IRRIGATION IN TAMIL NADU: TRENDS AND TURNING POINTS

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Abstract

Agriculture continues to be the most predominant sector of the State economy, as 70% of the population is engaged in Agriculture and allied activities for their livelihood. The State has as an area of 1.3 Lakh sq.km with a gross cropped area of around 63 Lakh. The Government's policy and objectives have been to ensure stability in agricultural production and to increase the agricultural production in a sustainable manner to meet the food requirement of growing population and also to meet the raw material needs of agro based industries, thereby providing employment opportunities to the rural population. Tamil Nadu has all along been one of the states with a creditable performance in agricultural production with the farmers relatively more responsive and receptive to changing technologies and market forces. This paper assess the trends of major exogenous drivers that influence the water sector development and presents the spatial and temporal trends of land use and cropping patterns, and crop production. Finally, we discuss major drivers that will influence the patterns of irrigation water use in the future.

Keywords: *Allied activities, population, employment, agricultural production, farmers, crop production.*

Introduction

Irrigation is a vital input for food security in the State of Tamil Nadu. Rice is the major staple food, accounting for three-fourths of the consumption of food grains. Irrigation covers most parts of the rice area. In 2000, 96% of the rice production was carried out under irrigation conditions. Groundwater contributes to a major part of the irrigated area. However, recent trends of groundwater water use in the state show that its abstractions in many regions exceed the total net annual recharge (CGWB 2006). Overall, groundwater exploitation exceeds 85% of the annual recharge. Moreover, irrigated areas under tank commands, once a dominant source of irrigation in Tamil Nadu, and under canal commands are decreasing.

Economic Growth Patterns

The composition of economic growth in Tamil Nadu is fast changing. In 2005, Tamil Nadu had the seventh largest state gross domestic product (SGDP) of all the states, contributing 8% of the GDP of India. The share of agriculture in SGDP has decreased considerably over the last decade, accounting for only 12% in 2005, compared to 19.6% at the all-India level. However, annual growth of SGDP is highly variable, and the variability is largely influenced by agricultural growth. If growth in agricultural SGDP is very low or negative, the average growth of SDGP is 3.4%. When agricultural growth is high (>4.7%), the growth of SGDP is 8.4%, indicating that although the share of agriculture on SDGP is decreasing, high agricultural growth is a vital component for higher growth of the overall economy in the state.

With rapid economic growth, water demand for domestic, service and industrial sectors will increase. The total domestic and industrial water demand in India is projected to have two-threefold increases by 2050. Tamil Nadu will account for a significant part of India's additional

water demand for the non-agriculture sectors. Meeting such demand in the presence of increasing water scarcities in the agriculture sector would be a serious challenge.

Irrigation and Crop Production: Trends and Turning Points

This section explores trends and turning points of irrigation and crop production between 1970 and 2005. The source of cropping patterns and crop production from 1971 to the late 1990s is the International Crops Research Institute for Semiarid Tropics (ICRISAT 2000), Hyderabad. This analysis only considers rainfall data of agro-climatic regions, for which the monthly estimates are available in the website of the Indian Institute of Tropical Meteorology. Rainfall within the state is a key determinant for both surface water and groundwater irrigation. Therefore, first it assesses the long-term trends of the average seasonal and annual rainfall and their variability. Next, it explores how these rainfall trends influenced the trends of cropping and irrigation patterns in Tamil Nadu and its agro-climatic sub-regions.

Rainfall Patterns

Bi-monsoonal patterns dominate rainfall in the sub-agro-climatic zone of Tamil Nadu. Being situated on the eastern side of the Western Ghats, most parts of Tamil Nadu miss a substantial part of dependable rainfall in the southwest monsoon. However, the southwest monsoon contributes to 60% of the annual rainfall of about 925 mm. But the southwest monsoon has high inter-annual variability, with a co-efficient of variation close to 35%, as against 20% in the northeast monsoon. Even with the high variation of monsoonal rainfall, irrigation has played a valuable role in agricultural development in Tamil Nadu.

Land-Use Patterns

Net irrigated areas: The central and northeast coastal regions have trends of NIA similar to that of the state, and share 60% of the total NIA. That is, there are no significant trends of NIA in these two regions, except for the effects due to low rainfall patterns in consecutive years. However, NIAs of the delta and southeast coastal regions have significant declining trends, with 16% and 11% drops, respectively, from the level in the 1970s. On the other hand, NIA in the northern region, with a share of 7% of the total, has increased by 40% from 1970, and has offset the drop of NIA in other regions.

Source-wise contribution to NIA: Groundwater irrigation expanded rapidly between 1971 and 2005. Canals and tanks were the main sources of irrigation in the 1970s and 1980s, contributing to about two-thirds of the total NIA. But, groundwater has been dominating irrigation since the mid-1990s, contributing to more than half the NIA in 2005.

Canal irrigation commands, which have lost more than 140,000 ha between 1971 and 2005, account for only 29% of the total canal NIA. The central and deltaic regions contribute to 84% of canal NIA in 2005. Half of this loss was in the deltaic region, contributing to 52% of the total under canal commands in 2005. The central region, with the second highest canal irrigated area, also lost about 20,000 ha, but it is only 12% of the total decline in the canal NIA.

Tank irrigation, which contributed to one-third of the total NIA in 1971, has lost more than half of its NIA by 2005. The northeast and southeast coastal regions share three-fourths of

the NIA under tanks. And these two regions lost more than 54% and 24%, respectively, of NIA under tank commands between 1971 and 2005. The central region, with 15% of total tank NIA, lost more than 27% area over the same period. Although low rainfall in three consecutive years explains the short-term variation, there seems to be a consistent declining trend in the recorded NIA under tanks during the last few decades.

Groundwater irrigation, which has contributed to a major part of NIA in recent years, had some notable trend patterns between 1971 and 2005.

- First, groundwater has replaced part of surface irrigation, especially a part of the area under tank irrigation. This pattern is prominent in the northeast coastal and central regions, where the NIA under tank commands has decreased by 243,000 and 103,000 ha, respectively, and NIA under canal irrigated areas has decreased by 38,000 and 10,000 ha, respectively. Over this period, the NIAs underground in the two regions have increased by 303,000 and 195,000 ha, respectively, and have offset the loss of surface irrigated area.
- Second, groundwater irrigation has also spread well outside surface command areas. Increases in net groundwater irrigated area in central and northeast coastal regions far exceed the loss of area under surface irrigation. In the north region, increase in groundwater irrigated area is even higher than the combined area of canal and tank irrigation. Indeed, these excess groundwater irrigated areas must have occurred outside the surface command areas.

Impacts of groundwater development: Although groundwater development has contributed to maintaining NIA at the present level, has led to environmental concerns in many regions. Many of the blocks in the north, central and northeast coastal regions are either critical or overexploited. These regions have 74% of the net available groundwater resources of the state, but contribute to 89% of the NIA underground. Indeed, sustaining groundwater irrigation at the present level is a major issue in these regions. In fact, after a continuous growth, the NIA under dug wells in all three regions has decreased between 2000 and 2005 whereas that under tube wells has increased over the same period and helped maintain a positive growth in area underground irrigation.

Gross cropped area: The GCA declined in the 1970s, remained steady during 1980s, and began declining again in the mid-1990s. Overall, GCA declined by 21%, or 1.58 Mha between 1971 and 2005 (Annex Table 3), to which the decline in NSA has contributed 94%. This shows that there are no major changes in cropping intensity (CI), ratio of GCA to NSA. The CI was 124% in 2025, compared to 120% in 1971. The GCA has declined significantly in all regions except in the north, where it slightly increased by about 0.2 Mha. The central and southeast coastal regions have the largest share of GCA (about 54%), and are also the largest contributors to the decline in GCA (about 68%).

Cropping Patterns of Food Grains

Paddy dominates the cropping pattern of food grains, accounting for 60% of the total food grain area, and more than 80% of the total food-grain irrigated area in 2005. However, area

under paddy has decreased over time, by 0.67 Mha of the total and by 0.64 Mha of irrigated area since 1970. This contributed to a major part of the decline in GCA and GIA.

Although the total paddy area has decreased, the share of food grains has remained steady over time. This is primarily due to the declining area under coarse cereals. The area under coarse cereals has also declined by 64%, from 1.48 to 0.54 Mha between 1971 and 2005. Only the area under maize has increased over this period. The growth in maize area is only a recent phenomenon, and the total area under maize has more than doubled between 2000 and 2005, indicating increasing demand for livestock feed.

Cropping Patterns Non-Grain Crops

Although the total area has not increased, major changes in cropping and irrigation patterns of non-food grain crops have occurred since the 1990s. The areas under oilseeds, once dominated non-food-grain cropping patterns, but area under cotton has decreased. The area under fruits, vegetables and sugarcane has more than doubled and virtually replaced the area of production of other non-food-grain crops. The area under fruits and vegetable has increased in all but the deltaic region, and area under sugarcane has increased in all regions. The area under oilseeds has declined significantly in central and northeast coastal regions, while the area under cotton has declined significantly in central and southeast coastal regions. Although the total crop area of non-food-grain crops shows no major change, the area under irrigation increased significantly between 1971 and 2000. Only one-quarter of area under non-food-grain crops was irrigated in 1971, and this has increased by 43% by 2000. Fruits/ vegetables and sugarcane contributed to a major part of additional irrigated area in non-food grain crops, increasing by 171,000 and 175,800 ha, respectively, between 1971 and 2000.

Crop Productivity

Growth of crop productivity varies between crops and also between regions. Paddy is the major crop in Tamil Nadu, and almost the whole paddy area is irrigated. Paddy yields increased only marginally in the 1970s, and significantly (3.77% annually) in the 1980s. However, the growth in yield10 as a whole stagnated in the 1990s (Figure 12). This is primarily due to decreased yields in the deltaic region, where canal irrigation dominates, and the stagnant yields in the southeast coastal region, where tank irrigation dominates. These two regions had 42% of the paddy area, contributing to 30% of the total paddy production in 2000. The paddy yields in the other three major paddy-producing regions, where groundwater irrigation dominates, have increased even in the 1990s.

Increasing reliability of irrigation supply in groundwater irrigated areas may be a factor in sustaining yield increase in the north, central and northeast coastal regions. In fact, the contribution from groundwater irrigation to the overall yield growth is about three times that of canal irrigation. The reliability of irrigation supply seemed to be lowest in canal irrigated area, where yield has been declining since 1990, as is indicated in the deltaic region. Increasing groundwater irrigation in tank command areas could have somewhat offset the negative impact due to unreliable water supply in tank irrigation, as is evident in the southeast coastal region.

Changes in trends of yields of other crops are also observed in Tamil Nadu. Among these, yields of:

- sorghum, a prominent coarse cereal crop in north and northeast coastal regions, had a slight declining trend of 1.2% annually in the 1990s,
- pearl millet and finger millet, which are prominent coarse cereal crops in the north and northeast, had a slightly increasing trend of 1.6% annually in the 1990s, pulses are stagnating in all regions except the north,
- oilseeds were gradually increasing by 1.21% in the 1980s and by 2.34% in the 1990s; Groundnut is the major oilseed crop in the state, contributing to 94% of the total oil seed production and its yield increased by 3.2% annually in the 1990s,
- Sugarcane, a prominent crop in the state, had no significant yield increases since 1980, and
- cotton increased by 4.2% in the 1980s and by 7.8% in the 1990s; the spreading of BT cotton has contributed to the sharp growth in yield in the latter period; this has contributed to increase cotton production by 42% between 1990 and 2000, although area under cotton declined by 36% over the same period.

Declining productivity and crop area have had a severe effect on the state's situation in food-grain security. Supply of food grain in 2004-05 was only 65% of the demand, in comparison to 96% in 2000. Importantly, rice production has dropped drastically, 31% over this period, accounting for only 61% of the demand in 2004.

Discussion of Future Scenarios

In this section, we discuss a few future scenarios emerging from recent trends or to explore in the irrigation sector in Tamil Nadu.

- The NSA of the state has been declining, and nonagricultural uses have taken up part of the decreased area. With rapidly increasing urban population and expanding industrial and service sectors, this trend is expected to continue.
- A part of the NSA area was also left fallow for an extended period of time. Increasing migration of agricultural labor to non-agriculture sectors, decreasing the agriculture dependent population and increasing competition for water from other sectors could aggravate this situation. Although no visible trends exist at present, opportunities for land consolidation for increasing economies of scale in land use in agriculture could emerge in the future.
- With increasing competition for surface water from other sectors, maintaining area under major/medium irrigation schemes at the present level could be a serious challenge. It is likely that net irrigated area under major/medium irrigation would further decrease. And most of the surface irrigation under major/medium schemes will be confined to high productive and high potential areas. Moreover, as a solution to the declining irrigated area, changing operations of irrigation deliveries to increase adoption of water saving technologies or changing to low-water intensive cropping patterns needs to be explored.

- Micro-irrigation techniques improve water-use efficiency, reduce irrigation demand and improve crop productivity. Yet, only about 66,000 ha of cropped area use drip and sprinkler irrigation, which is only 4% of the net area underground water irrigation. In general, groundwater irrigation is conducive to adopting micro irrigation. Groundwater is the source for a large part of irrigated area of non-grain crops such as vegetables, fruits and sugarcane. These crops and areas have the largest potential for adopting drip and sprinkler irrigation in India.
- Decreasing per capita demand, water scarcities and low prices are major reasons for decreasing paddy area. Paddy area seemed to have stabilized at around 2 million ha, and most of that are irrigated. Providing a reliable irrigation supply to support paddy growing in this area will be a key challenge. Water saving techniques, such as system of rice intensification (SRI) or aerobic rice (AR), reduce the irrigation demand and, in most cases, improve crop productivity. With increasing water scarcities, the demand for introducing water saving techniques in paddy cultivation will increase.
- Food demand for coarse cereals is decreasing. Thus, the area under other cereals is also decreasing. This trend will likely continue into the future.
- Demand for feed crops, such as maize, has increased sharply. The total and irrigated maize areas have had a six fold and fourfold increase, respectively, since 1990. Maize area will expand further, and much of that expansion will take place in areas under other coarse cereals. Thus, additional water demand for increasing maize production could be marginal.
- Sugarcane area, with most of it under irrigation, has increased until 2000 and declined sharply since then. Even this area has a significant production surplus now. Whether this decline is a blip in the cropping pattern or a continuous trend is not exactly clear.
- Although area under cotton is declining, its production is gradually increasing. Adoption of high-yielding varieties, such as BT cotton, could be the main driver for yield growth. This trend is likely to continue into the future.

Conclusion

The rain fed river irrigation system now only carries water in the heavy rainy season but in the dry winter all the canals remain dry & do not help the irrigation systems. The canal command area is characterized with numerous large & small tanks which used to use for irrigation. But more faith & dependency on canals, all the tanks have lost their importance in irrigation. So they are now beyond of regular maintenance being unexcavated since last 20 to 25 years & do not support the irrigation system in the dry season. All the farmers now entirely depend on the ground water for irrigation in the dry months. Excessive lifting of ground water now highly depletes the ground water level. Under these circumstances the present study examines the sustainability of this project & how far this project is truly making an impact on the socio-economic condition of the people there.

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