

# Effect of Geographical Factors on Utilizing Land Use Under Dry Farming in Iraqi Kurdistan Region

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## Abstract

This study carried out in Sulaimania area under dry farming in Iraqi Kurdistan region during 2009-2015 for utilizing some of their wild root stocks and sever of shallow and rocky soil ecosystem for fruit production under rained condition.

Sulaimania region is located at  $35^{\circ} 10' -360 27' -N$  and  $44^{\circ} - 40' - -460 22' - E$ . It forms a part of Zagreus Mountains. Its topography varies between plains, foothills and high mountains slopes.

Periods of rainfall shortage from 1-3 years every five years and even rainfall shortage within the same season. In addition to that shallow and rocky soil which comprise 20% of Iraqi Kurdistan region are among the serious obstacles facing agriculture development in present time and in distance future in the region. Thus Biological water harvesting through grafting of some fruits onto some wild root stocks under such severe ecosystem were used for the investment of the above sever ecosystem in Sulaimania region.

The results of this study show that it is possible to graft some local fruit varieties such as quince, loquat, pear, and apple onto wild hawthorn and several local varieties such as loquat , Nazca harmy ,harmy golawy on wild pear and peach and apricot and plum onto wild almond ,in addition to plum,apricot,peach and cherry on wild cherry ( Mahleb). The estimated water consumption of above mentioned fruits under regular irrigation in Kurdistan region is about 700 mm / season or 7000 m<sup>3</sup> water /Ha/ season/ . whereas, the above mentioned rootstocks which are among natural wild flora of Iraqi Kurdistan depend entirely on annual rainfall with water consumption of around 450 mm rainfall /ha/year. Consequently grafting fruits on wild root stocks resulting in biological water harvest of 700 mm/ water/season or 7000 m<sup>3</sup> water in comparison to grown fruits under regular irrigation .This make fruit producers more interested in using the above wild root stocks which resists severe ecosystems for exploitation of shallow, rocky ,calcareous and eroded soils . At the same time, it helps in facing drought years, which is considered as one of the greatest problems of current time and in the distant future in the region. Moreover, planting grafted hawthorn rootstocks with several fruits on the same tree provide the facility of facing the reciprocal climatological conditions due to differences in time of flowering and maturity as well as expanding horticulture areas and even in plains area under supplementary irrigations system as an important tool for drought challenge.

## Introduction

Rainfall, temperature, and nature of the lands are among geographical factors affecting land use. Rainfall and its fluctuation in the last decades are in front of obstacles facing agriculture production and land use in the Middle East countries including Kurdistan.

Rainfall fluctuations and periods of rainfall shortage from 1-3 years every five years ( Figs, 1,2,3 ) and even rainfall shortage within the same season, causes serious problems on development of plant flora, agricultural Production, and utilizing, lands in Sulaimania govern ate ( Mohamed Ali, 2012).

Although, Kurdistan is rich with water resources but Ghanats and springs, surface and deep wells are still the major sources of providing irrigation water for agriculture production due to disorganizing water resources in the region therefore expanding the orchard area under such condition is difficult.

Most of the Mountains in Iraqi Kurdistan region have rough, broken, and stony lands with shallow soil (Guest, 1966). Rocky and barren lands in the mountains are long with gullied lands in Iraqi Kurdistan region which comprise 15-20% of the regions total area and are classified as marginal or waste lands (Buringh, 1960). In addition to that more than five million hectare of forests, grazing and agricultural lands are transformed gradually to waste lands (Morgan, 1966). The percentage of waste lands increases unless soil conservation measures are put into effect.

To restore the rocky lands from more erosion, native plants species should be chosen (Guest, 1966). Reports show that 29 species around the world had roots in bed rocks to a depth of 60 m (Jones and Graham, 1993) and weathered rocks can serve as important rooting medium (Arkley, 1981). Many researches have shown that rocks are capable of holding available water for plant use (Stone and Kalisz, 1991).

In Iraqi – urdistan region, it has been found that the majority of the studied ecosystems include shallow soils and barren rocks. Not only these soils are shallow but also they are often coarse textured, particularly, those on sandstone and conglomerate formation.

On other hand Wang et al. (2003) mentioned that environmental drought is a main cause behind the decrease of vegetative growth of fruit trees and lowering of fruit production by more than 50%. The including of drought resistant fruit trees in breeding programs and exploitation of water resources will give an expected increase in fruit production.(Ercisli et al. 2008) observed that nowadays, the most common rootstocks used by fruit growers in Turkey are the wild types of apples, pears, plums, almonds and wild cherry ( mahleb) . The usage of these rootstocks is not important only in the increase of productivity, but also important in vegetative growth management and proper acclimatization of budded trees against environmental conditions such as drought and high temperatures.

Rootstocks of wild hawthorn, wild cherry, wild almond and wild Pear are among the rare native plants which grow under severe ecosystem in Iraqi Kurdistan region. The mentioned natural plants in such ecosystems undergoes severe stress during summer season due to lack of precipitation for more than 4 months. Moreover climate is very hot; dry and with high evapotranspiration 6-9 mm/ day in hot months (Mohamed Ali, 2012). In spite of such severe

conditions, the natural flora of the region can survive and give satisfactory yield ; due to some anatomical characteristics such as higher ability of roots (a deep root which is penetrating far below the soil overlying bed) to store and absorb water at high soil moisture potential.

Under above sever ecosystem, biological water harvest through grafting fruits onto wild root stocks is among the effective tools for exploitation the above sever ecosystems through utilizing their wild root stocks in the region such as wild pear ; wild cherry; wild almond wild ,oak, wild fig and wild hawthorn for fruit production .

Periods of rainfall shortage from 1-3 years every five years and even rainfall shortage within the same season in most years. Moreover shallow and rocky soil which comprise 20% of Iraqi Kurdistan region are among the serious obstacles facing agriculture development in present time and in distance future in the region. Thus water harvesting under such severe condition is of great importance.

The objectives of this study are to encourage and make farmers more interesting in exploitation of rocky and shallow soil through biological water harvest via utilizing some of their natural wild root stocks for fruit production under dry land farming and in the same time challenging the reciprocal climatological conditions under rained conditions in mountains area of Iraqi Kurdistan.

## Materials and Method

This study was conducted near Qula rash village during 2009-2015 at Azmar Mountains which is located at north east of Silemani (As Sulaymaniyah) city, Kurdistan Region-Iraq, 1330 meters above sea level and having an annual rainfall fluctuated from 300-1200 mm varying from year to year. At this location, many different species of wild root stocks such as hawthorns, Pears, Cherries ... etc. are naturally grown and prevailed (Photo 1.A,B,) and Photo(2 A and B) ( Mohammed Ali,2012) .

This study was performed for exploitation of sever ecosystem of rocky and sandy soil through biological water harvest via graft age of wild hawthorn tree with (apple, pear, quince and Loquat ,wild Pear with Locally desirable varieties like Nazca harmy and harmy golawy and wild cherry as rootstocks for budding different fruit varieties ,( peach,plum ,cherry ), using pipe-budding ( Mohammed Ali,J.J, and Noori,I.M 2011). The mentioned natural plants were headed back during March, leaving 50 cm stubs on lateral branches. When new shoots emerged on the stubs, 3-4 of them were selected from the outer periphery, the remainders were thinned out soon after their emergence, and desired shoots were removed from time to time.

During June, 2009, each scion cultivar was budded onto hawthorn trees and 20 buds were used for each scion cultivar as three replicates.

## Results and Discussion

Due to un-organizing water resources ,Ghanats , Springs ; surface wells and deep wells are still the main source for providing irrigation water for agriculture production in summer and autumn season. Therefore , the orchard area have not been expanded in Kurdistan region since drought years results in destroy even the established fruit area rather than establishing new orchard fields in region.

Biological water harvest is among the effective means for development orchard fields through utilizing wild plant rootstocks which depend entirely on rainfall for fruit production . The water consumption for the studied orchard fruits under regular irrigation in the region is a round 7000 mm or 7000 m<sup>3</sup> /year while the minimum water consumption for root stocks is 450mm ( Mohammed Ali, 2012 and Amin,2003). Thus biological water harvest through grafting of some fruits onto wild root stocks in each of the following graftages results in water harvest of 700 mm/season or 7000 cubic meter water /season in comparison to grown the studied fruits under regular irrigation .

The results of graft age of the above mentioned fruits onto wild root stocks are illustrated as below:

- 1- Utilizing of wild hawthorn rootstocks which depend entirely on rainfall for biological water harvest through it;s graft age with each of apple , Pear,Quince, and Loquat as it is shown in Photo 3 (A ,B,C,D,E) .
- 2- Utilizing of wild cherry (Mahleb) rootstocks which depends entirely on rainfall for biological water harvest through it's graft age with each of cherry and plum , as it is shown in Photo (4 ) and Photo (5) .
- 3- Utilization of wild Pear root stocks for biological water harvest through graftage of Loquat and Nazca Harny onto wild pear as it is shown in Photo (6).
- 4- Utilization of Wild cherry for biological water harvest through graftage with peach and apricot as it is shown in Photo (7).

The above results of utilizing natural plant resources in sulaimanyah governorate for fruit production under rain fed condition under sever ecosystem of rocky and shallow soil are confirmed with the achieved results reported with each of Mohammed Ali,2001;Mohammed Ali,2012; Eecisli,2006 and Wang et al.2003 . who reported that natural plant rootstocks and prevail age environment play a great role in the development of fruit production and recommended using of wild root stocks for fruit production under as one an effective method for fruit production.

The results of this study show that it is possible to utilize some wild root stocks of rosacea family under dry farming or rain fed condition in Sulaimania region at the sever eco system of shallow , rocky soil , calcite and eroded soil which depend entirely on rainfall for production of some economical fruits like apple ,quince ,pear and loquat on wild hawthorn through their onto wild root stocks of hawthorn , wild pear and wild cherry. while seasonal water consumption of mentioned orchard fruits under regular irrigation is around 700 mm/year or 7000 m<sup>3</sup> /Ha/ year and for root stocks is 450 mm . Consequently the graft age results in biological water harvesting of about 7000 m<sup>3</sup> water /ha/year in comparision to growing the above fruits under regular irrigations.

Moreover, planting grafted wild rootstocks of hawthorn, cherry and Pear provides and encourage the facility of a forestation and exploitation of the above mentioned types of soils in marginal areas including rocky and shallow soil as well as retarding desertification and expanding the growing areas of fruits under rain fed condition.

At the same time, it helps in retarding and facing drought years which are considered as one of the greatest problems of current time and in the distant future in the region which result in low production and loss of vegetation flora.

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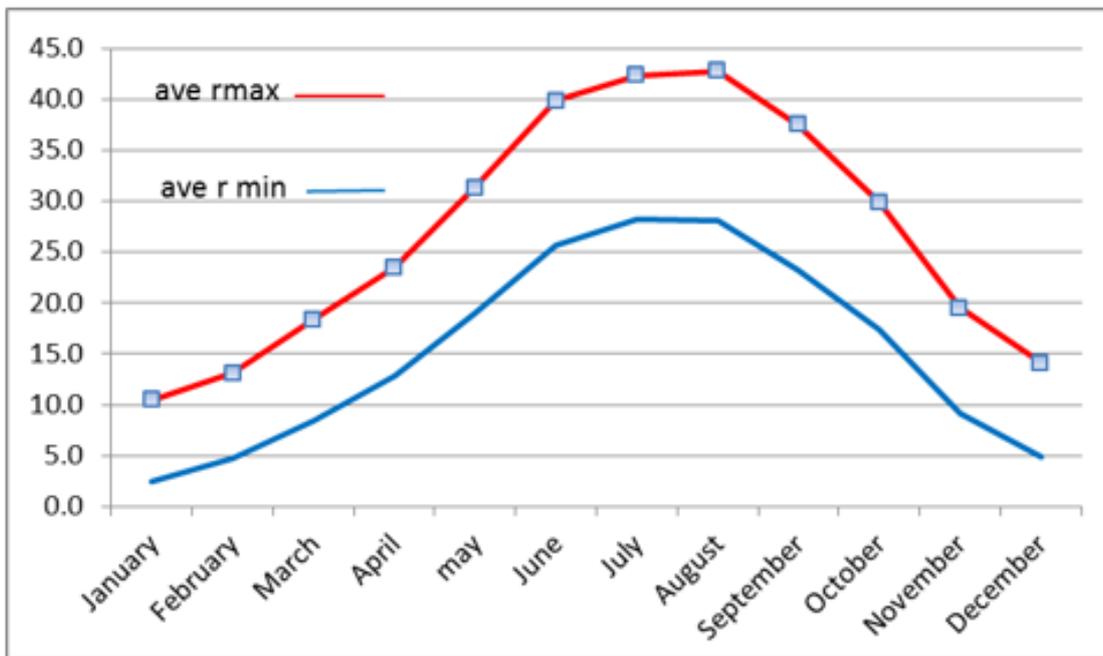


Fig: (1 ) Monthly average of maximum and minimum temperature in Metrological Station of Sulaimania during 1973 - 2012

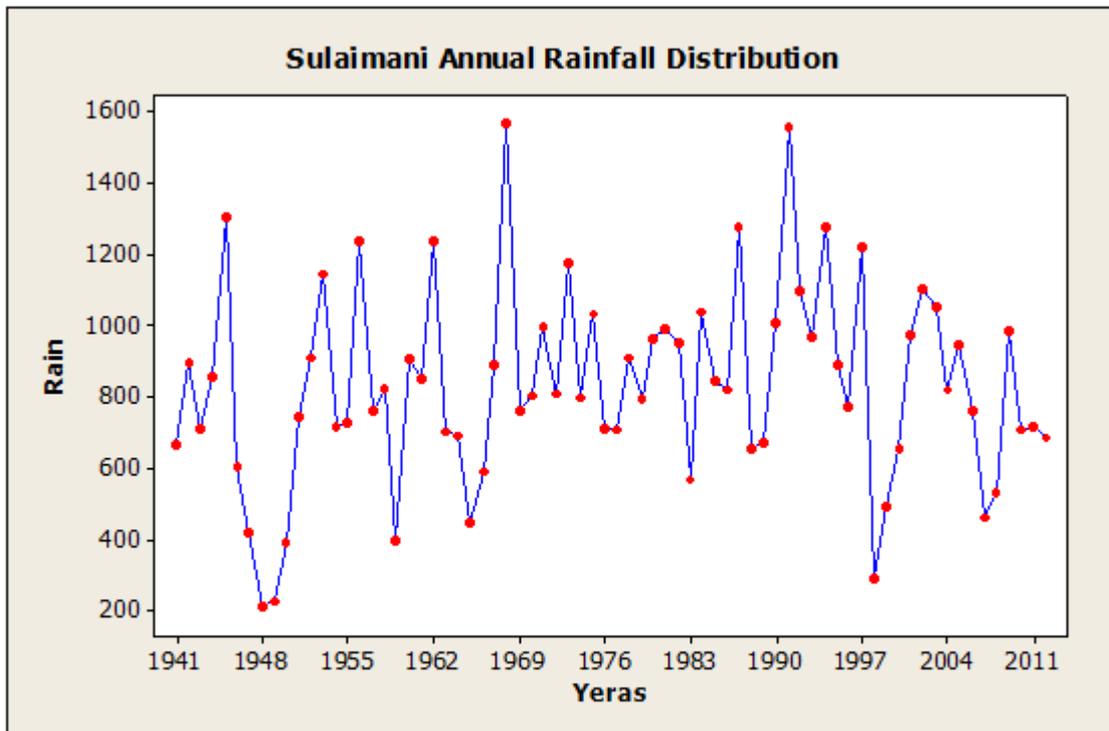


Fig (2) Annual rainfall distribution in Slemani Governorate during (1941 – 2013).

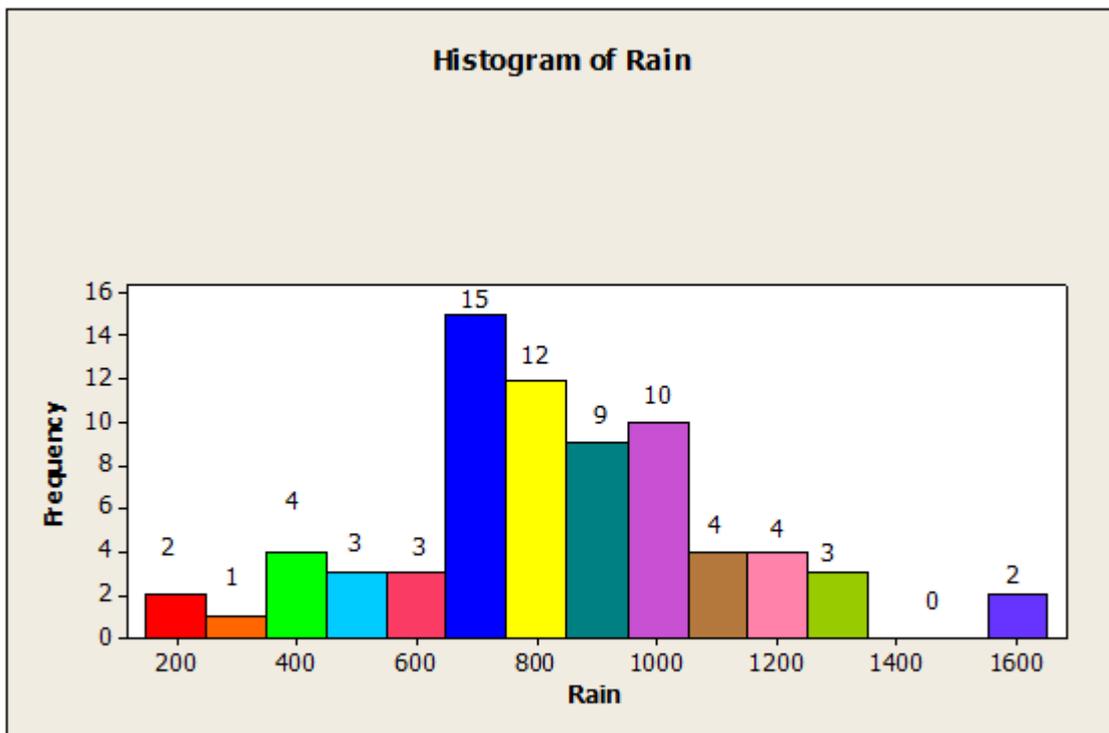


Fig (3) Frequency of rainfall distribution in Sulaimania governorate during 1941- 2013



Photo (1 ) A Natural Ecosystem in which Wild Hawthorn grow at Azmer mountains series



Photo (1) B- Natural Ecosystem in which Wild Hawthorn grow at Azmer mountains series



**A**



**B**

Photo (2): Some ecosystems onto which wild Almonds are naturally grown. Photos - A and B ,wild almond growing on limestone rocks and kometan formation .A- Ranya area. B- Goizha mountains



Photo ( 3) A- Graft age of Apple onto wild hawthorn bearing fruits in the third year of grafting.



Photo (3) B- Grafting of Loquat onto wild hawthorn bearing fruits in the third year of grafting.



Photo (3) C- Grafting of Quince on wild hawthorn in the third year of budding .



Photo (3) D Top graft age of Pear onto wild hawthorn in the first season of budding.



Photo(3) E shows Graft age of Loquat onto wild hawthorn in the first year of budding



Photo (4) Utilizing wild Cherry rootstocks for cherry production .



Photo (5) Show Graft age of Plum on Wild Cherry in the third year of budding.



Photo(6 A) show graftage of Loquat and common local variety of Nask harmy on wild pear.



Photo (6) B- Show Graftage of local variety Naska Harmy onto Wild Pear bearing fruits the second year using cleft grafting.



Photo (7 ) Show Graftage of Apricot and Peach onto Wild Cherry in third year of budding.