

of agricultural yield, better management, better seeds, use of fertilizer, pest control, use of insecticide and such other measure, known to increase the yield, are suggested. The Panel has laid great stress on the agricultural aspect of the problem. Very little consideration is given to other means of drainage, on chemistry of soil and water and other hydrological and engineering considerations. Installation of tubewells, mining of accumulated groundwater, disposal of saline groundwater, salinity build-up in the aquifer, spacing of tubewells, *etc.*, are the points discussed at length in the report. The points missed are the long term success of this measure with respect to the type and design of tubewells, their life and durability, their working cost and results of mining on water requirements of crops, effect of pumping saline water and its disposal, interaction of the quality of pumped water with the type of soils generally in existence, *etc.*

#### **Tubewells have Uneconomical Durability**

This country has had more than fifty years' experience of installing tubewells in fine to medium sand formation of the Indus Plain which contains some small percentages of fines, such as silt and clay. In spite of trials of many alternatives to develop a long-lasting tubewell, giving high economical yield, the solution has yet baffled success. Chocking of strainers and their incrustation is a major problem. Iron strainers have short lives in the soil and water of this Plain; strainers of inert materials like cadmium, brass and copper were all tried and found to get incrustated. Trials with inert materials like wood, and coir string also did not stop the incrustation. Recent suggestions have been to install large diameter tubewells and use strainers with wide slits. This was tried with iron and brass strainers without much success. In case of SCARP 1, tubewells were installed with all precautions but these have started to misbehave in a short period of four years.

It was suggested that for an economical performance, high discharge capacity tubewell units may be installed. This brought in the use of turbine pumps replacing the centrifugal pumps of 1 to 2 cusecs capacity. The life of components of a turbine pump, however, is lower than a centrifugal pump (*see*, Table I) and components of a turbine pump are difficult to procure.

TABLE I

Item	Estimated useful life
Well and casing	20 years
Pump turbine bowl (about 50 per cent of cost of pump unit)	8 years
Column, <i>etc.</i>	16 years
Pump, centrifugal	16 years
Electric motor	25 years
Diesel engine	14 years

Source: [5].