

Research Note

MONTHLY CONSUMPTIVE USE BY SUGARCANE AT FOUR REGIONAL SITES IN PUERTO RICO¹

The objective of this study was to estimate monthly water consumptive use (CU) by sugarcane, from January through December, for four regional sites in Puerto Rico. Temperature and rainfall data², a USDA-SCS computer program³, and information from USDA-SCS Technical Release 21⁴ were used to estimate monthly CU with the following relationship⁴:

$$CU = k_c \times k_t \times H \times p \times T + 0.8128) \dots \dots \dots /1/$$

where, k_c = a crop growth coefficient reflecting growth stage; k_t = a climatic coefficient which is related to mean air temperature; p = monthly percentage of total an-

nual daylight hours; T = mean air temperature (°C); and H = a humid area factor 0.8. K_c was 0.59 in April, 0.77 in May, 0.93 in June, 1.02 in July, 1.06 in August, 1.09 in September, 1.10 in October, 1.09 in November, 1.05 in December, 0.96 in January, 0.79 in February and 0.73 in March. The average K_c for the growing period was 0.84. It was assumed that sugarcane is planted 1 April and harvested 31 March.

Four Agricultural Experiment Substations of the University of Puerto Rico were Fortuna, Gurabo, Isabela and Lajas. These sites correspond to distinct climatic zones of Puerto Rico⁶. Table 1 indicates the geo-

TABLE 1.—*Geographical location of four agricultural experiment substations in Puerto Rico*

Description	Juana Díaz	Gurabo	Isabela	Lajas
Weather station No.	7292	4276	4702	5097
Location	Fortuna	Gurabo	Isabela	Lajas
Latitude	18°01'N	18°15'N	18°28'N	18°03'N
Longitude	68°32'W	66°00'W	67°04'W	67°03'W
Elevation above sea level	21.0 m	48.0 m	126.0 m	27.0 m
Climatic zone	Semiarid south coast	Eastern interior	Northern slopes	Semiarid south coast

¹Manuscript submitted to Editorial Board 5 October 1988. This study was conducted under USDA Grant No. 85-CSRS-2-2664, project CBAG-PR-23, Irrigation requirement estimation in Puerto Rico.

²Climatology of the United States No. 86-45 of Puerto Rico and U.S. Virgin Islands. In: Climatic Summary of the US Supplement. United States Dept. of Commerce, Washington, D. C.

³Hackbart, C. A., 1987. Conuse and SCS manual. USDA-SCS, Fort North-Tx.

⁴United States Department of Agriculture-Soil Conservation Service, 1970. Irrigation water requirements. Technical release No. 21. U.S. Govt. Printing Office, Washington, D. C.

⁶Soil Surveys of Arecibo, Humacao, Mayagüez, Ponce and San Juan Areas of Puerto Rico. USDA-SCS, San Juan, P. R.

TABLE 2.—*Monthly consumptive use (CU, cm) of sugarcane and climatic data for four climatic regions of Puerto Rico. Planting: April 01; harvesting: March 31*

Month	Parameter	Agricultural Experiment Substations in Puerto Rico			
		Fortuna	Gurabo	Isabela	Lajas
January	Temp °C	24.5	23.6	23.1	23.0
	Rainfall, cm	2.18	9.93	9.65	5.16
	Daylight, %	8.00	7.98	7.97	8.00
	CU, cm	11.8	11.2	10.9	10.9
February	Temp, °C	24.3	23.6	23.0	23.0
	Rainfall, cm	2.72	7.67	8.48	3.45
	Daylight, %	7.18	7.18	7.18	7.18
	CU, cm	8.6	8.3	8.0	8.3
March	Temp, °C	24.8	24.1	23.6	23.3
	Rainfall, cm	1.55	4.24	8.26	4.17
	Daylight, %	8.25	8.25	8.26	8.25
	CU, cm	9.6	9.2	8.9	8.9
April	Temp, °C	25.7	24.9	24.2	24.7
	Rainfall, cm	5.79	10.11	12.29	8.46
	Daylight %	8.28	8.29	8.30	8.28
	CU, cm	7.7	7.4	7.1	7.2
May	Temp, °C	26.5	25.9	25.1	25.8
	Rainfall, cm	11.40	15.90	21.44	8.78
	Daylight %	9.16	9.17	9.17	9.16
	CU, cm	12.3	11.9	11.4	11.8
June	Temp, °C	27.2	26.6	25.7	26.5
	Rainfall, cm	8.92	14.66	19.15	6.07
	Daylight, %	9.18	9.18	9.18	9.18
	CU, cm	15.3	14.9	14.2	14.9
July	Temp °C	27.5	26.7	26.2	26.5
	Rainfall, cm	6.96	15.24	12.70	8.59
	Daylight, %	8.92	8.94	8.95	8.92
	CU, cm	16.5	15.9	15.5	15.7
August	Temp. °C	27.6	26.9	26.2	26.3
	Rainfall, cm	11.91	22.91	16.97	14.94
	Daylight, %	8.72	8.74	8.75	8.73
	CU, cm	16.8	16.3	15.7	15.8
September	Temp, °C	27.4	26.7	26.1	26.1
	Rainfall, cm	15.06	22.38	17.53	18.14
	Daylight, %	8.25	8.25	8.25	8.25
	CU, cm	16.2	15.7	15.1	15.3
October	Temp, °C	27.1	26.3	25.7	25.6
	Rainfall, cm	13.49	21.49	16.56	14.43
	Daylight, %	8.24	8.23	8.23	8.24
	CU, cm	16.1	15.5	15.0	15.1

November	Temp, °C	26.3	25.5	25.0	24.8
	Rainfall, cm	9.40	13.46	13.77	11.38
	Daylight, %	7.91	7.89	7.88	7.91
	CU, cm	14.7	14.1	13.7	13.7
December	Temp, °C	25.2	24.5	23.9	23.6
	Rainfall, cm	3.40	11.50	10.97	6.68
	Daylight, %	7.91	7.89	7.88	7.91
	CU, cm	13.4	12.8	12.4	12.3
Total	Rainfall, cm	92.79	169.39	167.77	110.21
	CU, cm	159.2	153.1	148.0	149.6

graphical location of these weather data sources². Table 2 reveals the climatic data (rainfall, temperature, percentage daylight), and CU, from January through December, at these four locations. Monthly CU values were totaled to obtain the annual CU.

Estimated annual CU (mm) for sugarcane was 1592 at Fortuna, 1531 at Gurabo, 1480 at Isabela and 1496 at Lajas. On a monthly basis, CU ranged from 77 to 168 at Fortuna, 74 to 163 at Gurabo, 71 to 157 at Isabela and 72 to 158 at Lajas. Monthly CU was minimum in April and maximum in August at all sites. The declining order of magnitude for locations was Isabela < Lajas < Gurabo < Fortuna. The mean monthly CU for PR as a whole varied from 57 to 168 mm (1.9 to 5.6 mm/day). The average daily CU (mm per day) was 4.4 at Fortuna, 4.2 at

Gurabo, and 4.1 at Isabela, Lajas and Mayagüez.

The CU values were estimated with K_c corresponding to climatic areas similar to Puerto Rico. Experimental research to determine k_c in Puerto Rico has been lacking. It would be helpful to have CU estimates for good water management at the farm level and for planning irrigation projects. CU values have not been compared with measured CU, which are unavailable for Puerto Rico. The procedure to utilize CU for net irrigation requirements (NIR) and gross irrigation requirements (GIR) was outlined by Goyal⁶; this procedure is also valid for sugarcane.

Megh R. Goyal

Department of Agricultural Engineering

Eladio A. González Fuentes

Department of Agronomy and Soils

⁶Goyal, M. R. and E. A. González, 1989. Seasonal consumptive use of sweet peppers in semiarid and humid regions of Puerto Rico. *J. Agric. Univ. P. R.* 72 (4): 00.

