

## Effect of bio fertilization using banana and apple peels on flax plant's vegetative characteristics

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### ABSTRACT

The Arab lands represent a distinctive example of the problem of drought that some arid regions face and water deficiency, which are often linked to environmental stress such as heat, salinity, etc., so it is considered one of the main factors responsible for yield loss and reduced productivity. Consequently, interest has increased in recent years in sustainable agriculture to ensure sustainable development, and the allelopathic phenomenon was one of the means used to achieve sustainability in agriculture by taking advantage of plants that have stimulating or inhibitory effects to regulate plant growth and development. Since the discovery of the allelopathic phenomenon in the 1930s, much research has been conducted to clarify the biochemical mechanisms behind the effect of allelopathic compounds on the affected plant. Delaying, reducing, or enhancing seed germination is one of the essential and visible allelopathic effects that are secondary expressions of the primary effects on biochemical processes. At the Department of Biology, College of Science, University of Mosul, two experiments were carried out to examine the impact of banana and apple peel extracts on the germination and growth of flax plants. The experiments, conducted in the lab and greenhouse, respectively, involved the use of aqueous extracts of banana and apple peels at concentrations of 2, 4, and 6% w:v. The findings revealed that the use of these extracts significantly improved the growth of the flax plants, including an increase in plant height, shoot, fresh, and dry weight of the root, and levels of photosynthetic pigments compared to the control. Notably, the banana extract, particularly at a concentration of 4.6% w: v, was more effective than the apple peel extracts in enhancing most of the tested characteristics of the flax plant.

**Keywords:** Flax; *Linum usitatissimum*; banana peel; apple peel; growth.

### INTRODUCTION

Flax *Linum usitatissimum* is a flowering plant in Linaceae family, It is cultivated as a food and fiber crop in world regions of the temperate climates. Textiles made from flax are known in English as linen. In addition to the word "flax" referring to the fibers of the flax plant. The plant species is known as a cultivated plant, and it is domesticated just once from the wild species *Linum bienne*, called pale flax.

The flax plant is grown almost in most of the world's continents. It is very popular in Poland, India, Europe and some Arab countries, such as Egypt and Syria, where the flax plant has a high economic value. This is because its seeds contain a good percentage of oil, amounting to about 40%. Flax seed oil is used in the manufacture of various types of edible oils and paint oils. It is also used to treat heart disease and memory problems, There are many benefits of flax seeds. They contain antioxidants that reduce the risk of cancer, and flax seeds are prescribed to facilitate digestion. This is because they contain a high percentage of dietary fiber, and flax seeds treat liver diseases and obesity problems.

The flax plant increases the ability of the producing countries to export various textiles and meet the needs of the factories of the local market, as the fibers of the flax plant are used in the manufacture of linen textiles, fabrics, threads, ropes, currency notes and cigarette filters, and the stems of flax plants are also used for the manufacture of wood, and the seeds of the flax plant are used In the formation of a mixture of fodder for cows and sheep to increase their production of milk and meat.

Flax production depends on several factors, the most important of which are the type of flax seed, soil type, climatic conditions, and agricultural service, including fertilization.

Bio-stimulants play an important role in reducing the use of fertilizers, increasing plant growth, and resisting water shortage and various environmental stresses These materials are effective when used in low concentrations as they improve biological processes inside the plant and increase the productivity and quality of different crops.(Hussain et.al.,2023) . The phenomenon of allelopathy was one of the methods used as biostimulants by taking advantage of plants that have stimulating effects to regulate plant growth and

development. Since the discovery of the allelopathic phenomenon in the thirties of the last century, many researches have been conducted to clarify the biochemical mechanisms underlying the effect of allelopathic compounds on the affected plant (Taher and Hussain, 2021). The world generates millions of tons of bioorganic residue in the form of peels annually, thus requiring more sustainable solutions to valorize these bio resources. Therefore, the objectives of the current study of banana and apple peels on flax (*Linum usitatissimum*) plant's vegetative characteristics

## MATERIAL AND METHODS

Experiment accrued in collages of science Mosul university at 2023 to study effect of banana and apple peels on flax (*Linum usitatissimum*) plant's vegetative characteristics

It included laboratory experiments and others in the greenhouse to study the effect of banana and apple peels on the germination and growth of flax seedlings.

### Aqueous extracts of banana and apple peels and both together prepared :

Aqueous extracts of banana and apple peels, were prepared at concentrations of 2, 4, and 6% by taking (2, 4, 6 gm W: V) banana and apple peels, mixed with 100 ml of distilled water using an electric mixer for 10 minutes, then filtered using a Buechner funnel provided. Using Whatman No.1 filter paper, the liquid was collected for each concentration and stored in the refrigerator at 4°C until use. (Abbas and Hussain, 2020).

### Bio testing of aqueous extracts of banana and apple peels in the germination and growth of flax seedlings (Laboratory experiment).

To study the effect of aqueous extracts of banana, and apple peels on the germination and growth of flax seedlings (Sharda variety), Petri dishes with a diameter of (13.8 cm) were used, and 15 seeds were placed in each dish between two filter papers in three replicates. 6 ml of the previously prepared aqueous extract was added, and distilled water was used for comparison. The dishes were incubated at a temperature of 25±2°C in a Gallenkamp-type incubator. After seven days of planting, the germination rate was measured and the number of seedlings was reduced to (5) seedlings. After 14 days of planting, the lengths of the shoot and root were measured. For seedlings, take the dry weight of the

seedlings after drying them in the oven at 60°C for 72 hours (Al-Juhaishi, 2017).

The percentage of germination was measured according to Saied, (1984)

Gr. % = Natural seedlings NO. / Planted seeds NO. x 100

### Greenhouse experiment

An experiment was conducted in a greenhouse to study the effect of adding banana and apple peels to the soil and in addition ratios

2, 4, 6% banana, apple peel powder was mixed with air-dried soil at a ratio of 2, 4, 6% w: w, then distributed in plastic pots with a diameter of (20 cm) and a height of (26 cm), with three replicates for each treatment, and soil was used without any additive for comparison. Water was added to each pot, and the pots were left in the greenhouse for a week to ensure the decomposition of the plant remains. After the end of the incubation period, 10 seeds of the cluster were planted in each pot. The seeds were placed homogeneously and regularly in terms of the distance between the seeds and at a depth of (0.5 cm) from the surface of the soil. Then it was watered with water and placed in the greenhouse at a normal temperature of 20 ± 2°C.

### Studied traits

Percentage of germination (%): The percentage of germination was calculated 15 days after planting, according to Saied (1984):

Gr. % = Natural seedlings NO. / Planted seeds NO. x 100

shoot height (cm), root length system (cm), leaves number / plant, dry and fresh weight of both root and shoot (mg),

leaves area (cm<sup>2</sup>): leaves area was calculated based on (Kemp 1966):

leaves area (cm<sup>2</sup>) = leaves length x maxi. Leaf width x 0.905

### Determination of chlorophyll content

To estimate the chlorophyll content according to the method (Kundson et al. 1977), the absorbance was measured at 665 and 649 nm using a spectrophotometer. The amount of chlorophyll a, b, and total chlorophyll a was calculated according to the following equations: Ch,a = 13.7(A<sub>665</sub>) - 5.76(A<sub>649</sub>)

Ch,b = 25.8(A<sub>649</sub>) - 7.6(A<sub>665</sub>)

Total chlorophyll = Ch a + Ch b  
Weinterman & Demots (1965)

#### Estimating the average dry matter percentage:

Dry matter percentage was calculated based on Maitiq et al., (2019):

Dry matter percentage% = (dry weight)/(fresh weight) x 100

#### Estimating the average percentage of water content of plants:

Percentage of water content was calculated from the equation:

Percentage of water content = fresh weight - dry weight x 100 / fresh weight Al-Tajouri and Al-Sal, (2007)

### RESULT AND DISSECTION

Laboratory results table (1) show an increase in all studied traits at 4.6%, with the exception of the percentage of germination, which suffered a reduction in all treatments. The reason for the increase can be attributed to the role of banana peels in supporting the metabolic activities of the plant, involved in regulating around 50 enzymes in a plant; (DIY Fertilizers 2012). The highest rate of increase for PL.(cm) RL.(cm) Pdw(mg) Rd w.(mg) was (45, 35.71, 13.33, 53.84) by banana leaves at 6%.

While apple peels caused a decrease in the values of all the rare traits, and the inhibition increased with increasing concentration. The reason may be due to the effect of allelopathic compounds released from these peels, which cause inhibition in the germination and growth of plants (Hussein, 2020).

The results of the greenhouse showed a decrease in all the studied traits Gr.% ,SL(cm) , RL(cm), Rfr(mg) ,Rdr(mg) and in all the studied traits due to the influence of banana peels, with the exception of the increase in the dry and fresh weight of the flax shoots. The highest rate of increase was 6%, and the reason is due to bananas being rich in minerals including potassium, phosphorus, calcium, and others. Potassium is the most important element that is used as fertilizer. It is essential for growth (Hulbert, 2014) and these elements increased with a concentration increased banana peels .

The results of Table (3) showed an increase in leaf area due to the influence of banana peels, while it caused a decrease in total ch a and ch. The reason could be the presence of compounds Flavonoids, tannins, alkaloids, glycosides and terpenoids were found to be

present in banana peels, These phytochemicals have been reported to exert multiple biological effects (Chabuck et.al.,2013). As for apple peels, they caused a significant increase in the concentration of chlorophyll a and total chlorophyll in the flax plant at high concentrations due to the possibility that the allelopathic compounds act according to their concentration and chemical nature and may work to increase or decrease the construction of chlorophyll pigments, or the effect on the chlorophyll content may be due to affecting the Nutrient absorption (Taher, 2021).

The results showed Figure (1) Effect of aqueous extracts of banana and apple peels in leaves Number (leaf/plant) in flax seedlings. There was a decrease in the number of leaves in all treatments except for the increase at 4.6% due to the effect of banana peels, reason for the increase may be due to the presence of potassium in banana peels, while the reason for the reduction is due to the presence of secondary metabolic compounds in apple peels, especially tannins known for their inhibitory effect.

Effect of aqueous extracts of banana and apple peels in dry matter percentage of flax seedlings fig. (2), The results showed a decrease in the dry matter of flax seedlings in most treatments. The reason can be attributed to the effect of secondary metabolites released from banana and apple peels, especially phenolic compounds known for their high inhibitory effect, which can affect the nutritional status and abundance of mineral substances in the soil (Scavo et al., 2019).

Effect of aqueous extracts of banana and apple peels in Percentage of water content in flax seedlings percentage of flax seedlings fig. (3) results showed a decrease in the moisture content of flax in most treatments, and the highest rate of inhibition reached 34.52% when treated with 6% apple peel extracts. The reason can be attributed to the presence of polyphenols in its composition that considers as antioxidant components.

### CONCLUSION

The results showed that banana peels were superior in giving them high rates in most of the studied traits, leaf area, as well as chlorophyll content, especially in high concentrations. The reason was attributed to their high content of minerals, as well as the presence of secondary compounds in their composition.

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**Table 1:** Effect of aqueous extracts of banana and apple peels in flax seedlings germination and growth (Laboratory experiment).

Treatments	Con. Control	Gr.% 80a	PL.(cm) 7c	RL.(cm) 9c	Pdw(mg) 3c	Rdw.(mg) 1.3d
Banana peel	%2	80a	7c	9.5c	2.8d	1.6c
	%4	40b	8.5b	12b	3.1bc	1.8b
	%6	10c	13a	14a	3.4a	2a
Apple peel	%2	40b	6d	8d	3.2b	1.2d
	%4	10c	6d	6e	3.1bc	0.9e
	%6	10c	4e	4.5f	3c	0.8e

Gr.% :Germination percentage, PL: Plumle length ,RL: Root length , Pdw: Plumle dry weight, Rdw: Root dry weight

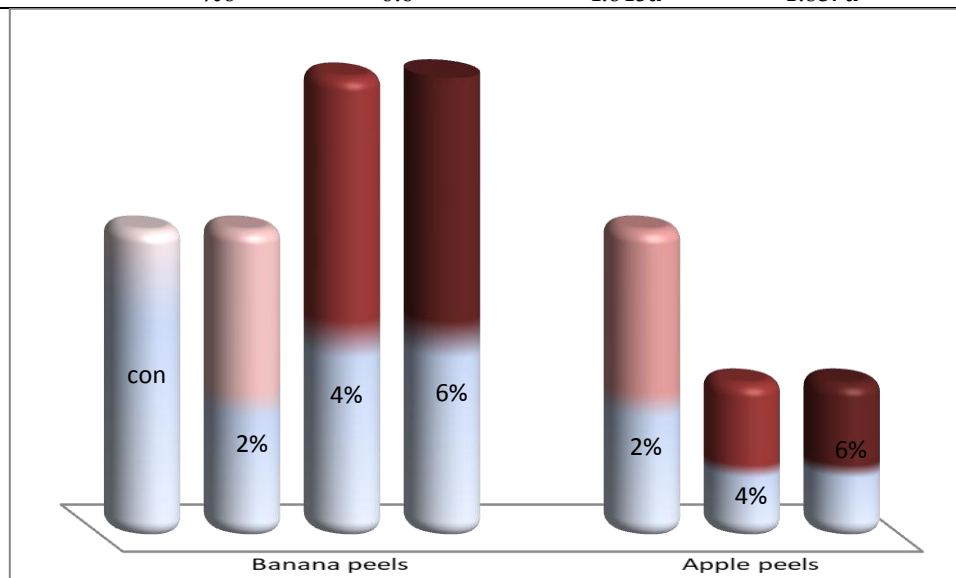
**Table 2:** Effect of aqueous extracts of banana and apple peels in flax seedlings germination and growth (greenhouse experiment).

Treatments	Con. Control	Gr.% 80a	SL(cm) 8c	RL(cm) 4.5a	Sfr(mg) 82c	Rfr(mg) 22a	Sdr(mg) 22d	Rdr(mg) 9.5a
Banana peel	%2	70b	7d	3.5c	57d	14d	27b	6.1c
	%4	70b	9ab	2f	89b	16c	28b	6.4c
	%6	50c	9.5a	4b	97a	19b	31a	9.6a
Apple peel	%2	70b	7d	2.5e	87b	14d	22d	8b
	%4	50c	5e	2.5e	30f	14d	10e	1.3e
	%6	40d	4.5ef	3d	48e	11e	25c	2.2d

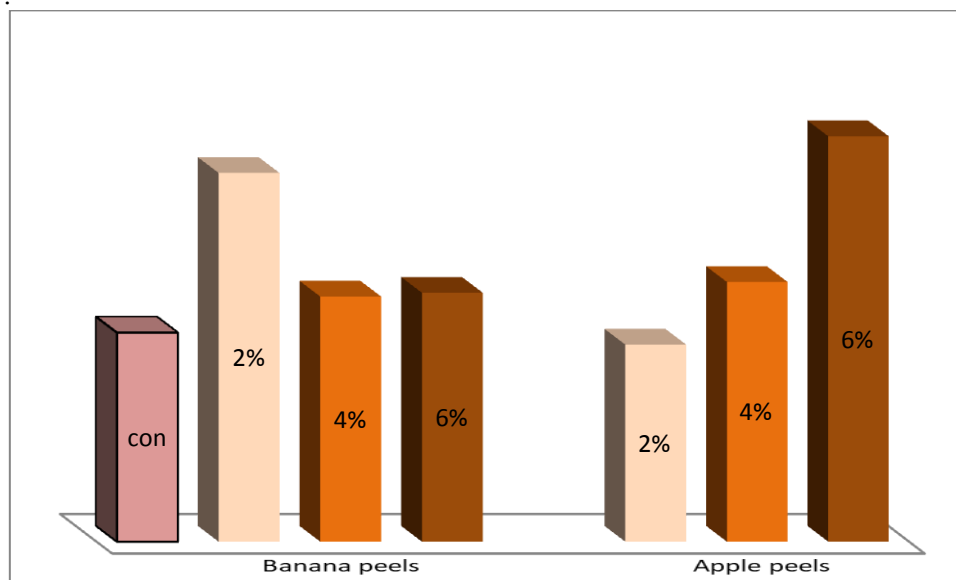
Gr.% :Germination percentage, PL: Plumle length ,RL: Root length , Pdw: Plumle dry weight, Rdw: Root dry weight

**Table 3:** Effect of aqueous extracts of banana and apple peels in leaves area and chlorophyll in flax seedlings .

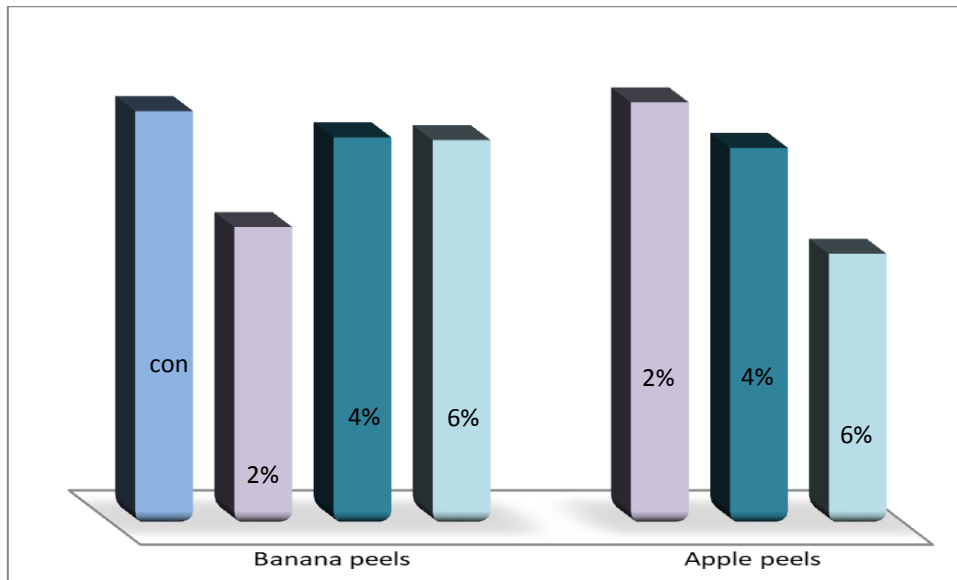
Treatments	Con.	leaves area (cm2)	Ch a	Ch b	Total ch.
	Control	0.8b	3.647cd	1.329bc	4.976c
Banana peel	%2	1a	3.123	1.238d	4.361d
	%4	0.9ab	3.775c	1.002	4.777c
	%6	0.9ab	2.902e	1.362b	4.264d
Apple peel	%2	0.8b	2.675f	1.227d	3.902de
	%4	0.6cc	4.101b	1.100e	5.201b
	%6	0.6	4.645a	1.837a	6.482a



**Figure 1:** Effect of aqueous extracts of banana and apple peels in leaves Number(leaf/plant) in flax seedlings .



**Figure 2:** Effect of aqueous extracts of banana and apple peels in Dry matter percentage of flax seedlings.



**Figure 3:** Effect of aqueous extracts of banana and apple peels in Percentage of water content in flax seedlings .

### تأثير التسميد الحيوي لقشور الموز والتفاح على الصفات الخضرية لنبات الكتان

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#### الملخص العربي:

تمثل الأراضي العربية مثالا مثيرا لمشكلة الجفاف التي تواجهها بعض المناطق القاحلة و نقص المياه الذي يرتبط غالبا بالإجهاد البيئي مثل الحرارة ، و الملوحة وغيرها، لذلك يعتبر من العوامل الرئيسية المسؤولة عن المحصول وخفض الإنتاجية. وبالتالي ازداد الاهتمام في السنوات الأخيرة بالزراعة المستدامة لضمان التنمية المستدامة وكانت ظاهرة الألبوباثي أحد الوسائل المستخدمة لتحقيق الاستدامة في الزراعة من خلال الاستفادة من النباتات التي تمتلك تأثيرات تحفيزية أو تثبيطية لتنظيم نمو النباتات وتطورها. منذ اكتشاف ظاهرة الألبوباثي في الثلاثينيات من القرن الماضي، أجريت العديد من البحوث لتوضيح الآليات البيوكيميائية الكامنة وراء تأثير المركبات الألبوباثية على النبات المتأثر، وبعد تأخر او اختزال أو تحفيز إنبات البذور من التأثيرات الألبوباثية المهمة والمرئية والتي تعد من التعبيرات الثانوية للتأثيرات الأولية على العمليات البيوكيميائية. أجريت تجربتان في قسم علوم الحياة كلية العلوم جامعة الموصل احدهما مختبرية والاخرى في البيت الزجاجي لمعرفة تأثير المستخلصات المائية لقشور الموز والتفاح على انبات ونمو نبات الكتان وبالتركيز 2,4,6% وزن : حجم في تحسين النمو ، اذ ادى استخدام المستخلصات المائية لقشور الموز والتفاح إلى زيادة ملحوظة في خصائص النمو (ارتفاع النبات، المجموع الخضري، الوزن الطازج والجاف للجذر) بالتزامن مع زيادة في مستويات أصباغ التمثيل الضوئي مقارنة مع المقارنة. ويلاحظ أن مستخلص الموز وخاصة بتركيز 4و6% وزن : حجم كان أكثر تأثيرا من المستخلصات المائية لقشور التفاح في زيادة معظم الصفات المختبرة لنبات الكتان.

الكلمات الاسترشادية: الكتان، قشور الموز، قشور التفاح، النمو.