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$$Ca = 3.3 + 3.86 * \text{Exp} (0.00058 * X)$$

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### Statgraph

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 $Y = / \times (X1 \times X2)$   
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 $Y = / + / \times (X1 \times X2)$   
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n =  $(t^2 * s^2) / E^2$   
 $n = (2^2 * 4.6^2) / 2.8^2 = 11$   
:n  
:s  
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:E

V

«STATGRAPH »

$$Y = \frac{1}{n} \sum_{i=1}^n y_i + \frac{1}{n} \sum_{i=1}^n \epsilon_i$$

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$$\hat{y} \pm t_{(\alpha, df)} \sqrt{(Mse)(1 + 1/n + \xi_{sp}^{-1} \xi)}$$

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$$Y = \frac{1}{n} \sum_{i=1}^n y_i + \frac{1}{n} \sum_{i=1}^n \epsilon_i$$





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- 12- FAO, Forestry paper, 1987, NO.49, Wood extraction with oxen and agriculture tractors.
  - 13- Mc Goncil, Keith· 1979: “Production study of Horse and Mule Logging“, Alabama.
  - 14-Toms C.·1996 “Animal logging in the Southern United States“, ASAE.
  - 15-Wang L. 1997 “Assassment of animal skidding and ground machine skidding“, China.

## Study of Log Production and Cost of Log Transportation by Mules and the Amount of Products through Traditional Processing Method

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### Abstract

Using animals is an old method to transport logs from the stumps to the landing. This method and its cost and destructive side-effect have been studied in countries such as the United States of America, China, India, Chile and European countries. Mules are widely used for transporting billets, firewood, pulpwood and lumbers in Iran. This research was conducted in Aban 1381 (November 2002) in Kheyroudkenar, Nowshahr. After defining the elements of the work, in order to assess the cost of log production and transportation by mules, the continuous time study was used and the models of transporting billets, firewood and lumbers by means of a V-shaped tool were developed. The quantity of produced and hauled billets was 2.135 m<sup>3</sup>/h that increased to 3.275 m<sup>3</sup>/h when the V-shaped tool was used. The amount of pulpwood hauled in this way was 1.246 m<sup>3</sup>/h. According to the agreement with the contractor, the price of hauling billets was 13,382 Rial/m<sup>3</sup> that reduced to 8,724 Rial/m<sup>3</sup> when the V-shaped tool was employed. The price for hauling pulpwood was 28,663 Rial/m<sup>3</sup>. In average, based on calculations and regarding cutting procedures in Patom and Namkhaneh, 88.37% of the products is produced using the traditional method and only 11.63% of the products is processed by mechanized methods.

**Keywords:** Forest Harvesting, Animal Logging, Production, Cost, Wood hauling model, Hauling time, Hauling distance, Load Volume