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SUMMARY AND CONCLUSION

THE PROBLEM: The main aim of each and every banana grower is to get maximum net revenue in banana production. To get maximum net revenue the banana grower should use the available resources efficiently with known technology in the production process and he should also get adequate price from the disposal of his produce.

Various research studies related to different crops, regions and time reveal that the available
resources are not utilised efficiently by the farmer in the process of production and he has received inadequate price in marketing his produce. Hence, an attempt is made to know whether similar conditions prevail in production and marketing of banana in Tirunelveli Kattabomman district where banana is an important commercial crop and stands first in area under fruits and vegetable cultivation.

The core of the problem of the present study is to diagnose the potentiality of increasing the net revenue of banana growers so as to sustaining banana production in order to meet the growing need for banana. This diagnosis depends on two aspects viz., efficient use of the available resources of the banana grower in the production process and adequate price for the banana bunches in marketing. A study on this problem compels the researcher to analyse two economic aspects, one relating to resource-use efficiency in banana production and the other relating to market margin in the disposal of banana bunches at the micro level in Tirunelveli Kattabomman district.

OBJECTIVES: The overall objective of this study was to evaluate the economics of banana production with attention to assess the scope for improvement in resource-use efficiency and in price received by the
banana growers. The specific objectives were:

i. to determine the structure of cost and revenue and to understand the resource-use pattern in banana production

ii. to evaluate the resource-use efficiency in banana production and to suggest the optimum use of resources if the resource-use is not efficient at the farm level

iii. to ascertain the yield gap between the forecast estimate of average yield and actual farm average yield per hectare and also between the yield of best farmers and backward farmers and to identify the important controllable and uncontrollable, factors responsible for limiting banana production, on the basis of the ranks given by the banana grower and

iv. to estimate the banana grower's share or margin in the ultimate consumer's price in different channels through the analysis of price spread from the first producer to the final consumer so as to determine the magnitude of market margin of each intermediary including the banana grower involved in banana market.
THEORY: The theory followed in the present study was that of the neo-classical production dealing with marginal analysis. According to this theory, the total output gets maximised when resources are allocated efficiently. Efficient use of resources involves in three relationships viz., input-output, input-input and output-output. In the present study, the first two relationships were explicitly examined.

As the banana grower contracted his whole banana garden to the pre-harvest contractor, no problem of marketing arose to the banana grower in the disposal of the bunches. Therefore, no specific marketing theory was followed. But, comparison of prices of bunches at different stages of marketing through market functionaries was made to estimate the market share or margin received by the banana grower from the ultimate consumer's price.

METHODOLOGY: The study was carried out to fulfil the objectives already mentioned on the basis of primary data collected from 303 sample banana growers (May-June 1994) and from 60 market functionaries or intermediaries (April-June 1995) by survey method with the aid of separate structured interview schedules.
Conventional tools of analysis bearing averages, ratios and percentages were used to study cost and revenue structure in banana production, resource-use pattern, yield gap and market margin. Fisher's Z-Statistic was applied to examine whether there existed significant difference in mean net revenue between varieties of banana, the size-groups of farm and the selected regions with respect to different varieties.

Student's t-test was employed to test the significance of difference in mean yield per hectare between best farmers and backward farmers within the sample. Garret ranking technique was adopted to identify the important factors which limited banana production, on the basis of the ranks given by the banana grower. A quadratic function was fitted to determine the maximum product within the sample.

Resource-use efficiency was evaluated by using modified Cobb-Douglas production function considering the ratios of Marginal Value Product to factor cost of variable factors.

COST AND REVENUE OF BANANA: The cost incurred by hired human labour and manures and fertilizers in total cost per hectare was more than 58 per cent in all varieties.
Sucker's cost was the least ranging from 1 to 6 per cent for the sample varieties. The total cost incurred in Peyen and Nendran was greater than that of Thozhuvan and Kadali per hectare. The overall average cost per tree was Rupees 12.12. The cost of applied inputs such as human labour, suckers, manures and fertilizers and plant protection measures had the major share ranging from 76 per cent in Kadali to 80 per cent in Thozuwan in the total cost of cultivation; Peyen and Nendran fell in between these two. The farmer growing Kadali spent comparatively less amount as cost of cultivation and for Nendran a higher amount per hectare. Much difference was not noticed in the ratio of hired human labour and family labour among the different varieties of banana.

Among the four varieties cultivated in the study area, Nendran yielded higher revenue and Thozhuvan, Peyen and Kadali ranked next respectively. Though yielding low revenue, Kadali was cultivated largely due to its resisting capacity against wind and diseases. Nendran, though yielded higher revenue was cultivated by few farmers because it could not resist wind and diseases as compared to Kadali and also it required higher amount of plant protection measures. Thozhuvan was cultivated largely due to its taste, high
demand and attractive price. The area under cultivation of Peyen was small because of its easy vulnerability to wind damages and diseases. The average net revenue of all varieties of banana was Rupees 52,524 per hectare. The benefit-cost ratio was high in Nendran and low in Kadali.

If a farmer spent one rupee as cost of cultivation, he would reap, on an average, a net revenue of Rupees 1.71.

Among the three groups classified, a banana grower in Group-I spent comparatively higher amount of money as cost of cultivation followed by the banana growers in Group-II and Group-III respectively. The grower in Group-I nurtured his small size of banana garden well near to the required inputs. In the size-groups of farm also major share in the cost of cultivation was swallowed by human labour and manures and fertilizers. The expenses in the use of manures and fertilizers per hectare went on decreasing as the farm size increased, so also in the total cost. An inverse relationship existed between the use of family labour and hired human labour as the farm size increased.

Banana farms belonging to Group-I were labour-intensive and in this group 260 mandays were used per
hectare per year. The use of mandays decreased as the size of farm increased. On an average, the ratio of hired human labour to family labour was 2.55. It means that more employment opportunities could be generated for agricultural labourers.

The gross revenue and net revenue varied according to size-groups of farm. Per hectare net revenue in Group-I was higher than the remaining groups so also the benefit-cost ratio. As the size of farm increased, the net revenue went on diminishing at an increasing rate. Therefore, Group-II should be advised to use the inputs rationally and Group-III to use more agricultural inputs in a better way.

**RESOURCE-USE EFFICIENCY:** Resource-use efficiency was evaluated on the basis of production elasticity coefficients worked out with the aid of the modified Cobb-Douglas production function. Returns to scale was studied summing up the elasticity coefficients by checking whether the sum is $>1$ or $=1$ or $<1$. The ratio of marginal value product (MVP) to factor cost of each input was used to understand whether the input was underutilised or overutilised or optimally utilised in the production process.
Among the four varieties of banana the gross revenue of Thozhuvan was significantly influenced by human labour. Manures and fertilizers ranked next. The banana grower had spent unnecessarily more money on suckers. The coefficient of determination $R^2$ was 0.96 indicating a 96 per cent variation in gross revenue explained by the inputs. $R^2$ was significant at 1 per cent level of statistical significance. The law of diminishing return operated in the cultivation of Thozhuvan. The ratios of MVP to factor cost for human labour and manures and fertilizers were greater than one. This result indicates that these inputs were underutilised. This means that there was more scope for further use of these inputs and expenses on suckers could be reduced thereby to increase the yield and revenue from Thozhuvan.

In the cultivation of Kadali only two inputs, namely, human labour and manures and fertilizers significantly influenced the gross revenue. Plant protection measures had positive but not significant impact on the revenue. $R^2$ was 0.94 and significant at 1 per cent level. Sum of elasticity coefficients indicates increasing returns to scale. On the basis of the ratios of MVP to factor cost it is observed that the inputs human labour and manures and fertilizers
were underutilised. These inputs could be used more to increase the yield and revenue.

All the inputs had positive elasticity coefficients in the cultivation of **Peyen**. Of these, human labour and manures and fertilizers influenced the gross revenue significantly. \( R^2 = 0.98 \) and was significant at 1 per cent level. As the sum of input coefficients was less than one, it is concluded that law of diminishing return operated in the cultivation of Peyen. The MVP to factor cost ratios of the inputs human labour and manures and fertilizers were greater than one indicating underutilisation of these inputs. These inputs could be used more in the cultivation of Peyen.

The gross revenue of **Nendran** was significantly influenced by human labour, manures and fertilizers and suckers. Plant production measures did not influence the revenue significantly. \( R^2 = 0.98 \) and was significant at 1 per cent level. The farmer growing Nendran was operating under increasing returns to scale. The ratios of MVP to factor cost of human labour, suckers and manures and fertilizers were greater than one. This means underutilisation of these resources. The expenses on these input resources could be increased to increase the yield and revenue.
Among the size-groups of farm already classified, the gross revenue in Group-I was significantly influenced by manures and fertilizers, suckers and plant protection measures. $R^2 = 0.82$ and was significant at 1 per cent level. Sum of the regression coefficients was 0.71, showing diminishing returns to scale.

In Group-II the gross revenue was significantly influenced by only manures and fertilizers and plant protection measures. The farms belonging to this group operated under diminishing returns to scale. The gross revenue of farms in Group-III was significantly influenced by human labour, suckers and manures and fertilizers. Plant protection measures had positive but not significant coefficient. $R^2 = 0.95$ was significant at 1 per cent level. The law of diminishing return operated in banana farms which belonged to Group-III.

The MVP to factor cost ratio of manures and fertilizers was greater than unity in all the size-groups of farm. This indicates underutilisation of this input. Therefore, this input could be used additionally to increase the yield and revenue. Human labour was overutilised in Group-III. The use of human labour should be reduced to make a reduction in the cost of cultivation. This could increase the net revenue of the
farmers belonged to this group.

Suckers were underutilised in Groups I and III and plant protection measures in Groups I and II. Hence there was ample scope for further use of suckers and plant protection measures in these groups of farm.

All the inputs included in the model at aggregate level had significantly influenced the gross revenue. Among these inputs, manures and fertilizers was highly significant. Next came plant protection measures, human labour and suckers respectively. $R^2 = 0.95$ and was significant at 1 per cent level. The sum of the elasticity coefficients was 0.98 which indicates the operation of the law of diminishing return in banana production.

The ratio of MVP to factor cost was less than unity in human labour, showing overutilisation of this input. It is concluded that the use of human labour should be reduced. This may affect the employment opportunities. But, employment opportunities could be generated by establishing banana-oriented agro-based industries in important revenue villages wherever necessary in the study area. The ratio of MVP to factor cost of suckers, manures and fertilizers and plant protection measures were greater than unity; indicating
underutilisation of these inputs. Therefore, it is inferred that the use of these inputs could be encouraged to increase the yield and revenue of banana.

**YIELD GAP:** Yield gap in banana production was estimated by comparing the forecast estimate of average yield with actual farm average yield. Only the yield of Kadali was above the forecast yield and the yields of the remaining varities were below the forecast yield. The high yield in Kadali was due to the size of bunch and the number of fruits in a bunch. But the price of Kadali in the market was below the prices of the remaining varieties. Therefore, cultivation of Kadali is not recommended on the basis of the higher yield. The farmers growing the Thozhuvan, Peyen and Nendra varieties should be advised to use the available resources efficiently so as to increase the yield.

Yield gap also existed between the forecast average yield and average yield of different size-groups of farm. Among the three groups classified, Group-I had the yield below the forecast estimate of average yield. This gap was negative but narrow. In Group-II this gap was negative and wide and in Group-III negative and wider. A rational use of available resources in Group-II and more use of the required
inputs in Group-III would narrow down the yield gap.

The yield gap existed between the best farmers and backward farmers was observed to be significant at 1 percent level of statistical significance. Backward farmers should be encouraged to use adequate input resources to increase the yield in order to make the yield gap narrower.

While attempting to identify the important factors that limit banana production, it was observed that the agro-biological factors such as severity of diseases and severity of wind and the economic and institutional factors like higher cost of manures and fertilizers and higher propping cost were the major causes limiting banana production.

The maximum yield or product within the sample farms was estimated by means of quadratic function and marginal analysis with respect to input costs and yield of banana. Theoretically, the total product will get maximum when the marginal product is equal to zero. Marginal product was calculated with the aid of derivative technique. The maximum possible yield estimated was 10.84 kgs. of banana using Rupees 23 as input cost. And, if a banana grower spent one rupee as additional cost, he would reap 472 gms. of banana as
additional yield until reaching maximum yield.

**PRICE SPREAD AND MARKET MARGIN:** The study of market margin through price spread was considered essential to find ways and means to safeguard both banana producer and consumer in order to promote banana cultivation in this district. For, the producer should get adequate price for his produce and the consumer should be protected from excessive price. If the both ends meet, the production of banana will be encouraged.

Three channels were observed in the study area. In **Channel-I** the banana grower (only 2 per cent of the sample) sold the banana bunches directly to consumer. Under this channel, the banana grower got highest share of 95.70 per cent per bunch from the consumer's price over the marketing cost of 4.30 per cent.

Under **Channel-II**, the sale was done through retailer (only 7 per cent of the sample), and the banana growers received a share of 82.96 per cent per bunch. The retailer's margin was 11.58 per cent. The marketing cost of them was 5.46 per cent.

Under **Channel-III**, bunches were sold through pre-harvest contractor (91 per cent of the sample). On an average, the banana growers received a margin of
58.18 per cent which was far below the margin or share received under Channels I and II. Among the three intermediaries, the retailer got a major share of 13.15 per cent, contractor 9.82 per cent and wholesaler 4.73 per cent per bunch respectively. But, the marketing cost incurred by retailer was 2.85 per cent followed by wholesaler with 3.82 per cent and contractor with 7.45 per cent respectively.

On the basis of these results, it is concluded that the retailer reaped abnormal share by exploiting consumer though he spent comparatively less amount as marketing expenses. The lower share received by banana grower was due to the existence of a chain of middlemen between the first producer and the final consumer. To reap a better price for both producer and consumer, the number of middlemen should be minimised or even eliminated from marketing services. Regulated market or co-operative banana market wherever necessary would be the solution.

The gist of the analysis of the study is highlighted as under:

i. Human labour and manures and fertilizers had the major share in the cost of banana cultivation

ii. Nendran banana yielded comparatively higher
net revenue and the cultivation of this variety is strongly recommended.

iii. Banana grower belonging to Group-I were more efficient due to more involvement of family labour and intensive care of the banana garden compared to the banana grower under Group-II and Group-III.

iv. The inputs human labour and manures and fertilizers influenced banana production significantly. However, human labour was overutilised. Manures and fertilizers, suckers and plant protection measures were underutilised. There was scope for further increase in the use of these inputs.

v. The average yield of all varieties except Kadali as well as of different size-groups of farm was below the forecast estimate of average yield per hectare. The difference in mean yield per hectare between best farmers and backward farmers for different varieties was statistically significant.

vi. The agro-biological factors such as severity of diseases and severity of wind and economic and institutional factors like higher cost of manures and fertilizers and higher propping cost were the major limiting factors in
vii. Banana grower received inadequate share in the ultimate consumer's price due to the existence of a chain of intermediaries in the banana market.

**SUGGESTIONS:** As banana production is highly profitable and involves risks and uncertainties, necessary steps should be taken by the government to compensate the loss due to risks and uncertainties and to expand banana cultivation elsewhere in Tirunelveli Kattabomman district. Crop insurance scheme may be extended to banana crop also.

The prevailing market prices of inputs such as manures and fertilizers and plant protection materials are higher. The banana grower is not able to make use of such inputs as required due to financial constraints. Therefore, financial institutions should make necessary provisions to banana grower at the time of crying need so as to improve the efficiency of input-use.

The net revenue of each banana variety can be increased by applying more and more measurable inputs except human labour. Human labour is over-used in the sense that its Marginal Productivity (MP) is low.
Therefore, the human labour may be shifted from banana farming to banana oriented agro-based small scale rural industries to be established at appropriate places in the study area. These industries can absorb the excessive human labour in producing food items such as jam, chips, flour and powder out of different varieties of banana. This will enhance capital formation in this district and will meet the growing need of such food items too.

The study indicates that the difference in yield per hectare between forecast estimate of average yield and actual average farm yield is quite obvious for different varieties of banana and size-groups of farm. Further, the difference in yield per hectare between best farmers and backward farmers is statistically significant. Therefore, extension workers and horticultural scientists should educate the banana growers especially backward farmers to make use of the available input resources efficiently. This may increase the banana yield and reduce the yield gap as the case may be.

Since the study reveals that human labour is over-used and suckers, manures and fertilizers and plant protection measures are under-used as guided by MVP to factor cost ratio, the use of additional units...
of under-used inputs, will certainly add to the yield and net revenue of banana grower. These inputs must be made available at low price without shortage.

Banana is irrigated under surface method once in every five to seven days and during summer or dry season once in every eight to ten days depending upon the soil and climatic conditions. Banana grower solely depends on dug wells and electric power for lifting water from dug wells to irrigate banana in the study area. Water is scarce in dug wells and banana grower suffers due to frequent power cut. This leads the banana growers unable to irrigate banana in the specified days of interval.

Drip irrigation method as introduced in Jalgaon district of Maharashtra State in the year 1992-93 can be followed in this district. In this drip irrigation method water is supplied to each and every banana plant by emitters or micro tubes through a net work of tubing. Under this method of irrigation, it is possible to save about 50-60 per cent of water without affecting the growth and yield of banana. This system, if introduced in Tirunelveli Kattabomman district will go a long way to solve the problem of water shortage, to increase the production and productivity of banana and
to bring high net revenue to the banana grower. In addition, electric power should be supplied to agriculture throughout the year without any cut.

As the present study reveals, the producer's share in the consumer's price was quite low and the price spread accounted a big chunk of the consumer's price. On further investigation, it was observed that there was no co-operative marketing society for banana in the study area. Banana trade was mainly in the hands of a chain of middlemen or private market functionaries. Absence of banana growers' co-operative or absence of any vertical integration of banana trade had contributed to higher price spread or higher margins of functionaries. If such a co-operative infrastructure is built up wherever necessary, there will be scope for eliminating superfluous middlemen in banana market so as to increase the efficiency of banana market and also the share or margin of banana grower.

Further, regulated weekly or bi-weekly banana market in each revenue village may be established to make a direct link between banana producer-seller and consumer in order to get better price for banana. This will augment banana cultivation in the study area and will protect both producer and consumer from the intermediaries.
The banana grower can grow short-duration (for a period of three months or less than four months) vegetable crops and oil seeds in the banana field as mixed crop(s) with the early stage of existing banana crop to reap much more higher revenue from banana field. However, agricultural scientists should come forward to do further research to establish the validity and or practical possibility of this suggestion.

Banana fibre is used to make fancy articles in cottage industries and its dried sheath is used to pack with snuff and or tobacco in cottage and small scale industries. To feed the materials to such industries banana cultivation should be encouraged thereby to contribute its share to the economy of this district.

AREA FOR FURTHER RESEARCH: In banana production the Marginal Value Product to factor cost ratios of all inputs included in the production function are different from unity. There is need to reorganise the resource structure for banana farms by identifying the constraints that stand in the way of increasing production and productivity of banana farms. Therefore, there is need to undertake a study on constraint
analysis in banana production.

Banana production may be good for one year and bad with another year. To study the stability in banana production at micro level a time series analysis of cost and revenue of banana production for at least five years is felt essential in order to suggest policy implications.

Banana farms are not certain about the level of maximum possible revenue from banana production due to occurrence of risk and uncertainty. To give allowance for this, a risk analysis decomposing into market (allocative) risk and production (technical) risk is felt necessary in order to measure empirically the influence of these risks and uncertainties in yield and revenue of banana in Tiruneveli Kattaboman district.

The economic efficiency comprises of both technical and allocative efficiency. The core of economic theory is concerned with the allocative or price efficiency - the marginal value product of factors might be equal to their marginal costs. The other important aspect of economic decision making process is to produce the greatest possible output from a given set of inputs. Cobb-Douglas production function ignores the problem of technical efficiency. Therefore,
a probabilistic production function approach using linear programming can be studied to measure both allocative and technical efficiency in banana production in this district.

Separate market analysis both internal and external in the disposal of banana bunches is needed because the prevailing banana market is imperfect and quite a lot of extraneous elements including demand and supply influence the functioning of the marketing system. Specific market theory may be followed to analyse the efficacy of banana market in Tirunelveli Kattabomman district.