

Cost-benefit Analysis of Pepper Cultivation in Kerala under Ideal Management

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PEPPER is rightly known as "King of Spices". This is an important spice crop of India. It is largely cultivated in Kerala which accounts for almost 96 per cent of the total area of 1,10,000 hectares under pepper in the country. During last few years the production of pepper has been varying between 25,000 tonnes and 30,000 tonnes, while its exports fluctuated around 23,000 tonnes. The average export earnings from black pepper during the period 1974-83 comes to Rs. 330 million per annum. However, the record export earnings of Rs. 500 million was realised in the year 1977-78.

Despite its significant importance to the national economy the production of pepper has virtually stagnated around 27,000 tonnes during the last decade. This is mainly because of the fact that this crop is grown under conditions of neglect with the general impression that higher investment on crop management does not pay. This is altogether misplaced notion. There is enough evidence to suggest that the present productivity level of 260 kg per hectare could be increased five to nine times by adopting available scientific crop management practices. Considering this aspect, recently several developmental programmes have been initiated for improving the productivity as well as production of black pepper in India. These include rehabilitation of existing pepper gardens by regular and adequate manuring, and plant protection measures; and replanting the senile, uneconomic and diseased vines with high-yielding varieties.

Objectives

An attempt has been made in this paper to examine the economic potential of pepper cultivation in Kerala under scientific management practices. More precisely, the objective of this study is to make cost-benefit analysis of pepper crop under given situations.

Methodology

The cost-benefit analysis in a perennial crop like pepper, unlike seasonals and annuals, poses some problems normally associated with the measurement of costs and benefits and the problems of choosing an appropriate discount rate to compare different streams of costs and benefits over a period of time. Studies of this nature are carried out under

certain assumptions due to obvious reasons. These have been highlighted here below :

LIFE CYCLE

In the case of pepper, pre-bearing period of four years has been considered as the establishment period and the following 11 years as economic-bearing period. Thus, the economic life-cycle of a pepper plantation has been assumed as 15 years in this study.

TECHNICAL CO-EFFICIENTS

Table 1 shows the year-wise and operation-wise labour requirements for scientific pepper cultivation. In order to determine the labour input, a consensus approach was taken, obtaining information from a few sources as it was not possible to adopt "Time and Motion Study" approach in this case. The fertiliser dose considered here in 100g N, 40g P₂O₅, 140g K₂O per vine per year. Total of 1100 vines have been taken for one hectare of plantation area. Table 2 gives the year-wise and item-wise material input requirements for raising pepper with package of practices.

FACTOR COSTS

For computing the factor costs barring labour wages, the 1984-85 factor market prices have been taken into account. Since the operational wage rates vary widely from region to region within the State of Kerala, between seasons and among the categories of agricultural labour, the shadow price (Rs. 20 per labour day) for this input was used. Land was not taken into consideration as an item of the investment since it is not a wasting asset when proper nutrition is provided to this resource for its exploitation. Table 3 presents the unit cost of each input alongwith the details of investment and annual maintenance cost at the bearing stage of plantation.

UNIT PRODUCTION

Even though the high-yielding varieties of pepper respond well to the ideal management for avoiding the influence of weather and other natural hazards, the yields have been considered at moderate levels than their potential under given package. For this study a stabilised yield level of 1250 kg per vine per year has been considered.

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PRODUCT PRICE

In order to determine the flow of benefits in different years, the average farm gate price of pepper in Kerala during the last five years (1980—84) was used as the unit value of pepper. Thus the unit value considered in this case is Rs. 12 per kg. of dry pepper, though the prevailing price now is more than Rs. 20 per kg.

ANALYTICAL TOOLS

Considering from the practical angle, the *ex-ante* concept of cost-benefit analysis was adopted here instead of *ex-post* concept. The scope of this study is, however, confined to the direct costs and benefits and the social cost-benefit aspects have not been accounted for due to lack of adequate information. The costs and returns were discounted at 14 per cent.

To test the worthiness of the investment on pepper production on modern line, three indicators of the financial analysis, namely, (i) Benefit-cost Ratio (BCR), (ii) Net Present Worth (NPW) and (iii) Internal Rate of Return (IRR) were subjected to scrutiny. The methods applied for determining the values of these indicators are :

$$(i) \text{ BCR} = \frac{\sum_{i=1}^n \frac{B_n}{(1+i)^n}}{\sum_{i=1}^n \frac{C_n}{(1+i)^n}}$$

$$(ii) \text{ NPW} = \sum_{i=1}^n \frac{B_n - C_n}{(1+i)^n}$$

$$(iii) \text{ IRR} = \sum_{i=1}^n \frac{B_n - C_n}{(1+i)^n} = 0$$

Where B_n = benefits in each year;
 C_n = costs in each year;
 n = number of years; and
 i = discount rate.

Results

Table 4 illustrates the cash-flow in respect of pepper production under given package, taking the rational factor-product price situations into consideration. It would be seen from Table 4 that the net present worth (NPW) of the future margins which represent a constant annual return over the life of the crop works out to be Rs. 13,400 per hectare. However, for determining the average annual margin from this crop the value of NPW was divided by the present worth of an annuity of Re. 1 for 15 years at 14 per cent (Rs. 6.14) and in this way the average annual margin from pepper production comes to Rs. 2,200 per hectare.

The BCR here was found out to be 1.28 and the IRR as 25 per cent. Since the BCR is greater than unity and the IRR is higher than the prevailing bank rate (14 per cent), the economic potential of scientific cultivation of pepper looks to be strongly viable under the present situation.

Further the analysis was subjected to sensitivity test by assuming eight additional situations besides the present one in respect of factor-product prices. The situations are : With existing factor costs and three different levels of product price, namely, (i) Rs. 12 (average price of last five years), (ii) Rs. 15, and (iii) Rs. 18; with 5 per cent rise in factor costs and given three levels of product price, with 10 per cent rise in factor costs and given three levels of product price. Table 5 reveals the estimated values of NPW, AAM, BCR and IRR in different situations under reference.

From this study one could conclude that though the modern technology in pepper production is both labour and capital intensive, it is economically most viable and stable as in all these cases BCRs are greater than unity, IRRs are higher than the bank rate and AAMs (Average Annual Margins) are very much competitive in Kerala situation.

TABLE 1—ESTIMATED LABOUR REQUIREMENTS FOR PEPPER (MAN-DAYS/ha./yr.)

Operation	Establishment period Years				Adult stage/year 5th year onwards
	1	2	3	4	
1. Fencing and repairs	70	8	8	8	8
2. Taking pits	40	—	—	—	—
3. Applying compost	10	10	10	10	10
4. Digging entire area	15	15	15	15	15
5. Planting pepper cuttings and standards	10	2	—	—	—
6. Applying fertilisers	8	12	15	15	15
7. Weeding	20	20	20	20	20
8. Mulching and tying vines	10	15	18	22	25
9. Watering in summer months	20	25	30	15	—
10. Spraying and other plant protection	8	10	15	18	20
TOTAL	211	117	131	123	113

TABLE 2—MATERIAL INPUT REQUIREMENTS IN PEPPER CULTIVATION AS MONO CROP PER HECTARE

Item	Unit	Establishment period Age of plantation				Adult stage
		1	2	3	4	
Cuttings	No.	1100	110	50	—	—
Erythrina	No.	1100	—	—	—	—
Farm yard manure	Tonne	11	11	11	11	11
<i>Fertilisers</i>						
Urea	Kg.	79	156	238	238	238
Muriate of potash	Kg.	85	170	255	255	255
Superphosphate	Kg.	91	183	273	273	273
<i>Plant Protection</i>						
B.H.C.	Kg.	11	22	44	88	90
Copper sulphate	Kg.	11	22	30	40	45
Lime	Kg.	11	22	30	40	45

TABLE 3—COST OF MAINTENANCE IN PEPPER CULTIVATION (Rs./ha.)

Item	Rate/Unit	Investment cost (Initial 4 years)	Maintenance cost adult stage
1. Labour	Rs. 20.00/man-days	11,640	2,260
2. Material for fencing & mulching		2,000	
3. Live standards		2,400	
4. Pepper cuttings	Rs. 17.0/100 cuttings	220	
5. Farm yard manure	Rs. 100/tonne	4,400	1,100
6. <i>Fertilisers</i>			
(a) Urea	Rs. 2.20/kg.	1566	524
(b) Superphosphate	Rs. 1.10/kg.	901	300
(c) Muriate of potash	Rs. 1.30/kg.	993	331
Total fertiliser cost		3,460	1,155
7. (a) BHC 5%	Rs. 1.10/kg.		
(b) Copper sulphate	Rs. 17.00/kg.		
(c) Lime	Rs. 1.50/kg		
Total plant protection cost (Rs.)		2,080	930
8. Harvesting and processing		500	3,000
9. Contingencies		400	155
		27,100	8,600

TABLE 4—COST-BENEFIT ANALYSIS OF PEPPER PRODUCTION/HA.

Year	Cost	Discounted cost @14%	Return	Discounted return @14%	Incremental benefit	Discounted incremental benefit @14%
	(Rs.)	DF(Rs.)	(Rs.)	DF(Rs.)	(Rs.)	DF(Rs.)
1.	10,619	9,312	—	—	—10,619	— 9,312
2.	4,761	3,661	—	—	— 4,761	— 3,661
3.	5,683	3,836	3,960	2,673	— 1,723	— 1,163
4.	6,051	3,582	9,900	5,860	3,844	2,275
5.	8,656	4,492	16,500	8,563	7,844	4,071
6.	8,656	3,947	16,500	7,524	7,844	3,576
7.	8,656	3,462	16,500	6,600	7,844	3,137
8.	8,656	3,038	19,800	6,949	11,144	3,911
9.	8,656	2,666	19,800	6,098	11,144	3,432
10.	8,656	2,337	19,800	5,346	11,144	3,008
11.	8,656	2,051	16,500	3,910	11,144	1,859
12.	8,500	1,768	13,200	2,745	4,700	977
13.	8,400	1,528	11,880	2,162	3,480	633
14.	8,400	1,344	10,560	1,689	2,160	345
15.	8,400	1,176	10,560	1,478	2,160	302
Net present worth (Rs.)	13,400					
Benefit-cost ratio	1.28					
Internal rate of return (%)	25					

TABLE 5—SENSITIVITY ANALYSIS OF PEPPER CULTIVATION UNDER VARYING FACTOR-PRODUCT MARKET SITUATION

Situation	NPW (Rs.)*	Average annual margin (AAM) (Rs.)*	B C R	I R I
A. With existing factor cost and given prices :				
(i) Rs. 12/kg. (Average price of last 5 years)	13,400	2,200	1.28	25
(ii) Rs. 15/kg.	28,800	4,700	1.60	35
(iii) Rs. 18/kg.	44,200	7,200	1.91	45
B. With 5% increase in factor cost and given prices :				
(i) Rs. 12/kg.	11,400	1,900	1.35	20
(ii) Rs. 15/kg.	28,400	4,600	1.52	32
(iii) Rs. 18/kg.	41,900	6,800	1.83	35
C. With 10% increase in factor cost and given prices :				
(i) Rs. 12/kg.	8,600	1,400	1.16	18
(ii) Rs. 15/kg.	24,000	3,900	1.45	30
(iii) Rs. 18/kg.	39,400	6,400	1.74	42

*Rounded to the nearest hundred.

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