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Soil moisture depletion pattern as influenced by irrigation regimes, methods and management practices in soybean

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Abstract : Field experiments were conducted on soybean (var. Co1) to study the effect of irrigation regimes, methods of irrigation and stress management practices. In the investigations, data on soil moisture parameters were recorded. The results revealed that higher available soil moisture (ASM) was noticed when irrigation was given at 0.6 IW/CPE ratio than at 0.40 IW/CPE ratio. Similarly higher ASM was observed under all furrow method and double row furrow method than under alternate furrow method. Application of coirpith at 12.5 t ha^{-1} was found to increase the ASM whereas, foliar spray of either kaolin or KCI had no influence on the ASM. With regard to moisture depletion pattern, the ASM in the furrow depletes more rapidly during the initial few days after irrigation, irrespective of irrigation regimes. Crop growth and productivity depends, mostly on moisture availability, study on moisture depletion pattern is a useful phenomena in irrigated agriculture. *(**Key words** : Irrigation regimes - methods of irrigation - Available soil moisture - depletion pattern).*

The water holding capacity of a soil profile can be determined easily by knowing the water held at field capacity and permanent wilting point. However, what fraction of this stored water is used by the crop without affecting the growth process is difficult to ascertain. Therefore, a detailed analysis of soil moisture was done. The present investigation is an attempt in devising suitable irrigation method with different management practices. Coirpith application increased the soil moisture content (Subramanian, 1980). However, very little information is available for assessing the consumptive use of water, water use efficiency and moisture extraction pattern of soybean in different situations of water availability in semi arid regions. Therefore, the present investigation was made to evaluate the effect of irrigation on consumptive use, waster use efficiency and soil moisture depletion pattern of soybean.

Materials and Methods

Field experiments were conducted at Agricultural College and Research Institute, Coimbatore during summer and monsoon seasons of 1996 in soybean variety Co1. The soils of experimental field were sandy clay loam with low in available N, medium in available P and high in available K; the pH of the soil was 8.1 and 7.9 with 0.42 and 0.50 per cent organic carbon ; the field

Table 1. Water use components

Treatments	Number of irrigations	Irrigation of water applied (mm)	Effective rainfall (mm)	Total water used (mm)
Summer				
I_1M_1	5	250	92	342
I_1M_2	5	147	92	239
I_1M_3	5	134	92	226
I_2M_1	7	350	83	433
I_2M_2	7	217	83	300
I_2M_3	7	202	83	285
Monsoon				
I_1M_1	5	250	109	359
I_1M_2	5	135	109	244
I_1M_3	5	122	109	231
I_2M_1	7	350	92	442
I_2M_2	7	209	92	301
I_2M_3	7	197	92	289

Table 2a. Soil moisturedepletion pattern as influenced by irrigation regimes (I) and methods of irrigation (M) (per cent available soil moisture) (summer)

Sampling period DAI	Depletion in cm	0.40 IW/CPE ratio			0.60 IW/CPE ratio		
		M_1	M_2	M_3	M_1	M_2	M_3
2	0-15	79.9	71.8	71.7	83.9	73.9	81.3
	15-30	83.8	75.7	81.4	80.5	79.0	84.5
4	0-15	69.7	61.6	66.1	74.1	64.7	70.4
	15-30	73.1	65.6	72.5	72.7	60.9	75.8
6	0-15	58.8	49.9	56.0	63.8	56.5	60.0
	15-30	64.2	57.6	61.9	69.1	59.6	67.2
8	0-15	49.2	40.6	46.4	54.5	48.0	50.8
	15-30	54.2	44.9	51.7	60.3	51.9	58.6
10	0-15	40.8	32.5	37.7	45.2	39.6	42.1
	15-30	45.5	38.5	43.3	52.2	45.0	50.4
12	0-15	33.8	26.8	30.5	38.6	33.0	35.9
	15-30	38.4	33.1	36.7	44.2	38.8	42.9
14	0-15	28.4	22.8	25.7	33.2	27.7	31.8
	15-30	32.2	28.6	30.5	37.9	31.5	36.5
16	0-15	24.2	20.7	22.8	-	-	-
	15-30	27.6	25.2	27.3	-	-	-
18	0-15	21.3	18.9	20.5	-	-	-
	15-30	24.3	23.4				

Table 2 b. Soil moisture depletion pattern as influenced by irrigation regimes (I) and methods of irrigation (M) (per cent available soil moisture) (summer)

Sampling period DAI	Depletion in cm	0.40 IW/CPE ratio				0.60 IW/CPE ratio			
		A_0	A_1	A_2	A_3	A_0	A_1	A_2	A_3
2	0-15	73.3	77.4	73.6	73.8	76.7	83.0	77.6	77.5
	15-30	78.2	81.0	78.4	78.9	82.7	84.3	83.6	83.6
4	0-15	62.3	67.1	62.7	62.8	65.7	73.3	66.5	66.6
	15-30	68.9	72.9	69.1	69.2	73.8	76.2	74.2	74.2
6	0-15	53.2	56.7	51.6	51.6	55.2	64.0	56.7	56.7
	15-30	58.2	62.4	58.3	51.5	64.5	68.4	65.3	65.3
8	0-15	42.8	47.8	42.2	42.2	45.4	54.1	57.2	57.2
	15-30	46.8	52.6	47.6	47.5	53.6	60.5	55.2	32.8
10	0-15	32.8	39.2	33.0	33.0	35.5	44.9	37.2	37.2
	15-30	38.1	44.3	38.8	38.6	43.2	52.7	45.6	45.4
12	0-15	26.8	31.7	27.1	27.0	29.6	36.2	30.9	30.6
	15-30	31.6	37.5	32.2	32.3	35.6	43.4	37.6	39.6
14	0-15	22.5	27.1	22.8	22.6	25.4	30.2	25.2	25.3
	15-30	26.8	31.8	27.3	27.3	30.2	36.4	31.8	31.6
16	0-15	19.5	23.5	19.7	19.7	-	-	-	-
	15-30	23.9	27.1	23.9	23.8	-	-	-	-
18	0-15	18.2	20.9	18.4	18.4	-	-	-	-
	15-30	21.3	23.6	21.6	21.6	-	-	-	-

capacity and permanent wilting point were 24.9 and 12.2 per cent in summer and 24.6 and 12.4 per cent in monsoon seasons, respectively. Experiments were carried out in split plot design with three replications. Two irrigation levels 0.40 (I_1) and 0.60 (I_2) IW/CPE ratio and three methods of irrigation viz., all furrow (M_1), alternate furrow (M_2) and paired row furrow irrigation (M_3) were allotted in main plots. In sub-plot control (A_0) coirpith application at 12.5 t/ha (A_1), kaolin 3 per cent foliar spray (A_2) and 0.5 per cent KCl foliar spray (A_3) were allotted. All other cultural practices to soybean were commonly followed as per recommendation. The yield was calculated. The soil moisture was determined gravimetrically from sowing to harvest at 2 days interval and also before and after each irrigation. The soil samples were taken at 0-15 and 15-30 cm depth of the soil profile.

Results and Discussion

Total water used

The crop water requirement is met through irrigation water and effective rainfall. In this study, the irrigation water was measured and the effective rainfall was calculated to arrive at the total water used in each 0.40 and 0.60 IW/CPE ratio through all furrow, alternative furrow and double row furrow irrigation (Table 2). Among the treatments, I_2M_1 treatment used 433 mm during summer and 442 mm during monsoon and the treatment I_1M_3 recorded lower water use of 226 mm during summer and 231 mm during monsoon. The increased soil water supply increased the total water used in soybean.

Soil moisture depletion pattern

Available soil moisture was found to be depleted more rapidly during initial few days after irrigation when compared to later days after irrigation irrespective of irrigation regimes. The above pattern of decline in ASM might, probably, be due to loosely held water in the soil particles in the initial days while it might have held more tenuously during the later days as drying advanced. This is in corroboration with the reports made by Selvarathinam (1992). More quantity of available soil moisture was recorded at 0.60 IW/CPE ratio. The available soil moisture during 2 days after irrigation was higher at 0-15 cm depth and lower at 16-30 cm depth.

The depletion of available soil moisture (DASM) in soil decreased as the depth increased owing to relatively finer texture in 16-30 cm layer in relation to top layer (0-15 cm) and more root

proliferation. Similar results were also reported by Vijayalakshmi and Aruna Rajagopal (1994). The more available soil moisture before and after irrigation was in 0.60 IW/CPE ration than in 0.40 IW/CPE ratio (Table 2) might be due to more frequent irrigation. This was evident that such increase in available soil moisture had favoured the growth, yield attributes and yield of soybean at 0.60 IW/CPE ratio. Lower available soil moisture as in 0.40 IW/CPE ratio in turn affected the uptake of nutrients, translocation of assimilates from source to sink and other physiological and bio-chemical processes.

Alternate furrow had lesser ASM than all furrow method, which might be due to lesser quantity of water applied in alternate furrow than in all furrow method. The difference in ASM between all furrow and alternate furrow was 14.8 per cent whereas the same under coir waste applied treatment was 6.5 per cent.

Application of coirpith at 12.5 t ha^{-1} had maintained higher available soil moisture (Table 3) due to its higher water holding capacity and therefore. application of kaolin and KCI as foliar spray, did not have much influence on ASM which is in confirmation with the report of Dhanabalan (1994).

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A study on the soil fertility status of sugarcane growing areas of Kancheepuram district, Tamil Nadu

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Abstract : A study was carried out to assess the available macro and micronutrient status of sugarcane growing soils of Uttiramerur taluk of Kancheepuram district, Tamil Nadu. The available nitrogen content was low in 96 per cent of the surface and 98 per cent of the subsurface soil samples. The available phosphorus was low in 50 per cent of the surface and 61 per cent of the subsurface soil samples and medium in 27 per cent of the surface and 21 per cent of the subsurface soil samples and high in 23 per cent of the surface and 18 per cent of the subsurface soil samples. Forty five per cent of surface and 68 per cent of subsurface soil sample were low, 51 per cent of surface and 28 subsurface soil samples were medium and the remaining were high in available potassium. The micronutrient content of the soil samples showed that the DTPA Fe was sufficient in 98 per cent of the surface and 91 per cent of the subsurface soil samples. DTPA Mn was sufficient in 73 per cent of surface and 96 per cent of subsurface soil samples. DTPA Zn was deficient in 91 per cent of surface and 99 per cent of subsurface soil samples. DTPA Cu was sufficient in 57 per cent of surface and 40 per cent of subsurface soil samples. Hot water soluble B was found sufficient in 84 per cent of the surface soil samples. *(Key words : Available nutrients, Surface, Subsurface, Sugarcane.)*

The importance of soil fertility is increasingly recognised in all countries especially in developing countries, which have a high pressure of population on the land. Universal deficiency of nitrogen, serious