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ECONOMICS OF PRODUCTION OF DRUMSTICK (*MORINGA OLEIFERA*) IN VADODARA DISTRICT OF GUJARAT

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ABSTRACT
The study was carried out in the year 2016-17, to study the feasibility of investment on drumstick cultivation in Vadodara district of Gujarat. A sample of 100 drumstick growers was drawn from four randomly selected villages of two highest drumstick producing talukas of Vadodara district. Required data was recorded on well structured pre tested schedules through personal interaction with selected drumstick growers. Tabular analysis was used to analyze the investment pattern and maintenance cost. Financial feasibility of investment was carried out using with and without finance approach. The sensitivity analysis of investment was also carried out under different cost and return scenarios. The establishment cost for one hectare drumstick farm was worked out at Rs 2, 42,686, of which material cost constituted around 87 per cent, rest was maintenance cost upto bearing stage. The drumstick bears pods in first year itself and the average yield was 191 quintals per hectare while the returns realized were Rs 537972.60 per hectare. The financial feasibility analysis revealed that the investments on drumstick farm of one hectare can be recovered in around one year and six months. The Benefit Cost Ratio (BCR) was more than 10, the Net Present Worth (NPW) was more than Rs 25 lakhs, and the Internal Rate of Return (IRR) was 89 per cent, with finance. BCR, NPW and IRR were around 12, Rs 26 lakhs, and 95 per cent, without finance. This shows that investment in drumstick enterprise is an attractive and highly profitable proposition. Sensitivity analysis revealed that even if the returns decrease by 50 per cent, and cost rises by 20 per cent, the investment on drumstick would be a better alternative than several other orchard enterprises, as the studies on other orchards in the study area revealed.

KEYWORDS: Investment, costs, returns, drumstick, Gujarat, India, NPV, BCR, IRR, Payback

INTRODUCTION

Poverty and large and fast growing population are significant and persistent problems in India. These problems, besides having close relationship with food insecurity are also related with poor health and malnutrition. Nutritional security has not received due attention because the main emphasis has been on alleviating hunger. In other words, while the requirement of food in bulk has been receiving due attention of the policy makers and administrators, the important requirement of assimilable nutrition has received little attention. A developing country like India, needs not only the adequate quantity of food but also quality of balanced nutritious food in order to enable its citizens to lead a healthy life. Burgeoning population has results in greater demand and higher pressure on the limited land to produce required quantity of food. Pressure on land for non-agricultural use is also increasing tremendously.

Therefore, India should identify and practice food crops, which are not only highly productive but nutritionally balanced. *Moringa Oleifera*, or drumstick as it is popularly known as, is one such crop, which meets both these requirements. It is rich in vitamins A, B complex, and C, minerals, and electrolytes. Drumstick, as it is called due to its high physical resemblance with sticks used to beat the drums, is a tree native to India. However, due to its medicinal uses, it has reached other countries also. The edible leaves are consumed throughout West Africa and in parts of Asia. In India, *Moringa* pod is used in a variety of curry dishes. The drumstick is valued mainly for its tender pods, which are relished as vegetable but all its parts - bark, root, fruit, flowers, leaves, seeds and even gum - are of medicinal value. The tree grows rapidly even in poor soils; it is well adapted to droughts, and is able to reach up to 15 m in height**.** Rohit-1, Coimbator-2, P.K.M. -1, P.K.M. -2, Durga, G.K.V.K. -1, G.K.V.K. -2, G.K.V.K. -3, Jafna, K.M.1, Chavalavacheri, Yalpanam, Shabanam, are the most common varieties grown all over the country. Tamil Nadu, Andhra Pradesh, Karnataka, and Maharashtra, are the major growers of drumstick trees. However, the tree has attracted farmers in Gujarat for its low establishment and maintenance and operational costs. The innovative farmers in Gujarat have taken the market by storm by processing drumstick leaves and pods into fine powder and marketing it to urban consumption centers. The state has a potential and favourable climate for the tree, howsoever due to low awareness about the economics of production, and less demand in local markets; the crop is concentrated in very limited region. Off late, it has been observed that due to the increasing awareness about the nutritional benefits of the crop, the demand of the commodity is building up in Gujarat. Study of the economics of drumstick production is indispensible since there is no proper farm business data on its cost of

production. The accurate figures on establishment cost, operating cost and input requirement of drumstick could be of great help to growers in Gujarat in general, and that of Vadodara district of Gujarat, in particular. Therefore an attempt was made to study the investment pattern in drumstick and to compute the costs and returns in drumstick cultivation in Vadodara district.

MATERIALS & METHODS

Vadodara district has the concentration of drumstick trees. Two talukas i.e. Vadodara and Padra were selected on the basis highest concentration of drumstick trees in Vadodara district. Bhayali and Jaspur villages were selected from Vadodara district while Bamangam and Luna villages were selected from Padra. A list of respondents (drumstick growers) in the two talukas was prepared and a sample of 100 drumstick growers was drawn for the study. The average age of the respondent was 44 years, with average family size of 10 heads. The information on number of persons working on farm revealed that family labour involved in the cultivation of drumstick was very low and the sample farmers had employed hired labour. Most of the sample farmers were graduates from higher secondary or Bachelors degree program, and were employed in services sector; therefore cutting short the number of work hours on farm. Drumstick cultivation is practiced in Vadodara district for years. More than 20 per cent sample farmers have been cultivating drumstick for more than twenty years. The average area under drumstick was 1.945 hectare (ha) per farm. The average life for which drumstick generates lucrative net returns per ha is 10 years. Therefore the data on various particulars/ parameters was recorded through personal interviews on well structured pre tested schedule for the period Jan 2016 to December 2016. Drumstick tree does not have a larger gestation period like other horticultural crops. The tree grows fast and flowers within 4 to 6 months usually letting two harvests in first year itself. The tree yields high till seventh year, while a decline in yield is observed from eighth year. Tabular analysis was employed to estimate the investment pattern, maintenance cost, pattern of labour use, yield and returns from one ha of drumstick farm. In order to know the relative profitability of investment in drumstick cultivation, measures of project evaluation- Pay Back Period (PBP), Net Present Worth (NPW), benefit Cost Ratio (BCR), and Internal Rate of Return (IRR) were used (Gittinger, 1982). The financial feasibility of investment was calculated using with and without finance approaches.

Net Present Worth (NPW): The present value represents the discounted value of the net cash inflows to the project. In the present study, a discount factor of 10 per cent was used to discount the net cash inflows representing the opportunity cost of capital. It can be represented as:

$$\sum_{t=0}^{r} \frac{R_t - C_t}{(1+I)^t}$$

Where,
R_t= Returns in the t^{th} year (in rupees)
C_t = Cost in the t^{th} year (in rupees)
I= Discount rate (10 per cent per annum)
t=Age of drumstick farm (in years)
T=Expected life of drumstick farm (in years)

Benefit Cost Ratio (BCR): BCR was worked out by discounting the future gross returns and cost during the life period of orchard at the rate of 10 per cent.
BCR = Discounted cash inflows (B)/Discounted cash outflows (C)

$$B = \sum_{t=0}^{r} \frac{B_t}{(1+I)^t}$$

&

$$C = \sum_{t=0}^{r} \frac{C_t}{(1+I)^t}$$

Where,
B_t= Benefit from the orchard in the t^{th} year
C_t= Cost of orchard in the t^{th} year
I = Rate of discount (10 per cent per annum)
t= Age of drumstick farm (in years)
T=Economic life of drumstick farm (in years)

Internal Rate of Returns (IRR): IRR is that discounted rate at which NPW is zero. The net cash inflows were discounted to determine the present worth following the interpolation technique.

IRR= Lower discount rate + Difference between two discount rates x (present worth of cash flows at lower discount rate / absolute difference between present worth cash flows stream at the two discount rates

$$\text{IRR} = \text{Lower discount rate} + \text{Difference between two discount rates} \times \left[\frac{\text{Present worth of cash flows at lower discount rate}}{\text{Absolute difference between present worth cash flows stream at the two discount rates}} \right]$$

Pay Back Period (PBP)

It is the number of years that investment takes to recover its costs from the returns generated in the project life cycle. i.e., the time required for the project to pay for itself. In the present study, payback period was calculated by successively deducting the initial investment from the net returns until the initial investment is fully recovered.

Sensitivity Analysis

Sensitivity analysis for the above measures was done with the following assumptions/situations. The average prices received by the sample farmers during the data collection period were Rs 28 per kg. It was noted that price moved as high as Rs 80 per kg and as low as Rs 4 per Kg during the year under record. Therefore the sensitivity analysis was carried out under following assumptions.

i. 10 per cent increase in cost
ii. 10 per cent increase in return
iii. 10 per cent decrease in return
iv. 10 per cent increase in cost and 10 per cent decrease in return
v. 20 per cent increase in cost
vi. 20 per cent increase in return
vii. 20 per cent decrease in return
viii. 20 per cent increase in cost and 20 per cent decrease in return
ix. 50 per cent decrease in return
x. 50 per cent increase in return
xi. 30 per cent increase in return
xii. 30 per cent decrease in return
xiii. 20 per cent increase in cost and 30 per cent decrease in return
xiv. 20 per cent increase in cost and 50 per cent decrease in return

RESULTS & DISCUSSION

The investment incurred on a drumstick farm of one ha in Vadodara district of Gujarat is presented in Table 1, and can be classified into two categories (Ravikumar *et al*, 2011). First, the cost of establishment in the zero period, and second, the operational and maintenance cost up to bearing stage (six months). Drumstick begins to yield pods in sixth month of expected economic life (ten years).

TABLE 1: Investment pattern on drumstick orchard of one ha in Vadodara district of Middle Gujarat Gujarat (Rs/ha)

S. No	Particulars	Cost (Rs/ha)	Share in total cost (%)
A	**Establishing costs**		
1	Rental value of land	20000.00	8.24
2	Plant Material	3720.00	1.53
3	Farm building and storehouse	91673.00	**37.77**
4	Farm Equipments	9230.00	3.80
5	Fencing	85000.00	**35.02**
6	Investment in digging and planting	2536.00	1.04
	Total	**212159.00**	**87.42**
B	**Operational and Maintenance cost up to bearing period (up to 6 months)**		
1	Land Preparation	4970.00	2.05
2	Fertilizer	538.00	0.22
3	Pesticides	640.00	0.26
4	Irrigation water charges	1000.00	0.41
5	Labour Charges (manual)	8522.00	3.51
6	Pesticide spray	472.00	0.19
	Total	**16142.00**	**6.65**
C	**Interest on working capital**	605.00	0.25
D	**Interest on fixed capital**	6970.00	2.87
E	**Depreciation**	6810	2.81
F	**Total Establishment cost (A+B+C+D+E)**	**242686.00**	**100.00**

The establishment cost or the cost in the zero time period comprise rental value of land, cost of plant material, cost of farm building / storehouse, expenditure on farm equipments, fencing and investment on planting the stems. After incurring this initial investment for establishing the drumstick farm, the farmer is required to make some more investments until tree reaches bearing stage. Such costs are known as operational and maintenance costs and are mainly incurred for land preparation, fertilizers and pesticides application, irrigation, and the labour utilized in the application of each of these inputs. The analyses of the collected data from the samples revealed that the total investment on the drumstick until the pods appeared was around Rs 242686 per ha, of which establishment costs accounted 87.42 per cent and operational and maintenance cost accounted 6.65 per cent. Farm building and fencing constituted around 38 per cent and 35 per cent, respectively of the total investment cost, and were the major cost components for investment. Fencing was required to prevent crop damage by Blue bulls, which were highly prevalent in the study area. The drumstick starts yielding returns from first half of the year. The operational and maintenance cost for the same period (six months) was included in the establishment cost, in which labour constituted about 3.50 %. Minimal maintenance cost (6.65 per cent) also indicates that the drumstick farm is easy to maintain and the incurred operational and maintenance expenses were less as compared to other input intensive horticultural crops, like pomegranate, lime, amla etc.(Patel, 2015; Ramanbhai, 2012; Gondalia and Patel, 2007). Table 2 presents maintenance cost of drumstick cultivation for its economic life, and also during bearing phase (seven years average) and mature phase (average of 8^{th} , 9^{th}, and 10^{th} year). The average cost of cultivation of drumstick for an economic life of 10 years was arrived at Rs 63033 per ha per year, of which fixed cost (including interest on fixed capital) constituted 75 per cent and working capital (including interest in working capital) constituted 25 per cent. Rental value of land had the largest share (31.73 per cent) in fixed cost while labour had the largest share in working capital (19 per cent). Human labour constituted 14 per cent and mechanical labour constituted 5 per cent of total labour. The expenditure made on fertilizers, plant protection

chemicals, planting material and irrigation constituted around four per cent of the total cost. The average yield of ten years was arrived at 191.60 qtls per ha per year.

The share of fixed cost in the bearing phase was 73 per cent while the variable costs constituted 27 per cent to total cost. In the mature phase, the fixed costs increased (constitute around 81 per cent of total cost), while the variable costs declined considerably with a high reduction in labour cost which comprised only 13.55 per cent of total cost in mature phase as against 21.37 per cent in bearing phase. A considerable reduction in labour cost for harvesting in mature phase was noted, as the yield declined. This is the phase when most of the farmers cut the trees from the lower part of the stem (around 10th year), and wait for another growth which is fast and flowers within 4-6 months. This is a usual cycle which was observed in the study area.

A drumstick farm in its economic life of 10 years yielded around 1915 qtls per ha and generated gross returns of Rs 53,79,726 per ha in ten years. It was observed from table 3 that the average quantity of pods produced per ha was 32.77 qtls in first year. The yield was highest (326 qtls) in fourth year. The average yield per farm per year in bearing phase (first seven years) was about 210 quintals per ha per year, while the average yield in mature phase (eighth, ninth and tenth year) was 149 quintals per ha per year. Proper management of the orchards is responsible for stable yields.

TABLE 2: Maintenance cost of cultivation of drumstick for economic life of ten years in Vadodara district of Middle Gujarat (Rs/ha /year)

		10 years (economic life)		7 years (bearing phase)		3 years (mature phase)	
S.No	Particulars	Average cost		Average cost		Average cost	
A	**Fixed Cost**	**Cost**	**% to total**	**Cost**	**% to total**	**Cost**	**% to total**
I	Rental value on Land	20000	31.73	20000	30.77	20000	34.21
II	Depreciation	13700.00	21.73	13700.00	21.08	13700.00	23.43
	Fixed cost	33700.00	53.46	33700.00	51.86	33700.00	57.64
III	Interest on fixed capital	13759.50	21.83	13759.50	21.17	13759.50	23.53
	Total fixed cost (I+II+III)	**47459.50**	**75.29**	**47459.50**	**73.03**	**47459.50**	**81.17**
B	**Working capital cost**						
I	Labour	12100.98	19.20	13890.49	21.37	7925.47	13.55
a	Tractor charges	3020.55	4.79	3898.09	6.00	972.96	1.66
b	Human	9080.43	14.41	9992.4	15.38	6952.51	11.89
II	Planting material	372.00	0.59	531.43	0.82	0	0.00
III	Fertilizer	474.55	0.75	403.31	0.62	640.79	1.10
IV	Plant Protection chemicals	712.33	1.13	641.92	0.99	876.62	1.50
V	Irrigation	894.93	1.42	915.26	1.41	847.51	1.45
VII	Working capital cost (I to V)	14554.80	23.09	16382.4	25.21	10290.4	17.60
VIII	Interest on Working Capital	1018.84	1.62	1146.76	1.76	720.33	1.23
	Total Working Capital (VII+VIII)	**15573.64**	**24.71**	**17529.16**	**26.97**	**11010.7**	**18.83**
D	**Total Cost (A+B+C)**	**63033.14**	**100.00**	**64988.66**	**100.00**	**58470.2**	**100.00**

TABLE 3: Yield and return structure of drumstick on a farm of one ha in Vadodara district of Middle Gujarat

S. No.	Economic life (in years)	Yield (qtls/ha)	Total Return (Rs/ha)
1	1st	32.77	96852.69
2	2nd	185.00	550190.00
3	3rd	219.24	634642.80
4	4th	326.00	931590.83
5	5th	276.48	736726.72
6	6th	209.69	573032.30
7	7th	219.43	611512.30
8	8th	163.00	444081.00
9	9th	153.73	437505.60
10	10th	130.64	363591.80
Total	**Total production**	**1915.80**	**5379726.05**
Average yield (tonnes/ha)		**191.58**	**537972.60**
Average Returns (Rs/ha)			

It was observed during the survey that farmers may take a loan of at most one lakh in order to meet their establishment cost and operational expenses by the time the crop generates positive returns. Therefore, the average benefit cost stream of investment on drumstick farms was calculated using with and without finance approach in order to understand the impact of loan on farm income and to know the financial feasibility of investment under two situations. Table 4 discusses the average benefit cost stream of investment on a drumstick farm of one ha in Vadodara district of Gujarat, when the loan was availed *i.e.* with finance. It was observed that the heavy investment was required only in the first year as the tree flowers within six months of establishment, bears pods and generates returns. The incremental returns were positive from second year itself and reached maximum in fourth year. While the per unit costs declined from fourth year due to higher yield, it was observed that the costs

increased again in ninth and tenth year of economic life due to increased expenses on plant protection and irrigation. Besides this, the labour charges also increased as the plant reaches height. Even though the yield declines but the picking time increases in these years (due to height), raising costs.

Investments in orchards generally are huge and are spread over the life time of the orchard (10 years in this case). A vast amount of resources are committed in raising orchards and management of inputs plays a key role. Therefore the costs and returns were analyzed carefully to test the worthiness of the investment in drumstick enterprise. Hence the technique of project evaluation such as payback period, net present value, benefit cost ratio, and internal rate of return were employed for investment on one ha of drumstick farm in Vadodara district. In analyzing the investment feasibility, the establishment costs, maintenance costs and gross returns were considered at 10 per cent discount rate representing the opportunity cost of capital. The establishment cost (with finance) was Rs 2, 58,546 per ha in first year. The debt servicing cost was calculated at 10% and was spread over the economic life of the tree.

Table 5 presents average benefit cost stream of investment on drumstick farm of one ha (without finance). It was observed that the cost reduced by the amount of cost of debt servicing, when the loan was not taken. Therefore the realization of returns or incremental cash flow increased without finance.

TABLE 4: Average benefit cost stream of investment on drumstick farm of one ha in Vadodara district of Middle Gujarat (With finance)

Project Life	Incremental cash outflows (Ct)	Incremental cash inflows (Bt)	Incremental net cash flow	D.F. at 10%	Discounted net cash flow
	(i)	(ii)	(iii)=(ii)-(i)	iv	v
1	258546.03	96852.69	-161693.34	0.909	-146979.25
2	53505.93	550190.00	496684.07	0.826	410261.04
3	57641.83	634642.80	577000.97	0.751	433327.73
4	56398.17	931590.83	875192.67	0.683	597756.59
5	49539.10	736726.72	687187.62	0.621	426743.51
6	47294.20	573032.29	525738.09	0.564	296516.28
7	45595.57	611512.29	565916.71	0.513	290315.27
8	43672.81	444081.00	400408.19	0.467	186990.62
9	47094.81	437505.60	390410.79	0.424	165534.18
10	47683.56	363591.83	315908.27	0.386	121940.59
	Total	5379726.05	4672754.02		2782406.56

TABLE 5: Average benefit cost stream of investment on drumstick farm of one ha in Vadodara district of Middle Gujarat (Without finance)

Project Life	Incremental cash outflows (Ct)	Incremental cash inflows (Bt)	Incremental net cash flow	D.F. at 10%	Discounted net cash flow
	(i)	(ii)	(iii)=(ii)-(i)	iv	v
1	242686.03	96852.69	-145833.34	0.909	-132562.51
2	37645.93	550190.00	512544.07	0.826	423361.40
3	41781.83	634642.80	592860.97	0.751	445238.59
4	40538.17	931590.83	891052.67	0.683	608588.97
5	33679.10	736726.72	703047.62	0.621	436592.57
6	31434.20	573032.29	541598.09	0.564	305461.32
7	29735.57	611512.29	581776.71	0.513	298451.45
8	27812.81	444081.00	416268.19	0.467	194397.24
9	31234.81	437505.60	406270.79	0.424	172258.82
10	31823.56	363591.83	331768.27	0.386	128062.55
	Total	5379726.05	4831354.02		2879850.40

Financial feasibility, and sensitivity analysis of investment on Drumstick farm (for one ha) in Vadodara district of Middle Gujarat

Table 6 presents investment analysis of drumstick farm under normal cost and returns, and is projected for different combinations of increase and decrease in costs and returns, given the relatively stable input costs in drumstick cultivation, while higher fluctuations in price as reported earlier. The analysis was done using with and without finance approach. A term loan of an average Rupees one lakh, as found through the survey was included in examining returns on investment under with finance approach. The cost of debt servicing was included as Rs 15860, for each year for the life of the project.

Payback period: It is the number of years that investment takes to recover its costs from the returns. Under normal costs and returns condition (on farm), the payback period was arrived at 1 year, 6 months, and 10 days, when the finance was availed, while it was 1 year, 5months, and 23 days when the finance was not availed. It signifies that the payback period increases after availing finance as farmer has to pay the cost of debt servicing too.

TABLE 6. Financial feasibility, and sensitivity analysis of investment on Drumstick farm (for one ha) in Vadodara district of Middle Gujarat

Particulars	With Finance				Without Finance			
	PBP	**NPV (Rs)**	**BC Ratio**	**IRR (%)**	**PBP**	**NPV (Rs)**	**BC Ratio**	**IRR (%)**
Under Normal Cost and Return	**1 year 6 months and 10 days**	**2523860.53**	**10.76**	**88.98**	**1 year 5months and 23 days**	**2637164.37**	**11.87**	**95.53**
10% Increase in cost	1year 6 months and 12 days	2512991.49	10.66	88.32	1 year 5 months 25 days	2626295.32	11.75	94.81
10% Increase in return	1 Year 5 months and 21 days	2852163.26	12.03	96.78	1 year 5 months and 6 days	2965467.10	13.22	103.6
10% decrease in return	1 year 7 months and 4 days	2195557.80	9.49	80.89	1 year 6 months and 14 days	2308861.64	10.51	87.17
10% decrease in cost and 10% decrease in return	1 year 7 months and 6 days	2184688.76	9.40	80.27	1 year 6months and 16 days	2297992.60	10.41	86.48
20% Increase in cost	1 year 6months and 14 days	2502122.45	10.56	87.67	1 year 5 months and 26 days	2615426.29	11.64	94.1
20% Increase in return	1 Year 5 months and 6 days	3180465.98	13.30	104.4	1 Year 4 months and 22 days	3293769.82	14.57	111.5
20% decrease in returns	2 years 1 months and 13 days	1867255.07	8.22	72.48	2 years and 4 days	1980558.91	9.16	78.49
20% Increase in cost and 20% decrease in returns	2 years 1 months and 22 days	1845516.99	8.05	71.28	2 years and 12 days	1958820.83	8.97	77.18
50% decrease in return	**2 years 11 months and 17 days**	**882346.89**	**4.41**	**44.28**	**2 years 8months and 24 days**	**995650.73**	**5.10**	**49.61**
50% Increase in return	**1 year 4 months and 2 days**	**4165374.16**	**17.11**	**125.9**	**1 year 3 months and 22 days**	**4278678.00**	**18.63**	**133.9**
30% Increase in return	1 year 4 months and 23 days	3508768.71	14.57	63.66	1 year 4 months and11 days	3622072.55	15.92	69.41
30%decrease in returns	1 year 9 months 15 days	1538952.35	6.95	111.7	1 year 8 months and 15 days	1652256.19	7.81	119.1
20% Increase in cost and 30% decrease in returns	2 years 2 months and 2 days	1517214.27	6.80	62.51	2 years 2 months and 13 days	1630518.11	7.63	68.15
20% increase in cost and 50% decrease in returns	2 years 9 months and 22 days	1020358.22	4.90	47.97	2 years 7 months and 9 days	1133662.06	5.61	53.25

Under different scenarios of increase and decrease in costs and returns, it was found that the minimum payback period was 1 year, 4 month, and 2 days, when the returns increase by 50 per cent and cost remains unchanged. The maximum payback period was arrived at 2 years, 11 months and 17 days when the returns decrease by 50 per cent other things remaining the same. It shows that the farmer is able to recover the cost on investment in drumstick relatively faster to several other orchard investments, where the payback period could increase from four to seven years.

Net Present Worth (NPW): It is a popular measure of profitability which is used to assess a given project's potential return on investment. The NPW was measured at a discount rate of 10 per cent for the investments under normal costs and returns and for various combinations too. The NPW under normal cost and returns was Rs 25,23,860.53 per ha and Rs 26,37,164.37 per ha, respectively under with and without finance approach. It indicates that the profitability was lower when the project is financed through debt because of debt servicing cost. The NPW was maximum when the returns increase by 50 per cent, and minimum when they decrease by 50 per cent, other things remaining the same.

Benefit Cost Ratio (BCR): A benefit cost ratio (BCR) attempts to identify the relationship between the cost and benefits of a proposed project. The BCR is calculated by dividing the present value of future cash inflow by present value of cash outflow. The higher the BCR, the better the investment. General rule of thumb is that if the benefit is higher than the cost, the project is a good investment. For the drumstick investment, we found that the BCR under normal cost and return condition was 10.76, and 11.87 respectively under with and without finance approach. It means that when the farmers' borrow debt, they earn Rs 10.76 on each rupee of investment. When they do not borrow, the profitability increases by Rs 1.11 making benefits rise to Rs 11.87 on each rupee invested. The BCR was maximum when the returns increased by 50 per cent, followed by 30 per cent, and 20 per cent increase in returns.

Internal Rate of Return: The internal rate of return was estimated to be 88.98 per cent and 95.53 per cent for with financing and without financing situations respectively. IRR which shows the earning capacity of the project was greater than the prime lending rate prevalent in the region. Thus investment on drumstick farm is financially feasible. The IRR was highest when the returns increase by 50 per cent and minimum when the returns decrease by 50 per cent.

SUMMARY & CONCLUSION

Drumstick is a highly profitable enterprise as the investment analysis revealed. The plantation increased in the study area over time due to the 'demonstration effect' and the active participation of the market which found the routes to other markets nationally, and internationally. Inspite of having a highly profitable enterprise, the plantation is not spread to other regions of Gujarat. The major reasons behind this are: the lack of a nearby market, lack of domestic consumption and lack of awareness about the profitability of the project as such. The costs incurred are minimal and the Establishment cost is also less, if the rental value of land is taken into consideration. However, with the newly purchased land, the establishment costs may rise by around 38 lakhs per ha which is the prevailing price of agricultural land in the study area. On the other hand, the lucrative enterprise it is, farmers in the study area On the other hand, the lucrative enterprise it is, farmers in the study area wish to adopting the "Miracle tree", provided they get a local market too. The government of Gujarat along with the State Agricultural Universities may conduct promotional campaigns in rural and urban areas to enhance local consumption of drumstick. This will be a win win situation for farmers and consumers as well.

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