Piedmont Plains of India and Pakistan

H. L. Chhibber

Department of Geography,
Benares Hindu University, India

There is hardly any literature on the piedmont plains of India, although their origin and other characteristic features are interesting. The base of the Himalayas is generally fringed by alluvial fans so closely spaced that they form one continuous plain. They are largely composed of gravels and sand, with interspersed boulders brought down by floods produced by torrential rains. The composition of the soils, their porosity, and their inability to retain water are some of the factors that render them unfit for cultivation. On the other hand, they are covered locally with forests or dense jungle. In India there are excellent examples of such plains, which are called *bhabar*. These fans merge with the alluvial plains composed of finer materials, called *tarai*.

Bhabar plains. Bhabar forms a narrow belt lying immediately below the foothills of the Himalayas. It is a sloping deposit of gravels with occasional sand and clay beds. It is especially developed in the Naini Tal district, is generally covered with forest, and is remarkable for a complete absence of water. On reaching this *bhabar* zone most streams disappear. Large streams preserve their courses with marked diminution in volume, and their breadth increases abruptly, but the smaller watercourses, which have their origin in the lower hills, lose themselves in the shingle deposit. The slope of the surface is generally toward the south, and the breadth of the zone varies from 5 to 15 miles. The forest vegetation derives its nourishment from a thin covering of alluvial soil that overlies the coarse alluvium. Instead of tall grasses, large trees of haldu (*Adina cordifolia*) and *Acacia catechu* are to be observed. The cultivation depends upon canal irrigation, which is provided from the streams of lower hills. The slope of the ground between the foothills and the *tarai* is appreciable, though not easily observed. The population is largely migratory and moves to the hills in summer and returns in November.

Tarai plains. Below the *bhabar* occur the *tarai* plains, which form a belt about 11 miles wide from north to south in Nepal, Bihar, in the districts of Naini Tal, etc. The plain slopes gently toward the southeast and is covered with forests and swamps, broken by scattered patches of cultivation. The northern half consists either of jungle or savanna, where the country is suited only for grazing.

At the southern edge of the *bhabar,* springs appear in a series of morasses, their number and size depending upon the breadth of the *bhabar*. Where the *bhabar* is narrow, the springs are feeble. From them rise sluggish streams with poorly defined channels.

The moist plains of *tarai* pass gradually into the plains of the Ganges at lower elevations. The change is transitional, as the soil loses its marshy nature, different vegetation appears, and the climate becomes more healthful. Rice is the main crop of this region. The partition of the country and the refugee problem have thrown extra pressure on the land, and the *tarai* lands, especially in the Naini Tal region, are being reclaimed for the rehabilitation of some refugee families.

Piedmont plain of Baluchistan. Baluchistan provides an interesting example of the piedmont plains in an arid climate. Here the mountains are fringed by alluvial fans and talus of Pleistocene age. The slope of these coalescing fans, locally called *daman,* is so gentle that it looks like a very gently inclined plain. These compound fans have a variable composition, consisting of alternating coarse conglomerates and finer deposits. The scanty rainfall is absorbed and stored in the permeable conglomerates, which perform an important role in the economic geography of the region. Horizontal tunnels, called *karez,* which may be several miles in length, are bored into the sloping deposits until they reach the water table. The water is held under hydrostatic pressure, which makes it flow at the mouth of the tunnel. Recently artesian wells have been sunk in these deposits, creating oases in an otherwise barren desert.

Free Amino Acids in Potato Tubers Altered by 2,4-D Treatment of Plants

Merle G. Payne, Jess L. Fults, and Ruth J. Hay[1]

Colorado Agricultural Experiment Station,
Colorado A & M College, Fort Collins

A number of workers have studied the effects of natural and synthetic plant hormones on nitrogen metabolism (*1–13*). A survey of the literature has failed to show a critical study of the free amino acids in plants treated with natural or synthetic plant hormones. The free amino acids, especially glutamic acid, have been shown to occupy a key position in the interpretations of the mechanisms of respiration and protein synthesis. Investigations of the free amino acids in hormone-treated potatoes were begun at this station in the summer of 1950.

The Red McClure potatoes used were selected from the "field test samples" described by Payne *et al.* (*14*). Treated and untreated tubers were frozen and then allowed to thaw. The free soluble amino acids were extracted according to Morrow and Sandstrom (*15*). The filtrates were concentrated to one fifth their original volume. The technique of paper partition chromatography, devised originally by Consden, Gordon, and Martin (*16*), and later used on potato extracts by Dent, Stepka, and Steward (*17*), was employed. For the one-dimensional chromatograms 1 μl of the concentrated filtrate was used on Whatman No. 1 filter paper in a phenol-H_2O system.

Relative densities of the amino acid spots were

[1] Published with the approval of the director, Colorado Agricultural Experiment Station, as Scientific Series Paper No. 358.