

AGRO-CLIMATIC ZONES OF SINDH: FOR PROPER PLANNING OF AGRICULTURE

By
M.H. Panhwar

The importance of climate for agriculture is little realised today, though it was given due attention before Independence in 1947. Climate includes all factors like temperature, humidity, rain-fall, cloud cover, fog, solar insolation, winds, total amount of accumulated heat for most of plants to grow, flower and fruit and total chill needed for some plants to achieve dormancy before new growth and flowering. The climatic factors determine the environments suitable for different plants to survive and thrive.

The British realised the importance of climate and the Bombay Presidency published the first meteorological map of the Presidency on size 22" X 17" in 1878. In 1884 the Government of India issued first rainfall chart on the South Asia on a size 37"x19". The first Gazetteer of Sindh published 1874 and revised in 1876, discusses climate of various districts and talukas of Sindh. The Hunter's Imperial Gazetteer of India (1886) gives climatic maps. The survey of Pakistan's Atlas issued in 1983 gives the same climatic divisions of Sindh as Hunter's Gazetteer of 1886, printed almost 100 years before. Atlas of Bombay Presidency published in 1887 gives the district wise position of the climate of Sindh. Since 1889 various gazetteers of India, Bombay Presidency and Sindh, as well as its districts, have given average temperatures and rain-fall of most of the towns of Sindh.

The importance of climate of agriculture was so well realised that at the turn of century, since 1904, temperature and rainfall data were collected daily by the Mukhtiarkars (County Officers) of each taluka and sent telegraphically to the Director of Agriculture, who published these figures as well as annual averages over the period, from 1904 onwards in the Sindh Government Gazette each year. Last such data for a year 1904-1945 were published by the Director of Agriculture in Sindh, in the Sindh Government Gazette in 1946 and it included the data for all the talukas of Sindh with annual average for 41 years and their means. The various Gazetteers of Sindh and its districts, issued in 1907, 1919 and 1927 have discussed temperature and rain-fall of various districts and towns and so did the Imperial Gazetteer of India 1909 and Gazetteers of Bombay Presidency issued in 1889 and 1909. The various executive engineers of Irrigation Department also maintained meteorological instruments in their offices and compiled the data. All Government farms had meteorological instruments for recording rainfall and maximum-minimum temperatures. The Meteorological Department of India, fully understood the implications of climate and in 1945 published a book, "Climate and Indian Farmer". In this publications besides rainfall, temperature, pan-evaporation and

atmospheric pressure they laid the criteria of 5 inches rainfall in 30 days, 7 days, and 24 hours. Even today same criteria are used internationally, for agriculture planning.

The interest in the climate was to the extent that all English and Sindhi paper published maximum and minimum temperatures of major cities of the South Asia daily and also some stations of Sindh namely; Jacobabad, Rohri, Pad-Idan, Hyderabad, Chore, Drigh Road, Karachi Sadar, Manora and probably one or two more. With independence in 1947, interest in climate as applied to agriculture, vanished. The various Government farms have collected climatic data, but they have never been compiled them for the past fifty eight years. They have manuscript registers for entering daily data. WAPDA (Water and Power Development Authority) collects and publishes data but these are not in the form as the data published by the Director Agriculture Sindh before 1946 AD i.e., data for various sites, month and year-wise averages over along period.

A look at a few maps published in various Government reports, shows as if these had originated from a meteorological maps published 70-80 years ago. They divide Sindh into three climatic zones only.

- Hot very dry (very arid):- Rain, less than 5" (125mm).
- Hot dry (arid):- Rain, 5-10" (125-255mm).
- Warm semi-arid:- Rain 10-14" (255-355mm).

The present writer had made an attempt to collect the meteorological data for different areas of Sindh from a number of sources, for years 1904-1984 and based on these has constructed an agro-climatic map of Sindh. One new but very important factor that has been evaluated for various areas of Sindh, is the total accumulated heat or heat index, under which most of the plants grow, mature and produce fruit/grain or fibre. The internationally accepted criteria for heat indices is the total degree-days i.e., temperatures prevalent between 12.8 to 37°C. Below or above these two limits of temperatures, most sub-tropical plants stop vegetative growth. Annual rainfall has become unimportant in the irrigated plains of Sindh, where assured canal water is available. Rainfall is important for Thar and Kohistan which depend totally upon rain. Aridity has been categorised as difference in evaporation and rainfall and from this point the whole Sindh is arid except small south-eastern tip of Nagar Parker and Mithi Talukas, which are semi-arid. Aridity becomes redundant where assured irrigation water is available. Evaporation and evapo-transpiration are important for scheduling irrigation, but farmer through his experience re-schedules irrigation month after month, as soil communicates to him, when water is needed.

Besides heat accumulation or total heat indices, total winter chill, called chill units is another important criteria for preparation of climatic maps. The winter chill is the total annual hours below 7.2°C and above 0°C. Chill units determine breaking of winter dormancy of plants and on completion of it, plants re-grow. Chill units influence flowering, fruiting and yield of many fruit varieties and their numerous cultivars. Mangoes, dates, lychee, sapodilla, citrus and many

vegetables need winter chill to flower. In absence of adequate chill units, the stress needed by plants is achieved by stopping water, a practice which affects health of plant, its total yield, and life expectancy, but it works in meeting chill requirement of plants. This practice is doubted by some-authorities, but adequate experimental data is not available.

In order to built a climatic map of Sindh, the present writer had made use of many years climatic data of 18 stations in Sindh, including one at Karachi Sadar and has worked-out winter chill units between November and February and summer heat indices between March and October, ignoring the negating of chill units and heat indices by adverse factors. From these data an agro-climatic map of Sindh has been constructed, dividing it into nine zones. These nine zones have been further divided in to a few extra sub-zones based on difference of heat indices within three out of nine zones. The map thus has nine chill unit and twelve heat index zones.

Zone-I

It consists of areas from Rohi to Jacobabad, having 4,969 heat indices and 420 chill units. In terms of total heat accumulated between March and October it is hottest area of Sindh, but is by no means coldest area, which happens to be unsuspected Zone-II. In the former zone, there are two sub-zones (a) and (b), the hottest part (a) falling within Thul, Shikarpur, Ghari Yasin and Ghari Khairo Talukas. High heat of this area is mainly on account of vast desert of Sibi-Kachhi Plains to the north. It appears that Temple Dera (Dera Murad Jamali) in Baluchistan may be hottest place in the South-Asia. The eastern part (b) forming another sub-zone covering Kashmore, Kandhkot, Rohri, Ghotki, Pano Akil, Ubavro and Mathelo Taluka is not as hot and approximates to Zone-II in summer heat indices.

Zone-II

It covers the whole district of Larkana, Shahdad Kot districts and of Dadu district and small strip adjoining the left bank of the river Indus from Khairpur Mir's to Moro. It is the coldest areas of Sindh having 550 chill units, matching that of the Central Punjab. Before independence this area was well known for citrus, pomegranates and wine grapes. All three fruits were raised there on commercial scale in 1918-1920, as reported by Barkazai an agricultural officer of that era. In recent years, water logging, has deteriorated its citrus to insignificance and other two crops have disappeared altogether. With about 4,500 heat indices in summer, it is less hot than Jacobabad. The area adjoining of Kot Diji Hills, sub-zone (a) is very hot in summer and is only next to Jacobabad in summer heat accumulation. Cold spell in winter, is caused by trapping of cool northern winds by lofty Khirthar Hills from Shahdadkot to Sehwan rising 6,500 to 7,200 ft above the mean sea level. Many deciduous fruit varieties can be raised in Zone-II, if suitable plants are made available and technology of raising temperate zone fruits in low land sub-tropics is acquired. Besides it can also grow pomegranate, persimmon, loquat and many other fruits of high latitude sub-tropics.

Zone-III

It includes Sorah on Eastern Nara, Pad-Iddan and Daulatpur in the South. It has high summer heat (4,450-4,500 heat indices) like Zone-II and is slightly cooler than Zone-I in winter. This is due movement of cold winds from Zone-II, accumulating 450 chill units.

Zone-IV

It includes Nawabshah, Sanghar, districts except Tando Adam Taluka. It has 360 winter chill hours and its 4450 heat indices are same as Larkana and Pad-Iddan. Its heat is not as harsh to humans as of the latter area, as summer comes earlier and recedes late. Thus total length of summer season is longer, but maximum summer temperatures are lower than in Zone-II and III.

Zone-V

It covers, Tando Adam, Khipro, Tando Jam Taluka and Mirpurkhas and Matiari districts. It is colder in winter than Hyderabad-Kotri-Jamshoro (Zone-IX). In summer it is cooler than Zone-I to IV, though with about 4200 heat indices, it is slightly hotter than Zone-VI. Its summer heat is well spread over eight months and winter chill units of 250 ± 50 , makes the local mango and lychee cultivars regular bearers, invariably year after year. Some deciduous low chill fruits can also be raised here. Temperature difference of about 15°C between day and night allows many plants to keep growing throughout the summer. Climatically these factors make it most productive area of Sindh. Due to high velocity winds blowing from the Arabian sea to the Great Indian Desert from April to September over Zones, V, VI and VII, dust is blown up in the sky. Dust cover interferes with solar insolation during day and radiation from earth to the skies at night, making it cooler than Zone I to IV during the day, but hotter than these zones at night. May is hottest month of the year in this zone, against June in Zone-I to IV.

Zone-VI

One time called the Lower Sindh, after which the Lower Sindh Barrage (Kotri Barrage) was planned and executed, has comparatively mild summer usually beginning with early March and continuing up to end October. Winters too are mild, but cold January gives it 150-200 chill units. Within this zone there is small area here-after called Zone-VI(b) bounded by Mirpur-Bathoro, Sujawal, Mirpur Sakro and Ghora Bari, having very mild summers and winters, giving it almost semi-tropical climate which is suitable for raising palm oil, pineapple, cashew, atemoya, (sharifa), macadamia and etc.

Zone-VII

Zone-VII is coastal area, having semi-tropical summers and about 100 chill units and 3700-3800 heat indices. It can raise same fruit crops as Zone-VI (b).

Zone-VIII

Zone-VIII covers high hills mountains of the northern Dadu, Shahdadkot and the Larkana districts, with height varying between 2000 to 7200 ft. It accumulates between 700 to 2000 chill units, with mild summers. It can grow any type of deciduous crops, if water was made available.

Zone-IX

Zone-IX is Hyderabad-Jamshoro-Kotri area which is slightly hotter than surrounding areas in summer and has mild winter of less than 150 chill hours. This classification of Zone-IX is based on 80 years average data of Hyderabad from 1904 onwards and therefore the recent industrial heat cannot be considered responsible for the averages. The industrial heat, thickly populated towns have reduced its chill units and increased heat hours. Area is warm in winter and hot in summer due to hills, on which the zone stands. Industrial and town heat will further increase temperatures in years to come. Just a few miles outside the town chill units are over 250.

Climatic Zones can be used for many new horticultural crops if proper planning is done. Map of various Zones are included.