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RESEARCH ARTICLE

IMPACT OF BIOCLIMATE AND CLIMATE FACTORS ON PLANT YIELD IN THE AREA OF JENIN AT THE NORTH OF PALESTINE

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ABSTRACT

Apricot (*Prunus armeniaca L.*) is one of the most important export crops in Palestine. In this study, we analyzed the mean monthly temperature and precipitation using data from one weather station of the Palestine Meteorological Department, recorded in the period from (1993-2009), with the same years of plant production (rainfed) from the Palestinian Central Bureau of Statistics (PCBS). Statistical analysis included a bioclimatic analysis of Palestinian meteorological station for the period previous by using bioclimatic classification of the Earth of Rivas Martinez Salvador, with regard to simple continentality index, compensated thermicity index, annual ombrothermic index, water deficit and soil water reserve. In concluded, when we applied a principal component analysis (PCA), observed that the Jenin type plot during (1996-2004) are positively correlated and affected by the bioclimate factors as annual ombrothermic index, compensated thermicity index and climate factors as a soil water reserve to plant yield, while negatively correlated and influenced by the rest factors of the climate as temperature, deficit water and precipitation during (1993-1996 and 2004-2009). Furthermore, the optimum of the plant production is achieved with values of simple thermicity index between (16-22), annual ombrothermic index (2.7 - 4.5), compensated thermicity index (250-420), precipitation more than 800 mm., temperature (18-32^{0}C) at the summer, and thermomediterranean to mesomediterranean of thermotype in Jenin at the north of Palestine.

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INTRODUCTION

Apricot (*Prunus armeniaca L.*) is a fruit or the tree that bears the fruit of several species in the genus Prunus (stone fruits), also called ansu, Siberian and Tibetan apricot. It is a belong to the Rosaceae family, the native is somewhat uncertain due to its extensive prehistoric cultivation, though almost certainly somewhere in Asia, it was known in Armenia during ancient times, an archaeological excavation at Garni in Armenia found apricot seeds in an Eneolithic-era site (Arakelyan, 1968) and it is extensively cultivated in many countries in the world and into the wild. It can grow in Mediterranean climates if enough cool winter weather allows a proper dormancy, a dry climate is good for fruit maturation, the tree is tolerating winter temperatures as cold as -30 °C (-22 °F), spring frost has impact on apricot cause it tend to flower very early (in early March in western Europe), meaning spring frost can kill the flowers, and thus affect the biological life of the plant, such as physiology, growth, production and development. Moreover, the trees are sensitive to temperature changes during the winter season and apricot is resistant to winter colds, although it is safely grown in the Mediterranean Basin countries, quite a big amount of the production is in the continental climates. There are many researchers have found that there is the influence of climate factors on production, harvesting time, planting and flowering of apricot (Orhan Gunduz *et al*., 2011, Ighbareyeh *et al*., 2015 e, f, g..i). Furthermore recent studies (Ighbareyeh *et al*., 2014a, b, c, d; Ighbareyeh *et al*., 2015a, b, c, d, e, f, g, h, i; Ighbareyeh *et al*., 2016a, b, c; Cano-Ortiz A., 2014) have highlighted the influence of bioclimatology and climatology applied on biology, physiology, yield and growth of plant. Statistics show that in 2013, that Turkey, Iran, Uzbekistan, Italy, Algeria and

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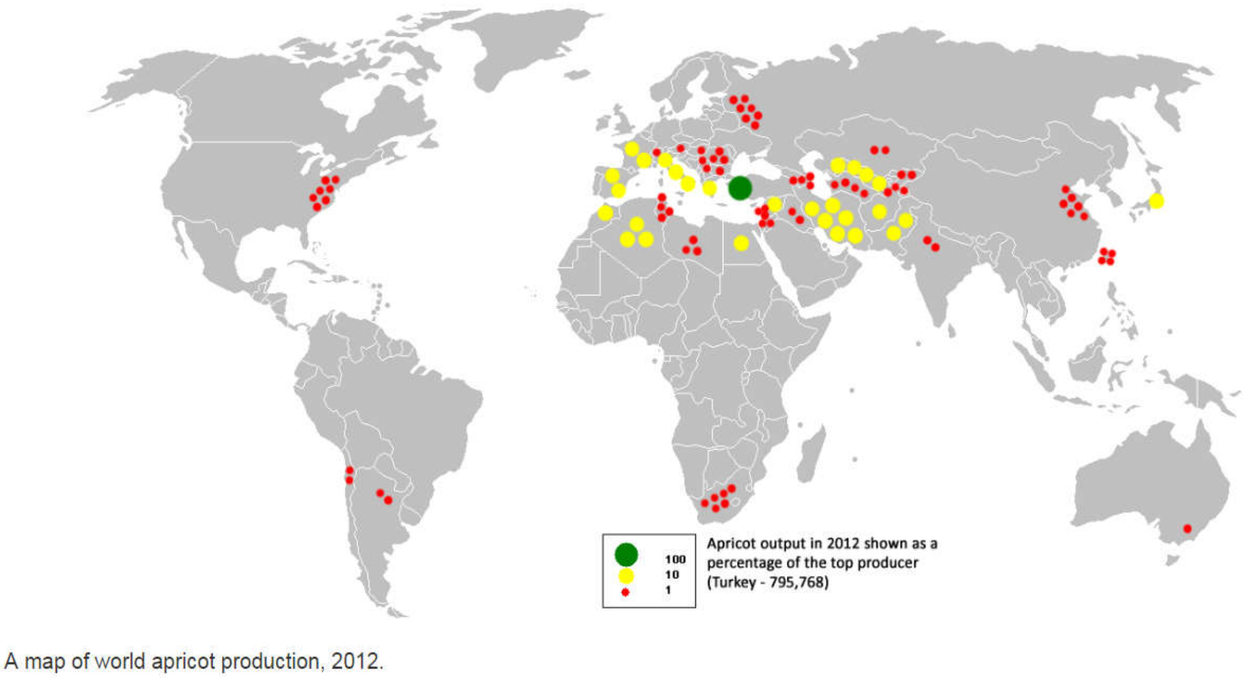

Fig.1. A map of world apricot production, 2012

others countries from the top producers of apricots in the world (United Nation Food and Agriculture Organization, 2013), (Fig. 1). In Palestine, agriculture sector is still a relatively important, the total value of agricultural production during the agricultural year 2007/2008 approximately US $ 6.366,1 million distributed 9.60% of plant production and others, apricot production has reached 600 tons in Jenin almost in 2008/2007 (PCBS, 2009). Furthermore, Jenin has a Mediterranean climate with mild and rainy winters, it has a main and the biggest natural forest remaining in the West Bank that represents the Mediterranean bio-geographical ecosystem. Jenin bioclimatic belt belongs to the inframediterranean and thermomediterranean of thermotype and arid to subhumid ombrotype (Ighbareyeh *et al*., 2014b). The aim of the study is to find the relationship between the influence of bioclimatic, climatic factors and apricot production to contribute to increase the production of plum in Jenin and then increase the Palestinian national economy and for the participation in the development of strategic agricultural policy.

MATERIALS AND METHODS

Study Area

Jenin was known in ancient times as the village of "Ein-Jenin" or "Tel Jenin (Mariam Shahin, 2005), it is a Palestinian city in the northern West Bank, situated at the foot of the rugged northernmost hills (Jabal Nablus), and along the southern edge of the Jezreel Valley "Marj Ibn Amer", (Zeitoun, Mark, 2008) which the city overlooks. (Von Tischendorf, Constantin, 1853), with a coordinates 32° 27′ 40″ N, 35° 18′ 0″ E. its rises 178 above sea level, Jenin area alone to 21,000 acres (without its villages), making it the third largest Palestinian city in the West Bank after Hebron and Nablus, while the Jenin area 583 square kilometers which 9.7% of the total area of the West Bank.

Data Analysis

Bioclimate indicators are directly related to plant physiological processes determining productivity (Leathwick *et al*., 2003), bioclimate indicators has been developed since Köppen used observed vegetation patterns to subdivide five global climate zones: Thornthwaite, 1943) stressed the importance of including better measures to represent seasonality and plant available moisture, developing a classification based on humidity, and aridity indices (Thornthwaite, 1948), while (Holdridge, 1947) devised a life zone system using a three-dimensional bioclimate classification based on biotemperature, precipitation and an aridity index, and (Emberger, 1930) developed a tailored pluviothermic indicator for distinguishing climate zones in the Mediterranean. Although there have been several more recent classifications using bioclimate indicators to model terrestrial ecosystem distributions (Sayre *et al*., 2009), they are now mainly used in modeling the impacts of climate change on vegetation (e.g. Sitch *et al*., 2003; Thuiller *et al*., 2005), and bioclmate classification of the earth (Rivas Martinez *et al*., 2011). Data were used from the meteorological station in Jenin for the years 1993 to 2009, (Fig. 2) and for the same years for production of plant (Table 1). The study analyzed the relationship between bioclimate, climate factors (independent variables) and apricot yield (dependent variable) by using time series data belong to the climate variables such as mean monthly temperature (T), precipitation (P), soil water reserve (R), and deficit water (Df) during the time period of 1993-2009; and bioclimate factors as annual ombrothermic index (Io), simple continentality index (Ic), and compensated thermicity index (It/Itc), these factors were obtained according methodology of Salvador Rivas-Martinez (Rivas Martinez S. *et al*., 2011, 1999; Rivas Martinez, 1996, 2004, 2008).

Moreover, in this study, the Shapiro-Wilk and Jarque-Bera normality tests were applied (Jarque, C., Bera, A., 1980; 1987; Shapiro and Wilk, 1965; Shapiro, *et al*., 1968), and the p-value was obtained for the seven variables. For this paper, several of the most important and analyzing have been reviewed to identify relevant bioclimate and climate factors. We applied analysis of variance (ANOVA) linear regression analysis to each of the eight variables (independent and dependent variables), the three bioclimatic variables (Io, Ic and It/Itc) and the four remaining physical variables as (climate factors), and the dependent variable (apricot production), in order to obtain the Pearson's correlation matrix and the principal component analysis (PCA) were subsequently applied in order to have a eigenvectors and eigenvalue, correlation between variables and factors and to determine the influence of independent variables on production, and these statistical analyses were done using the XLSTAT software.

RESULTS AND DISCUSSION

Bioclimatic variables are derived from the monthly temperature and rainfall values in order to generate more biologically meaningful variables. The Rivas Martinez methodology (Rivas Martinez *et al*., 1999), determines a generic world-wide climate classification in five macrobioclimates (tropical, Mediterranean, temperate, boreal and polar) on the basis of bioclimatic indexes. However, we used the bioclimatic classification of earth to Salvador Rivas-Martinez to analyses of the climate factors and bioclimatic parameters (independent variables). And after application of the Shapiro-Wilk normality test (Shapiro, S., Wilk, M., 1965; Shapiro, S. *et al*., 1968), the p-value obtained from the variables studied tended to be below 0.05, a conventionally accepted value.

Correlation matrix

A correlation is a number between -1 and +1 that measures the degree of association between two variables. The formula for the Pearson correlation is computed as:

$$r = \frac{\sum_{i=1}^{n}\left(X_i - \bar{X}\right)\left(Y_i - \bar{Y}\right)}{(n-1)S_X S_Y}$$

Table 2 shows the correlation matrix between the variables studied, precipitation (0.984), annual ombrothermic index (0.903) and simple continentality index (0.896) were positively correlated to yield and growth activates of plant, a positive value for the correlation implies a positive association between the factors previous (P, Io and Ic) and the plant, and the correlation coefficient is a strong positive significance because correlation coefficient value between 0.7 to 1.0, whereas mean monthly temperature, deficit water, soil water reserve, and compensated thermicity index were negatively correlated between different variables, a negative value for the correlation implies a negative or inverse association between the factors of (T, R, Df and It/Itc) and the plant activities as growth, yield, sustainability, quality and quantities, and a high correlation negatively was observed with mean monthly temperature (-0.959), deficit water (-0.695), soil water reserve (-0.305) and compensated thermicity index (-0.579). In the other hand, the correlation coefficient is a strong negative association or significance in case of the mean monthly temperature (-0.959) because correlation coefficient value is closed to -1 and weak negative association with the factors of deficit water , soil water reserve and compensated thermicity index cause correlation coefficient value between (-0.7 to -0.3).

Principal component analysis

Principal component analysis (PCA) is a useful statistical technique that has found application in fields such as face recognition and image compression, and is a common technique for finding patterns in data of high dimension, it covers standard deviation, covariance, eigenvectors and eigenvalues.

Eigenvectors and eigenvalue

Eigenvalues and eigenvectors play a prominent role in the study of ordinary differential equations and in many applications in the physical sciences. The calculate of the Eigenvectors and eigenvalue given by: Let M be an n x n matrix.

$$\sqrt{{v_1}^2 + \ldots + {v_n}^2} = 1$$

V is an eigenvector of M if M x v = λv.
λ is called the eigenvalue associated with v.
For any eigenvectors v of M and scalar *a*, M x *a*v = λav.
Thus you can always choose eigenvectors of length 1:
If M has any eigenvectors, it has n of them, and they are orthogonal to one another.
Thus eigenvectors can be used as a new basis for a n-dimensional vector space.
And AX = λ X, for some scalar λ. The scalar λ is called an eigenvalue of A, and x is called the eigenvector of A corresponding to the eigenvalue λ.

PCA was used to help identify the variables different, using factor extraction with an eigenvalue 1 after varimax rotation. The results of PCA, including the factor loadings with a varimax rotation as well as the eigenvalues, are tabulated in (Table 3). Two of the eigenvalues were found to be 1 and the total variance for the three factors is about (68.392 %). Factor 1 was dominated by climate factor as precipitation (0.415) and bioclimate factors as annual ombrothermic index (0.404) and simple contenentality index (0.402) except compensated thermicity index , with accounts for (5.471) of eigenvalue and (68.392 %) the total variance or variability. Factor 2 is a highly dominated by soil water reserve (0.663), compensated thermicity index (0.572), annual omrothermic index (0.213) and simple contenentality index (0.162), while negatively to the rest of factors, with accounts for (2.152) of eigenvalue and (26.904 %) the total variance. Factor 3 was dominated by all bioclimate factors as compensated thermicity index, annual ombrothermic index and simple contenentality index , but it is negatively to some of climate factors such as temperature (-0.279) and soil water reserve (-0.087), with accounts for (0.376) of eigenvalue and (4.704 %) the total variance, as tabulated in (Table 3).

Correlations between variables and factors

The correlation coefficient, R is a normalized version of the covariance and is given by:

$$r = \frac{S_{xy}^2}{S_x S_y}$$

In the general, the correlation coefficient is constrained for fall in the range ±1. A value of +1 tells us that the points (xi, yi) define a straight line with a positive slope. A value of -1 tells us that the points (xi, yi) define a straight line with a negative slope.

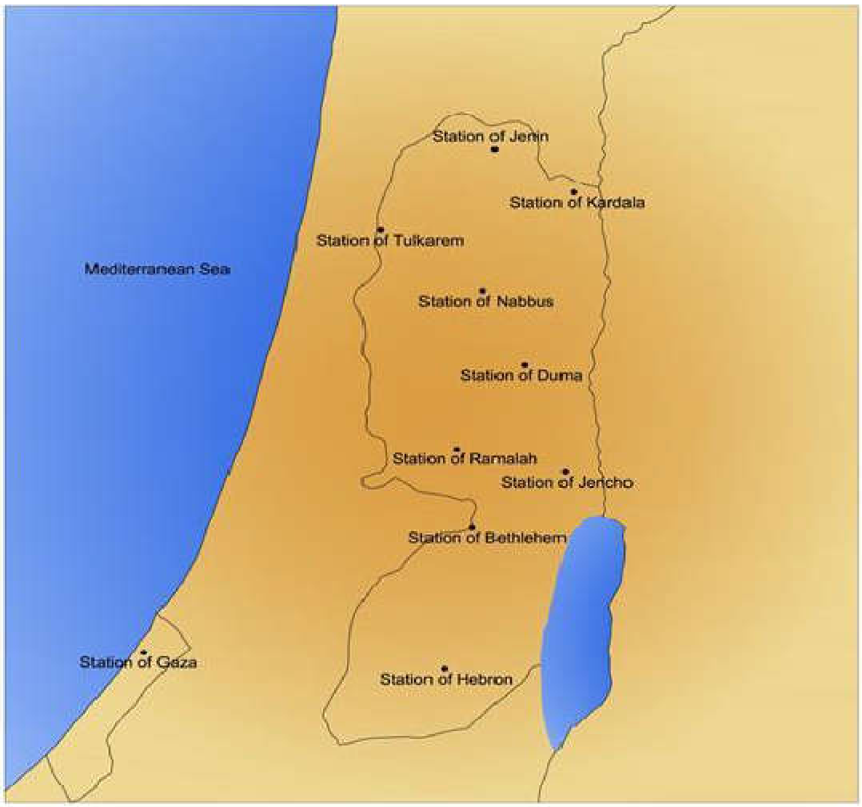

Fig. 2. Location of the meteorological Palestinian stations

Table 1. Represents of the variables, independents variables (Climate and bioclimate factors) and dependent factors (Plant production) from 1993-2009

Years	T	P	Df	R	It/Itc	Ic	Io	Production of Apricot
1993-1996	20	498	761	400	450	17.9	2.1	620
1996-2000	21.4	477	788	420	477	17.6	1.88	455
2000-2004	22.5	466	769	455	487	17.3	1.79	411
2004-2009	22.6	470	796	388	456	17	1.57	398

Yield: Kg. dunum.

Table 2. Pearson's correlation matrix between the different variables

Variables	T	P	Df	R	It/Itc	Ic	Io	Production of apricot
T	1	-0.944	0.648	0.178	0.397	-0.980	-0.964	-0.959
P	-0.944	1	-0.555	-0.454	-0.674	0.861	0.844	0.984
Df	0.648	-0.555	1	-0.380	0.012	-0.683	-0.787	-0.695
R	0.178	-0.454	-0.380	1	0.915	0.004	0.083	-0.305
Itc	0.397	-0.674	0.012	0.915	1	-0.208	-0.178	-0.579
Ic	-0.980	0.861	-0.683	0.004	-0.208	1	0.988	0.896
Io	-0.964	0.844	-0.787	0.083	-0.178	0.988	1	0.903
Apricot production	-0.959	0.984	-0.695	-0.305	-0.579	0.896	0.903	1

Table 3. Factors of eigenvectors and eigenvalue of the PCA and variables data (dependent and independent factors)

Variables	F1	F2	F3
T	-0.421	-0.038	-0.279
P	0.415	-0.163	0.025
Df	-0.303	-0.362	0.756
R	-0.097	0.663	-0.087
Itc	-0.210	0.572	0.380
Ic	0.402	0.162	0.390
Io	0.404	0.213	0.172
Apricot production	0.425	-0.058	-0.126
Eigenvalue	5.471	2.152	0.376
Variability (%)	68.392	26.904	4.704
Cumulative %	68.392	95.296	100.000

A value of 0 shows that there is no dependence of y on x or vice versa (i.e., no correlation). In this study, we applied correlation coefficient between variables and factors. Factor 1 was correlated by climate factors as precipitation (0.971) and bioclimate factors as annual omrothermic index (0.944) and simple contenentality index (0.941) except compensated thermicity index is negatively, and these factors were located at the left of axes F1 with accounts variance (68.392 %) as in (table 4 and figure 3). Factor 2 is a high correlated by soil water reserve (0.972), and bioclimate factors as annual omrothermic index (0.312) and simple contenentality index (0.238) and compensated thermicity index (0.839), with a large proportion of the variance explained by axes F1 and F2 (95.30 %) (Fig. 3), but the rest of factors were correlated negatively because the tendency in the straight line of the variables was negative and below the y-axis and therefore this confirms that these variables have a negative impact on the production of apricot.

Factor 3 is a high correlated by precipitation, deficit water, annual ombrothermic index, simple continentality index and compensated thermicity index , while negatively correlated by soil water reserve and mean monthly temperature and these factors were located at the right of axes F2 with accounts variance (26.90%).

Table 4. Correlations between variables and factors

Variables	F1	F2	F3
T	-0.984	-0.056	-0.171
P	0.971	-0.239	0.016
Df	-0.709	-0.531	0.464
R	-0.227	0.972	-0.053
Itc	-0.492	0.839	0.233
Ic	0.941	0.238	0.239
Io	0.944	0.312	0.105
Apricot production	0.993	-0.086	-0.077

Moreover, we observed that the variables that located in the area of the x-axis and above y-axis was a slope straight line for these variables positive meaning that it has a positive effect on the production of apricot, unlike variables that have occurred under the y-axis was negative.

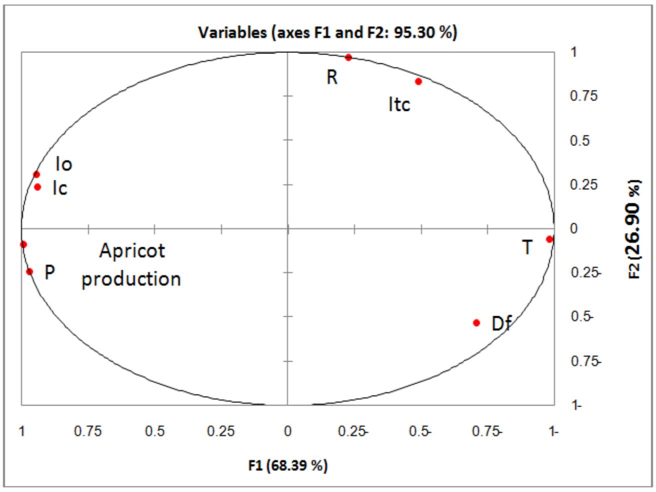

Fig. 3. Graphic of principal component analysis to correlations between variables and factors

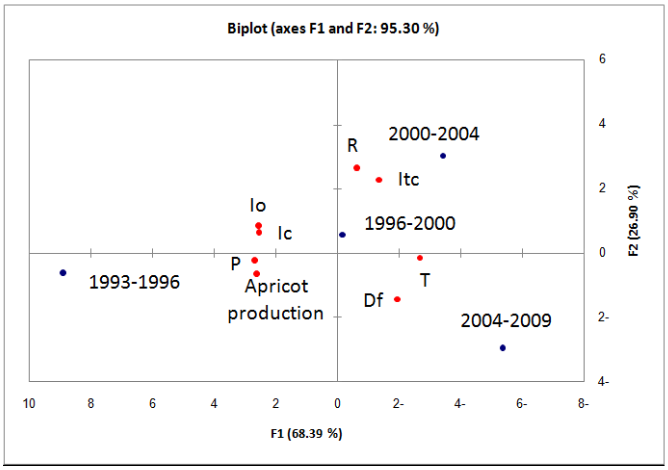

Fig. 4. Graphic of principal component analysis using both eigenvectors and biplot axes of a new data points variables

F1 is a positively affected by precipitation, simple continentality index and annual ombrothermic index on plant yield and a high correlated.

Nevertheless, when we applied a Principal Component Analysis (PCA), observed that the Jenin type plots are located at the left of axis 1 during (1993-1996) affected by the bioclimate factors of simple continentality index and annual ombrothermicindex, while precipitation was a negative effect on the plant for this occurred in the y-axis negative; and Jenin type plots are located at the right of axis 1 during (2004-2009) affected by the bioclimate factor as compensated thermicity index, and climate factors as deficit water and mean monthly temperature, also these factors have a negative impact on the plant because it lies in the negative X-axis (Fig. 4); whereas when Jenin plots are located at the left of axis 2 during (1996-2004) positively affected by annual ombrothermic index and soil water reserve, with a large proportion of the variance explained by axes 1 and 2 (95.30 %) (Fig. 4). In the fact, it is clear that there is a relationship between climate, bioclimate factors and plant production (Ighbareyeh *et al*., 2015a, b, c, e, f, h, i, e; Ighbareyeh *et al*., 2016 a, b, c), especially apricot, and in the winter needs a cool atmosphere to some extent, while summer temperatures needs to be suitable for the ripening process between (18-32 ^{0}C), temperatures great importance to determine the biological process of the apricot, as it is blooms early in spring and has a short maturity period, so that it is ready for fresh market in early summer from May to June in the plains, or September to October in the highlands, and it is prefer well-drained soils with a pH of 6.0 to 7.0.

Conclusion

Both the climate and bioclimate factors were a key role impact on plant growth and productivity. However, when we applied a principal component analysis (PCA), observed that the Jenin type plot during (1996-2004) are positively correlated and affected by the bioclimate factors as annual ombrothermic index, compensated thermicity index and climate factors as a soil water reserve to plant yield, while negatively correlated and influenced by the rest factors of the climate as temperature, deficit water and precipitation during (1993-1996 and 2004-2009). Furthermore, the optimum of the plant production is achieved with values of simple thermicity index between (16-22), annual ombrothermic index (2.7 - 4.5), compensated thermicity index (250-420), precipitation more than 800 mm., temperature (18-32^{0}C), and thermomediterranean to mesomediterranean of thermotype in Jenin at the north of Palestine.

REFERENCES

Ana Cano Ortiz, Jehad M. H. Ighbareyeh, Eusebio Cano 2014. Bioclimatic Applications and Soil Indicators for Olive Cultivation (South of the Iberian Peninsula. *Global Advanced Research Journal of Agricultural Science* (ISSN: 2315-5094) Vol. 3(12) pp. 433-438.

Arakelyan, B. 1968."Excavations at Garni, 1949–50", p. 29 in *Contributions to the Archaeology of Armenia*. Henry Field (ed.). Cambridge.

Emberger, L. 1930. Sur une formule climatique applicable en géographie botanique. Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences, 181, 389–391 (in French).

Holdridge, L.R. 1947. Determination of world plant formations from simple climatic data. Science, 105, 367–368.

von Humboldt, A. 1867 Ideeen zu einem Geographie der Pflanzen nebst einem naturgemälde der Tropenländ.

Ighbareyeh J. M. H., A. Cano-Ortiz, E. Cano Carmona, Mohammed M. H. Ighbareyeh, Asmaa A. A. Suliemieh, 2015e. Study Effect of Biology and Bioclimatology Applied on Plant in the Area of Hebron at the South of Palestine, volume 3 Issue 4, May 2015, PP 56-64, *International Journal of Research Studies in Biosciences (IJRSB)*, ISSN 2349-0357 (Print) & ISSN 2349-0365. www.arcjournals.org.

Ighbareyeh J. M. H., A. Cano-Ortiz, E. Cano Carmona, Mohammed M. H. Ighbareyeh, Asmaa A. A. Suliemieh 2015f. Effect of Biology and Bioclimatology Applied On Plant in the Area of Jenin at the North of Palestine, *International Journal of Research Studies in Biosciences (IJRSB),* Volume 3, Issue 6, June 2015, PP 1-6 ISSN 2349-0357 (Print) & ISSN 2349-0365 (Online) www.arcjournals.org.

Ighbareyeh J. M. H., A. Cano-Ortiz, E. Cano Carmona, Mohammed M. H. Ighbareyeh, Asmaa A. A. Suliemieh. 2015h. Modeling of Biology and Bioclimatology Applied on Plant in Palestine. *Swift Journal of Agricultural Research*, Vol. 1(3) pp. 021-027 July, 2015. http://www.swiftjournals.org/sjar.

Ighbareyeh J. M. H., Cano-Ortiz, A. and Cano, E. 2014c. Biological resources management in Palestine, Department of Animal and Plant Biology and Ecology, Faculty of Experimental Sciences, University of Jaen, Jaen, Spain, doctorate thesis, p 102-105.

Ighbareyeh Jehad M. H., A. Cano Ortiz, Eusebio Cano Ortiz, Mohamed M. H. Ighbareyeh and Asmaa A. A. Suliemieh. 2015g. Study of climatology and bioclimatology applied on plant in area of Hebron in Palestine, International Multidisciplinary Research Journal, Volume – 5, Issue – 1, July – 2015, ISSN 2231-5063, Available online at www.lsrj.in.

Ighbareyeh Jehad M. H., A. Cano-Ortiz, E. Cano Carmona, Mohammed M. H. Ighbareyeh, Asmaa A. A. Suliemieh, 2015a. Study of Biology and Bioclimatology of Date Palm (Phoenix Dactylifera L.) To Optimize Yield and Increase Economic in Jericho and Gaza Cities of Palestine, *International Journal of Research Studies in Biosciences (IJRSB)* Volume 3, Issue1, January 2015, PP 1-8, ISSN 2349-0357 (Print) & ISSN 2349-0365 (Online). www.arcjournals.org.

Ighbareyeh, J. M. H., A. Cano-Ortiz & E. Cano 2014a. Biological and bioclimatic basis to optimize plant production: Increased economic areas of Palestine. *Agricultural Science Research Journal,* 4(1); pp. 10- 20, Available online at http://www.resjournals.com/ARJ , ISSN: 2026 – 6332 ©2014 International Research Journals.

Ighbareyeh, J. M. H., Cano-Ortiz, A. and Cano, E. 2014b. Case Study: Analysis of the Physical Factors of Palestinian Bioclimate. *American Journal of Climate Change*, 3, 223-231. http://dx.doi.org/10.4236/ajcc.2014.32021.

Ighbareyeh, J. M. H., Cano-Ortiz, A., Suliemieh, A. A. A., Ighbareyeh, M. M. H. and Cano, E. 2014d. Phytosociology with Other Characteristic Biologically and Ecologically of Plant in Palestine. *American Journal of Plant Sciences*, 5, 3104-3118. http://dx.doi.org/10.4236/ajps.2014. 520327.

Ighbareyeh, J. M. H., Cano-Ortiz, A., Suliemieh, A. A. A., Ighbareyeh, M. M. H. and Cano, E. 2015c. Biology and Bioclimatology Applied on Plant in Palestine, *International Journal of Research Studies in Biosciences (IJRSB)* Volume 3, Issue 3, March 2015, PP 79-86 ISSN 2349-0357 (Print) & ISSN 2349-0365 (Online) www.arcjournals.org.

Ighbareyeh, J. M. H., Cano-Ortiz, A., Suliemieh, A. A. A., Ighbareyeh, M.M.H. and Cano, E. 2015d. Assessing Crop Yield Sustainability under the Climatic and Bioclimatic Change in the Area of Palestine. *American Journal of Climate Change*, 4, 48-56. http://www.scirp.org/journal/ajcchttp://dx.doi.org/ 10.4236/ajcc.2015.41005.

Ighbareyeh, J. M. H., Cano-Ortiz, A., Suliemieh, A. A. A., Ighbareyeh, M.M.H. and Cano E. 2015i. Effect of Biology and Bioclimatology Applied Studies on Plant in the Area of Jerusalem in Palestine, *International Journal of Research Studies in Biosciences (IJRSB)*, Volume 3, Issue 9, September 2015, PP 135-140, ISSN 2349-0357 (Print) & ISSN 2349-0365 (Online), www.arcjournals.org.

Ighbareyeh, J. M. H., Cano-Ortiz, A., Suliemieh, A. A. A., Ighbareyeh, M. M. H. and Cano, E. 2016 a. Study of Biology and Bioclimatology Applied of Apricot (Prunus Armeniaca L.): to Increase the Economy and Maintaining Food Security in Palestine, *International Journal of Research Studies in Biosciences (IJRSB)*, Volume 4, Issue 2, February 2016, PP 12-20, ISSN 2349-0357 (Print) & ISSN 2349-0365 (Online), www.arcjournals.org.

Ighbareyeh, J. M. H., Cano-Ortiz, A., Suliemieh, A. A. A., Ighbareyeh, M.M.H. and Cano E. 2016b. Effect of Biology, Climatic and Bioclimatic Applied Studies on Plant: to Increase the Economy and Maintaining Food Security in the Jerusalem Occupied of Palestine, *International Journal of Research Studies in Biosciences (IJRSB)*, Volume 4, Issue 2, February 2016, PP 54-60 ISSN 2349-0357 (Print) & ISSN 2349-0365 (Online) www.arcjournals.org.

Ighbareyeh, J. M. H., Cano-Ortiz, A., Suliemieh, A. A. A., Ighbareyeh, M.M.H. and Cano E. 2016c. Modeling of biology and bioclimatology applied studies on plant in *Palestine International Journal of Development Research* Vol. 06, Issue, 10, pp.9585-9590, ISSN: 2230-9926, October, (2016) Available online at http://www.journalijdr.com.

Ighbareyeh, J. M. H., Cano-Ortiz, A., Suliemieh, A.A.A., Ighbareyeh, M. M. H. and Cano, E. 2015b. Assessment of Biology and Bioclimatology of Plant to Increase Economic in Palestine. *International Journal of Research Studies in Biosciences (IJRSB)*, Volume 3, Issue 3, March 2015, PP 1-8 ISSN 2349- 0357 (Print) & ISSN 2349-0365, www.arcjournals.org.

Jarque, C., Bera, A. 1987. A test for normality of observations and regression residuals. *International Statistical Review,* 55, 163-172.

Jarque, C., Bera, A.1980. Efficient tests for normality homoscedasticity and serial independence of regression residuals. *Econometric Letters*, 6, 255-259.

Köppen, W. 1900. Versuch einer Klassification der Klimat, Vorsuchsweize nach ihren Beziehungen zur Pflanzenwelt. Geographische Zeitschrift, 6, 593–611, 657–679 (in German).

Leathwick, J.R., Overton, J.M. & McLeod, M. 2003. An environmental domain classification of New Zealand and its use as a tool for biodiversity management. *Conservation Biology*, 17, 1612–1623.

Mariam Shahin, 2005. *Palestine:A Guide*. Interlink Books. p. 183. ISBN 1-56656-557-X.

Orhan Gunduz, Vedat Ceyhan, Zeki Bayramoglu , 2011. Influence of climatic factors on apricot (Prunus armeniaca L.) yield in the Malatya province of Turkey, *Asian Journal of Agricultural Sciences*, 3(2): 150-155, 2011 ISSN: 2041-3890.

Palestinian Central Bureau of Statistics (PCBS), 2009. http://pcbs.gov.ps/Downloads/book1620.pdf.

Rivas Martinez S., Sanchez Mata D. and Costa M. 1999. North American boreal and western temperate forest vegetation (Syntaxonomical synopsis of the potential natural plant communities of North America, II). Itinera Geobot. 12: 5–316.

Rivas Martínez, S. 1996. Clasificación bioclimática de la Tierra. *Folia Bot. Matritensis*., 16:1-20.

Rivas Martinez, S. 2004. Worldwide Bioclimatic Classification System www.globalbioclimatics.org.

Rivas-Martinez S. 2008. Global bioclimatic, Internet: http://www.globalbioclimatics.org.

Rivas-Martínez S., Rivas-Sáenz S., Penas A. 2011. Worldwide Bioclimatic Classification System. *Global Geobotany,* vol. 1:1-634.

Sayre, R., Comer, P., Warner, H. & Cress, J. 2009. A new map of standardized terrestrial ecosystems of the conterminous United States: US Geological Survey Professional Paper 1768. US Geological Survey, Reston, VA.

Shapiro, S., Wilk, M. 1965. An analysis of variance test for normality (complete samples). Biometrika 52, 591-611.

Shapiro, S., Wilk, M., Chen, H. 1968. A comparative study of various tests for normality. *Journal of the American Statistical Association*, 63, 1343-1372.

Sitch, S., Smith, B., Prentice, I.C., Arneth, A., Bondeau, A.,Cramer, W., Kaplan, J.O., Levis, S., Lucht, W., Sykes, M.T., Thonicke, K. & Venevsky, S. 2003. Evaluation of ecosystem dynamics, plant geography and terrestrial carbon cycling inthe LPJ dynamic vegetation model. *Global Change Biology*, 9, 161–185.

Thornthwaite, C. W. 1948. An approach toward a rational classification of climate. *The Geogr. Rev*., 38, 55–94.

Thornthwaite, C. W. andP. Kaser, 1943: Wind-gradient observations. Transact. Amer. Geophys. Union. Reports and Papers.24, 166–182.

Thuiller, W., Lavorel, S., Araujo, M.B., Sykes, M.T. & Prentice, I.C. 2005. Climate change threats to plant diversity in Europe. Proceedings of the National Academy of Sciences USA, 102, 8245–8250.

United Nation Food and Agriculture Organization. 2013. "Production of Apricot by countries, Archived from the original on 2016-10-07. Retrieved 2016-04-14.

Von Tischendorf, Constantin, 1853. *Travels in the East*. Longman, Brown, Green, and Longmans. p. 226.

Zeitoun, Mark, 2008. *Power and Water in the Middle East: The Hidden Politics of the Palestinian-Israeli Water Conflict*. I.B.Tauris. p. 88.

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