

# Physical Properties of Jasmine Flower (*Jasminum multiflorum* L)

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## ABSTRACT

Basic information on the physical properties of flowers is of great importance and helpful to engineers towards efficient process and machine development. Some of the physical properties of jasmine (*Jasminum multiflorum* L) have been studied to provide data needed in designing jasmine processing machinery. These Properties include the length of corolla (mm), the diameter of corolla (mm), the weight of 1000 flowers (g), flower projected area (cm<sup>2</sup>), stalk thickness (mm), the strength of stalk (kgf), bulk density (g/cm<sup>3</sup>), moisture content (%), color values such as L\*, a\* and b\*. The average range of these properties for jasmine is in the range of 32.16 to 36.11 mm for the length of corolla, 6.05 to 6.49 mm for the diameter of the corolla, 134.19 to 177.11 g for weight of 1000 flowers, 6.8 to 8.5 cm<sup>2</sup> for flower projected area and 1.30 to 1.54 for bulk density (g/cm<sup>3</sup>). The strength of the stalk falls in the range of 1.38 to 1.98 kgf. Moisture content is in the range of 72 to 74.3, and color values fall in the range of 67.62 to 73.69 for L\*, -0.95 to -2.11 for a\*, and 11.90 to 16.15 for b\*.

## HIGHLIGHTS

- ① Description of methods used to find physical properties of flower.
- ① Determining the physical properties of Jasmine flowers.

**Keywords:** Physical properties, jasmine, processing machinery

Jasmine (*Jasminum spp.*) is one of the oldest fragrant flowers cultivated by man. The word 'Jasmine' has been reported to be derived from the Persian word 'Yasmyn', meaning 'fragrance' or 'gift from God'. Jasmines have been cultivated for various purposes, and they have adorned the gardens of Central Asia, Afghanistan, Iran, Nepal, and many other tropical and subtropical countries. In India, jasmine is used in rituals like marriages, religious ceremonies, and festivals. The flowers are also used to prepare hair ornaments, decorations, and rangoli. Jasmine is also cultivated commercially for both domestic and industrial uses. It has its special place in south Indian flower crops. *Jasminum*

*grandiflorum*, *Jasminum auriculatum*, *Jasminum sambac* are the three commercially important species with fragrant flowers, while *Jasminum multiflorum*, popularly called "Kakada", anon-fragrant flower, is also gaining market. Jasmine is an ideal crop for small farmers whose landholdings are less than one acre. However, the demand for jasmine flowers in the market is not throughout the year. It is mainly

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dependent on the season, such as festivals and marriages during which these flowers are sold at a very high price. Due to the perishable nature of flowers, there is huge -harvest loss in flowers ranging from 30-50 percent. Qualitative losses like consumer acceptability of fresh produce are much more challenging to assess than quantitative losses. Quantitative losses occur during the entire market chain given due to improper post-harvest handling (Bhattacharjee, 2006). Most of the processing methods employed are still traditional. There is a need to develop appropriate technologies for its processing. The development of the technologies will require the properties of the flower. This study was conducted to determine the physical properties of the flower, such as the length of corolla, the diameter of the corolla, weight of 1000 flowers, flower projected area, stalk thickness, and so on.

## MATERIALS AND METHODS

Fresh flowers of jasmine variety (*Jasminum multiflorum*. L) is harvested manually from farmers' field early in the morning and kept in the refrigerator at 4° C.

### Length and diameter of corolla

The length and thickness of the corolla make an impact on conveying of flowers. The length of the corolla was measured by a digital vernier caliper having a least count of 0.01 mm, and the diameter of the corolla was measured using a digital screw gauge having a least count of 0.01 mm (Hattori *et al.* 2015).

### Stalk length and thickness

The length and thickness of the flower stalk is important parameter that affects conveying characteristics of flowers. The length of the stalk was measured by a digital vernier caliper having a least count of 0.01 mm, and the thickness of the stalk was measured using a digital screw gauge having a least count of 0.01 mm (Hattori *et al.* 2015).

### Flower weight

For the determination of flower weight, 100 randomly selected flowers were weighed using a precision balance having an accuracy of  $\pm 0.001$  g, and multiplying the average weight of 100 flowers

by 10 gives the weight of 1000 flowers. The weights measurement was replicated thrice, and the average of the readings was recorded as flowers' weight in grams (Amin *et al.* 2004).

### Projected area of flower

The projected area is one of the important physical properties of biological materials. For determining the projected area, a jasmine flower was placed on the drawing paper, and the outline was traced using a pencil. The initial point was marked on the outline of the drawing paper, and the planimeter was traced along the outline in a clockwise direction till it reached the initial point. The surface area of the jasmine flower displayed by the planimeter was recorded (Mohsenin, 1986).

### Strength of stalk

The strength of the flower stalk was measured using the textural analyzer. The texture analyzer was a microprocessor-controlled system, which was interfaced with a personnel computer. The textural analyzer measures force, distance, and time, thus providing a three-dimensional product analysis (Heidari *et al.* 2014).

### Moisture content

The moisture content (%) of flowers was determined using the procedure detailed by Simonyan *et al.* (2009). Fresh flower samples in triplicate were weighed in petri dishes and dried in an oven at 105 °C for 24 h (AOAC, 2005). The percentage loss in weight was expressed as percentage moisture content. The average moisture content was calculated using the following relationship (Simonyan *et al.* 2009).

$$\text{Moisture content (\% w.b)} = \frac{W_1 - W_2}{W_1} \times 100$$

Where,

$W_1$  = Initial weight of sample, g

$W_2$  = Final weight of sample, g

### True and Bulk density

Twenty randomly selected samples were weighed and lowered into a burette containing toluene. A narrow rod will be used to ensure submerging



the flower parts during the measurements. The net volumetric displacement of toluene for each individual flower part will be recorded as the volume of the sample. The actual density was calculated using the following equation:

$$\rho_t = \frac{m}{v}$$

$\rho_t$  is the True density ( $\text{g/cm}^3$ ),  $m$  is mass (g), and  $v$  is the volume ( $\text{cm}^3$ ).

Cylindrical containers of known volumes were employed for the measurement of bulk density ( $\rho_b$ ). Each container is filled with flowers by dropping the samples from the height of 150 mm at a constant rate. Then, containers content is carefully weighed using a digital electronic scale. Knowing the volume and the weight flower, the bulk density was obtained. The Bulk density was calculated using the following equation (Emadi *et al.* 2011):

$$\rho_b = \frac{m}{v}$$

Where  $\rho_b$  is the Bulk density ( $\text{g/cm}^3$ ),  $m$  is mass (g), and  $v$  is the volume ( $\text{cm}^3$ ).

**Colour:** Hunter lab colorimeter is used to measure the color of fresh jasmine flowers. It provides reading in terms of  $L^*$ ,  $a^*$  and  $b^*$ . Where luminance ( $L^*$ ) forms the vertical axis, which indicates whiteness (+) to darkness (-). In the same way,  $a^*$  indicates redness (+) to greenness (-) and  $b^*$  indicates yellowness (+) to blueness (-) (AOAC, 2005).

## RESULTS AND DISCUSSION

### Length and diameter of corolla

The Minimum value, Maximum value and mean values are presented in Table 1. The length and diameter of the corolla vary between 32.2 to 36.1 and 6.05 to 6.49. The dimensions of flowers are essential for harvesting, separation, sizing, and sorting equipment (Sahay *et al.* 1996).

### Flower Weight

The numerical mean values of thousand flowers were found to be 158.31. From the earlier findings (Patel *et al.* 2014), the values of Co-1 Pitchi variety are lower compared to the values of Jasmine flower.

These variations in the yield may be due to the genetic makeup of the varieties and also may be due to the seasonal effects (Patel *et al.* 2017).

### Bulk Density

Results of bulk density at different moisture content are represented in Table 3. The bulk density of the flower increased linearly with the increase in moisture content, and ranged between 1.44 to 2.23  $\text{g/cm}^3$  as moisture content increased from 72.0 to 74.3 % (d.b). At the same time, a positive relationship of bulk density concerning moisture content is generally expected and has been reported in many studies (Dursun *et al.* 2005; Nimkar *et al.* 2005; Sessiz *et al.* 2007). The studied values can be applied in designing drying, storing, and packaging equipments for jasmine flowers.

The relationship between bulk density and moisture content is represented by following regression equation:

$$Y = 0.2767 X - 18.401 \quad (R^2 = 0.9238)$$

### Strength of stalk

The minimum and maximum values were found between 1.38 to 1.98 (Table 1).

**Table 1:** Physical properties of Jasmine flower

| Sl. No. | Properties                              | Min Value | Max value | Mean   | Standard deviation (S) |
|---------|---|-----------|-----------|--------|------------------------|
| 1       | Length of Corolla (mm)                  | 32.16     | 36.11     | 33.9   | 1.367                  |
| 2       | Diameter of Corolla (mm)                | 6.05      | 6.49      | 6.2    | 0.153                  |
| 3       | Wight of 1000 flowers (g)               | 134.19    | 177.11    | 158.31 | 18.19                  |
| 4       | Flower Projected area ( $\text{cm}^2$ ) | 6.8       | 8.5       | 7.64   | 0.625                  |
| 5       | Bulk density ( $\text{g/cm}^3$ )        | 1.44      | 2.23      | 1.84   | 0.274                  |
| 6       | Moisture Content (%) (d.b)              | 72        | 74.3      | 73.16  | 0.952                  |
| 7       | Stalk thickness (mm)                    | 2.54      | 3.15      | 2.93   | 0.216                  |
| 8       | Strength of stalk (kgf)                 | 1.38      | 1.98      | 1.58   | 0.209                  |

The mean values were found to be 1.58. No research results are available for stalk strength. Still, the findings of Babalar *et al.* (2016) on shear strength

for gerbera flowers ranged from 4.23 to 7.83 kg for different levels of pre-treatment with potassium silicate and salicylic acid.

## Colour Properties

Color values for jasmine flower range from 67.62 to 73.69 for L\*, which shows a brighter appearance, -2.1 to -1.0 for a\* represents light green in color, and 11.9 to 16.2 for b\* shows yellowish appearance.

**Table 2:** Colour properties of Jasmine flower

| Sl. No. | Properties             | Colour |       |       |
|---------|------------------------|--------|-------|-------|
|         |                        | L*     | a*    | b*    |
| 1       | Min value (mm)         | 67.62  | -2.1  | 11.9  |
| 2       | Max value (mm)         | 73.69  | -1.0  | 16.2  |
| 3       | Mean (mm)              | 70.46  | 1.48  | 14.55 |
| 4       | Standard deviation (S) | 2.192  | 0.402 | 1.619 |

**Table 3:** Effect of Moisture content on Bulk density (g/cm<sup>3</sup>)

| M.c (%)<br>d.b) | Bulk density<br>(g/cm <sup>3</sup> ) | Regression equation | R <sup>2</sup><br>Value |
|-----------------|--------------------------------------|---------------------|-------------------------|
| 72.0            | 1.44                                 | Y= 0.2767 X -18.401 | 0.9238                  |
| 72.1            | 1.66                                 |                     |                         |
| 73.4            | 1.89                                 |                     |                         |
| 74              | 2.01                                 |                     |                         |
| 74.3            | 2.23                                 |                     |                         |

## CONCLUSION

The investigation of various physical properties of the Jasmine flower (*Jasminum multiflorum*. L) revealed the following observation:

1. Length of Corolla of Jasmine flower varies from 32.16 to 36.11 mm.
2. Diameter of Corolla varies from 134.19 to 177.11, Wight of 1000 flowers (g) from 6.8 to 8.5, Flower Projected area ranges from 1.30 to 1.54 cm<sup>2</sup> and strength of the stalk falls in between 1.38 to 1.98 kgf, respectively.
3. The bulk density of flower increased linearly with the increase in moisture content, and ranged between 1.44 to 2.23 g/cm<sup>3</sup> as moisture content increased from 72.0 to 74.3% (d.b).
4. Color values fall in the range of 67.62 to 73.69 for L\*, -0.95 to -2.11 for a\*, and 11.90 to 16.15 for b\*.

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