

## Disease and Environmental Factor of Cracking Pomegranate Fruit (*Punica granatum* L.)

Rabar Fatah Salih<sup>1</sup>

<sup>1</sup>Department of Field Crops, College of Agriculture, Salahaddin University, Erbil, Iraq  
Correspondence: Rabar Fatah Salih, Salahaddin University, Erbil, Iraq.  
Email: rabarfatah@yahoo.com or rabar.salih@su.edu.krd

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**Abstract:** Pomegranate is one of the important fruits not only as healthy fruit but also as economical production. It can be used for many purposes, such as a fresh fruit, juice, jam, medicine. However, pomegranate tree can be grown in wide range of conditions. This article reviewed the factors that cause cracking pomegranate fruit and how to control that issue. The cracking of pomegranate fruits may have occurred due to variety, diseases and environmental factor. As known, if diseases on plant are increased the agriculture production is decreased. On the other hand, this article aims to reach high quality of production and avoid or reduce any factors that destroy it.

**Keywords:** Pomegranate, Cracking, Factors, Resistance

### 1. Introduction

Punicaceae is a family of pomegranate (*Punica granatum* L.) which consists of only one genus and two species. It is an important economic fruit, and one of the oldest edible fruit tree species. *Punica granatum* L. is the most marketability produced even though pomegranate originated in central Asia. It has a wide geographic distribution additionally high ability to adaptation in diverse environmental situation (da Silva et al., 2013). Stover and Mercure (2007) reported that Iran, Turkey, Greece, Armenia, Egypt, Palestine, Tunisia, India, Afghanistan, China, Japan, Morocco, Spain, France, Cyprus, and Italy are the famous and the most important countries around the world which produce pomegranate. However, Turkey, Iran, Afghanistan, Syria, Morocco, Spain and India can produce pomegranate fruit with good quality then export to other countries (Isik et al., 2015). Additionally, Halabja state from South of Kurdistan-Iraq is very famous to produce high quality of pomegranate. The biggest festival of pomegranate has been celebrated in 2016 at Halabja/ Kurdistan (Figure 1). Generally, the climatic conductions of Kurdistan are helpful to reach high production of pomegranate.

As has been reviewed by Teksur (2015) pomegranate is usually consumed as a fresh fruit, juice, syrup, jams, or wine. Currently, the rising consumer consciousness for the health benefits of pomegranates has led to a quickly growing in interest in them. As mentioned earlier, pomegranate tree has ability to adaptation in different environmental condition despite that, it has a lot of problems especially at period of fruit development. El-Rhman (2010) reported that fruit cracking is

one of the physiological disorders wherever pomegranate trees are grown. It may be due to moisture imbalances as this fruit is very sensitive to variation in soil moisture. Prolong drought causes hardening of peel and if this is followed by heavy irrigation the pulp grows and then the peel grows and cracks. However, cracking causes a major fruits loss, which is a serious commercial loss to farmers. Fruit cracking, seems to be a problem that lessens the marketability to a great extent. Kumar et al. (2010) also found that changing of soil moisture, climate and tree nutrition with cultivars are the factors have responsibility of fruit cracking. In the next part explaining the factors are reducing and avoiding those problems.



Figure 1: Some pomegranate pictures at pomegranate festival in Halabja state from Kurdistan (2016)

## 2. Research Methodology

This study was conducted in private farms in Kurdistan Region. It was done to recognize the factors affected on the fruit cracking of pomegranate. The researcher applied the objective by visiting and interviewing the farmers from many cities and villages. Then, great information was collected from them and compared to results were found by other researchers.

## 3. Results and Discussions

All information were collected during visited the farm showed that pomegranate trees have several problems it was not only relationship to period of fruit development but also with different growth stages.

### 3.1. Relationship between Plant Nutrition and Fruit Cracking

Plants require nutrient not only for development and completing their stages of lifecycle but also for maturity of the fruit. As mentioned earlier cracking of fruit needs immediate treatment to reduce the loss in cultivation.

Numerous studies showed that micronutrients and macronutrients significantly affected the quality and yield of pomegranate fruits. As has been found by Bambal et al. (1991) iron, boron, manganese and zinc increased fruit yield, whereas boron reduced the percentage of cracking fruits. On the other hand, fruit cracking was reduced significantly with application of 300 ppm pacloputrazol (Khalil & Aly, 2013). Moreover, Salih et al. (2016) reviewed that maximum total fruit production, highest proportion of fruit production appropriate for marketing, good in quality, great in mineral content and good in keeping quality are required great amount of potassium. Additionally, quality of production has a good relationship with the amount of chemical compounds in the cell wall structures (Salih, 2015).

Calcium and boron contents with calcium/boron ratio in soil and plant tissue are probably main factors on fruit cracking. Increasing boron, potassium, magnesium and sodium up take increases severity of calcium deficiency with result of higher cracked fruit ratio (Aydin & Kaptan, 2015).

Other researchers showed that calcium applications caused to reduce number of cracking fruit in fig and pomegranate (Aksoy & Anaç, 1993; Hepaksoy et al., 2000). Hasani et al. (2012) also reviewed that decrease in juice percent of pomegranate fruits caused by zinc spray was related to producing smaller fruits, increase in fruit peel weight and reducing total arils of fruits. Singh et al. (1990) used the GA3 solution concentration of 200 mg/L to pomegranate trees, which is showed that fruit cracking was reduced.

Results from experiments of (El-Khawaga, 2007) showed that foliar application with paclobutrazol and zinc-sulphate reduced the percentage of splitting fruits in Manfaluty pomegranate cultivars in both seasons 2002 and 2003 at El-Balyna, District, Sohag Governorate. However, Ahmed et al. (2000) observed that splitting in fruits in Manfalouty pomegranate cultivar was reduced when trees by paclobutrazol were sprayed.

### 3.2. Factors Affecting Fruit Cracking

#### 3.2.1. Fruit Cracking Caused by Irrigation

Fruit cracking occurred as a pre-harvest disorder which may result from the fluctuation of soil moisture and relative humidity, dry wind, rain or heavy irrigation following a dry spell, and states that the potential to develop crack resistant varieties still exist (Hepaksoy et al., 2000).

Other researchers reviewed that a sudden change in soil moisture causes moisture stress, which affects fruit development adversely and leads to fruit cracking (Meshram et al., 2010). They also reviewed that drip irrigation at 8 l/hr/day for 3 hrs increased yield from 17.7 kg/plant in the control to 28.2 kg/plant with considerable reduction in fruit cracking. Table 1 shows the water requirements of pomegranate tree 1 liter per day (l/day). According to the results from this table, time is not only requirement but also age of the tree is more important for irrigation in the end to receive excellent

production of quality and quantity. Based on the interviewed, farmers in Kurdistan have not applied this kind of schedule of irrigation. It also may be correct for other countries in the world. As found, they believed that pomegranate tree in the stage of fruit development need to more water compared to other stages. On the other hand, a lot of them said that irrigation has no role in fruit cracking but it gets affected by disease. Additionally, other problems might be due to the style of the farm since they planted many kinds of tree together in the same farm at that moment they cannot irrigate trees based on ages and types.

Table 1: Water requirement (l/day) for pomegranate tree\*

Months	Age of tree (years)				
	1	2	3	4	5
January	2.70	7.59	20.93	29.90	38.87
February	2.83	10.39	28.66	40.95	53.23
March	2.96	11.10	31.08	44.40	57.72
April	3.24	12.15	34.02	48.60	63.18
May	3.40	12.75	35.70	51.00	66.30
June	1.99	7.69	21.95	31.35	40.75
July	1.54	5.94	16.94	24.20	31.46
August	1.33	5.13	14.63	20.90	27.14
September	1.33	5.13	14.63	20.90	27.17
October	1.57	6.07	18.90	27.00	35.10
November	1.80	6.75	18.90	27.00	35.10
December	1.68	6.30	17.64	25.20	32.76

\* Bangar and Kadam (2000)

Figure 2 (a, b) is an evidence for that issue. Same cause of fruit cracking was reached in both farms. Fatah was a farmer, who believed that cracking of pomegranate fruit has strong relationship with disease not with irrigation. He also said that maybe it depends to the type of water, since in his village (Darbasar village, Kurdistan) there are many oil fields that may cause water pollution. Despite that, areas with high relative humidity or rain are totally unsuitable for its cultivation, as fruits produced under such conditions tend to taste less sweet and are prone to cracking (Glozer & Ferguson, 2008). Shayma has an MSc in Agriculture Science and also she supervised her father's pomegranate farm in Garmian, Kurdistan. She said that, last year the average of fruit cracking was too high due lack of schedule and frequency of irrigation. By contrast, in this year the average of fruit cracking was reduced by reducing number of irrigation and then applied schedule of irrigation, additionally they used some pesticides and herbicides in different stages of growth such as; flowering and fruiting.

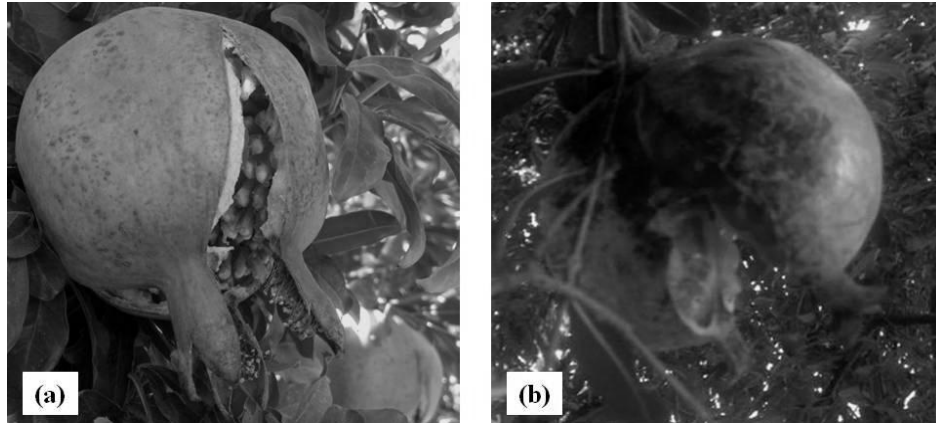


Figure 2: Pomegranate cracking caused by irrigation: (a) at Fatah farm, Darbasar village, Kurdistan; (b) at Balakaeaty, Choman, Kurdistan.

### 3.2.2. Fruit Cracking Caused by Diseases

Pest and disease increased when fruit is fully matured and late of harvesting also which leads to cracking of the fruits (Khalil & Aly, 2013). Nevertheless, cracking of the fruit leads to storage disease. Figure 3 shows some pomegranate fruit that were cracked due to disease.

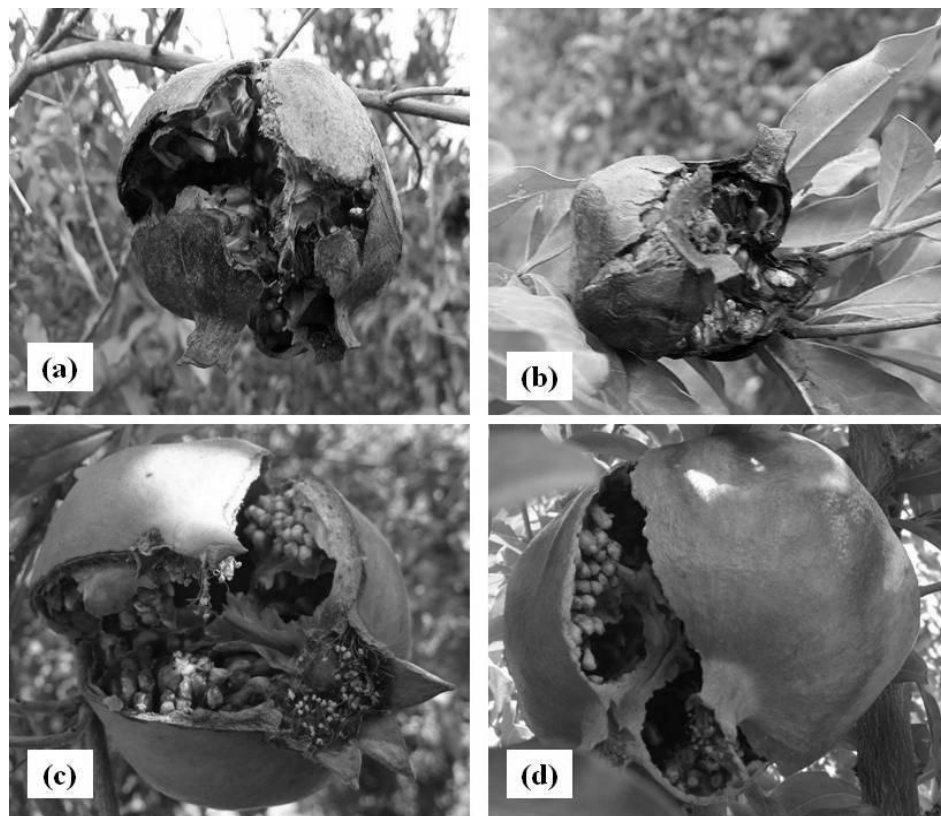


Figure 3: (a,b) Disease of pomegranate caused by Bacterial Blight on fruit; (c,d) other diseases found in Fatah farm at Darbasar village, Kurdistan

As explained by Deshpande et al. (2014), the most severe disease of pomegranate is bacterial blight. It is found on same parts of the tree, which is on the stem part next spread through leaves and then to fruits. Disease begins as brown to black spot around the nodes which is on the stems. After stems the spots transport to the leaves and then infected leaves may drop off. In the end, fruits are contaminated by the brown to black spots with cracks passing through the spots.

Based on the results as found in the farm, diseases correlated of cracking (Figure 4 a). Cracking attracted pests and insects then it may lead to diseases (Figure 4 b). By contrast, some time diseases caught inside the fruits then followed by cracking (Figure 4 c, d).

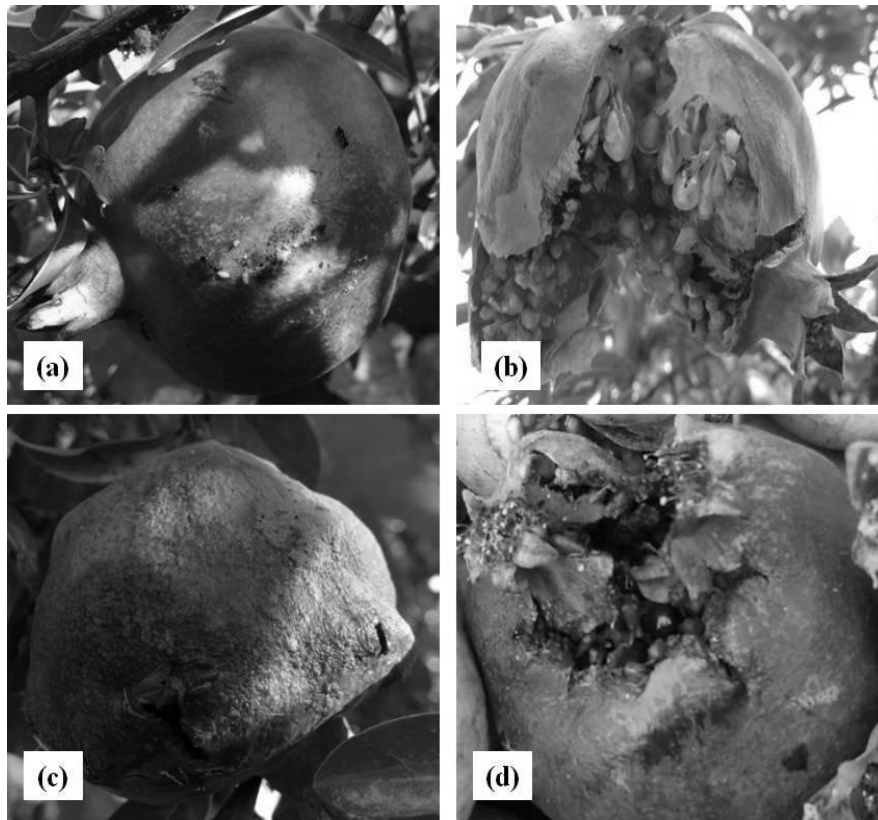


Figure 4: Disease of pomegranate; (a,b,c) at Bakhtyar farm, Balisan; (d) at Shayma farm, Garmian, Kurdistan.

On the other hand, from the research of Pant (1976) observed that increase of air temperature to be other factor of fruit cracking. Fruit cracking may also happen due to great differences of temperatures among day and night (El-Rhman, 2010), as observe in the (Figure 5). Jafar was another farmer had a pomegranate farm in Erbil, Kurdistan so he believed that, fruit cracking occurred due to dry fruit wall's by increasing temperature and sun bright in summer and then with decreasing temperature in autumn.

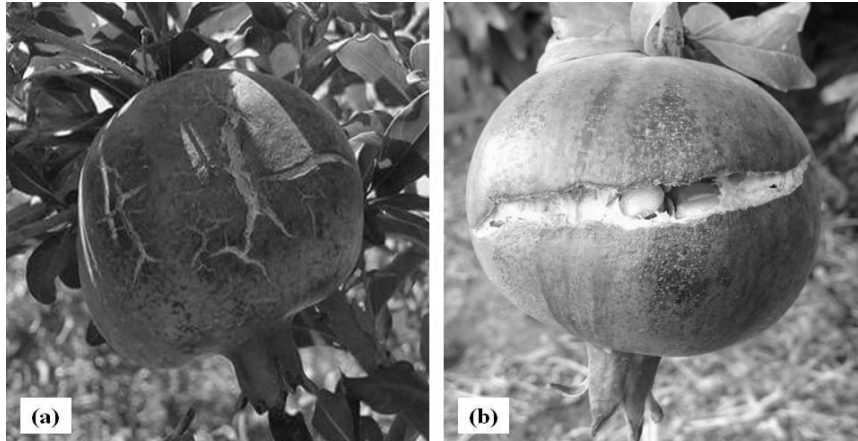


Figure 5: Disease of pomegranate caused by temperature changing; (a) at Jafar farm, Erbil, Kurdistan; (b) at Bakhtyar farm, Balisan, Kurdistan.

### 3.2.3. Fruit Cracking Caused by Varieties

As has been reviewed by Ahmed et al. (2014) hot dry weather, heredity, variety, fruit growth and cultural practices are the main factors involved in enhancing fruit cracking of pomegranate. However, Hepaksoy et al. (2000) summarized that the differences among the cultivars of pomegranate in respect to fruit cracking, an important physiological disorder, seems to be significant. Koycegiz and Siyah were sensitive to cracking, Kadi and Lefon were resistant to cracking, but Cekirdeksiz (Seedless) and Feyiz were intermediate to cracking. Figure 6 shows fruit cracking caused by varieties.



Figure 6: Pomegranate cracking caused by variety  
Source: Najat Dargalayi, Halabja, Kurdistan

### 3.2.4. Fruit Cracking Caused by Maturity

Results from farm interviewed showed that, maturity was another factor affected of fruit cracking as can be seen in (Figures 7 and 8). Abubakar et al. (2013) observed that fruit cracking can happen due to several characters which are, orchard soil management, unsuitable levels of water at maturity phase, temperature, light, and micronutrient deficiency. Another evidence of fruit cracking caused by maturity is appear from the research was done by Mars (2000), if the soil become too dry followed by heavy irrigation or rains during fruit maturity lead to cracking. Images: (a,b,c) from figure 7 show some pomegranate fruits were cracked due to maturity. Additionally, figure 8 shows pomegranate was totally opened also due late maturity.

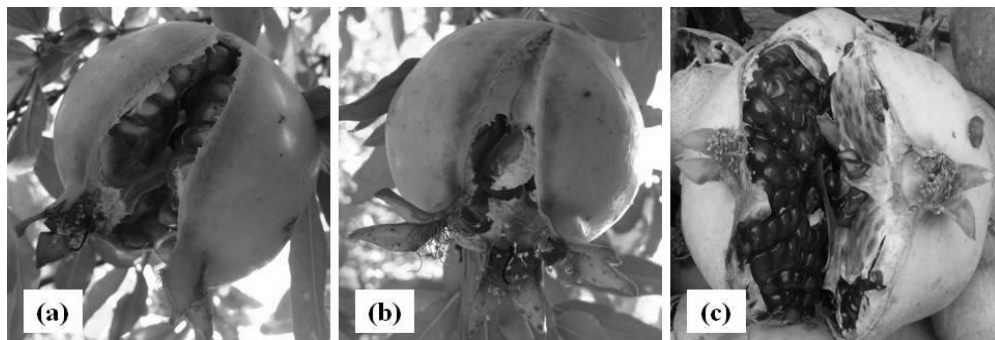


Figure 7: Pomegranate cracking caused by maturity: (a, b) at Bakhtyar farm, Balisan, Kurdistan; (c) at Shayma farm, Garmian, Kurdistan



Figure 8: Pomegranate cracking caused by late maturity. Source: Bashdar farm, Qasrok, Kurdistan

## 4. Resistance to Fruit Cracking

According to the previous studies the resistance of fruit cracking were correlated to several factors and can be controlled, that factors as; environmental factors, cultivation process, and the factors relationship to the variety. A mixture containing salicylic acid at 100 ppm, magnesium sulphate at 0.5%; chelated-Zn at 0.05%, boric acid at 0.05% and calcium chloride at 2% were suggested to spray the trees four times, it was for reducing fruit splitting and improving productivity of Manfalouty pomegranate trees, grown under Assiut region conditions (Ahmed et al., 2014). Additionally, Abubakar et al. (2013) believed that some morphological properties of pomegranate

fruit cv. Kandhari kabuli and lowest amount fruit splitting were recorded in trees when treated with cytozyme 4 ml/l. On the other hand, it can be resistance of fruit cracking if controlling climate and orchard management, particularly water regime and irrigation scheduling (Glozer & Ferguson, 2008).

## 5. Conclusion

This research showed some possible factors which may have impact on fruit cracking of pomegranates and then it provided methods to avoid the factors. For example, regular irrigation is necessary for improving development of fruits and to avoid fruit cracking. On the other hand, applying several chemicals may have positive effecting for that purpose. Besides that, variety has crucial role to resistance fruit cracking consequently choose that kind of variety is more important.

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