The Asia Pacific Association of Agricultural Research Institutions (APAARI) is now way ahead in its commitment to collect, organise and disseminate information in the form of success stories and other publications for the benefit of member nations and others. The three success stories published by APAARI during the past one year have been well received. The topics were selected diligently by the APAARI Executive and these included diverse key elements of strategic importance to countries, which ranged from a particular commodity or a specific situation to a system-wide coverage. Nevertheless, in all such cases, the basic idea was to bring to the fore various technical, technological and socio-economic aspects related to the theme covering the analysis of the problem, planning, infrastructure/skeleton applied, methodology, result and the overall impact. A positive analysis of each success story also tended to catalyse the situation in all possible dimensions and endorsed the role of APAARI which *inter alia* has been to focus on gaps and suggest for their appropriate bridging, to facilitate a strong institutional support for research, training and human resource development in a collective/collaborative mode. Also the aim had been to activate the idea for its possible adoption by other interested member nations.

Success of Wheat Production in Iran highlights the salient managerial, socio-economic, political and R&D factors that led to its
enhanced production, to the extent of nearly 75 percent in a period of just five years.

The rationale in this success story is worth following by other developing nations. I am sure this publication will serve the intended purpose to catalyse the readers so as to get advantage of similar approaches for increasing both production and productivity of crops in their countries.

New Delhi
1 September, 1997

R.S. PARODA
Executive Secretary

INTRODUCTION

Wheat constitutes the primary staple food of the people of Iran, having been adopted since ages due to local wisdom, banking upon its immense nutritional value as well as low price. It is consumed during the three course meals almost every day. It meets up to 40 per cent of the daily requirements per person for calories and 50 per cent that for protein. The per capita consumption for breadwheat in the country is about 150 kilogram. With the ever increasing population

Wheat – the amber gold
resulting into a greater demand for wheat, and the difficulties faced in meeting the demand from internal sources, it became necessary to import this commodity from abroad. Further, the continued reliance of the country on world market for wheat drained its foreign exchange. This led to a serious thinking on the part of the government and the parliament of the Islamic Republic of Iran during which the potential capability of the country to enhance its own wheat production was critically examined. It was observed that about 53.8 per cent of the total area of Iran, on the whole, is under annual field crops, including both irrigated and rainfed cropping, which provides ample scope for enhancement in production through concerted efforts. A Five Year Agricultural Development Programme was first implemented during 1989-1994, mainly with a view to enhance the country's wheat production in the irrigated cultivation belt. This story tells of the considerable success achieved in terms of enhanced wheat production and provides a model for its suitable adoption by other APAARI member nations.

Iran is situated within the principal centre of origin and domestication of wheat. This crop has been grown in the country by the natives since time immemorial. Wild species of wheat, which are so important to the humankind, are still largely available. Presently, wheat is grown in several parts of Iran; 36.5 per cent of the current area under wheat cultivation, on an overall basis, is situated in three provinces, namely, Khorasan, East Azerbaijan and Khuzestan; 35 per cent is centered in the provinces of Fars, Hamadan, Zanjan, Kermanshah, Kurdistan, East Azerbaijan, Gorgan, Gonbad and the Central Province; whereas the rest of the country accounts for nearly 28.5 per cent of wheat planted.

The pre programme implementation status showed that during the course of five preceding years (1984-1989), an average of 6.38 million hectares of land was under wheat cultivation; of this, about 33.6 per cent area was under irrigated wheat and the rest 4.24 million hectares were covered under rainfed wheat. It was made quite clear from the expert consultations and the results of systematic investigations conducted to evaluate the potentials of rainfed cultivated areas that it was not advisable to increase the surface area of land under rainfed cultivation. This was mainly attributed to the possible limitations for systematic development of dryland farming in marginal lands and the direct relation of production with amount and distribution of rainfall. Further, in order to make wheat production economical, even a gradual reduction of rainfed area under its cultivation was recommended.
corresponding with an increase in overall production. The latter was proposed to be achieved through well conceived, target oriented Five Year Development Plans.

The wheat pivotal project was established as a consequence to the foregoing discussions, which commenced from 1989-1990 with the main objective to augment per hectare yield under irrigated wheat farming. In order to better understand the results obtained since its implementation, it may be vital to investigate and compare situation of irrigation prior to the implementation of the project (1984-1989) (Table 1). The five-year average data on wheat, prior to the commencement of the first developmental plan in 1989, showed that the area under irrigated wheat was 2.14 million hectares, and the average yield being 1976 kg/ha, its total production was 4.23 million tonnes.

**Table 1**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Area under Cultivation ('000 ha)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irrigated</td>
<td>2189</td>
<td>2131</td>
<td>2330</td>
<td>2017</td>
<td>2039</td>
</tr>
<tr>
<td>Rainfed</td>
<td>4006</td>
<td>4173</td>
<td>4261</td>
<td>4535</td>
<td>4218</td>
</tr>
<tr>
<td>Total</td>
<td>6195</td>
<td>6304</td>
<td>6591</td>
<td>6552</td>
<td>6257</td>
</tr>
<tr>
<td>Total Production (000 tonne)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irrigated</td>
<td>4054</td>
<td>4328</td>
<td>4576</td>
<td>4050</td>
<td>4125</td>
</tr>
<tr>
<td>Rainfed</td>
<td>2576</td>
<td>3213</td>
<td>3025</td>
<td>3215</td>
<td>1864</td>
</tr>
<tr>
<td>Total</td>
<td>6630</td>
<td>7541</td>
<td>7601</td>
<td>7265</td>
<td>5989</td>
</tr>
<tr>
<td>Yield per hectare (Kilogram)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irrigated</td>
<td>1852</td>
<td>2031</td>
<td>1964</td>
<td>2008</td>
<td>2023</td>
</tr>
<tr>
<td>Rainfed</td>
<td>643</td>
<td>770</td>
<td>710</td>
<td>709</td>
<td>442</td>
</tr>
<tr>
<td>Total</td>
<td>1070</td>
<td>1196</td>
<td>1153</td>
<td>1109</td>
<td>957</td>
</tr>
</tbody>
</table>

Source: Ministry of Agriculture

**PROJECTIONS AND LIMITATIONS**

Considering the rate of increase of population as a limiting factor, it was estimated, prior to the implementation of the First 5-Year Agricultural Development Programme (1988-1989), that the annual increase in population of the country would be approximately 2.5 million people; thereby anticipating a population of around 60 million people at the end of First Development Programme. Further, looking into the facts that as much as 30 per cent of the country’s wheat requirements were met through import prior to the implementation of the project and also that an additional quantity would be required to meet the anticipated increase in population as above, it was clearly estimated that every year about 300-350 thousand tonnes of wheat shall have to be added to the list of commodities for import.

In-depth technical investigations were made, right from the stage-I, in order to ascertain the most appropriate medium through which wheat production per unit area could be augmented and area under its cultivation increased. Several limiting factors were anticipated, particularly in terms of expansion of land resources. Nevertheless, augmentation of yield through various means, namely, efficient use of resources, adoption of improved agrotechniques and breeding for specific situations, being solely for the irrigated conditions, was instrumented as the best medium to achieve this national ambition. It was recommended to realize the targets through making timely and workable policy decisions, at each critical step, and their effective implementation through Research and Development.
ACHIEVEMENTS

The project “Enhancement of Production of Irrigated Wheat of the Country” was triggered as a pivotal irrigated wheat project which commenced in 1989-1990 and continued its activities through the total duration of five years in the First Five Year Agricultural Development Plan (1989-1994).

During the course of the Plan period actual increase in the area under cultivation was only marginal (Table 2). However, at the same time, a large increase in total production of irrigated wheat was observed, mainly due to eye-catching improvement in yield per hectare (Figure 1).

Table 2

<table>
<thead>
<tr>
<th>Year</th>
<th>Area under Cultivation (000 ha)</th>
<th>Total Production (000 t)</th>
<th>Yield per hectare (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Irrigated</td>
<td>Rainfed</td>
<td>Total</td>
</tr>
<tr>
<td>1989-90</td>
<td>2137</td>
<td>4142</td>
<td>6279</td>
</tr>
<tr>
<td>1990-91</td>
<td>2224</td>
<td>3969</td>
<td>6193</td>
</tr>
<tr>
<td>1991-92</td>
<td>2318</td>
<td>4322</td>
<td>6640</td>
</tr>
<tr>
<td>1992-93</td>
<td>2341</td>
<td>4466</td>
<td>6807</td>
</tr>
<tr>
<td>1993-94</td>
<td>2395</td>
<td>4059</td>
<td>6454</td>
</tr>
</tbody>
</table>

Source: Ministry of Agriculture

Figure 1. Total production and yield of irrigated wheat during the five-year development plan (1989-1994) in relation to base year (1988-1989).

Changes and transformation that took place could also be attributed to research, extension, and production support. At the end of the First Five Year Agricultural Development Plan (1994), the total area under wheat cultivation was recorded to be 2.39 million hectares, the average yields were 3090 kg/ha and the total wheat produced was 7.4 million tonnes. In other words, there was an increase of 11.9 per cent in cultivated area, 56.4 per cent in yield per hectare and 74.9 per cent in the wheat production. This summarily presented success in Iran is worth a follow up in a more cohesive manner and by using intensive cultivation approach. At the same time, it appears to be useful and worth sharing the experience with other developing countries in the Asia and the Pacific region.
DISBURSEMENT OF FUNDS VIS-A-VIS ECONOMIC GAINS

Considerable national investment was made at various levels, such as, planning, R&D, technical expertise, training, extension and, above all, technical and funding support. A sum of 49.167 billion rials (US $ 1 = 1750 Rials) was disbursed under the Irrigated Wheat Pivotal Project; which, in the successive years of its implementation, amounted to 4,226, 8,374, 8,550, 7,110 and 20,907 billion rials. Returns for the heavy investment in this project were also impressive; a fundamental transformation in terms of wheat production could be achieved along with significant increase in its productivity.

The extent of surplus production during the course of five years of implementation of the pivotal project, in relation to the production in the years 1987-1988 (4.05 million tonnes), totalled 10.9 million tonnes (Table 3). The production figures in successive years were 0.786, 1.65, 2.67, 2.45 and 3.35 million tonnes; which indicate remarkable gains in terms of both enhanced self-reliance and savings of foreign exchange. While giving due consideration to the indirect economic benefits, such as, decrease in traffic load at ports that helped in curtailing the transportation expenses, insurance, depreciation of vehicles and local roads, etc., and thereby saving an exorbitant sum of money, it is estimated that an amount of $ 1.6 billion of foreign exchange could be economized exclusively through the increase in wheat production in the country.

Table 3

<table>
<thead>
<tr>
<th>Year</th>
<th>Development fund disbursed (000 Rials)</th>
<th>Total production (000 t)</th>
<th>Surplus wheat produced in relation to 1987-88 (000 t)</th>
<th>Value of surplus wheat produced (000 US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989-1990</td>
<td>4,226,000</td>
<td>4,836</td>
<td>786</td>
<td>119,472</td>
</tr>
<tr>
<td>1990-1991</td>
<td>8,374,000</td>
<td>5,696</td>
<td>1,646</td>
<td>250,192</td>
</tr>
<tr>
<td>1991-1992</td>
<td>8,550,000</td>
<td>6,722</td>
<td>2,672</td>
<td>406,144</td>
</tr>
<tr>
<td>1992-1993</td>
<td>7,110,000</td>
<td>6,501</td>
<td>2,451</td>
<td>372,552</td>
</tr>
<tr>
<td>1993-1994</td>
<td>20,907,000</td>
<td>7,400</td>
<td>3,350</td>
<td>509,200</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>49,167,000</strong></td>
<td><strong>31,155</strong></td>
<td><strong>10,905</strong></td>
<td><strong>1,657,560</strong></td>
</tr>
</tbody>
</table>

- An amount of US$ 152 has been taken into account for per tonne surplus wheat produced
- The total irrigated wheat produced in the years 1987-88 was equivalent to 4050 thousand tonnes

Source: Department of Statistics and Information of Ministry of Agriculture.
FACTORS LEADING TO SUCCESS

The success of the mission was commendable. Main factors that underlie the target achievement may be enumerated as below:

**Provision of Certified Seed**

Seed, an important factor in the production of agricultural crops, was accorded particular significance in this programme. Realizing that the genetic capacity of improved varieties has an overall effect in determining the productivity, production and economic returns, a definite attempt was given to this aspect, as follows:

i. Procurement of sufficient Parent Seed of improved varieties for multiplication, and

ii. Provision of Certified Seed for use by Farmers

An estimated 16,000 tonnes of parent seed was required annually for the production of about 150 thousand tonnes of certified seed. A part of the parent seed requirement was met from the various regional Experimental Research Stations of the country, whereas the rest were produced by signing contracts with seed propagators. The certified seeds were produced on seed farms under the technical supervision and responsibility of Seed and Plant Breeding Research Institute. After the certification, purchase, cleaning, chemical treatment, packaging and sealing, the seed was distributed throughout the country.

Up to one-third of the total annual requirement of seed for irrigated wheat was distributed amongst the wheat growers in the form of certified seed, whereas the rest two-third was produced by the farmers themselves. Certain necessary facilities for cleaning and treatment of farmers’ seed were specifically created.

**Improved Varieties**

Extensive varietal development work done in the past, helped in identification of breadwheat (*Triticum aestivum*) varieties conducive to diverse climatic and soil conditions, such as, those resistant to saline-sodic soils, dwarfed varieties resistant to lodging, varieties resistant to yellow rust and *Fusarium* diseases and varieties suitable to cold, semi-cold, semi-tropical, tropical and mild regions of the country. Durum wheat varieties (*Triticum turgidum* var. Durum) developed and released to meet the needs of Macaroni industries. However, during the period of implementation of pivotal project, particular success was achieved due to three wheat varieties, namely, *Falat, Navid* and *Ghods* which were...
very effective in the augmentation of yield per unit area. Particulars of these varieties are given below:

**Navid**

It is an improved variety, received through Turkey from Oregon State University of USA. After mass selection and adaptability trials, it was named Navid in the year 1990. It is a semi winter type wheat, with medium height, great tillering capacity, stiff culms and resistance to lodging. It has white spikes, awned heads, medium density, relatively soft grains and with a 1000-grain weight of 35-40g. It is resistant to cold, semi susceptible to yellow rust and semi resistant to brown leaf rust. This variety shows wide adaptability and, because of short span between heading stage and maturity, it is also resistant to shrivelling. On the other side, it is very sensitive to seed shattering and possesses poor to medium baking quality. The Navid variety is recommended for planting in cold regions of Iran, with medium to high soil fertility. It is not recommended particularly for the foot-hill regions with extremely cold weather and also regions with intensive winds during grain filling stage. The production potential of this variety was 9600 kg/ha.

**Falat**

It was selected from the lines of test seeds received from the International Research Center (CIMMYT), Mexico; released in 1990 after the requisite adaptability trials. Falat possesses spring growth habit and early maturing characteristics. It is dwarf, with a height of 90-95 cm and is very resistant to lodging. It possesses white awned heads, yellow coloured seeds and is semi sensitive to seed shattering. The grain size is medium, having its 1000-grains between 32 to 38g. Falat wheat has good baking quality and bread making properties. It is resistant to mildew but is sensitive to yellow rust and Fusarium. This variety possesses extensive adaptability to varying climatic conditions of warm and mild regions and holds the largest cultivated areas in the respective regions. The potential yield of this variety is 9900 kg/ha.
**Ghods**

It is derived from a double-cross, between Omid and Roshan with 2 alien lines. It was indigenously developed by the Research Department of Wheat and, after thorough testing, released in 1988. This variety possesses spring growth habit, medium duration of maturity, medium height of 90-115 cm and resistance to lodging. It has white, awned heads, yellow coloured grains, 1000-grain weight between 38 to 42g and a medium baking quality. It is partially resistant to seed shattering, semi sensitive to cold and susceptible to rusts, drought and soil salinity. Its most evident positive characteristics are the wide adaptability, high production potential, very good regeneration capacity under green grazing and frost, less sensitivity to late sowing and adaptability to two crops per year in rotation. This variety was capable of being planted in all the mild regions of the country, but because of its susceptibility to *Puccinia striiformis*, its cultivation is restrained in the yellow rust affected regions. It has the potential capacity to produce 10.5 t/ha of wheat grain.

**Mechanization**

Deployment of machines and tools in agricultural activities, particularly for high yielding, irrigated farming systems is indispensable for the adoption of modern technology, including optimum utilization of resources and high agricultural inputs. During the first five year term, all out efforts were made to transform the traditional agriculture into a semi/fully mechanized system. The results showed that by the end of the programme, in 1993-94, out of the total 2.16 million hectares brought under irrigated wheat pivotal project, about 1.5 million hectares were covered under mechanized farming and another 0.66 million hectares were brought under semi-mechanized cultivation. In order to attain this major achievement, the farmers were provided with ample support in the form of substantial number of Tractors, Combine Harvesters, various other planting and harvesting machinery and tools.
Integrated Pest Management

Management of pests, diseases and weeds remained an integrated part of the programme in order to save depletion of realizable wheat yields. Among the pests, Sunn Pest (Eurigaster integriceps) has been the most important. During the course of first five year plan, a total of 4.55 million hectares of crop were sprayed free of charge, by aerial and ground sprays, for the control of this pest. The total area subjected to chemical control of wheat rust, during the farming years of 1993-94, exceeded 47,250 hectares.

Looking into the research data, that showed a loss in wheat yield to an extent of 30 per cent, all out efforts were made to control the weeds through IPM. Training was given for the correct use of proper herbicides and attempts made to control the broad as well as thin leaved weeds through aerial and ground sprays. During the cropping season of 1993-94, about 1.03 million hectares of weed prone irrigated wheat fields were treated successfully.

For the control of smut and brown rust diseases, prophylactic measures were adopted, that is, seeds were treated prior to sowing. During the cropping season of 1993-94 alone, a total of 739,740 tonnes of chemicals were used for treatment of 270,162 tonnes of wheat seed.

Soil and Water Management

It was envisaged during the course of first five year developmental plan that the average irrigation efficiency throughout the country be increased from 31.5 per cent to 33.5 per cent. Therefore, as a follow-up action, large amount of developmental funds were invested for the recommended measures, such as, integration of lands, lining of traditional canals and promotion of pressurized systems of irrigation.

The results obtained were undoubtedly encouraging, that is, in addition to saving 5.1 billion cubic meter of water, through consolidation of irrigation fields, provision and extraction of new water resources was to the tune of about one billion cubic meter of water for the said
of irrigated wheat per unit area. In order to upgrade the level of awareness of farmers, it was envisaged to essentially plan and implement training and extension programmes at various levels. Also, the exploitation of diverse fields of expertise, through holding conferences, symposia, popular talks, etc., and also with the help of radio, television, audio-visual aids, posters, publications and press media, was included as a part of Action Programme with the sole objective to achieve the necessary improvement in production of irrigated wheat.

Education and training programmes were organized for individuals as well as groups. The common topics covered were crop rotation, agrotechniques and field operations, proper utilization of pesticides and herbicides, proper use of machinery, efficient use of soil and water, etc. Monitoring of all aspects of cultivation, from sowing to harvest, was also done by specialists, extension agents of rural districts and agricultural offices on area basis in the entire irrigated wheat belt. Assistance of identified, skilled farmers was also sought towards promotion of technology and proper execution of the pivotal project. The dedicated involvement of Research, Education and Extension personnel was also instrumental, at large, for the success achieved. These specialists helped in judiciously transferring the research findings, and they also carried out the responsibilities for the supervision of farming operations in the target areas.

**Institutional Support**

The success of this project could, nevertheless, be primarily attributed to the support received from the government and parliament. Political will to support the Project was well received in terms of the following:

i. timely ratification of the pivotal project,
ii. notification of rules and regulations, and
iii. sanctioning and allocation of sufficient funds.

The Ministry of Agriculture executed the project through a technical committee, who examined the overall technical affairs, took decisions and held the supervisory authority. Further, the executive disciplines at various provincial, district and local levels took necessary steps for smooth
implementation of the programme. Some of the supportive actions taken by the government were as follows.

Setting of guaranteed purchase price of Wheat
In order to augment wheat production, the government specified the price of wheat higher than the estimated market price and purchased the surplus wheat produced by the farmers. In the base year (1988-89), the per kilogram price of wheat was 57 rials which, during the course of implementation of the plan (1989-1994), increased to 106, 147, 150, 225 and 264 rials/kg, in the respective years.

Agricultural Crop Insurance
On an average, 560 thousand hectares of wheat annually, came under the support and cover of insurance through the Agricultural Crop Insurance Fund and the Agricultural Bank. Farmers were assured compensation for damages incurred due to natural disasters like flood, hail, torrential rains, storm, earthquake, cold and frost; which were actually paid to the affected cases in the respective years, after the execution of necessary evaluation.

Government investment
Allocation made from the development fund by the Iranian Government, establishment of sifting industries, warehouses for the safe storage of seeds and pesticides, provision of small air strips for aerial sprays and lining of irrigation canals were altogether smoothly implemented. Also, the timely delivery of reasonably cheap agricultural machinery in sufficient quantities, portable sifting machines, various kinds of sprayers, seed, chemical fertilizers, pesticides and herbicides was ensured with the help of government’s will and support.

The results were encouraging, exemplary and repeatable, in all their probability, due to substantial awareness generated, particularly in terms of ‘efforts paid the dividends’.

A dedicated team of extension workers interacting with cultivators in the early phase of wheat crop in far remote areas
The key factors responsible for the enhancement in wheat production in the irrigated belt of Iran may be summarily presented as follows:

1. Critical assessment of the proposal and effective policy planning,

2. Political will of the Government and Parliament

3. Socio-economic factors
   Timely implementation of the programme

5. Winning over the confidence of the farmers in the early phase of the project through ensured help in terms of critical inputs, finance, insurance cover and support price,

6. Available research results and technology, and further incentive for research, education and training,

7. Appropriate extension and monitoring mechanism, and

8. Willing people’s support to the programme.
enhanced production of irrigated wheat in Iran is a success story which could be an example for other countries of the region. Achievement of targets during the course of the First Five Year Developmental Plan has been influenced by innumerable factors which, without shadow of doubt, are not solely limited to quantitative and qualitative improvement of farming operations and use of scientific findings, but encompass many other economic and social measures taken and other phenomena, such as, developing suitable strategies and policies, execution of efficient procedures, sincere guidance and supervision of method of execution, acceptance of project by farmers and producer, etc. Above all, the socio-economic issues were probably at the top, being actually responsible for the realization of the objectives as per forecast. The increase in productivity, from 1964 kilogram per hectare in 1966-1987 to 3090 kg/ha in the fifth year of the plan, i.e., 1993-94 could be achieved due to the aspirations of the cultivators to produce more bread of their own. Moreover, a lot of financial investments made and the developmental work accomplished in the very first year of the First Five Year Plan succeeded in winning over the confidence of farmers who toiled hard to achieve this national objective.

Like the residual effect of the manure and fertilizers helping the succeeding crops, the various facilities generated in the first Plan period, such as, establishment of sifting industries, seed, pesticide and fertilizer warehouses, construction of air strips for aerial spraying, lining of irrigation canals, strengthening of research, education and extension
establishments, delivery of tractors, combines and innumerable kinds of machinery and sprayers, etc., shall also show persistent effect in the Second Five Year Agricultural Development Plan in several ways, including the following:

i. the expenditure incurred for the continuation of enhancement in wheat production programme is likely to be substantially reduced, and

ii. the utilization efficiency of inputs and other resource is likely to increase.

It is, therefore, again recommended that the experience gained by Iran, in respect to increasing its production of irrigated wheat, should be examined and shared by all others who are interested in developing target oriented projects with limited scope and with specific commodity for particular situations, in the Asia-Pacific and other regions.

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