RESEARCH PAPER

Influence combination of Fruits Peel and Fertilizer Methods on growth and yield of Chickpea (Cicer areitinum) L. Plants

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ABSTRACT:
This experiment conducted in the greenhouse of Biology Department in the College of Science- University of Salahaddin- Erbil, for studying the influence of fruit peels (banana and orange peels) as a natural fertilizer at doses (0, 4, 8, 12 g.pot⁻¹) by different methods powder, powder extract and foliar spray on growth and development of chickpea plants. The study consists of 12 treatments with three replications. The following growth parameters were observed plant height, number of branches, stem diameter, dry weight of shoot system, water content, and yield characteristics including number of pods per plant, number of seeds per pod, dry weight of 100 seeds and chlorophyll content. The results elucidate that fruit peels significantly increased plant height, number of branches, water content, number of pods, chlorophyll a, total chlorophyll content, and carotenoids. It is noticed that fruit peels had a positive effect on growth and development of chickpeas plants.

KEY WORDS: Fruit peel, Chickpea, Yield components, Carotenoids.
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INTRODUCTION:

Chickpea (Cicer arietinum L.) is an important annual herbaceous legume crop, belongs to leguminous family domesticated independently in Mediterranean region and now grown worldwide both for dry and as green (Khan et al., 2014). Among major legumes the chickpea is the third important crops after the faba bean and soybeans. It is the main crop that have role in symbiotic fixed nitrogen in the nodules of root, by their role in soil fertility. It’s an important source food of both of human and animals being its rich in protein source, complex carbohydrate, fiber, vitamins and minerals make this legume an important composition of human diet in developing world. Generally, its protein quality is higher than that of many other legumes (Ismail et al., 2017).

Fruit peels are important sources of mineral nutrients like calcium, iron, potassium, zinc etc. It is used as a natural fertilizer. There are two main types of fertilizer, organic and inorganic fertilizers which added to a soil for plant growth as essential nutrients. Organic or natural fertilizer contains different antioxidants and carbonaceous matter. Inorganic or commercial fertilizer usually wholly manufactured, as in case of sulphate of ammonia; or they may be processed from quarries, which are cheapest and harmless materials are used for plant growth. Fruit peels used in the soil as fertilizer, regulating pH of the soil and also in supplementing of micronutrients like iron, calcium, zinc (Jariwala and Syed, 2017). Banana peel is a source of dietary proteins, essential amino acids, fiber, polyunsaturated fatty acids and potassium (Sonia et al., 2014). Citrus peels like

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orange peels contain an important compound like sugar, and acids which have role in acidity of soil and their effect on photosynthesis process and plant growth (Shed, 2005). (Mercury et al, 2014) reported that different fruit peels (pomegranate, banana, sweet lime orange peel) increased plant height and size of leaves in fenugreek plants. (Jariwala and Syed, 2017) explained that fruit peels (sweet lime peel, orange peel, banana peel, pomegranate peel, citrate peel powder, alkaline peel powder) used as a good PH regulator of soil which citrate peel powder used to decreased P of soil and alkaline peel powder to increased PH of soil, and also these fruit peels contain high amount of nutrient N, P, K which required as a natural fertilizer. (Panwar, 2015) found that Banana peels increase soil fertility and soil productivity by increasing nutrients for plants, in addition the best way to decrease pollution.

The objectives of this study were to determine the effect of fruit peels in different ways (peel powder, powders powder extract, and foliar application) as a natural fertilizer on growth and development of chickpea plants.

2. MATERIALS AND METHODS

2.1. Study area

The study was conducted in the glasshouse of Biology department, College of Science, University of Salahaddin-Erbil, during October 24, 2017 to January 26, 2018. Pot experiment consisted of combination treatments of fruit peels (banana and orange peel) with different concentrations at doses (0, 4, 8, 12 g.pot⁻¹) and different methods of application (powder, powder extract, and foliar spray). 12 treatments with three replications, include 36 plastic pots each pot with a diameter of 24 cm in length and 21 cm in depth filled with 7kg of dried sandy loam soil of Askikalak area, the soil sievedthrough 2mm pore size sieves. Some physical and chemical properties of the soil are shown in Table (1). From each pot, three seeds were sown and then thinned to one plant later. Fertilizers at the rate of 10kg.donn⁻¹ which included urea containing 46.6 N, super phosphate P₂O₅ containing 45% P, added to the pots as solutions at the beginning of planting (Muhummed, 2004). The following measurements taken for each pot; plant height (cm), plant⁻¹, number of leaves.plant⁻¹, number of branches.plant⁻¹, shoot dry weight.plant⁻¹, water content (g.plant⁻¹) of shoot system, and yield components such as number of pods.plant⁻¹, number of seeds.pod, dry weight of 100 seeds.

Water content of the shoot system estimated as follows: fresh weight, shoot system dried at 110°C for 1 hrs, and then dried at 70°C for 24 hrs, in an oven. After cooled at room temperature, dry weight of shoot obtained for half an hour (He et al, 2005).

**Water content =F.wt.-D.wt.**

**F.wt. =fresh weight**

**D.wt. =dry weight**

Chlorophyll content in leaves (µg g⁻¹) estimated by taking 0.5g of fresh leaves left in 10 ml of absolute ethanol for 24 hrs. In dark condition, this process repeated three times to complete extraction of chlorophyll the end volume reached 30 ml were spectrophotometrically estimates on two wave length 649and 665 nm as follows (Waterman Demote, 1965):

\[
\text{µg chlorophyll a/ml solution} = (13.70) \quad (A665nm)-(5.76) \quad (A649nm)
\]

\[
\text{µg chlorophyll b/ml solution} = (25.80) \quad (A649nm)-(7.60) \quad (A665nm)
\]

**Total chlorophyll =chlorophyll a + chlorophyll b**

**A=absorbance**

**nm =nanometer**

2.2. Collection and Processing of fruit peels

Fruit peels like banana and orange peels collected from fruit shops, these fruit peels washed with tap water, cut to small pieces then dried at sunlight for 20 days in late summer after that powered then sieved and stored at room temperature (El- Bassiony et al, 2016). Fruit peels (banana and orange) as Powder methods applied to each pot mixed with soil; in powder extract method (1g) of fruit peel was 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 (Mercy et al, 2014), this extract prepared previously used as Foliar spray for each pot.

| Fruit peel            | content | Formulations of fruit peel |
|-----------------------|---------|----------------------------|
| Orange and banana peels| 1g     | 1g+100ml water |

2.3. Experimental Design
The data was designed according as factorial experiment in Completely Randomized Designs with three replications and twelve treatments. Duncan Multiple Range Test was used for the comparison of treatment means at 5% for green house parameters and 1% levels for laboratory parameters (Al-Rawi and Khalafulla, 1980). The statistical analysis was done by using Statistical Package for Social Sciences (SPSS version 16 software). For drawing graph, Excel 2007 software was used.

Table 2: Some physical and chemical properties of the soil used in the experiments

| Properties                          | Value      |
|-------------------------------------|------------|
| Sand                                | 70.10 %    |
| Silt                                | 24.22 %    |
| Clay                                | 5.68 %     |
| Soil texture                        | Sandy loam |
| Soil moisture                       | 3.1 %      |
| Organic matter                      | 0.91 %     |
| PH                                  | 7.24       |
| CaCO₃ (Trimetric method)            | 25.7 %     |
| Electrical conductivity (ds m⁻³ at 25°C) | 0.58        |
| Total nitrogen % (kjeldahl method)  | 0.4%       |
| Total phosphorus ppm(Olsen method)  | 118 ppm    |
| Total potassium ppm (flame photometer) | 45 ppm  |
| Total calcium ppm (atomic absorption method) | 240 ppm |

3. RESULTS AND DISCUSSION

3.1. Vegetative growth characteristics

Table (3) shows that fruit peels applied by different methods have significant effect on vegetative growth characteristics, fruit peels significantly (p≤0.05) increased plant height at dose (4g) by foliar application method as compared to their control, and also significantly (p≤0.05) increased number of branches at doses (8g ) by powder extract method as compared to their control, water content of shoot system significantly (p≤0.05) increased at dose (4g) by foliar application method as compared with their control, there were significant difference between treatments (Fig. 1). These results agreed with those obtained by (Mercy and Jenifer, 2014), which fruit peels as a natural fertilizer increased plant growth. (Jariwala and Syed, 2017) mentioned that fruit peels as a natural fertilizer fulfills as a requirements of micronutrients. Fruit peels contain sugar, protein, nutritional components especially potassium which necessary for plant growth (El-Bassiouny, et al., 2016). The increase of growth of plants in response to fruit peels concentration by different methods especially by powder extract and foliar application method.

3.2. Yield characteristics

Data presented in table (4) showed that fruit peels at dosed ( 8 g) by foliar application significantly (p≤0.05) increased number of pods per plant and number of seeds per plant at dose (8g) by powder extract as well as dry weight of 100 seeds at dose (4g) by powder method as compared to their controls. Powder extract at dose (8g) was most effective treatment than other treatments in number of pods, there were significant difference between treatments. These results partially agreed with those mentioned by (El- Bassiouny, 2016), that fruit peels contain antioxidants which enhancing protein synthesis and delay senescence. (Panwar, 2015) notice that banana peel contain nutrients such as potassium, calcium, magnesium, sulphur, phosphate, and sodium which are needed by the plants and also help plants to resistant diseases. Increased in plant growth which increased number of branches, and yield components, then increase production of plants.

3.3. Photosynthetic pigments

According to results presented in table (5) fruit peels significantly (p≤0.01) increased chlorophyll a at (8, 12 g) by powder extract methods as compared to their control. Fruit peels significantly (p≤0.01) increased total chlorophyll at dose (12 g) by powder extract method as compared with their control. Fruit peels significantly (P≤0.01) increased carotenoid at doses (12 g) by powder extract methods as compared with their control. Increasing in chlorophyll a, b, and total chlorophyll increased photosynthetic process which increasing yield of plants and increase production. Carotenoids play as a free radical which increased chlorophyll of such plants (Bakry et al., 2012). (El-Bassiouny, et al., 2016) found that orange peels due to presence of natural antioxidants such as flavonoids and Vitamin C.
increasing antioxidant enzyme activity and promoting photosynthesis, maintain enzyme activity. Fruit peels increased nutrients in plants especially N, P which is used in biosynthesis of chlorophyll content.

Table 3: Interaction effects of fruit peels (Banana and orange peels) and methods of application on vegetative growth characteristics after 45 days from application

| Interaction treatments | vegetative growth characteristics |
|------------------------|-----------------------------------|
|                        | Methods of application | Fruit peels concentration (g) | Plant height(cm) | Number of branches | Stem diameter |
| Powder                 | Powder                 | 0                            | 42.66 bc         | 22.33 bc          | 1.03 a        |
|                       | 4                      | 45.5 bc                      | 22.00 bc         | 1.16 a            |
|                       | 8                      | 42.83 bc                     | 23.33 abc        | 1.33 a            |
|                       | 12                     | 43.16 bc                     | 20.33 c          | 1.06 a            |
| Powder extract        | 0                      | 43.00 bc                     | 22.00 bc         | 1.02 a            |
|                       | 4                      | 43.66 bc                     | 22.00 bc         | 1.09 a            |
|                       | 8                      | 44.16 bc                     | 31.66 a          | 1.23 a            |
|                       | 12                     | 47.83 b                      | 26.00 abc        | 1.40 a            |
| Foliar application    | 0                      | 41.30 c                      | 21.00 c          | 1.02 a            |
|                       | 4                      | 51.33 a                      | 30.66 bc         | 1.36 a            |
|                       | 8                      | 44.33 bc                     | 25.00 abc        | 1.20 a            |
|                       | 12                     | 43.00 bc                     | 24.66 abc        | 1.33 a            |

*Data presented as mean, the same letters mean not significant differences while the different letters mean significant differences p≤0.05

Table 4: Interaction effects of fruit peels (Banana and orange peels) and methods of application on yield characteristics

| Interaction treatments | Yield characteristics |
|------------------------|-----------------------|
|                        | Methods of application | Fruit peels concentration (g) | Number of pods,plant⁻¹ | Number of seeds,pod⁻¹ | Dry weight of 100 seeds |
| Powder                 | 0                     | 13.66 bcd                   | 1.12 bcd               | 37.00 bcd             |
|                       | 4                     | 16.66 ab                    | 1.16 b                 | 44.66 a               |
|                       | 8                     | 16.33 ab                    | 1.11 bcd               | 41.00 abc             |
|                       | 12                    | 10.33 b                     | 1.03 fg                | 35.33 cd              |
| Powder extract        | 0                     | 13.66 bcd                   | 1.13 bcd               | 35.00 bcd             |
|                       | 4                     | 15.33 abc                   | 1.21 a                 | 43.33 ab              |
|                       | 8                     | 18.00 a                     | 1.07 ef                | 39.00 abed            |
|                       | 12                    | 12.66 cde                   | 1.15 bc                | 41.33 abc             |
| Foliar application    | 0                     | 13.00 cde                   | 1.11 cde               | 36.15 bcd             |
|                       | 4                     | 15.66 abc                   | 1.02 g                 | 39.23 abed            |
|                       | 8                     | 17.66 a                     | 1.10 de                | 37.33 bcd             |
|                       | 12                    | 12.33 de                    | 1.06 fg                | 34.00 d               |

*Data presented as mean, the same letters mean not significant differences while the different letters mean significant differences p≤0.05
Table 5: Interaction effects of fruit peels (Banana and orange peels) and methods of application on photosynthetic pigments of leaves (mg·g⁻¹ fresh weight)

| Interaction treatments | Photosynthetic pigments (mg·g⁻¹ fresh weight) | Methods of application | Fruit peels concentration (g) | Chlorophyll a | Chlorophyll b | Total chlorophyll | Carotenoids |
|------------------------|-----------------------------------------------|------------------------|-------------------------------|---------------|---------------|-------------------|-------------|
|                        |                                               | Powder                 | 0                            | 0.98 c        | 1.56 a        | 2.53 bc           | 0.51 c      |
|                        |                                               | 4                      | 0.94 c                       | 1.29 a        | 2.24 c        | 0.49 c            |             |
|                        |                                               | 8                      | 1.13 bc                      | 1.54 a        | 2.68 abc      | 0.58 bc           |             |
|                        |                                               | 12                     | 1.07 c                       | 1.36 a        | 2.49 bc       | 0.53 bc           |             |
|                        |                                               | Powder extract         | 0                            | 0.96 c        | 1.51 a        | 2.53 bc           | 0.52 c      |
|                        |                                               | 4                      | 1.04 c                       | 1.57 a        | 2.62 bc       | 0.55 bc           |             |
|                        |                                               | 8                      | 1.54 a                       | 1.27 a        | 2.82 ab       | 0.68 ab           |             |
|                        |                                               | 12                     | 1.52 a                       | 1.64 a        | 3.17 a        | 0.76 a            |             |
|                        |                                               | Foliar application     | 0                            | 0.99 c        | 1.48 a        | 2.50 bc           | 0.53 c      |
|                        |                                               | 4                      | 1.36 ab                      | 1.55 a        | 2.91 ab       | 0.66 ab           |             |
|                        |                                               | 8                      | 0.63 d                       | 2.17 b        | 2.80 ab       | 0.48 c            |             |
|                        |                                               | 12                     | 1.11 b                       | 1.58 a        | 2.69 abc      | 0.55 bc           |             |

*Data presented as mean, the same letters mean not significant differences while the different letters mean significant differences p≤0.01

Figure 1: Interaction effects of fruit peels (Banana and orange peels) and methods of application on water content of shoot system

*Data presented as mean, the same letters mean not significant differences while the different letters mean significant differences p≤0.05
4. CONCLUSIONS

Application of fruit peels banana and orange peels by different methods such as powder peels, powder extract, and foliar spray have effective roles in growth and development by enhancing vegetative growth such as plant height, number of branches, water content, stem diameter, yield characteristics and chemical contents. Foliar application of banana and orange peels has more effective than other methods.

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