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Returns analysis of technology of paclobutrazol application in rainfed Alphonso mango production in Maharashtra

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ABSTRACT : The Paclobutrazol (PBZ) application has induced early flowering in rainfed mango orchard due to enhanced use of critical inputs as a per canopy of mango tree. The application of manures and fertilizers viz., N.P.K. when compared with recommended levels. The analysis revealed that the input gap for manures was to the extent of 78.5 per cent in PBZ non-adopter group and 74.7 per cent in PBZ adopter group. In case of chemical fertilizer viz., N.P.K. was to the extent of 58.67 per cent, 34 per cent and 59 per cent in PBZ non-adopter group and 9.33 per cent, 14 per cent and 46 per cent in PBZ adopters group, respectively. On account of this, the per hectare productivity of rainfed mango orchard was 6.2 t/ha in PBZ adopter category and 3.9 t/ha in PBZ non-adopter category. The per hectare cost of cultivation was Rs. 122373/- and Rs. 69561/- with per tone cost of cultivation of mango was to the tune of Rs. 26037/- and Rs. 23822/- in PBZ adopter and PBZ non-adopter category, respectively. The per hectare gross returns were Rs. 251450/- and Rs. 119720/- with benefit cost ratio of 2.05 and 1.72 in PBZ in the same order. The benefits due to PBZ, application were valued to Rs. 95230/ha with an additional cost of Rs. 27730/ha realizing net incremental benefits to the tune of Rs. 67460/ha. Better productivity and price advantage grabbed in the early start of marketing season, were the benefits to the PBZ adopter category which resulted into higher per hectare income. As a whole, the net returns were 157.33 per cent higher for PBZ adopters than to PBZ non-adopters.

KEY WORDS : Paclobutrazol, Adopters, Non-adopters, Incremental benefits

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The challenges being faced by Indian mango is low productivity and enormous post harvest losses. Although there are several factors associated with low productivity in rainfed mango and occurrence of alternate bearing habit in commercial varieties like Alphonso, Dashehari, Chausa and Langra. In order to obtain regular bearing in Alphonso variety of mango application of paclobutrazol (PBZ) has made major change to break alternate bearing and early flowering in mango for betterment of rainfed mango growers and boosting economy of the region. Hence, in view of this,

the present study was undertaken in south Konkan region which is most important rainfed mango growing zone in Maharashtra state and it exclusively famous for growing Alphonso mango.

Objective :

The specific objectives of the present study are as under.

- To study the input use in rainfed mango production.
- To estimate impact of paclobutrazol (PBZ)

application on cost, returns and profitability in rainfed mango production.

RESEARCH METHODS

On the basis of area under mango, two tahsils namely Vengurle and Malvan were selected purposively. From each tahsil five villages were selected randomly, from each village 6 paclobutrozol technology (PBZ) adopter and 6 paclobutrozol technology (PBZ) non-adopters rainfed mango growers were selected. Thus, final sample consisted of 60 PBZ adopters and 60 non-adopters of PBZ. The care was taken to select mango growers having more than 10 years old rainfed mango orchard.

Analysis of data :

Simple statistical tools *viz.*, average, percentages and standard cost concept were used to analyze the data. Data pertained to the agricultural year 2011-12.

RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Size of mango orchard :

The information in respect of per farm operational holding and per farm area under rainfed mango is given in Table 1.

PBZ adopters and PBZ non-adopter mango grower were grouped into three size groups on the basis of

operational holding as small, medium and large. It is revealed from Table 1 that 65 per cent mango growers in adopter category were large farmers, whereas, 55 per cent mango growers in non-adopter category were medium farmers. The average size of operational holding and size of rainfed mango orchard was 5.02 ha and 4.07 ha and 3.11 ha and 2.32 ha in PBZ adopter and non-adopter categories, respectively.

Paclobutrozol application :

The information about time schedule of application of PBZ by the rainfed mango orchard is given in Table 2.

It is observed from the Table 2 that the rainfed mango growers (adopters) were having average experience of 6 to 8 years of applying PBZ from 2nd fortnight of June to 1st fortnight of August. However, more than three fifth (63.33 %) were following recommended time schedule for application of PBZ. This has reflected in early flowering in rainfed mango orchard in the range of 2 to 4 weeks.

Physical input use and input gap :

The per hectare physical input use and input gap was worked out separately for PBZ adopter and PBZ non-adopter categories of rainfed mango growers and is presented in Table 3.

Along with PBZ, the use of manures and fertilizers was comparably higher on adopter farms than to non-adopter mango farms. The application of manures and fertilizers *viz.*, N.P.K. when compared with

Sr. No.	Particulars	Adopters (n=60)			Non-adopters (n=60)		
		Number of growers	Operational holding	Area under mango orchard	Number of growers	Operational holding	Area under mango orchard
1.	Small (Upto 2.00 ha.)	3 (5.00)	1.83	1.43	23 (38.33)	1.79	1.52
2.	Medium (2.01 to 4.00 ha.)	18 (30.00)	3.16	2.97	33 (55.00)	3.84	2.65
3.	Large (4.01 and above)	39 (65.00)	6.12	4.79	04 (6.67)	4.76	4.24
	Average		5.02	4.07		3.11	2.32

Figures in parentheses are percentage to total

Sr. No.	Time schedule of application of technology	No. of respondent (n= 60) (*)		Quantity utilized (lt/ha.) (**)
		Number	Percentage	
1.	June 2 nd fortnight	4	6.67	2.40
2.	July 1 st fortnight	18	30.00	2.25
3.	July 2 nd fortnight	28	46.66	2.10
4.	August 1 st fortnight	10	16.67	2.50

* Average experience of using PBZ were 6-8 years; ** Comparative earliness in flowering were 2 to 4 weeks

recommended levels. The analysis revealed that the input gap for manures was to the extent of 78.5 per cent in PBZ non-adopter group and 74.7 per cent in PBZ adopter group. In case of chemical fertilizer viz., N.P.K. was to the extent of 58.67 per cent, 34 per cent and 59 per cent in PBZ non-adopter group and 9.33 per cent, 14 per cent and 46 per cent in PBZ adopters group, respectively.

Thus, along with PBZ application rainfed mango growers increased the use of these critical inputs. However, This might be result of requirement of these inputs as per canopy of mango tree. The finding of the study were similarly reported earlier by Mandape (2009) and Wagale (2005).

Productivity of rainfed mango orchards :

In PBZ adopter and non-adopter categories of mango orchard, the average productivity was observed to 4.70 t/ha and 2.92 t/ha, respectively (Table 4). This indicated that the productivity was positively associated with size of rainfed mango orchard in both the categories.

The age wise per hectare productivity of rainfed

mango orchards is presented in Table 5.

The productivity was maximum during the age of 31-50 years which was 6.2 t/ha. in PBZ adopter category and 3.9 t/ha in PBZ non-adopter category. The difference in productivity over non-adopters according to age of mango orchard varied from 1.4 t/ha to 2.3 t/ha. Similarly, the productivity was observed to increase and later on decreased as the orchard becoming very old i.e., greater than 50 years of age.

Cost and returns :

The per hectare annual cost of maintenance of mango orchard estimated for PBZ adopters and PBZ non-adopters is presented in Table 6.

The per hectare cost of cultivation was Rs. 122373/- and Rs. 69561/- in PBZ adopter and PBZ non-adopter category, respectively. Due to enhanced use of inputs in PBZ adopter category, the cost of cultivation of rainfed mango was on higher side. Therefore, per tone cost of cultivation of mango was to the tune of Rs. 26037/- and Rs. 23822/- in PBZ adopter and non-adopter category,

Table 3 : Per hectare physical input use and input gap in rainfed mango orchard

Sr. No.	Inputs	Recommended levels	Adopters (n=60)		Non-adopters (n=60)	
			Actual	Gap	Actual	Gap
1.	Mannures (tone)	10 (100.00)	2.53 (25.30)	7.47 (74.7)	2.15 (21.50)	7.85 (78.5)
2.	Fertilizers (kg)					
	N	150.00 (100.00)	136.00 (90.67)	14.00 (9.33)	62.00 (41.33)	88.00 (58.67)
	P	50.00 (100.00)	43.00 (86.00)	7.00 (14.00)	33.00 (66.00)	17.00 (34.00)
	K	100.00 (100.00)	54.00 (54.00)	46.00 (46.00)	41.00 (41.00)	59.00 (59.00)
3.	Paclobutrazol (lt)	3.00 (100.00)	2.23 (74.33)	0.77 (25.67)	--	--

Figures in parentheses indicate per cent gap in the input use to the recommended levels

Table 4 : Per hectare productivity rainfed of mango orchard

Sr. No.	Particulars	Adopters (n = 60)		Non-adopters (n = 60)	
		Number of growers	Productivity (t/ha)	Number of growers	Productivity (t/ha)
1.	Small	3 (5.00)	3.27	23 (38.33)	2.63
2.	Medium	18 (30.00)	4.39	33 (55.00)	3.06
3.	Large	39 (65.00)	4.96	04 (6.67)	3.48
	Average productivity	-	4.70	-	2.92

Figures in parentheses are percentage to total

Table 5 : Age wise per hectare productivity of mango orchard

Sr. No.	Age group of orchard (years)	Adopters (n = 60)		Non-adopters (n = 60)	
		Number of growers	Productivity (t/ha)	Number of growers	Productivity (t/ha)
1.	Young (< than 15 years)	12 (20.00)	3.2	14 (23.33)	1.80
2.	Adult (16 to 30 years)	17 (28.33)	4.8	16 (26.67)	3.6
3.	Old (31 to 50 years)	12 (20.00)	6.2	17 (28.33)	3.9
4.	Very old (>than 50 years)	19 (31.67)	4.6	13 (21.67)	2.4
	Average productivity	-	4.7	-	2.92

Figures in parentheses are percentage to total

respectively (Garg and Yadav, 1975; Patil, 1997 and Misal, 2002).

Profitability of rainfed mango production :

The profitability in rainfed mango production is given in Table 7.

It is revealed from the Table 7 that the per hectare cost of cultivation was Rs. 122373/- and Rs. 69561/-, gross returns of Rs. 251450/- and Rs. 119720/- with benefit cost ratio of 2.05 and 1.72 in PBZ adopter and PBZ non-adopter category, respectively. Considering cost and gross returns, the net returns estimated at cost A, cost B and cost C were more than double in PBZ adopter category over non-adopter category. Better productivity and price advantage grabbed in the beginning of season, were the benefits to the PBZ adopter category which

resulted into higher per hectare income. As a whole, the net returns were 157.33 per cent higher for PBZ adopters than to PBZ non-adopters.

Impact of PBZ application in rainfed mango :

The economics of PBZ application along with added inputs is worked out for PBZ adopter category over PBZ non-adopters and corresponding added productivity was worked out and presented in Table 8.

The total additional input cost incurred by the PBZ adopter mango grower including cost of PBZ was observed to the tune of Rs. 27770/ha and added mango production was 1.78 t/ha with a value of Rs. 95230/ha. Therefore, the incremental benefits realized at input cost level were to the tune of Rs. 67460/ha.

This profitability advantage of PBZ is note worthy.

Sr. No.	Particulars	Adopters (n=60)		Non-adopters (n=60)	
		Amount (Rs.)	Percentage	Amount (Rs.)	Percentage
1.	Hired labour				
	Male	8363	6.83	5290	7.60
	Female	3723	3.04	2981	4.28
	Total	12086	9.88	8271	11.89
2.	Manures	6325	5.17	5378	7.73
3.	Fertilizers	7174	5.86	3930	5.65
4.	Plant protection	14234	11.63	9624	13.83
5.	Paclobutrozol	13380	10.93	-	-
	Input cost	53199	43.47	27203	39.11
6.	Land revenue and other cesses	46	0.04	46	0.07
7.	Depreciation and repairing	568	0.46	384	0.55
8.	Interest on working capital (@6%)	3192	2.61	1632	2.35
	Cost A	57005	46.58	29265	42.07
9.	Interest on fixed capital (@10%)	836	0.68	521	0.75
10.	Rental value of land (1/6th of the gross returns)-land revenue	41862	34.21	19907	28.62
11.	Amortization value	9741	7.96	9741	14.00
	Cost - B	109444	89.43	59434	85.44
12.	Family labour				
	Male	4372	3.57	4792	6.89
	Female	3237	2.64	2615	3.76
	Total	7609	6.22	7407	10.65
13.	Supervision charges (@10% of input cost)	5320	4.35	2720	3.39
	Cost C	122373	100.00	69561	100.00
14.	Production (t)	4.70	-	2.92	-
15.	Value of produce	251450	-	119720	-
16.	Cost of cultivation/tonne	26037	-	23822	-
17.	Benefit cost ratio	2.05	-	1.72	-

Figures in the parentheses indicate percentage to the total cost

The rainfed mango growers were convinced to use this PBZ technology and realized better returns from market with early start of marketing season. The sample farmers opined that profitability can be further extended, if PBZ is applied as per given schedule and applying quantities of manures, fertilizers and plant protection chemicals properly as per canopy of tree and monitoring flowering through following timely spray schedule. Shinde (2011)

concluded with similar findings in her study.

Price behaviour in mango marketing season :

For understanding, the profitability of early marketing season in mango, month wise pattern of quantities marketed and prices realized were compiled and presented in Table 9.

The quantity marketed by the both the categories

Sr. No.	Particulars	Adopters (n=60)	Non-adopters (n=60)
1.	Yield (t.)	4.70	2.92
2.	Gross returns (Rs.)	251450	119720
3.	Cost of cultivation at		
	Cost-A	57005	29265
	Cost-B	109444	59434
	Cost-C	122373	69561
4.	Net income at		
	Cost-A	194445	90455
	Cost-B	142006	60286
	Cost-C	129077	50159
5.	Benefit cost ratio	2.05	1.72
	Per cent increase in net income of PBZ adopters over non-adopters	157.33	-

Sr. No.	Particulars	Debit		Credit	
		Amount (Rs.)		Amount (Rs.)	
(I)	Additional cost			Additional returns	
	Cost of PBZ	13380 (48.18)		1.78 t.@ Rs. 53500/tonn	95230
	Labour cost	4017 (14.47)		-	
	Manures and fertilizers cost	4191 (15.09)		-	
	Plant protection cost	4610 (16.60)		-	
	Interest on working capital	1572 (5.66)			
	Reduced returns	Nil		Reduced cost	Nil
	Total (A)	27770 (100.00)		Total (B)	95230
(II)	Incremental benefits at input cost due to use of PBZ per ha. = Rs. 67460				

Month	Quantity sold in quintals						Market price Rs. per quintal			
	Adopter (n=60)			Non-adopter (n=60)			I*		II**	
	I*	II**	Total	I*	II**	Total	Min.	Max.	Min.	Max.
February	1.60(0.02)	14.90(0.13)	16.50(0.15)	-	-	-	28050	30800	19480	24600
March	216.80(1.89)	1309.70(11.41)	1526.5(13.30)	19.70(0.48)	263.69(6.49)	283.39(6.98)	16000	21000	10000	13580
April	6102(53.17)	1906.85(16.61)	8009.43(69.78)	837.69(20.61)	1687.72(41.52)	2525.41(62.13)	8000	11000	4800	6800
May	1312.43(11.43)	612.54(5.34)	1924.97(16.77)	907.80(22.33)	348.04(8.56)	1255.84(30.90)	3500	4800	2500	3500
Total			11477.40 (100.00)			4064.64 (100.00)				

*Ist fortnight, **IInd fortnight

(Figures in perentheses are percentages to total quantity sold)

of mango growers was observed to be maximum in the month of April. However, PBZ adopter started their marketing season from February onwards and PBZ non-adopters from March onwards. On the other hand, prices were substantially higher in the beginning months compared to May. This early start of marketing season of mango had positive and profound influence on higher income levels of PBZ adopters. Gurav (1993) and Kumar *et al.* (2000) concluded with similar findings in their study. The results are contrary to Naik (2005) in his study entitled an economic analysis of mango production, processing and export in south Konkan region of Maharashtra. Aski and Hirevenkanagoudar (2010) in their study of extent of adoption of improved mango cultivation practices by the KVK trained farmers. More or less similar findings were obtained by Jadav and Solanki (2009) and Jadhav *et al.* (2009)

Conclusion :

- The application of PBZ has induced early flowering by two to four weeks.
- Increase use of manures, fertilizers and plant protection chemicals with PBZ enhanced mango productivity level from 2.92 MT/ha to 4.7 MT/ha under rainfed situation.
- Increased additional cost of inputs along with PBZ application resulted in incremental net returns which is observed to be more than double.

Policy implication :

The rainfed mango growers in Konkan region need to be trained for PBZ application and adoption of recommended levels of inputs for realizing higher productivity as per canopy of tree through extension and development agencies.

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