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Short Communication

Application of water balance studies in irrigated sugarcane

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The state of Karnataka is the second largest sugarcane growing state in India. Sugarcane is largely cultivated in the northern dry zone (Zone No.3) and southern dry zone and (Zone No. 6) in the state. Protective irrigation available through the canal irrigation facilitates this larger area of sugarcane cultivation. The southern dry zone consists of Mysore, Tumkur, Mandya districts and the part of Hassan district. The zone normally receives about 810 mm of annual rainfall, which is bi-model in nature. May and October months receive the highest rainfall. Two crops could be grown in some parts of the zone with protective irrigation. Considering the economic profits, the farming community is increasing the area under sugarcane cultivation. Hence, it has become essential to use the canal water very effectively and scientifically, so that the larger area could be brought under protective irrigation.

This investigation is aimed at estimating rainwater that could be harvested for use as protective irrigation to partly replace canal irrigation through application of water balance technique. The water balance for dryland crop in the eastern dry zone of Karnataka has been attempted by Rajegowda *et al* (1996, 2000) and Rukmani *et al* (1996). This methodology is highly useful in the command area for effective use of the available storage water. Since the rainwater also adds in to the sugarcane fields during the monsoon season, the area of cultivation could be increased.

Sugarcane transplantation is normally done in two seasons that is during July-August and January-February months. As the crop water requirement is low and there is no limitation for water during July-August, it is easy to retain ratoon as well as freshly planted cuttings and there is no limitation for water during this period.

The southern dry zone (Agroclimatic zone-6) lies between 11° 30'N and 13° 05' N Latitude, 76° 05' and 77° 45'E Longitude and Altitude of 800- 900 m.a.s.l with the mainly plane land comprising of two district head quarters Mysore and Mandya. These two places represent the average climatic features of the entire region and water balance of the region was worked out using weather data for these two locations. Daily weather data of for the period of 30 years from 1970 to 1999 has been analysed and the weekly normal have been worked out.

The weekly normal potential evapotranspiration (PET) values have been computed using Penman's (Doorenbos and Pruitt, 1977) method for the stations RRS, Mandya and ARS, Mysore. The weekly soil water balance calculations were carried out using simple soil water balance model of FAO (Frere and Popov, 1979). The available water holding capacity of the soil was taken as 116 mm m^{-1} depth of the soil

Table 1: Water balance (mm) table for the July planted sugarcane

Months	Weeks	Kc	PET	WR	Rain fall	Water Use	Soil moisture	Excess Water storage	Additional water required.
July	1	0.5	30.2	15.1	18.6	15.1	115.5	0.0	0.0
	2	0.6	30.2	16.6	21.5	16.6	115.5	4.9	0.0
	3	0.6	31.2	18.7	22.5	18.7	115.5	3.8	0.0
	4	0.7	30.0	19.5	22.6	19.5	115.5	3.1	0.0
August	5	0.7	29.9	20.9	22.2	20.9	115.5	1.3	0.0
	6	0.8	28.6	21.5	25.4	21.5	115.5	4.0	0.0
	7	0.8	27.9	22.3	26.9	22.3	115.5	4.6	0.0
	8	0.9	29.5	25.1	32.4	25.1	115.5	7.3	0.0
Sept.	9	0.9	28.4	25.0	28.3	25.0	115.5	3.3	0.0
	10	0.9	28.0	25.8	30.2	25.8	115.5	4.4	0.0
	11	0.9	29.5	27.9	36.9	27.9	115.5	9.0	0.0
	12	1.0	29.4	28.4	53.1	28.4	115.5	24.7	0.0
Oct.	13	1.0	27.0	26.5	46.8	26.5	115.5	20.3	0.0
	14	1.0	24.5	24.3	49.1	24.3	115.5	24.8	0.0
	15	1.0	25.6	25.6	43.1	25.6	115.5	17.5	0.0
	16	1.0	24.9	25.2	30.1	25.2	115.5	4.9	0.0
	17	1.0	24.5	24.9	22.3	24.9	112.9	0.0	0.0
Nov.	18	1.0	22.5	23.0	22.1	23.0	112.1	0.0	0.0
	19	1.0	22.1	22.7	21.0	22.7	110.4	0.0	0.0
	20	1.0	21.8	22.5	13.7	22.5	101.7	0.0	0.0
	21	1.0	21.7	22.5	12.1	22.5	91.3	0.0	0.0
Dec.	22	1.0	21.2	22.0	5.1	22.0	74.4	0.0	0.0
	23	1.0	20.0	20.9	5.1	20.9	58.6	0.0	0.0
	24	1.0	19.4	20.3	3.4	20.3	41.7	0.0	0.0
	25	1.0	20.8	21.8	1.4	21.8	21.3	0.0	0.0

	26	1.0	22.5	23.6	1.3	22.6	0.0	0.0	1.0
Jan.	27	1.0	22.3	23.4	1.5	1.5	0.0	0.0	21.9
	28	1.1	22.5	23.6	1.9	1.9	0.0	0.0	21.7
	29	1.0	23.5	24.7	0.9	0.9	0.0	0.0	23.8
	30	1.0	24.6	25.8	0.2	0.2	0.0	0.0	25.6
Feb.	31	1.0	25.8	27.0	0.7	0.7	0.0	0.0	26.3
	32	1.0	27.6	28.7	0.5	0.5	0.0	0.0	28.2
	33	1.0	28.2	29.3	1.5	1.5	0.0	0.0	27.8
	34	1.0	30.4	31.4	3.7	3.7	0.0	0.0	27.7
March	35	1.0	31.8	32.8	1.0	1.0	0.0	0.0	31.8
	36	1.0	32.2	33.0	1.7	1.7	0.0	0.0	31.3
	37	1.0	33.5	34.2	1.8	1.8	0.0	0.0	32.4
	38	1.0	36.1	36.6	2.0	2.0	0.0	0.0	34.6
	39	1.0	34.7	35.0	3.9	3.9	0.0	0.0	31.1
April	40	1.0	36.1	36.1	3.8	3.8	0.0	0.0	32.3
	41	1.0	36.0	35.5	8.9	8.9	0.0	0.0	26.6
	42	1.0	37.5	36.4	9	9.0	0.0	0.0	27.4
	43	0.9	37.7	35.4	12.3	12.3	0.0	0.0	23.1
	44	0.9	37.9	34.1	17.60	17.6	0.0	0.0	16.5
May	45	0.9	36.0	30.6	19.1	19.1	0.0	0.0	11.5
	46	0.8	38.4	30.7	25.9	25.9	0.0	0.0	4.8
	47	0.8	36.3	27.2	23.7	23.7	0.0	0.0	3.5
	48	0.7	38.2	26.7	26.4	26.4	0.0	0.0	0.3
June	49	0.7	33.9	22.0	22.6	22.6	0.6	0.0	0.0
	50	0.6	32.1	19.3	15.3	15.9	0.0	0.0	3.4
	51	0.6	32.9	18.1	9.1	9.1	0.0	0.0	9.0
	52	0.5	33.3	16.7	11.5	11.5	0.0	0.0	5.2
Total				**1346**	**843.7**	**818.3**		**138**	**528.6**

and assumed to be constant throughout the growth cycle.

The crop coefficient values (K_c) for sugarcane crop was adopted from Doorenbos and Pruitt (1979). The crop coefficient during initial stage is around 0.5 and then gradually increase during vegetative phase and reaches maximum during flowering and reproductive phase and decreases to 0.6 at the time of maturity.

The available water holding capacity of the soil is about 115.5 mm for 100 cm soil depth. In Table 1, the months, weeks after planting the crop, K_c, weekly PET, WR, rainfall, water used by the crop (AET), soil moisture storage, excess water (drainage & runoff) and the additional water required through the irrigation were given. The total water requirement is 1346 mm. The results indicate that the irrigated sugarcane crop planted during the month of July with field capacity can grow without any further irrigation till December. From July to December i.e up to 25 weeks from planting the rainwater is sufficient to meet the crop water requirement. Since there is no rain from December onwards, additional water through irrigation has to be provided to meet the crop water requirement from January onwards. The weekly additional water required is also shown in last column of the Table 1.

Under the annual rainfall of 843.7 mm in the zone, the annual surplus is about 138 mm, the total water available for the crop growth from the rainfall is about 818.3 mm. The additional need of about 528.6 mm is met through supplementary irrigation.

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