STUDY ON EFFECT OF TREE DIAMETER, HEIGHT AND ACID TREATMENT ON TRACE ELEMENTS AND YIELD OF GUM EXTRACTED FROM *Acacia nilotica* (BABUL)

JANI, B. L. ; *GOJIYA, D. K. AND VYAS, D. M.

DEPARTMENT OF PROCESSING AND FOOD ENGINEERING
COLLEGE OF AGRICULTURAL ENGINEERING AND TECHNOLOGY
JUNAGADH AGRICULTURE UNIVERSITY
JUNAGADH – 362 001, GUJARAT, INDIA

E-mail: dkgojiya@gmail.com

ABSTRACT

The tapping and extraction of gum was carried out at Khadiya Camp Site, Dungar Dakshin Range, Forest Department, Junagadh with the cooperation of Forest Department, Junagadh. The trees of desired diameter (< 10 cm, 10-20 cm, > 20 cm) have been selected on which an incision was made at predefined tapping (< 40 cm, 40 to 80 cm, > 80 cm) height as per treatment by an axe. The cut was of about 40 cm in width and treated with different concentration of H_2SO_4 (0, 40, 60 %) to find out effect on yield and trace elements. The gum accumulated in width of cut was collected after 25 days once oozing started. The purified gum was analyzed for trace elements like copper, ferrous, manganese and zinc. From the study, it was concluded that the maximum gum yield and trace elements was found from the Acacia tree at the bark diameter should be more than 20 cm and tapping height either more than 80 cm or less than 40 cm from ground level. It was also found that H_2SO_4 treatments gave significant effect on gum yield and trace elements.

KEY WORS: Acacia nilotica, babul, gum, tapping, trace element

INTRODUCTION

The generic name of this plant derived from ακακία (akakia), the name given by early Greek botanist-physician Pedanius Dioscorides (ca. 40-90) to this tree as a medicinal, in his book Materia Medica. This name derived from the Greek word for its characteristic thorns, ακις (akis, thorn). *Acacia Nilotica* is a tree 5 to 20 m high with a dense spherical crown, stems and branches usually dark to black coloured, fissured bark, grey-pinkish slash which exudes a reddish low quality gum. The tree has thin, straight, light and grey spines in axillary pairs, usually in 3 to 12 pairs, 5 to 7.5 cm long in young trees, mature trees commonly without thorns. The leaves are bipinnate, with 3 to 6 pairs of pinnulae and 10 to 30 pairs of leaflets each, tomentose, rachis with a gland at the bottom of the last pair of pinnulae. Flowers in globulous heads 1.2 to 1.5 cm in diameter of a bright golden-yellow colour, set up either axillary or whorly on peduncles 2 to 3 cm long located at the end of the branches. Pods are strongly constricted, hairy, white-grey, thick and softly tomentose. Its seeds number approximately 8000 per kg (database. prota. org/ PROTA. html/ *Acacia Nilotica*_En. htm).

Acacia gum is dried gummy exudate that collects on the surfaces of the branches and the stems of the Acacia trees. At the end of the rainy season, the stems begin to exude the gum. In about fifteen days, it thickens in the furrow down in which it runs. It then hardens on

exposure to the air usually in the form of round or oval tears, about the size of a pigeon's egg but sometimes in vermicular forms, white or red, according to whether the species is a white or red gum tree. Thereafter, it is harvested and marketed as 'Gum Arabic'. There are many kinds of Acacia Gum in commerce. The gum exported from Alexandria, is considered the best and generally used in pharmacy. All the gum yielding Acacia exhibits the same general appearance but differing only in technical characters (Orwa *et al.*, 2009).

Gum Acacia for medicinal purposes should be in roundish 'tears', colourless or pale yellow in color or broken into angular fragments with a glass like and sometimes iridescent fracture. It should be almost entirely soluble in two parts of water, forming a viscid neutral solution (mucilage), which, when evaporated, yields the gum unchanged. It should not yield more than 4 % of ash. There are many kinds of Acacia Gum. Indian Gum is sweeter in taste than that of the other varieties. It is odourless, soluble in water which forms a viscid solution acid to litmus and insipid or bland in taste. It is insoluble in alcohol and ether. It is demulcent and astringent. Free radical scavenging activity of acetone extracts of *Acacia auriculiformis A. cunn*. The bark powder was demonstrated to possess antioxidant, antiseptic and antibacterial power. The gum is aromatic, stimulant and nervine tonic (Orwa *et al.*, 2009).

In the Indian subcontinent, it furnishes the prime important ingredient of the nourishing food used for lactating mothers especially during the first three months of postnatal period. It is used as a binding agent in the preparation of lozenges, pastilles and compressed tablets. Nectar from acacia flowers converted into honey by bees is used in confectionaries. It has antibacterial properties. The ripe seeds have been pressed for cooking oil. Oil distilled from the flowers has been used for flavoring (Anonymous, 1998).

An important benefit of gums and resins is that they generate foreign currency earnings gained through exports. The gums and resins subsector also contributes to the local economy and to rural livelihoods. Women in particular benefit from the processing and retailing of gums and resins. The subsector contributes to the local economy also in terms of employment, income diversification, emergency food supply and direct support of other economic sectors, principally livestock production (Lemenih and Kassa, 2011).

The lack of modern production and processing technology means that gums and resins are collected, cleaned, sorted and graded using traditional, labour intensive processes. Gum and resin products are an important source of income for households in producing areas. In some cases, gums and resins are the only source of household income, whereas in others they function as a safety net (Lemenih and Kassa, 2011).

There are many elements found in acacia gum, but most of them are having very low amount. So, the major available and important four elements were studied and discussed here. The major elements like copper, ferrous, manganese and zinc were analyzed using Atomic Absorption Spectrometer, while the elemental content was determined by XRF Spectrometer.

MATERIALS AND METHODS

Present investigation was conducted at two places. Tapping and extraction of gum was done at Khadiya Camp Site, Dungar Dakshin Range, Forest Department, Junagadh while the analytical part carried out at the Department of Processing and Food Engineering, College of Agricultural Engineering and Technology, Junagadh Agricultural University, Junagadh during the year 2013-2014.

Trees of desired diameter were

selected in the forest area of Khadiya camp site under Department of Forest in the Junagadh district. Due to abundant availability and isolation from the movement of animals and locality, this was beneficial to workout in this region. For different treatment combinations, it was required to have different diametric babul trees. As it was a prime requirement for gum to be oozed out from the tree, for better oozing, tapping was done at different height from the ground level and was taken as a treatment. The tapped portions on desired diameter trees at different heights was sprayed with H_2SO_4 with different concentrations as 0%, 40% and 60% with the view to check out oozing quantity and changes, if occurs, in the quality parameters of the treated babul gum. After tapping and treating with different concentrations of H_2SO_4, the exudation started after about 4 weeks, which was continuously increased up to 25 days. So, after 4 weeks period since exudation of gum starts, the exudated and stitched gum over the surface, was collected and taken in to small glass jars. At the time of collection, the gum was in lump shape from 15 gram to 90 gram each. The exudates gum was with debris of small size soil particles. It was like tears and sparkling in the open field.

The collected raw gum then taken to the Department of Processing and Food Engineering, College of Agricultural Engineering and Technology, JAU, Junagadh for preliminary manual cleaning and shade drying. The drying was carried out only to remove excess liquid form freshly exudation for 3 to 4 days in shade. Then the dried acacia gum was crushed. The crushed gum then liquidified using distilled water. The 10% gum solution was then centrifuged in Table top centrifuge so that small particles settled down. Then the solution was filtered using Whatmann #1 filter paper and kept in glass bottles. Again drying was done followed by crushing in mixture to prepare fine powder for further analysis. The elemental content of gum was determined by using non-destructive technique of EDXRF. Energy dispersive X-ray fluorescence spectrometry (PW4030/45B, MiniPal 4 Panalytical) was used for elemental analysis. The analysis of elemental content was done on XRF Spectrometer. The experiment was carried out in a Factorial Completely Randomized Design with three replications (Panse and Sukhatme, 1985). The details of treatments and variables are mentioned in Table 1.

RESULTS AND DISCUSSION

Copper content

The observations on copper content (ppm) of gum of different treatments are shown in Table 2 & Figure 1. From the observations, it was seen that copper content found higher in the trees with diameter less than 10 cm. While in relation to tapping height from ground level, higher value of copper content was found when the tapping has done at a height less than 40 cm followed by height in between 40 and 80 cm. The concentration of H_2SO_4 showed mixed effect. The copper content of gum found higher in gum collected from treatment without spray of H_2SO_4 over tapped portion and was followed by 60 % concentration

Ferrous content

The observations on ferrous content (ppm) of gum of different treatments are shown in Table 2 & Figure 2. It was observed that ferrous content analyzed higher in the trees with diameter more than 20 cm. For tapping height from ground level, higher value of ferrous content indicated in gum samples of trees tapped at a height more than 80 cm. The concentration of H_2SO_4 gives negative effect, as without spray of H_2SO_4 over tapped portion, the ferrous content of gum was higher followed by 60 and 40 % concentration.

Manganese content

The observations on manganese content (ppm) of gum of different treatments are shown in Table 2 & Figure 3. From the observations, it can be seen that manganese content found higher in the gum samples of trees with diameter more than 20 cm. In respect to tapping height from ground level,

higher value of manganese content found in the samples of trees tapped at a height more than 80 cm. The concentration of H_2SO_4 gives negative effect, as without spray of H_2SO_4 over tapped portion, the manganese content of gum was higher than 60 % and 40 % concentration.

Zinc content

The observations on zinc content (ppm) of gum of different treatments are shown in Table 2 & Figure 4. From the observations on zinc content, it was found that zinc content was higher in the samples of trees with diameter more than 20 cm followed by 10-20 cm. While for tapping height from ground level, higher value of zinc content in the extracted sample was found when obtained from the trees tapped at a height more than 80 cm followed by height in between 40 and 80 cm. The concentration of H_2SO_4 showed mixed effect, as without spray of H_2SO_4 over tapped portion, the zinc content of gum was higher which followed by 60 % concentration.

CONCLISION

From the results obtained on elemental content of gum exudated and its analysis, it was seen that copper content found higher in the trees with diameter less than 10 cm with tapping height from ground level, at a height less than 40 cm followed by height in between 40 and 80 cm and H_2SO_4 concentration showed mixed effect. The ferrous content analyzed higher in the samples of trees with diameter more than 20 cm and tapped at a height more than 80 cm and H_2SO_4 concentration indicated negative effect, while manganese content was found higher in the gum samples of trees with diameter more than 20 cm and tapped at a height more than 80 cm and H_2SO_4 concentration showed negative effect. The zinc content was found higher in the samples of trees with diameter more than 20 cm followed by 10-20 cm. While for tapping height from ground level, higher value of zinc content in the extracted sample was found when obtained from the trees tapped at a height more than 80 cm followed by height in between 40 and 80 cm and H_2SO_4 concentration showed mixed effect. The results on elemental compound indicated that the calcium was the major elemental present in the gum.

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Table 1: Details of treatments.

Sr. No.	Factor	Code	Details
1	**Diameter of tree**	A1	< 10 cm
		A2	10 to 20 cm
		A3	> 20 cm
2	**Tapping height from Ground Level**	B1	< 40 cm
		B2	40 to 80 cm
		B3	> 80 cm
3	**Treating with H_2SO_4**	C1	0 %
		C2	40 %
		C3	60 %

Table 2: Comparative effects of treatment levels on trace elements.

Quality Parameters	Diameter of Bark (cm)			Tapping Height From Ground Level (cm)			Treating with H_2SO_4 (%)		
	< 10	10-20	> 20	< 40	40 to 80	> 80	0	40	60
Copper	H			H	F1		Mixed Effect		
Ferrous			H			H	H	F1	F2
Manganese			H			H	H	F1	F2
Zinc		F1	H			H	H	F1	F2
H= Maximum value				***F1= Value less than H,***			***F2= Value less than F1***		

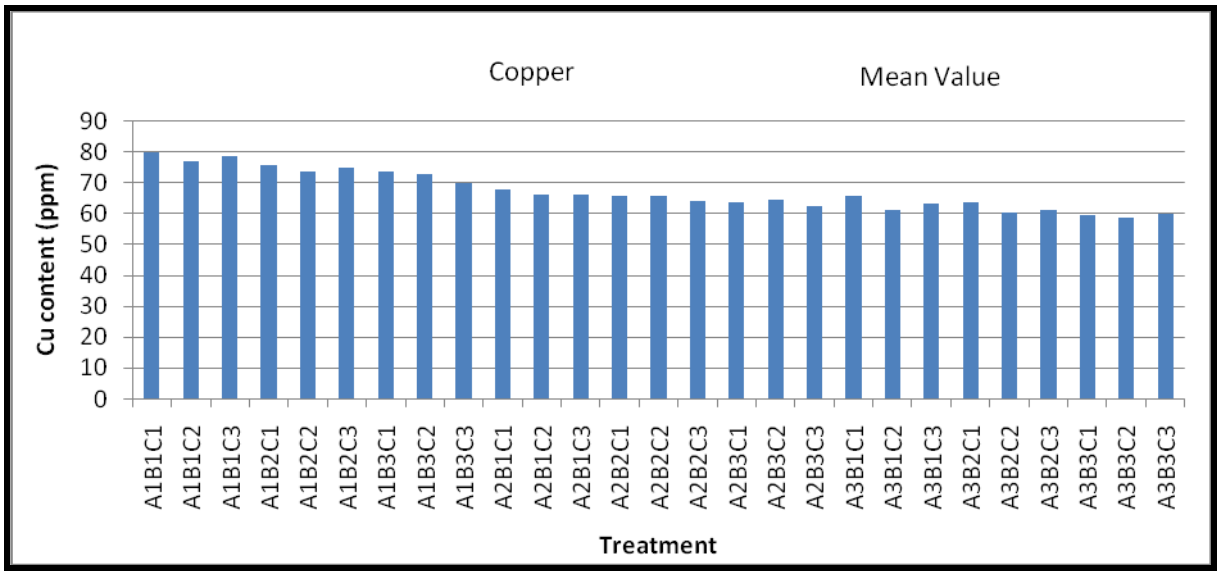

Figure 1: Variation in copper content of gum with treatments

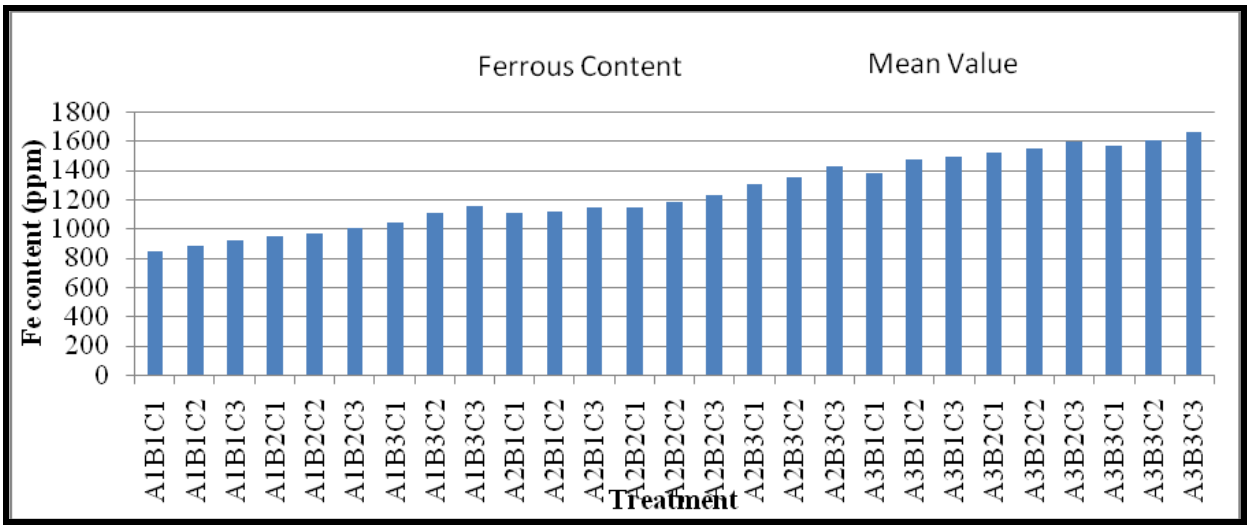

Figure 2: Variation in ferrous content of gum with treatments.

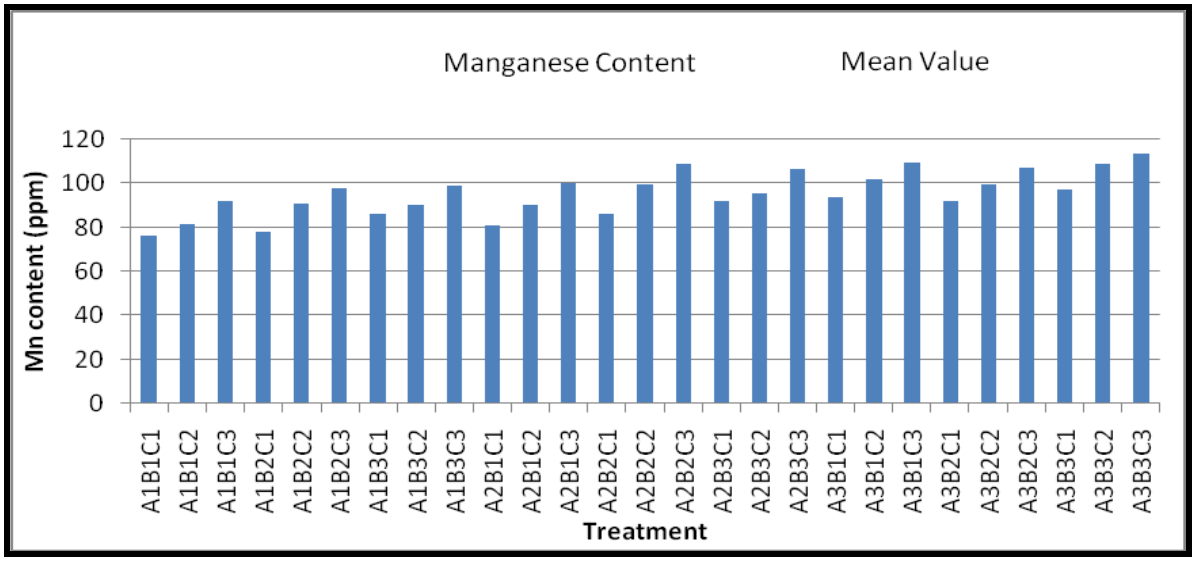

Figure 3: Variation in manganese content of gum with treatments

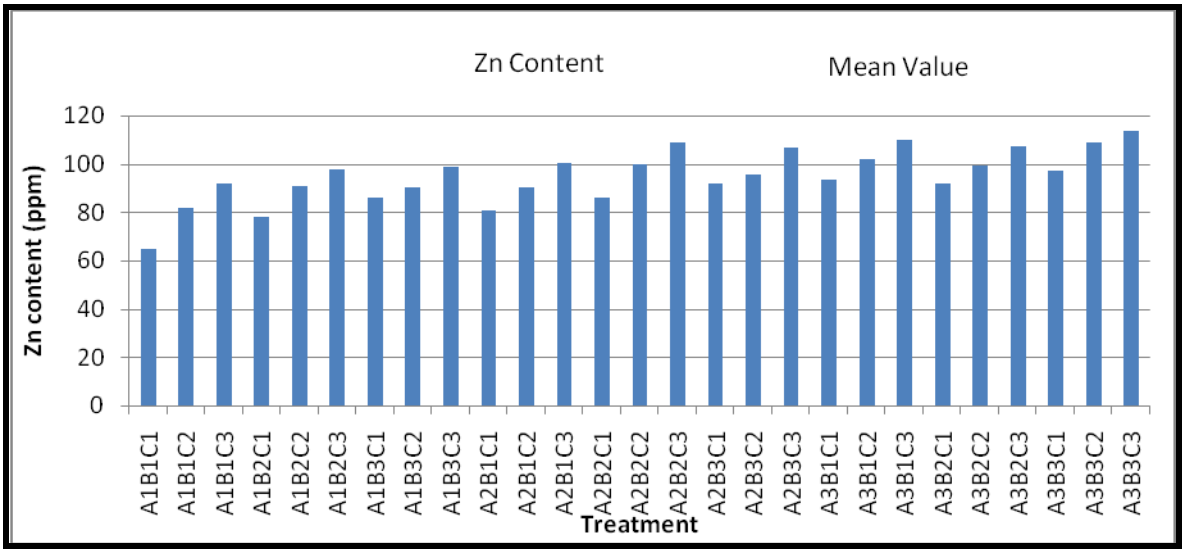

Figure 4: Variation in zinc content of gum with treatments

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