Plant Water Consumption of SIIRT Pistachio using Blaney Cridlle and Penman - Monteith Methods

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Abstract**—** *Pistachio cultivation is carried out in many provinces of Turkey; however, it is mainly concentrated in the southeastern Anatolia Region due to the suitability of the climate. The pistachio is intensively grown in Gaziantep and Şanlıurfa, Adıyaman, Mardin and Siirt provinces of southeastern Anatolia, and has a significant impact on the economy of the region. Local varieties are mostly grown in Gaziantep and Şanlıurfa provinces, while Siirt variety is mainly grown in Siirt region. The continental climate of the Siirt province causes the summer to be extremely hot and the precipitation regime to be irregular. Therefore, irrigation in the region along with other cultural practices is important in pistachio cultivation. The increase in population and development of industrialization caused a significant decrease in natural resources; therefore, water resources have to be used as most economical and efficient way as possible. Sustainable use of limited water resources and continuous, high-level benefit from water can only be achieved by determining the amount of crop water consumption in accordance with the climatic conditions, and by creating appropriate irrigation programs considering the crop growing periods. This study was carried out to calculate the crop water consumption for Siirt Pistachio plant using modified Blaney Criddle and modified Penman–Monteith methods.*

Keywords**— *Siirt pistachio, Irrigation, Plant water consumption.***

I. INTRODUCTION

Pistachio (*Pistacia vera* L.), which is grown in the Near East, Mediterranean Region, western regions of Asia and United States of America, is mainly grown in Gaziantep and Şanlıurfa provinces of Turkey. The number of provinces where pistachios are grown is 44 which are located in Southeast Anatolia, Mediterranean, Aegean and Central Anatolia Regions of Turkey, however, the highest production takes place in Gaziantep, Kahramanmaraş, Adıyaman, Şanlıurfa, Mardin, Kilis, Diyarbakır and Siirt provinces. There are many pistachio varieties in Turkey, and Siirt pistachio (Figure 1) has an important share among the varieties grown in Turkey. Domestic varieties are grown mostly in Gaziantep and Şanlıurfa provinces, while Siirt variety adapted to the region is grown in Siirt region. The Siirt pistachios grown in Siirt and Şanlıurfa are preferred because of their large grains and high crack rate. The pistachio is highly drought tolerant plant and can be grown in marginal areas where precipitation is very low (150 mm annual precipitation). However, irrigation water is needed at every stage of agricultural activity and pistachio varieties (Uzun, Siirt, Kırmızı, Halebi, etc.) also need irrigation.

Some researchers indicated that water stress may cause low yield and periodicity, which are among the most important problems of pistachio cultivation (Kanber et al., 1993). The reports revealed that irrigation has a positive effect on yield by reducing water stress. In addition, irrigation improved product quality and has the effect of reducing periodicity. Therefore, the irrigation is a prerequisite for optimum yield in pistachio cultivation. Similarly, Arpacı et al. (1995) stated that Siirt pistachio yields better under irrigated conditions than rainfed conditions, and therefore, Siirt pistachio cultivation should be carried out under irrigated conditions. The purpose of this study was to determine the crop water consumption of Siirt pistachio by modifying the Siirt province climate data to the Blaney Criddle equation.

FIGURE 1: SIIRT Pistachio Orchard

II. MATERIAL AND METHOD

The continental climate with cold and rainy winters and hot and dry summers is dominant in the Siirt region. The average temperature is 26 ºC in summer and 2.7 ºC in winter. The highest annual relative humidity is 70.2% in January and 26.9% in August. The annual average relative humidity is 50.41%. Total annual precipitation is 669.2 mm, and the monthly precipitation varies between 103.6 mm and 1.3 mm (Anonymous 2020). The soils of the experimental area are classified as brown forest soil (Dengiz et al., 2013). The soil has a clay texture, low electrical conductivity and the lime content does not pose a problem for plant growth. In addition, the soil has low phosphorus, high potassium and moderate organic matter content. Land use capability map of Siirt province is given in Figure 2.

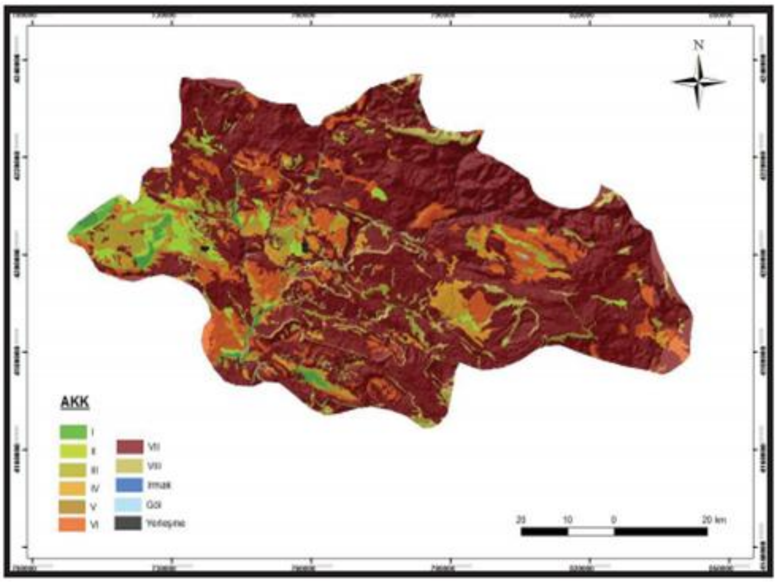

FIGURE 2: Land use capability map of Siirt province.

2.1 Plant water consumption

The concept of 'Evapotranspiration' (ET) in many national and international sources is defined as 'Crop Water Consumption' in Turkish. The ET refers to evaporation from soil and plant. In general, evaporation refers to the movement of liquid water from an environment to the atmosphere by evaporation. Evaporation of water from any surfaces, especially soil and open water surfaces, is called 'evaporation'. The energy must penetrate the water to start the evaporation. The source of energy in nature is mostly solar radiation and air temperature. Evaporated water moves through vapor pressure difference between the surface in question and the atmosphere surrounding this surface. The atmosphere surrounding the surface where evaporation occurs becomes saturated with water and the saturated air does not move, evaporation stops. At this stage, air movement occurs with winds. Evaporation occurs entirely based on solar radiation, air temperature, humidity and wind speed (Bayramoğlu 2013). The amount of shading the soil surface by the above-ground plant parts and the water content at the depth of the soil exposed to evaporation significantly affect the amount of evaporation from soil surface.

2.2 Determining Plant Water Consumption

Crop water consumption is both directly measured and estimated using climate data. The direct measurement methods may provide reliable results; however, they are quite expensive and time consuming. Therefore, the direct measurement of crop water consumption is only carried out to calibrate the estimation equations using the climate data and to obtain the local crop coefficients. Therefore, in practice, crop water consumption values are commonly determined using estimation equations based on climate data.

Many equations have been developed to estimate crop water consumption using climate data. Some of the equations developed by using several climatic factors are easy to solve, and can give accurate results for long periods. Others developed using many climatic factors affecting plant water consumption are rather complex equations, and give accurate results even for short periods.

The common way of estimating the crop water consumption values is to first define potential crop water consumption in which considering only climatic factors and develop empirical equations that can be used. Then, the potential crop water consumption values are corrected using the crop coefficients, which are the function of crop type and crop development stages (Güngör et al., 2004).

$$ET = Kc * ETp \qquad (1)$$

In the equation; ET is the crop water consumption (mm day^{-1}), Kc is crop coefficient, ETp is the potential crop water consumption (mm day^{-1}).

Standard definition of potential crop water consumption has not yet been made, causing some confusion in the interpretation. Therefore, the concept of "benchmark crop water consumption" has been widely used recently instead of potential crop water consumption. Initially, a benchmark crop with certain conditions is determined and empirical equations are developed that can be used to estimate the water consumption of this crop. Then, the equations are corrected with the crop coefficients, which are a function of the crop species and crop growth stage, so that these equations can be used in the estimation of water consumption for other crops.

$$ET = Kc * ET_o \qquad (2)$$

In the equation; ET is the crop water consumption (mm day^{-1}), Kc is crop coefficient, ETo is benchmark crop water consumption (mm day^{-1}).

Meadow plants, sesame, alfalfa and similar plants are used as benchmark plants. The benchmark of crop water consumption for meadow plants is defined as the water consumption in a large area covered with 8-10 cm high, same height, effectively growing, fully covering the area, adequately irrigated meadow plants.

2.2.1 Blaney-Criddle Method

The climate data used in this method are average temperature, daylight hours, minimum relative humidity and average daytime wind speed. The method gives rather rough results due to the use of only a few climatic factors. Therefore, the method is used for estimation of crop water consumption for at least monthly periods. The Blaney-Criddle equations used in estimating the benchmark crop water consumption for a given month are given below. The schematic representation of the Blaney-Criddle method.

ET_o=cf

f=p(0.46t+8)

In the equations; ETo daily average water consumption (mm day^{-1}), c is the correction factor, f is daily climate factor (mm day^{-1}), p is the ratio of mean daily daylight hours to annual daylight hours, and t is average daily temperature (°C).

First, the f values are calculated, and the ET_o values are taken directly from the relevant graphs. Average daytime wind speed is the value measured at 2 m height, and if there are no daytime average wind speed values, then 24-hour average wind speed values are obtained by multiplying by 1.33. The p value in the equation is taken from the relevant Tables according to the latitude of the region.

2.2.2 Penman-Monteith

Penman developed an equation for evaporation from the open water surface in 1948 using records of climate data (insolation, temperature, humidity, pressure, and wind speed). This method was further developed by Monteith in 1976 by adding aerodynamic and surface resistance factors for plants. In 1990, various experts came together and FAO developed the Penman-Monteith method. Although this method has different names in different countries, it is widely used as FAO56-PM with the concept of "reference crop water consumption" instead of potential water consumption ((Koç & Güner, 2005); (İlhan & Utku, 1998); Allen et al., 1998). In the Penman-Monteith Method, the water consumption of the plants (ETc) is determined following the reference crop water consumption is corrected with the single crop coefficient (kc) or the double crop coefficient (ke + kcb). In addition, the change in crop water consumption due to various stresses caused by drought, salinity, disease and other factors can also be determined by using the stress coefficient (ks) (Yürekli, 2010; Allen et al., 1998).

2.2.2.1 Penman-Monteith Method for Benchmark Crop Water Consumption

In this method, benchmark crop water consumption can be calculated using Equation 1.3, as follows;

$$ET = \frac{\delta}{\delta+\gamma^*}(R_n - G)\frac{1}{\lambda} + \frac{\gamma}{\delta+\gamma^*}\frac{900}{T+275}u_2(e_a - e_d) \quad (3)$$

The equations used in the calculation of some terms in Equation 3 are given below.

$$\delta = \frac{4098\,e_a}{(T+237.3)^2} \quad (4)$$

$$\lambda = 2.501 - 2.361 \times 10^{-3}T \quad (5)$$

$$\gamma = 0.0016286\frac{P}{\lambda} \quad (6)$$

$$\gamma^* = \gamma(1 + 0.34u_2) \quad (7)$$

$$R_n = R_{n_s} - R_{nl} \quad (8)$$

$$R_{n_s} = 0{,}75R_s \quad (9)$$

$$R_{n_l} = 2{,}451f(T)f(e_d)f\left(\frac{n}{N}\right) \quad (10)$$

$$R_5 = \left(0.25 + 0.50\frac{n}{N}\right)R_a \quad (11)$$

$$e_d = e_a\frac{RH}{100} \quad (12)$$

$$u_2 = u_z\left(\frac{2}{z}\right)^{0.2} \quad (13)$$

In the equation;

ET is the reference plant water consumption, mm/day, δis the slope of wapor pressure line (kPa/°C)

γ^* *is the modified psicometric constant* ($kPa/°C$)

γ *is the psicometric constant* ($kPa/°C$)

P is the atmospheric pressure (kPa)

R_n is the net radiation from plant surface $(\frac{\frac{MJ}{M2}}{day})$

R_a is the Radiation reaching the outer surface of the atmosphere $(\frac{MJ}{M2}/day)$

R_s is the short wave radiation reaching earth $(\frac{MJ}{M2}/day)$

R_{n_s} is the short wave net radiation $(\frac{MJ}{M2}/day)$

R_{n_l} is the long wave net radiation $(\frac{MJ}{M2}/day)$

$f(T)$ is the temperature function

$T = Sıcaklık, ° C$

$f(e_d)$ is the vapor pressure function

e_d is the actual vapor pressure at average air temperature (kPa)

e_a is the saturated vapor pressure at average air temperature (kPa)

$f(^n/_N)$ is the insolation rate function

n is the insulation period (h)

N is the possible maximum insulation period (h)

G is the heat flow in soil (MJ/m^2/day) (Soil temperature does not change much in successive period; therefore, mean soil temperature can be neglected)

λ is the latent heat of evaporation, $\frac{MJ}{kg}$ (mean value of $2.45\frac{MJ}{kg}$ can be used)

u_2 is the wind speed at 2 m height, m/s

u_z is the wind speed measured at z m height, $\frac{m}{s}$

z is the height that wind speed measured, m

(In Turkey, meteorological bulletins usually give wind speed values measured at 10 m height), and RH is the average relative humidity (%).

In terms of pressure units;

1 mb = 0.1 kPa

and in terms of the radiation unit;

1 cal/cm^2/day =0.041868 MJ/m^2/day = 0.01706 mm/day.

2.3 General Climate Characteristics of Siirt Province

The region is under the influence of dry and hot tropical air masses settled in the low pressure center of Basra in the summer. The highest daily temperature rises above 40 degrees. The dry and hot winds called "samyeli", formed by the expansion of the Basra low pressure center towards Anatolia, cause both excessive evaporation and dust storms. In addition, sometimes dusty and polluted air coming from the Syrian and Arabian deserts cover the Siirt region. In the winter season, the region is under the influence of the precipitation fronts coming from the Central Mediterranean region and the precipitation continues until April (Atalay ve Mortan 2003).

The annual average temperature between 1938 and 2019 was 16.1 °C. The average temperature, which may be at the lowest level with the effect of external factors affecting Turkey during the winter months, start to rise rapidly as of March and rise above 25°C in May and June (Table 1). The average temperature in summer (June, July and August) is 26°C, which does not fall below 2.7°C in winter (December, January and February). The average temperature in January, the coldest month, is 2.7°C and 30.5°C in July, the hottest month, with an average temperature difference of 27.8°C. Another reason for defining a continental climate in the area where the experiment was conducted is the high temperature difference between the seasons. The average temperature in Siirt Center is 28.8°C in the summer months, while the average temperature in the winter months is 3.8°C. Temperature values in the experimental area are higher than in many regions of our country. There are several factors affecting the temperature variations, of which the latitude is an important factor. The area where the experiment was conducted is located in the south of Turkey. The experimental area receives the sun rays at steeper angles than many other regions of Turkey. In addition, the landforms are effective on the temperature values of the area where the experiment was conducted.

The basin where the experiment was conducted is located on the outskirts of the Southeastern Taurus Mountains of the Taurus mountain range. Therefore, the effect of cold air coming from the north is not frequently observed. In the south, there are no obstacles to prevent the effects of hot weather. Another important factor affecting the temperature in the region is the continental climate dominating our country in general. The air temperature in the regions with continental climate rises very rapidly and become very hot. Therefore, summers are very hot and winters are very cold in the region. Low altitude and cloudiness are other factors affecting the warming in the region. The distribution of precipitation also varies according to the seasons. The season with the highest precipitation is spring with 40%, followed by winter with 38%. Precipitation in winter and spring constitutes 78% of the total. In autumn, 20% precipitation occurs, and the least precipitation is in summer, with a rate of 2%. Snowfall is low in the region and generally occurs in December, January and February. Winter is the season when both snowfall occurs and the number of days covered with snow is the highest.

The average wind speed slightly changes during a year and it was in the region between 1938 and 2019 is1.2 m/sec The highest average wind speed is 0.6 m/sec in March, April, May, June, July, August and September, and the lowest value is 0.3 m/sec in November, December and January. The highest wind speed occurs in October (5.8 m/sec) and the lowest wind speed (2.4 m/sec) in December and March. The highest number of wind blows occurs in the spring with 26% (42,487), followed by summer and winter with 25% and autumn with 24%.

TABLE 1
LONG TERM METEOROLOGICAL DATA FOR SIIRT PROVINCE (1938-2019).

Parameter	Max. Temp. (°C)	Min. Temp. (°C)	Mean Relative Humidity (%)	Mean Total Precipitation (mm)	Maximum Precipitation (mm)	Mean Evaporation (mm)	Mean Insulation duration (hour)
Duration of the records (Year)	**79**	**79**	**78**	**78**	**79**	**79**	**57**
January	19.7	-19.3	71.9	34.6	53.4	12.0	3.6
February	20.6	-16.5	67.1	29.4	53.2		4.4
March	28.5	-13.3	62.0	24.1	63.0	33.0	5.4
April	32.9	-4.1	58.0	22.4	71.4	84.0	6.5
May	36.2	2.0	50.7	21.2	68.1	186	9.0
June	40.2	8.2	34.6	15.5	16.7	284.8	11.7
July	44.4	13.1	27.4	13.5	22.2	368.0	12.2
August	14.4	46.0	26.4	13.3	12.2	351.8	11.4
September	39.9	8.5	31.2	14.4	37.5	254.3	9.9
October	36.6	0.3	46.7	49.7	70.8	137.6	7.2
November	25.8	-14.1	62.4	82.5	102.9	53.0	5.2
December	24.3	-14.6	70.6	94.5	71.8	13.1	3.6
Annual	46	-19.3	50.8	719.8	102.9	1753.6	7.5

In addition, the latitude degree, average temperature, wind speed, average relative humidity, duration of insulation and atmospheric (actual) pressure values of the region and the period for the crop water consumption will be calculated were taken from the 15th Regional Meteorology Directorate station in Siirt province.

2.4 Climate Data of Siirt Province between 2019 and 2021

Average wind speed, relative humidity, temperature, atmospheric (actual) pressure and insulation duration data for June, July, August, September and October were prepared in Batman 15th Regional Meteorology Directorate and obtained from Siirt Meteorology Directorate.

2.4.1 Data of the Study (Blaney – Criddle)

- **Latitude of Siirt province:** 38° 42 '
- **Periods:** June, July, August, September and October in 2020
- **Mean temperature, T :** 28.0°C
- **Wind speed measured at 10 m height, u_{10} :** 1.2 m/s
- **Mean relative humidity, RH :** % 24.7
- **Insulation period, n :** 10 h 39 minutes

1) At the beginning f value is v-calculated.

The p value is equal to 0.301 based on the periods and the location (38° 42').

2) Insulation rate

n= 10 h 39 min. = 10 45 h

TABLE 2
THE HIGHEST POSSIBLE INSULATION PERIOD, N (h/day).

Latitude	Months							
	March	April	May	June	July	August	September	October
44	11.9	13.4	14.7	15.4	15.2	14.0	12.6	11.0
42	11.9	13.4	14.6	15.2	14.9	13.9	12.6	11.1
40	11.9	13.3	14.4	15.0	14.7	13.7	12.5	11.2
35	11.9	13.1	14.0	14.5	14.3	13.5	12.4	11.3
30	12.0	12.9	13.6	14.0	13.9	13.2	12.4	11.5

By interpolation;38° 42 ' latitude and

- For June N = 14.8 h
- For July N = 14.5 h
- For August N = 13.6 h
- For September N = 12.46 approximately 12.5 h and
- For October N = 11.24 approximately 11.2 h

13.32 h approximately 13.3h is used.

3) Equivalent of daily wind speed at 2 m height

$$\mu_2 = \mu_z \left(\frac{2}{z}\right)^{0.2} = 1.2\ m/s$$

4) Benchmark crop water consumption

RH_{min} = % 24.7, n/N = 0.79

When RH_{min} = % 24.7, n/N = 0.79 and u_z= 1.2 m/s.

$$f = p(\,0.46t + 8\,)$$

= 0.301*(0.46*28 + 8) = 6.28 mm/day is calculated.

From this value, draw a perpendicular line to the 2nd line, and look at the left from the intersection, and ET_o is calculated as 7.9mm/day. Finally, reference daily crop water consumption is calculated as 7.9 mm.

When the average number of days for June, July, August, September and October is considered as 30 days, reference crop water consumption will beET_o= 30 * 7.9 = 237 mm/month.

2.4.2 Data of the study

- **Latitude of Siirt province:** 38° 42 '
- **Periods:** For June, July, August, September and October in 2020
- **Average temperature, T:** 28.0°C
- **Wind speed at 10 m height, u_{10} :** 1.2 m/s
- **Mean relative humidity, RH :** %24.7
- **Insulation period, n :** 10h 39 minutes
- **Atmospheric pressure (actual pressure),** P : 909 mb = 90.9 kPa

1) Saturated vapor pressure at average air temperature is determined.

TABLE 3
SATURATED VAPOR PRESSURE AT AVERAGE AIR TEMPERATURE, e_a

T, ∘ C e_a, kPa	1 0.66	2 0.71	3 0.76	4 0.81	5 0.87	6 0.93	7 1.00	8 1.07	9 1.15
T, ∘ C e_a, kPa	10 1.23	11 1.31	12 1.40	13 1.50	14 1.61	15 1.70	16 1.82	17 1.94	18 2.06
T, ∘ C e_a, kPa	19 2.20	20 2.34	21 2.49	22 2.64	23 2.81	24 2.98	25 3.17	26 3.36	27 3.57
T, ∘ C e_a, kPa	28 3.78	29 4.01	30 4.24	31 4.49	32 4.76	33 5.03	34 5.32	35 5.62	36 5.94

For T = 28.0 °C e_a **3.78 kPa**

1) Saturated vapor pressure at average air temperature is calculated.

$$e_d = e_a \frac{RH}{100} = 3.78 * \frac{24{,}7}{100} = \mathbf{0.9\ kPa}$$

2) The slope of the vapor pressure line is calculated.

$$\delta = \frac{4098 e_a}{(T+237.3)^2} = \frac{4098*3.78}{(28+237{,}3)^2} = \mathbf{0.220\ kPa/°C}$$

3) The psychrometric constant is calculated

$$\gamma = 0.0016286\frac{P}{\lambda} = 0.001 * \frac{90.9}{2{,}45} = \mathbf{0.0604}\ \boldsymbol{kPa}/°\mathbf{C}$$

4) Wind speed at 2m height;

$$u_2 = u_z\left(\frac{2}{z}\right)^{0.2} = \mathbf{1.2m/s} \text{ is given.}$$

5) Modified psychrometric constant is calculated.

$$\gamma^* = \gamma(1 + 0.34u_2) =$$

$$0.0604 * (1 + 0.34 * 1.2) = \mathbf{0.085}\ \boldsymbol{kPa}/°\mathbf{C}$$

6) Maximum possible insulation duration is found.

By interpolation;

38° 42 ' latitude and

- For June N = 14.8 h
- For July N = 14.5 h
- For August N = 13.6 h
- For September N = 12.46 approximately 12.5 h and
- For October N = 11.24 approximately 11.2 h.

The average of these values is calculated: 13.32 h approximately 13.3 is used.

7) Insulation rate is calculated.

n = 10 h 39 minutes = 10.45 h

$$\frac{n}{N} = \frac{10.45}{13.3} = \mathbf{0.78}$$

8) Radiation reaching the outer surface of the atmosphere is found.

38° 42 ' latitude and

- For June Ra = 42.2 MJ/$m2/day$
- For July Ra =40.9 MJ/$m2/day$
- For August Ra = 37.5 MJ/$m2/day$
- For September Ra = 31.4 MJ/$m2/day$
- For October Ra = 24.5 MJ/$m2/day$

From here, the average is calculated as 35.3 MJ/$\boldsymbol{m2/day}$.

9) The short-wave radiation reaching the earth is calculated.

$$R_s = \left(0.25 + 0.50\frac{n}{N}\right)R_a$$

= (0.25+0.50*0.78)*35.3 = **22.6 MJ/$\boldsymbol{m2/day}$**

10) The short-wave net radiation is calculated.

$$R_{n_s} = 0{,}75R_s$$

= 0.75*22.6 = **16.9MJ/$\boldsymbol{m2/day}$**

11) Temperature function is found.

For T = 28°C f(T)= **16.3**

12) Vapor pressure function is found.

$$e_d = 0.8\ kPa\ için\ \mathrm{f}(e_d) = 0.22\ and$$

$$If\ e_d = 1.0\ kPa\ için\ \mathrm{f}(e_d) = 0.20, then\ interpolation\ is\ carried\ out,$$

For $e_d = 0.9\ kPa\ \mathrm{f}(e_d) is\ used\ as\ \mathbf{0.23}$.

13) The insulation rate is found.

For n/N =0.75 f(n/N) = 0.78,

for n/N =0.80 f(n/N) = 0.82, then

for n/N =0.78 f(n/N) = **0.80.**

14) Long wave net radiation is calculated.

$$R_{n_l} = 2{,}451 f(T) f(e_d) f\left(\frac{n}{N}\right)$$

= 2.451*16.3*0.23 = **9.19 MJ/$m2/day$**

15) Net radiation on plant is calculated.

$$R_n = R_{n_s} - R_{nl}$$

= 16.9- 9.19 = **7.71 MJ/$m2/day$**

16) Benchmark plant water consumption is calculated.

$$ET = \frac{\delta}{\delta+\gamma^*}(R_n - G)\frac{1}{\lambda} + \frac{\gamma}{\delta+\gamma^*}\frac{900}{T+275}u_2(e_a - e_d) =$$

$$\frac{0{,}220}{0{,}220+0{,}085} * (7.71-0) * \frac{1}{2.45} + \frac{0.0604}{0.220+0.085} * \frac{900}{28+275} * 1.2 * (3.78-0.9) = \mathbf{8.0\ mm/day}.$$

When the average number of days for June, July, August, September and October is considered as 30 days, reference crop water consumption will be ET_o= 30 * 8.00 = 240 mm/month.

III. RESULTS

The daily reference water consumption calculated using Blaney-Criddle estimation method is **7.9 mm,** and the daily crop water consumption calculated using Penman – Monteith method was **8.00 mm**. The monthly average (considering June, July, August, September, October) water consumption will be **237 and 240 mm/month,** respectively.

IV. CONCLUSION AND RECOMMENDATIONS

Climatic change, which has emerged as a serious threat due to global warming, leads to the depletion of limited water resources. Water is extensively used in agricultural production; therefore, determining the amount of long or short term plant water consumption realistically depending on the climate data is of great importance for irrigation projects. Therefore, one of the Blaney-Criddle and Penman-Monteith methods, which estimate crop water consumption using meteorological data, can be preferred. An appropriate irrigation program should be established according to the climatic conditions of each region to conserve water resources. For this purpose, the water consumption of crops grown needs be calculated and an irrigation program should be prepared, using the climatic data of the region.

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