Production performance of agriculture in Thanjavur District
CHAPTER III

PRODUCTION PERFORMANCE OF AGRICULTURE IN THANJAVUR DISTRICT

3.1. Introduction

The rate of growth of agricultural production and its instability has become a much debated issue in recent years. The factors underlying this phenomena need to be examined particularly at the regional level to develop a relatively deeper understanding of the problem and to draw inference for production possibilities in future. This may be attempted by interpreting the time-series data on production and by assessing the changes in the productivity of factors of production. In this chapter, an attempt has been made to analyse the rate of growth of agriculture in Thanjavur district by using the time-series data. In this context, the effect of high yielding varieties, fertiliser and rainfall on paddy production has been examined.

3.2. Organised Programme for Agricultural Development

Various developmental programmes have been initiated in the district from time to time

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1 The changes in the productivity of factors of production have been examined in Chapter V on the basis of cross-section data at two parts of time.
identifying the special attributes of its agricultural potential in terms of cultivated area, irrigated area, production and marketing. Hence, a brief history of such programmes would not be out of place.

In 1953-54, under the 'National Extension Service Scheme', a plan was drawn for increasing rice production by 75,000 tonnes in the course of next three years. Intensive Agricultural District Programme (IADP) was initiated since 1960. This package programme was a source of new inputs like fertiliser and improved seeds embodying science and technology. This largely accounted for a change in the potential and efficiency of primary input land, as well as, total production. Another significant development

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2 Government of Tamil Nadu, Season and Crop Report of Tamil Nadu (1953-54), (Tamil Nadu: The Directorate of Statistics, 1955)

3 Thanjavur was one of the seven principally chosen IADP districts. It was selected as it had (a) high percentage of irrigation, (b) Community Development Blocks for development, and (c) an organised cooperative set up. For further details, see C. Malone Cart, Background of Indian Agriculture and India's Intensive Agricultural District Programme, (New Delhi: (Ford Foundation, May 1969)

4 Ibid
during 1966-67 was the introduction of a locally evolved strain of paddy ADT-27 with an objective to cover an area of 0.8 lakh hectares within a short span of two years.\(^5\) This led to further increase in production.

The "Multiple Cropping Programme" or "Samba Conversion", as it has been locally called, was launched in 1967-68. It converted a major portion of the single cropped land into double cropping lands, raising either two short duration paddy crops or a paddy crop combined with a crop of pulses or cotton or green manure.\(^6\) The next phase was the introduction of exotic high yielding strains like IR-8, IR-5 etc. on a large scale from 1969-70 in the place of local HYV strains like ADT-27 and CO-25.\(^7\)


\(^7\) Ibid
3.3. Trends in production

A 'critical minimum' has been provided in Thanjavur by IADP which was a coordinated programme to learn and demonstrate the accelerated rate of growth in agriculture. Hence, it would be logical to analyse the variations in production over time in two phases as follows:

(a) Years preceding the inception of IADP, and
(b) Years after the inception of IADP, sub-divided to allow for an analysis of the impact of the introduction of HYVP.

3.4. Pre-package period
(1951 to 1960)

Paddy was the important crop even in the pre-package period. Table 3.1 presents growth rates of area, output and productivity per cropped

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8 A minimum quantum of investment is necessary, though not sufficient condition of success. This, in essence, is the contention of the theory of big push, see N. Paul Rosenstein - Rodan, "Problems of Industrialisation of Eastern and South-eastern Europe", Economic Journal, pp.204-7, June-September 1943.

9 New Opportunities through IADP for Growth in India's Agriculture, New Delhi: Ford Foundation, 1967.
acre of paddy. The output of paddy grew at a compound rate of 2.26 per cent per annum.
1.60 per cent of this was due to increase in productivity and 0.57 per cent was on account of increase in area under paddy. This increase in productivity may be attributed to the favourable impact of National Extension Service Programme. Under this programme, farmers were provided with working capital through cooperatives and were able to cultivate better with more inputs. 10

However, fertiliser consumption per hectare in 1959-60 was only 6.92 kgs per acre.

Table 3.1

Compound Rate of Growth of Output, Area and Yield of paddy per annum (In per cent)

<table>
<thead>
<tr>
<th>Period</th>
<th>Growth rate of Output</th>
<th>Growth rate of Area</th>
<th>Growth rate of Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>1951-60</td>
<td>2.27</td>
<td>0.67</td>
<td>1.60</td>
</tr>
<tr>
<td>1961-67</td>
<td>(-)0.66</td>
<td>0.26</td>
<td>(-)0.92</td>
</tr>
<tr>
<td>1968-79</td>
<td>(-)0.62</td>
<td>(-)1.22</td>
<td>0.60</td>
</tr>
<tr>
<td>1951-79</td>
<td>1.23</td>
<td>0.23</td>
<td>1.00</td>
</tr>
</tbody>
</table>

10 Season and Crop Report, op.cit. 1953-54
3.5. Package period
(1960-61 to 1966-67)

The implementation of Intensive Agricultural District Programme in Thanjavur District was to bring about qualitative as well as quantitative changes in the agricultural economy of the district. In spite of this there had been an absolute decline in the level of output and yield of paddy during the period 1961-67. This had happened mainly because three agricultural years were climatically below normal years - two were affected by drought and one by floods on account of heavy rainfall in the district. In Thanjavur, where almost the whole paddy crop is grown under irrigation, the yield rate declined during the period under reference due to restricted water supply in the irrigation channels as a result of inadequate rainfall in the catchment areas of Cauvery river. Though the district escaped the severe drought of 1965-66 because of irrigation facilities, it was affected by floods in the kuruvai season of 1966-67 because of heavy rainfall. Only one area showed an increase of 0.26 per cent per annum.

It may appear surprising that both output
and yield of paddy declined in absolute terms in this period in spite of the fact that more than 90 per cent of the paddy area of the district is irrigated by canal and ADT-27,\textsuperscript{11} a variety of paddy, which was described as "27th star", "the seed of destiny" and "heavenly gift" was introduced in a wider area\textsuperscript{12} in the district in the year 1966-67. But for this and increased fertiliser consumption, the production performance of paddy could have been still worse during the period.\textsuperscript{13}

\textsuperscript{11} ADT-27 is a "variety of rice developed as a cross between India and Japonica strains at the Regional Research Station, Aduthurai" - Modernising Indian Agriculture, op.cit. 2.12

\textsuperscript{12} Nearly 77 per cent of the traditional Kuruvai area and about 94 per cent of the Samba area converted to double cropping were cultivated with ADT-27 strain.

\textsuperscript{13} G.G. Michael Schluter and W. Richard Longhurst, Some aspects of the suitability of High Yielding Rice and Bajra varieties for the Small Farmer, Thanjavur and Mehsana Districts, India", Occasional paper No.57, Department of Agricultural Economics, Cornell University, USAID - Employment and Income Distribution Project - p.10
Besides, this could also be due to delay in water release from Mettur Dam and unusual high/heavy rainfall at the time of harvesting of Kuruvai crop, middle of samba crop and planting of Thaladi crop.14

The fertiliser off-take has increased about five times in this period.15 The per hectare consumption of fertiliser also went up to 47.25 kg in 1967-68 from 16.9 kg in 1962-63.16 Not only the off-take of pesticides increased 15 times, even the coverage increased from 6 per cent of cropped area in 1961-62 to nearly whole of the cropped area by 1967-68. (Annexure Table III 1 & 2). This to

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(b) Quick Study of the Causes for not Converting the Entire Proposed Samba Lands into Double Crop Lands during 1967-68, Research Studies IADP, Thanjavur.


some extent may be taken to explain an average yield of 15.5 quintals for the seven year period against 12.7 quintals for pre-package period in spite of the bad weather and irrigation conditions.

3.6. Package period II
(1967-68 to 1978-79)

The short duration ADT-27 with its suitability for samba cultivation was instrumental for double cropping of paddy. This paved the way for a change in cultivation practices in this district which was previously raising only single samba crops. The double cropping programme or samba conversion programme has consistently made progress till 1974, after which there were decline in its phase due to uncertain weather conditions. In this district, uncertainty in weather conditions not only seems to affect productivity but also total cropped area (Annex Table III.3). This might be the reason for about 40 per cent of the total cropped area of paddy or 76 per cent of earlier samba area still being under single crop samba.

Starting with 35.52 per cent of paddy area under HYV in 1968-69, in a period of 10 years
more or less the whole paddy area has been brought under HYV cultivation (Annex Table III.4). The application of fertiliser has also been increasing at a compound rate of 10.6 per cent per annum (Annex Table III.2). This is reflected in the 0.6 per cent rate of growth of yield for this period. Contribution of area was negative and hence the output declined at the rate of 0.60 per cent per annum. Interestingly enough, productivity in Kuruvai season shows an increase of 2.5 per cent whereas it is about 0.9 per cent per annum for both samba and Thaladi. Therefore, the decline in output could be explained either in terms of extension of Thaladi crop cultivation to less favourable area or as explained elsewhere due to the adverse effect of rain and drought on Thaladi crop.

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17 Single crop samba cultivation has been in vogue in those areas where it has not been possible to cultivate two crops. With the creation of more favourable production conditions - improved irrigation facilities, introduction of new short-term varieties, more fertilisers, pesticides - more and more area was brought under double cropping on an extensive scale. As stabilised production in the newly brought in area entails a time-lag, the rate of growth may naturally be low in the area.
A comparison of production performance of paddy between three periods indicates that the rate of growth of output declined substantially during the second and third periods as compared to the first period. This has happened mainly because of decline in the rate of growth of both area and yield in the second period and exclusive decline of area in absolute terms in the third period. Taking the entire period into consideration, the rate of growth of output has been 1.23 per cent, that of yield 1.00 per cent and area 0.23 per cent. Since major part of the growth in output is accounted for by that of yield in Thanjavur, it would be important to know the influence of different factors on the yield of paddy.

3.7. Factors affecting productivity

In Thanjavur District, the inputs were channelled through IADP for increasing productivity of crops. These can be classified into 3 categories: (a) new machines, (b) new materials and (c) new methods, or what may be called 3 'M's of technological change. Under the category of the machines,
tractors for ploughing and pumps for irrigation are included. These two are also used by small farmers on hire.

In spite of its being an IADP district, mechanical contrivences like grain cutters, threshers, are not in common use. This is because overwhelming proportion of the holdings are small in size.

As regards the methods and materials, the increase in area under double cropping and HYV has been accounted for by the progressive change of varieties. (Annex Table III.4). Karuna with better yield replaced ADT-27. Karikalan with still higher yield slowly replaced the Karuna in Kuruvai season. In Samba and Thaladi seasons, short duration and finer grain varieties, like Pussa-33 and Ponni, are cultivated in the place of CO-25. IR-8 performed poorly in water-logged areas. Hence it was replaced by IR-20 which has

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been increasingly cultivated by the farmers as it is resistant to major pest and diseases (stem borer, brown hopper, grain leaf hopper, tongru virus, ful grain pest etc.). It is also preferred by the consumers because of its better taste although its yield is lower. Another HYV, ADT-31 with a duration of 130 days and yield capacity of 5.56 tonnes of paddy per hectare has also been increasingly cultivated. Hence the increase in productivity of paddy is not only due to the increase in area under HYV but also due to the successive improvements in high yielding varieties.

There has been significant increase in fertiliser consumption (Annex III.3) because of the widespread adoption of high yielding varieties concomitant of the introduction of HYV seeds.

In spite of significant increase in fertiliser consumption per hectare, growth in productivity is not significant. It may be


attributed to the fact that intensive cultivation of paddy is said to result in decline in soil fertility. Hence the entire quantum of fertiliser applied as such cannot be taken to increase yield. A sizeable portion of the fertility may go for maintaining basic soil fertility, rather than improving the fertility. Secondly, as seen, water is a real constraint in the area, and without the required irrigation intensity, fertiliser cannot be expected to increase yield.

Widespread cultivation of HYV Paddy has resulted in incidence of pests and diseases likeful grain, hort maggot, leaf roller and climbing cut worm. As mentioned earlier, this is reflected in the off-take and use of pesticides and fungicides and the entire area in the district is under crop protection.

Irrigation is another important input whose impact on yield, intensity of cropping and cropping pattern has been substantial in the past. The district has been facing acute shortage

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24 Ibid, III. P.21 and 137
of irrigation water during recent years and this has come in the way of increasing crop production in the district. There are studies that have identified the inadequacy of irrigation facilities and insufficiency of water management system.\(^{25}\)

Generally, delays and insufficiency in water supplies at the tail end of the channels and inundation and drainage problem during the North-East monsoon have been observed to cause damage to the standing crops. This affects productivity and hence production. One of the reasons for wastage of water during monsoon and irrigation season could be a long distance the river had to flow and lack of subsidiary storage facilities at intervals and inadequate regulatory contrivance. Drainage, desilting of canals is another facet of the problem especially in old delta.

Cultivation mainly depends on the release of water from the Mettur reservoir. Apart from inadequacy of rain during monsoon in catchment areas, the release of water has also assumed a political dimension. Out of 19 years (1960-78),

\(^{25}\) (a) M. Srinivasan, Ibid 
(b) V. Shanmugasundaram, op.cit. 
(c) MIDS Bulletin, op.cit. 
(d) IADP, op.cit. 
(e) K. Revi, op.cit.
in 11 years the water was released from Mettur reservoir only in July. This delays the cultural operations by one month. Out of remaining years, the water was released in time only in four years. Besides the date of release of water, the quantum of water issued into the river for irrigation has also been less than the normal (less than 2.9 MCft in 6 years (Annex table III.5)

Late release, less issue of water and the continuing rains during the Kuruvai Season result in

(i) delaying the transplantation of seedling,
(ii) submerging of standing kuruvai crops,
(iii) endangering the crops through the disastrous paddy pest. High cost of inputs and uncertain supply of water are daunting risks for the small farmers. This can be best expressed in the words of Guy Hunter, "To lose both the crop and Rs.700 of input is a sheer disaster" 26

3.8. Regression Equations

The statistical validity of the foregoing discussion has been attempted by regression approach for the package period. The impact of gross cropped area under paddy, area under HYV, fertiliser, irrigation and rainfall on productivity has been analysed by fitting a log-linear function of the form:

\[
\begin{align*}
\log Y &= \log a + b \log F + c \log G \quad \text{-- 1} \\
\log Y &= \log a + b \log F + c \log T + d \log H \quad \text{-- 2} \\
\log P &= \log a + b \log F + c \log RW + d \log N \quad \text{-- 3}
\end{align*}
\]

where:

- \( Y \) = Paddy output (quintals)
- \( P \) = Productivity (kilograms)
- \( F \) = Fertiliser (Rupees)
- \( G \) = Area under all varieties of paddy (hectares)
- \( H \) = Area under high yielding varieties (hectares)
- \( N \) = Net sown area (in hectares)
- \( RW \) = Weighted annual rainfall
- \( T \) = Time variable
Since almost the whole area under paddy is irrigated in Thanjavur, it has been taken to represent the irrigation variable. Area under high yielding varieties of paddy in different years has been taken to represent the varietal improvement in paddy crop. This would also include the effect of irrigation as the whole area under high yielding varieties is irrigated. As already mentioned the effect of excess rainfall is two fold: (i) pest infection, (ii) water logging. Therefore, assuming that the irrigation use is homogeneous across farms, it is attempted to measure the effect of rainfall on output by taking the annual rainfall. When annual rainfall is taken it ignores the adverse effect of rainfall. Hence to bring out its adverse effect weighted annual rainfall\(^{27, 28}\)

\[\text{Weighted annual rainfall is calculated using the formula} \]
\[
\frac{W_1 P_{ij} + W_2 P_{ij} + W_3 P_{ij} + W_4 P_{ij}}{W_1 R_1 + W_2 R_2 + W_3 R_3 + W_4 R_4} \times 100
\]

Where \(W\) = Weight assigned in 1 to 4 quarters.

Where \(P_{ij}\) = average rainfall of preceding 3 years in \(i\) th quarter in \(j\) th year

\(R\) = Normal rainfall in 1 to 4 quarters.

\(^{27}\) Where the annual rainfall was taken in quadratic term to bring out its effect on productivity, the resultant fit was unsatisfactory. Therefore, the weighted rainfall approach was adopted.
has been calculated. Weights were assigned on the basis of three year's productivity average of respective paddy crop seasons. In equation having rainfall as an independent variable, irrigation has been represented in terms of net sown area under paddy mainly because to separate its effect from rainfall as the latter is confined to one crop season only and as such, may not have any effect on the intensity of cropping. In order to separate the effect of high yielding varieties from other technological factors an independent variable of time was also included on the same regression along with the area under high yielding varieties.

3.9. The results:

The regression results of the three equations are presented in Table 3.2.

These equations explain 63 to 65 percent of variations in productivity across the years. The elasticity co-efficient of irrigation is positive and

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29 Due to non-availability of data, a better index could not be constructed.
Table 3.2.

Productivity - Time series regression results

<table>
<thead>
<tr>
<th>Equation No.</th>
<th>Constant</th>
<th>F (Fertiliser)</th>
<th>G (Area varieties of HYV)</th>
<th>DN (Weighted Net rainfall sown index)</th>
<th>Y (Time)</th>
<th>DW</th>
<th>SEE</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-2.2180</td>
<td>0.0722*</td>
<td>1.3764*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.68</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.291)</td>
<td>(3.079)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>-4.1260</td>
<td>0.2403</td>
<td>1.6290*</td>
<td></td>
<td>(-0.1838)</td>
<td></td>
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</tr>
<tr>
<td></td>
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<td>(1.708)</td>
<td>(3.351)</td>
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<td>(1.225)</td>
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<td></td>
</tr>
<tr>
<td>3</td>
<td>-3.6445</td>
<td>-0.0529</td>
<td></td>
<td>-0.0463 0.0299*</td>
<td></td>
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<td>2.42</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.814)</td>
<td></td>
<td>(0.675) (2.464)</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant at 5 per cent level.
significant in all the three equations. Its magnitude is higher for area irrigated under high yielding varieties of paddy as compared to that of all varieties of paddy taken together. This implies that the response of yield to irrigation is higher under high yielding varieties than under other varieties. It is also worth noting that response of yield to net irrigated area (equation - 3) is much lower than that to gross irrigated area in other two equations. This is quite understandable in view of the fact that the irrigation has played relatively a more important role through the increased intensity of irrigation. It is striking to note that the impact of rainfall on productivity is not significant for paddy crop in Thanjavur whereas that of irrigation is significant. Response of yield to fertiliser is significant in one equation but not in other two. The insignificance could be because of inclusion of one more variable in the equations. The impact of fertiliser may, therefore, be taken as significant on productivity of paddy in Thanjavur. It could thus be concluded that irrigation, high yielding varieties and fertiliser contribute significantly to the yield
of paddy crop. So far as the impact of rainfall and technology other than high yielding varieties (measured through time) is concerned, their impact on the productivity appears to be insignificant.

3.10. Production possibilities

As mentioned earlier, inadequacy and erratic supply of canal water and a little too frequent recurrence of flood and water logging in the district have made the efficient water management as the most important factor for increasing production of paddy in Thanjavur district. The problem has been well recognised by both the experts and policy makers. As early as in 1971, assistance was obtained from World Bank to modernise Cauvery Delta. This modernisation envisaged the lining of vulnerable points of canals and channels to solve the problem of seepage which is at times as high as 40 to 50 per cent. It further envisaged to convert the existing bed-dams into regulators to solve the problem of flooding and drainage. Besides, it was also expected under

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the scheme that the improvement of the existing channels and providing support to irrigation-cum-drainage canals would benefit about 20,000 hectares on par with other irrigation channels. The only problem is that the work would take 15 years for completion as the work would have to be carried out only in summer i.e., from March to June, when the channels will be free without water. This modernisation scheme is assumed to provide irrigation for 1.82 lakh hectares of additional acreage for cultivation and to add about 3.5 lakh tonnes of paddy.

In order to avoid the impact of rain caused floods on Kuruvai crop, new short duration varieties and new method of raising seedlings in 10 days time has been suggested. The technique of inducing dormancy on the ear head during the rainy harvesting time if adopted would lead to a

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31 Ibid, p.20
32 Ibid, p.1
reduction in loss to farmers on account of rains.\textsuperscript{33}

However, progress in the ground water exploitation by constructing more of private tube wells, filter points and deepening of wells can help to counter effect of the late release of Mettur water resulting in the late harvesting of Kuruvaï crop in the North East monsoon period. This can also ensure adequate water supply to Thaladi and Samba crops. Besides, it could also provide the scope for raising a third crop of grams.\textsuperscript{34} It has also been found that by using ground water there is scope for increasing crop production by 68.9 per cent by changing cropping pattern and cropping intensity.\textsuperscript{35}

\textsuperscript{33} Tamil Nadu Agricultural University, has developed this technique and dormancy is induced in the ear heads by Folier spray of mallic Hydrazids. The advantage of this technique is that grain in protected and germination is normal after 3 weeks - Madras Institute of Development Studies, \textit{Op.cit.}, Oct 1976

\textsuperscript{34} M. Srinivasan, \textit{Op.cit.} page 12

\textsuperscript{35} Quoted in Madras Institute of Development Studies, \textit{Op. cit.} July 1972
The imperativeness of efficient water management for agriculture in this district has been brought out in a study of Union Agricultural Ministry (Directorate of Economics and Statistics). According to the Study, "excess water damaged heavily 6.9 percent and moderately 2.6 per cent of Kuruvai fields and 3.9 per cent and 0.9 per cent of Thaladi fields. Drought damaged heavily 15.6 per cent and moderately 6.1 per cent of Thaladi fields and 1.8 per cent and 0.6 per cent of Kuruvai".

Adequate and timely availability of crucial inputs are extremely important for realising higher yields. On the basis of the comparison of control field trials data, it has been observed that the shortage and low quality of inputs come in the way of increase in the yield of paddy.  

The yield difference of 2 to 3.5 quintals per acre between treated and untreated field trials has been explained in terms of 40 to 45 per cent lesser use of fertiliser than the recommended dosage. The

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field trial of ADT-27 has also shown to yield more than double the yield of the district.

Another study on HYV shows that the yield in the farmer's fields is much lower (as less as 40 per cent) than the demonstration plots which in turn is lower than the yield at experimental station. These imply that the potential to increase the yield of paddy is still high in Thanjavur District.

Having examined the production performance of agriculture over the time period in Thanjavur, it is of interest to know the same at the farm household level, such analysis is attempted in the immediate two subsequent chapters.
