

Application Of Different Fruit Peels Formulations As A Natural Fertilizer For Plant Growth

Mercy S, Mubsira Banu S, Jenifer I

Abstract: Fruit peels of Banana, Pomegranate, Sweet lime and Orange are highly rich in potash, iron, Zinc etc. Above fruit peels powder were formulated from the trace amounts and gradually increased for the preparation of three formulations as Formulation 1, Formulation 2 and Formulation 3. Three different formulations were applied for plant growth in two methods such as fruit peel powder, fruit peel powder extract as a natural fertilizer. Fenugreek seeds were used to test the utilization of fruit peel powder as a natural growth enhancer. After 45 days of application of fertilizer, plant growth was measured and the yield of fenugreek vegetables was counted. Among the three formulations of fruit peel powder and fruit peel extract, formulation 1 was found more suitable for plant growth. Cheapest and harmless materials were used in the present investigation.

Key words: Fruit peels, Fertilizers

Introduction:

Fertilizers are 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 the plants. Fruit contains a high amount of antioxidants that are beneficial to our health in many ways (Faria *et al* 2006). Organic fertilizers include substances such as dried blood or seaweed derivatives, which are of animal and plant origin respectively. Inorganic fertilizers are usually wholly manufactured, as in the case of sulphate of ammonia; or they may be processed from a mined or quarried mineral, as in the case of ground limestone. Fertilizers typically provide, in varying proportions. Good fertility is fundamental to successful plant growth, and the application of fertilizers and manures is an essential graining act activity. The maintenance of adequate levels of nutrients in soil is essential for healthy plant growth. Many plants have been tested for their nematicidal activities. Tsay, *et al* 2004 reported that the extract from roots of *Gaillardia pulchella* was effective for the control of *M. incognita* and *Rotylenchulus reniformis*. Soil analysis can help to prevent over application by establishing existing soil nutrient concentrations. Where nutrient hungry crops are regularly grown, or a new area is being developed, or after a long period without cultivation, soil analysis is recommended. Cheapest and harmless materials can be used for the plant growth. The present study deals with the utilization of fruit peels for the effective growth of plants and higher yield. Different fruit peels such as Pomegranate, Orange, Sweet lime and Banana were used.

Methodology

Collection and processing of soil Sample collection Soil Quality Test

The soil was collected from farm yard of Kilakarai, Ramanathapuram district. Soil is rarely or not cropped by farmers and is not cultivated for many years. The collected soil was stored in one regions of herbal garden under open condition. The soil normally contain clay, pebbles, root, rock pieces, these soil is sieved by using 5mm sieve to remove the pebbles, root, rock pieces. The collected soil was taken separately and filled with many pots. Each pot contains 4 kg of soil. The soil samples were air-dried, the dried soil was crushed with wooden mortar pestle and care should be taken to avoid crushing of pebbles, concretions, roots. This dried soil was packed in sterile polythene bags and sent to soil quality centre, Paramakudi.

Collection and Processing Of Fruit Peels

Fruit peels of pomegranate, orange, sweet lime and banana were collected separately from Katharia and Jothi fruit shops, Ramanathapuram. Collected fruit peels were washed thoroughly with tap water to remove the unwanted material including seeds. The washed peels were cut in to small pieces [1-5 cm] and air dried in sunlight for 20 days (Figure 1). The dried fruit peels were powdered individually, sieved and stored at room temperature (Figure 2).

- Mercy S, Mubsira Banu S, Jenifer I
- Department of Microbiology and Biotechnology, Thassim Beevi Abdul Kader College for Women, Kilakarai-623 517, Ramanathapuram District, Tamilnadu
- Corresponding Author: mercysteephen84@gmail.com



Figure 1 & 2: Shows the dried fruit peel and powder: a) Pomegranate b) Orange c) Sweet lime d) Banana Preparation of different formulation

Comparative study of different fruit peel powder and fruit peel extract

Preparation of Fruit Peel Extract

Different formulation of fruit peel powder was used to compare the plant growth. Each formulation was mixed with water in different quantities. 1g of fruit peel powder of pomegranate, orange, sweet lime, banana were taken in 100 ml of distilled water and mixed thoroughly for the preparation of extract. This mixture was stirred for 3 days by using magnetic stirrer. This was considered as F1. 3g of fruit peel powder of pomegranate, orange, sweet lime, banana were taken in 300 ml of distilled water and mixed thoroughly for the preparation of extract. This mixture was stirred for 3 days by using magnetic stirrer. This was

considered as F2. 6g of fruit peel powder of pomegranate, orange, sweet lime, banana was taken and 600 ml of distilled water was added and mixed thoroughly for the preparation of extract. This mixture was stirred for 3 days by using magnetic stirrer. This was considered as F3.

Application of Fruit Peels Powder in Soil

Three formulations of fruit peel powder were applied in soil and properly mixed for uniform distribution. Control and three replications were maintained for each formulation. After 15 days, seeds of fenugreek were sown on various pots. Each pot sown with 100 seeds and water was poured every day. Results were observed after 45 days of inoculation.

Table 1: Quantity of fruit peel powder used for used for the preparation of Fruit Peel formulations

S.No	Fruit Peel Powder						
	Name of the fruit peels	F1 Powder	F1 Peel powder Extract	F2 Peel powder	F2 Peel powder Extract	F3 Peel powder	F3 Peel powder Extract
1	Pomegranate	1 g	1 g + 100 ml water	3 g	3 g + 300 ml water	6 g	6 g + 600 ml water
2	Orange	1 g	1 g + 100 ml water	3 g	3 g + 300 ml water	6 g	6 g + 600 ml water
3	Sweet Lime	1 g	1 g + 100 ml water	3 g	3 g + 300 ml water	6 g	6 g + 600 ml water
4	Banana	1 g	1 g + 100 ml water	3 g	3 g + 300 ml water	6 g	6 g + 600 ml water

Application of Fruit Peel Extract in Soil

Three formulations of fruit peel extract were applied in soil and mixed properly for uniform distribution. Control and three replications were maintained for each formulation. After 15 days, seeds of fenugreek were sown on various pots. Each pot sown with 100 seeds and water was poured every day. Results were observed after 45 days of inoculation.

Testing of Different Plants by Using the Suitable, Identified Formulation

After 45 days of inoculation of seeds, the suitable formulation was found. The suitable formulation which was identified from previous experiment was used further for testing some of the seeds such as Rice, Mustard and Rye. Rice, Mustard and Rye were sown on soil which was supplemented with identified formulation to check the

growth of Rice, Mustard and Rye. Replication and control were maintained.

Enumeration of Microorganisms

Pour plate technique was done to know the enhancement and count the number of micro organisms. Control, three formulation of fruit peel extract applied soil were serially diluted. 1ml of serially diluted soil samples from 10^{-6} dilution was individually poured in sterile empty petridishes and the nutrient agar was poured on the plate containing serially diluted soil samples. They were uniformly mixed. After 24 hours of incubation results were observed.

Formulation of media by fruit peel powder for the invitro propagation of plants

Preparation of media

In vitro propagation of shoots was done as a trail to test the fruit peel powder for the growth of plants. Among all the fruit peel powder, pomegranate was removed and orange, sweet lime, banana peel powder were used to prepare the media. 0.1 gm of each fruit peel powder was mixed with 100 ml of distilled water. The pH of the media was adjusted to 5.8-5.9, gelled with 0.2 gm agar (Hi Media, Mumbai,

India) and transferred to small conical flask, autoclaved at 121°C for 20 min and cooled.

Preparation of Explants

Well grown shoots of *Vinca rosea* were collected and surface sterilized with HgCl_2 (0.1%) 6 minutes duration and thoroughly rinsed with sterile distilled water to remove the traces of these two disinfectants. 2 cm length of excised shoots were placed on sterile blotting paper, dried and inoculated on the fruit peel media supplemented with BAP (1 mg/l) and control was maintained without hormones. All cultures were maintained at $25 \pm 2^{\circ}\text{C}$ and grown under 16 hours photoperiod provided by cool white fluorescent tubes (Phillips, Mumbai, India) with a light. Results were observed after 15 days of incubation.

Results

Soil Quality Test

Control soil, fruit peel fertilized- both powder and extract applied soil samples were analyzed for the nutritive values of soil. Nitrogen, Phosphorous, K (Potassium) were mainly observed. After the application of three different formulations in soil, soil fertility is increased (Table 2).

Table 2: Major nutritive values of soil

S.No	Names of soil	N (mg/g)	P (mg/g)	K (mg/g)
1	Control	1	2.3	1.3
2	Formulation 1	2.7	2.4	1.2
3	Formulation 2	3.6	2.9	1.7
3	Formulation 3	4.7	3.5	2.1

Comparative Study of different Fruit Peel Powder and Fruit Peel Extract Fruit Peel Powder

The soil was fertilized with different formulation of fruit peel powder. After 15days of application of fruit peel powder. The seeds of fenugreek (*Trigonella foenum graecum*) were sown in fertilized soil which was already fertilized by formulation of fruit peel. Control was maintained without formulation. After 45 days of seedling the plant length was measured for control and test. Control was maintained without formulation. Length of the plant was very less in control than the fruit peel powder applied soil (Figure 3).

Fruit Peel Extract

Three formulation of fruit peel powder extract was mixed properly with soil. After 15days of application of fruit peel powder extract, the seeds of fenugreek (*Trigonella foenum graecum*) were sown in fertilized soil which was already fertilized by formulation of fruit peel. Control was maintained without formulation. After 45 days of seedling the plant length was measured for control and test. Length of the plant was observed lower in control and the plant growth which was observed in fruit peel powder applied soil than (Figure 5). Size of the leaves was also increased in the plants which were grown on formulations (Figure 6). Vegetables of fenugreek were also produced earlier than

control and more number of vegetables was also identified from the soil enriched with three formulations (Figure 7 & 8)



Figure 3: Shows the different growth ranges of fenugreek from different formulation fruit peel applied soil a) Control b) Formulation 1 c) Formulation 2 d) Formulation 3

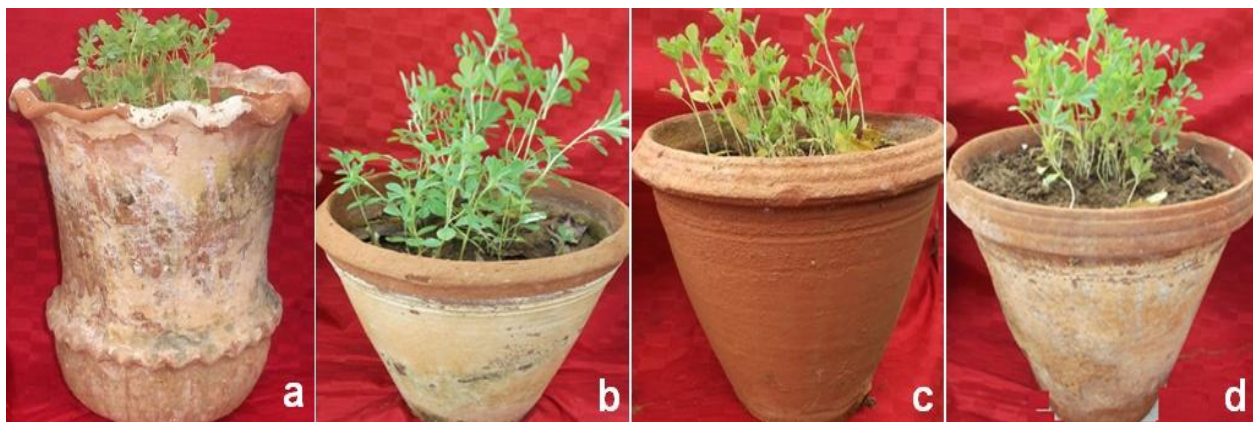


Figure 4: Shows the different growth ranges of fenugreek from different formulation of fruit peel extract applied soil a) Control soil b) Formulation 1 c) Formulation 2 d) Formulation 3

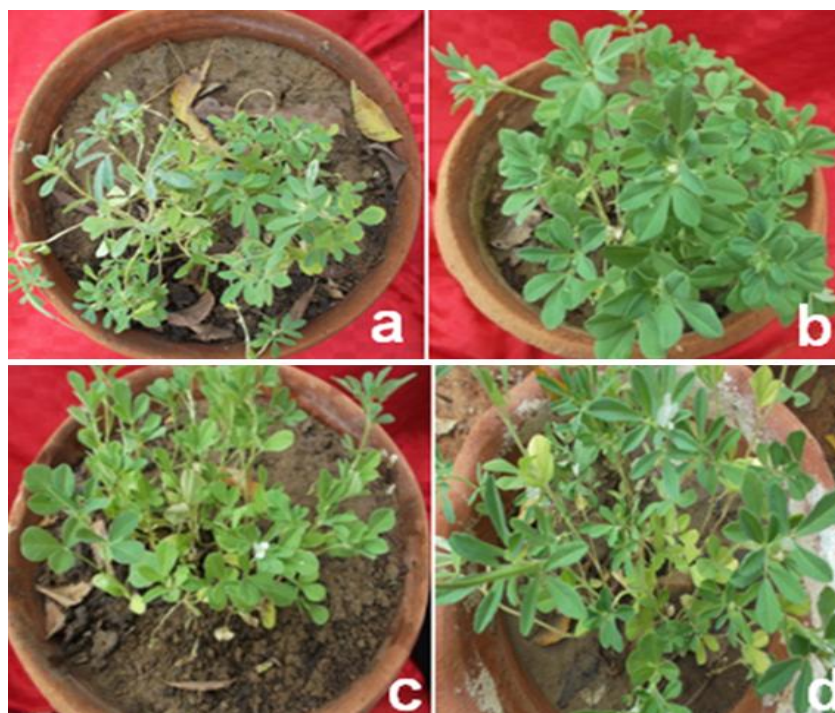


Figure 5: Shows the different leaf size of fenugreek. Fenugreek plant is grown on different formulation of fruit peel extract applied soil. a) Control soil b) Formulation 1 c) Formulation 2 d) Formulation 3

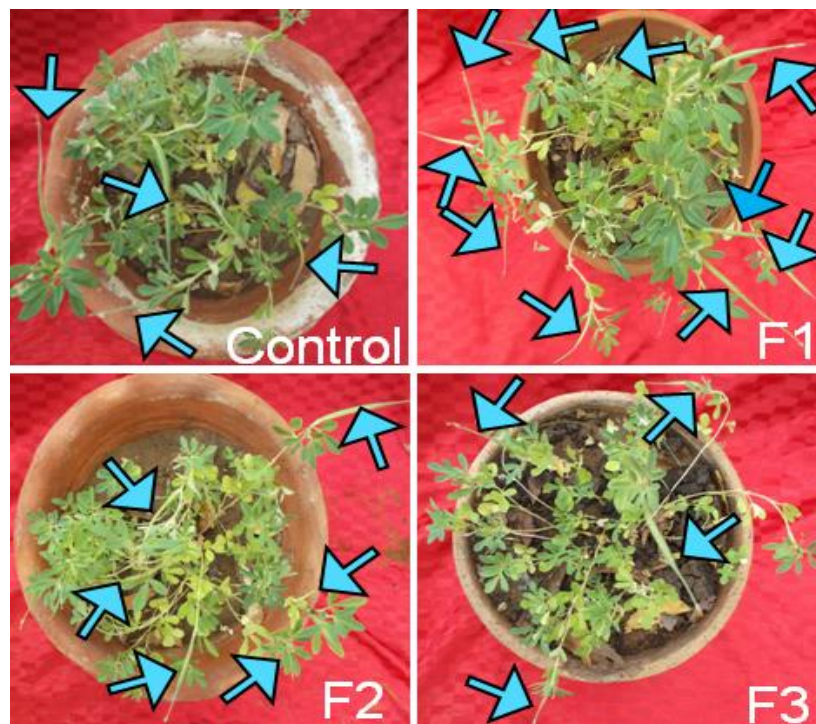


Figure 6: Shows the number of fenugreek seeds produced. a) Control soil b) Formulation 1 c) Formulation 2 d) Formulation 3

Result of the above experiment revealed that the Formulation 1 was found more suitable. Some other seeds such as mustard (*Brassica juncea*), Rice (*Oryza sativa*), Rye (*Secale cereale*) also tested in order to test the effect

of Formulation 1. After 30 days, the result of plant growth was observed. When compared to the control soil, improved growth was observed in tests (Figure 7, 8, 9).



Figure 7: Shows the difference in growth of mustard plant
a) Control soil b) Plants from Formulation 1 applied soil

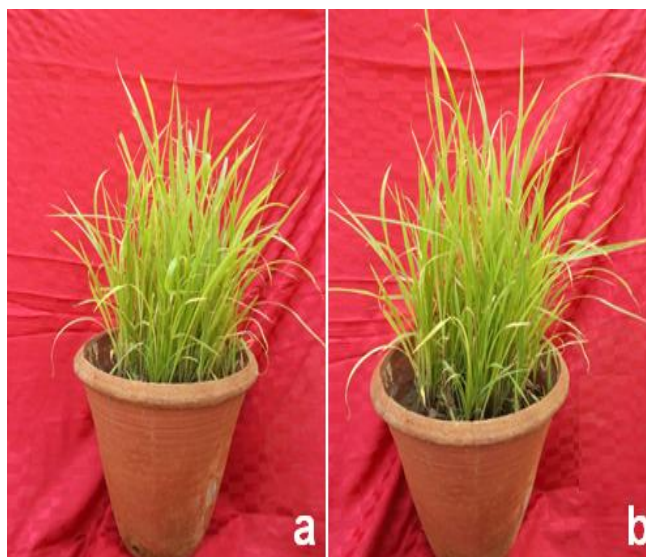


Figure 8: Shows the difference in growth of rye plant

a) Control soil b) Plants from Formulation 1 applied soil



Figure 9: Shows the difference in growth of rice plant

a) Control soil b) Plants from Formulation 1 applied soil

Inhibitory Effect of Fruit Peel Extract

By using the agar well diffusion method, this experiment was done to know the inhibitory effects of fruit peel extract on soil micro organisms. Figure 12 shows the diffusion of fruit peel extract on nutrient agar but not showed the inhibitory effect. After 24 hours of incubation small pinch of culture was picked nearby the well and streaked on the fresh nutrient agar plate to confirm the zone of inhibition. Plates showed the presence of micro organisms nearby the well.

Enumeration of Microorganisms by Pour Plate Technique

Pour plate technique was done to know the enhancement and number of micro organisms. Control soil, three formulation of fruit peel extract applied soil was serially diluted. 1ml of serially diluted soil samples from 10^{-6} dilution was individually poured in sterile empty petridishes and the nutrient agar was poured on the plate containing serially diluted soil samples. From this method the total number of colonies was counted after 24 hours of incubation. When compared to control three formulations shown the more

number of micro organisms due to the breakdown of fruit peel nutrients and utilization of nutrients by the available micro organisms in soil (Figure 10). Among all the

formulation, formulation 1 increased the number of micro organisms.

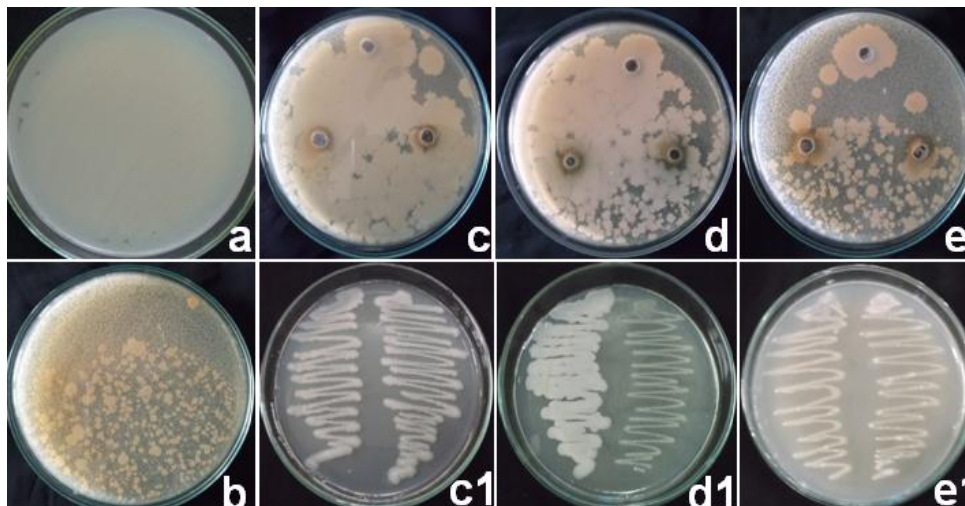


Figure 10: Shows the inhibitory effects of fruit peel extract on soil micro organisms

a) Negative Control, b) Positive Control soil c) Formulation 1 applied soi1, c1) Presence Colonies streaked from the region of zone of inhibition on fresh agar plates d) Formulation 2 applied soi1, d1) Presence Colonies streaked from the region of zone of inhibition e) Formulation 3 applied soil, e1) Presence of Colonies streaked from the region of zone of inhibition

Formulation of media by fruit peel powder for the invitro propagation of plants

Shoot induction

In vitro propagation of shoots was done as a trail to test the fruit peel powder for the growth of plants. Among all the fruit peel powder, pomegranate was removed and orange,

sweet lime, banana peel powder were used for the preparation of media. Because the Pomegranate peel was highly rich in phenols. Phenols inhibited the growth of plants for callus induction. Due to this reason pomegranate peel powder was not added. After 15 days of incubation, new shoots were proliferated from the internodal region of explants (Figure 11).

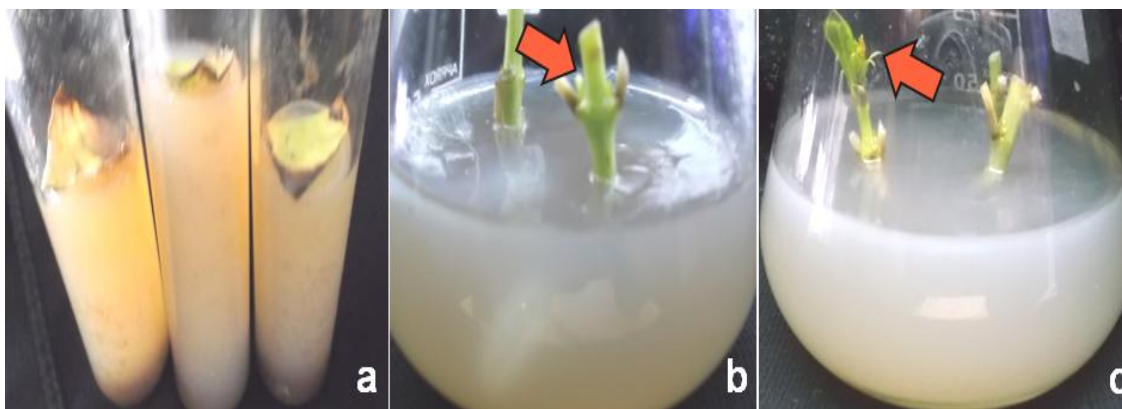


Figure 11: Shows the shoot induction of *Vinca rosea*.

a) Fruit peel formulated media with pomegranate fruit peel powder, b) Shoots grown on fruit peel formulated media without growth hormones c) shoots grown on fruit peel formulated media with growth hormones

Discussion

Fertilizers are 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 the plants. Chemical fertilizer also gets a lot of water out of the soil which it contaminated and therefore pollute water. Investigations made on the effect of different

formulations of fruit peels, revealed that the increased fertility of soil and soil micro organisms. Most of the fruit peels contain potassium, vitamins, minerals and some essential elements which enhance the growth of plants. Some of the fruit peels such as citrus varieties may used to kill the nematodes. Many plants have been tested for their nematicidal activities. Tsay, et al 2004 reported that the

extract from roots of *Gaillardia pulchella* was effective for the control of *M. incognita* and *Rotylenchulus reniformis*. Alternatively the fruit peels must enhance the beneficial microbes. Pomegranates, orange, sweet lime, banana enhance the number of micro organisms by the utilization of micro nutrients. Formulation applied soil contains approximately two fold number of micro organisms per ml than control soil. No report is published regarding the formulation of fruit peel and its utilization for plant growth and especially in in vitro propagation of plants. This is the first report revealed that the fruit peel powder and extract increase the soil fertility, soil microbes, plant growth and yield. In order to overcome these problems fruit can be used as alternative and effective nutrients for the enriched growth and higher yield. From this research, the fruit peel powder extract increased the growth of plants and yield and the leaves of the plants were remaining green till harvesting. Additionally growth of microorganisms were also increased by the application of fruit peel powder and extract. In addition fruit peel powder can be used for the preparation of tissue culture media. This research reveals that the media which was prepared by using fruit peel powder induced the shoots from *Vinca rosea*. This research concludes that the chemical fertilizers can be replaced by the fruit peel powder and extract to protect the soil from the infertility.

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