Effect of Nano and bio fertilizer on production of bioactive compounds of *Solidago canadensis* L.

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Abstract

The experiment was conducted to assess the effect of different concentrations of Nano fertilizer at three concentrations 0, 1 and 2 gm./L, and the bio fertilizer at two concentrations 0 and 20 gm./L and their combinations on production of Bioactive compound of *Solidago canadensis* L. (goldenrods), that planted in pots. After ending experiment, the active compounds in alcohol extract of shoot were detected by Gas Chromatography-Mass Spectrometry (GC-Mass). The results show that the experimental treatment effect alterations in all detected bioactive compounds. GC-Mass analysis shows quantitative and qualitative variations of bioactive compound of alcohol extract from shoot of goldenrods, where shoot content of active compounds many of the most important bioactive compounds (Figure1) Chemical description of extract has been conducted out using gas chromatography and mass spectrometry (GC-Mass). seventy identified compound in *S. canadensis* of total compounds in the fundamental compounds were identified as medical activity the results show increase the present of **Alpha.-Amyrin** after treatment by 2 gm./L Nano fertilizer without Bio fertilizer so that, The **Kolavenol** show increase by treatment 20 gm. /L Bio fertilizer without Nano fertilizer, **Propanoic acid** increase by treatment 1 gm./L Nano fertilizer and 20 gm. /L Bio fertilizer, **Copaene** show increase by all treatment except with 2 gm./L Nano fertilizer and 20 gm. /L Bio fertilizer ,while **Hexadecanoic acid** show increase by all treatments (Figure2 -7).

Key wards : goldenrods, *Solidago Canadensis*, Bioactive constituents, GC-MS, nanofertilizer and biofertilizer
Introduction

Medicinal plants play an essential role in the progress of human civilizations, as medicinal plants are a great resource for traditional medicines many modern medicines are produced. Medicinal plants have been used for thousands of years to treat health disorders and preserve current food epidemic diseases. This is the secondary metabolism products produced by plants responsible for the biological properties of plant species that operate around the world (Dar, Shahnawaz and Qazi 2017) Solidago canadensis L belongs to Asteraceae family, a medicinal plant that has been widely used in traditional medicine around the world for several hundreds of years (Suleymanova, Nesterova and Matyushin 2019) It has been used in European botanical therapy for 700 years to treat chronic nephritis, cystitis, Urolithiasis and Rheumatism, and as an anti-inflammatory drug. (Apati 2003) And also it has the characteristics of anti-spasm Spasmolytic diuretic (Apati 2003). It also has antioxidative activity and is also used for other diseases such as Arthritis, Eczema and other skin disorders, Antibacterial, Antitussive, Analgesic, Spasmolytic, Sedative and Hypotensive (Kołodziej, Kowalski and Kędzia 2011) It is also used medically to treat diarrhea, Fever, and Snakebites (Moerman 1998). Since Nano materials can act as chemical stimuli for defense in plants that are often accompanied by the production of various secondary metabolites (Hatami, Naghdi Badi and Ghorbanpour 2019). In recent years, many researchers have studied the role of Nano materials as a catalyst for secondary metabolism (Yarizade and Hosseini 2015). It possesses great potentials applied as new effective Abiotic elicitors in plant biotechnology to stimulate the biosynthesis of secondary metabolism products (Fakruddin, Hossain and Afroz 2012). In addition, bio-fertilizers are also applied as inducers to improve the synthesis of secondary metabolites in medicinal plants (Patel and Krishnamurthy 2013). They include microorganisms, when applied plant surfaces or soil, colonizing the root or inner part of the plant and promoting growth by rising the availability of the primary nutrients of the plant. Nutrients are added through the natural processes of phosphorus dissolution and nitrogen fixation, and stimulating plant growth through the synthesis of growth-enhancing substances (Kapoor, Pandit and Ametha 2015). Therefore, it is important to use Nano and bio fertilizers to increase the production of active substances in the plant, because cultivation in a habitat other than its original habitat, as the environmental conditions and the soil are completely different and may not be appropriate for the medicinal plant growth. Therefore, the study aims to know the effect of Nano and bio fertilizer on production of active ingredient of plant that measured by G.C. Mass.

Materials and methods

Experiment was performed in College of Science, Biology Department, Al-Qadisiyah University, which inclusive planting of goldenrods in 18 plastic pots (plant per pot) on 2/10/2019. Treatments were carried out on 2/11/2019, as Nano fertilizer
was sprayed on the shoot the complete at three concentrations 0, 2 and 4 gm/L , while bio fertilizer was added on soil at two concentrations 0 and 20 gm./L. The addition of two treatments was repeated after one month.

After ending the experiment (01/5/2020) , bio active compounds of each plant were detected by alcohol extrac of shoot of goldenrods according to the method of (Deepa 2012), by GC-MS technique (Manufacturer: Agilent 5977 A MSD , USA).

Results and Discussions

The results show that the treatment effect a variations in all detected bioactive compound (Table 1). GC-Mass analysis shows qualitative and quantitative variation of bioactive compounds of alcohol extract from shoot of goldenrods, where shoot content of active compounds many of the most important bioactive substance (Figure 2-7).

Table 1 : Relative area of bioactive compound of alcohol extract from shoot of goldenrods (Solidago canadensis L.) from different combination treatments of Nano fertilizer and Bio fertilizer.

| Bioactive constituents | RT  | 0gm/L | 1gm/L | 2gm/L |
|------------------------|-----|-------|-------|-------|
| Nano fertilizer        |     | 0gm/L | 20gm/L| 0gm/L | 20gm/L| 0gm/L | 20gm/L|
|                        |     |       |       |       |       |       |       |
| Bio fertilizer         |     |       |       |       |       |       |       |
| Beta.-cpaene           | 16.093 | 0.16 | 0.96 | 19.27 | 21.68 | 1.22 | -----|
| 1)R,7S,E)-7-Isopropyl-4,10-dimethy | 19.310 | 6.17 | 6.30 | 2.22 | 2.78 | 3.64 | 4.57|
| Neophytadiene 2-(2-Ethyl-1,3-dimethyl- | 20.865 | 1.37 | 0.74 | 0.85 | 0.72 | 1.43 | 1.57|
| Hexadecanoic acid     | 22.121 | 0.16 | 0.59 | 0.95 | 0.68 | 0.66 | 1.01|
| Stigmasta-7,16-dien-3-ol(Cholan-24-oic acid) | 34.197 | 9.44 | 9.04 | 3.50 | 1.50 | 8.04 | 13.36|
| Benzene, 1-t-butyl-2,3-dichloro- | 25.962 | 0.62 | ------ | 0.58 | 0.55 | 0.97 | 1.27|
| Kolavenol             | 25.017 | 2.69 | 4.76 | 0.42 | ------ | 1.74 | 1.66|
| Ethanone, 1-(2-ydroxy-5-methylphenyl | 14.659 | 3.01 | 1.55 | ------ | ------ | 1.90 | 1.13|
| Benzene, 1-t-butyl-2,3-dichloro- | 25.962 | 0.62 | ------ | 0.58 | 0.55 | 0.97 | 1.27|
| 6-Isopropenyl-4,8a-dimethy | 18.923 | 1.20 | 1.94 | ------ | ------ | 3.64 | 1.73|
| alpha.-Amyrin         | 35.384 | 2.72 | ------ | ------ | ------ | 3.07 | 2.43|
| 1H-Pyrrole, 1-(3-bromopropyl)- | 32.293 | 7.58 | ------ | ------ | 0.52 | 3.35 | 4.84|
| Squalene              | 29.105 | ------ | 0.61 | 1.92 | 2.68 | 2.50 | 1.61|
Chemical description of extract has been conducted out using GC-Mass. seventy identified components (Table 2) (Figure 1) in S. canadensis of total compounds in the essential compounds were explained as medical activity the results show increase the present of alpha.-Amyrin after treatment by 2 gm./L Nano fertilizer without Bio fertilizer and treatment by 1 gm./L Nano fertilizer without Bio fertilizer so that , The Kolavenol show increase by treatment 20 gm. /L Bio fertilizer without Nano fertilizer, propanoic acid increase by treatment 1 gm./L .

![Figure 1](Image)

**Figure 1** Number of bioactive constituents in shoot depend on deferent treatment concentration .

| Compound     | A1B1 | A1B2 | A2B1 | A2B2 | A1B3 | A2B3 |
|--------------|------|------|------|------|------|------|
| Succinic acid| 22.354|------|------|------|------|------|
| Phytol       | 23.504| 2.58 | 5.18 | 3.43 | 1.77 | 3.24 |
| propanoic acid| 23.993| 0.32 | 3.75 | 4.42 |------| 0.55 |

Table 2: Explain deferent treatment concentration labeling.

Nanofertilizer and treatment by 20 gm./L Bio fertilizer and **copaene** show increase by all treatment except with 2 gm./L Nano fertilizer and 20 gm./L Bio fertilizer while **Hexadecanoic acid** show increase by all treatment. **Phytol** show increase by treatment 20 gm./L Bio fertilizer without Nano fertilizer and treatment by 1 gm./L Nano fertilizer without Bio
fertilizer, 2 gm./L Nano fertilizer without Bio fertilizer. The results also showed new compounds that did not appear in control treatments.

The results indicate that the treatment 20 gm./L Bio fertilizer without Nano fertilizer increase of compounds (copaene, \( R,7S,E \)-7-Isopropyl-4,10-dimethy, Hexadecanoic acid, Kolavenol, 6-Isopropenyl-4,8a-dimethy) (0.96, 6.30, 0.59, 4.76, 94.1) Respectively. Compared of the control parameters that were recorded (copaene: 0.16, \( R,7S,E \)-7-Isopropyl-4,10-dimethy: 6.17, Hexadecanoic acid: 0.16, Kolavenol: 2.69, 6-Isopropenyl-4,8a-dimethy: 1.20).

Also showed the results of treatment 1 gm./L Nano fertilizer and without Bio fertilizer increase of compounds (copaene, Hexadecanoic acid) (5.68, 0.95) Respectively. Compared of the control parameters that were recorded (copaene: 0.16, Hexadecanoic acid: 0.16).

Also showed the results of treatment 1 gm./L Nano fertilizer and 20 gm./L Bio fertilizer increase of compounds (copaene, Hexadecanoic acid) (4.42, 0.68) Respectively. Compared of the control parameters that were recorded (copaene: 0.16, Hexadecanoic acid: 0.16).

Also showed the results of treatment 2 gm./L Nano fertilizer and without Bio fertilizer increase of compounds (copaene, Neophytadiene 2-(2-Ethyl-1,3-dimethyl)-, Hexadecanoic acid, Benzene, 1-t-butyl-2,3-dichloro-, 6-Isopropenyl-4,8a-dimethy, alpha.-Amyrin, ). (1.22, 1.43, 0.66, 0.97, 3.64, 3.07) Respectively. Compared of the control parameters that were recorded (copaene: 0.16, Neophytadiene 2-(2-Ethyl-1,3-dimethyl-), Hexadecanoic acid: 0.16, Benzene, 1-t-butyl-2,3-dichloro-: 0.62, 6-Isopropenyl-4,8a-dimethy: 1.20, alpha.-Amyrin: 2.72).

fertilizer increase of compounds (Neophytadiene 2-(2-Ethyl-1,3-dimethyl)-, Hexadecanoic acid, Cholan-24-oic acid, Benzene, 1-t-butyl-2,3-dichloro-, 6-Isopropenyl-4,8a-dimethy). (1.57, 1.01, 13.36, 1.27, 1.73) Respectively. Compared of the control parameters that were recorded (Hexadecanoic acid: 0.16, Cholan-24-oic acid: 9.44, Benzene, 1-t-butyl-2,3-dichloro-: 0.62, 6-Isopropenyl-4,8a-dimethy: 1.20).

Alcoholic extract contains a number of compounds with medicinal effectiveness. Like Copaene use as antioxidant (Türkez, Çelik and Toğar 2014). Observed highest values Copaene of these traits were of treatments 1 gm./L Nano fertilizer without Bio fertilizer where a value was recorded (5.68) while the lowest values on 20 gm./L Bio fertilizer without Nano fertilizer where a value was recorded (0.96) compared of the control parameters that were recorded (0.16).

Alpha.-Amyrin as anti-inflammatory activity (Okoye et al. 2014). Observed highest values 2 gm./L Nano fertilizer without Bio fertilizer where a value was recorded (3.07) while the lowest values 2 gm./L Nano fertilizer and 20 gm./L Bio fertilizer where a value was recorded (2.43) compared of the control parameters that were recorded (2.72).

Kolavenol were active against Trypanosoma brucei (Nyasse et al. 2004). Observed highest values 20 gm./L Bio fertilizer without Nano fertilizer where a value...
was recorded (4.76) while the lowest values 1 gm./L Nano fertilizer without Bio fertilizer where a value was recorded (0.42) compared of the control parameters that were recorded (2.69).

**Hexadecanoic acid** use as Anti-oxidant (Tyagi and Agarwal 2017). Observed highest values 2 gm./L Nano fertilizer and 20 gm./L Bio fertilizer a value was recorded (1.01) while the lowest values (0.59) compared of the control parameters that were recorded (0.16).

**Phytol** use as Anti-oxidant , antimicrobial , inflammatory (Islam et al. 2018) . Observed highest values 20 gm./L Bio fertilizer without Nano fertilizer where a value was recorded (5.18) while the lowest values 1 gm./L Nano fertilizer and 20 gm./L Bio fertilizer a value was recorded (1.77) compared of the control parameters that were recorded (2.58).

According to the results in this research, Nano fertilizer and Bio fertilizer treatments effected of Increasing the percentage of compounds and producing new compounds. also, there were differences within the value of secondary metabolites in shoot that treatments by different bio fertilizer . The Synthesis of secondary metabolism in plants are popular rise in response to environmental stresses like as insects and infection by diseases (Bourgaud et al. 2001).

Nano fertilizers are agrochemicals are produced within the size of 100–250 nm, it also reduce elements loss by leaching and emissions and enhance long term and they dissolve in water more effectively. linked by soil microorganisms that controlled releasing of fertilizers may also develop soil health by detraction toxic effects related with increased addition fertilizers. The treatments of Nano fertilizer, even when they do not effect to changes in morphological and increase yield , results increase in metabolites by mechanisms like as reduction of water stress (Kolenčík et al. 2019).

Bio stimulators act as a source of plant development hormone, such as gibberellins, which could affect the activity of plant growth and development. In the case of abiotic stress (Tanaka et al. 2005),(Yaronskaya et al. 2006),(Yaseen and Al-Rekaby 2012). The application of amino acids ameliorate plant growth by rising the concentration of photosynthetic pigments (Al-Rekaby 2018). And it impact processes involved in plant nitrogen metabolism (Iwai et al. 2004).

**Conclusions**

The results data indicate that their treatment has a fundamental role in effect Variations quantity and quality Compared to its various medical Effective substances. With control plants. A mixture of 2 mg /L. Nano fertilizer and 20gm /L Bio fertilizer.
Figure 2
GC-MS analysis of alcohol extract from shoot of *Solidago canadensis* L. from interactions treatment of 0 gm./L Nano fertilizer and 0 gm./L bio fertilizer.

Figure 3
GC-MS analysis of alcohol extract from shoot of *Solidago canadensis* L. from interactions treatment of 2 gm./L Nano fertilizer and 0 gm./L bio fertilizer.
Figure 4
GC-MS analysis of alcohol extract from shoot of *Solidago canadensis* L. from interactions treatment of 2 gm./L Nano fertilizer and 20 gm./L bio fertilizer.

Figure 5
GC-MS analysis of alcohol extract from shoot of *Solidago canadensis* L. from interactions treatment of 0 gm./L Nano fertilizer and 20 gm./L bio fertilizer.
Figure 6
GC-MS analysis of alcohol extract from shoot of Solidago canadensis L. from interactions treatment of 4 gm./L Nano fertilizer and 0 gm./L bio fertilizer.

Figure 7
GC-Mass analysis results of alcohol extract from shoot of Solidago canadensis L. from interactions treatment of 4 gm./L Nano fertilizer and 20 gm./L bio fertilizer.

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