparing the means of germination for humic acid, it is cleared that maximum germination (89 %) of mango seeds was observed for 6g m⁻² of humic acid, closely followed by seeds sown at 3g m⁻² of humic acid (69.5 %) and the minimum germination (66.75 %) was recorded for the control (0g m⁻²). Maximum germination at high level of humic acid might be due to the fact that humic acid have hormone-like properties and cause the increase in germination percentage, root development and rapid growth of aerial parts of plants [8]. Similar result was also reported that biologic fertilizers like HA

and bio phosphorous increased radicle and plumule length of two wheat cultivars [9]. Comparing the means of germination for seed size, it is cleared that higher germination (86 %) of mango seeds was observed from larger size seed, closely followed by medium size seeds (72.25 %) while minimum germination (66.75 %) was recorded for the small size seed. It might be due to the fact that larger seed have more food source for germination. The results were also similar with the findings of [10]. Who reported that large seed showed higher seed germination as compared to small in *Ancardceaefamily*. Germination is an event which denotes transition from seed being dependent on food sources from the mother plant to an independent plant capable of taking up nutrients and growing independently

Figure 1. Germination percentage

Shoot length (cm)

The analysis of variance showed that shoot length (cm) was significantly influenced by humic acid, seed size, and their interaction. The means recorded for humic acid showed that maximum shoot length (28.09cm) was found in seeds sown in 6g m^{-2} of humic acid, followed by (23.56cm) seeds sown in 3g m^{-2} of humic acid, while the minimum shoot length (21.23cm) was recorded for control (0g m^{-2}). Similar findings were also founded by [11] that the increasing level of HA constantly and significantly increased

shoot length (cm). The means recorded for seed size showed that maximum shoot length (26.69cm) was produced by the plants grown from larger size seed, closely followed by shoot length (23.13cm) from small size whereas minimum shoot length (23.07 cm) was recorded for medium seed size. Similar findings were also founded by [12] who reported that the effect of potassium humate (salt of humic acid) increases the root length and shoot length of *Triticuma estivum* (L.) of larger seed.

Figure 2. Shoot length (cm)

Diameter of stem (mm)

The analysis of variance showed that stem diameter was influenced significantly by humic acid and seed size, while non-significantly by their interaction. Data pertaining stem diameter showed that maximum stem diameter (1.10 mm) was produced by the plants grown in 6g m^{-2} of humic acid, followed by (1.02mm) by plants grown in control (0g m^{-2}) while minimum (0.97 mm) was noted for 3g m^{-2} for humic acid. The present results are in line with the findings of [13] who stated that humic substances (HS) promoter mainly by changes on root architecture and growth dynamics of stem. The means recorded for seed size showed that maximum stem diameter (1.10 mm) was produced by the plants grown from large size seed, followed by (1.01mm) and (0.99 mm) was noted by plants grown from medium and small seed size respectively.

Similar findings were also founded by [12] who reported that the effect of potassium humate (salt of humic acid) increases the root length and shoot length of *Triticum aestivum* (L.) of larger seed.

Number of Leaves plant⁻¹

Analysis of variance declared significant differences among the seed size of mango and humic acid while their interaction had non-significant effect on number of nodes plant⁻¹. Data regarding humic acid indicated that more number of leaves (7.98) plant⁻¹ was found in seeds sown for 6g m^{-2} of humic acid followed by control (0g m^{-2}) (6.44), while less number of leaves (6.37) plant⁻¹ was recorded for 3g m^{-2} of humic acid. This result confirmed the studies of [14]. The present study examined the effectiveness of powder humic acid (HA) as a source for enhancing growth and quality parameters including plant height, number of leaves. HA maintain soil nutrients supply

compared to control. Our results are supported by [15-17] who have reported that HA increase crop growth and productivity, and help in moisture retention and mitigation of salinity. The data for seed size showed that higher number of leaves (7.72) plant⁻¹ were found from seeds sown of large size, followed by those sown from seeds of medium size (6.70), while minimum number of leaves (6.37) plant⁻¹

were produced by those sown from seeds of small size. Larger seed showed more number of leaves may be due the fact that there is more store food in large seed. The results are also similar with [12] revivals the effect of potassium humate (salt of humic acid) increases the root length and shoot length of *Triticum aestivum* (L.) of larger seed.

Figure 3. Stem diameter (mm)

Figure 4. Number of leaves plant⁻¹

Conclusion

This experiment revealed that Mangoes seed grown at 6 gm. humic level showed good results in most of the plant growth parameters as compared to other humic levels. In case of seed size most of the growth parameters showed good results on

large seed as compared to medium and small.

Authors' contributions

Conceived and design the experiment: N Bostan, Performed the Experiments: F Ghani, Analyzed the Data: F Ghani & MR Khan, Contributed reagents/ materials/

analysis tools: F Ghani & MR Khan, Wrote the paper: MR Khan.

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