Internat. J. agric. Sci. Vol.3 No.1 January 2007 : 28-34

Resource use efficiency in Alphonso mango production in Sindhudurg district (M.S.)

S.A. Wagale, J.M. Talathi*, V.G. Naik and D.B. Malave
Department of Agril. Economics, Dr. B.S.Konkan Krishi Vidyapeeth, Dapoli, RATNAGIRI (M.S.) INDIA

ABSTRACT
The present study entitled "An economic analysis of resource use efficiency in Alphonso mango production in Sindhudurg district" was undertaken with a cross-sectional sample of forty farmers each from small (upto 1.00 ha), medium (1.01 to 2.00 ha) and large (above 2.00 ha) mango orchard categories were selected randomly from Vengurla and Deogad Tahsils. The average size of holding of sample mango growers was 2.54 ha. At overall level, the average size of mango growers using different inputs in mango production revealed that overall level, 61.67 per cent mango growers were using manures, 70.83 per cent were using fertilizers and 76.67 per cent mango growers were using plant protection chemicals. The growth retardant users were negligible (12.5%). The per hectare quantity of manures used was 33.33 quintals. The per hectare quantities of N, P_2O_5 and K_2O used were 110.34 kg, 38.39 kg and 48.62 kg, respectively. At overall level, the plant protection chemicals i.e. carbamate (1.04 kg) was used on large scale, followed by copper based fungicide (1.02 lit), cyclodine compound (1.01 lit), sulphur based fungicides (0.91 lit) and organophosphate (0.62 lit). The per hectare cost of cultivation (Cost-C) Rs. 43198.00, Rs. 44310.00 and Rs. 48103.00 in small, medium and large size groups, respectively. At overall level, the per quintal cost of cultivation was Rs. 1445.00 and that of production Rs. 1729.00, profit at Cost-A, Cost-B and Cost-C was Rs. 45703.00, Rs. 32290.00 and Rs. 25318.00, respectively, leaving the net returns of Rs. 16409.00. The net returns were Rs. 13594.00, Rs. 16747.00 and Rs. 18879.00 in small, medium and large size of orchard, respectively. The Cost : Benefit ratio at total cost of production was estimated to 1.26, 1.31 and 1.33 in small, medium and large size of orchard, respectively, while it was 1.30 at overall level. The coefficient of determination (R^2) indicated 96.00 per cent variation in mango production. The applied 't' test indicated that constant return to scale have prevailed in mango production. The ratio of MVP/FC was more than unity in case of manures, phosphorus and potassium indicating the scope of expanding the use of these inputs. The expenditure on area, nitrogen, human labour and plant protection need to be curtailed. The constraint faced by mango growers, marketing of mango in the hands of commission agents (47.50%), lack of technical knowledge (42.50%) and non-availability of cold storage facility (29.17) were of high intensity.

Key words : Input use, Cost Returns, Profitability, Resource Productivity and Allocative efficiency.

INTRODUCTION

Mango (*Mangifera indica* L.) a member of Anacardiaceace, the fourth most important crop of the world and is the most important fruit crop in Asia, since a time immemorial (Mathew *et al.*, 1993). Mango consists of more than one thousand varieties and is cultivated in the Indian sub-continent over 4000 years ago.

In Maharashtra, the area under mango cultivation is 381466 hectares and production is 810384 M.T. In Maharashtra, the Konkan region is well known for mango production having an area of 140319 hectares and production of Konkan region is 293673 M.T. In Konkan region, the Sindhudurg district is popular for mango production having an area of about 22498 hectares and production is about 63634 M.T. (Srinivasan, 2005).

Mango plantation is capital intensive and its gestation period is quite long. Low productivity is the major bottleneck in boosting its exports. The world mango productivity is about 14 to 16 tonnes/ha, while in India, it ranges from 8 to 10 tonnes/ha (Anonymous, 1993). However, the mango production in the Konkan region particularly Alphonso variety is very low which ranged about 2.5 tonnes/hectares (Goveker, 1995). This may be due to various factors like alternate bearing, application of inadequate fertilizer doses, lack of proper management of spraying schedule, difference in productivity, duration of flowering and fruiting and upto some extent inequality of Alphonso fruits, across different farm size and locations. Further, there is no proper utilization of available resources that affect the yield and management of mango and its profitability. Therefore, to estimate practically, whether there are real differences across the different farm size, the present study was undertaken with following specific objectives.

Objectives :

i) To study inputs utilization across the farm size.
ii) To study size productivity relationship in mango production.
iii) To study resource use efficiency on different size of farms.
iv) To analyze the constraint faced by mango growers in production process.

MATERIALS AND METHODS

Mango cultivation is mostly concentrated in Ratnagiri and Sindhudurg districts accounting for about 46.26 per cent of the area under mango in the Konkan region. In view of this, Sindhudurg district was selected purposively for present investigation. From two Tahsils, i.e. Vengurla and Deogad, eight villages were selected randomly i.e. four villages from each tahasil. Then all mango growers were classified for selected villages in three different size groups

* Author for corrospondence.

of mango orchards viz., 1) Less than 1.0 ha (small), 2) 1.01 to 2.0 ha (medium) and 3) above 2.01 ha (large). From each category, five farmers were selected randomly. Thus, final sample was consisted of 8 villages and 120 mango growers. The data pertained to the agriculture year 2003-2004.

The cost, returns and profitability in mango production was studied with the help of standard cost concepts and resource use efficiency in production was estimated through following Cobb-Douglas production form.

$Y = AX_i^{bi} e$

Where,

Y = Mango yield per plant per year
X_i = Explanatory variable
bi = Elasticity of coefficient of respective variables.
e = Error term.
X_i = No. of bearing trees per farm.
Age of orchards (yrs)
Human labour (man days)
Manures (quintal)
Nitrogen (kg)
Phosphorus (kg)
Potassium (kg)
Plant protection (Rs.)

RESULTS AND DISCUSSION

Size of Orchard :

The details of orchards selected in three size of farms is given in Table 1.

Table 1 : Information of sample mango orchards

S. No.	Particulars	Size groups of orchard			
		Small	Medium	Large	Overall
1.	Average area per orchard (ha)	0.62	1.55	3.20	1.79
2.	Average age of orchard (yrs)	23.20	22.30	26.90	24.13
3.	Number of trees				
	a) Per farm (No.)				
	i) Bearing trees	42.77	121.00	280.5	148.09
	ii) Non-bearing trees	17.45	32.47	40.53	30.15
	TOTAL	60.22	153.47	321.03	178.24
	b) Per hectare (No.)				
	i) Bearing trees	68.98	78.06	87.65	78.23
		(71.02)	(78.84)	(87.38)	(79.16)
	ii) Non-bearing trees	28.15	20.95	12.66	20.59
		(28.98)	(21.16)	(12.62)	(20.84)
	TOTAL	97.13	99.01	100.31	98.82
		(100)	(100)	(100)	(100)

(Figures in parentheses are percentages to total)

At overall level, the average size of mango orchard was 1.79 ha, having 178.24 trees. The per hectare number of trees was 98.82 and there was no much variation among different size groups. Out of total number of trees, the proportion of bearing and non-bearing trees was 79.16 per cent and 20.84 per cent, respectively.

The area of mango orchard increased from 0.62 ha in small group to 3.20 ha in large group. The number of trees per hectare varied from 97 in small group to 100 trees in large group. The proportion of bearing trees was the highest in large size group (87.38%), followed by in medium (78.84%) and small (71.08%) size groups. The average age of orchard was 24.13 years at overall level.

Input utilization :

The per hectare size groupwise inputs used for mango orchard are given in Table 2.

At the overall level, the quantity of of manures used was 33.33. Among the groups, it was maximum (42.78) and 29.33 in large and medium size group, while it was 27.89 in medium size group. At the overall level, per hectare quantities of N, P_2O_5 and K_2O used were 110.34 kg, 38.39 kg and 48.62 kg, respectively.

The plant protection has assumed an important place in commercial mango cultivation. Plant protection chemicals were classified in groups on the basis of their chemical composition. At overall level carbamate (1.04 kg) was used on large scale followed by copper based fungicide (1.02 lit), Cyclodine compound (1.01 lit), sulphur based fungicide (0.91 lit) and organophosphate (0.67 lit).

Most of the mango growers did not use growth promoters because of lack of knowledge and high cost. At overall level, the quantity of growth promoter viz. Cultar was found to be 0.07 lit, while it was 0.08 lit, 0.06 lit and 0.07 lit in small, medium and large size groups, respectively.

Cost of production :

Cost of production includes the cost of cultivation plus marketing cost. Item wise per hectare cost of production for different groups of mango orchards is presented in Table 3.

Among the different categories of costs, out of total

Table 2 : Size groupwise inputs used per hectare of mango orchard.

S. No.	Inputs	Size group of orchards			
		Small	Medium	Large	Overall
1.	Manures (q)	27.89	29.33	42.78	33.33
2.	Fertilizers (kg)				
	i) N	108.41	103.83	118.79	110.34
	ii) P_2O_5	35.69	38.64	41.15	38.49
	iii) K_2O	43.39	49.96	52.52	48.62
3.	Plant protection chemicals				
	i) Organo phosphates (lit.)	0.69	0.64	0.69	0.67
	ii) Carbamate (kg)	1.04	1.02	1.07	1.04
	iii) Cyclodine compound (lit.)	0.99	1.03	1.02	1.01
	iv) Sulphur based fungicide (lit.)	0.95	0.82	0.97	0.91
	v) Copper based fungicide (lit.)	0.98	1.00	1.07	1.02
4.	Growth promoters cultar (lit.)	0.08	0.06	0.07	0.07

cost of production cost-A was 45.86 per cent, cost-B increased to 68.80 per cent and subsequently at cost-C level, it was 83.53 per cent, while the remaining share of cost was 16.47 per cent was utilized to employ marketing expenses as the cost of marketing of mango is quite expensive.

On the basis of per hectare total cost of cultivation and cost of production, the per quintal cost was worked out. At overall level, the per quintal cost of cultivation was Rs. 1445.00 and that of production Rs. 1729.00. The per quintal cost of cultivation was varied from Rs. 1400.00 in large size group to Rs. 1528.00 in small size group. The per quintal cost of cultivation was minimum (Rs. 1400.00) in large size orchard due to higher productivity. The per quintal cost of production was minimum (Rs.1654.00) in large size orchard, Rs. 1722.00 in medium and Rs. 1829.00 in small size orchards.

Profitability of orchard :

The per hectare profitability of mango orchard was worked out by deducting different costs viz., Cost A, Cost B, Cost C and Total Cost of production from the per hectare gross returns. From the Table 3, it is observed that at the overall level, profit at cost A, cost B and cost C was Rs. 45703.00, Rs. 32290.00 and Rs. 25318.00, respectively. At the overall level, the net returns at cost of production were Rs. 16409.00, while it was Rs. 13594.00 in small size orchards Rs. 16747.00 in medium orchards and Rs. 18879.00 in large orchards.

The cost-benefit ratio at total cost of production was found to be 1.26 in small orchard, 1.31 in medium orchard and 1.33 in large orchard, whereas, it was 1.30 at overall level. The cost : benefit ratio was more than unity indicating that mango production is profitable venture. Considering topography in the study area, agro-climatic situation, even the cropping patterns of the sample farms were dominated by perennial crop. The mango orchards income was dominant in the farming system. This encourages even farmers to bring more area under mango production.

Resource use efficiency :

The resource use efficiency in mango production was studied with the help of Cobb-Douglas production function for different size group of farms and the overall level. The results of this analysis are presented in Table 4.

Small orchard :

The elasticity coefficient (X_2) bearing trees (X_3), age of orchards (X_4), manures were positive and significant at one per cent level of probability. This indicated that the bearing trees, age of orchard and manures were the important inputs to which the yield of mango was highly responsible. Specifically one per cent increase in the bearing trees is expected to increase yield by 0.96 per cent. The elasticity coefficient for age of orchards was also positive and significant at one per cent level of probability. This indicated that yield of Alphonso mango increases with an increase in age of orchard. The elasticity coefficient for manures was also positive and significant at one per cent level of probability. This indicated that yield of Alphonso mango increases with increase in quantity of manures. The elasticity coefficient for nitrogen was negative and significant, indicating that there was decline in yield with increase in level of nitrogen. The elasticity coefficient for P_2O_5 was positive and significant at five per cent level of probability. This indicated that increase in P_2O_5 was expected to increase yield. The elasticity coefficient for K_2O was negative and significant at five per cent level of probability. This indicated that there was decline in yield with increase in quantity of K_2O. The elasticity coefficients for other variables though positive but were non-significant. The variation in yield of Alphonso mango explained by the explanatory variables was 96 per cent indicating that all important variables were included in the equation.

Medium orchard :

The elasticity coefficients (X_2) bearing trees (X_7) K_2O was positive and significant at one per cent and five per cent level of probability, respectively. This indicated that

Table 3 : Per hectare cost of maintenance of mango orchard

(Figures in Rs.)

S. No.	Particulars	Size group of orchards			
		Small	Medium	Large	Overall
1	2	3	4	5	6
1.	Hired labour				
	a) Male	4616	5066	6436	5373
		(8.92)	(9.42)	(11.32)	(9.93)
	b) Female	1193	1425	1995	1537
		(2.31)	(2.65)	(3.51)	(2.84)
2.	Manures	2789	2933	4278	3333
		(5.39)	(5.46)	(7.53)	(6.16)
3.	Fertilizers	1918	1981	2176	2025
		(3.71)	(3.69)	(3.83)	(3.74)
4.	Plant protection	1793	1571	1808	1724
		(3.47)	(2.92)	(3.18)	(3.19)
5.	Growth promoter (Cultar etc.)	480	360	422	421
		(0.93)	(0.67)	(0.74)	(0.78)
5.	Growth promoter (Cultar etc.)	480	360	422	421
		(0.93)	(0.67)	(0.74)	(0.78)
	Input cost (Rs.)	12789	13335	17115	14413
		(24.73)	(24.81)	(30.11)	(26.64)
6.	Land revenue and other cesses	42	45	48	45
		(0.081)	(0.084)	(0.084)	(0.083)
7.	Depreciation on implements and machinery	580	540	620	580
		(1.12)	(1.00)	(1.09)	(1.07)
8.	Amortization value	7904	7904	7904	7904
		(15.28)	(14.70)	(13.91)	(14.61)
9.	Interest on working capital(13% for 12 months)	1663	1734	2225	1874
		(3.22)	(3.22)	(3.91)	(3.46)
	Cost – A	22978	23558	27912	24816
		(44.43)	(43.81)	(49.10)	(45.86)
10.	Interest on fixed capital	620	714	650	661
		(1.20)	(1.33)	(1.15)	(1.22)
11.	Rental value of land	10888	11753	12619	11753
		(21.04)	(21.86)	(22.20)	(21.72)
	Cost – B	34486	36025	41181	37230
		(66.67)	(67.00)	(72.45)	(68.80)
12.	Family labour				
	a) Male	5548	5325	4106	4993
		(10.72)	(9.90)	(7.23)	(9.23)
	b) Female	1886	1626	1104	1538
		(3.65)	(3.02)	(1.94)	(2.84)
13.	Supervision charges	1278	1334	1712	1441
		(2.47)	(2.48)	(3.01)	(2.66)
	Cost – C	43198	44310	48103	45202
		(83.51)	(82.40)	(84.63)	(83.53)
14.	Marketing cost	8534	9460	8735	8909
		(16.49)	(17.60)	(15.37)	(16.47)
15.	Total cost of production	51732	53770	56838	54111
		(100.00)	(100.00)	(100.00)	(100.00)
		Small	Medium	Large	Overall
16.	Yield in quintal	28.28	31.23	34.37	31.29
17.	Value of produce	65326	70517	75717	70520
18.	Net returns at				
	a) Cost – A	42348	46959	47805	45703
	b) Cost – B	30840	34492	34536	32290
	c) Cost – C	22128	26207	27614	25318
19.	Profit at cost of production	13594	16747	18879	16409
20.	Cost benefit ratio at total cost of production	1.26	1.31	1.33	1.30
21.	Per quintal cost of				
	a) Cultivation	1528	1419	1400	1445
	b) Production	1829	1722	1654	1729

Table 4 : Elasticity coefficients for selected variables

S. No.	Particulars/Variables	Size group of orchards			
		Small	Medium	Large	Overall
1.	Constant intercept	3.801999	- 4.02544	- 1.55168	-0.60568
		(2.427653)	(3.917532)	(0.51651)	(1.481241)
2.	X_1 area (ha)	0.087702	- 0.5327	- 0.16158	-0.1723
		(0.338404)	(0.824378)	(0.101131)	(0.339048)
3.	X_2 bearing trees	1.777436*	1.180199*	-0.0073	1.10426*
		(0.285024)	(0.238197)	(0.039668)	(0.133873)
4.	X_3 age of orchard (years)	0.520338*	0.42007	- 0.28797*	0.405635*
		(0.124221)	(0.294376)	(0.031052)	(0.116561)
5.	X_4 manures (q)	1.261997*	- 0.35579	1.283743*	0.529724*
		(0.428366)	(0.503924)	(0.0224)	(0.124213)
6.	X_5 N (kg)	- 4.82879*	- 0.82209***	0.040199	-0.56955*
		(1.417042)	(0.424766)	(0.040422)	(0.207523)
7.	X_6 P_2O_5 (kg)	4.724195**	0.405025	0.049994	0.03776
		(1.804489)	(0.356062)	(0.33022)	(0.163976)
8.	X_7 K_2O (kg)	-2.302243**	1.01359**	- 0.00507	0.08189
		(1.055768)	(0.42766)	(0.033031)	(0.192772)
9.	X_8 male labour (days)	0.171544	- 0.50375	0.054582	-0.06383
		(0.194238)	(0.770819)	(0.067201)	(0.236095)
10.	X_9 female labour (days)	- 0.079996	0.111489	0.050629	-0.17885
		(0.086579)	(0.659013)	(0.065663)	(0.119377)
11.	X_{10} plant protection (Rs.)	0.042906	0.369568	0.003644	-0.06035
		(0.100029)	(0.318384)	(0.065663)	(0.092731)
12.	R^2	0.961781	0.855315	0.997332	0.960004

*Significant at 1 per cent level of probability
**Significant at 5 per cent level of probability
***Significant at 10 per cent level of probability

one per cent increase in bearing threes was expected to increase yield by 85 per cent. In case of K_2O indicated that the five per cent increase in K_2O was expected to increase yield by 85 per cent.

The elasticity coefficient for nitrogen was negative and significant at 10 per cent level of probability. This indicated that there was a decline in yield with advancement of nitrogen. The elasticity coefficients for other variables i.e. area, manures and male labour were negative and non-significant and remaining variables were positive but non-significant. The variation in yield of Alphonso mango explained by the explanatory variables in medium size orchards was 85 per cent indicating that all important variables were included in the equation.

Large orchard :

The elasticity coefficient (X_4) manures were positive and significant at 1 per cent level of probability. This indicated that one per cent increase in quantity of manures was expected to increase yield by 99 per cent. The elasticity coefficient for (X_3) age of orchards was negative and significant indicating that there was a decline in yield with advancement of age of trees. The elasticity coefficients for other variables through positive but were non-significant. The variation in yield of Alphonso mango explained by the explanatory variables in large size orchard was 99 per cent indicating that all important variables were included in the equation.

Overall :

The elasticity coefficient (X_3) bearing trees, (X_4) age of orchard and (X_5) manure were positive and significant at 1 per cent level of probability. This indicated that one per cent increase in age, quantity of manure and number of bearing trees were expected to increase yield by 96.00 per cent. The elasticity coefficient (X_6) nitrogen was negative and significant indicating that there was decline in yield with addition of nitrogen. The elasticity coefficient for other variables i.e. P_2O_5 and K_2O though were positive but non-significant. The elasticity coefficient for male labour, female labour and plant protection were negative and non-significant indicating the excess utilization of these resources. The variation in yield of Alphonso mango explained by the explanatory variables at overall level was 96 per cent indicating that all important variables were included in the equation.

Resource productivity :

Marginal value products of the selected variables were computed by multiplying marginal physical product at

geometric mean level with the per crate prices (Table 5). The per unit cost of the factors was calculated and the ratio of marginal value product of factor cost was worked out.

One of the objectives of the present study is to find out input productivity and efficiency of their use. For the purpose, geometric means of the input resources and estimates of total returns (γ) at geometric means levels of inputs (X_i) were found out with the help of estimated log linear production functions.

Table 5 : Geometric mean levels of input resources.

S. No.	Input resources	Geometric mean			
		Small	Medium	Large	Overall
1.	Area (ha)	0.30	2.64	14.15	2.24
2.	Manures (q)	582.01	6148.37	76314.4889	6487.838
3.	N (kg)	14617.26	113929.57	844296.52	112029.70
4.	P_2O_5 (kg)	1129.58	11193.24	74337.67	9795.554
5.	K_2O (kg)	1744.90	20800.46	128786.99	16720.10
6.	Male labour (days)	38199.35	298730.79	1710932.98	269271.30
7.	Female labour (days)	5594.90	50174.95	228945.44	40056.32
8.	Plant protection (Rs.)	9567842.11	58863217.88	433012067.7	62476832.42
	Estimated total returns (γ) at G.M. level of Xi (Rs. per farm)	551.70	6068.78	43867.30	5276.14

Allocative efficiency :

Marginal value product and factor price for selected variables with respect to Cobb-Douglas production function for small size orchard are given in Table 6.

The marginal value product of variables manures (X_2), P_2O_5 (X_4) was positive. Ratio of MVP/FC were more than unity in case of manures, P_2O_5 etc. indicating the scope of expanding the use of these inputs. But the expenditure on other variables needs to be curtailed. The MVP/FC ratio for non-cash inputs factors like age of orchards and number of bearing trees could not be worked out.

Table 6 : Marginal value product and factor price in small size orchard.

S.No.	Variables	MPP	MVP	MVP/FC	Remarks
1.	X_1 area (ha)	159.0884	367335.2	0.947962	Excess use
2.	X_2 manures (q)	1.196279	2762.208	27.62208	Under utilization
3.	X_3 N (kg)	-0.18225	-420.827	-48.4265	Excess use
4.	X_4 P_2O_5 (kg)	2.307357	5327.688	284.1433	Under utilization
5.	X_5 K_2O (kg)	-0.72792	-1680.77	-237.397	Excess use
6.	X_6 male labour (days)	0.002478	5.72019	0.088011	Excess use
7.	X_7 female labour (days)	-0.00789	-18.214	-0.40475	Excess use
8.	X_8 plant protection (Rs.)	$2.47E^{-06}$	0.005713	0.005713	Excess use

Marginal value, product and factor price for selected variables with respect to Cobb-Douglas production function for medium size orchard are presented in Table 7.

The marginal value product of variable phosphorus (X_4), potassium (X_5) was positive. Ratio of MVP/FC was more than unity in case of phosphorus and potassium indicating scope of expanding the use of these inputs. But the expenditure on other variables i.e. manures, nitrogen, male labour etc. need to be curtailed. The MVP/FC ratio for non-cash inputs factors like age of orchard and number of bearing trees could not be worked out.

Marginal value, product and factor price for selected variables with respect to Cobb-Douglas production function for large size orchard are presented in Table 8.

Marginal value, product and factor price for selected variables with respect to Cobb-Douglas production function at overall size are presented in Table 9.

The marginal value product of variable manures (X_2), phosphorus (X_4) and potassium (X_5) was positive. The ratio of MVP/FC was more than unity in the case of manures, phosphorus and potassium indicating the scope of expanding the use of these inputs. The expenditure on other variables i.e. nitrogen, human labour, plant protection etc. need to be curtailed. The MVP/FC ratio for non-cash input factors like age of orchard and number of bearing trees could not be worked out.

This allocative resource use efficiency across different orchard size revealed that mango growers have to be given adequate know-how for resource management and their use. The mango farmers can increase their profitability in mango production by proper reallocation of resources.

Table 7 : Marginal value product and factor price in medium size orchard.

S.No.	Variables	MPP	MVP	MVP/FC	Remarks
1.	X_1 area (ha)	-1222.76	-2760999	-2.84949	Excess use
2.	X_2 manures (q)	-0.35118	-792.969	-7.92969	Excess use
3.	X_3 N (kg)	-0.04379	-98.8798	-11.3786	Excess use
4.	X_4 P_2O_5 (kg)	0.219598	495.8522	26.44545	Under utilization
5.	X_5 K_2O (kg)	0.294784	665.6233	94.01459	Under utilization
6.	X_6 male labour (days)	-0.01023	-23.1078	-0.3555	Excess use
7.	X_7 female labour (days)	0.013485	30.44896	0.676644	Excess use
8.	X_8 plant protection (Rs.)	0.0000381	0.086035	0.086035	Excess use

Table 8 : Marginal value product and factor price in large size orchard.

S.No.	Variables	MPP	MVP	MVP/FC	Remarks
1.	X_1 area (ha)	-500.851	-1103375	-0.55152	Excess use
2.	X_2 manures (q)	0.737925	1625.648	16.25648	Under utilization
3.	X_3 N (kg)	0.002089	4.60129	0.529493	Excess use
4.	X_4 P_2O_5 (kg)	0.029502	64.99258	3.466271	Under utilization
5.	X_5 K_2O (kg)	-0.00173	-3.80365	-0.53724	Excess use
6.	X_6 male labour (days)	0.001399	3.083001	0.047431	Excess use
7.	X_7 female labour (days)	0.009701	21.37084	0.474908	Excess use
8.	X_8 plant protection (Rs.)	$3.69E^{-07}$	0.000813	0.000813	Excess use

Table 9 : Marginal value product and factor price at overall size orchard.

S.No.	Variables	MPP	MVP	MVP/FC	Remarks
1.	X_1 area (ha)	396.5366	894983.2	0.799796	Excess use
2.	X_2 manures (q)	0.448941	1013.26	10.1326	Under utilization
3.	X_3 N (kg)	-0.02344	-52.8975	-6.08717	Excess use
4.	X_4 P_2O_5 (kg)	0.031437	70.95406	3.784217	Under utilization
5.	X_5 K_2O (kg)	0.054379	122.7323	17.33507	Under utilization
6.	X_6 male labour (days)	-0.00084	-1.89288	-0.02912	Excess use
7.	X_7 female labour (days)	-0.02298	-51.8759	-1.1528	Excess use
8.	X_8 plant protection (Rs.)	$-4.4E^{-06}$	-0.0099	-0.0099	Excess use

REFERENCES

Govekar, M.A. (1995). Junya Amba Kalmanche Punarjeevan Karun Utpadan Vadava. *Bali Raja.* **26 (3)** : 32 – 33.

Mathew, H., Litz, R.E., Wilde, H.D. and Wetzskin, H.K. (1993). Genetic transformation of mango. *Acta. Hort.* **341** : 93 – 97.

Srinivasan, N. (2005). Development initiatives by NABARD for promotion of mango export. In consultation workshop of mango Export Projects of Indian mangoes held on 23rd February, 2005 at Mumbai.

Received : January, 2006; Accepted : August, 2006