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Comparative study of effect of sugar on yield of different legume plants

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Abstract
This project was to determine the legume plants which grew stronger, healthier, larger, better number of leaves and better yield by the addition of the right amount of sugar through their watering. Plants required some amount of sugar for proper development. We need to evaluate the best sugar concentration for their growth and cultivation. So we have undergone a comparative study of three different legume plants *Vigna radiata*, *Vigna unguiculata* and *Arachishypogaea*. We have done the project with five different concentration Control, 5 grams of sugar per liter of water, 25 grams of sugar per liter of water, 50 grams of sugar per liter of water and 75 grams of sugar per liter of water. And also we have done the Phytochemical analysis of aqueous solution of leaf and seed extract in different sugar concentration plants based on their growth and yield.The seeds were analyzed under FTIR Spectrometer for their quantitative analysis. We believe that plants that receive 50 grams of sugar per liter of water would help the legume plants to grow stronger, healthier, larger, better growth and yield, because they would get the right amount of energy from the sugar.

Keywords: sugar concentration, legume plants, *Vigna radiata*, *Vignaunguiculata*, *Arachishypogaea*, number of leaves, plant height, better growth and yield

Introduction

A Legume plant belongs to the family Fabaceae. When it used as a dry grain, the seed is known as Pulse. Legumes composed of a single carpel. The Legume family consists of plants that produce a pod which contains the seeds inside. Legumes or Pulses are common in diet which are rich in Carbohydrates, Proteins and Minerals. Well-known legumes include beans and it's varieties, peas and it's varieties, peanuts/groundnuts, lentils, lupins, carob, tamarind and clover. Phytochemicals are the chemicals that present naturally in legumes or pulses and other Plant minerals (Alba Tor-Roca *et al*., 2020) [3]. It is more popular for its countless medicinal uses (A. Gayathri *et al*., 2016). They are almost exclusive sources of drugs for majority of the world population. Legumes are used for human consumption, agricultural purpose and soil-enhancing green manure.

Photosynthesis is a process by which the plants produce their food. Plants receive the sunlight and produce carbohydrates, sugars and starches, in which it converts to energy. Logically, if we add sugar in water, we would increase the growth of the plant. Water is one of the most important element, that plant need to survive. Without it, they can't take up nutrients in the soil. Adding sugar water to the plants increases the nutrients available in the soil. We can logically assume that if sugar water is added to a plant, then it is being provided with additional food, and thereby boosting growth as a result (Charles Pearson, 2017) [5].

If your plantsneed quick boost, you should supplement the sucrose by watering them with a sugar water. At best sugar solution it may end with encourage growth in some plants, while at worst sugar solution it may harm the plants (Nicole LeBoeuf-Little, 2017) [8]. Right amount of sugar are actually good for your plants. It easily absorbs into the plant's root and gives your plants an energy boost. This boost occurs throughout the process of Pinocytosis, or cell drinking (Steven White, 2017) [13].

Plants naturally use the photosynthesis process to produce their own food like sugar or glucose. So this sugar solution is converted into energy in the form of ATP. As human beings, intake the sugar in order to provide energy for the metabolic process. Sugar is crucial for the energy releasing process because it helps with synthesizing ATP, both in humans and plants (Adalynn Zhang and Erin He-Prezi). Sugar is important to plant life as it helps cellular respiration and cell growth (Sean Russel, 2010) [11].

So, additional sugar solution being added, should be in right amount for the plants because more amount of sugar can harm the plants. Were the right amount of sugar water in soil will speed up the growth of the stem in plants. So from the different concentration, the plants need right concentration for the effect of the plant in growth and yield.

Materials and Methods

Legume plants required some amount of sugar to grow very well. So we need to evaluate the rear amount of concentration of sugar required by the legume plants for the study. The seeds of *Vigna radiata*, *Vigna unguiculata* and *Arachishypogaea* were bought from the nearby village for the study. So the seeds of three different legume plants were dressed with five different concentrations control, 5 grams of sugar/litre of water, 25 grams of sugar/litre of water, 50 grams of sugar/litre of water, 75 grams of sugar/litre of water. And we should water each plants with 22.5ml per day in each concentration. Phytochemical analysis were done under Dey and Raman method (R.K. Ranjan *et al*., 2013) [10]. FTIR is perhaps the most powerful for identifying the types of Functional groups (Chemical bonds) present in compounds. The wavelength of light absorbed is characteristics of the chemical bond as it can be seen in the annotated spectrum (P. Arockia Sahayaraj *et al*., 2015) [9]. Dried powder of different plant seeds were used for FTIR analysis. The parameters measured were plant height, number of leaves, phytochemical analysis and FTIR peaks with functional groups.

Vigna radiate *Vignaunguiculata* *Arachishypogaea*

Fig 1

Results

Observation chart

Table 1: This table shows the height of Cowpea, Mung bean and Peanut in 5 different concentration

No. of weeks	Height of the plants (cm)														
	Control			5g sugar/litre water			25g sugar/litre water			50g sugar/litre water			75g sugar/litre water		
	Cow pea	Mung bean	Pea nut	Cow pea	Mung bean	Pea nut	Cow pea	Mung bean	Pea nut	Cow pea	Mung bean	Pea nut	Cow pea	Mung bean	Pea nut
1st week	16	15	1.8	17	15.5	2.2	16	16.1	2.1	18	17	3	16.5	16	3.2
2nd week	19	19.3	3.1	20	20.1	3.2	20.5	20.6	3	22.5	21.5	3.5	19.5	19.5	3.3
3rd week	36	40	8	37.4	40.2	8.5	35.8	41.3	8.4	43.5	41.6	8.6	38.5	40.8	8.3
4th week	37	43.6	9	38.3	44	9.8	38	44.3	8.5	45.3	44.8	12	39.7	43.9	9.5

Table 2: This table shows the number of leaves count in Cowpea, Mung bean and Peanut in 5 different concentration

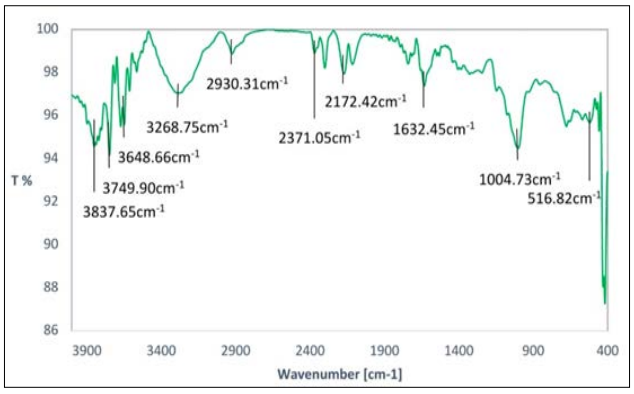
No. of weeks	Number of leaves														
	Control			5g sugar/litre water			25g sugar/litre water			50g sugar/litre water			75g sugar/litre water		
	Cow pea	Mung bean	Pea nut	Cow pea	Mung bean	Pea nut	Cow pea	Mung bean	Pea nut	Cow pea	Mung bean	Pea nut	Cow pea	Mung bean	Pea nut
1st week	12	16	24	14	16	24	10	16	26	14	18	24	12	20	32
2nd week	40	42	28	38	45	28	45	50	30	48	55	28	38	50	36
3rd week	60	68	32	59	80	32	57	70	34	65	75	34	56	75	40
4th week	80	79	304	77	85	300	70	80	292	81	91	388	65	90	352

Phytochemical analysis

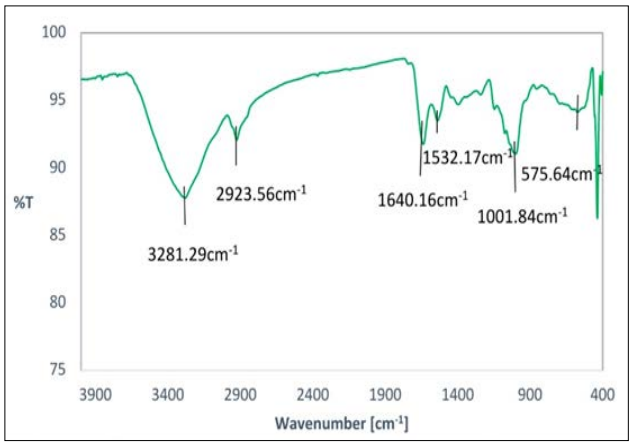
Table 3: This table shows the Phytochemical analysis of Mung bean, Cowpea, Peanut based on their yield

Phytochemicals	Mung bean (50g sugar/litre of water)		Cowpea (Control)		Groundnut (50g sugar/litre of water)	
	Leaf (Aqueous)	Seed (Aqueous)	Leaf (Aqueous)	Seed (Aqueous)	Leaf (Aqueous)	Seed (Aqueous)
Carbohydrate	+	+	+	+	+	+
Protein	+	+	+	+	+	+
Alkaloid	+	+	-	-	+	+
Flavonoid	-	-	+	+	-	-
Phenolic	+	+	+	+	+	+
Tannin	-	-	-	-	-	-
Saponin	+	+	+	+	-	-
Terpenoid	+	+	-	-	+	+

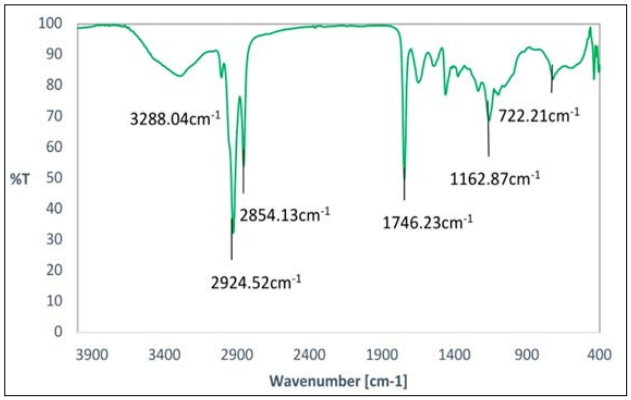
FTIR on three different plant seeds



Graph 1: *Vigna radiata*



Graph 2: *Vigna unguiculata*



Graph 3: Peanut

Discussion

Table:1 represents the height of *Vigna radiata*, *Vignaunguiculata*, *Arachishypogaea* in five different concentrations in which 50g of sugar/litre of water has given the better height compared to other four different concentration in all three legume plants. Table:2 represents the number of leaves count in *Vigna radiata*, *Vignaunguiculata*, *Arachishypogaea* in five different concentrations in which it also given better number of leaves in 50g of sugar/litre of water in all three legume plants.

Table:3 represents the Phytochemical analysis of *Vigna radiata*, *Vignaunguiculata*, *Arachishypogaea* in better yield concentration were Mung bean and Groundnut is analysed with 50g of sugar/litre of water and Cowpea is analysed with control concentration. In the analysis of Phytochemicals in Mung bean Carbohydrate, Protein, Alkaloid, Phenolic, Saponin, Terpenoid are present and Flavonoid, Tannin are absent. In Cowpea Carbohydrate, Protein, Flavonoid, Phenolic, Saponin are present and Alkaloid, Tannin, Terpenoids are absent. In Groundnut Carbohydrate, Protein, Alkaloid, Phenolic, Terpenoids are present and Flavonoid, Tannin, Saponins are absent.

The above graphs, Graph:1 represents the FTIR on *Vigna radiata* seeds which describes the wavelength of highest peaks in FTIR, 3837.65cm^{-1} having the functional group of aromatic, 3749.9cm^{-1} and 3648.66cm^{-1} having the functional group of alcohol, 3268.7cm^{-1} having the functional group of Carboxylic acid and 2930.31cm^{-1} having the functional group of alkane.Graph:2 represents the FTIR on *Vigna unguiculata* seeds which describes the wavelength of highest peaks in FTIR, 3281.29cm^{-1} having the functional group of alcohol, 2923.56cm^{-1}having the functional group of alkane, 1640.16cm^{-1} having the functional group of alkene and 1532.17cm^{-1} having the functional group of aromatic ring. Graph:3 represents the FTIR on *Arachishypogaea* seeds which describes the wavelength of highest peaks in FTIR, 3288.04cm^{-1} having the functional group of carboxylic acid, 2924.52cm^{-1} and 2854.13cm^{-1} having the functional group of alkane, 1746.23cm^{-1} having the functional group of ester and 1646.91cm^{-1} having the functional group of alkene.

In this project, the comparative study shows that the plants watered with 50 grams of sugar/litre of water were the strongest, healthiest, largest and have given better growth and yield. Because compared to *Vigna unguiculata*, the *Vigna radiata* and *Arachishypogaea* are the two legume plants were grown in better yieldwith 50g sugar/litre of water. Were *Vignaunguiculata* is grown in concentration of Control. So, at most concentration with better yield is 50g sugar/litre of water. This was determined by measurement, Phytochemical analysis instrumentation and visual inspection.

Conclusion

In conclusion legume plants dressed with 50 grams of sugar/litre of water had more number of leaves, better plant height, strongest, healthiest, better growth and yield.

Recommendation

It is a significant difference among the treatments, it is therefore recommended that the legume plants should be dressed with 50 grams of sugar/litre of water concentration so as to gives the better growth and yield.

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