EFFECTS OF DIFFERENT PRUNING TIMES ON GROWTH AND YIELD OF BER (ZIZYPHUS MAURITIANA LAMK), CV. “ALU-BUKHARA”

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ABSTRACT

This study was conducted at Horticultural Research Institute, AARI, Faisalabad during 2011-12 and 2012-13 to assess the effects of pruning times on the fruit characteristics and yield of ber (Ziziphus mauritiana Lamk.) cv. Alu-bukhara. Experiment was laid out in RCBD with five replications. Each replication contained two plants per treatment. Hence there were total 30 plants. Three pruning treatments were applied i.e. T₁ (pruning on 15th May), T₂ (pruning on 30th May) and T₃ (pruning on 15th June). Maximum number of branches per tree (23.00), days to flowering (65 days), early blooming (26th August to 30th October), highest fruit weight (32.45g), maximum fruit size (38.50 mm²), highest TSS (16.62%), highest sugar (6.25%) and maximum vitamin-C contents (132.65mg/100mg) in T₁, while minimum fruit weight (24.74g) and minimum fruit size (30.71mm²) was recorded in T₃. Highest acidity percentage (0.57%) was recorded in T₃. Fruit yield was also highest (208kg per tree) in T₁ while lowest (176 kg per tree) in T₃. It was concluded that 15th May is most suitable pruning time to maximize fruit yield and quality in ber cv. Alu-Bukhara.

KEYWORDS: Zizyphus mauritiana; ber; pruning time; fruit quality; growth; yield; Pakistan.

INTRODUCTION

Ber or Jujube (Ziziphus mauritiana Lamk.) belongs to family Rhamnaceae is called king of arid fruits, originated in Indo-Pak and China where its cultivation is older than 4,000 years (23). In Pakistan, ber is successfully cultivated in Lahore, Faisalabad, Multan, Bahawalpur, Sargodha, Hyderabad and Khairpur divisions and in some regions of KPK. Ber is exported to Middle East countries. In ancient times small sized ber fruit was cultivated (less then 10g), with inferior quality and sour taste. But now with advancement in research, large size ber varieties with good physicochemical characters have been
introduced through selection. In Pakistan more than 35 ber varieties exist which have huge export potential (27). Ber fruit has excellent medicinal properties such as anticancer, antioxidant, sedative and used to cure many diseases like sour throat, diarrhea and obesity (17, 22, 35). Alu-bukhara variety is being preferred by fruit growers due to large size, high yield and more income per area. Ber is an ideal fruit for cultivation in arid and semi-arid regions of Pakistan (16).

Like other fruit trees appropriate cultural practices are needed in ber orchards to ensure good flowering, fruit setting and ultimately first-rate yield (20). Most important cultural practice for ber orchards is pruning at right time and in right quantity. Pruning is necessary to improve tree vigor, productivity, fruit size and quality (31). In ber flowering and fruiting occurs on current season growth in axils of leaves, so ber trees respond well after pruning. (2). Appropriate pruning not only improve yield but also improve quality of fruits. Pruning promotes bud sprouting and good annual vegetative growth including leaf size, number of shoots, shoot length, leaf area. (15,12).

Pruning time is very important and any delay can result in low yield (4) as early flowering introduce early fruiting. Some earlier scientists (1, 11, 25, 26, 31) reported 15 and 30 April, 15 and 30 May and 15 June primary dates for controlling insect pest in ber. Very little work has been reported against physicochemical characteristics and yield of ber by various pruning timings. So the objective of this study was to evaluate the best pruning time for better fruit yield of ber cultivar Alu-bukhara.

MATERIALS AND METHODS

Experiment was carried out at Horticultural Research Institute, AARI, Faisalabad, (71°34’ 11.68 E & 13°14’ 17.08 N, 343ft altitude) during 2011-12 and 2012-13. Three pruning treatments i.e. pruning on 15th May (T1), pruning on 30th May (T2), pruning on 15th June (T3) were carried out.

The trees were marked for this experiment by painting the treatment numbers on their stems. NPK was applied @ 1000-500-500g along with 40 kg FYM per tree during July. Nitrogen was applied in two split doses i.e. before flowering during July and at pea fruit stage during October. Experiment was laid out in RCBD with five replications. Each replication contained two plants per treatment, hence making total 30 plants. Pruning level used for all treatments was 50% (fifty percent branch length was removed). Data were recorded on following parameters.

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- Number of branches per tree were counted which sprouted after pruning.
- Total blooming period and days to flowering were calculated.
- Five branches towards, east, west, north and south were selected and tagged.
- Fruit size was measured by electronic digital caliper.
- Fruit weight (g) was measured by electronic scale (SF-400).
- TSS was determined by digital refractometer.
- Tritatable acidity (%) was determined by titrating samples with 0.1M NaOH.
- Vitamin-C was quantified as described by Ruck, J.A. (24).
- The reducing and non-reducing sugars were measured as described by Hortwitz, W. (10).
- Fruit yield for all the pickings in each tree was recorded.

Data were analyzed statistically by using Fisher’s analysis of variance technique and treatments were compared by using least significant difference (LSD) test at 5 percent probability level (34).

RESULTS AND DISCUSSION

Total blooming period (days)

Blooming started earlier in ber trees when early pruning was done. Data (Table 1) showed that in T₁ blooming started from 26th August and continued upto 30th October. But in T₂ blooming started late i.e. from 6th September and continued upto 28th October. In case of T₃, a further delay in blooming was noted i.e. from 14th September to 30th October. Thus a delay of 19 days was noted in first and third pruning treatment. Gupta et al., (9) and Kundi et al., (13) reported that in subtropical conditions (India) the most suitable time for ber pruning is in month of May, when trees have shed their leaves during dormancy period. Godara et al., (5) also reported early blooming if pruning is done during first fortnight of May. Early pruning causes early flowering and ultimately early fruit maturity (33). Results are in line with the findings of Pareek and Nath (19) who reported that pruning during early May resulted flowering in last week of August.

Days to flowering

Maximum flowering days (65.00) were recorded in T₁ followed by T₂ (55.60) and T₃ (46.60). Similar results have been reported by Sandhu et al., (25) who recorded more number of flowering days when pruning was done in early May compared to the trees pruned at end of June. Singh and Sandhu (33) reported significant results when pruning in ber cv. Umran was done at
fortnightly intervals ranged from 15th April to 15th July. Pruning induces early flowering, it was also observed that more number of flowers per cyme result if pruning is practiced in early May.

Table 1. Total blooming period, days to flowering and number of branches per tree of ber cv. Alu-Bukhara after different pruning treatments.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Total blooming period</th>
<th>Days to flowering</th>
<th>Number of branches per tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁ (Pruning on 15th May)</td>
<td>26th August to 30th October</td>
<td>65.00a</td>
<td>23.00a</td>
</tr>
<tr>
<td>T₂ (Pruning on 30th May)</td>
<td>6th September to 28th October</td>
<td>52.00b</td>
<td>19.40b</td>
</tr>
<tr>
<td>T₃ (Pruning on 15th June)</td>
<td>14th September to 30th October</td>
<td>46.60c</td>
<td>15.73c</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td></td>
<td>8.6818</td>
<td>1.7780</td>
</tr>
</tbody>
</table>

Number of branches per tree

Data (Table 1) showed that number of branches per tree was highly affected with pruning time. It can be seen from the results that the number of secondary and tertiary branches per tree was significantly higher (23.00) in T₃ when pruning was carried out on 15th May, followed by T₂ (19.40) when pruning was done on 30th May. Minimum number of branches (15.73) were recorded in T₃ when pruning was done on 15th June. The results showed that there was emergence of more branches in trees pruned on 15th May. That was primarily connected with appropriate pruning time plus suitable temperature favourable for sprouting of more number of branches. The number of branches per tree decreased significantly when pruning was delayed up to 15th June. Gupta (7) recorded that bud-sprouting percentage heavily concerned with pruning time. Raturi and Chadha (21) also recorded that thicker shoots were produced when pruning was done in end of April.

Fruit weight (g)

Maximum fruit weight (32.45g) was recorded when fruits were harvested from trees pruned on 15th May while minimum fruit weight (24.74g) was recorded from fruits which were harvested from T₃ (Table 2). Kundu et al., (14) observed that pruning has direct effect on physical characters of ber fruit. They recorded maximum fruit weight and pulp stone ratio from trees pruned in early May while minimum fruit weight was obtained from trees pruned in last fortnight of June. Singh et al., (32) also reported that time of pruning had significant influence on fruit weight.
Fruit size (mm²)

Maximum fruit size (38.50 mm²) was obtained from fruits harvested on trees pruned on 15th May while minimum fruit size (30.71 mm²) was recorded from fruits harvested from trees pruned on 15th June (Table 2). Results are in line with findings of Singh, U. R. et al (32) who pruned ber during last week of June and recorded bad effects on ber fruit size with further delay in pruning time. Kundu, S.S. et al (15) also reported similar results.

Table 2. Physico-chemical analysis of ber cv. Alu-Bukhara after different pruning treatments.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Fruit weight (g)</th>
<th>Fruit size (mm²)</th>
<th>TSS (%)</th>
<th>Acidity (%)</th>
<th>Vitamin - C (mg/100g)</th>
<th>Total sugar (%)</th>
<th>Fruit yield (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁ (Pruning on 15th May)</td>
<td>32.45a</td>
<td>38.50a</td>
<td>16.62a</td>
<td>0.37c</td>
<td>132.65a</td>
<td>6.25a</td>
<td>208a</td>
</tr>
<tr>
<td>T₂ (Pruning on 30th May)</td>
<td>29.08b</td>
<td>34.00b</td>
<td>14.32b</td>
<td>0.45b</td>
<td>128.34b</td>
<td>5.34b</td>
<td>193b</td>
</tr>
<tr>
<td>T₃ (Pruning on 15th June)</td>
<td>24.74c</td>
<td>30.71c</td>
<td>13.27c</td>
<td>0.57a</td>
<td>120.49c</td>
<td>4.02c</td>
<td>176c</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>3.3759</td>
<td>4.4704</td>
<td>1.5362</td>
<td>0.0529</td>
<td>4.2767</td>
<td>1.1472</td>
<td>11.948</td>
</tr>
</tbody>
</table>

TSS (%)

Highest TSS percentage (16.62%) was noted when fruits were collected from T₁ followed by T₂ (14.32%), while minimum TSS (13.27) was found in T₃ (Table 2). These results are in agreement with the findings of Siddiqui, S and O. P. Gupta (29) who recorded that pruning time had significant effect on TSS of ber fruit.

Sugar content (%)

Maximum sugar (6.25%) was found in T₁ followed by T₂ (5.34%) while minimum sugar percentage (4.02%) was recorded in T₃ (Table 2). Such variations in sugar contents of ber cultivar Gola have also been reported by Chadha, K. L. and O. P. Pareek (3).

Vitamin-C (mg/100g)

Maximum vitamin-C contents (132.65mg/100g) were examined in T₁ followed by T₂ (128.34 mg/100g). Minimum Vitamin-C contents were found in T₃ (120.49 mg/100g) (Table 2). Results are supported by findings of Kundi et al.,
(13) who recorded maximum vitamin-C contents in cv. Umran when pruned in first fortnight of May.

**Acidity (%)**

Highest acidity percentage (0.57%) was observed in T\textsubscript{3} followed by T\textsubscript{2} (0.45%) while minimum acidity (0.37%) was recorded in T\textsubscript{1} (Table 2). Siani, S. \textit{et al} (28) showed that acidity is very much linked to pruning time. Such changes in physico-chemical characters of fruit might be induced due to variation in time of pruning. Maximum fruit weight, size, TSS and Vitamin-C were observed when pruning was practiced early. It might be attributed to tree physiology as ber fruits get proper time for development and maturity.

**Yield (kg/tree)**

Fruit yield per tree was recorded highest (208 kg per tree) (Table 2) in T\textsubscript{1} followed by T\textsubscript{2} (193 kg/tree), while lowest yield (176 kg/tree) was obtained from T\textsubscript{3}. Gupta \textit{et al} (6) recorded highest fruit yield when they pruned trees during first fortnight of April and lowest when pruning was done in early June. Nijjar, G. S. (18) reported superior fruit set, if pruning was practiced at right time and in right quantity. Singh, B. P. \textit{et al} (30) also recorded average fruit yield increase with earlier pruning in cultivar Sanaur-2 under Andhra Pradesh. Singh, U.R. \textit{et al} and Singh, Z. \textit{et al} (32, 33) recorded maximum yield from cv. Umran when pruned in last week of May.

**CONCLUSION**

It is concluded that early flowering, more number of branches per tree, good quality ber fruit (like fruit weight, fruit size, TSS, sugar, vitamin-C) and more yield was obtained when pruning was done on 15\textsuperscript{th} May and any further delay after 15\textsuperscript{th} May will badly affect the yield and quality of ber cultivar Alubukhara. Therefore, the most suitable time to get high yield and a fruit is found to be 15\textsuperscript{th} May.

**REFERENCES**


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Naseem Sharif : Conducted the research, analysed the data and Prepared the write up.
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Muhammad Afzal Javaid : Managed the literature search
Muhammad Azhar Bashir : Helped in statistical analysis and reviewed the results