Effects, uses and benefits of coffee

INTRODUCTION :

Coffee is one of the most popular beverages in the world and it is the second most traded physical commodity worldwide, ranking second only to petroleum. There are two main types of coffee beans which are Arabica and Robusta. These two types of coffee beans make up over 90% of coffee beans sold worldwide. Arabica typically produce higher quality coffees, while Robusta are more economically favourable for their hardiness to thrive. From the beans, it can be turn out to many types of coffee drinks such as cappuccino, latte, espresso, mocha and others. The taste of the coffee that is simply delightful of course makes it as one of the reasons why people love to drink coffee. In Seremban, Malaysia (my current location), there are so many coffee shops such as Starbucks, Old Town White Coffee, etc.

The fact that why I chose coffee to be my experiment is because there are so many waste coffee being produced every day, whether from kitchen waste or from coffee shops. It is such a waste if the waste coffee is being thrown away just like that. The question in my mind about “ what can I do with these waste coffee” had trigger me to do a research in internet and I found that many people use waste coffee grounds to be as fertilizer and they claim that the waste coffee grounds can stimulate the growth of plants. I admit that this knowledge is something new to me.

Then, I make a further reading about coffee in the internet. It was said that coffee grounds can stimulate the growth of plants is because due to the nutrients that present in coffee grounds such as nitrogen, potassium, calcium etc which are the elements essential to plant growth. Not only that,

coffee grounds also help plants by being a great slug deterrent because the presence of caffeine in coffee gives toxic effect on slugs and thus slugs will avoid eat plants that have coffee solution (high concentration of caffeine can kill the slugs).

Another reason that makes coffee be as a good fertilizer is because the pH of the coffee that is acidic, which is in range between 3. 0 and 5. 0 that can help plants to grow better by reducing the pH of the soil (increase soil acidity) thus it is suitable to use on acid loving plants. Besides that, the presence of coffee grounds in the soil can attract worms to eat them. As we know, the presence of worms plays a vital role in soil and aids in the growth of plants such as help water flow through the soil, break down organic matter, produce castings that act as fertilizer and others.

As been mentioned above, there are several reasons why people said waste coffee grounds are good for plants. But, there are also arguments that said coffee can retard the growth of plants because the presence of caffeine that makes the growth of the plant to slow down and make the plant tend to be small in size. So, it can be that the plants are growing slower because of the caffeine and it also can be a possibility that the benefits of coffee that I stated in paragraph before cause the plants to grow much faster and better. There is no definite answer regarding this.

Thus, there are so many questions in my mind regarding this whether waste coffee grounds can help the plants to grow much better or not, and why. Is it because the nutrients present in the coffee, or the acidity of the coffee, or because coffee can attract worms and deter slugs?

So, this doubt has leaded me to choose this topic to be as my Biology Extended Essay topic in IB programme. I would like to carry out an experiment to study the relationship between waste coffee grounds and its effects on plant. A research question has been constructed which is " How do different concentrations of used coffee grounds which are 0 gram, 2 grams, 4 gram and 6 grams affect the growth of Coleus, Solenostemon scutellarioides sp in term of height, diameter and number of leaves?". To narrow the scope of the study, from the reasons why coffee is said can help to stimulate the growth of plants, I chose to eliminate the factor of slug deterrent and worms attraction by having this experiment conducted in my bedroom (near the window). So, the scope of study is whether the nutrients and acidity in the coffee affect the growth of the plants or not. As stated in the research question, the plant that will be used in my experiment is Solenostemon scutellarioides sp. and the type of coffee to be used is arabica.

The coffee used in this experiment: Coffea arabica

Coffea arabica, also known as mountain coffee or arabica coffee, is a species of coffee from Rubiaceae family and it is native to the countries of Yemen and Ethiopia. Due to its quality, coffea arabica are said to be among the best coffee beans in the world and contains less caffeine compared to some other coffee plants such as robusta and liberica. A high quality coffee should consist of 100% arabica beans in order to produce a good taste and flavour. Thus, for my experiment, I will use waste coffee from McDonald because they use 100% arabica beans in their coffee drinks and plus, the location of McDonald is near to my hostel.

The plant used in this experiment: Coleus, Solenostemon scutellarioides sp.

Locally know as “ ati-ati”, Coleus or scientifically known as Solenostemon scutellarioides sp is a species of perennial and a member of Lamiaceae family. Originally from Southeast Asia and Malaysia, Solenostemon scutellarioides sp is now grown over most of the world. This plant also known as painted leaf, painted nettle and flame nettle. Desired for their colourful foliage, Solenostemon scutellarioides sp has more than 300 cultivars in a huge variety of colours. The leaves of Solenostemon scutellarioides sp can exist in several colours such as green, yellow, red, maroon, pink, purple and almost every colour except for blue. Most leaves have two or more sharply contrasting colours. Solenostemon scutellarioides sp as is used widely in Malaysia as traditional medicine to cure headache, fever, cough etc.

Coleus. (2010). Retrieved August 07, 2010 from Margaret’s Garden: http://margaretsgarden. wordpress. com/2010/07/29/coleus/

Reasons for choosing Solenostemon scutellarioides sp for my experiment:

Solenostemon scutellarioides sp is a beautiful plant, and I can say it is one of my favourite plants.

Solenostemon scutellarioides sp is easy to get (since it is native to Malaysia) and easy to care because it needs low maintenance.

Since Solenostemon scutellarioides sp can grow in partially shaded area where the sunlight is indirect, I can place them in my bedroom for this experiment.

Solenostemon scutellarioides sp can grow fast and also resistant to most diseases and insects.

From my reading in internet, there is no experiment has been done to study the effects of coffee on the growth of Solenostemon scutellarioides sp.

The significance of this experiment:

To find alternative to chemical fertilizers.

To implement 3R (reduce, reuse, recycle) method on organic waste.

To reduce the cost of planting.

Limitations:

Further investigation:

According to statistic that had been announced by Ministry of Housing and Local Government Malaysia, each person in Malaysia produced at least 0. 8 kg of waste every day, and 40% of the waste is organic waste which is from kitchen waste. For my experiment, I just use one of the organic wastes which is coffee to be tested on plants. So, my further investigation in the next time is to use other organic waste such as tea waste, animal bones (chicken, fish), fruit peels (mango, orange), animal exoskeletons (crab, prawn) and others.

HYPOTHESIS :

From my introduction, there are opinions that said coffee grounds can promote the growth of plants. It might be because of the use of used coffee grounds would add nutrients to the soil such as nitrogen, potassium, calcium

and others. Coffee grounds also are said can increase the soil acidity due to the behaviour of the coffee that is acidic. Since Solenostemon scutellarioides sp best grows in slightly acidic or neutral soil, so I will use alkaline soil which pH in range between 7. 5 and 8. 5 so the coffee grounds can reduce the pH of the soil to neutral or slightly acidic soil.

By using this assumption, a hypothesis is constructed which is the higher the concentration of waste coffee use the greater the growth of Solenostemon scutellarioides sp, with my prediction that Solenostemon scutellarioides sp that grow in pots that receive the highest concentration of used coffee grounds will show the most positive growth, meaning that the Solenostemon scutellarioides sp have the greatest increase in term of height, diameter and number of leaves compared to the other Solenostemon scutellarioides sp in the other groups. The reason is because the Solenostemon scutellarioides sp supposedly got the highest nutrients from the coffee grounds which are mainly nitrogen and potassium compared to the other Solenostemon scutellarioides sp in the other groups.

APPARATUS AND MATERIALS :

– 12 small pots (height: 10cm, diameter: 14cm)

– metre ruler

– thread

– pH meter

– 50 cm3 beaker

– 10 litres of black soil

– 12 Coleus stems (Solenostemon scutellarioides sp)

– 2 kg used coffee grounds (coffea arabica)

– water

– spatula

– permanent marker pen

– electronic balance

– spade

VARIABLES :

Independent variable : weight (gram) of used coffee grounds which are 0 gram (no coffee grounds), 2 grams, 4 grams and 6 grams.

Use different concentrations of used coffee grounds to add on to different pots of the Solenostemon scutellarioides sp. The concentrations are manipulated by using different weight of used coffee grounds in the unit of gram.

Dependent variable : the growth of Solenostemon scutellarioides sp

The growth of Solenostemon scutellarioides sp is indicating by the diameter of the stem, height and number of leaves of the Solenostemon scutellarioides sp. Height is measured from the ground to the highest part of the plant. Diameter is measured at the same part of the stem each time

measurement is taken. That part is mark by using a permanent marker pen. Height and diameter are measured in the unit of centimetre by using thread and metre ruler.

Constant variable : for all experiments, these things are need to be constant –

The type of plant used which is Coleus, Solenostemon scutellarioides sp

The volume of water each time the Solenostemon scutellarioides sp is watered which is (30. 0 ± 0. 5) cm3

The time to water the plant which is at morning (8. 00 am) and evening (5. 30 pm)

The type of soil used which is black soil.

The type of coffee ground use which is arabica.

The volume of soil per pot which is (6. 0 ± 0. 5) cm (height) of the pot.

The size of the pot used which height is 10 cm and diameter is 14 cm.

The quantity of Solenostemon scutellarioides sp stem per pot which is one.

The location of the experiment which is at partially shaded place where the plant can get at least 6 hours of sunlight. For this experiment, the place will be in my room.

The duration of the experiment which is 4 weeks.

PARAMETERS :

The following parameters are recorded throughout my experiment –

The height of the Solenostemon scutellarioides sp.

The stem’s diameter of the Solenostemon scutellarioides sp.

The number of leaves of the Solenostemon scutellarioides sp.

The pH of the soil.

PROCEDURE :

Prepare four groups of pots. Each group has three pots. Name the groups as A, B, C and D.

Labelled all the pots according to their group –

Group A – Pot A1, A2 and A3

Group B – Pot B1, B2 and B3

Group C – Pot C1, C2 and C3

Group D – Pot D1, D2 and D3

Measure the pH of the black soil that will be used by using a pH meter. Then fill each pot with the black soil until it reaches a height of 6 cm.

For all pots, put a Solenostemon scutellarioides sp stem into the soil.

Place all the pots at a partially shaded place where the Solenostemon scutellarioides sp can receive at least 6 hours of sunlight. (For this experiment, the place will be in my room)

During week 1, water each of the Solenostemon scutellarioides sp with (30. 0 ± 0. 5) cm3 of water twice a day in the morning at 8. 00 am and at the evening at 5. 30 pm by using a 50cm3 beaker. At the end of week 1, measure the height of Solenostemon scutellarioides sp and diameter (in the unit of centimetre) by using thread and metre ruler.

Starting from week 2, water all the plants as in step 5, but at time 5. 30 pm, add together with the water –

For each pot in:

Group A – Controlled experiment. Add no coffee grounds.

Group B – Add 2 grams of used coffee grounds.

Group C – Add 4 grams of used coffee grounds.

Group D – Add 6 grams of used coffee grounds.

For every week, measure the diameter of the stem, height and number of leaves of the Solenostemon scutellarioides sp in each pot.

Repeat steps 6 and 7 until week 4.

At the end of week 4, measure the pH of the soil in each pot.

Record all the data in the table below.

Note :

* Dry the used coffee ground first before use it to prevent mould from growing on it.

* For each of the Solenostemon scutellarioides sp, mark a point at the part of the stem that is

(2. 0 ± 0. 5) cm above the ground for diameter measurement by using a permanent marker. Every

diameter measurement will be taken at the part of the stem that has been marked.

WEEK 1 :

Group

Pot

Height / cm

(±0. 05)

Diameter / cm

(±0. 05)

Number of leaves

Soil pH

A

A1

A2

A3

B

B1

B2

B3

C

C1

C2

C3

D

D1

D2

D3

WEEK 2 :

Group

Pot

Height / cm

(±0. 1)

Diameter / cm

(±0. 1)

Number of leaves

Soil pH

A

A1

A2

A3

B

B1

B2

B3

C

C1

C2

C3

D

D1

D2

D3

WEEK 3 :

Group

Pot

Height / cm

(±0. 1)

Diameter / cm

(±0. 1)

Number of leaves

Soil pH

A

A1

A2

A3

B

B1

B2

B3

C

C1

C2

C3

D

D1

D2

D3

WEEK 4 :

Group

Pot

Height / cm

(±0. 1)

Diameter / cm

(±0. 1)

Number of leaves

Soil pH

A

A1

A2

A3

B

B1

B2

B3

C

C1

C2

C3

D

D1

D2

D3

Changes in quantitative data from week 1 to week 4 :

Group

Pot

Changes in height / cm

(±0. 1)

Changes in diameter / cm

(±0. 1)

Changes in number of leaves

Changes in soil pH

A

A1

A2

A3

B

B1

B2

B3

C

C1

C2

C3

D

D1

D2

D3