Economic Analysis of Mango Production in the Eastern Dry Zone of Karnataka

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Abstract

The present study was undertaken to assess the cost, returns and problems associated in production of mango in the Eastern Dry Zone of Karnataka. The study was based on the primary data collected from 60 mango cultivators for the year 2019-20. The standard cost concept was used for working out cost and returns. The study revealed that, per acre establishment cost of mango orchard during five years was Rs. 1,46,122. The per acre cost of cultivation of mango orchard during bearing period for the sample as a whole was Rs.58,257 out of which share of variable cost (61.45%) was higher as compared to fixed cost(38.55%). Total human labour requirement was 38.86 mandays and that of bullock labour was 6.56 machine hours. At overall level, annual average yield was 4.45 t/ac and 90 kg/tree. Average gross and net returns were Rs. 94,217 and Rs. 35,961 respectively. The returns per rupee of total cost was 1.62 indicating mango cultivation was profitable to the growers in the study area.

Keywords: Eastern Dry Zone, Cost and Returns, Input use Pattern, Returns per Rupee

Introduction

Mango is known to be the most important tropical fruit of the world, currently ranks fifth in total production among major fruit crops worldwide. India, where the mango is considered as the "national fruit", is the main global producer with an area of 2.25 Mha under mango cultivation and a production of 21.82 Mt (Anonymous, 2018). Thus India contributes 40 per cent of total area and 41 per cent of total production in the world. India is a home for 1000 varieties and about 30 varieties are grown on a commercial scale in different states in India. Indian Alphonso is the leading commercial variety and rated best in the world. Other important varieties are Totapuri, Neelum, Dashehari, Chausa, Kesar, Bombay green, Banganapalli *etc.,* and important hybrids are Mallika, Amrapali, Ratna, Sendura *etc.,* India's major marketing season is April to July. Uttar Pradesh is the leading mango producing state followed by Andhrapradesh, Karnataka, Telangana, Bihar, Gujarat and Tamilnadu.

The fresh mango and mango products act as a source of food & household income to the growers and helps in poverty reduction by providing employment opportunities to the rural people, to the non-growers through various activities such as marketability of fresh mangoes and processing of different products, both in raw and ripe stages. It earns foreign exchanges as well. Major export destination for Indian mangoes are United Arab Emirates, Saudi Arabia, UK, Qatar and USA. In 2017-18 India earns Rs. 38,234 lakhs from export of fresh mango and Rs. 67,392 lakhs from that of mango pulp (Anonymous, 2018).

Karnataka is among the top mango producing states in the country, growing the fruit in 0.19 Mha with the production of 1.82 Mt in 16 districts, including Kolar, Ramanagara, Tumkur, Chikkaballapura, Dharwad and others (Anonymous, 2018). Government of Karnataka established the Karnataka State Mango Development and Marketing Corporation Limited (KSNDMC) in 2011 with an objective of overall development of Mango industry. The main intention of Mango Corporation is to facilitate mango growers for quality mango production, post-harvest management, direct marketing, export and processing. Badami is the famous variety in Karnataka and called as Karnataka Alphonso. The State could be divided into three mango belts. The south belt, including Kolar,

Ramanagara, Tumakuru, Bengaluru Urban and Bengaluru Rural, harvests 40 per cent of Badami and 60 per cent of Totapuri, Neelam, Banganapalle, Mallika and others. Thus Eastern Dry Zone is contributing major proportion to mango production in Karnataka with a production of 0.9 Mt from an area of 0.10 Mha (Anonymous, 2018).

The north belt, comprising Belagavi, Dharwad and Haveri, grows Badami variety exclusively. However, Banganapalli mangoes are grown in Bidar. The central belt, that includes parts of Chitradurga, Davanagere, Chikkamagaluru, Shivamogga and Hassan, harvests 50 per cent of Badami variety and the rest of the share includes Totapuri, Banganapalle, Mallika and other types.

The mango fruit crop is gaining strength in economy day by day and many research efforts in the similar lines have been made to study in detail about the mango fruit crop in the entire India. But many studies hadn't taken place in the Eastern Dry Zone of Karnataka, especially in Tumkur and Ramanagara districts as they are the leading mango producing districts in Karnataka. However, in recent years mango growers are facing several production problems such as shortage and high cost of labour, high incidence of disease *etc.,* have threatened the cultivation of mango. The information on establishment cost, operating cost and input requirement of mango orchard would be of immense help to mango growers of Ramanagara and Tumkur region. It enables the farmers in making decision in farm planting and enterprise selection the result will be of immense use to the financial institutions in fixing the scale of finance and schedule of repayment. Hence, the present study was conducted with the specific objectives: to analyse cost and return structure of mango, and to find out the constraints in the production of mango in the study area.

Methodology

The study was carried out in Eastern Dry Zone of Karnataka. Ramanagara and Tumkur districts were selected as these districts ranks second and third in the area and production of mango (2019-20), respectively. Ramanagara taluk from Ramanagara district and Gubbi taluk from Tumkur district were selected as they are the leading mango producing taluks in the respective districts. Finally, three villages were considered randomly in each selected taluk. From each village 10 farmers were randomly selected. Thus totally 60 farmers comprised of 20 having young orchards, 20 having medium and 20 having old orchards were selected.

The cost and returns were calculated based on the standard method of cost of cultivation. The gestation period of five years was considered for mango orchards from the date of planting. The capital investment made in the first five years for the establishment of mango orchard was divided into equal annual instalments for the economic life of mango orchards (50 years) starting from sixth year, as amortization cost. The amortization was calculated by using formula:

$$A = P \times \frac{r(r+1)^n}{((1+r)^n)-1}$$

Where,

A = Annual amortized cost

P = Establishment cost

n = Economic life of mango orchard (taken as 50 years)

r = interest rate (4 %)

The total cost of irrigation groundwater, which comprises of both variable and fixed cost component. Total cost of ground water irrigation is the total amortized cost of investment on borewell and using the following formula.

I= (TAC/TWU)

Where,

TAC is the total amortized cost of irrigation investment on all borewell, TWU is the total volume of groundwater extracted from all the borewells in acre inches. Dividing TAC by TWC gives the irrigation cost per acre inch of groundwater. The cost of ground water irrigation is the amortized cost of irrigation given by Amortized cost on borewell + Amortized cost on investment on pump sets + Amortized cost on conveyance structure + Amortized cost storage structure if any + annual repairs cost (Kiran *et al.,* 2015)

$$TAC = \text{Initial investment} \times \frac{r(r+1)^{AL}}{((1+r)^{AL})-1}$$

Where,

AL= Average life of borewell

r = discount rate taken as 2 per cent

ii) Total ground water used (TWU)

TWU = [(Number of hours required for the irrigation)× (Frequency of irrigation per month) × (Number of months of crop) × (Average yield of well in gallons per hour)]/22611 gives water use for each crop in acre inches. For hired irrigation water charges, the amount actually paid by the sample mango farmers was considered.

Garrett Ranking Technique was used to study problem faced by the farmers in production and marketing of mango using the formula:

$$\text{Per cent position} = 100\ \frac{(R_{ij} - 0.5)}{N_j}$$

Where,
R_{ij} = rank given for i^{th} factor by j^{th} individual
N_j = number of factors ranked by j^{th} individual

The per cent position of each rank then converted into scores referring to the table given by Garret and Woodsworth (1969). For each factor, the scores of individual respondents were added together and divided by the total number of the respondents for whom scores were added. These mean scores for all the factors were arranged in descending order, ranks were given and most important factors were identified.

Results and Discussion

Proper establishment of mango orchard for optimum production in future is crucial for the profitability of the mango enterprise. The input use pattern during establishment period of mango cultivation per acre were per annum was estimated and presented in table 1. The important material inputs used in mango cultivation were seedlings, FYM, chemical fertilizers, plant protection chemicals and irrigation water.

The results showed that, on an average, sample farmers had used 52 seedlings, 6.33 tractor loads of FYM, 44.6 kgs of fertilizers, 17.82 acre inches of bore well water and 9.35 tankers of water for irrigation in the entire establishment period. Usage of inputs like irrigation water and FYM was highest in first year as

Table 1: Input use pattern during establishment period of mango cultivation (per ac)

S. No.	Particulars	Units	I year	II year	III year	IV year	V year	Total
A	Material input							
1	Seedlings	No.	52	6	3	2	1	64
2	Farm yard manure	Tractor load	1.55	1.02	1.18	1.31	1.28	6.33
3	Chemical fertilizer							
	N	kg.	3.65	-	-	4.13	4.25	12.03
	P	kg.	5.31	-	-	6.25	6.94	18.5
	K	kg.	4.10	-	-	4.76	5.21	14.07
	Total fertilizer		13.06	-	-	15.14	16.4	44.6
4	Irrigation	Acre inch	3.76	3.54	3.5	3.4	3.6	17.82
		Tanks	2.2	1.71	1.64	1.69	2.11	9.35
B	Labour input							
1	Land preparation	Mandays	1.54	-	-	-	-	1.54
		Machine hrs.	2.79	-	-	-	-	2.79
2	Pit opening	Machine hrs.	1.89	-	-	-	-	1.89
		Mandays	1.86	-	-	-	-	1.86
3	Planting and pit filling	Mandays	2.12	-	-	-	-	2.12
4	Manuring	Mandays	1.21	1.19	1.21	1.11	1.24	5.96
5	Chemical fertilizer application	Mandays	-	-	-	0.66	0.65	1.35
6	Plant protection chemical application	Mandays	1.1	1.025	1.21	1.26	1.38	5.97
7	Weeding	Mandays	1.72	1.84	2.01	2.12	2.29	9.98
8	Inter-cultivation operation	Mandays	0.38	0.4	0.43	0.43	0.5	2.14
		Machine hrs.	2.82	2.56	3.29	3.2	3.29	15.16
9	Pruning	Mandays	-	-	1.02	1.16	1.5	3.68
10	Irrigation	Mandays	8.35	5.76	5.62	5.68	5.72	31.13
11	Gap filling	Mandays	-	1.96	1.44	0.65	0.5	4.55
12	Watch and ward	Mandays	6.12	5.73	5.87	6.03	6.35	30.10
13	Total mandays		22.54	17.91	17.79	19.14	20.13	98.53
14	Total machine hours		7.50	2.56	3.28	3.20	3.29	19.84

compared to other years.

The total human labour requirement for the entire establishment period was 98.53 mandays and that of machine power was 19.84 machine hours. Out of total human labour used, highest mandays were used for irrigation (31.60 %) followed by watch and ward (30.25 %), weeding (10.13 %), plant protection chemicals application (6.06 %), manuring (6.05 %) and pruning (3.74 %). Out of total machine labour, highest machine hours was used for inter cultivation operation (76.41 %) followed by land preparation (14.06 %) and pit opening (9.53 %). Among five years of establishment period labour requirement was highest in the first year (22.54 mandays and 7.50 machine hours) due to operations like land preparation, pit opening, planting and pit filling were performed in the first year. Next to first year, labour requirement was high in fifth year followed by fourth, second and third year. These results are in line with the study of Vinodhini and Deshmukh (2017).

Table 2 represents the total cost per acre for establishing mango orchard for the entire five years was Rs. 1,46,122. Out of the total cost, variable cost

accounted for 71.97 per cent (Rs. 1,04,652) and fixed cost accounted for38.09 per cent (Rs. 40,880).

Among five years of establishment, the highest cost was incurred in the first year, 28.04 per cent of the total establishment cost (Rs. 40,972) followed by fifth year, (19.25 %), fourth year (17.79 %), third year 17.12 % and second year (16.96 %). The share of variable cost to total cost was highest in first year *i.e.* 77.49 per cent followed by fifth, third, fourth and second year with a share of 71.04 per cent, 69.47 per cent, 68.66 per cent and 68.35 per cent, respectively.

Labour cost had a highest share of 38.02 per cent in the non-bearing period and it had increased from 34.93 per cent in first year to 39.50 per cent in fifth year. The cost of machine labour was high in first year (Rs. 5250) as compared to rest of the years due to the use of machine power for land preparation, bunding and pit opening operations. The total material cost accounted for 29.29 per cent of the total cost and it was highest in first year (37.49 %) followed by fifth year (36.90 %) and almost same in rest of the years. But in first year maximum cost was incurred on material inputs (37.49 %) than all types of cost

Table 2: Establishment cost of mango cultivation in non-bearing period (Rs./ac)

S. No.	Particulars	I year	II Year	III Year	IV year	V Year	Total
I	Variable cost						
	Material cost						
1	Seedlings	7703	900	450	300	150	9503(6.50)
2	Farm yard manure	4650	3060	3540	4018	3840	19108(13.08)
3	Chemical fertilizer	657	-	-	723	758	2138(1.46)
4	Plant protection Chemicals	217	300	361	391	531	1800(1.23)
5	Irrigation a. Borewell	752	708	700	680	720	3560(2.44)
	b. Tanker	1100	855	820	845	1055	4675(3.20)
6	Miscellaneous cost	500	350	350	350	470	2020(1.38)
A	Sub total	15362(37.49)	6173(24.91)	6221(24.87)	6284(24.17)	7524(36.90)	42805(29.29)
Labour cost	1. Human labour	9016	7162	7116	7656	7928	39410(26.97)
	2. Machine labour	5250	1792	2303	2240	2303	13888(9.50)
B	Sub total	14310(34.93)	9654(38.96)	9827(39.29)	10596(39.42)	11050(39.50)	55561(38.02)
C	Interest on working capital @ 7% per annum	2077	1107	1123	1181	1300	6798(4.65)
D	Total variable cost (A+B+C)	31749(77.49)	16934(68.35)	17171(68.66)	18062(69.47)	19874(71.04)	105165(71.97)
II	Fixed Cost						
1	Depreciation	321	326	302	315	311	1575(1.08)
2	Rental value of land	5500	5500	5500	5500	5500	27500(18.82)
3	Land revenue	25	25	25	25	25	125(0.09)
4	Managerial cost @10% of working capital	2967	1582	1604	1688	1857	9712(6.65)
5	Interest on fixed capital @ 7 % per annum	409	409	407	408	408	2044(1.40)
E	Total fixed cost	9222(22.51)	7843(31.65)	7839(31.34)	7936(30.53)	8101(28.96)	40956(28.03)
F	Total cost (D+E)	40971	24778	25011	25998	27976	146122(100.00)
	Proportion to total cost (%)	28.04	16.96	17.12	17.79	19.25	100

Note: Figures in parenthesis are in percentage

while, the share of labour cost was high in the remaining years.

Among the material cost, maximum cost was incurred on FYM (13.08 %) followed by seedlings (6.50 %), irrigation (5.64 %) in the non-bearing period. But in first year, among the material cost, maximum cost was spent on the purchase of seedlings, followed by FYM and irrigation. Total fixed cost accounted for 28.03 per cent of the total establishment cost. It was highest in second year (31.65 %) followed by third (31.34 %), fourth (30.53 %), fifth (28.96 %) and was least in first year (22.51 %). Among the fixed cost, rental value of land (18.82 %) and managerial cost (6.65 5) were the major items.

These findings were similar to the study by Pardeep (2017) where the cost incurred during non-bearing period of peach orchards has shown a positive relation with age of the plants. Rental value of land contributed more to the total cost than all other components.

Proportion of material cost was higher than the labour cost in the first year, primarily because of the cost of seedlings use of more inputs. Much difference was not seen in the quantity of material inputs used between all the years, except cost incurred on seedlings. Cost incurred on labour had increased every year from first to fifth year.

Input use pattern and cost incurred was calculated by segregating the orchards into three age groups *i.e.* young orchards (6 – 15 years), medium aged orchards (16 – 25 years) and old orchards (25 - 35 years).

Table 3 depicts annual per acre use of resources in different age groups and the results showed that, at overall level, material inputs used per acre per annum was 1.59 kg of manure, 20.65 kg of chemical fertilizers, 0.51 kg of micronutrients, 3.53 acre inch of ground water and 2.57 tankers of water. Usage of all material

Table 3: Input use pattern of mango orchard during bearing period (per ac)

Sl. No.	Particulars	Units	Young (6-15 yrs)	Medium (15-25 yrs)	Old (25-35 yrs)	Overall (6-35 yrs)
A	Material input					
1	Manure	Tractor load	1.76	1.87	1.31	1.59
2	Chemical fertilizer					
	N	kg.	5.37	7.64	4.23	5.75
	P	kg.	10.16	11.19	8.20	9.50
	K	kg.	5.71	7.94	3.20	5.65
3	Micro nutrients	kg.	0.38	0.49	0.41	0.51
4	Irrigation	acre inch	3.46	3.61	3.52	3.53
		no. of tankers	2.42	2.76	2.54	2.57
B	Labour input					
1	Inter-cultivation	Mandays	0.38	0.38	0.41	0.50
		Machine hrs.	3.02	3.05	3.29	4.00
2	Basin preparation	Mandays	2.45	2.56	2.21	2.57
3	Manuring	Mandays	1.31	1.45	1.23	1.33
4	Chemical fertilizer application	Mandays	0.71	0.72	0.52	0.59
5	Plant protection chemicals	Mandays	0.33	0.74	0.70	0.60
		Machine hrs.	1.85	2.73	2.94	2.56
6	Pruning	Mandays	1.72	1.91	1.84	1.80
7	Weeding	Mandays	4.50	5.20	5.30	5.01
8	Irrigation	Mandays	4.10	4.50	3.82	3.98
9	Watch and ward	Mandays	11.60	12.20	12.13	11.98
10	Harvesting	Mandays	3.20	5.23	4.10	4.01
11	Loading	Mandays	1.36	1.97	1.49	1.6
12	Packaging	Mandays	0.5	0.53	0.5	0.51
13	Unloading	Mandays	1.47	2.03	1.48	2.2
14	Total mandays		33.53	39.42	35.73	36.68
15	Total machine hours		4.87	5.78	6.23	6.56

inputs was highest in middle aged orchards compared to other two groups. Inputs like manure, chemical fertilizers were used more in young orchards compared to old orchards and inputs like micro nutrients, irrigation water were used more in old orchards than that of young. Other material inputs such as plant protection chemicals and packing material are not considered here because of different units of measurement and difficult to quantify them in one simple unit of measurement.

Total human labour required per acre per annum for maintaining mango orchard including marketing of

mango was 36.68 mandays and that of machine labour was 6.56 machine hours at overall level. Labour requirement was found to be high in medium age orchards (39.51 mandays) followed by old age orchards (35.62 mandays) and young age orchards (3.63 mandays). In case of young orchards human labour were used more for operations like watch and ward (11.60 mandays), weeding (4.5 mandays), irrigation (4.1 mandays) and harvesting (3.10 mandays). In medium aged orchards, as high as 12.20 mandays were required for watch and ward operation, 5.23 mandays

Table 4: Maintenance cost of mango orchard in bearing period (Rs./ac/annum)

S. No.	Particulars	Young (6-15 years)	Medium (16-25 years)	Old (26-35 years)	Overall (6-35 years)
I	Variable cost				
	Material cost				
1	Manure	5290(10.01)	5591(8.64)	3930(7.14)	4766(8.18)
2	Chemical fertilizer	792(1.50)	886(1.37)	601(1.09)	760(1.30)
3	Micro nutrients	279(0.53)	323(0.50)	286(0.52)	202(0.35)
4	Plant protection chemicals	886(1.68)	950(1.47)	800(1.45)	879(1.51)
5	Growth regulators	151(0.29)	587(0.91)	357(0.65)	365(0.63)
6	Irrigation	a. Borewell 706(1.21)	692(1.31)	722(1.12)	704(1.28)
		b. Tanks 1287(2.21)	1210(2.29)	1380(2.13)	1270(2.31)
7	Transportation of resources	400(0.76)	514(0.79)	345(0.63)	420(0.72)
A	Sub total	9700(18.36)	10953(16.93)	8010(14.56)	9384(16.11)
	Labour cost				
	Human labour	12063(22.83)	13957(21.57)	12961(23.55)	12947(22.22)
	Machine labour	3409(6.45)	4046(6.25)	4361(7.92)	4592(7.88)
B	Sub total	15472(29.29)	18003(27.83)	17322(31.48)	17539(30.11)
C	Interest on working capital@7 % per annum	1762(3.34)	2027(3.13)	1773(3.22)	1885(3.23)
	Marketing cost				
	Labour cost	1332(2.52)	1812(2.80)	1388(2.52)	1724(2.96)
	Transportation	812(1.54)	850(1.31)	896(1.63)	853(1.46)
	Commission paid	3541(6.70)	4957(7.66)	3729(6.78)	4076(7.00)
	Miscellaneous	342(0.65)	332(0.51)	341(0.62)	338(0.58)
D	sub total	6027(11.41)	7951(12.29)	6354(11.55)	6990(12.00)
E	Total variable cost (A+B+C+D)	32962(62.39)	38934(60.19)	33458(60.80)	35797(61.45)
	Fixed Cost				
1	Depreciation	300(0.57)	320(0.49)	290(0.53)	303(0.52)
2	Rental value of land	9018(17.07)	14003(21.65)	10596(19.26)	11206(19.23)
3	Land revenue	25(0.05)	25(0.04)	25(0.05)	25(0.04)
4	Managerial cost @10% of working capital	2517(4.76)	2896(4.48)	2533(4.60)	2692(4.62)
5	Interest on fixed capital @7 % per annum	654(1.24)	1004(1.55)	764(1.39)	807(1.39)
6	Risk premium @5% of 80% of working capital	1007(1.91)	1158(1.79)	1013(1.84)	1077(1.85)
7	Amortized establishment cost	6349(12.02)	6349(9.81)	6349(11.54)	6349(10.90)
E	Total fixed cost	19870(37.61)	25755(39.81)	21570(39.20)	22460(38.55)
G	Total cost (E+F)	52832(100.00)	64689(100.00)	55029(100.00)	58257(100.00)

Note: Figures in parenthesis are in percentage

Table 5: Yield and returns structure of mango orchard in the study area (Rs./ac)

Sl. No.	Particulars	Young	Medium	Old	Overall
1	Variable cost	32962	38934	33458	35797
2	Fixed cost	19870	25755	21570	22460
3	Total cost of cultivation	52832	64689	55029	58257
4	Average number of trees (per acre)	51	49	51	51
5	Yield per tree (Kg)	73.72	114.48	78.2	87.31
6	Yield (t/ac)	3.76	5.61	3.99	4.45
7	Price (Rs./t)	21.01	21.03	21.43	21.15
8	Gross return	78997	117978	85505	94217
9	Returns over total cost	26166	53289	30477	35961
10	Returns over variable cost	46036	79044	52048	58421
11	Returns per rupee of variable cost	2.40	3.03	2.56	2.66
12	Returns per rupee of total cost	1.50	1.82	1.55	1.62

for harvesting, 5.20 mandays for weeding and 4.50 mandays for irrigation. In case of old orchards, highest quantity labour was used for watch and ward (12.13 mandays) followed by weeding (5.30), harvesting (4.10 mandays) and irrigation (3.82 mandays).

Machine labour was used to carry out inter-cultivation and PPC applications in all groups. Machine labour used was high in old age orchards (6.23 machine hours) followed by medium (5.78 machine hours) and young age (4.87 machine hours). Because in case of old orchards, canopy of the trees was large hence it requires more machine power for PPC application. Inputs used was more in medium age orchards compared to old and young, because 16 – 25 years of age was found to be most productive period in mango cultivation and hence farmers tend to use more inputs to exploit the yield as much as possible. Hence labour usage for marketing was also high in medium aged orchards due to high yield.

From the table 5, it could be viewed that the economic yield of the mango orchard started from sixth year after planting and according to sample farmers it can give economic yield up to 50 years. But in the study area farmers have started commercial mango cultivation only 35 years ago. So the estimation of yield, cost and return were done only up to 35 years. Annual average yield was 4.45 t/ac and 87.31 kg/tree. Average cost of cultivation was Rs. 58,257 per acre. Average gross and net returns were worked out to be Rs. 94,217 and Rs. 35,961 respectively. Returns per rupee of total cost were 1.62. When we look into the different age groups, average yield of young orchards was 3.76 t/ac, it increased to 5.61 t/ac in case of medium aged orchards and then decreased to 3.99 t/ac in old orchards.

Per tree yield was highest in medium aged trees (114.48 kg/ tree) followed by old (78.20 kg/tree) and young (73.72 kg/tree). The total cost of cultivation was high in medium aged orchards (Rs. 62,348) followed by old (Rs. 53,239) and young (Rs. 51,525). Highest gross returns was observed in case of medium aged orchards (Rs. 1,17,978) followed by old (Rs. 85,505) and young (Rs. 78,997).

The above analysis revealed that, medium aged orchards were more productive with stable yield than other age groups. Farmers had spent more on medium aged orchards in order to exploit the yield to the maximum extent. Hence maximum net returns was observed in case of medium aged orchards (Rs. 55,631), then in old aged (Rs. 32,267) and young aged (Rs. 27,472) orchards. Returns per rupee of total cost were highest in medium aged orchards (1.53) followed by old 1.89 and young 1.61 Thus investment on mango cultivation was found to be profitable. This is in line with Datarkar *et al*. (2014).

Table 6 presents the production constraints faced by sample farmers in mango production. The table shows that occurrence of natural calamities was ranked first with a mean score of 72.73 followed by water scarcity for irrigation (60.57), high cost of labour (57.58), alternate bearing nature of some mango varieties (55.97), shortage of labour (50.82), high input cost (43.33) severity of pest and diseases (32.00) and finally lack of awareness about credit availability was ranked last with a mean score of 28.13. These results are in contrast with study of Bhosale (2016) were

Table 6: Constraints faced by farmers in production mango

Factors	Garrett score	Mean score	Rank
Natural calamities	80	72.73	I
Water scarcity	67	60.57	II
High cost of labour	60	57.58	III
Alternate bearing	53	55.97	IV
Shortage of labour	47	50.82	V
High input cost	40	43.33	VI
Severity of pests and disease	32	32.00	VII
Lack of awareness about credit availability	20	28.13	VIII

heavy investments, pest and disease and fruit drop were the most important problems in the production of mango and similar to the study of Golappanavar and Patil (2016) where they found that inadequate irrigation facilities, rainfall, resources, non-availability of labour were the major production constraints.

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