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Short communication

Assesment of agroclimatlc potentials of north Gujarat agroclimatic zone

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The climatic water balance technique is an unique tool to assess the agroclimatic potentials of any region. The water balance technique of Thornthwaite and Mather (1955) takes into account not only the rainfall distribution but also the atmospheric demand and soil factor of the area. The study pertaining to this aspect for Gujarat in general and north Gujarat in particular is very limited (Biswas, 1982; Sekh, 1989; Pandey and Gupta, 1991). In the present paper therefore, attempt has been made to assess the agroclimatic potentials of 17 talukas of north Gujarat comprising of Banaskantha, Sabarkantha, Mehsana and Ahemdabad districts.

The normal monthly rainfall and potential evapotranspiration (Rao *et al.*, 1971) were utilised to workout the water balance components. The water balance parameters viz., soil moisture storage (SMS), actual evapotranspiration (AET), water surplus (WS) and water deficit were computed following Thornthwaite and Mather (1955) technique in which soil moisture storage (SMS) was computed by

$$SMS = AWC \quad EXP\ (APWL/AWC)$$

where, AWC is available water capacity, which is the moisture content of soil between field capacity and permanent wilting point. Depending upon soil type its value varied between 100 mm in light sandy soil of Tharad to 250 mm in deep black soils of Bayad and Modasa. APWL is accumulated potential water loss which is summation of negative difference of precipitation and PET.

The ratio of AET to PET, the moisture adequacy index, is computed to findout the start and cessation of crop growing season. The approximate dates were obtained through graphical interpolation of different values assuming that these are centred on 15th of each month.

When AET/PET is > 0.75, the crop growing season is with slight stress condition;
when 0.75 >AET/PET < 0.50, it is said to be under moderate stress condition;
and when AET/PET < 0.50, the crop is said to be under severe stress condition.

The normal water balance components for 17 stations are presented in Table 1. Tharad, Radhanpur, Mandal and Viramgam which are western most part of the zone receive rainfall less than 600 mm while the eastern part receives more than 750 mm. The PET is more in low rainfall areas, therefore, most of the rainfall is evaporated in due course of time and no surplus water is available in these areas. Deesa, Patan, Kalol, Prantij, Sanad and Dholka have suplus water less than 50 mm while Ahemdabad, Bayad and Modasa have surplus water between 50 to 100 mm. The most potential areas for water surplus are Idar,

Table 1: Climatic water balance parameters of north Gujarat

Stations	RF	PET	AET	WS	WD	MI
1. Deesa	621.5	1714	587.8	33.7	1126.2	-63.7
2. Palanpur	749.8	1686	639.9	109.9	1046.1	-55.5
3. Tharad	507.2	1735	507.2	0.0	1227.8	-70.8
4. Radhanpur	510.0	1751	509.5	0.5	1241.5	-70.9
5. Mehsana	613.0	1700	610.7	2.3	1089.3	-63.9
6. Patan	618.2	1725	584.8	33.4	1140.2	-64.2
7. Kalol	691.1	1678	662.8	31.3	1015.2	-58.6
8. Himatnagar	794.2	1629	679.7	114.5	949.3	-51.3
9. Idar	974.0	1626	728.9	245.1	897.1	-40.1
10.Prantij	739.0	1639	716.8	22.2	922.2	-54.9
11.Modasa	827.2	1617	736.8	90.4	880.2	-48.8
12.Bayad	784.7	1614	724.2	60.5	889.8	-51.4
13.Ahemdabad	782.8	1678	729.0	53.8	949.0	-53.3
14.Sanand	677.5	1726	662.6	14.9	1063.4	-60.8
15.Viramgam	585.4	1787	585.4	0.0	1201.6	-67.2
16.Mandal	521.7	1794	521.7	0.0	1272.3	-70.9
17.Dholka	706.7	1735	689.9	16.8	1045.1	-59.3

where,
RF- Rainfall (mm); PET- Potential evapotranspiration (mm);
AET-Actual evapotranspiration (mm); WS- water surplus (mm);
WD- Water deficit (mm) and MI- Moisture index (%)

Himatnagar and Palanpur. The water deficit varies between 875 to 1275 mm. The moisture indices indicate that Tharad, Radhanpur, Mandal and Viramgam fall under arid climate while rest of the areas fall under semiarid climate.

The length of crop growing season under various stress condition was determined based on the ratio AET/PET. The start and cessation of growing season and its duration are presented in Table 2. The crop growing season starts between June 15 to 27 in various parts of north Gujarat. As we advance the sowing dates the stress condition is reduced. The cessation of growing season starts from September 8th and continues upto November 23rd in some parts of the zone. The start of sowing time mainly coincides with onset dates of monsoon and therefore there is not much variation at this time. However a large variation in the cessation of growing season in the different parts of the zone is evident.

The length of growing season under slight stress condition is the shortest (66 days) at Mandal followed by Tharat (74 days) and Radhanpur (77 days) with the longest duration of 113 days at Modasa. This suggests that the area is suitable for growing short duration crops of 66-113 days duration under dryland condition. However for drought resistant

Table 2: Start, cessation and duration of crop growing season in north Gujarat

Stations	Startof season	Cessation of season	Duration(days)	
			with slight stress	with moderate stress
1. Deesa	Jun.25-Jul.5	Sep.26-Oct.15	83	111
2. Palanpur	Jun.23-Jul.4	Oct. 2-Oct.24	90	123
3. Tharad	Jun.27-Jul.5	Sep.17-Oct. 2	74	97
4. Radhanpur	Jun.27-Jul.6	Sep.21-Oct. 5	77	98
5. Mehsana	Jun.23-Jul.4	Sep.29-Oct.18	87	117
6. Patan	Jun.24-Jul.4	Sep.24-Oct.12	82	110
7. Kalol	Jun.18-Jul.1	Oct. 6-Nov. 2	97	139
8. Himatnagar	Jun.18-Jul.1	Oct.12-Nov. 8	103	143
9. Idar	Jun.15-Jun.29	Oct.16-Nov.15	109	153
10.Prantij	Jun.19-Jul.2	Oct.15-Nov.15	105	149
11.Modasa	Jun.16-Jun.30	Oct.21-Nov.23	113	160
12.Bayad	Jun.18-Jul.1	Oct.21-Nov.22	112	157
13.Ahemdabad	Jun.17-Jul.1	Oct.15-Nov.12	106	148
14.Sanand	Jun.21-Jul.3	Oct. 5-Nov. 1	94	131
15.Viramgam	Jun.24-Jul.4	Sep.21-Oct. 8	79	106
16.Mandal	Jun.24-Jul.4	Sep. 8-Sep.26	66	94
17.Dholka	Jun.17-Jun.30	Oct. 8-Nov. 2	100	148

crops, the area is suitable for 94-160 days growth duration.

The results reveal that the arid parts of the zone (Tharad, Radhanpur,Mandal and Viramgam) are suitable only for drought resistant short duration crops. Deesa, Palanpur, Patan, Mehsana, Viramgam and Sanad areas are suitable for drought resistant crops of medium duration (100-140 days). The remaining parts of Ahmedabad and Sabarkantha districts are suitable for long duration (140-160 days) drought resistant crops.

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