COMPARISON OF B-CAROTENE AND IRON CONTENT OF VEGETABLES ULTIVATED IN BIRBHUM DISTRICT BY USING ORGANIC FERTILIZER AND UREA- BASED FERTILIZER

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Abstract: For the purpose of our work we selected Adivasi village (santal) near Shantiniketan in Birbhum district, where, organic and urea based fertilizers are used in two separate fields for cultivation of vegetables. Ammonium nitrates (NH_4-N) of both organic and urea-based fertilizers were estimated. We also compared β-carotene content of carrot colorimetrically and Iron content of spinach by using Wong's method. All the processes were performed twice for each sample. From the data we can conclude that-

- Ammonium nitrate content of compost was less in organic fertilizer than urea-based fertilizer.
- In general, the β-carotene content of carrot was found more but iron content of spinach was less in vegetables cultivated by using organic fertilizers than urea-based fertilizers.

Key words: Organic and Urea-based fertilizers, vegetables (carrot, spinach), β-carotene, Iron, Nessler's method, Wong's method.

Introduction: Fertilizer is any organic or inorganic material of natural or synthetic origin (other than liming materials) that is added to a soil to supply one or more plant nutrients essential to the growth of plants (Fertilizer Manual, 1998). Fertilizers are broadly divided into organic fertilizers (composed of enriched organic matter—plant or animal), and inorganic fertilizers (composed of synthetic chemicals and/or minerals).

Inorganic fertilizer

A chemical fertilizer is known as inorganic fertilizer when its constituents are originated through synthetic means making them non- degradable. Inorganic fertilizer is often synthesized using the Haber-Bosch process, which produces ammonia as the end product. The types of inorganic fertilizers are - nitrate-containing fertilizers, phosphoric acid fertilizers and potassium fertilizers.

One of the problems with inorganic fertilizer is trace mineral depletion. Many inorganic fertilizers may not replace trace mineral elements in the soil which become gradually depleted by crops. In Western Australia deficiencies of zinc, copper, manganese, iron and molybdenum were identified as limiting the growth of broad-acre crops and pastures in the 1940s and 1950s. Soils in Western Australia are very old, highly weathered and deficient in many of the major nutrients and trace elements. Application of inorganic fertilizers even at balanced amount did not sustain the soil fertility and productivity under continuous cropping **(Kumpawat, 2004)**. The impact of such high dose of fertilizers on growth and yield of tea was well documented by many authors **(Chaudhury et al., 1983)**.

Organic fertilizer

Organic fertilizers are naturally occurring fertilizers (e.g. compost, manure). Naturally occurring organic fertilizers include manure, slurry, worm castings, peat, seaweed, humic acid, and guano. Sewage, sludge used in organic agricultural operations in the U.S. has been extremely limited and rare due to USDA prohibition of the practice (due to toxic metal accumulation, among other factors) **(Heinrich Dittmar et.al, 2009)**.

Processed organic fertilizers include compost, bloodmeal, bone meal, humic acid, amino acids, and seaweed extracts. Other examples are natural enzyme-digested proteins, fish meal, and feather meal. Decomposing crop residue (green manure) from prior years is another source of fertility.

History of organic farming reveals that Organic farming (of many particular kinds in different eras and places) was the original type of agriculture, and has been practiced for thousands of years. The three main sources of organic fertilizers are as follows – Animal (Example:- Animal-sourced and human urea are suitable for application organic agriculture, while pure synthetic forms of urea are not) (Gowariker, 2009; Neves et.al, 2010), Plant (Example:-

Leguminous cover crops) and Mineral (Example:- Mined powdered limestone)

Organic fertilizers also re-emphasize the role of humus and other organic components of soil, which are believed to play several important roles, such as, mobilizing existing soil nutrients, so that good growth is achieved with lower nutrient densities while wasting less, releasing nutrients at a slower, more consistent rate, helping to avoid a boom-and-bust pattern, helping to retain soil moisture, reducing the stress due to temporary moisture stress,

improving the soil structure, helping to prevent topsoil erosion (responsible for desertification and the Dust bowl). Organic fertilizers also have the advantage of avoiding certain problems associated with the regular heavy use of artificial fertilizers. The problems are like, the necessity of reapplying artificial fertilizers regularly (and perhaps in increasing quantities) to maintain fertility, extensive runoff of soluble nitrogen and phosphorous leading to eutrophication of bodies of water (which causes fish kills) **(Mark Schonbeck, 2004)**, costs are lower for fertilizer, if they are locally available.

For the purpose of our research work we selected the Adivasi village (Santal) near Shantiniketan in Birbhum district(23.6776° N, 87.6852° E). The people of this area use both urea based and organic fertilizer for cultivating the vegetables. Two vegetables which we selected were Carrot(*Daucus carota* subsp. *sativus*) and Spinach (*Spinacia oleracea).*

Composition of Urea based fertilizer

- Urea(500gm)
- Khol(500gm)
- gadasar(made from household leftovers)
- detergent water(25gm detergent/2liter)
- insecticide -Somidon

Composition of Organic fertilizer

- gadasar (made from household leftovers)
- cow dung
- pond mud('pank')
- liquid fertilizer, ('subakhol , seem pata/madar pata/gobor-1 mug)
- insecticides- neem solution(250 gm neem leaves/L)

The main objective of the work is- to assess the variation in micronutrient(β-carotene, Iron) contents among the vegetables (spinach, carrot) grown separately by using organic and inorganic fertilizers.

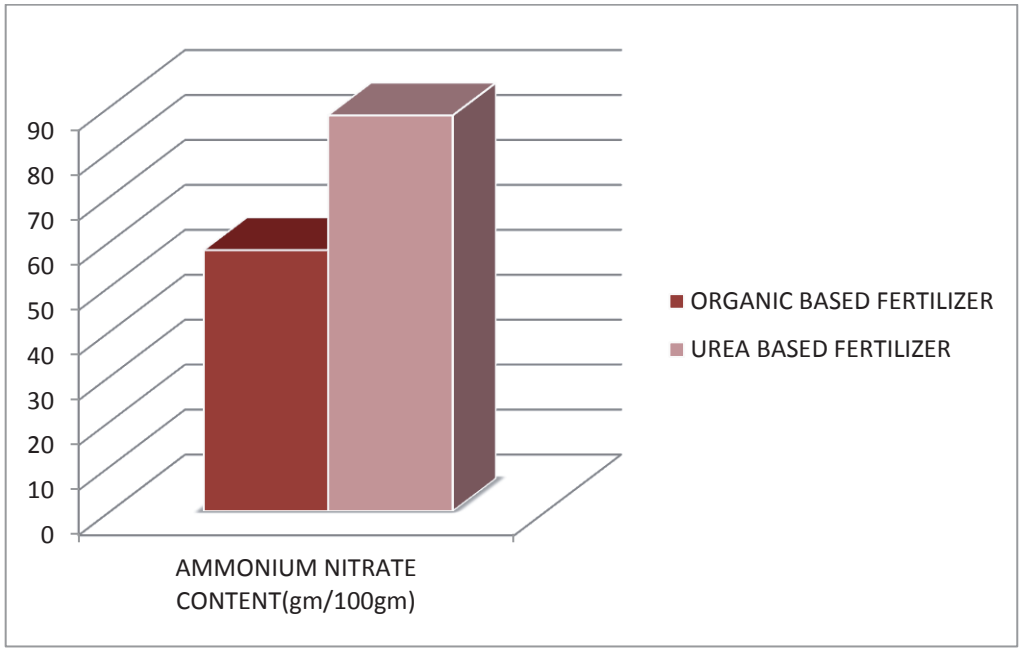
Methods:

The methods used were as follows:

- Ammoniacal nitrogen (NH_4-N) content of organic & inorganic fertilizers were estimated by Nessler's method. **(Leonard R H., 1963)**
- β-carotene content of carrot cultivated with both organic and inorganic fertilizers were evaluated. **(Raghuramulu N et.al, 2003)**
- To estimate the iron content of spinach cultivated with both organic and inorganic fertilizers at first ash solution was prepared **(Raghuramulu N. et.al, 2003)** by the samples then iron was determined by Wong's method. **(Wong, 1928)**

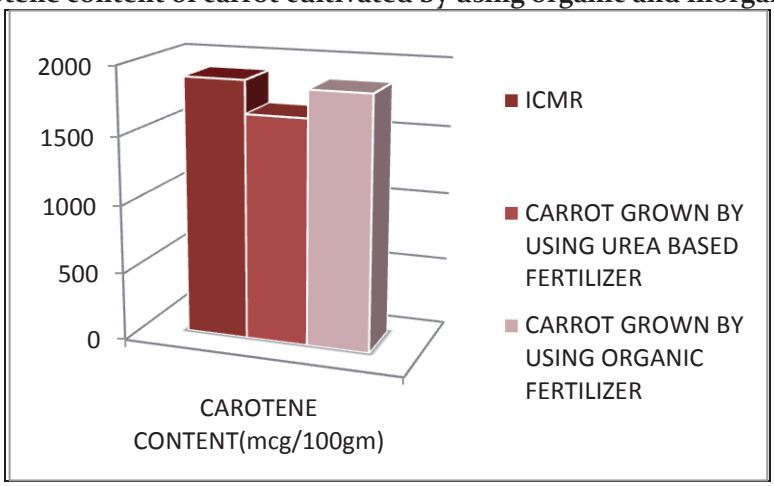
Result:

FIG-1 : Ammoniacal nitrogen (NH_4-N) content of organic and inorganic fertilizers



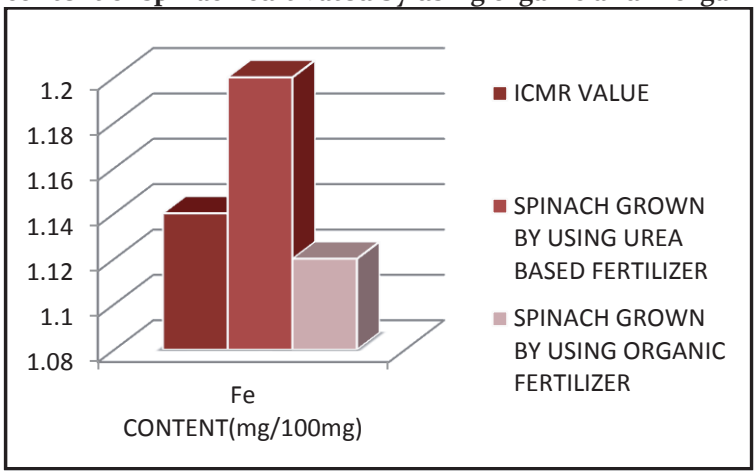
Organic based fertilizer contains **58gm** of ammonium nitrate per 100gm and urea based fertilizer contains **88gm** of ammonium nitrate per 100gm.

FIG-2 : β-carotene content of carrot cultivated by using organic and inorganic fertilizers



Concentration of β-carotene content of carrot cultivated by using organic fertilizer was found (1.85 X 1000=1850mcg/100gm) **1850mcg/100gm** and that of inorganic fertilizer was found (1.65 X 1000=1650mcg/100g) **1650mcg/100gm**.

FIG-3 : Iron content of spinach cultivated by using organic and inorganic fertilizers



Concentration of Fe content of spinach cultivated by using organic fertilizer was found **1.12mg/100gm** and that of inorganic fertilizer was found **1.2mg/100gm**.

Note: If use of reagent containing traces of Fe cannot be avoided, it should be seen that the final solution of standards and test contain identical quantities of these reagents. Potassium thiocyanate should be added just before taking the reading.

Discussion: We analyzed ammonium nitrate content of both organic and urea based compost. It was observed that-organic fertilizer contains 58gm of ammonium nitrate/100gm and urea based fertilizer contains 88gm of ammonium nitrate/100gm. Therefore, ammonium nitrate content of organic compost was less than urea based fertilizer but literature survey showed that biofertilisers fix atmospheric nitrogen in the soil and root nodules of legume crops and makes them available to the plants. **(Roychowdhury et al, 2014)**

We analyzed β-carotene content of carrot. It was observed that- carrot cultivated by using organic fertilizer contains 1850mcg of β-carotene/100gm whereas carrot cultivated by using urea based fertilizer contains 1650mcg of β-carotene/100gm. Therefore, β-carotene content of carrot was found more in vegetables cultivated by using organic compost than urea based fertilizer.

We analyzed Iron content of spinach. It was observed that- spinach cultivated by using organic fertilizer contains 1.12mg of Fe/100gm.On the other hand spinach cultivated by using urea based fertilizer contains 1.2mg of Fe/100gm. Therefore, iron content of spinach was found slightly less in vegetables cultivated by using organic compost than urea based fertilizer.

Although the nitrogen and iron content of above mentioned vegetables grown by using urea–based fertilizers were high, but literature survey showed

that the availability of nitrogen and iron were more in vegetables grown by using organic fertilizers than vegetables grown by using urea-based fertilizers(**Artur Granstedt and Lars Kjellenberg, 1997).**

Conclusion: From above discussion, we can conclude that the use of organic fertilizers is beneficial as well as economically feasible & hazard free as these are environment friendly and are helping in having sustainable agricultural practice.

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