WATER-RESOURCE MANAGEMENT-STRATEGY

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ABSTRACT

Water-resource pattern has been disrupted in Pakistan throughout the Indus Basin, affecting the Northern areas, Punjab and Sindh, all of which are reeling from the effects of the current drought. This, consequently, affects the country's agrarian economy and indeed the economy as a whole, since the economy is directly linked to the performance of agriculture.

The water shortages are likely to persist with the increase of population and consequent pressure on agriculture. It will be further aggravated by weather effects of elnino and lanino. This essentially calls for a proper water-management strategy. The strategy consists of short-term measures, medium-term measures and long-term measures, as below:

Short-Term Measures

1. *Ridge cultivation: Improving methods of irrigation from border to furrow. Most of the crops, including wheat, can be sown on ridges, which would save about 30% water.*

2. *Precise Land-Levelling: saves 30 to 40% of water with zero tillage, but levelling effects last for three crops only. The laser-levelling apparatus is being locally manufactured by PINSTECH at 40% cost of the imported gadget. Steps need to be taken in commercialising the manufacture and marketing of laser-levelling equipment, so that it is brought within the farmers' reach. It also improves yield-per-acre and results in better seedings and germination of crops.*

3. *Watercourse: Improve water-courses (not lining), to reduce wastages, and design rotation programmes of channels, in consultation with Agriculture Department, so that water is given to the priority areas within the Province.*

4. *Taking up, with community-participation, minor storage-schemes so as to harvest rain- water, especially in areas of Thar and Cholistan.*

5. *Timely delivery of good-quality inputs, like seed, fertiliser, pesticides, in the agricultural sector.*

6. *Improving marketing of agricultural produce.*

Medium-Term Measures

1. *Improving seed-technology, through agricultural research. Time-bound result-oriented programme of research should be undertaken, to improve seed, variety and the production. Pioneer maize-seeds and mexi-pak for wheat are the examples, in point.*

2. *Agricultural research to improve water-stress resisting varieties.*

3. *Canal Seepage: Indigenous research needs to be undertaken to stop the canal seepage especially in saline ground-water zone, right from the source and to re-use it.*

   a. *In Punjab Province, the re-charge to ground-water seepage is 40-42 maf, of which over 35 maf is being exploited - private tube-wells 32 maf, scarp tube-wells 3 maf.*

      In Sindh Province, the re-charge at present is about 21 maf, while pumpage by both private and scarp tube-wells is 3.5 maf.

   b. *By using proper technology, like multiple-bore tube-wells and radial tube-wells, etc, the additional potential of 12-13 maf can be exploited in Sindh and Punjab. This would be a much better alternative than stopping seepage through lining, which is very capital intensive.*

4. *Tube-well Technology needs to be standardized, in order to make it more popular in the farmers community.*

5. *Cultural practice of `Pancho' irrigation system needs to be replaced by more efficient rice-crop husbandry practices.*

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Long-Term Measures

Larger storages have longer gestation-period, but there is no substitute available against the large storage reservoirs. The schemes need to be prioritized, through national consensus, and then taken up under critical path, so that the effects of shortages of water can be mitigated.

Alternate Measures

Till the larger storages schemes materialize, smaller, off-farm storages could be considered, with participatory efforts of the beneficiary. These beneficiary or off-farm storages or village ponds can be excavated and maintained by beneficiaries themselves to an average depth of 4 ft. or more, wherever feasible. These could be filled during Kharif and Monsoon, with flood supplies. Even rain-water can be harvested if these ponds are suitably located. It has been estimated that about 1 lakh irrigation out-lets are there in Pakistan, covering an area of 33 million acre. On the average, 4 ft. depth of pond on an area of one acre would store 4 Acre feet of water and the grand total would come to 0.4 maf. The storages can be increased by increasing surface area of the ponds or their number, or their depth.

These ponds would be located more suitably in the base lines or unculturable wastes, so that these do not encroach upon the CCA. These ponds would be suitably lined with polythene membrance to save seepage. This alternate, although not a complete substitute of storage reservoirs, can be implemented immediately to store about 2.5 maf of water. These would be used in Rabi shortages.

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1. EXISTING SITUATION

Pakistan is predominantly an agriculture country; 26% of the GDP, 70% export and 52% labour force is contributed by this sector. Inspite of favourable conditions of soils, irrigation, water and climate, the agriculture suffers from under-production, both in terms of yield per acre and production per farm worker. Yield per acre is one of the lowest in the world. It is marginally less than India and about 50% less than Egypt and other developed countries. Comparison of important crops, in terms of yield for various countries is given in **Table-1.**

Consequently the majority of farmers live at, or below, poverty line. The country is heavily dependent upon agriculture for food and fibre requirements for ever- increasing population. In order to cope with these requirements, it is essential to increase food and fibre production, not only for self-sufficiency but also to the extent of exportable surplus for earning foreign exchange. Pakistan is heavily under debt-burden; 50% of its annual production is taken away by debt-servicing and it cannot afford luxury of import of food, being itself an agricultural country.

About 90% of agricultural value-added comes from irrigated agriculture. Unfortunately, irrigation supplies have been inadequate for the last 2 years. On the average, 3ft water is provided per culturable acre for agriculture per year, according to our present diversion of water from the rivers. This is further reduced by about 48% during conveyance and so the nett delivered, below the out-let, is reduced to 1.6 ft per acre per year, which is quite inadequate for the arid and semi-arid climate of Pakistan.

Table-1: Comparison of Yields for Some Crops

	Wheat	**Rice Paddy**	**Sugar Cane**	**Cotton**	**Maize**
WORLD Average	*Kg/Hect*	*Kg/Hect*	*Kg/Hect*	*Kg/Hect*	*Kg/Hect*
	2700	3832	64694	1620	4309
China	1690	6017	-	2638	4916
USA	2441	6274	74010	1575	-
India	2510	2879	69197	903	1633
Pakistan	2018(75)	2753(72)	46963(72)	1803(+11)	1457(-34)
Iran	1687	-	-	1941	-
Mexico	3894	-	-	1600	2158
Egypt	-	8173	-	2775	-

This has to be supplemented by other sources i.e. tube-well, rain, etc. The quality of tube-well water has become questionable for many areas and has given rise to secondary salinization of soils. For proper maintenance of agricultural regime of soil, it has to be mixed with adequate quantity of canal water for use in irrigation. Rain-fall has failed for the second consecutive year and that is not a dependable source.

2. WATER-RESOURCE MANAGEMENT

Inadequate irrigation-supply is one of the major constraints in agricultural production; this essentially requires management of water-resources for optimum use and for maximising production. The irrigation supplies can be improved in two ways:

1. Exploiting new resources, i.e construction of more dams and tube-wells;

2. Conserving the existing irrigation supplies, by making a more efficient use of the available water, through reduction of undue wastage, such as seepage/leakage, overspilling and over-irrigation to crops, etc.

3. NEW RESOURCES

Dams

The former method of improving irrigation supplies is very expensive and time-consuming. It takes decades before such programme is found feasible and ready for execution. Recently, environmentalists have added a new dimension to planning of large Dams: replacement of affected Infrastructures and displacement of communities in Pakistan, is a problem in itself. Then there are apprehensions of co-basin Provinces about the fair distribution of water. Large water-development Projects have longer gestation period. Therefore, these schemes have no attraction for the private investors and have to be taken up by the Governments.

Tube-Wells

Tube-wells offer a potential, but the quality of Tube-well water has to be kept in mind. There are a number of private tube-wells in the Punjab and these are increasing at the rate of 8% per year. The quality of tube-well water has deteriorated, due to two consecutive drought years. Lowered water-table is uneconomical to pump, and further deterioration in quality is due to less re-charge and over mining. The actual operation time of private tube-wells is 6 to 8%, which makes the whole investment less economical.

Tube-wells in Sindh have a good potential, but a lot of home-work is required to tap the seepage of canal and rivers at source. Little research work has so far been done in this direction and the farmers are not ready to invest in such marginal production-schemes. At present, an estimated 50,000 tube-wells are working in Sindh Province.

In view of the above, the International Commission of the Irrigation and Drainage has stressed the needs of conservation of existing supplies on world- wide scale, as under:-

"Conservation of water-supplies is becoming increasingly important as the demand continues to increase and new sources of supply become harder to find. The time is rapidly approaching when the only additional natural water-supplies available will be those salvaged from loss through transpiration, evaporation, consumptive waste, inefficient storage and transportation practices. Principles of conservation require that full use be made of our natural water-supplies and greatest results probably can be accomplished on most irrigation projects by a reduction in amount of water lost through seepage during transportation to the farmers field".

4. CONSERVING EXISTING RESOURCES: CANAL & WATER-COURSE LINING

Lot of investment has been made at farm-gate level to check the wastage of water from the water-courses in the last two decades. More investment has been done on water-courses than on irrigation system. Tall claims of affecting water-savings equal to two Manglas could not be realised. About 38% of the total water-courses has been lined or improved.

The author conducted the study of the irrigated figures from the freshly lined water-courses and it was found that lining of water-course resulted in increase of irrigated area from 10 to 13% for about five years and, later, it would drop to the previous figures, due to deterioration and siltation of the water-course.

Next step can be to check seepage from earthen channels, which is estimated at 48% of the canal head discharges. International

experts usually call this seepage as loss of water. This is not correct. In fresh ground-water area, seepage of canals, rivers and rains is a gift of Mother Nature, which has provided a water-reservoir below the feet of farmers, which can be exploited at the time of need. This seepage can be termed as “re-charge factor”. Re-use of seepage increases efficiency of our system from 35-45% to 60-70% which is highest in the world.

Of course lining of water courses and canals is recommended in saline ground-water areas, for which a lot of home work should be done to justify the heavy investment. Ponding test would be a pre-requisite for justification of lining. Another alternative can be to tap seepage, right from the source, by tube-wells or interceptor drains.

In order to optimise use of water we need to improve our irrigation practices. It is time we switch over from border to furrow irrigation, which would require 30% less water. Other irrigation practices, like sprinkler and trickle-irrigation method, affect savings of water but are much more capital-intensive and require use of energy for its operation and maintenance. Ever-increasing prices of fuel and electricity vitiate the economics of these methods of irrigation.

Less Efficiency of Input

Efficiency of fertilizer-use is only 30%, and also indiscriminate use of pesticides is poisoning our soils and sub-soil water, which calls for caution in their use. For maximising production, we need to develop seed-varieties. In late 50s, Mexi-Pak seed was imported, which doubled the production of wheat (more than 30 mands per acre) with the same farmers, same practices and same water. In Sahiwal area in Punjab, 'pioneer' maize seed has revolutionized maize production, which is now comparable to any international standard.

Timely and in adequate quantity, delivery of good-quality inputs, like seed fertilizers, pesticides, is an area which requires close monitoring.

If Nature favours us and we have a bumper crop, then its marketing is another grey area, which needs careful study in order to sustain agriculture in this country as a profitable business.

5. RECOMMENDED MEASURES

These have been given in the Short-term, Median-term and Long-term Measures in the Abstract.