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Phenology and growth of dryland pearl millet at Hisar

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ABSTRACT

Phenology, growth and development of two pearl millet hybrids grown under dryland conditions were studied at Research Farm CCS HAU, Hisar, during *kharif* seasons of 1997 and 1998. Delayed sowing led to shortening of vegetative phase utilizing lesser heat units. The heat unit requirement during the panicle development phase remained unaffected by sowing date. At physiological maturity around 50 per cent of the above ground biomass was allocated to the reproductive parts. A strong positive correlation was observed between biomass and the accumulated heat units or accumulated PAR. An improvement in correlation was achieved when biomass of reproductive parts instead of plant biomass was used in the study.

Key words: Phenology, pearlmillet, PAR

For most of the millet-growing areas in India, the length of growing period extends from 60 to 90 days. In the Hisar region of Haryana state, the kharif growing season extends from late June to mid September when an average rainfall of 360 mm is received in 20 rainy days. The soils of the region are sandy with low water holding capacity. Further, in this region long dry spells during the crop growth season are frequent and occur at unpredictable frequency. Information on plant parameters such as phenology, leaf area development and dry matter production in pearl millet in dry tropical marginal environment is scanty.

MATERIALS AND METHODS

The pearl millet hybrids, HHB-67 and HHB-60 were raised using three dates of sowing during *kharif* seasons of 1997 and 1998. First sowing was done soon after onset of monsoon rains. Second sowing was done after receipt of 2nd effective rains following a dry spell after monsoon onset. Third sowing was done in late July or early August (Table 1). The sowings were planned in such a way that earliest sown crop was expected to encounter drought during vegetative phase (GS1), and in two subsequent sowings, drought could coincide with panicle development phase (GS2) and somewhere in between GS2 and grain filling phase (GS3), respectively. The crop was given recommended package of practices for the region.

Phenology was recorded by visual observations on alternate days following Maiti and Bidinger (1981). Heat units were accumulated for three major growth phases. Three plants were sampled for leaf area and dry matter (g m^{-2}) measurements at various growth stages. Correlation coefficients between above ground plant biomass and

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Table 1: Sowing and harvest dates of pearl millet hybrids

Sowing Dates		1997		1998	
		Sowing	Harvest	Sowing	Harvest
D_1	HHB-67	12-07-97	15-09-97	17-07-98	19-09-98
	HHB-60	12-07-97	20-09-97	17-07-98	24-09-98
D_2	HHB-67	20-07-97	22-09-97	02-08-98	01-10-98
	HHB-60	20-07-97	01-10-97	02-08-98	09-10-98
D_3 *	HHB-67	30-07-97	30-09-97	12-08-98	11-10-98

* *HHB-60 was not sown in third sowing date*

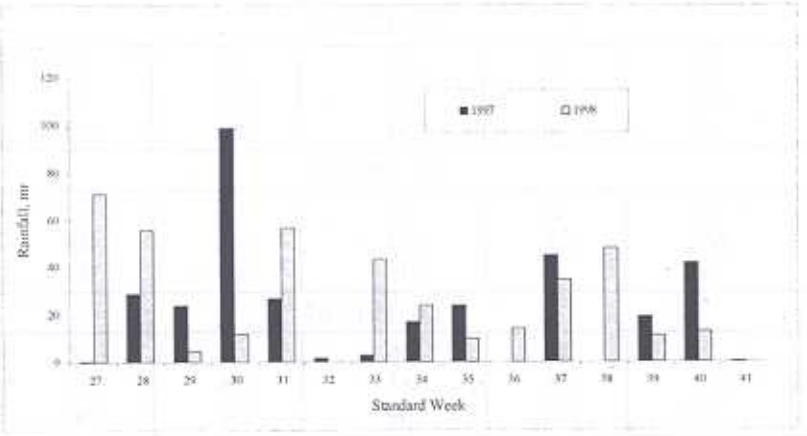

Fig. 1: Weekly rainfall during two crop seasons

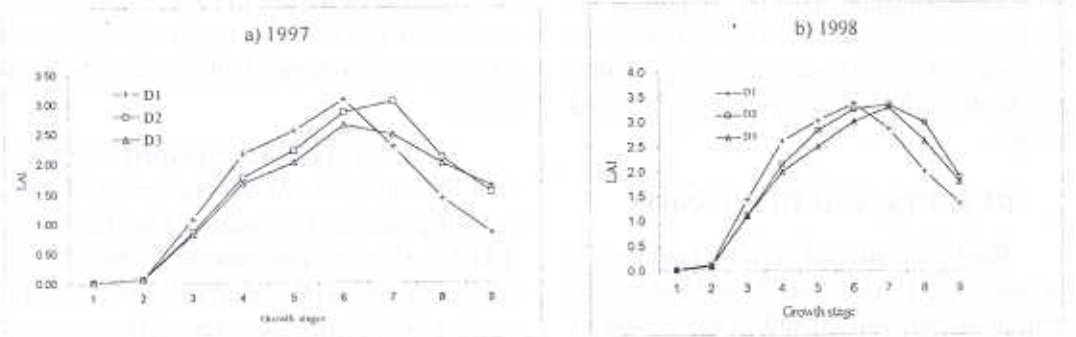

Fig. 2: Effect of different monsoon environments on leaf area index of pearl millet.

Table 3: Duration of growth phases in pearl millet with cumulative heat units (AHU, Day °C) and dry matter production (DM, g m^{-2})

	GS1		GS2		GS3	
	1997	1998	1997	1998	1997	1998
D1 : HHB-67						
Days	30	29	14	14	21	20
AHU	588	569	310	275	405	387
DM	43	65	212	288	184	283
D1 : HHB-60						
Days	29	32	15	16	23	21
AHU	539	624	334	302	435	388
DM	45	65	306	398	250	323
D2 : HHB-67						
Days	29	25	16	14	21	21
AHU	539	472	350	277	367	355
DM	45	49	254	285	208	338
D2 : HHB-60						
Days	31	28	17	16	25	24
AHU	634	528	363	312	488	393
DM	40	47	331	460	263	335
D3 : HHB-67						
Days	28	25	16	15	18	20
AHU	605	476	313	278	337	314
DM	50	48	209	290	190	265

GS1 - Vegetative phase GS2 - Panicle development phas GS3 - Grain- filling phase

accumulated heat units (CHU) or intercepted photosynthetically active radiation (IPAR) was obtained and also between earhead dry matter and weather based parameters mentioned above.

RESULTS AND DISCUSSION

Rainfall distribution in two seasons is shown in Fig.1. A total of 331 and 398 mm of rainfall occurred in 20 and 23 rainy days in 1997 and 1998, respectively. Onset of monsoon was delayed by a week in 1998. During 1997, rainfall of 152 mm was received in July, but August was comparatively dry (72 mm of rain).

Sowing of pearl millet beyond third week of July resulted in overall shortening of crop growth period and less accumulated heat units (AHU). However, an interesting observation was that the AHU over the period from sowing to 50% stigma emergence in crop sown after 3rd week of July were either higher than

or equal to early sown crops (Table 2). The two hybrids had extended growth period and accumulated higher HU in 1997 than 1998 because of early sowing of crop with early monsoon onset. Hybrid HHB-67 has a definite short vegetative phase and low heat unit requirement as compared to HHB-60 irrespective of sowing date (Table 2). The crop growth period divided into three distinct growth phase viz., vegetative (GS1), panicle development (GS2) and grain filling (GS3) revealed that GS1 was the longest and GS2 was the shortest phase irrespective of sowing date or hybrid (Table 3). The present results are in conformity with earlier reports of Forest and Lidon (1984) for sorghum crop. They stated that excess water at the start of crop growth reduces the efficiency of heavy organic and mineral fertilization and also reduces activity of the root system. The crop duration was longer during 1997 than 1998 and consequently the AHU were also higher.

A continuous gain in dry matter (g m^{-2}) was recorded with crop age in both years of study (Table 2). The accumulated dry matter during the three phases was higher in all three environments during 1998 than 1997. The excess water due to continuous rainfall during initial crop growth phase in 1997 substantially affected growth. Consequently, gain in dry matter during vegetative phase was lower in 1997 than 1998.

During 1997 crop season, the plant growth in D_1 sowing suffered more adversely during vegetative phase due to higher rainfall than that in D_2 and D_3 sowings and this effect was more prominent during GS2 when the crop encountered a long dry spell during August. In an earlier study in sorghum, Forest and Lidon (1984) have concluded that sorghum and millet crops are more susceptible to moisture deficit between 30 and 50 days after sowing, a period corresponding to the emergence of the last leaf (growth point differentiation). The results of present study hold good in view of above conclusions.

The dry matter accumulation during GS3 was better in 1998 crop season than 1997 (Table 2). The poor rainfall during August month in 1997 crop season resulted in poor source development which led to poor growth during GS3 phase.

Leaf area index values in two hybrids were similar and hence values for HHB-67 has been depicted in Fig.2. LAI curves clearly indicated a better source development in 1998 than 1997. Though, crop in 1997 took more days and AHU even then the growth parameters were better in the latter season because of higher rainfall and more even and fair distribution (Fig. 1).

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