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Short communication

Determination of crop consumptive use and development of crop coefficient curve for summer groundnut

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In canal irrigation system under command areas of southern Rajasthan, summer groundnut crop has occupied a good place in the cropping pattern. Ground water recharge caused by heavy seepage and deep percolation losses during irrigation in Rabi season is used for growing the crop through a network of open wells and tube wells. It has been observed that the groundnut production is stagnated and depth of water applied for summer groundnut is much higher than that is required as per soil moisture depletion (Pal 1989, Das Gupta 1990). Further, no research on consumptive use and crop coefficient for summer groundnut is available for agro-climatic conditions of southern Rajasthan. The present study is therefore, undertaken with a view to determine the consumptive use and crop coefficient at different crop development stages and for crop life cycle.

The present study was undertaken at Instructional Farm, College of Technology and Engineering, (Maharana Pratap University of Agriculture and Technology) Udaipur, during summer season of 1998 and 1999. Udaipur is situated at 24°35' N latitude, 73°42' E longitude and at an elevation of 582.17 meter above sea level. The area is characterized by sub-humid climate with an average annual rainfall of 642.6 mm.

Daily values of evaporation from mesh covered pan evaporimeter for summer seasons 1998 and 1999 were collected from Meteorological Observatory, College of Technology and Engineering, Udaipur. These were transformed into reference crop evapotranspiration by using appropriate values of pan coefficient (Doorenbos and Pruitt, 1977). Three plots of the size 5.3 m x 5.3 m were selected. The soil was loamy sand. The physical properties of soil for different soil depths are given in Table 1. The field was primarily ploughed with disc plough followed by a cultivator. Sowing of summer groundnut (var. GG2) with a seed rate of 80 kg kernels per hectare was done manually on March 14, 1998 and March 15, 1999 with a row to row spacing of 30 cm and plant to plant spacing of 10 cm. Application of nitrogen and phosphorous was done as per recommendation and weeding and earthing was also done at 35 days after sowing. Irrigation was applied

Table 1: Physical properties of experimental soil

Soil depth (cm)	Sand (%)	Silt (%)	Clay (%)	Bulk density (gm/cc)	Field capacity (%)	permanent wilting point (%)
0-15	80.3	14.9	4.8	1.74	19.74	7.60
15-30	83	12.5	4.5	1.74	20.37	7.96
30-45	84.3	12.0	3.7	1.54	20.11	7.96

from an open well and the discharge being maintained at 370 liters per minutes.

Determination of crop consumptive use

The crop (summer groundnut, var. GG2) was sown and followed by an irrigation of 24.0 and 27.0 mm in 1998 and 1999 respectively to bring the soil moisture to field capacity within the seed zone to provide proper moisture for seed germination. Afterwards the irrigation was applied initially at an interval of five days and later on at an interval of four days. Depth of root zone has been assumed to be 15, 30 and 45 cm up to 30, 60 and 90 days after sowing (DAS) respectively. Soil moisture content before each irrigation was determined by gravimetric method and depth of irrigation was applied after appropriate corrections for water application losses. Final irrigation was given on June 18, 1998 and June 20, 1999. Consumptive use of crop for different durations and for life cycle was determined by evaluating soil moistu and depletion from various depths during the duration (Table 2). The consumptive use for different crop development stages are 74.6 mm for initial growth stage, 153.7 mm for flowering and pegging stage, 293.7 mm for pod development stage and 67.5 mm for ripening stage. The seasonal crop consumptive use is 589.5 mm.

Development of crop coefficient curves

Values of crop coefficient for different intervals (Table 2) were determined with help of following relationship:

$$Etc = Kc.\ ETo \qquad \text{——————(1)}$$

where, Etc is crop consumptive use for the duration (mm) ETo is reference crop evapotranspiration (mm) and Kc is crop coefficient

These Kc values for different durations have been plotted with respect to time and are shown in Fig. 1. In taking the coordinates of time for a particular Kc values for a particular duration, the mid point of the duration was assigned the corresponding Kc value. Further, the entire crop period was divided into four-crop development stages viz., initial growth stage (35 days), flowering and pegging stage (25 days), pod development stage (28 days) and ripening stage (18 days). The average Kc values for these stages are 0.38, 0.86, 1.24 and 0.79 respectively. The

Table 2: Open pan evaporation (Eo), reference crop evapotranspiration (ETo) , crop consumptive use (ETc), pan coefficient (Kp) and crop coefficient (Kc) for different durations for summer groundnut

Duration	Depth of root zone (cm)	Eo		Kp	ETo (mm)		Average Kc	ETc (mm)	
	1998 & 99	1998	1999		1998	1999	1998	1998	1999
15-19 March	15	31.7	29.30	0.60	19.02	17.58	0.34	06.47	05.98
20-24 March	15	21.0	32.50	0.58	12.18	18.85	0.36	04.38	06.79
25-29 March	15	31.0	42.10	0.63	19.53	26.52	0.38	07.42	10.08
30Mar.-3April	15	40.2	47.80	0.60	24.12	28.68	0.33	07.96	09.46
4-8 April	15	37.5	45.60	0.50	18.75	22.80	0.38	07.13	08.66
9-13 April	15	47.8	54.70	0.59	28.20	32.27	0.41	11.56	13.23
14-18 April	30	59.6	47.90	0.59	35.16	28.26	0.45	15.82	12.72
19-23 April	30	48.5	52.30	0.56	27.16	29.29	0.55	14.94	16.11
24-28 April	30	45.3	55.90	0.55	24.92	30.75	0.69	17.19	21.21
29 Apr-3 May	30	55.7	65.00	0.60	33.42	39.00	0.95	31.75	37.05
4-8 May	45	84.4	61.30	0.59	49.80	36.17	1.01	50.29	36.53
9-13 May	45	72.9	58.10	0.60	43.74	34.86	1.11	48.55	38.69
14-17 May	45	56.6	45.80	0.55	31.13	25.19	1.20	37.36	30.23
18-21 May	45	42.3	38.80	0.58	24.53	22.50	1.23	30.18	27.68
22-25 May	45	58.8	25.50	0.66	38.81	16.83	1.30	50.45	21.88
26-29 May	45	48.6	40.60	0.63	30.62	25.58	1.39	42.56	35.55
30 May-2 June	45	58.7	41.30	0.56	32.87	23.13	1.26	41.42	29.14
3-6 June	45	51.9	42.40	0.65	33.74	27.56	1.30	43.86	35.83
7-10 June	45	43.9	39.60	0.65	28.54	25.74	1.22	34.81	31.40
11-14 June	45	33.9	31.00	0.73	24.75	22.63	0.85	21.03	19.24
15-18 June	45	23.5	22.60	0.65	15.28	14.69	0.83	12.68	12.19
19-28 June	45	64.2	60.40	0.65	41.73	39.26	0.70	29.21	27.48

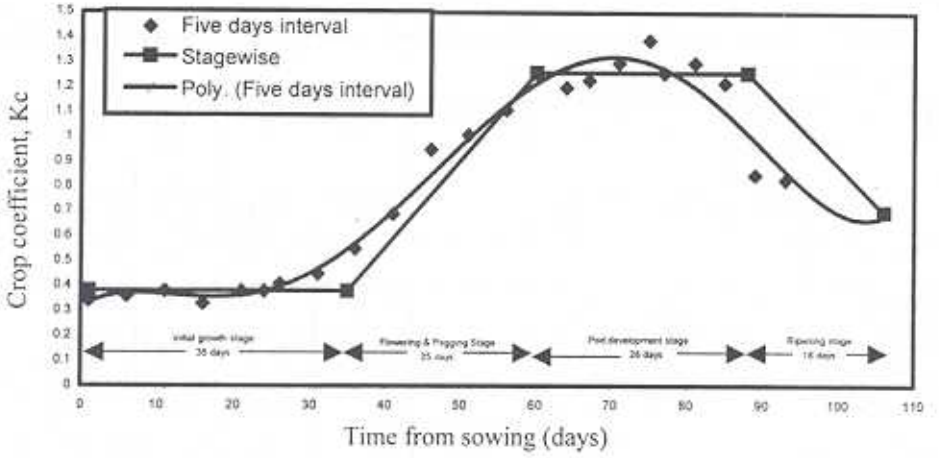

Fig. 1: Crop coefficient curve for summer groundnut

maximum values of Kc was found to be 1.3 and minimum was 0.34 only.

REFERENCES

Das Gupta, M. and K. Bhargava 1990. Determination of crop consumptive use for summer groundnut. An unpublished thesis submitted to Rajasthan Agricultural University,

Doorenbos, J. and W.O. Pruitt 1997. Crop Water Requirements, Irrigation and Drainage Paper No. 24, Food and Agriculture Organization of United Nations, Rome.

Pal, S.1989 Stagnant Production and Changing Production Instability of Oil Seeds in India 1950-1984. Agricultural Situation in India. New Delhi.