

Water Harvesting Through Utilization of Wild Pear Rootstocks For Production of Some locally grown pear cultivars under Rained Conditions In Sulaymaniyah Region

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ABSTRACT

This study was carried out at Azmar mountains, Sulaymaniyah city, Kurdistan region-Iraq, under(rained condition during the seasons 2011 – 2014 for water harvesting through utilizing wild Pear as a rootstock for production of some common local pear cultivars such as Naska harmy , Harmy Golawy and Harmy lasora and utilizing at the same time shallow, rocky and eroded soils which comprises more than 20% of the lands of Iraqi Kurdistan region.. The results show that it is possible to graft common Naska harmy ,Harmy golawy and Harmy lasora by cleft method of grafting onto wild pear rootstock which depend entirely on rainfall with minimum water requirement of 450 mm rainfall. Whereas , locally grown pear cultivars Naska harmy ,Harmy golawy and Harmy lasora require under normal irrigation system about 700 mm rainfall/year or 7000 m³water /ha/year. Consequently the grafting results in water harvesting of about 7000 m³ water /ha/year and makes people more interested in using wild pear rootstocks for fruit production which resist severe ecosystems in which wild pear is grown in mountains area in sulaimanyah region .Thus at the same time, it helps in expanding the pear growing area under normal irrigation in plain area of the region.

Keywords: Water harvesting, Rootstocks, Wild Pear, Rained condition , Grafting

INTRODUCTION

Wild Pear rootstocks *Pyrus* Species are among the rare native plants which grow under severe ecosystem in Iraqi Kurdistan region (Guest, 1966). Photos (1a and 1b) shows some wild pears in the studied area. The mentioned natural plants in such ecosystems undergoes severe stress during summer season due to complete lack of precipitation for more than 4 months during Jun to September and little amount of rainfall in May and October. 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.

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

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).

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.

Although, Kurdistan is rich with water resources but surface water and deep wells are still the major sources of providing irrigation water for agriculture production including orchard production due to disorganizing water resources in the region. Moreover rainfall shortage every 3 years among five years results in minimizing water resources in some years. Therefore ,expanding the orchard area under such condition is difficult .Thus 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 including pear rootstocks.

The objectives of this study are for water harvesting through expanding the pear growing area in mountains area under rained condition beside its growing under normal irrigation system in plains area through grafting natural wild pears in mountains area with common locally grown pears.

MATERIALS AND METHODS

Variety characters

This study deals with grafting of wild pear which is grow as natural wild root stocks in mountains areas of sulaimanyah governorate under completely rain condition near the Kolarash village with desirable local pear varieties of Naska hamy, Harmy golawy and Harmy Lasora which have some desirable characteristic such as storage ability , delicious taste and aroma.

Grafting:

On 10th Jun, 2011 natural rootstocks of wild pear were grafted with common local varieties of Harmy golawy Naska hamy and Harmy lasora at *Azmer mountains near Kolarash village, Sulaymaniyah city, Kurdistan region*- using Clift method of grafting (Hartmann *et al.*, 1997).

Experiment Design:

The experiment carried out in completely randomized design with 10 replications . The studied varieties were of Harmy golawy, Naska hamy and Harmy lasora which were grafted on wild pear.

RESULTS AND DISCUSSIONS

Table (1) shows the average annual precipitation and temperature for the last 10 years and F-parameter suggested by (Lang). The results indicate that F-parameter ranges from 23.16 in Chamchamal weather station to 80.96 in Penjwen. The small value of F-parameter indicates more aridity.

Fig (1) shows the distribution of annual precipitation from 1942-2013 as recorded in Sulimaniyah meteorological station which indicates the probability of coming 1-3 drought years every 5-7 years in which precipitation declines to less than 500 mm and in some years to less than 400mm which is considered as drought years. (Mohamad Ali, 2008)

Fig(2) shows that there are 13 years among 73 years, in which the precipitation is low and not enough for re-activation the springs and Ghanats which is still the main source of irrigation orchard fields in the region. Therefore, Finding new root stocks in rainfed area which comprises more than 85% of agricultural lands in the region. In addition to that providing supplementary irrigations in plains area might be considered as effective mean toward expanding the orchard growing area.

Fig (3) Frequency of rainfall distribution in Sulaymaniyah governorate during 1941-2013, in which rainfall are represent in the form of histogram. Fig (4) Monthly average of relative humidity distribution of Sulaymaniyah Meteorological station during 1973-2012. Relative humidity is high during winter and low in summer while it is conviennet in spring months for grafting ,therefore most of grafting is done in spring months.

Table 2 shows that there are significant differences among the studied varieties in this study in term of the studied characters (bud shoot length , bud shoot diameter number of successful grafting). In this study three locally common varieties namely Naska harmy ,Harmy lasora and Harmy golawy were successfully grafted onto wild pear rootstock,This results agree with those reported by (Ercisli et al. 2008). Who reported that the including of drought resistant fruit trees in breeding programs and exploitation of water resources will give an expected increase in fruit production.Moreover 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.

The variety Nacka harmy is surpassed the other two varieties in terms of bud shoot length, bud shoot diameter and number of successful grafting .Variety No1 recorded the highest value of bud shoot length of 118.75cm, bud shoot diameter of 48.60 mm and number of successful grafting 8 with 80%. The superiority of the variety of Nacka harmy over other varities might be attributed to availability of comp ability between wild pear and Nascka harmy and environmental conditions. (Hartmann *et al.*, 1997).

Results show that it is possible to graft local common varieties of pears namely Naska harmy ,Harmy lasora and Harmy golawy onto wild pear using cleft method of grafting with good percentage of 80% 70% and 50% respectively. Therefore grafting resulting in water harvesting of around 700 mm in comparison with grown the mentioned varieties under normal irrigations which need 700 mm during the growing season. This will help in expanding the grown area of pears in mountains area besides its growing in plains area.

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Table 1. Some climatological data for weather stations in mountainous regions of Sulaimaniyah governorate.

Site	Meaan annual precipitation (mm)	Mean annual temperature (C°)	F-parameter * F= P/T
Bazyan	720.1	17.16	41.96
Halabja	640.0	17.8	35.95
Penjwen	1255.0	15.5	80.96
Sulaymaniyah	658.0	18.5	35.57
Chamchamal	458.5	19.8	23.16
Dokan	719.0	18.9	38.04
Darbandekhan	458.0	19.0	24.01

*F is a parameter proposed by (Lang)

Lang- parameter calculated according to formula, $F=P/T$, in which P= mean of annual precipitation and T = mean of annual temperature.

Table 2. Bud Shoot length, Bud Shoot diameter, number of successful grafting and Percentage of successful grafting of three common pears varieties after three year of grafting onto wild pear



Photo. (1a) show wild pear bearing fruits in the studied area at Azmar mountains area near Kola rash Village in 2014.

Variety	Bud Shoot length (cm)	Bud Shoot Diameter (mm)	Number of Successful grafting	Percentage % of successful grafting
Harmy golawy	112.33 c	44.50 c	5 c	50
Harmy Lasora	117.5 b	46.40 b	7 b	70
Naska harmy	118.75 a	48.60 a	8 a	80



Photo. (1b) show wild pear bearing fruits in the studied area at Azmar mountains area near Kola rash Village in 2014.

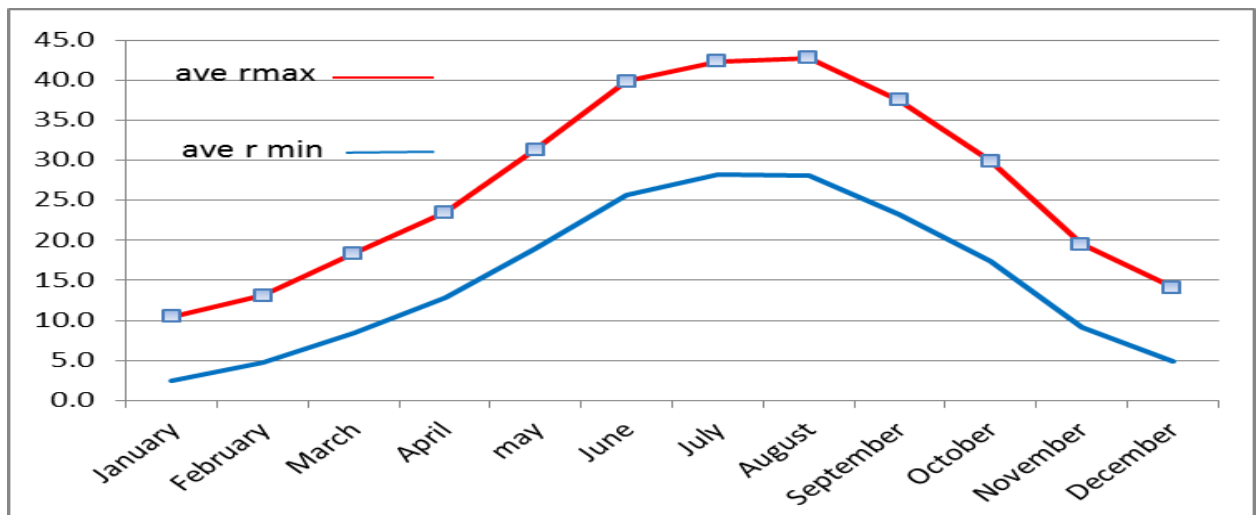


Fig. 1. Monthly average of maximum and minimum temperature as recorded in Meteorological station of Sulaymaniyah during 1973 - 2012.

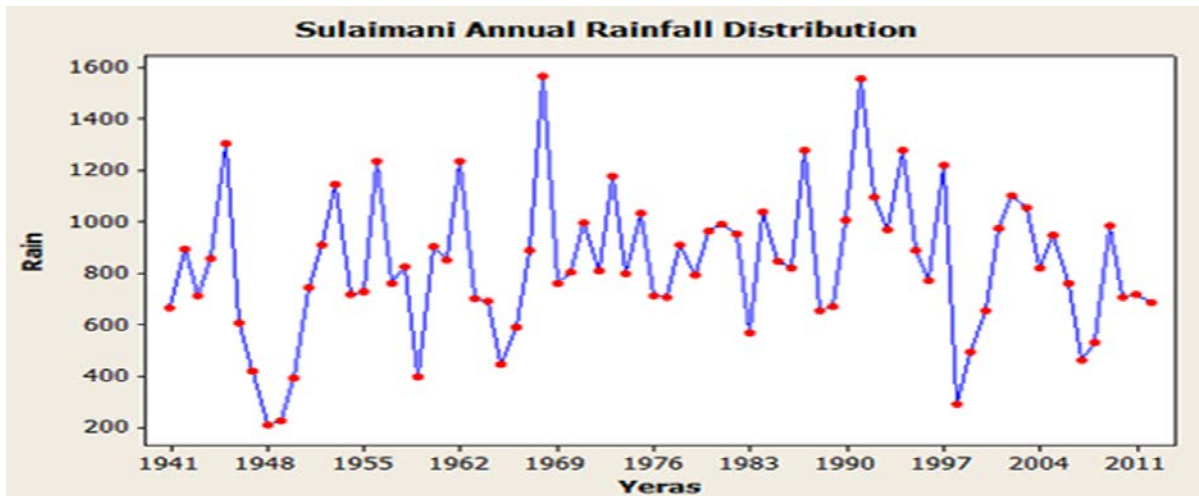


Fig. 2. Annual rainfall distribution in Sulaymaniyah Governorate during 1941 – 2013.

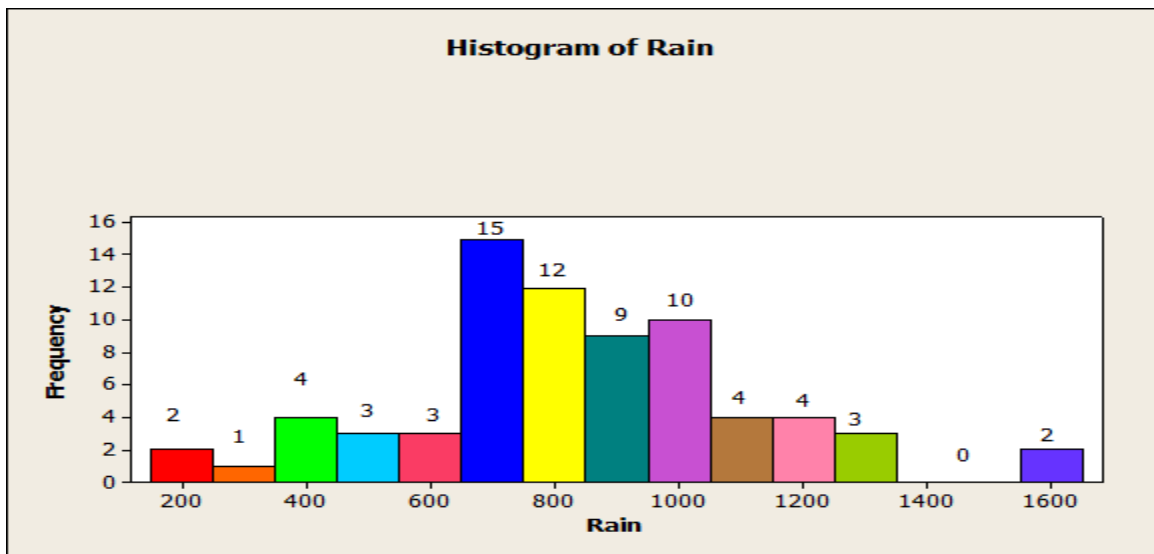


Fig. 3. Frequency of rainfall distribution in Sulaymaniyah governorate during 1941- 2013

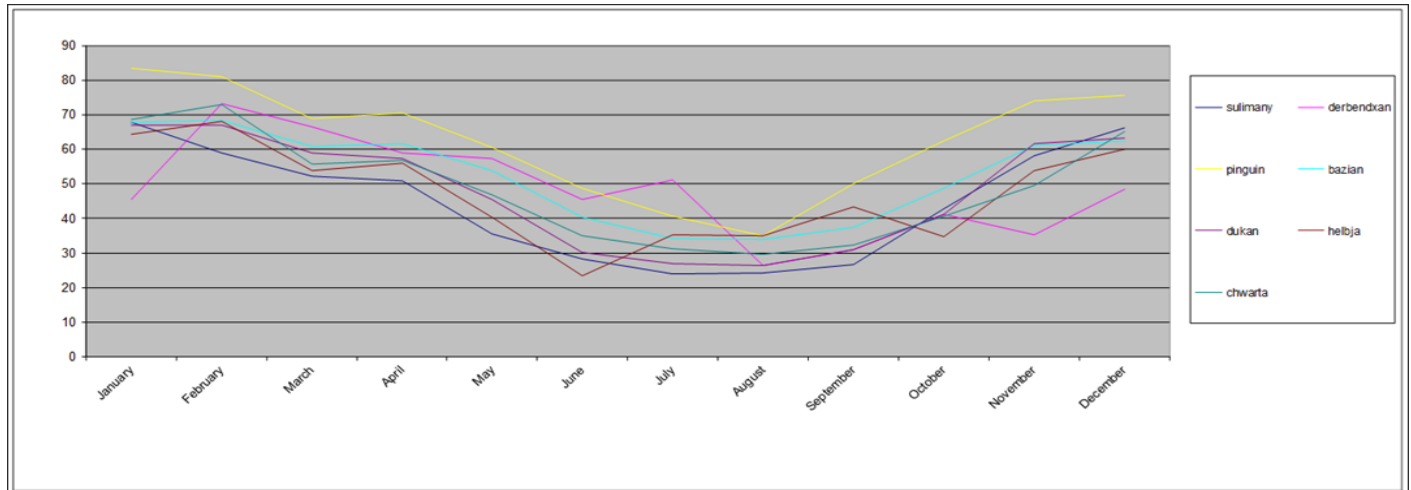


Fig. 4. Monthly average of relative humidity distribution of Sulaymaniyah Meteorological station during 1973-2012.