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Evaluation of Water Requirement for Major Crops Grown In Vyara (Tapi-Dist.) Using CROPWAT 8.0

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Abstract: India is the second-largest producer of agricultural section. 58% of India's population prime source of livelihood is agriculture. Increasing the water scarcity and India's population, it is highly essential for the irrigation engineers to know and to satisfy the demands of the most effective management practices of efficient use of water. So generally in the view of efficient use of water, most typically practice is calculating the crop water requirement and also managing the irrigation scheduling. In the present study most significant role of calculate the crop water requirement and irrigation scheduling for major crops grown in Vyara taluka for using CROPWAT tool. In Vyara taluka most grown crops like Sugarcane, Rice, Brinjal(eggplant), Ladyfinger (okra), Jowar, Mango, Onion, Banana, paddy, etc. during this study four crops are using, 1st Sugarcane, 2nd Rice, 3rd Brinjal, 4th Ladyfinger. The crop water requirements for every crops determined by using the collected data from farmers and a few data collected from STATE WATER DATA CENTER. The crop grown is four stages like initial, development, mid and late season. Also, kc value for various crops and different stages are varied, and this value obtains irrigation manual. In this study reference evapotranspiration (ETo) was resolute by using FAO Penman Montheith method and effective rainfall was calculated by using USDA SCS method. In this study ETo varied from 9.23 to 2.86 mm /day. In the present study crop water requirement calculate from 2001 to 2005.Irrigation requirement for brinjal varied 405.5 to 639.3 mm /Dec and usually month of December water is more required. In case of sugarcane varied 1713.0 to 2093.7 and more water required in month of May in development stage. In case of rice varied 979.9 to 1110.9 mm /Dec and more water requirement in month of May. In case of ladyfinger varied 405.5 to 693.3 mm/Dec. During this research study all crops NIR is a smaller amount than GIR.

Index terms: Agriculture, crop water requirement, evapotranspiration, CROPWAT, irrigation scheduling, effective rainfall.

Introduction:

Agriculture is the one of the largest water consumer sector compared to the other sector like industrial, domestic, municipal and environmental. Effective and efficient use of water is that the key of agricultural sector. India is a second-largest producer of agricultural product like vegetables, fruit, sugarcane, rice, wheat etc. India is also famous because India is part of agriculture sector. In past few decades Indian economy is busted up thanks to agricultural sector. India's 58% population and their primary source of livelihood is agriculture.

In India Most important part of the agricultural, In case of increase the population increases the grown product. India's climate varies from the each and every location vise, so evapotranspiration is also depending on the climatology. India's economic growth in year of 2018 is 6.75 % and this value is improved for both industry and services. In year 2020-2021 estimates, GDP contribution from agriculture alone constitutes around 14% of the India's economy. The agriculture and its allied sectors are very critical to the sustainable advancement and development of the country's economy.

Every year India's population and food grain production is increase, and therefore the India's rank is top of the list for producers of wheat, rice, sugarcane, and cotton. Agriculture depends on basically the nature of soil, water and climatic condition. In 2021, 51% of agriculture area covered by the irrigation and other is depending on the rainfall. Irrigation sources like surface water and groundwater, that the improving the system of the surface water canal lining for the efficient use of water in agriculture. Currently, in India irrigation sector consume the water is 80%.

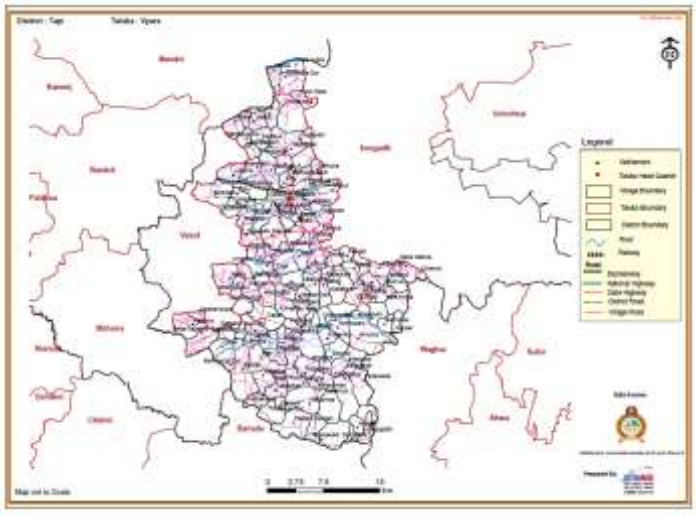
In India's local farmers adopted conventional method and wasting important irrigation due to of conservative mentality, and then results loss of water and yield production is also low. Using the fertilizer and pesticide contamination of water occur and result is improper application and inefficient use of water. In case of increase of population, urbanization, changing the climate is that the serious impact of the agriculture. Because of above condition of agriculture sector also required the educational people for understanding and optimal allocation of evapotranspiration and crop water requirement, and local farmers are need of technical support because of farmers are not compromising their crop high yielding product. Calculating the crop water requirement and scheduling many methods are available, but these methods are time-consuming and tedious. Simple and better estimate crop water requirement, FAO (Food And Agriculture) organization find out the best software tool CROPWAT 8.0. This tool is employed to calculate the CWR, Irrigation scheduling, evapotranspiration, effective rainfall and cropping pattern. In the present study using CROPWAT 8'0 software for calculating the CWR, and scheduling in Vyara taluka for most grown crops.

Study area:

In the present study my research area is Vyara taluka in Tapi district. Vyara taluka located at latitude 21.12˚ N and longitude 73.4˚ E and altitude is 69 m. 812.49 km^2 is the Vyara taluka geographical area and including 150 villages. In year 2021 population of this taluka is 28, 3500 and currently 2022 population is 228500. Most grown crop in this area i.e. sugarcane, rice, brinjal, ladyfinger, wheat, jowar, tuver, paddy, onion, banana, etc. Generally Vyara taluka soil nature is deep black soil and sandy soil and few part of clay. Basically in this area farmers are more, this is the area of south, so agriculture area is large and irrigation is provided by the Ukai

dam. Most of the villagers are dependent on the agriculture for their livelihood. In this study maximum temperature in the research area is in month of April and May.

Fig.1 this image shows the Vyara taluka.



Data collection:

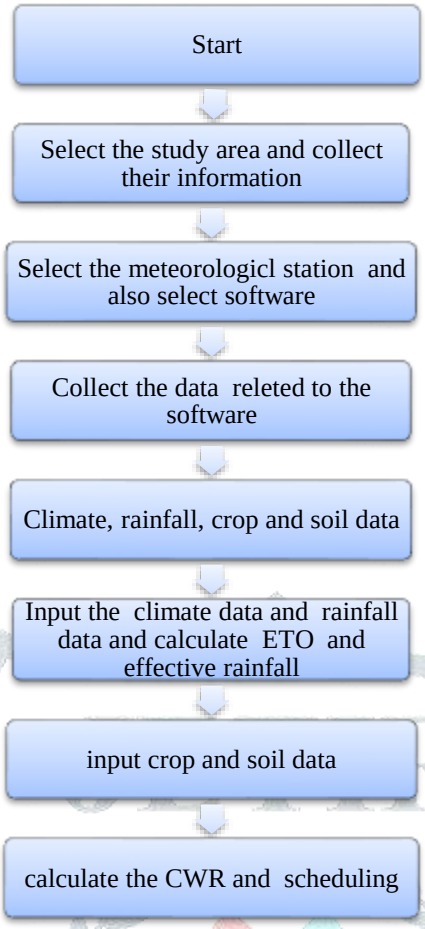
In the present study calculate the crop water requirement and irrigation scheduling using CROPWAT 8.0. Calculate the both term, climate data; rainfall data, crop data and soil data are required. Here I am calculating the both value from the year 2001 to 2005. Climate data is collected from the state water data center and a few missing data collected the NASA power data access view portal website. Rainfall data collected the state water data center. Crop information is found out the FAO manual and half information related to crop height and grown stages day information is collected from the farmer through the interview. Some soil data is collected the manual of irrigation and some information like moisture contain is collected by the carried out the soil testing in Bhavnagar soil shreeji laboratory and this data compere to manual data and input this nearest data. Here are table from which data is collected for using calculating CWR and scheduling. This data using the CROPWAT tool and calculate the both value.

Table: 1 show the all data name using calculation for CWR using CROPWAT

1	Climate data	Sunshine hours, minimum and maximum temperature, humidity and wind speed.
2	Meteorological data	Rainfall data
3	Soil data	Total available soil moisture, maximum rain infiltration rate, maximum rooting depth, initial soil moisture depletion, initial available soil moisture.
4	Crop data	Crop coefficient, grown stage days, rooting depth, height, critical depletion, yield response factor.

Research Methodology:

In the present study methodology adopted has been shown in the below flow chart. In this research using CROPWAT 8.0 tool so the methodology is based on this tool.



CROPWAT 8.0: In the present study the CROPWAT tool using for achieving above objective. To predict CWR, scheduling and net irrigation requirement this software is most commonly used. CROPWAT is developed by the land and water resources of FAO. CWR depends on the crop area and type, soil type, growing season, crop production frequencies and climate condition. In this software calculating the reference evapotranspiration based on Penman-Monteith equation.

$$ETo = \frac{0.408\Delta(Rn - G) + \frac{\gamma 900}{T + 273} u2(es - ea)}{\Delta + \gamma(1 + 0.34u2)}$$

Where,
ETo = Reference Evapotranspiration, mm day^{-1}
Rn = Net Radiation at The Crop Surface, MJ m^2 day^{-1}
G = Soil Heat Flux Density, MJ m^2 day^{-1}
T = Mean Daily air Temperature at 2 m Height, °C
u2 = Wind Speed at 2 m Height, m s^{-1}
es = Saturation Vapour pressure, kPa
ea = Actual Vapour Pressure, kPa
es - ea = Saturation Vapour Pressure Deficit, kPa
Δ = Slope Vapour Pressure Curve, kPa $°C^{-1}$
γ = Psychrometric Constant, kPa $°C^{-1}$.

The effective rainfall is calculate in the present study also using CROPWAT and this tool using different method but hear select the USDA soil conservation service method, below this equation given.

$$Peff = \frac{P*(125-0.2*P)}{125} \text{ For P<=250mm}$$
$$Peff = 125 + 0.1 * P \text{ For P>250mm}$$

Soil and crop data is also input and calculate the crop water requirement and scheduling. Crop water requirement calculating by using equation multiply the reference evapotranspiration and crop coefficients. kc value is the obtain by the FAO manual for different stages. Fig.2 show the crop data input, in this table kc value, rooting depth, critical depletion fraction, and yield response factor details are given in FAO manual. Other details collect the farmers. Fig.3 show the soil data input image, in this image all details given in manual FAO and moisture contain calculate based on laboratory testing in mm/m. "Crop Water Requirements and Irrigation Scheduling, module 4" is the name of manual.

Fig.2 show the input crop data

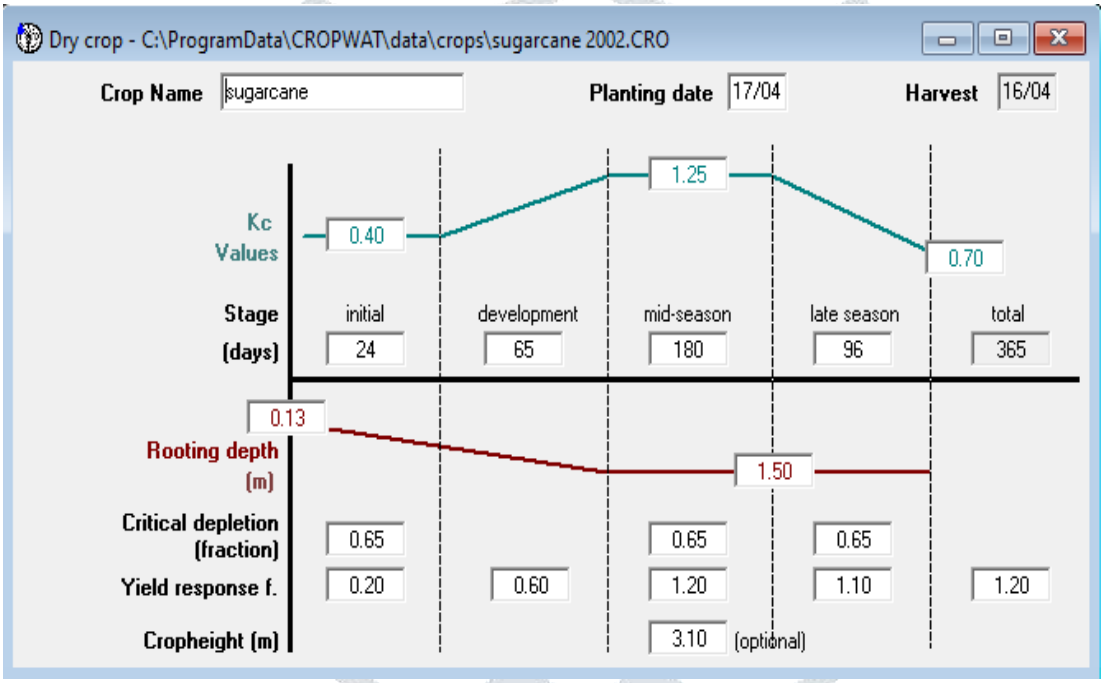
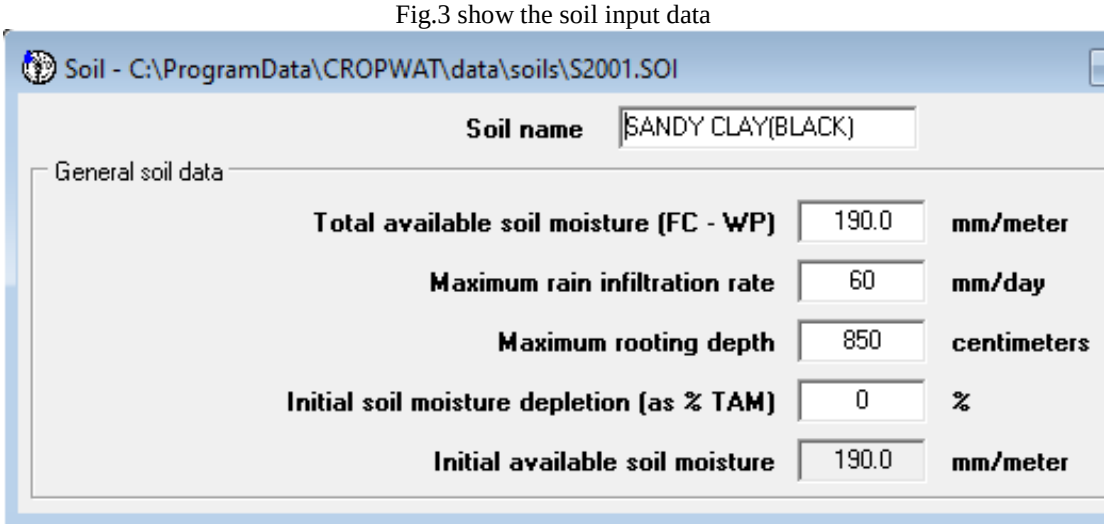


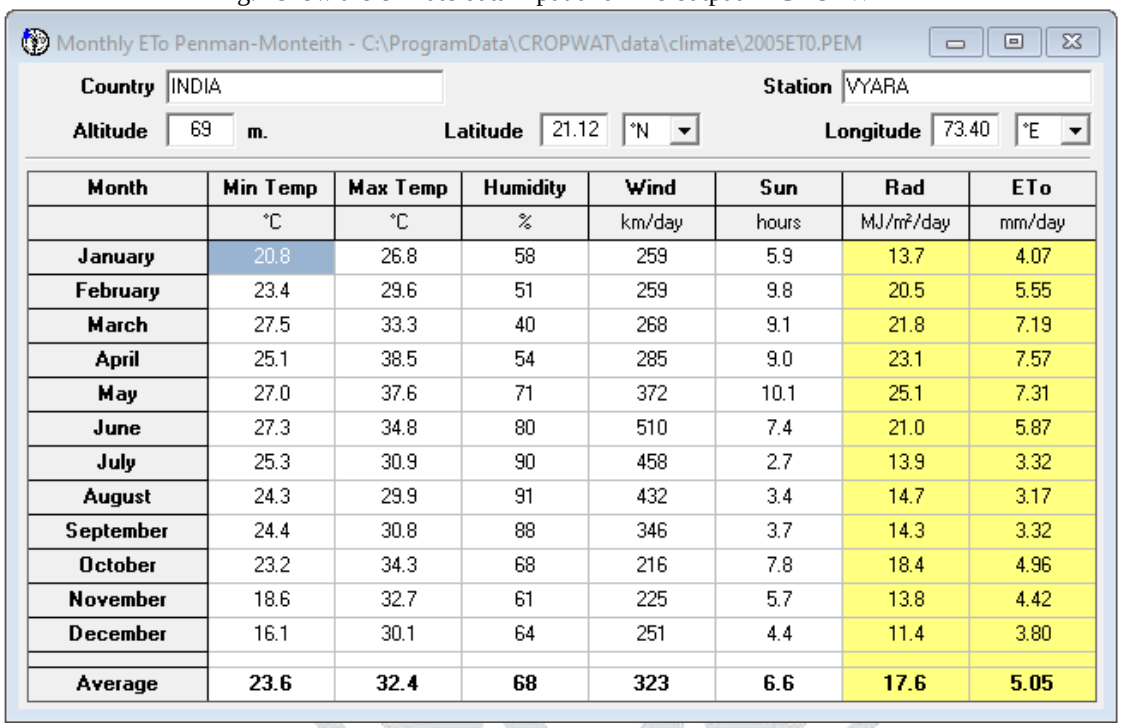
Fig.3 show the soil input data



Result and Discussion:

In the present research study I am using the data of 2001 to 2005 year for calculate four various crops. Here I am showing reference evapotranspiration and effective rainfall calculation in tabular form. Effective rainfall calculates using USDA-SCS method and reference evapotranspiration is using the penman's method. In this table all values put the monthly value and I am collecting daily value, so first I am convert this value in monthly form in MS-EXCEL and then put the value. Here I am showing only one crop (SUGARCANE) for the example how to put value and get the value for effective rainfall and ET0 and other four different year different crop is same to put value and calculate this both value. In this page show the fig.4 ETo calculation and below table: 2 show the effective rainfall calculation.

Fig.4 show the climate data input and ETo output in CROPWAT



Month	Min Temp	Max Temp	Humidity	Wind	Sun	Rad	ETo
	°C	°C	%	km/day	hours	MJ/m²/day	mm/day
January	20.8	26.8	58	259	5.9	13.7	4.07
February	23.4	29.6	51	259	9.8	20.5	5.55
March	27.5	33.3	40	268	9.1	21.8	7.19
April	25.1	38.5	54	285	9.0	23.1	7.57
May	27.0	37.6	71	372	10.1	25.1	7.31
June	27.3	34.8	80	510	7.4	21.0	5.87
July	25.3	30.9	90	458	2.7	13.9	3.32
August	24.3	29.9	91	432	3.4	14.7	3.17
September	24.4	30.8	88	346	3.7	14.3	3.32
October	23.2	34.3	68	216	7.8	18.4	4.96
November	18.6	32.7	61	225	5.7	13.8	4.42
December	16.1	30.1	64	251	4.4	11.4	3.80
Average	23.6	32.4	68	323	6.6	17.6	5.05

Table: 2 show the effective rain calculation in CROPWAT

station: Vyara		effective rain method :USDA-SCS
	Rain	Effective rain
	mm	mm
January	0	0
February	0	0
March	0	0
April	0	0
May	0	0
June	32.7	31
July	22.2	21.4
August	15.2	14.8
September	20.8	20.1
October	0	0
November	0	0
December	0	0
Total	90.9	87.3

Crop water requir

ement: This calculation for each crop, here only shows less and more water requirement between the years of 2001 to 2005. The amount of water using by each crop as the depth to meet the water loss through evapotranspiration can be referred as CWR. The CWR is calculating by multiplying the reverence evapotranspiration and crop coefficient. The result of CWR for each crop selected in the study area has been presented only less and more requirement.

(Crop water requirement) ETc=Kc*ETo

Sugarcane: In the study of sugarcane the year of 2001 to 2005. The sugarcane CWR varied between 1713.0 to 2093.7 mm/Dec. Planting date of sugarcane is 13/03. Generally the water requirement in the month of May is in 3rd stage. In the year of 2004 irrigation requirement are more 2093.7mm/Dec and the year of 2005 less water used. Effective rainfall in the year of 2004 is 57.6mm/Dec and the year of 2005 is 85.6mm/Dec, so the crop growth, additional water is required. The CWR is presented in different stage. Following table also presents the relationship between irrigation requirement and effective rainfall.

Table: 3 show the CWR for sugarcane for high water requirement

Month	Decade	Stage	Kc	ETc	ETc	Eff rain	Irr. Req.
			coeff	mm/day	mm/dec	mm/dec	mm/dec
Mar	2	Init	0.78	6.61	52.9	0	13.2
Mar	3	Init	0.4	3.36	37	0	37
Apr	1	Deve	0.42	3.5	35	0	35
Apr	2	Deve	0.54	4.5	45	0	45
Apr	3	Deve	0.67	5.73	57.3	0	57.3
May	1	Deve	0.8	7.22	72.2	0	72.2
May	2	Deve	0.94	8.71	87.1	0	87.1
May	3	Deve	1.08	8.94	98.4	0.1	98.3
Jun	1	Mid	1.21	8.74	87.4	1.5	85.8
Jun	2	Mid	1.26	8.01	80.1	2.3	77.8
Jun	3	Mid	1.26	6.99	69.9	3.3	66.7
Jul	1	Mid	1.26	5.89	58.9	4.1	54.8
Jul	2	Mid	1.26	4.84	48.4	5	43.4
Jul	3	Mid	1.26	4.46	49.1	6.6	42.5
Aug	1	Mid	1.26	3.96	39.6	9.5	30
Aug	2	Mid	1.26	3.45	34.5	11.7	22.8
Aug	3	Mid	1.26	3.96	43.5	8.2	35.3
Sep	1	Mid	1.26	4.54	45.4	3.5	41.9
Sep	2	Mid	1.26	4.97	49.7	0.4	49.3
Sep	3	Mid	1.26	5.35	53.5	0.3	53.1
Oct	1	Mid	1.26	5.73	57.3	0.6	56.7
Oct	2	Mid	1.26	6.11	61.1	0.2	60.9
Oct	3	Mid	1.26	6.35	69.8	0.1	69.7
Nov	1	Mid	1.26	6.59	65.9	0.1	65.8
Nov	2	Mid	1.26	6.83	68.3	0	68.3
Nov	3	Mid	1.26	7.06	70.6	0	70.6
Dec	1	Late	1.26	7.34	73.4	0	73.4
Dec	2	Late	1.21	7.34	73.4	0	73.4
Dec	3	Late	1.16	6.8	74.8	0	74.8
Jan	1	Late	1.11	6.09	60.9	0	60.9
Jan	2	Late	1.06	5.57	55.7	0	55.7
Jan	3	Late	1.01	5.83	64.1	0	64.1

Feb	1	Late	0.95	6.1	61	0	61
Feb	2	Late	0.9	6.2	62	0	62
Feb	3	Late	0.86	6.31	50.5	0	50.5
Mar	1	Late	0.81	6.44	64.4	0	64.4
Mar	2	Late	0.78	6.61	13.2	0	13.2
					2190.9	57.6	2093.7

Table: 4 show the CWR for sugarcane for low requirement

Month	Decade	Stage	Kc	ETc	ETc	Eff rain	Irr. Req.
			coeff	mm/day	mm/dec	mm/dec	mm/dec
Mar	2	Init	0.67	4.89	39.1	0	9.8
Mar	3	Init	0.4	2.95	32.5	0	32.5
Apr	1	Deve	0.42	3.13	31.3	0	31.3
Apr	2	Deve	0.54	4.09	40.9	0	40.9
Apr	3	Deve	0.67	5.04	50.4	0	50.4
May	1	Deve	0.81	6.03	60.3	0	60.3
May	2	Deve	0.94	6.97	69.7	0	69.7
May	3	Deve	1.08	7.45	82	0.1	81.9
Jun	1	Mid	1.22	7.82	78.2	8.2	70.1
Jun	2	Mid	1.27	7.57	75.7	12.2	63.4
Jun	3	Mid	1.27	6.45	64.5	10.5	53.9
Jul	1	Mid	1.27	5.03	50.3	8.1	42.2
Jul	2	Mid	1.27	3.83	38.3	7	31.3
Jul	3	Mid	1.27	3.89	42.8	6.3	36.5
Aug	1	Mid	1.27	4.08	40.8	5.3	35.5
Aug	2	Mid	1.27	4.01	40.1	4.4	35.7
Aug	3	Mid	1.27	4.08	44.9	5.2	39.7
Sep	1	Mid	1.27	4.06	40.6	6.9	33.7
Sep	2	Mid	1.27	4.08	40.8	7.9	33
Sep	3	Mid	1.27	4.82	48.2	5.2	43
Oct	1	Mid	1.27	5.76	57.6	0.1	57.5
Oct	2	Mid	1.27	6.54	65.4	0	65.4
Oct	3	Mid	1.27	6.23	68.5	0	68.5
Nov	1	Mid	1.27	5.83	58.3	0	58.3
Nov	2	Mid	1.27	5.6	56	0	56
Nov	3	Mid	1.27	5.33	53.3	0	53.3
Dec	1	Late	1.26	5.05	50.5	0	50.5
Dec	2	Late	1.21	4.59	45.9	0	45.9
Dec	3	Late	1.14	4.44	48.8	0	48.8
Jan	1	Late	1.08	4.21	42.1	0	42.1
Jan	2	Late	1.01	4.02	40.2	0	40.2
Jan	3	Late	0.95	4.26	46.9	0	46.9
Feb	1	Late	0.88	4.47	44.7	0	44.7
Feb	2	Late	0.82	4.56	45.6	0	45.6
Feb	3	Late	0.76	4.66	37.3	0	37.3
Mar	1	Late	0.71	4.75	47.5	0	47.5
Mar	2	Late	0.67	4.89	9.8	0	9.8
					1829.9	87.5	1713

Rice: In the study of rice of the year of 2001 to 2005. The rice CWR varied between 979.9 to 1110.9 mm/Dec. Planting date of rice is 28/2. Generally the water requirement is, in the month of

May in 3rd stage of development. In the year of 2004 irrigation requirement are more 1110.9mm/Dec and the year of 2001 less water use. Effective rainfall in the year of 2004 is 6.6mm/Dec and the year of 2002 is 9.9mm/Dec. So the in crop growth, additional water is required. The CWR is presented in different stage. Following table also present the relationship between irrigation requirement and effective rainfall.

Table: 5 show CWR for low water requirement

Month	Decade	Stage	Kc	ETc	ETc	Eff rain	Irr. Req.
			Coeff	mm/day	mm/dec	mm/dec	mm/dec
Feb	3	Init	1.02	5.63	5.6	0	5.6
Mar	1	Init	1.02	5.78	57.8	0	57.8
Mar	2	Init	1.02	5.94	59.4	0	59.4
Mar	3	Deve	1.05	6.44	70.9	0	70.9
Apr	1	Deve	1.14	7.28	72.8	0	72.8
Apr	2	Deve	1.22	8.15	81.5	0	81.5
Apr	3	Mid	1.28	8.58	85.8	0	85.8
May	1	Mid	1.28	8.78	87.8	0	87.8
May	2	Mid	1.28	8.87	88.7	0	88.7
May	3	Mid	1.28	8.01	88.1	0.1	88
Jun	1	Late	1.24	6.83	68.3	2.9	65.4
Jun	2	Late	1.09	5.33	53.3	4.3	49
Jun	3	Late	0.94	3.99	31.9	2.6	28.6
					852.1	9.9	841.6

Table: 6 show the rice CWR for high water requirement

Month	Decade	Stage	Kc	ETc	ETc	Eff rain	Irr. Req.
			Coeff	mm/day	mm/dec	mm/dec	mm/dec
Feb	3	Init	1.02	7.5	7.5	0	7.5
Mar	1	Init	1.02	8.07	80.7	0	80.7
Mar	2	Init	1.02	8.61	86.1	0	86.1
Mar	3	Deve	1.05	8.83	97.2	0	97.2
Apr	1	Deve	1.13	9.42	94.2	0	94.2
Apr	2	Deve	1.21	10.05	100.5	0	100.5
Apr	3	Mid	1.26	10.79	107.9	0	107.9
May	1	Mid	1.27	11.4	114	0	114
May	2	Mid	1.27	11.81	118.1	0	118.1
May	3	Mid	1.27	10.56	116.2	0.1	116
Jun	1	Late	1.22	8.81	88.1	1.5	86.5
Jun	2	Late	1.06	6.73	67.3	2.3	65
Jun	3	Late	0.91	5.04	40.4	2.6	37.1
					1118.1	6.6	1110.9

Ladyfinger: In the study of ladyfinger of the year of 2001 to 2005. The ladyfinger CWR varied between 284.2 to 514.1 mm/Dec. Planting date of ladyfinger is 15/11. Generally the water requirement is, in the month of January and February. In the year of 2003 irrigation requirement are more 514.1mm/Dec and the year of 2005 less water use. Effective rainfall in the both year is 0.0 mm/Dec. So the in crop growth, additional water is required. The CWR is presented in different stage. Following table also present the relationship between irrigation requirement and effective rainfall.

Table: 7 shows the low water requirement for ladyfinger

Month	Decade	Stage	Kc	ETc	ETc	Eff rain	Irr. Req.
			Coeff	mm/day	mm/dec	mm/dec	mm/dec
Nov	2	Init	0.2	0.88	5.3	0	5.3
Nov	3	Init	0.2	0.84	8.4	0	8.4
Dec	1	Init	0.2	0.8	8	0	8
Dec	2	Deve	0.26	0.97	9.7	0	9.7
Dec	3	Deve	0.36	1.41	15.5	0	15.5
Jan	1	Deve	0.47	1.83	18.3	0	18.3
Jan	2	Mid	0.55	2.18	21.8	0	21.8
Jan	3	Mid	0.55	2.49	27.4	0	27.4
Feb	1	Mid	0.55	2.8	28	0	28
Feb	2	Mid	0.55	3.08	30.8	0	30.8
Feb	3	Late	0.68	4.13	33.1	0	33.1
Mar	1	Late	0.75	5.05	50.5	0	50.5
Mar	2	Late	0.75	5.48	27.4	0	27.4
					284.2	0	284.2

Table: 8 shows the high water requirement

Month	Decade	Stage	Kc	ETc	ETc	Eff rain	Irr. Req.
			Coeff	mm/day	mm/dec	mm/dec	mm/dec
Nov	2	Init	0.5	2.46	14.8	0	14.8
Nov	3	Init	0.5	2.57	25.7	0	25.7
Dec	1	Deve	0.54	2.92	29.2	0	29.2
Dec	2	Deve	0.71	4.04	40.4	0	40.4
Dec	3	Deve	0.9	4.98	54.8	0	54.8
Jan	1	Mid	1.05	5.48	54.8	0	54.8
Jan	2	Mid	1.05	5.34	53.4	0	53.4
Jan	3	Mid	1.05	5.55	61	0	61
Feb	1	Late	1.05	5.7	57	0	57
Feb	2	Late	0.99	5.5	55	0	55
Feb	3	Late	0.91	5.57	44.6	0	44.6
Mar	1	Late	0.87	5.81	23.2	0	23.2
					514.1	0	514.1

Brinjal: In the study of brinjal of the year of 2001 to 2005. The brinjal CWR varied between 1405.5 to 639.3 mm/Dec. Planting date of brinjal is 24/10. Generally the water requirement is, in the month of December in 3rd stage of mid-season. In the year of 2004 irrigation requirement are more 639.3mm/Dec and the year of 2005 less water use. Effective rainfall in the year of 2004 is 0.0mm/Dec and the year of 2004 is 0.2 mm/Dec. So in the crop growth, additional water is required. The CWR is presented in different stage. Following table also present the relationship between irrigation requirement and effective rainfall.

Table: 9 shows the brinjal high water requirement

Month	Decade	Stage	Kc	ETc	ETc	Eff rain	Irr. Req.
			Coeff	mm/day	mm/dec	mm/dec	mm/dec
Oct	3	Init	0.6	3.02	24.2	0.1	24.1
Nov	1	Init	0.6	3.14	31.4	0.1	31.3
Nov	2	Deve	0.6	3.28	32.8	0	32.8
Nov	3	Deve	0.71	3.96	39.6	0	39.6

Dec	1	Deve	0.85	4.98	49.8	0	49.8
Dec	2	Deve	1	6.03	60.3	0	60.3
Dec	3	Mid	1.1	6.45	70.9	0	70.9
Jan	1	Mid	1.1	6.07	60.7	0	60.7
Jan	2	Mid	1.1	5.82	58.2	0	58.2
Jan	3	Mid	1.1	6.4	70.5	0	70.5
Feb	1	Late	1.06	6.79	67.9	0	67.9
Feb	2	Late	0.97	6.64	66.4	0	66.4
Feb	3	Late	0.92	6.74	6.7	0	6.7
					639.5	0.2	639.3

Table: 10 shows the low water requirement for brinjal

Month	Decade	Stage	Kc	ETc	ETc	Eff rain	Irr. Req.
			Coeff	mm/day	mm/dec	mm/dec	mm/dec
Oct	3	Init	0.6	2.95	23.6	0	23.6
Nov	1	Init	0.6	2.76	27.6	0	27.6
Nov	2	Deve	0.65	2.89	28.9	0	28.9
Nov	3	Deve	0.8	3.37	33.7	0	33.7
Dec	1	Deve	0.95	3.81	38.1	0	38.1
Dec	2	Mid	1.05	3.97	39.7	0	39.7
Dec	3	Mid	1.05	4.07	44.8	0	44.8
Jan	1	Mid	1.05	4.1	41	0	41
Jan	2	Late	1.04	4.11	41.1	0	41.1
Jan	3	Late	0.93	4.19	46.1	0	46.1
Feb	1	Late	0.81	4.09	40.9	0	40.9
					405.5	0	405.5

Irrigation scheduling: In the CROPWAT tool allows the user how to plan irrigation scheduling. Many options are there in this tool to plan the scheduling but in the present study using the irrigation timing. Here are selected the irrigation at critical depletion 100%, refill soil to field capacity 100% and irrigation efficiency is 70%. The net irrigation and gross irrigation requirement for the crop considered in this study and plan for the scheduling. Here I will show the table of the NIR and GIR in the form of more water requirement for the crop. Only more water requirement year is shown in this table.

Table: 11 shows the high requirement for all crops NIR and GIR

Sr.no	Crops	Duration	NIR(mm)	GIR(mm)
1	Sugarcane	365	1953.8	2791.2
2	Rice	121	1067.1	1524.4
3	Brinjal	121	599.4	856.3
4	lady finger	110	474.1	677.3

Conclusion:

In this study using the four major crops grown in Vyara taluka is i.e. sugarcane, rice, brinjal, and ladyfinger and their crop water requirement was calculated using FAO CROPWAT 8.0 tool. In this study result shows the effective rainfall is lower than the crop water requirement for each crops. NIR and GIR are calculated using scheduling option and 70% efficiency is considering.

In this research study result can be using the irrigation engineer for future scheduling and save the water while meeting agricultural water requirement. These results are also useful to prepare the plan of the farming. The study will be useful for predict the effective rainfall is more and the least irrigation water consumption and farmer can plan well for crop, the result of crop yield is high for effective use of water. Farmer also become educated so then this study is very useful to the farmer for future planning for this work, it can also useful as a guide for farmers to select the amount and frequency of irrigation for the crops studied. The results of this study can be used by irrigation engineer for calculating irrigation scheduling and crop water requirement assessment there by helping to save water in meeting the CWR, and can be used as a guide for farmers to select the amount and frequency of irrigation for the crops studied. This study is also useful for the irrigation department of Ukai dam for planning of how much water applied to the Vyara taluka canal for future work.

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