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FTIR analysis by application of organic nutrients in sativa (*Stevia rebaudiana* Bert.)

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Abstract
FTIR analysis Infra-Red spectrum in mid infra-red region (600 to3000/cm^{-1}) was used for treatments of application of organic nutrients (Neem Cake, Bone Meal and Vermicompost) found that various functional groups present in stevia. The functional groups of biomolecules were found that amines, alcohols, nitro compound, alkenes, ethers, esters, carboxylic acid, ketenes and aldehydes. FTIR the existence of various characteristics in stevia by application of organic nutrients was better improvement of bimolecular present in stevia leaves.

Keywords: Stevia, FTIR, organic nutrient

Introduction
Stevia (*Stevia rebaudiana* Bert.) is a perennial herb, having chromosome number 2n=22 belong to the family asteraceae. It is native to the subtropical regions of North and South America. Stevia is also known as "Sweet herb of Paraguay" or "sugar leaf" in India. Stevioside is popularity natural sweetener isolated from the leaves of *Stevia rebaudiana* and it is up to 300 times sweeter than sucrose. Individual tissues of Stevia appear to differ significantly in the stevioside content declining in order: leaves > shoots > roots > flowers. Stevia contains many nutrients like calcium, phosphorus, zinc, protein, magnesium, riboflavin, miocene, selenium and chromium. It is used as a household sweetener in many of the home made recipes. Stevia is available in many forms, the fresh leaves being the least sweet and the extracted from the sweetest. Stevia is planted for five years and the returns also come early and are high compared to the other traditional crops.

Material and Methods
The experiment was laid out during the Rabi season of 2012-13 at the main experimental station, School for bioscience and biotechnology of Department of Applied Plant Science Horticulture Babasaheb Bhimrao Ambedkar University, Lucknow (U.P). Geographically this area falls under humid sub- tropical climate. The planting materials one variety of stevia i.e. Meethi was selected for the present study and obtained from CENTRAL INSTITUTE OF MEDICINAL AND AROMATIC PLANTS, (Lucknow). The treatment was comprised of three organic nutrients i.e. Neem Cake, Bone Meal and Vermicompost. Application of organic nutrients F. Y. M. - 5 Kg/m^2, Vermicompost- 250 g/plotm^2, Neem cake- 120g/plotm^2, Bone Meal- 100g/plotm^2 These organic nutrients were applied as per the treatment.

The observed data were tabulated and analyzed statistically using analysis of variance (ANOVA) by the method of (Panse and Sukhateme 1967) [1]. The statistical origin followed for the experiment was randomized block design with 10 treatments and 3 replication.

Results and Discussion
In present investigation FTIR of stevia in presented (Fig.1) treatment (T$_2$) showed that various bio-molecules were present amines, alkenes, nitro compound C-H, -N-H-NO$_2$ wavelength between at (600 to 3700 cm^{-1}). whereas (500 to 3700 cm^{-1}) spectrum were found under the treatment (T$_3$) of (Fig.2) amines, alkenes, alcohols, esters, ethers and also nitro compound are present (Table 2). While data pertaining to bio molecules of stevia were showed in various treatments found that similar to amines, alkenes, ester, ethers, and nitro compound at wavelength ranges at (500-3700, 600-3000, 600-3700) the bonding structure responsible for the presence of alkyl groups, amines, alkenes, ethers esters, carboxylic acid ketenes and,

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aldehydes nitro compound. The maximum functional groups (Table 3) were found under treatment T_4 (vermicompost +neem cake 75:25) followed by under treatment T_9 (neem cake +bone meal 50:50) (Table 4).

The result of functional groups analysis using FTIR revealed the existence of various characteristics in stevia which proved that application of organic nutrients was better improvement of bimolecular present in stevia leaves. The improvement by the application of organic and bio fertilizers was also reported by Patel *et. al.* (2011) [2] in medicinal crops.

Conclusion
In this present study, it may be concluded that the application of vermicompost and bone meal at (75:25) was proved to be the best for improving the quality in terms of effective biomolecules (amines, alcohols, nitro compound, alkenes, ethers, esters, carboxylic acid, ketenes and aldehydes) of stevia cv. Meethi.
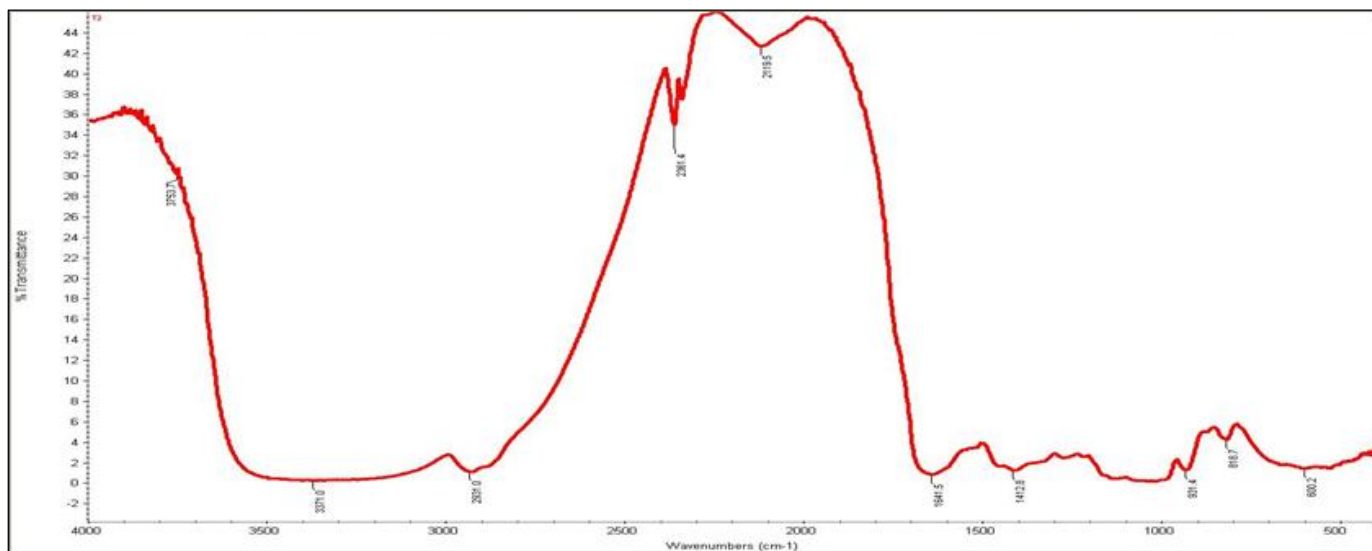

Fig 1: FT-IR for Effect of organic nutrition on growth, yield and quality of stevia (T_2)

Table 1: characteristics infrared absorption regions

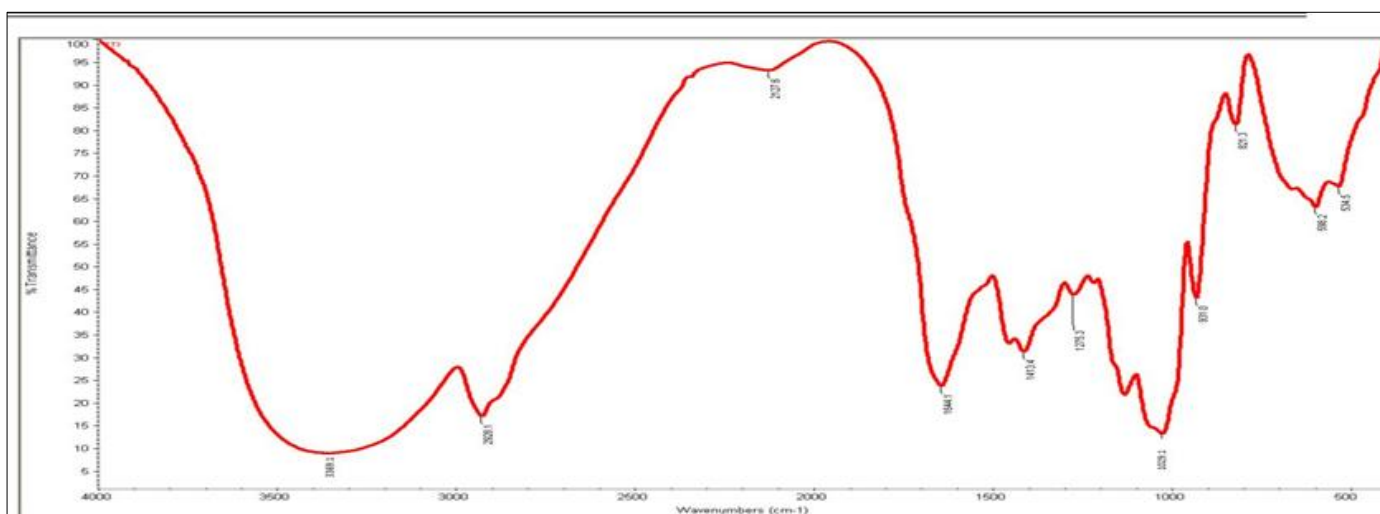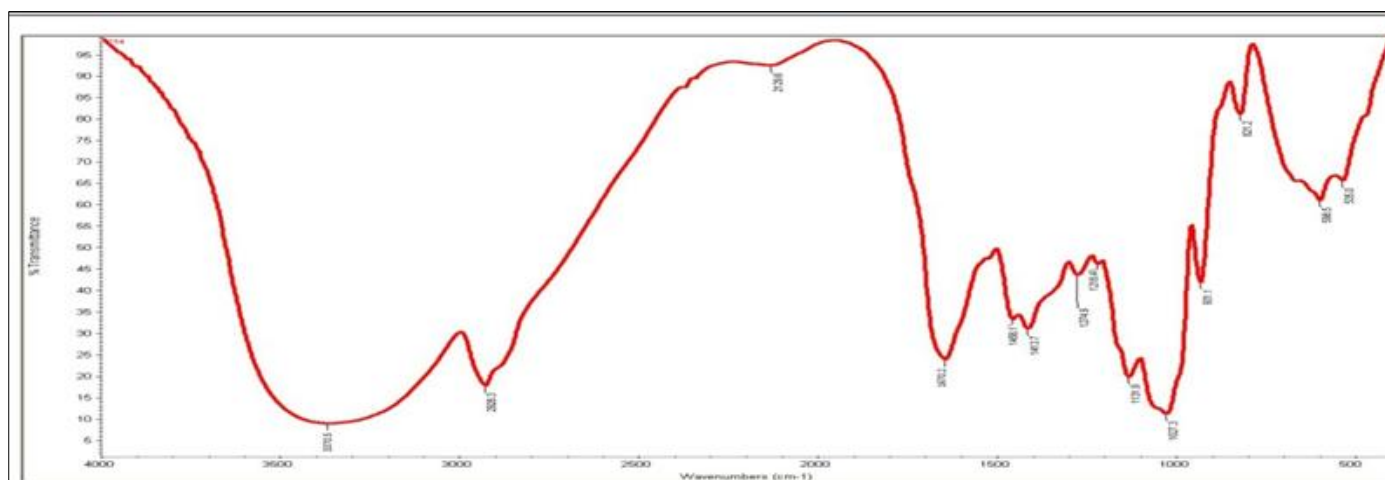| Wavelength(in μm)	Frequency(in cm^{-1})	Bond	Type of compound
3753.7	3000-3700	N-H	Amines
3371.0	3300-3500	N-H	Amines
2931.0	2850-2960	C-H	Alkenes
2119.5	2100-2660	C=C-	Alkenes
1641.5	1620-1680	>C=C<	Alkenes
1412.8	1330-1560	-NO$_2$	Nitro
931.4	600-1500	-C-C-	Alkenes
818.7	600-1500	-C-C-	Alkenes
600.2	600-1500	-C-C-	Alkenes

Fig 2: FT-IR for Effect of organic nutrition on growth, yield and quality of stevia (T_3)

Table 2: Characteristics infrared absorption regions

Wavelength(in µm	Frequency(incm-1)	Bond	Type of compound
3369.1	3000-3700	N-H	Amines
2928.1	2500-3000	-O-H	Alcohols
2127.6	2100-2660	C=C-	Alkynes
1644.1	1620-1680	>C=C<	Alkenes
1413.4	1330-1560	-NO$_2$	Nitro
1275.3	1180-1360	-C-N-	Amines
1029.1	1000-1300	-C-O-	Alcohols, Ethers
931.0	600-1500	-C-C-	Alkenes
821.3	600-1500	-C-C-	Alkenes
598.2	500-600	C-Br	Alkenes
534.5	500-600	C-Br	Alkenes

Fig 3: FT-IR for Effect of organic nutrients on growth yield and quality of stevia (T$_4$)

Table 3: Characteristics infrared absorption regions

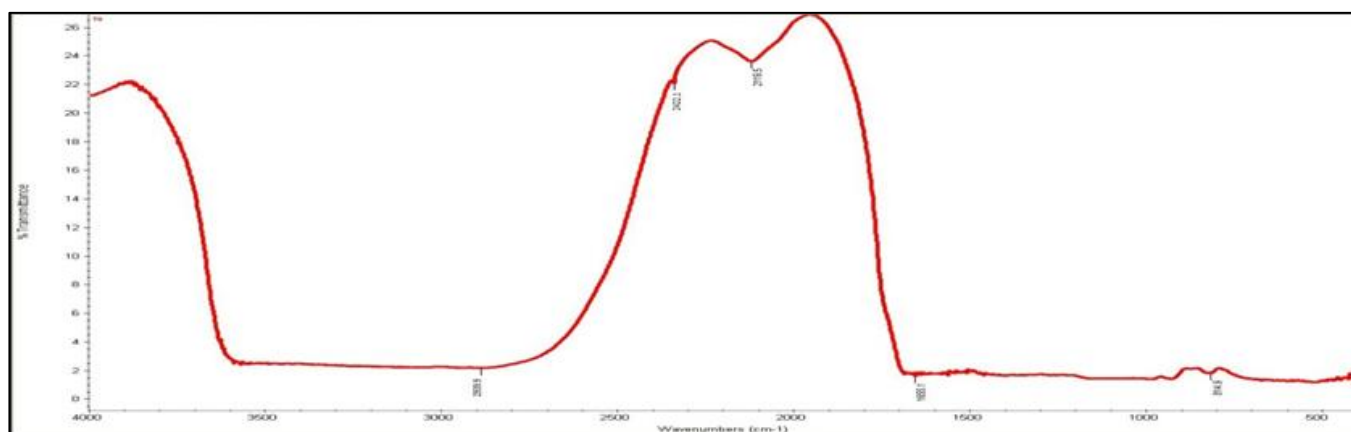| Wavelength(in µm)	Frequency (cm^{-1})	Bond	Type of compound
3370.5	3000-3700	N-H	Amines
2928.3	2850-2960	N-H	Alkenes
1670.2	1620-1680	C-H	Alkenes
1458.1	1330-1540	-NO$_2$	Nitro
1413.7	1330-1540	-NO$_2$	Nitro
1274.9	1180-1360	-C-N-	Amines
1218.4	1180-1360	-C-N-	Amines
1131.9	1000-1300	-C-O-	Alcohols, Ethers
1027.3	1000-1300	-C-O-	Alcohols, Ethers
931.1	600-1500	C-C-	Alkenes
821.2	600-1500	C-C-	Alkenes
598.5	500-600	C-Br	Alkenes
535.0	500-600	C-Br	Alkenes

Fig 4: FT-IR for Effect of organic nutrients on growth yield and quality of stevia (T$_9$)

Table 4: Characteristics infrared absorption regions

Wavelength(in μm)	Frequency(in cm^{-1})	Bond	Type of compound
2939.9	2500-3000	-O-H	Alcohols
2422.1	2500-3000	-O-H	Alcohols
2119.5	2100-2660	-C≡C-	Alkynes
1655.1	1620-1680	>C=C>	Alkenes
814.9	600-1500	>C=C>	Alkenes

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